**SECTION 042100**

 **STRUCTURAL BRICK MASONRY UNITS**

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| NOTE TO SPECIFIER:Editing Conventions:Coordinate requirements in the Specifications containing **indicated on the Drawings** with the Drawings.Verify that items in red are used on the project or are referred to the right section of the code.Work info contained herein into a broader masonry section 042000 Unit Masonry, or supplement this section with sections which include mortars and groutsThe information presented in this document is for general information only. It should not under any circumstances be relied upon for specific without independent review and evaluation by a licensed design professional familiar with its specific use and application. Anyone making use of this information does so at their own risk and assumes any and all liability resulting from such use. |

1. GENERAL
	1. SUMMARY
		1. Section Includes: Hollow Brick Masonry Units.
		2. Related Sections:
			1. Section 013119 - Project Meetings.
			2. Section 014000 - Quality Requirements
			3. Section 040513 – Masonry Mortaring [information may be combined in one broader scope masonry section]
			4. Section 040516 – Masonry Grouting [information may be combined in one broader scope masonry section]
			5. Section 040519 – Masonry Anchorage and Reinforcing [information may be combined in one broader scope masonry section]
			6. Section 071900 - Water Repellents.
			7. Section 079200 - Joint Sealants.
	2. REFERENCES
		1. American Society for Testing and Materials (ASTM):
			1. C 33 - Specification for Concrete Aggregates.
			2. C 67 - Test Methods of Sampling and Testing Brick and Structural Clay Tile.
			3. C 126 - Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
			4. C 216 - Specification for Facing Brick.
			5. C 270 - Specification for Mortar for Unit Masonry.
			6. C 476 – Grout for Masonry
			7. C 652 - Specification for Hollow Brick.
			8. C 1019 - Method of Sampling and Testing Grout.
		2. International Building Code (ICC) adopted addition
		3. Building Code Requirements (IBC/IRC/TMS 402) and Specification for Masonry Structures (TMS 602) current adopted addition.
		4. Most current editions of ASTM standards as cited herein.
	3. SUBMITTALS
		1. Product Data, and Evaluation Reports as required for installation.
		2. Shop Drawings: Include elevations of each wall indicating type and layout of units.
		3. Samples: Include samples of stretcher units in sufficient quantity to illustrate color range.
		4. Test Reports from an independent testing laboratory showing compliance with applicable specifications.
	4. QUALITY ASSURANCE
		1. Continuous Inspection:
			1. Employ a qualified masonry inspector for continuous inspection of the masonry work. Acceptance by a State or municipality having a program of examining and certifying masonry inspectors will be considered adequate qualifications. The masonry inspector shall be at the site during all masonry construction and perform the following duties:
				1. Review Drawings and Specifications and meet with the CONTRACTOR to discuss requirements before work commences.
				2. Before masonry work commences, CONTRACTOR and the Contractor's Quality Control Representative shall attend meeting with ENGINEER to review the requirements for surveillance and quality control of the masonry work.
				3. Check brand and type of cement, lime (if used), and source of sand.
				4. Ensure that foundation is clean, rough, and ready to receive units.
				5. Check reinforcing steel dowels for straightness, proper alignment, spacing, size, and length.
				6. Observe field proportioning of mortar. Visually check aggregate to determine uniformity of grading, cleanliness, and moisture.
				7. Ensure that joints are full of mortar and kept tight during work. Inspect grout cells to assure that fins will not interfere with grouting. Ensure that masons keep grout cells clean of mortar droppings and inspect to determine compliance.
				8. Continuously observe placing of grout.
				9. Perform or supervise performance of required sampling and testing.
			2. Keep complete record of inspections. Report daily to the Contractor's Quality Control Representative the progress of the masonry inspection.
		2. Mock-up:
			1. Prior to starting construction of masonry, construct minimum 4-foot square mock-up.
			2. Use accepted materials, containing each different kind and color of brick masonry units to illustrate wall design.
			3. Show color range, texture range, bond, mortar color, joint tooling, critical design details and quality of workmanship.
			4. Masonry construction may not proceed until the Architect/Engineer approves mock-up.
			5. When not accepted, construct another mock-up.
			6. When accepted, mock-up will be standard of comparison for remainder of masonry work.
			7. Upon completion and acceptance of Project, dispose of mock-ups in legal manner at offsite location.
		3. Pre-installation Conference: Conduct as specified in Section 013119.
		4. Masonry Prism Testing: Perform masonry prism testing in accordance with ASTM C1314 Standard Test Method for Compressive Strength of Masonry Prisms.
		5. Certification: Furnish manufacturer’s certification that clay brick units provided meet or exceed the requirements of this specification.
	5. DELIVERY, STORAGE, AND HANDLING
		1. Store masonry units above ground to prevent contamination by mud, dust or other materials likely to cause staining or other defects.
		2. Cover and protect masonry units from inclement weather to maintain quality control and physical requirements.
		3. Transport and handle brick masonry units as required to prevent discoloration, chipping, and breakage.
		4. Locate storage piles, stacks, and bins to protect materials from heavy traffic.
		5. Remove chipped, cracked, and otherwise defective units from jobsite upon discovery.
	6. PROJECT CONDITIONS
		1. Cold Weather Requirements:
			1. In accordance TMS 602 Section 1.8 C.
			2. Provide adequate equipment for heating masonry materials when air temperature is below 40 degrees Fahrenheit.
		2. Hot Weather Requirements:
			1. In accordance with TMS 602 Section 1.8 D.
			2. When ambient air temperature exceeds 100 degrees Fahrenheit, or when ambient air temperature exceeds 90 degrees Fahrenheit and wind velocity is greater than 8 miles per hour, implement hot weather protection procedures.
			3. Wet mortar board before loading and cover mortar to retard drying when not being used.
			4. Do not spread mortar beds more than 48 inches ahead of placing masonry units.
			5. Place masonry units within one minute of spreading mortar.
		3. Wetting of Brick: shall be required at the time of laying if the unit’s initial rate of absorption (IRA) exceeds 30 grams per 30 square inches per minute or 1 g/ 645mm2.
		4. Assess all preceding work prior to starting brick installation and confirm all such work is complete and ready to receive the masonry installation. Document all issues found unsuitable or not within project parameters (location, plumbness, etc.), that will impact brick installation. Report such found items to the general contractor or construction manager, as appropriate, and seek resolution prior to initiating work
	7. SEQUENCING AND SCHEDULING
		1. Because structural brick may impact the critical path of construction, the General Contractor should contact the brick supplier for availability and scheduling prior to selecting a mason contractor to assure adequate time for manufacturing.
2. PRODUCTS
	1. HOLLOW LOAD BEARING BRICK MASONRY UNITS
		1. Manufacturers:
			1. Interstate Brick: [www.interstatebrick.com](http://www.interstatebrick.come)
				1. Sales Representative:

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* + 1. Type: ASTM C 652, Grade SW, Type HBX [HBS] with minimum gross area compressive strength of 6000 psi.
		2. Surface Texture: Matte unless otherwise noted on drawings: (To be selected by Architect/Engineer from manufacturer’s full range of available textures.)
		3. Colors:
			1. Color as selected by Architect/Engineer from standard colors.
		4. Nominal Size: 8 inches wide x 4 inches high x 16 inches long, unless otherwise **indicated on the Drawings**.
		5. Special Sizes and Shapes: As required for window and door soldier coursing and custom sills where indicated, corners, bond beams, piers, lintels, control joints, and other special applications to minimize cutting.
1. EXECUTION
	1. PREPARATION
		1. Protect adjacent construction with appropriate means from mortar droppings and other effects of laying of brick masonry units.
		2. Thoroughly clean foundations of laitance, grease, oil, mud, dirt, mortar droppings, and other objectionable matter.
		3. Review brick material prior to installation and report any unsatisfactory units to the manufacturer. Set aside all units deemed unsatisfactory for further review by testing agency and/or brick manufacturer’s representative.
		4. Prepare mock-up wall utilizing materials, craftsmanship, and details intended to be representative of the project installation. Include interfacing elements and materials (windows, louvers, flashings, special detailing, weeps, vents, etc.) as directed. LSelect brick from multiple pallets or cubes to provide a uniform random pattern to the brick hues provided or to a specified blend pattern specified, when occurs. Lay brick in a pattern acceptable to the Architect. Seek and obtain approval of mock-up prior to project installation. Remove and replace mock-up material or craftsmanship identified as unacceptable until installation is approved, prior to main project installation.
	2. BRICK MASONRY UNITS
		1. Provide Level of Quality in accordance with ASTM C652 and C216.
		2. Review brick material prior to installation and report any units deemed unsatisfactory to the manufacturer. Set aside (do not discard or remove from site) all units deemed unsatisfactory for further assessment by testing agency and/or brick manufacturer’s authorized representative, as deemed mutually acceptable. immediately notify supplier if quantities that are set aside are projected to create a shortfall of useable units. Installation or units placed in service constitutes mason’s acceptance of, and responsibility for, the brick quality.
		3. Lay units in uniform and true courses, level, plumb, and without projections or offset of adjacent units.
		4. Select units from multiple (at least 3) pallets or cubes to blend hues to create a uniform random pattern when placed in service to avoid patches of light and dark brick. Install patterns of color as directed where a specific blend of colors is specified. In all cases lay brick in a pattern acceptable to the Architect.
		5. Lay units to preserve unobstructed vertical continuity of cells to be filled with grout or insulation.
		6. Protect cells intended to remain free of grout using grout stops, mortar dams, or by other means.
		7. Align vertical cells to be filled with grout to maintain clear, unobstructed continuous vertical cell measuring not less than 2 by 3 inches.
		8. Butter vertical head joints for thickness equal to face shell thickness of units, and shove joints tightly together so that mortar bonds to both masonry units in the head joints.
		9. Solidly fill joints from face of units to inside face of cells.
		10. Lay units to desired height with joints of uniform thickness within tolerances listed in TMS 602 Section 3.3 F.
		11. Bond shall be plumb throughout.
		12. Lay units to avoid formation of cracks when units are placed. Keep cells of units as free of mortar as possible as masonry wall height increases.
		13. Lay masonry plumb, true to line, planar, with courses level. Keep bond pattern plumb throughout. Lay masonry within the tolerances of TMS 602 Section 3.3 F.
		14. When positions of units shift after mortar has stiffened, bond is broken, or cracks are formed, relay units in new mortar.
		15. Remove mortar, mortar droppings, debris, and other obstructions and materials from inside of cell walls.
		16. Seal cleanouts after inspection and before grouting or placing insulation.
	3. LOOSE FILL INSULATION
		1. Lay brick masonry units protecting cells to receive grout from filling into those not intended to be grouted.

* + 1. Pour insulation into cells not intended to be grouted.
		2. Ensure that no insulation gets into cells which are to be filled with grout.
		3. Do not lay units more than 4 feet vertically ahead of units filled with loose insulation.
	1. MORTAR JOINTS
		1. Make joints straight, clean, smooth, and uniform in thickness.
		2. Pointing: Tool exposed joints, slightly concave, unless detailed otherwise. Strike concealed joints flush.
		3. Joint Thickness: Make vertical and horizontal joints as required to achieve nominal dimensions on drawings and within tolerances listed in TMS 602 Section 3.3 F.
		4. Where fresh masonry joins totally or partially set masonry, clean and roughen set masonry before laying new units.
	2. BOND PATTERN
		1. Lay brick masonry units in running bond pattern, unless otherwise **indicated on the Drawings**.
	3. GROUTING AND REINFORCEMENT
		1. Provide splices in vertical and horizontal reinforcing as outlined in TMS 402 Section 6.1.6. Hold vertical reinforcing bars in position at top and bottom and at intervals not exceeding 200 bar diameters. Use steel wire bar positioners to position bars and tie reinforcing bars to dowels with wire ties.
		2. Obtain acceptance of reinforcement placement before grouting.
		3. Fill all spaces and cells containing reinforcing or intended to be grouted solidly with grout.
		4. Low-lift Grouting:
			1. Grout pours of 12 in. or less
				1. Consolidate grout pours of 12 in. or less in height by mechanical vibration or puddling.
			2. Grout pours of 12 in. to 5 ft. 4 in.
				1. Construct the masonry wall up to 5 ft. 4 in.
				2. For partially grouted walls, use expanded metal mesh or other grout stop materials that would not interfere with the bond to confine grout to the cells to be grouted.
				3. Grout the wall 1½ in. below of the top of the constructed section of the wall, where wall continues in subsequent sequences. Fill with grout to top of units at the top of wall unless otherwise shown or detailed.
				4. Consolidate the grout using mechanical vibration and reconsolidate after initial water loss and settlement.
				5. Top off grout after reconsolidation at top of wall, to fill to top of units unless shown or detailed otherwise.
		5. High-lift Grouting:
			1. If grouting is accomplished by the high-lift method the masonry shall be allowed to cure for at least 4 hours before grouting.
			2. In double wythe construction, vertical grout barriers shall be built across the grout space to the height of the grout lift.
			3. Grout barriers shall not be spaced more than 30 feet apart. Grout shall be placed in lifts not to exceed 12 ft. 8 in. If bond beams occur within the grout pour, limit the grout lift to the bottom of the lowest bond beam that is more than 5 ft. 4 in. above the bottom of the lift.
			4. Each lift shall be allowed to set for 10 minutes after initial consolidation of grout before successive lift is placed.
			5. The full height of each section of wall shall be grouted in one day.
		6. Grout in cells shall have full contact with surface of concrete footings.
		7. When grouting stops for one hour or longer, form horizontal construction joints by stopping grout placement 1½ inches below top of uppermost unit containing grout.
		8. After placement, consolidate grout using mechanical immersion vibrators designed for consolidating grout.
		9. Placement:
			1. Use a hand bucket, concrete hopper, or grout pump.
			2. Place grout in final position within 1½ hours after mixing.
			3. Place grout so as to completely fill the grout spaces without segregation of the aggregates.
			4. Do not insert vibrators into lower grout placements that are in a semi-solidified state.
		10. For units with small cells, as are found in specialty perforated screen wall brick, use fine-self consolidation grout.
	4. BOND BEAMS
		1. Place horizontal reinforcement and solidly grout bond beam units in place.
		2. Provide wire mesh at openings in bottom of bond beams to support grout where walls are not grouted solid.
	5. CUTTING BRICK MASONRY UNITS

When possible, use full units of the proper size in lieu of cut units. Cut units as required to form chases, openings, for anchorage, and for other appurtenances.

* + 1. Cut and fit units with power-driven carborundum or diamond disc blade saw.
		2. Avoid using units that are cut to less than half of a full unit by adjusting layout or combining with partial length units without impacting the reinforcing layout. Reinforcing should be placed in full size sells, not truncated cells due to cutting units.
	1. CONTROL JOINTS / EXPANSION JOINTS
		1. Provide in masonry walls where **indicated on the Drawings**.
		2. Make full height and continuous in appearance.
		3. Run bond beams and bond beam reinforcing bars continuously through control joints. Stop horizontal reinforcing at expansion joints
		4. Insert control joint filler in joints as wall is constructed.
		5. Insert 50% (or higher) compressible neoprene expansion joint material in expansion joints.
		6. Apply sealant as specified in Section 079000.
	2. OPENINGS AND LINTELS
		1. Place horizontal reinforcement in fully grouted bond beam units.
		2. Use lintel units where underside of lintel will be exposed.
		3. Provide minimum of 8-inch bearing at each end of lintel.
		4. Embed reinforcing bars minimum 24 inches or 40 bar diameters, whichever is longer, into wall past edges of openings or as **indicated on the Drawings**.
			1. At corners, provide 90-degree bend with equivalent total embedment.
	3. STEEL DOOR FRAMES
		1. Anchor and fully grout jambs and head of steel door frames connected to brick unit masonry.
		2. Fill frames with grout as each 2 feet of brick unit masonry is laid.
	4. BEARING PLATES
		1. Provide minimum of 12 inches of grouted brick unit masonry below steel bearing plates and beams bearing on masonry walls.
	5. ANCHOR BOLTS
		1. Hold anchor bolts in place with template during grouting to assure precise alignment.
		2. Do not cut or ream members being anchored or use other means to accommodate misaligned anchor bolts in roof deck support angles.
		3. Provide minimum 6-inch-wide grouted brick unit masonry entirely around anchor bolts and other attachment devices.
	6. ENCLOSURES
		1. Where brick masonry units enclose conduit, pipes, stacks, ducts, and similar items, construct chases, cavities, and similar spaces as required, whether or not such spaces are **indicated on the Drawings**.
		2. Point openings around flush mounted electrical outlet boxes with mortar, including flush joints above boxes.
		3. Do not cover enclosures until inspected and when appropriate, tested.
	7. OTHER EMBEDDED ITEMS
		1. Build in wall plugs, accessories, flashings, pipe sleeves, and other items required to be built-in as the masonry work progresses.
	8. PATCHING
		1. Patch exposed brick masonry units at completion of the Work and in such manner that patching will be indistinguishable from similar surroundings and adjoining construction.
	9. MISCELLANEOUS
		1. Build in required items, such as anchors, flashings, sleeves, frames, structural steel, lintels, anchor bolts, and metal fabrications, as required for complete installation.
	10. WATER REPELLENT - BREATHABLE
		1. Apply water repellent as specified in Section 071900.
	11. FIELD QUALITY CONTROL
		1. Have minimum 3 masonry units of each type proposed for Project tested in accordance with ASTM C 67 to verify conformance with Specifications.
		2. Tests shall include gross compressive strength, severe weather water absorption requirements (24-hour cold water absorption, 5-hour boiling water absorption, and Saturation Coefficient (if required)), Initial Rate of Absorption and Unit Weight.
		3. Perform compressive strengths on structural units by cutting the units in half lengthwise and into rectangular unit without any flanges and cap according to ASTM C67 prior to testing.
		4. Employ and pay acceptable independent testing laboratory to perform testing.
	12. CLEANING
		1. Use the least aggressive cleaning methods and products that will produce the desired result starting with ‘bucket and brush’ using the least caustic commercially prepared cleaning solutions as per the masonry unit manufacturer’s recommendations
			1. Select an inconspicuous location to perform a test cleaning, and seek approval prior to mass cleaning .
		2. Exercise extreme care to prevent mortar splotches.
		3. Do not attach construction supports to masonry walls.
		4. Wash off brick scum, mortar spills, and grout spills before scum, mortar, and grout set.
		5. Remove grout stains from walls.
		6. Clean exposed masonry. Remove scaffolding and equipment. Dispose of debris, refuse, and surplus material offsite legally.
		7. Correct efflorescence on exposed surfaces with commercially prepared cleaning solution acceptable to masonry unit manufacturer.
			1. Apply only commercially produced and packaged cleaning solution from new unopened containers in accordance with cleaning solution manufacturer's printed instructions.
			2. Do not use unbuffered acids as cleaning solution.
			3. Do not use abrasive blast cleaning equipment.
			4. Do not use high pressure water – pressure in excess of 400 psi
	13. FORMS AND SHORES
		1. Where required, construct forms to the shapes **indicated on the Drawings**.
			1. Construct forms sufficiently rigid to prevent deflection which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout.
			2. Do not remove supporting forms or shores until the supported masonry has acquired sufficient strength to support safely its weight and any construction loads to which it may be subjected.
				1. Wait at least 16 hours after grouting masonry columns or walls before applying uniform loads.
				2. Wait at least 72 hours before applying concentrated loads.
	14. PROTECTION
		1. Provide temporary protection for exposed masonry corners subject to damage.
		2. Bracing:
			1. Adequately brace masonry walls over 8 feet in height to prevent overturning and to prevent collapse unless wall is adequately supported by permanent supporting elements, so wall will not overturn or collapse.
			2. Keep bracing in place until permanent supporting elements of structure are in place.
		3. Limited Access Zone:
			1. Establish limited access zone prior to start of masonry wall construction.
			2. Zone shall be immediately adjacent to wall and equal to height of wall to be constructed plus 4 feet by entire length of wall on non-scaffolded side of wall.
			3. Limit access to zone to workers actively engaged in constructing wall. Do not permit other persons to enter zone.
			4. Keep zone in place until wall is adequately supported or braced by permanent supporting elements to prevent overturning and collapse.
	15. GROUTING EQUIPMENT
		1. Grout Pumps:
			1. Do not pump grout through aluminum tubes.
			2. Operate pumps to produce a continuous stream of grout without air pockets.
			3. Upon completion of each days pumping, eject grout from pipeline without contamination or segregation of the grout.
				1. Remove waste materials and debris from the equipment.
				2. Dispose of waste materials, debris, and all flushing water outside the masonry.
		2. Vibrators:
			1. Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout.
			2. Maintain at least one spare vibrator, at the site at all times.
			3. Apply vibrators at uniformly spaced points not further apart than the visible effectiveness of the machine.
			4. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation.

 END OF SECTION