SECTION 047200 - CAST STONE MASONRY

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS
				1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			2. SUMMARY
				1. Section Includes:

Cast-stone trim**[.][ including the following**:]

Window sills.

Lintels.

Surrounds.

Coping.

Cornices

Wall caps.

Belt courses.

Water tables.

Quoins.

Pilasters.

Column covers.

Medallions.

Cast-stone steps.

Cast-stone bollards.

Cast-stone benches.

Cast-stone curbing.

* + - * 1. Related Sections:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

Section 034500 "Precast Architectural Concrete."

Delete subparagraph below if installation of cast stone is specified in this Section.

Section 042000 "Unit Masonry" for installing cast-stone units in unit masonry.

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product.

Usually retain subparagraph below for cast-stone items that are manufacturer's stock units.

For cast-stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

* + - * 1. Sustainable Design Submittals:

Usually retain "Shop Drawings" Paragraph below for custom-made units.

* + - * 1. 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.

Include building elevations showing layout of units and locations of joints and anchors.

* + - * 1. Samples for Initial Selection: For colored mortar.
				2. Samples for Verification:

For each color and texture of cast stone required, 10 inches square in size.

For each trim shape required, 10 inches in length.

Delete subparagraph below if installation of cast stone is specified in Section 042000 "Unit Masonry."

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. Full-Size Samples: For each [**color] [texture] [and] [shape**] of cast-stone unit required.

Make available for Director’s Representative's review at Project site[ **or at manufacturing plant, if acceptable to Director’s Representative**].

Option in first subparagraph below may present timing problems. If Samples are not made far enough in advance, changing materials may not be possible (although adjustment of mixes and finishing techniques may be possible). However, if Samples are made too far in advance, they may not be made from materials from same lot used for production of units for Project.

Make Samples from materials to be used for units used on Project[ **immediately before beginning production of units for Project**].

Approved Samples may be installed in the Work.

Usually retain "Qualification Data" Paragraph below unless manufacturers are limited to those known to produce only acceptable products. Coordinate with qualification requirements in "Quality Assurance" Article.

* + - * 1. Qualification Data: For [**manufacturer] [and] [testing agency**].

Consider deleting subparagraph below. Unless testing to verify compliance with ASTM C1364 was required for previous projects, manufacturers may not be able to supply test reports.

Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C1364.

Consider deleting "Material Test Reports" Paragraph below if only a few units are required or if tests are considered unnecessary. Delete option if resistance to freezing and thawing is not required. Some consider testing for freeze-thaw resistance unnecessary because compressive-strength and water-absorption requirements in ASTM C1364 tend to ensure a durable product. Freeze-thaw testing is expensive, but manufacturers should have previously tested their typical products.

* + - * 1. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C1364**[, including test for resistance to freezing and thawing**].

Provide test reports based on testing within previous two years.

* + - 1. QUALITY ASSURANCE

The three certification programs in "Manufacturer Qualifications" Paragraph below are not all the same.

* + - * 1. 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**].

Retain "Testing Agency Qualifications" Paragraph below if Contractor is required to retain an independent testing agency for testing required by ASTM C1364.

* + - * 1. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

Retain one of two "Mockups" paragraphs below if mockups are required.

* + - * 1. Mockups: Furnish cast stone for installation in mockups specified in Section 042000 "Unit Masonry."
				2. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects[ **and set quality standards for materials and execution**].

Retain subparagraph below for mockup of masonry wall that includes cast-stone units. Indicate on Drawings the portion of wall represented by mockup, or draw mockup as separate element.

Build mockup of typical wall area as shown on Drawings.

* + - 1. DELIVERY, STORAGE, AND HANDLING
				1. Coordinate delivery of cast stone[ **with unit masonry work**] to avoid delaying the Work[ **and to minimize the need for on-site storage**].
				2. Pack, handle, and ship cast-stone units in suitable packs or pallets.

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.

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.

Delete two paragraphs below if installation of cast stone is specified in Section 042000 "Unit Masonry."

* + - * 1. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
				2. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
			1. PROJECT CONDITIONS

Delete this article if installation of cast stone is specified in Section 042000 "Unit Masonry."

* + - * 1. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.

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.

* + - * 1. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.
1. PRODUCTS
	* + 1. MANUFACTURERS
				1. Source Limitations for Cast Stone: Obtain cast-stone units from single source from single manufacturer.

Delete "Source Limitations for Mortar Materials" Paragraph below if installation of cast stone is specified in Section 042000 "Unit Masonry."

* + - * 1. 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.
			1. CAST-STONE MATERIALS

Delete this article if material requirements in ASTM C1364 are sufficient or if only stock units are required.

* + - * 1. General: Comply with ASTM C1364.

"Portland Cement" Paragraph below is more restrictive than requirements in ASTM C1364.

* + - * 1. Portland Cement: ASTM C150, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C114. Provide natural color or white cement as required to produce cast-stone color indicated.

Revise "Coarse Aggregates" and "Fine Aggregates" paragraphs below if specific aggregates and gradations are required.

* + - * 1. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C33; gradation and colors as needed to produce required cast-stone textures and colors.
				2. Fine Aggregates: Natural sand or crushed stone complying with ASTM C33, gradation and colors as needed to produce required cast-stone textures and colors.
				3. Color Pigment: ASTM C979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable,[ **free of carbon black**,] nonfading, and resistant to lime and other alkalis.
				4. Admixtures: Use only admixtures specified or approved in writing by Director’s Representative.

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.

Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.

Retain option in "Air-Entraining Admixture" Subparagraph below if air entrainment is required for exterior units (for freeze-thaw resistance).

Air-Entraining Admixture: ASTM C260.[ **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**.]

Water-Reducing Admixture: ASTM C494, Type A.

Water-Reducing, Retarding Admixture: ASTM C494, Type D.

Water-Reducing, Accelerating Admixture: ASTM C494, Type E.

Revise "Reinforcement" Paragraph below if another grade of steel is required. ASTM C1364 states that reinforcement "shall be noncorrosive" where exposed faces have less than 1-1/2 inches of cover.

* + - * 1. Reinforcement: Deformed steel bars complying with ASTM A615, Grade 60. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast-stone material.

Epoxy Coating: ASTM A775.

Galvanized Coating: ASTM A767.

Retain "Embedded Anchors and Other Inserts" Paragraph below and one of two options if embedded items are required.

* + - * 1. Embedded Anchors and Other Inserts: Fabricated from [**stainless steel complying with ASTM A240, ASTM A276, or ASTM A666, Type 304] [steel complying with ASTM A36 and hot-dip galvanized to comply with ASTM A123**].
			1. CAST-STONE UNITS
				1. Cast-Stone Units: Comply with ASTM C1364.

Retain first subparagraph below and one of two options to limit method of manufacture.

Units shall be manufactured using the [**vibrant dry tamp] [wet-cast**] method.

Delete subparagraph below if freeze-thaw resistance is not required. Some consider testing for freeze-thaw resistance unnecessary because compressive-strength and water-absorption requirements in ASTM C1364 tend to ensure a durable product. Freeze-thaw testing is expensive, but manufacturers should have previously tested their typical products.

Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C666, Procedure A, as modified by ASTM C1364.

* + - * 1. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.

Provide raised fillets at backs of sills and at ends indicated to be built into jambs.

Provide drips on projecting elements unless otherwise indicated.

* + - * 1. Fabrication Tolerances:

Tolerances in "Variation in Cross Section," "Variation in Length," "Warp, Bow, and Twist," and "Location of Grooves, False Joints, Holes, Anchorages, and Similar Features" subparagraphs below are based on recommendations of the Cast Stone Institute.

Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.

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.

Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.

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.

* + - * 1. Cure Units as Follows:

First two subparagraphs below are based on recommendations of the Cast Stone Institute.

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.

Keep units damp and continue curing to comply with one of the following:

No fewer than five days at mean daily temperature of 70 deg F or above.

No fewer than six days at mean daily temperature of 60 deg F or above.

No fewer than seven days at mean daily temperature of 50 deg F or above.

No fewer than eight days at mean daily temperature of 45 deg F or above.

Method in first paragraph below is standard for finishing cast-stone units; revise if another method is required.

* + - * 1. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

Exact matches of existing units may be impossible. Creating a sample with known ingredients that is an acceptable approximate match, rather than simply requiring the manufacturer to match existing units and hoping for the best, may help alleviate disputes.

* + - * 1. Colors and Textures: [**Match Director’s Representative's samples] [Match existing units] [As selected by Director’s Representative from manufacturer's full range**].

Retain one of three options in "Colors and Textures" Paragraph above, or provide descriptions of colors and textures required, as in the two example "Colors and Textures" paragraphs below. A description is always somewhat imprecise and subject to interpretation; therefore, it may not be the best method of specifying appearance characteristics. For public work, a description may be necessary and adequate, especially if there is little control over the appearance of other building materials.

* + - * 1. Colors and Textures: Provide units with fine-grained texture and buff color resembling [**smooth-finished] [sand-rubbed**] Indiana limestone.
				2. Colors and Textures: Provide units with fine texture and red-brown color resembling brownstone on adjacent buildings.
			1. MORTAR MATERIALS

Delete this article if installation is specified in Section 042000 "Unit Masonry."

* + - * 1. Provide mortar materials that comply with Section 042000 "Unit Masonry."

Retain paragraph above or select from remaining paragraphs. Coordinate selection of paragraphs below with requirements in "Mortar Mixes" Article.

Retain one or more of "Portland Cement," "Hydrated Line," "Portland Cement-Lime Mix," "Masonry Cement," and "Mortar Pigments" paragraphs below. Delete masonry cement and mortar cement if not allowed by "Mortar Mixes" Article. See the Evaluations in Section 042000 "Unit Masonry" for discussion of masonry cement and mortar cement.

* + - * 1. Portland Cement: ASTM C150, 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.
				2. Hydrated Lime: ASTM C207, Type S.

Mix in "Portland Cement-Lime Mix" Paragraph below allows better control of proportions than job-mixed, portland cement-lime mortar. If retaining, also retain "Portland Cement" and "Hydrated Lime" paragraphs above.

* + - * 1. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
				2. Masonry Cement: ASTM C91.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Argos USA LLC.

Cemex S.A.B. de C.V.

Lafarge North America Inc.

Lehigh Hanson; HeidelbergCement Group.

Lehigh White Cement Company.

QUIKRETE.

SAKRETE of North America LLC.

Approved equivalent.

Retain "Mortar Pigments" Paragraph below for colored cement or for pigments added at Project site.

* + - * 1. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979. Use only pigments with a record of satisfactory performance in masonry mortar.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Davis Colors.

Lanxess Corporation.

Solomon Colors, Inc.

Approved equivalent.

Mixes in "Colored Cement Products" Paragraph below allow better control of color than job-mixed colored mortar. If retaining, also retain paragraphs above that specify materials included in the mixes retained below.

* + - * 1. Colored Cement Product: Packaged blend made from [**portland cement and hydrated lime] [masonry cement] [or] [mortar cement**] and mortar pigments, all complying with specified requirements, and containing no other ingredients.

Colored Portland Cement-Lime Mix:

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Argos USA LLC.

Holcim (US) Inc.

Lehigh Hanson; HeidelbergCement Group.

Approved equivalent.

Colored Masonry Cement:

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Cemex S.A.B. de C.V.

Lafarge North America Inc.

Lehigh Hanson; HeidelbergCement Group.

Approved equivalent.

Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.

Retain one or both subparagraphs below to suit types of cement retained above. Percentages are for pigments containing only metallic oxides. If using pigments containing carbon black, carbon black must be limited to 2 percent of portland cement by weight or 1 percent of masonry or mortar cement.

Pigments shall not exceed 10 percent of portland cement by weight.

Pigments shall not exceed 5 percent of [**masonry cement] [or] [mortar cement**] by weight.

* + - * 1. Aggregate for Mortar: ASTM C144.

For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

White-Mortar Aggregates: Natural white sand or crushed white stone.

Retain "Colored Aggregates" Subparagraph below for colored-aggregate mortar.

Colored Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

* + - * 1. Water: Potable.
			1. ACCESSORIES
				1. Anchors: Type and size indicated, fabricated from [**Type 304 stainless steel complying with ASTM A240, ASTM A276, or ASTM A666] [steel complying with ASTM A36 and hot-dip galvanized to comply with ASTM A123**].
				2. Dowels: 1/2-inch- diameter round bars, fabricated from [**Type 304 stainless steel complying with ASTM A240, ASTM A276, or ASTM A666] [steel complying with ASTM A36 and hot-dip galvanized to comply with ASTM A123**].

Delete "Proprietary Acidic Cleaner" Paragraph below if cleaning is specified in Section 042000 "Unit Masonry." Before retaining, verify compatibility with surrounding masonry.

* + - * 1. 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.

Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

Diedrich Technologies, Inc.; a Hohmann & Barnard company.

EaCo Chem, Inc.

PROSOCO, Inc.

Approved equivalent.

* + - 1. MORTAR MIXES
				1. Comply with requirements in Section 042000 "Unit Masonry" for mortar mixes.

Retain paragraph above or first paragraph below.

* + - * 1. Do not use admixtures including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

Do not use calcium chloride in mortar or grout.

Retain one or more options in subparagraph below to indicate acceptable mortar types.

Use portland cement-lime, masonry cement, or mortar cement mortar unless otherwise indicated.

* + - * 1. Comply with ASTM C270, Proportion Specification.

Retain one mortar type in each of two subparagraphs below. The Cast Stone Institute recommends Type N; other types may be required by special circumstances.

For setting mortar, use [**Type S] [Type N**].

For pointing mortar, use [**Type N] [Type O**].

* + - * 1. 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**].

Retain first three subparagraphs below if retaining option in "Pigmented Mortar" Paragraph above. Percentages in first two subparagraphs are for pigments containing only metallic oxides. If using pigments containing carbon black, carbon black must be limited to 2 percent of portland cement by weight or 1 percent of masonry cement or mortar cement.

Pigments shall not exceed 10 percent of portland cement by weight.

Pigments shall not exceed 5 percent of [**masonry cement] [or] [mortar cement**] by weight.

Insert materials and proportions used for sample in first subparagraph below if known.

Mix to match Director’s Representative's sample.

Application: Use pigmented mortar for exposed mortar joints.

* + - * 1. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

Insert materials and proportions used for sample in first subparagraph below if known.

Mix to match Director’s Representative's sample.

Application: Use colored-aggregate mortar for exposed mortar joints.

* + - 1. SOURCE QUALITY CONTROL

Consider deleting this article if only a few units are required or if testing is considered unnecessary. Revise if Director’s Representative employs testing agency.

* + - * 1. Engage a qualified independent testing agency to sample and test cast-stone units according to ASTM C1364.

Delete subparagraph below if freeze-thaw resistance is not required. Some consider testing for freeze-thaw resistance unnecessary because compressive-strength and water-absorption requirements in ASTM C1364 tend to ensure a durable product. Freeze-thaw testing is expensive.

Include one test for resistance to freezing and thawing.

1. EXECUTION
	* + 1. EXAMINATION
				1. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
				2. Proceed with installation only after unsatisfactory conditions have been corrected.
			2. SETTING CAST STONE IN MORTAR

Delete first paragraph below if considered unnecessary or if Section 042000 "Unit Masonry" is not used.

* + - * 1. Install cast-stone units to comply with requirements in Section 042000 "Unit Masonry."

Retain applicable paragraphs remaining in this article, with or without paragraph above.

* + - * 1. 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.

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

Coordinate installation of cast stone with installation of flashing specified in other Sections.

* + - * 1. Wet joint surfaces thoroughly before applying mortar or setting in mortar.
				2. Set units in full bed of mortar with full head joints unless otherwise indicated.

Retain applicable subparagraphs below; delete those not applicable.

Set units with joints [**1/4 to 3/8 inch] [3/8 to 1/2 inch] <Insert dimension**> wide unless otherwise indicated.

Build anchors and ties into mortar joints as units are set.

Fill dowel holes and anchor slots with mortar.

Retain first subparagraph below for composite masonry.

Fill collar joints solid as units are set.

Build concealed flashing into mortar joints as units are set.

Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.

Keep joints at shelf angles open to receive sealant.

Retain first two paragraphs below unless cast stone is set in mortar without pointing.

* + - * 1. 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.
				2. 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.

Revise first paragraph below if another joint profile is required.

* + - * 1. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

Retain first two paragraphs below if joints are pointed with sealant.

* + - * 1. 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.
				2. Point joints with sealant to comply with applicable requirements in Section 079200 "Joint Sealants."

Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

Retain first paragraph below for movement joints whether or not cast stone is pointed with mortar or sealant.

* + - * 1. Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.

Keep joints free of mortar and other rigid materials.

Build in compressible foam-plastic joint fillers where indicated.

Form joint of width indicated, but not less than [**3/8 inch] [1/2 inch**].

Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."

* + - 1. SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS
				1. 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.

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

Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.

Cavities in first paragraph below are recommended, but local codes may require space to be grouted solid.

* + - * 1. 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.
				2. Fill anchor holes with sealant.

Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.

* + - * 1. 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.
				2. 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.

Form open joint of width indicated, but not less than [**3/8 inch] [1/2 inch**].

* + - * 1. Prime cast-stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
				2. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 079200 "Joint Sealants."
			1. INSTALLATION TOLERANCES

Delete this article if tolerances in Section 042000 "Unit Masonry" govern. Tolerances in "Variation from Plumb," "Variation from Level," "Variation in Joint Width," and "Variation in Plane between Adjacent Surfaces (Lipping)" paragraphs below are based on those included in Section 042000 "Unit Masonry." If retaining, revise to suit Project.

* + - * 1. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
				2. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
				3. 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.
				4. 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.
			1. ADJUSTING AND CLEANING
				1. 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 Director’s Representative.
				2. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.
				3. In-Progress Cleaning: Clean cast stone as work progresses.

Remove mortar fins and smears before tooling joints.

Remove excess sealant immediately, including spills, smears, and spatter.

Delete "In-Progress Cleaning" Paragraph above and "Final Cleaning" Paragraph below if installation and cleaning are specified in Section 042000 "Unit Masonry."

* + - * 1. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Director’s Representative's approval of sample cleaning before proceeding with cleaning of cast stone.

Delete first two subparagraphs below if no cleaners are allowed or specified in Part 2.

Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

Retain one of two subparagraphs below.

Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

Coordinate subparagraph below with products retained in Part 2. If high-pressure water cleaning or other methods are acceptable, revise subparagraph and insert applicable requirements.

Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 047200