

SECTION 04 20 00  
UNIT MASONRY

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies requirements for construction of masonry unit walls.

**1.2 RELATED WORK**

A. Mortars and grouts: Section 04 05 13, MASONRY MORTARING, Section 04 05 16, MASONRY GROUTING.

B. Sealants and sealant installation: Section 07 92 00, JOINT SEALANTS.

**1.3 SUBMITTALS**

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Samples:

1. Concrete masonry units, when exposed in finish work.

3. Anchors, and ties, one each and joint reinforcing 1200 mm (48 inches) long.

C. Shop Drawings:

1. Special masonry shapes.

2. Drawings, showing reinforcement, applicable dimensions and methods of lintel masonry and reinforcing masonry for embedment of anchors.

3. Shop Drawings: Submit shop drawings for fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.

D. Certificates:

1. Certificates signed by manufacturer, including name and address of contractor, project location, and the quantity, and date or dates of shipment of delivery to which certificate applies.

2. Indicating that the following items meet specification requirements:  
a. Solid and load-bearing concrete masonry units, including fire-resistant rated units.

3. Testing laboratories facilities and qualifications of its principals and key personnel to perform tests specified.

E. Laboratory Test Reports:

1. Fire rated block.

F. Manufacturer's Literature and Data:

1. Anchors, ties, and reinforcement.
2. Reinforcing bars.

**1.4 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
- A951-06.....Steel Wire for Masonry Joint Reinforcement.
  - A615/A615M-09.....Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
  - A675/A675M-03 (R2009)....Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties C34-03 Structural Clay Load-Bearing Wall Tile
  - C55-09.....Concrete Building Brick
  - C56-10.....Structural Clay Non-Load-Bearing Tile
  - C62-10.....Building Brick (Solid Masonry Units Made From Clay or Shale)
  - C67-09.....Sampling and Testing Brick and Structural Clay Tile
  - C90-11.....Load-Bearing Concrete Masonry Units
  - C126-10.....Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units
  - C216-10.....Facing Brick (Solid Masonry Units Made From Clay or Shale)
  - C476-10.....Standard Specification for Grout for Masonry
  - C612-10.....Mineral Fiber Block and Board Thermal Insulation
  - C744-11.....Prefaced Concrete and Calcium Silicate Masonry Units.
  - D1056-07.....Flexible Cellular Materials - Sponge or Expanded Rubber
  - D2000-08.....Rubber Products in Automotive Applications
  - D2240-05 (R2010).....Rubber Property - Durometer Hardness
  - D3574-08.....Flexible Cellular Materials-Slab, Bonded, and Molded Urethane Foams
  - F1667-11.....Fasteners: Nails, Spikes and Staples
- C. Masonry Industry Council:  
Hot and Cold Weather Masonry Construction Manual-98 (R2000).
- D. American Welding Society (AWS):

- D1.4-11 Structural Welding Code - Reinforcing Steel.
- E. Federal Specifications (FS):
  - FF-S-107C-00.....Screws, Tapping and Drive
- F. Brick Industry Association - Technical Notes on Brick Construction (BIA):
  - 11-2001.....Guide Specifications for Brick Masonry, Part I
  - 11A-1988.....Guide Specifications for Brick Masonry, Part II
  - 11B-1988.....Guide Specifications for Brick Masonry, Part III  
Execution
  - 11C-1998.....Guide Specification for Brick Masonry Engineered  
Brick Masonry, Part IV
  - 11D-1988.....Guide Specifications for Brick Masonry  
Engineered Brick Masonry, Part IV continued
- G. Masonry Standards Joint Committee; Specifications for Masonry Structures  
TMS 602-08/ACI 530.1-08/ASCE 6-08 (2008 MSJC Book Version TMS-0402-08).

**PART 2 - PRODUCTS**

**2.1 CONCRETE MASONRY UNITS**

- A. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
  - 1. Unit Weight: Normal weight.
  - 2. Fire rated units for fire rated partitions.
  - 3. Sizes: Modular. 6" x 8" x 16"
  - 4. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.
  - 5. Use bullnose concrete masonry units at corners exposed in finished work with 25 mm (one inch) minimum radius rounded vertical exterior corners (bullnose units).

**2.2 ANCHORS, TIES, AND REINFORCEMENT**

- A. Steel Reinforcing Bars: ASTM A615M, deformed bars, grade as shown.
- B. Joint Reinforcement:
  - 1. Form from wire complying with ASTM A951.
  - 2. Galvanized after fabrication.
  - 3. Width of joint reinforcement 40 mm (0.16 inches) less than nominal width of masonry wall or partition.
  - 4. Cross wires welded to longitudinal wires.
  - 5. Joint reinforcement at least 3000 mm (10 feet) in length.
  - 6. Joint reinforcement in rolls is not acceptable.
  - 7. Joint reinforcement that is crimped to form drip is not acceptable.

8. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.
  9. Ladder Design:
    - a. Longitudinal wires deformed 5 mm (0.20 inch) diameter wire.
    - b. Cross wires 4 mm (0.16 inch) diameter.
  10. Trussed Design:
    - a. Longitudinal and cross wires not less than 4 mm (0.16 inch nominal) diameter.
    - b. Longitudinal wires deformed.
- C. Ridge Wall Anchors:
1. Form from galvanized steel not less than 25 mm (1 inch) wide by 5 mm (3/16 inch) thick by 600 mm (24 inches) long, plus 50 mm (2 inch) bends.
  2. Other lengths as shown.

### **2.3 PREFORMED COMPRESSIBLE JOINT FILLER**

- A. Thickness and depth to fill the joint as specified.
- B. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.
- C. Non-Combustible Type: ASTM C612, Class 5, 1800 degrees F.

### **2.4 ACCESSORIES**

- A. Masonry Cleaner:
1. Detergent type cleaner selected for each type masonry used.
  2. Acid cleaners are not acceptable.
  3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.
- B. Fasteners:
1. Concrete Nails: ASTM F1667, Type I, Style 11, 19 mm (3/4 inch) minimum length.
  2. Masonry Nails: ASTM F1667, Type I, Style 17, 19 mm (3/4 inch) minimum length.
  3. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting.

## **PART 3 - EXECUTION**

### **3.1 JOB CONDITIONS**

- A. Protection:
1. Cover tops of walls with nonstaining waterproof covering, when work is not in progress. Secure to prevent wind blow off.
  2. On new work protect base of wall from mud, dirt, mortar droppings, and other materials that will stain face, until final landscaping or other site work is completed.
- B. Cold Weather Protection:

1. Masonry may be laid in freezing weather when methods of protection are utilized.
2. Comply with MSJC and "Hot and Cold Weather Masonry Construction Manual".

### **3.2 CONSTRUCTION TOLERANCES**

- A. Lay masonry units plumb, level and true to line within the tolerances as per MSJC requirements and as follows:
- B. Maximum variation from plumb:
  1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
  2. In 6000 mm (20 feet) - 10 mm (3/8 inch).
  3. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).
- C. Maximum variation from level:
  1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
  2. In 12 000 mm (40 feet) or more - 13 mm (1/2 inch).
- D. Maximum variation from linear building lines:
  1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
  2. In 12 000 mm (40 feet) or more - 19 mm (3/4 inch).
- E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:
  1. Minus 6 mm (1/4 inch).
  2. Plus 13 mm (1/2 inch).
- F. Maximum variation in prepared opening dimensions:
  1. Accurate to minus 0 mm (0 inch).
  2. Plus 6 mm (1/4 inch).

### **3.3 INSTALLATION GENERAL**

- A. Keep finish work free from mortar smears or spatters, and leave neat and clean.
- B. Anchor masonry as specified in Paragraph, ANCHORAGE.
- C. Wall Openings:
  1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
  2. If items are not available when walls are built, prepare openings for subsequent installation.
- D. Tooling Joints:
  1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
  2. Tool while mortar is soft enough to be compressed into joints and not raked out.

3. Tool Exposed interior joints in finish work concave unless specified otherwise.

E. Partition Height:

1. Extend following partitions to overhead construction.
  - a. Where noted smoke partitions, FHP (full height partition), and FP (fire partition) and smoke partitions (SP) on drawings.
  - b. Both walls at expansion joints.
  - c. Corridor walls.
  - d. Walls at stairway and stair halls, elevators, dumbwaiters, trash and laundry chute shafts, and other vertical shafts.
  - e. Reinforced masonry partitions

F. Lintels:

1. Openings 1025 mm (3 feet 4 inches) wide to 1600 mm (5 feet 4 inches) wide with no structural steel lintel or frames, require a lintel formed of concrete masonry lintel or bond beam units filled with grout per ASTM C476 and reinforced with 1- #15m (1-#5) rod top and bottom for each 100 mm (4 inches) of nominal thickness unless shown otherwise.
2. Use steel lintels, where no other lintels are used unless shown otherwise.
3. Doors having overhead concealed door closers require a steel lintel, and a pocket for closer box.
4. Length for minimum bearing of 100 mm (4 inches) at ends.

G. Wall, Furring, and Partition Units:

1. Lay out field units to provide for running bond of walls and partitions, with vertical joints in second course centering on first course units unless specified otherwise.
2. Align head joints of alternate vertical courses.
3. At sides of openings, balance head joints in each course on vertical center lines of openings.
4. Use no piece shorter than 100 mm (4 inches) long.
5. Use not less than 100 mm (4 inches) nominal thick masonry for free standing furring unless shown otherwise.
6. Do not abut existing plastered surfaces except suspended ceilings with new masonry partitions.

- H. Before connecting new masonry with previously laid, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.

- I. When new masonry partitions start on existing floors, machine cut existing floor finish material down to concrete surface.
- J. Wetting and Wetting Test:
  - 1. Do not wet concrete masonry units before laying.
- K. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.
- L. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.
- M. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and all other reasonable temporary loads that may be placed on them during construction.

### **3.4 ANCHORAGE**

- A. Anchorage of Abutting Masonry:
  - 1. Anchor interior masonry bearing walls or interior masonry partitions over 100 mm (4 inches) thick to masonry walls with rigid wall anchors spaced at 400 mm (16 inch) maximum vertical intervals.
  - 2. Anchor abutting masonry walls and partitions to concrete with dovetail anchors. Install dovetail slots vertically in concrete at centerline of abutting wall or partition. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals. Secure anchors to existing wall with two 9 mm (3/8 inch) by 75 mm (3 inch) expansion bolts or two power-driven fasteners.
  - 3. Anchor abutting interior masonry partitions to existing concrete and existing masonry construction, with corrugated wall ties. Extend ties at least 100 mm (4 inches) into joints of new masonry. Fastened to existing concrete and masonry construction, with powder actuated drive pins, nail or other means that provides rigid anchorage. Install anchors at 400 mm (16 inch) maximum vertical intervals.

### **3.5 REINFORCEMENT**

- A. Joint Reinforcement:
  - 1. Use as joint reinforcement in CMU wythe of combination brick and CMU, cavity walls, and single wythe concrete masonry unit walls or partitions.
  - 2. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.
  - 3. Additional joint reinforcement is required in mortar joints at both 200 mm (8 inches) and 400 (16 inches) above and below windows, doors,

- louvers and similar openings in masonry, except where other type anchors are required for anchorage of masonry to concrete structure.
4. Joint reinforcement is required in every other course of stack bond CMU masonry.

**B. Steel Reinforcing Bars:**

1. Install in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for lintels and bond beam horizontal reinforcement.
2. Use grade 60 bars if not specified otherwise.
3. Bond Beams:
  - a. Form Bond beams of load-bearing concrete masonry units filled with ASTM C476 grout and reinforced with 2-#15m (#5) reinforcing steel unless shown otherwise. Do not cut reinforcement.
  - b. Brake bond beams only at expansion joints and at control joints, if shown.
4. Stack Bond:
  - a. Locate additional joint reinforcement in vertical and horizontal joints as shown.
  - b. Anchor vertical reinforcement into the foundation or wall or bond beam below and hold in place.
  - c. Provide temporary bracing for walls over 8 ft. tall until permanent horizontal bracing is completed.

**3.6 CMU CONTROL JOINTS.**

- A. Provide CMU control (CJ) joints where shown on drawings.
- B. Keep joint free of mortar and other debris.
- C. Interrupt steel joint reinforcement at expansion and control joints unless otherwise shown.
- D. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

**3.7 ISOLATION SEAL**

- A. Where full height walls or partitions lie parallel or perpendicular to and under structural beams or shelf angles, provide a separation between walls or partitions and bottom of beams or shelf angles not less than the masonry joint thickness unless shown otherwise.
- B. Insert in the separation, a continuous full width strip of non-combustible type compressible joint filler.
- C. Where exposed in finish work, cut back filler material in the joint enough to allow for the joint to be filled with sealant material specified in Section 07 92 00, JOINT SEALANTS.

### 3.8 CONCRETE MASONRY UNITS

#### A. Kind and Users:

1. Provide special concrete masonry shapes as required, to include but limited to, corner units. Use solid concrete masonry units, where full units cannot be used, or where needed for anchorage of accessories.
2. Provide solid load-bearing concrete masonry units or grout the cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
3. Provide rounded corner (bullnose) shapes at opening jambs in exposed work and at exterior corners.
4. Do not use brick jambs in exposed finish work.
5. Masonry assemblies shall meet the required fire resistance in fire rated partitions of type and construction that will provide fire rating as shown.

#### B. Laying:

1. Lay concrete masonry units with 10 mm (3/8 inch) joints, with a bond overlap of not less than 1/4 of the unit length, except where stack bond is required.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill such voids with mortar or grout.
7. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
8. Lay concrete masonry units so that cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings not less than 50 mm (2 inches) by 75 mm (3 inches).
9. Do not wedge the masonry against the steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
10. Install deformed reinforcing bars of sizes shown.
11. Steel reinforcement, at time of placement, free of loose flaky rust, mud, oil, or other coatings that will destroy or reduce bond.
12. Steel reinforcement in place before grouting.
13. Minimum clear distance between parallel bars: One bar diameter.

14. Hold vertical steel reinforcement in place by centering clips, caging devices, tie wire, or other approved methods, vertically at spacings noted.
15. Support vertical bars near each end and at intermediate intervals not exceeding 192 bar diameters.
16. Reinforcement shall be fully encased by grout or concrete.
17. Splice reinforcement or attach reinforcement to dowels by placing in contact and secured or by placing the reinforcement within 1/5 of the required bar splice length.
18. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
19. Grout cells of concrete masonry units, containing the reinforcing bars, solid as specified under grouting.
20. Cavity and joint horizontal reinforcement may be placed as the masonry work progresses.

### **3.9 GROUTING**

#### **A. Preparation:**

1. Clean grout space of mortar droppings before placing grout.
2. Close cleanouts.
3. Install vertical solid masonry dams across grout space for full height of wall at intervals of not more than 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
4. Verify reinforcing bars are in cells of units or between wythes as shown.

#### **B. Placing:**

1. Place grout by hand bucket, concrete hopper, or grout pump.
2. Consolidate each lift of grout after free water has disappeared but before plasticity is lost.
3. Do not slush with mortar or use mortar with grout.

#### **4. Interruptions:**

- a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inch) below top of last masonry course.
- b. Grout from dam to dam on high lift method.
- c. A longitudinal run of masonry may be stopped off only by raking back one-half a masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.

#### **C. Low Lift Method:**

1. Construct masonry to a height of 1.5 m (5 ft) maximum before grouting.

2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

### **3.10 PLACING REINFORCEMENT**

- A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on the Contract Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.
- B. Position reinforcement accurately at the spacing indicated. Support and secure vertical bars against displacement. Horizontal reinforcement may be placed as the masonry work progresses. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 25 mm (1 inch), whichever is greater.
- C. Splice reinforcement bars where shown; do not splice at other places unless accepted by the VA COR. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
- D. Provide not less than minimum lap as indicated on shop drawings, or if not indicated, as required by governing code.
- E. Embed metal ties in mortar joints as work progresses, with a minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.
- F. Embed prefabricated horizontal joint reinforcement as the work progresses, with a minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement not less than 150 mm (6 inches) at ends. Use prefabricated "L" and "T" sections to provide continuity at corners and intersections. Cut and bend joint reinforcement as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

### **3.11 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY**

- A. Do not wet concrete masonry units (CMU).
- B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed joint widths shown, or if not shown, provide 10 mm (3/8 inch) joints.

- C. Where solid CMU units are shown, lay with full mortar head and bed joints.
- D. Walls:
1. Pattern Bond: Lay CMU wall units in 1/2-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.
  2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
  3. Where horizontal reinforced beams (bond beams) are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.
- E. Grouting:
1. Use "Fine Grout" per ASTM C476 for filling spaces less than 100 mm (4 inches) in one or both horizontal directions.
  2. Use "Coarse Grout" per ASTM C476 for filling 100 mm (4 inch) spaces or larger in both horizontal directions.
- F. Low-Lift Grouting:
1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 mm<sup>2</sup> (8 square inches) in vertical cores to be grouted.
  2. Place vertical reinforcement prior to grouting of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 3 m (10 feet).
  3. Lay CMU to maximum pour height. Do not exceed 1.5 m (5 foot) height, or if bond beam occurs below 1.5 m (5 foot) height, stop pour 38 mm (1-1/2 in) below top of bond beam.
  4. Pour grout using chute container with spout or pump hose. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 38 mm (1-1/2 inches) below top course of pour.

5. Bond Beams: Stop grout in vertical cells 38 mm (1-1/2 inches) below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as shown. Place grout in bond beam course before filling vertical cores above bond beam.

### **3.12 CLEANING AND REPAIR**

#### **A. General:**

1. Clean exposed masonry surfaces on completion.
2. Protect adjoining construction materials and landscaping during cleaning operations.
3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
4. Remove mortar droppings and other foreign substances from wall surfaces.

#### **B. Concrete Masonry Units:**

1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
2. Allow mud to dry before brushing.

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