

SECTION 04 20 00 - UNIT MASONRY

1.1 SECTION INCLUDES

- A. Qualitative requirements for unit masonry assemblies.
 - 1. Masonry mortar and mixing masonry assemblies.
 - 2. Masonry grout and mixing masonry grout.
 - 3. Masonry anchorage and reinforcement devices.
 - 4. Masonry accessories.
 - 5. Manufactured concrete masonry units; both loadbearing and nonloadbearing and intended for use in unit masonry assemblies with mortar.
 - a. Concrete masonry units
 - b. Sound absorbing concrete masonry units
 - c. Sound diffusing concrete masonry units
 - d. Decorative concrete masonry units
 - 6. Manufactured clay masonry units; both loadbearing and non-loadbearing.
 - a. Brick
 - b. Structural-Clay Facing Tile

1.2 QUALITY ASSURANCE

- A. Masonry Standard: Comply with ACI 530.1 / ASCE 6 / TMS 602, unless otherwise noted.
 - a. Provide a 2-inch minimum clear air-space.
- B. Protection of Masonry: During erection, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 - 2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.
- C. Mockups: Build mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials, execution, and aesthetic effect. Observation and evaluation of the mock-up shall be by the masonry installer, general trades contractor, A/E, CM, OSFC-PA, Commissioning Agent, window installer, testing agency, and air barrier certifier.
 - 1. Build mock-up of typical wall area(s) as shown on Drawings including Movement Control Joints (Sealant Filled) 1'4" (minimum length), Air Barrier, Blocking for Window, Horizontal and Vertical Reinforcing Shelf Angles and Supports, Bond Beams and Lintels, Brick Ties and Anchors Flashing, End Dams, Weeps and Vents, Cavity Drainage Material (if required), Window Head, Sill and Jamb Details.
 - a. Include a sealant-filled joint at least 16 inches long in each exterior wall mock-up.
 - b. Include lower corner of window opening at upper corner of exterior wall mock-up. Make opening approximately 12 inches wide by 16 inches high.
 - c. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mock-up approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
 - d. Mock-up shall include a complete through-wall penetration by each trade

contractor including fire protection, plumbing, mechanical and electrical.

2. The window contractor shall provide and install in the mock-up wall a sample window of the type and profile used in the classrooms. (leaving portions of the perimeter exposed for inspection of the fasteners and air barrier transition to the masonry; some portions to receive final caulking inside and out)
3. Prior to starting general masonry cleaning, prepare mock-up for cleaning using the same cleaning materials and methods proposed for the Work.
4. Protect accepted mock-ups from the elements with weather-resistant membrane.
5. The construction of the mock-up shall be photographed or videotaped by the masonry contractor to be part of a presentation for groups of trades people as they join the project work force.
6. Refer to OSDM page 9101-5 for additional information.

1.3 CONCRETE MASONRY UNITS

- A. Concrete Masonry Units (CMU): Light weight, medium weight, or normal weight.
- B. Concrete Building Brick
- C. Sound Absorbing Concrete Masonry Unit (SACMU)
 1. Face sizes, unit weights, and finish textures shall match those of required regular concrete masonry units.
 2. Provide flared slots, metal septa, and incombustible fibrous cavity fillers of the following:
 - a. 8 inch (53 STC) and 12 inch (56 STC) thick walls.
- D. Sound Diffusing Concrete Masonry Units (SDCMU)
 1. Aggregate shall meet ASTM C90 and ASTM C129.
 2. Fiberglass inserts shall be installed at the block plant to ensure proper positioning.
- E. Decorative Concrete Masonry Units: Light weight, medium weight, or normal weight.
 1. Finish: Exposed faces of the following general description matching color, pattern, and texture of Architect's samples:
 - a. Normal-weight aggregate, ground finish (not acceptable if used as a comparison for LFI calculations)
 - b. Normal-weight aggregate, split-face finish
 - c. Normal-weight aggregate, split-ribbed finish
 - d. Normal-weight aggregate, standard finish, scored vertically so units laid in running bond appear as square units laid in stack bond
 - e. Normal-weight aggregate, standard finish, triple scored vertically so units laid in running bond appear as vertical units laid in stacked bond
- F. Prefaced Concrete Masonry Units: Light weight hollow or solid units with smooth resinous facing.
- G. Integral Water Repellent: Provide units made with liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength.

1.4 BRICK

- A. Face Brick: ASTM C 216
 1. Grade and Unit Compressive Strength: Provide units with grade indicated below:
 - a. Grade: SW., Type FBX or FBS
- B. Building (Common) Brick: ASTM C 62 and as follows:

1. Grade and Unit Compressive Strength: Provide units with grade indicated below:
 - a. Grade: MW or SW.
2. Application: Use where brick is indicated for concealed locations.

1.5 STRUCTURAL-CLAY FACING TILE

- A. Glazed Structural – Clay Facing Tile: ASTM C126, Grade S or SS.
- B. Unglazed Structural – Clay Facing Tile: ASTM C212, Type FTX or FTS, Standard class.

1.6 STONE

- A. Stone Trim Units: Limestone.

1.7 MORTAR MATERIALS

- A. Portland Cement: ASTM C150, Type I or III, non-staining, without air entrainment and of natural color or white, to produce the required color of mortar or grout.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C150, Type I or III, and hydrated lime complying with ASTM C207.
- D. Masonry Cement: ASTM C91. (optional)
- E. Mortar Cement: ASTM C1329. (optional)
- F. Aggregates: ASTM C144, except for joints less than 1/4 inch, use aggregate graded with 100 percent passing the No. 16 sieve.
- G. Water: Potable.
- H. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes.
- I. Epoxy Pointing Mortar:
- J. Integral Water Repellent Admixture (Exterior): An integral liquid polymeric admixture intended for use with concrete masonry units, containing integral water repellent.

1.8 MORTAR MIXES

- A. Do not use calcium chloride in mortar or grout.

TABLE A1 - Guide for the Selection of Masonry Mortars* (Modified)

Location	Building Segment	Mortar Type
Exterior, above grade	loadbearing wall	S
	nonloadbearing wall, parapet wall, chimney and veneer wall	N
Exterior, at or below grade	foundation wall, retaining wall, manholes, sewers, pavements, walks and patios	S
Interior	loadbearing wall	N
	nonloadbearing partitions	N

* This table does not provide for many specialized mortar uses, such as reinforced masonry, acid-resistant mortars and fire box mortar.

1.9 GROUT MATERIALS

- A. Portland Cement: ASTM C150, Type I.
- B. Fine Aggregates: ASTM C404, clean, sharp, natural sand.
- C. Coarse Aggregates: ASTM C404. Maximum aggregate size 3/4 inch.
- D. Water: Potable.

- E. Fly ash: May be substituted for up to 20 percent of the total cementitious materials in the grout mix.

1.10 GROUT MIXES

- A. Grout mixes shall be plant mix or factory blended (dry mix with water added at the site).
- B. Do not lower the freezing point of grout by use of admixtures or anti-freeze agents.
- C. Do not use calcium chloride in grout.
- D. Grout for Unit Masonry: Comply with ASTM C476.
 - 1. Fine Grout: 2500 psi average compressive strength at 28 days for 6 inches and smaller hollow concrete masonry units and between 2 wythes of masonry where space is less than 2 inches in width.
 - 2. Coarse Grout: 2500 psi average compressive strength at 28 days for 8 inches and larger hollow concrete masonry units and between 2 wythes of masonry where space is 2 inches in width or wider.

1.11 CONTINUOUS WIRE REINFORCING AND TIES FOR MASONRY

- A. Masonry Joint Reinforcement.
- B. For single wythe and composite masonry, provide ladder type joint reinforcing.
- C. For multi-wythe masonry, provide as follows:
 - 1. When both wythes are to be constructed simultaneously:
 - a. Provide ladder type joint reinforcing.
 - 2. When each wythe is to be constructed separately:
 - a. Provide adjustable ladder type joint reinforcing fabricated with two steel side rods, cross rods, eyes and double legged pintles. Longitudinal rods shall be spaced for each face shell of CMU; eye sections shall extend into walls cavity, and pintles shall rest upon bed joints of face brick.

1.12 ANCHORING DEVICES FOR MASONRY

- A. Rigid Anchors: Where masonry is to be rigidly anchored to structural steel beams, provide galvanized steel straps, bars or rods welded to the steel beam and extending into the mortar joint.
- B. Flexible Anchors: Where masonry is to be laterally supported from structural steel, while permitting only vertical movement or both vertical and horizontal movement, provide adjustable anchors.

1.13 REINFORCING BARS

- A. Uncoated Steel Reinforcing Bars

1.14 FLASHING

- A. Embedded Flashing Materials
 - 1. Provide one of the following types of flashing materials:
 - a. Copper-Fabric Laminate.
 - b. Rubber Asphalt Sheet Flashing.
 - c. Elastomeric Thermoplastic Flashing.
 - d. EPDM Flashing.
 - 2. **Stainless** Sheet Metal Drip Edge: Fabricated from stainless steel with hemmed edge.

- a. Application: Where drip edge is required per recommendations of NCMA-TEK 19-4, and at all through wall flashings.
- b. Embedded flashing materials should not be used for drip edges.

1.15 INSULATION

- A. Insulation: Provide insulation as required to meet or exceed thermal performance required or modeled by ASHRAE Standard 90.1.
 1. Primary insulation shall be one of the following:
 - a. Extruded-Polystyrene Board Insulation: ASTM C578, Type IV.
 - b. Closed-cell polyurethane foam insulation.
 - c. Closed-cell polyisocyanurate foam core insulation: ASTM C1289, Type I or II, Class 1 or 2, Grade 2 (20 psi).
 - d. Foil faced closed cell rigid foam insulation.
 2. Secondary, if required for thermal resistance:
 - a. Loose-Granular Fill Insulation.
 - b. Molded-Polystyrene Insulation Units.
 - c. Polyurethane Spray Foam (Foamed-in-Place Insulation).

1.16 RELATED MATERIALS

- A. Additional accessories, including compressible fillers, preformed control-joint gaskets, bond breaker strips, weep/vent products, cavity drainage material, reinforcing bar positioners and cleaners may be used at the discretion of the Project Designer to provide a complete weathertight masonry assembly.

1.17 CONTROL JOINTS – EMPIRICAL METHOD

- A. Concrete Masonry Units

TABLE 1
CONTROL JOINT SPACING FOR RECOMMENDED ABOVE GRADE EXPOSED
CONCRETE MASONRY WALLS (NCMA TEK-10-2B)

Distance between joints should not exceed the lesser of:	
Length to height ratio	or ft (m)
1-1/2	25 (7.62)

Notes:

1. Table values are based on the use of horizontal reinforcement having an equivalent area of not less than 0.025 in.²/ft. (52.9 mm²/m) of height to keep unplanned cracks closed.
2. Criteria apply to all concrete masonry units.
3. This criteria is based on experience over a wide geographical area. Control joint spacing should be adjusted up or down where local experience justifies but no farther than 25 ft. (7.62 m).
 - a. Where concrete masonry is used as backup of other materials:
 - 1) Extend control joints through facing if it is rigidly bonded (masonry bond).
 - 2) Control joint need not extend through facing when bond is flexible (metal ties).
 - b. Provide a horizontal slip plane where reinforced lintel beam terminates at a control joint. Provide horizontal slip plane at junction of roof and load-bearing masonry terminating at a control joint.

- B. Expansion Joints in Brick: Provide in accordance with BIA Technical Note No. 18B.

1.18 FLASHING AND WEEP HOLES

- A. General: Installed embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
1. Install concealed through-wall flashing in accordance with SMACNA "Architectural Sheet Metal Manual" Chapter 4 Flashing and with NCMA TEK Bulletins 19-4 and 19-5 details to ensure water resistant masonry construction.
 2. Installed preformed corners and end dams, under flexible flashing membrane, bedded in sealant (as approved by manufacturer of preformed corner, end dams, and flexible flashing for compatibility) in appropriate locations along wall.
 3. **Weep/Cavity vent cellular plastic or polyethylene mesh.**

1.19 SOURCE QUALITY CONTROL

- A. Masonry Contractor shall water test cavity to verify all water is draining to the exterior through the weeps before continuing with exterior wythe before capping wall.
1. Contractor shall perform tests in the presence of CM, A/E, testing lab representative, and General Contractor.
 - a. Do not proceed more than 3 veneer courses above flashing without testing, observation, and picture documentation by testing lab representative.
 2. Contractor shall hold water hose and with standard water pressure force water into the cavity at a cell vent so water can be observed coming out adjacent weeps for a period of at least 5 minutes. Contractor shall continue down the wall to the next cell vent where a weep did not indicate water wicking out and continue this process until the entire length of flashing is tested.
 3. Where water is observed inside the building or outside the building away from the weeps, masonry units shall be removed and flashing re-inspected and repaired.
 4. Water test shall be re-performed where flashing was repaired.

LEED SUGGESTIONS

- 2.1 Masonry normally generates large volumes of construction waste. However, masonry is clean waste and is, therefore, easily recycled as fill material. **Where appropriate, reuse masonry waste as a fill material.**

DESIGN CONSIDERATIONS

- 3.1 Flashing: Through-wall flashing and weep holes are detailed and installed in exterior masonry wall construction to collect and divert moisture to the outside of the wall that penetrates the exterior veneer. Through-wall flashing must be provided at the base of the wall, at roof and wall intersections, and at the top of parapets. Flashing is also needed over and under door and window openings, at shelf angles, and at other horizontal discontinuities in the cavity.

- A. One non-ideal design issue that has surfaced is when the top of the roofing counter-flashing is not in the same joint as the bottom of the through-wall flashing. This causes some masonry to be unprotected. Since all masonry is permeable to water, water permeating this unprotected masonry can possibly enter the building. Ideally, the design would provide the through-wall flashing drip edge and the top of the roof counter-flashing in the same joint, thereby leaving no masonry wall area unprotected.
- B. Flashing details that should be included to avoid construction deficiencies include:
 1. Roof-wall flashing integration along sloped roofs.
 2. Stepped counter-flashing along sloped roof-wall intersections.
 3. Stepped roof-wall flashing and counter-flashing where the elevation of a flat roof changes.
 4. Flashing integration where parapets intersect with walls.
 5. End dams.

3.2 Weeps or Vents:

- A. Weeps or vents installed at the top of walls, under window sills, etc. can aid in the venting of the cavity if properly installed and detailed and should be considered.

3.3 Penetrations of joists, beams, etc.:

- A. Joists, beams and other items that penetrate the masonry wall should be sealed completely with grout on both sides of the wall to prevent rotation and to ensure that the cavity remains completely separated from the interior of the wall and building.

END OF SECTION

Table 1 – Calculated STC Ratings for Concrete Masonry Walls (ref. 1)

Nominal Unit thickness, In.(mm) ^b	Density, pcf (kg/m ³)	STC ^a			
		Hollow unit	Grout-filled unit	Sand-filled unit	Solid unit
4 (100)	85 (1,362)	43	46 ^c	45	45
	95 (1,522)	44	46 ^c	45	45
	105 (1,682)	44	46 ^c	46	46
	115 (1,842)	44	47 ^c	46	46
	125 (2,002)	45	47 ^c	46	47
6 (150)	85 (1,362)	44	49	47	47
	95 (1,522)	44	50	48	48
	105 (1,682)	45	50	48	49
	115 (1,842)	45	51	49	50
	125 (2,002)	46	51	49	51
8 (200)	85 (1,362)	45	53	50	50
	95 (1,522)	46	53	51	51
	105 (1,682)	46	54	51	52
	115 (1,842)	47	55	52	53
	125 (2,002)	47	55	52	54
10 (250)	85 (1,362)	46	56	53	53
	95 (1,522)	47	57	53	54
	105 (1,682)	48	58	54	55
	115 (1,842)	48	58	55	57
	125 (2,002)	49	59	56	58
12 (300)	85 (1,362)	47	60	56	59
	95 (1,522)	48	61	56	57
	105 (1,682)	49	62	57	59
	115 (1,842)	49	62	58	60
	125 (2,002)	50	63	59	62
	135 (2,162)	51	64	59	63

^a Based on: grout density of 140 lb/ft³ (2,243 kg/m³); sand density of 90 lb/ft³(1,442 kg/m³); unit percentage solid from mold manufacturer's literature for typical units (4-in.(100-mm) 73.8% solid, 6-in.(150-mm) 55.0% solid, 8-in.(200-mm) 53.0% solid, 10-in.(250-mm) 51.7% solid, 12-in. (300-mm) 48.7% solid). STC values for grout-filled and sand-filled units assume the fill materials completely occupy all voids in and around the units. STC values for solid units are based on all mortar joints solidly filled with mortar.

^b Metric dimensions reflect equivalent metric unit sizes as opposed to direct SI conversions. Therefore, STC ratings of these hard metric units may be slightly different from the ratings listed here.

^c Because of small core size and the resulting difficulty consolidating grout, these units are rarely grouted.