

## SECTION 04 22 00

### CONCRETE UNIT MASONRY

#### PART 1 GENERAL

##### 1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Injected Masonry Fill Insulation.
3. Reinforcement, anchorages, and accessories.
4. Procedure and preparation for exposed concrete and/or polished concrete floors
5. Observation and Required Special Inspections
6. Mockup panel

B. Products Installed but not Furnished Under this Section:

1. Section 03 21 00 - Concrete Reinforcement
2. Section 05 50 00 - Metal Fabrications: Loose steel lintels.
3. Section 07 62 00 - Sheet Metal Flashings and Trim.

C. Related Sections:

1. Section 01 40 00 – Quality Control: Required Special Inspections
2. Section 03 30 00- Cast-In-Place Concrete: grout.
3. Section 03 35 20 - Polished Concrete Finish System
4. Section 04 05 13 – Mortar
5. Section 07 27 26 – Fluid-Applied Weather Barrier System
6. Section 07 21 00 – Insulation
7. Section 07 92 00 - Joint Sealers: Rod and sealant at control joints.
8. Section 09 91 00- Painting and Finishing.

##### 1.2 REFERENCES

- A. ASTM C90 - Hollow Load-Bearing Concrete Masonry Units.
- B. ASTM C145 - Solid Load-Bearing Concrete Masonry Units.
- C. TMS 402/602 Masonry Code - Recommended Practices and Guide Specifications for Hot & Cold Weather Masonry Construction.
- D. ASTM A153 – Zinc Coating (Hot Dip)

##### 1.3 PERFORMANCE REQUIREMENTS

- A. Provide unit masonry that develops the following installed compressive strengths (fm) at 28 days.
1. For Concrete Unit Masonry: As follows, based on net area:
    - a.  $F'm = 2000 \text{ psi (13.1 Mpa)}$ .

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#### 1.4 SUBMITTAL

- A. Submit samples of actual units to be used for Architect's approval.
- B. Submit to Architect the insulation type proposed.
- C. Submit mix design for concrete grout

#### 1.5 MOCK-UP SAMPLE PANEL

- A. Before commencing any work, Contractor shall erect a 4' x 4' panel of each type of CMU specified with correct mortar color. Lay in pattern to simulate wall pattern. The panel is NOT PART OF THE BUILDING and is to remain in place until removal is authorized by the Architect. The contractor shall have sufficient brick on site to erect two panels if necessary.
- B. Panel face shall show mortar, bond, widths, and tooling of joints.
- C. Approval of Architect is required before proceeding with any part of the building.
- D. Panel is to remain in place until completion of the work.
- E. Construct mock-up panel in "cut-away" view, exposing all wall assembly components. Refer to Section 01 40 00 Quality Control-Mock-Ups.

#### 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Cold Weather Requirements: Hot and Cold Weather Masonry Construction Guide - Recommended Practices and Specifications for Cold Weather Masonry Construction.
- B. Lay no masonry when the temperature is below 40 degrees F. without Architect's permission. Such permission shall not relieve the Contractor of responsibility for the work, however. If permitted to work below 40 degrees F., but above 32 degrees F., make provisions to heat and dry materials and protect work from freezing during the installation and curing period. No masonry is to be laid when temperatures are holding, dropping or are predicted to go below 32 degrees F. unless heated protection is provided during installation and curing period and has been approved by the Architect.
- C. External exposed CMU: Provide units with integral water repellent

## 1.7 PRE-INSTALLATION MEETING

- A. The Contractor will schedule and conduct a pre-installation meeting **prior to construction of cmu walls**. Those attending are to include Contractor, Architect, Owner, Structural Engineer, mason, cmu grout-mix representative and 3<sup>rd</sup> party special inspector. Items to be discussed are as follows but are not limited to these:
1. Schedule
  2. Installation of rebar
  3. Required grout mix design strength.
  4. Frequency of testing and inspections
  5. Placement of grout
  6. Construction height of CMU walls
  7. Control joints and corners
  8. Other items associated with cmu wall construction.

## PART 2 PRODUCTS

### 2.1 CONCRETE MASONRY UNITS

- A. Hollow Load Bearing Units: ASTM C90:
1. Common CMU: Light weight (ASTM C331) above grade; normal weight (ASTM C33) below grade.
- B. Solid Load-Bearing Units: ASTM C145, Grade N, Type 1:
1. Common CMU: Light weight (ASTM C331) above grade; normal weight (ASTM C33) below grade.
- C. Masonry Units: Modular units sized as required to achieve details shown; provide special units for bond beams, control and expansion joints, and lintels.
1. Common CMU: Where indicated on drawings.
- D. Quality Control: All standard masonry units shall be manufactured by one manufacturer and shipped from the same plant. All units are subject to inspection and rejection by the Architect for defects such as excessive porous surface, chipped corners, irregular faces or sizes, etc. Sample units submitted shall be retained and shall set the standard for quality expected. Meeting ASTM C90 minimum requirements is not considered to be adequate in the areas mentioned.
- I. Fire Resistance Classification: CMU walls and partitions shall have fire resistance ratios as indicated on the drawings. Units shall be of minimum equivalent thickness (ASTM C140) specified for the fire rating and corresponding aggregate type.

## 2.2 REINFORCEMENT AND ANCHORAGES

- A. **CMU Horizontal Joint Reinforcement:** Install horizontal joint reinforcement 16 inches on center, except space at 8 inches in parapet walls and below finished floor, or where otherwise indicated on Drawings. 120 Truss or 220 Ladder-Mesh LoxAll design, manufactured by Hohmann & Barnard, Inc., or approved alternate. Minimum 9-gauge welded steel wire; hot-dip galvanized after fabrication to 1.5 oz. Per ASTM A153 Class B-2 for use in exterior walls, mill galvanized wire for interior walls. Reinforcement width to be 1 1/2 to 2 inches less than wall thickness.
- B. Provide reinforcement with receiver eyes for brick veneer. See Section 04 21 13.
- C. Miscellaneous Masonry Anchors: Fabricated from 16 gage steel sheet or 3/8 inch steel rod, 1.5 oz. hot-dip galvanized after fabrication.
- D. Construction/Control Joints: Construction/Control joints shall be spaced as shown on the drawings. Caulk joints in accordance with Section 07 92 00. Unless shown otherwise less than 24'-0" on center, space joints for CMU veneer no more than 24'-0" on center along same plane. Provide control joints at corners no more than 12'-0" from corner or closer if shown on drawings.. Coordinate locations with Architect and Structural Engineer.

## 2.3 ACCESSORIES

- A. Joint Filler: Closed cell foam, oversized 50 percent; self-expanding joints.
- B. Preformed Control Joint Filler:
  - 1. VS Series by Hohmann & Barnard, Inc.
  - 2. No. 2901 by Wire Bond.
- C. Cavity Wall Flashing System: Components by Hohmann & Barnard or Mortar Net "Totalflash" masonry flashing system. See Section 07 10 00.
- D. Reinforcing Bar Positioners:
  - 1. D/A 811; Dur-O-Wal, Inc.
  - 2. D/A 816; Dur-O-Wal, Inc.
  - 3. No. 376 Rebar Positioner; Heckman Building Products, Inc.
  - 4. #RB Rebar Positioner; Hohmann & Barnard, Inc
  - 5. #RB-Twin Rebar Positioner; Hohmann & Barnard, Inc.
  - 6. Double O-Ring Rebar Positioner; Masonry Reinforcing Corporation of America
  - 7. O-Ring rebar Positioner; Masonry Reinforcing Corporation of America.
  - 8. Hot-dip galvanized after fabrication.

## 2.4 INJECTED MASONRY FILL INSULATION

- A. Injected Masonry Fill Insulation: CfiFOAM Aminoplast Foam Insulation by CfiFOAM, Inc., P.O. Box 10393, Knoxville, TN 37939. Phone: (865) 588-4465, Core-Fill-500 by Tailored Chemical Products, Inc., 3719 First Ave., SW, Hickory, North Carolina. STM E-119, H.U.D. 6.2.9., or approved alternate. Product must be premixed from factory.

## 2.5 CONCRETE GROUT OR SPEC MIX GROUT

- A. Concrete grout to be produced at a ready-mix batch plant, capable of producing specified concrete grout or spec mix grout, each as listed below.
- B. Concrete Grout:
  - 1. Portland Cement: Type I Portland, meeting "Standard Specifications for Portland Cement", (ASTM C150-Current Edition) shall be used.
  - 2. Aggregates: All aggregates shall be clean, hard strong and durable particles free of chemicals or foreign material that may affect the bonding of cement paste and shall conform to "Specifications for Concrete Aggregates" (ASTM C33). Nominal maximum aggregate size for concrete grout shall be 3/8" diameter.
  - 3. Mixing Water: Water shall be fresh, clean and potable.
  - 4. Slump: 9 inch maximum: plus tolerance 1 inch, minus tolerance 1 inch.
  - 5. Mix proportioning: To produce 28 day minimum compressive strength of moist cured laboratory samples, 2,000 psi at all locations.
- C. Spec Mix Grout:
  - 1. Spec Mix Core Fill Grout, Coarse (CF-02), preblended product containing cementitious materials and dried aggregates to meet ASTM C 476 and CSA A179.
  - 2. Packaging: 80lb packages or 3,000lb bulk bags for use in Spec Mix silo system.
  - 3. Mixing Water: Water shall be fresh, clean and potable.
  - 4. Slump: 9 inch maximum: plus tolerance 1 inch, minus tolerance 1 inch.
  - 5. Mix proportioning: To produce 28 day minimum compressive strength of moist cured laboratory samples, 2,000 psi at all locations.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Verify items provided by other sections of work are properly sized and located.
- B. Establish lines, levels, and coursing. Protect from disturbance.
- C. Provide temporary bracing during erection of masonry work. Maintain in place until building structure provides permanent bracing.

### 3.2 COORDINATION WITH OTHER TRADES

- A. It will be a requirement of this section to verify and coordinate work with other trades and specification sections. Do not begin work on concrete slabs on grade or elevated concrete slabs until minimum strength and cure time has been reached.
- B. Procedure and preparation for exposed concrete and/or polished concrete floors**
  - 1. Concrete floors in whole or in part as shown on drawings, are scheduled to be Polished Concrete. No masonry walls constructed on slab-on-grade are to begin erection until concrete slab has received initial grind from floor polishing contractor. Refer to Sections 03 35 20 for requirements. This requirement includes slabs-on-grade.
  - 2. Where sealed concrete floors, polished concrete finish is scheduled, floor areas at the base of CMU walls are to be protected from concrete and mortar droppings during construction of CMU walls. Floors at base of CMU walls are to be cleaned at the end of each work day, free of concrete and mortar droppings.
  - 3. Any equipment used on slabs to be sealed or polished, shall meet the requirements of Sections 03 35 20 concerning diapering of equipment to prevent fluid leak stains and utilizing tire socks to prevent tire marks.

### 3.3 COURSING

- A. Place masonry to lines and levels indicated.
- B. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.
- C. Lay concrete masonry units in running bond unless adjoining work is involved, or called out on drawings otherwise. Course one block unit and one mortar joint to equal 8 inches vertically. Form flush mortar joints where joint will be covered by other construction. **Mortar joints on concealed areas where fluid applied cavity wall weather barrier is to be applied must be fully filled with no voids, holes, or cracks. Provide tooled, concave joints** where wall will be left exposed and painted, or is a finished product, unless specifically called out to be otherwise.

### 3.4 PLACING AND BONDING

- A. Lay solid concrete masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints. Remove excess mortar.
- B. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and foundation walls and in all courses of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. For starting courses on footings where cells are not grouted, spread out full mortar bed, including areas under cells.

- C. Fully bond intersections, and external and internal corners.
- D. Do not shift or tap masonry units after mortar has taken initial set. Where adjustment must be made, remove mortar and replace.
- E. Perform job site cutting with proper tools to provide straight unchipped edges. Take care to prevent breaking masonry unit corners or edges.
- F. Isolate masonry partitions from vertical structural framing members with a control joint.
- G. Where masonry is installed, all vertical and horizontal joints to align according to bond types. Where differing masonry types are installed in same wall, joints are to align between each masonry unit type unless noted otherwise.

### 3.5 TOLERANCES

- A. Tolerances to conform to requirements of TMS 402/602 and below, whichever is more stringent.:
  1. Alignment of Pilasters: Maximum 1/4 inch from true line.
  2. Variation from Unit to Adjacent Unit: 1/32 inch.
  3. Variation from Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet.
  4. Variation from Plumb: 1/4 inch per story non-cumulative.
  5. Variation from Level Coursing: 1/8 inch in 3 feet; 1/4 inch in 10 feet; 1/2 inch maximum.
  6. Variation of Joint Thickness: 1/8 inch in 3 feet.

### 3.6 REINFORCEMENT AND ANCHORAGES

- A. Install horizontal joint reinforcement 16 inches on center, except space at 8 inches in parapet walls and below finished floor, or where otherwise indicated on Drawings.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend 24 inches minimum each side of opening. Place joint reinforcement continuous in first and second joint below top of wall.
- C. Lap joint reinforcement ends at a minimum of 6 inches. Discontinue at control joints. Extend 24 inches minimum each side of openings. Place reinforcing bars supported and secured against displacement. Maintain position within 1/2 inch of true dimension.
- D. Cells that contain vertical reinforcing are to be grouted full. Lap vertical reinforcing a minimum of 48 bar diameters and ensure bar is positioned in the cell as indicated on the structural plans. **Fill cells in 5'-4" lifts maximum.** Power vibrate grout in each cell full height of each lift. Maximum diameter of power vibrator for grout consolidation is 3/4". Maximum allowable CMU height for installing grout in cells is **5'-4"** or to course immediately below bond beam, whichever is lower. Contractor's option to grout to course immediately below bond beams and provide 4" tall block outs at interior walls and

standard size block outs on exterior side of CMU for visual confirmation by 3<sup>rd</sup> party special inspector that cells are grouted.

- E. Bar Positioners: As vertical reinforcing is being placed, the use of reinforcing bar positioners for correct bar positioning in the wall is required. Install at each bar, locating at maximum 8'-0" o.c vertical, and/or at each bar splice point.
- F. Verify that anchorages embedded in concrete or attached to structural steel members are properly placed.
- G. Reinforce joint corners and intersections with strap anchors 16 inches on center.

### 3.7 INJECTED MASONRY FILL INSULATION

- A. Masonry fill insulation contractor shall be licensed, approved and certified by Foam Manufacturer with a minimum of 5 years experience.
- B. **Masonry fill insulation is not to be placed in wall until exterior finish on wall is installed and interior side of wall is permanently protected from adverse weather and moisture.**
- C. Place in cured masonry wall, through holes placed in mortar joints at each masonry cell. Fill voids in wall full with masonry fill insulation under pressure.
- D. Pump insulation into wall in vertical layers 3 to 5 feet high, repeat process in sections with no section greater than 10 feet higher than other sections until full height of wall is reached.
- E. Remove all excess foam from walls. Patch mortar joints with matching mortar, brush and tool joints as required to blend into place.

### 3.8 LINTELS

- A. Install loose steel lintels as scheduled.
- B. Install reinforced unit masonry lintels over openings where steel or pre-cast concrete lintels are not scheduled. Construct lintels using concrete fill and reinforcing. Maintain minimum 8 inch bearing on each side of opening.
- C. Use reinforcing bars of one piece lengths only.
- D. Place and consolidate grout fill without disturbing reinforcing. Allow lintels to reach strength before removing temporary supports as affirmed by laboratory compressive strength testing of field-cast grout prisms.



### 3.9 CONTROL JOINTS

- A. Do not continue horizontal joint reinforcing thru control joints. Continue bond beams across control joints by use of "Slip Joints" as detailed on plans. Ensure use of asphalt paper wrap to create bond break. 3/4" diameter x 24" dowels with expansion cap at each bond beam at each control joint.
- B. Install preformed control joint filler at locations indicated on Drawings. Space no further than 24'-0" o.c. or less if shown on drawings. Provide control joints at corners no more than 12'-0" or closer if shown on drawings. Use proper size material to create sealant joint space; See Section 07 92 00 for sealant performance.

### 3.10 BUILT-IN WORK

- A. As work progresses, build in metal door frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and other items to be built in the work supplied by other Sections.
- B. Build in items plumb and level.
- C. Bed anchors of metal door and glazed frames in mortar joints. Fill masonry cores with grout minimum 12 inches horizontally from framed openings.
- D. Build in door and window frames and their anchors. Slush steel door frame jambs and heads full of mortar. Slush cells full of mortar where excessive cutting for conduit or other devices has weakened masonry
- E. Do not build-in organic materials subject to deterioration.

### 3.11 CUTTING AND FITTING

- A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Cooperate with other Sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting any area not indicated or where appearance or strength of masonry work may be impaired.
- C. **Do not** thin CMU walls to accommodate plumbing piping, electrical conduit of other items routed in CMU walls. Consult Architect if conditions are found that do not allow proper installation of CMU.

### 3.12 TESTING CMU CONCRETE GROUT OR SPEC MIX GROUT

- A. Strength Tests:
  - 1. Testing per ASTM C 1019.
  - 2. Three (3) test specimens shall constitute one (1) sample. A strength test shall be the average of the strengths of the specimen tested at the age specified.

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3. Slump to be 9 inches, plus or minus one inch.
4. Specimens shall be tested at 7 and 28 days.
5. The compression strength will be considered satisfactory if the average of three consecutive tests of the grout is equal to or greater than the specified strength and no individual strength test falls below the specified strength by more than 500 psi..

B. Frequency: Minimum of Two (2) times a week from start of production.

C. Testing Laboratory: The testing laboratory, in addition to meeting requirements of ASTM E-329, and must be an approved laboratory competent to perform cement physical testing. All tests must be performed in strict accordance with the applicable ASTM standard.

D. Distribution of Results of Tests: Within 24 hours of results of tests, copies of the results shall be submitted to the Architect, Contractor, masonry contractor, and the grout supplier if applicable.

E. Test mix design prior to beginning construction of CMU walls. The compressive strength test of the laboratory mix design must meet or exceed the specified 28 day design compressive strength of **2,000** psi grout unless noted otherwise.

F. Contractor shall bear costs for all masonry testing.

### 3.13 CLEANING

A. Remove excess materials, mortar droppings. Remove mortar droppings on connecting or adjoining work before its final set.

B. Protect all other trade's work and other items set into wall.

C. Remove, replace defective materials, correct defective workmanship, and leave masonry clean.

D. Replace defective mortar. Match adjacent work.

E. Remove excess mortar and smears.

F. Use non-metallic tools in cleaning operations.

### 3.14 AIR / MOISTURE BARRIERS

A. Prior to installation of veneer at cavity wall construction with CMU backup, or metal panel system with CMU backup, apply Liquid-Applied Cavity Wall Moisture/ Air Barrier on all CMU walls where concealed in cavity wall. Refer to Section 07 27 26, Fluid Applied Weather Barrier System.

### 3.15 PROTECTION

- A. Maintain protective boards at exposed external corners which may be damaged by construction activities.
- B. Provide protection without damaging completed work.
- C. At day's end, cover unfinished walls to prevent moisture infiltration. Secure cover down to prevent blow-off and maintain protection for fresh masonry work.

### 3.16 OBSERVATION AND SPECIAL INSPECTIONS

- A. CMU placement and CMU reinforcement and placement shall be periodically observed by the Architect during laying of CMU units. Inspection of CMU placement and CMU reinforcement and placement for conformance to the construction documents shall be completed by the designated third party Special Inspector at a minimum frequency of two (2) times per week from start of production.
- B. Special Inspector Qualifications: As required per TMS 402/602

END OF SECTION

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