

Replace the term "Design Professional" with the identity of the design professional as defined in the General and Supplementary Conditions.

## SECTION 042713 – COMPOSITE CONCRETE UNIT MASONRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Division 01 Specification Sections, Drawings, General Conditions, Supplementary General Conditions, and Special Conditions apply to this section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Concrete masonry units (CMUs).
2. Mortar and grout.
3. Reinforcing steel.
4. Control joint materials.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.

- B. Products installed, but not furnished, under this Section:

Edit the following list as needed.

1. Section 055000 Metal Fabrication for steel lintels and shelf angles for unit masonry.
2. Section 076200 Sheet Metal Flashing and Trim.

- C. Related Sections:

Edit the following list as needed.

1. Section 042200 Concrete Unit Masonry
2. Section 042200.13 Concrete Unit Veneer Masonry
3. Section 042223.23 Prefaced Concrete Unit Masonry for Astra-Glaze-SW glazed masonry units.
4. Section 042300 Glass Unit Masonry for glass block.
5. Section 047200 Cast Stone Masonry.
6. Section 071900 Water Repellents for water repellents applied to unit masonry assemblies.
7. Section 076200 Sheet Metal Flashing and Trim for exposed sheet metal flashing.
8. Section 078413 Penetration Firestopping for firestopping at openings in masonry walls.
9. Section 078443 Fire-Resistive Joint Sealants for fire-resistive joint systems at heads of masonry walls.
10. Section 079200 Joint Sealants for sealing control and expansion joints in unit masonry.
11. Section 321413 Precast Unit Paving for interlocking concrete pavements.
12. Section 323223 Segmental Retaining Walls for dry-laid, concrete unit retaining walls.

### 1.3 SUBMITTALS

Edit the following list as needed.

- A. Certificates of compliance with respective ASTM standards shall be submitted on all products specified herein.
  - 1. Concrete masonry units.
  - 2. Spec Mix preblended mortar: Include test report or batch data for verification of proportions of materials.
  - 3. Grout: Include mix design for verification of proportions of materials.
  - 4. Steel reinforcing bars.
  - 5. Wall ties.
  - 6. Preformed control joint gaskets.

For samples required below, state quantity of each.

- B. Samples for Verification: For each type and color of the following:
  - 1. Exposed concrete masonry units.

Include subparagraph below if colored mortar is specified.

- 2. Mortar, for color selection or confirmation.

### 1.4 QUALITY ASSURANCE

Preconstruction verification of  $f'_m$  is required by the 2006 IBC for Quality Assurance/Inspection Levels 1 and 2 (for engineered masonry), by means of the unit strength method or prism test. The unit strength method is "easier" in that one can reference a table for the values and simply test cmu and grout, typically in less time than needed for prisms.

However, when  $f'_m$  values exceed 1500 net psi, and especially when greater than 2500 psi, the values from the unit strength table – which are very conservative – may negatively impact the project. Excessively high strength requirements for cmu will typically require special order products with mix designs that may affect color and texture, altering the appearance versus originally selected samples. Lead times for special order products may be substantial.

Alternatively, planning in advance for prism tests – setting procurement and construction schedules early enough to allow for prism construction, curing, and testing – allows time for either method to be utilized as best suits the project for its given design strength and specified cmu.

Of course, the quality assurance and inspection plan, including the testing protocol, is required to be included in the project documents, yet provision should be considered to allow for an alternate method of verification if it can be shown to benefit the project. Such recommendation should come from the masonry contractor as soon as possible after the award of contract.

Note also the 2007 California Building Code requires that all projects with  $f'_m$  greater than 1500 net psi MUST verify by prism test.

Generally, then, the choices as noted below are recommended.

- A. Preconstruction Testing.

1. Owner will select a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner.

If  $f'_m \leq 1500$  psi, specify the unit strength method and delete subparagraph for prism testing.

2. The compressive strength of masonry shall be determined based on strength of the unit and type of mortar specified (Unit Strength Method) per IBC Table 2105.2.2.1.2 (ACI 530.1/ASCE 6/TMS 602 Table 2).
  - a. Concrete Masonry Units: Test per ASTM C 140.

IBC Section 2105.2.2.1.2.3 offers two options for grout: Grout conforms to ASTM C 476, which may be a proportion specification, therefore no compression testing intrinsically required, OR grout compressive strength equals or exceeds the  $f'_m$ , but not less than 2,000 psi (property specification). Include the following only if a property specification is given for grout, or is otherwise required.

- b. Grout: Test per ASTM C 1019.

If  $f'_m > 1500$  psi (this is mandatory in CBC, optional in IBC), specify the prism test method and delete the unit strength subparagraph above.

3. The compressive strength of masonry shall be determined by the prism test method in accordance with ASTM C 1314. Schedule masonry procurement sufficiently in advance to allow for prism construction and curing.
  - a. Prism Test: For each type of construction required, construct and test three[five for CBC] prisms per ASTM C 1314.

If  $f'_m > 1500$  psi AND this project is under DSA jurisdiction, the CBC also requires masonry core testing (see Part 3 field quality control), as well as mortar and grout tests, regardless of how they are specified. For non-DSA work, mortar specified by proportion is not subject to compression testing. However, CBC requires it (Section 2105A.5). Include the following subparagraph for DSA/CBC work. Otherwise, for non-DSA, delete it.

4. Mortar and grout tests: At beginning of work, sample mortar and grout on three successive working days per CBC Section 2105A.5.

Delete first paragraph below if fire-rated masonry is not used.

- B. Fire-Resistance Ratings: Where required, provide materials and construction with fire-resistance ratings determined by equivalent concrete masonry thickness in accordance with IBC Table 720.1(2) Material 3. Concrete Masonry Units.
- C. Sample Panels: Construct an approximate [Width:] long by [Height:] panel for representation of completed masonry, joint tooling, design details, and workmanship. Comply with requirements in Division 01 Section "Quality Requirements" for mockups.

If it is desirable to demonstrate particular units or areas of critical detailing, specify them in the following subparagraph, otherwise delete it.

1. The following shall be installed in the sample panel:
  - a. [Specify units]
  - b. [Specify details or conditions]

It is typically good practice to conduct preinstallation meetings to provide opportunity to clarify critical details, schedules, specification intent, inspections, etc. If the work under this section is of a minor nature, delete the following subparagraph.

- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination",

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. All materials of this section shall be protected to maintain quality and physical requirements.
- B. All masonry units shall be stored on the jobsite so that they are protected from rain, stored off-ground and kept clean from contamination. Prevent units from being otherwise wetted.
- C. Store Spec Mix preblended mortar mix in manufacturer's original, unopened, undamaged containers with identification labels intact, covered and protected from weather, or in a Spec Mix dispensing silo.

#### 1.6 FIELD CONDITIONS

- A. Securely cover tops of all unsheltered walls and partially completed walls when work is not in progress.

Cold-weather and hot-weather masonry construction is addressed in IBC Sections 2104.3 and 2104.4, respectively. Include and modify below as necessary.

- B. Cold-weather procedures when ambient temperature falls below 40°F (4°C) or the temperature of masonry units is below 40°F (4°C):
  - 1. Wet or frozen units shall not be laid.
  - 2. Implement cold weather construction procedures in accordance with IBC Section 2104.3.
- C. Hot-weather procedures when ambient temperature exceeds 100°F (38°C), or exceeds 90°F(32°C) with a wind velocity greater than 8 mph:
  - 1. Implement hot weather construction procedures in accordance with IBC Section 2104.4.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURER

- A. Concrete masonry units.
  - 1. Angelus Block Co., Inc.
    - a. Sun Valley, CA (818) 767-8576
    - b. Orange, CA (714) 637-8594
    - c. Fontana, CA (909) 350-0244
    - d. Gardena, CA (310) 323-8841
    - e. Oxnard, CA (805) 485-1137
    - f. Indio, CA (760) 347-3245
- B. Preblended mortar.
  - 1. Spec Mix Preblended Mortar Mix, by E-Z Mix, Inc.

## 2.2 MASONRY PERFORMANCE REQUIREMENTS

- A. Provide materials to achieve the net compressive strength of concrete unit masonry equal to or greater than 1500 psi  $f'_m$ .

Coordinate with Structural documents. Either insert design strength (e.g., 1500) in paragraph above as stated in structural documents (edit above as necessary), or insert below a reference to its location within such documents. Keep only one of the paragraphs.

- B. Provide materials to achieve the net compressive strength of concrete unit masonry equal to or greater than the  $f'_m$  as indicated [insert reference location].

## 2.3 CONCRETE MASONRY UNITS

The CBC requires “reinforced grouted masonry”, the previous terminology for what MSJC refers to as “composite masonry”, to be made with solid concrete building brick conforming to ASTM C 55. Change the paragraph below accordingly if this project is under the CBC.

- A. Concrete Masonry Units: ASTM C 90.

The majority of structural design is based on the mediumweight classification; therefore, the greatest availability in Southern California of structural sizes and shapes is in mediumweight. Edit below if structural design considers a different weight classification.

- 1. Weight Classification: Mediumweight unless otherwise indicated.

Although it is common to call out colors and textures on elevation drawings or legend tables within the drawings set, it is helpful to also coordinate and list them here. Examples of Color: Sandstone, Warm Gray. Examples of Texture: Precision, Split Face, Burnished. If compatible mortar color other than natural gray is intended, specify in Article 2.8.

- 2. Color(s) and texture(s):
  - a. [Color] [Texture]

## 2.4 MORTAR AND GROUT MATERIALS

Preblended mortar below provides greater control and consistency than field-mixed. Spec Mix meets both proportion and properties requirements of ASTM C 270; specifying to proportions eliminates the need for mortar tests except for CBC requirements when  $f'_m$  exceeds 1500 psi.

- A. Spec Mix Masonry Mortar preblended factory mix: ASTM C 270, proportions.
  - 1. Portland cement: ASTM C 150
  - 2. Hydrated lime: ASTM C 207
  - 3. Aggregate for mortar: ASTM C 144.
- B. Grout:
  - 1. Portland cement: ASTM C 150
  - 2. Aggregate: ASTM C 404.

Fly ash may be used as a partial cement replacement, and is a practical means of introducing recycled content into the masonry wall without adversely affecting aesthetic control of exposed masonry units.

3. Fly ash: ASTM C 618.
- C. Water: Potable.
- D. Admixtures:
  1. The use of admixtures shall not be permitted except as specified herein, or as approved by the Architect or Engineer of Record and the Building Official.

The admixture below is recommended to decrease grout shrinkage and compensate for volume loss due to water absorption, as well as lowering the water/cement ratio, increasing compressive and shear bond strengths.

2. PRE-MIX Products Grout Additive manufactured by E-Z Mix, Inc. Use per manufacturer's specifications.

## 2.5 REINFORCEMENT

Item below is typically used. Revised as required by structural design.

- A. Steel Reinforcing Bars: ASTM A 615, Grade 60.

## 2.6 METAL TIES

Select one of the following permitted types of ties:

- A. Wall ties of size W1.7 steel wire conforming to ASTM A 82 bent to form a rectangle 4 inches wide by 2 inches less than the overall wall thickness.
- B. Ladder-type masonry joint reinforcement conforming to ASTM A 951.
  1. Masonry joint reinforcement used in exterior walls shall be hot-dipped galvanized.

## 2.7 FLASHING MATERIALS

- A. Provide metal flashing in accordance with Section 076200 Sheet Metal Flashing and Trim.

## 2.8 MISCELLANEOUS MASONRY ACCESSORIES

PVC gaskets are typically used. Rubber gaskets are desirable for cold-weather climates or where exposure to oils and solvents is likely. Keep only one of the following:

- A. PVC Preformed Control-Joint Gaskets: per ASTM D 2287, Type PVC.
- B. Rubber Preformed Control-Joint Gaskets: per ASTM D 2000, Designation M2AA-805.

## 2.9 MORTAR AND GROUT MIXES

- A. Type S Spec Mix Preblended, Dry Mortar Mix.
  1. Complies with ASTM C 270 Proportion Specification.

Natural gray is often used, including use with colored cmu. Specify colors, and if appropriate, mortar colors correlated to cmu colors, here.

2. Natural gray color.

B. Grout for Unit Masonry: per ASTM C 476.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Prior to the start of masonry installation, verify all conditions pertinent to the performance of work in this Section are acceptable.
  - 1. Foundation shall be level and at correct grade such that the initial bed joint shall not be less than 1/4 inch nor more than 3/4 inch.
  - 2. Verify that reinforcing dowels are properly placed.
- B. Masonry work shall not proceed until unsatisfactory conditions have been corrected or cleared by the governing authority.

### 3.2 INSTALLATION

- A. Cut units as required to fit; use motor-driven masonry saw. Install cut units with cut surfaces edges concealed as much as possible.
- B. Lay dry units only, unless otherwise approved.
- C. Select and arrange units for exposed masonry to produce a uniform blend of colors and textures.
  - 1. Mix units from several pallets or cubes as they are placed.
- D. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602.

### 3.3 LAYING MASONRY WALLS

- A. All masonry shall be laid true, level, plumb, and in accordance with the drawings.
- B. Masonry shall be laid in running bond unless otherwise indicated.

Running bond is the typical pattern. If stack bond or another pattern is to be used, delete paragraph above and edit paragraph below, or refer to drawings. Otherwise delete the following two paragraphs.

- C. Exposed masonry shall be laid in [stack bond][or other] unless otherwise indicated.
- D. Concealed masonry with shall be laid in running bond unless otherwise indicated.
- E. Install built-in items specified in this and other Sections as work progresses. Solid grout all spaces around built-in items unless otherwise noted on the drawings.

### 3.4 MORTAR BEDDING AND JOINTING

- A. Lay hollow units with head and bed joints filled with mortar for the thickness of the face shell.
- B. Lay solid units with full head and bed joints. Do not fill head joints by slushing with mortar. Bed joints shall not be furrowed deep enough to produce voids.

If another joint profile is used, revise first paragraph below or show on Drawings. Note that some decorative joint profiles are not recommended for weather exposure; consult your Angelus Block representative.

- C. All mortar joints on exposed walls shall be concave, unless otherwise indicated, and struck to produce a dense, slightly concave surface well bonded to the surface of the masonry unit.
- D. Cut joints flush for masonry walls to receive plaster, unless otherwise indicated.

If the unit strength method is used for verification of  $f'_m$  in Article 1.5 A, include the following provision:

- E. Thickness of bed joints shall not exceed 5/8 inch.

### 3.5 WALL TIES

- A. Install ties in horizontal mortar joints at maximum spacing of 36 inches horizontally and 24 inches vertically, but not less than one tie per  $2 \frac{2}{3}$  ft<sup>2</sup> of wall area. Stagger ties in alternate courses.

### 3.6 CONTROL AND EXPANSION JOINTS

- A. Construct control joints as detailed in the drawings as masonry progresses.

### 3.7 INSTALLATION OF REINFORCING STEEL

- A. Place reinforcement as detailed on the drawings.
  - 1. Maintain clear distances between reinforcement and masonry, and maintain placement tolerances in compliance with requirements in ACI 530.1/ASCE 6/TMS 602.

### 3.8 GROUTING

- A. Comply with grout placement requirements in ACI 530.1/ASCE 6/TMS 602.

### 3.9 FIELD QUALITY CONTROL

Statement of Special Inspections per IBC Sections 1704.1.1 and 1705.

- A. Inspection tasks and frequency shall be performed in accordance with the Statement of Special Inspections.

Retain the following paragraph only if the Quality Assurance/Special Inspection requirements are at Level 2, OR if this is a DSA project utilizing the prism test method.

- B. Unless indicated otherwise, perform one set of tests for each 5000 sq. ft. of wall area or portion thereof.

Keep the following paragraph if the Unit Strength Method is specified in Part 1 Quality Assurance.

- C. Concrete Masonry Units: test per ASTM C 140.

Keep the following paragraph if the Unit Strength Method is specified in Part 1 Quality Assurance AND grout is per the properties spec or otherwise required as in Part 1 quality assurance.

- D. Grout: Test per ASTM C 1019.

If prism testing is specified, delete the two preceding paragraphs and retain the following subparagraph. If the unit strength method is specified, delete the following subparagraph.

- E. Prism Test: For each type of construction indicated, construct and test three prisms per ASTM C 1314 at 28 days.

Keep the following two paragraphs if prism testing AND the project is under the CBC AND  $f'_m$  is > 1500 psi.

- F. Masonry Core Test: Core and test per CBC Section 2105A.4 from locations selected by the Design Professional.
- G. Mortar and grout tests: Sample mortar and grout at minimum one-week intervals per CBC Section 2105A.5.

### 3.10 POINTING, AND CLEANING

- A. Point and tool holes in mortar joints to produce a uniform, tight joint.
- B. During construction, minimize any mortar or grout stains on the wall. Immediately remove any staining or soiling that occurs.
  1. For precision or textured units, except as noted below, clean masonry by dry brushing before tooling joints.
  2. For burnished concrete masonry units, immediately remove any green mortar smears or soiling with a damp sponge
- C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

Light sandblasting is a common, non-chemical means of final cleaning of stains and efflorescence prior to the application of water repellents. Water blasting is sometimes used, but saturating the unprotected masonry can often lead to further development of efflorescence.

If other chemical means are desired, edit this subparagraph according to manufacturer's recommendations, and specify the product in Part 2.

1. Clean exposed cmu walls with a light sandblast. All nonmasonry work near the area to be sandblasted shall be covered or protected before the sandblasting starts. Care shall be taken to avoid contamination to areas that are not to be sandblasted.
  - a. Glazed, burnished, or pre-finished masonry units, shall be protected from sandblast operations.
  
- D. At completion of masonry work, remove all scaffolding and equipment used during construction, and remove all debris, refuse, and surplus masonry material from the site.

Include the following article for jobsite sandblasting when a sandblasted texture is specified for design purposes. This is different than light sandblasting for cleanup; sandblasting for textural effects is incorporated with the cleanup sandblasting. Specify "light", "medium", or "heavy" texture, or other defined reference for the desired effect.

### 3.11 JOBSITE SANDBLASTING

- A. Sandblast for textural effects as indicated on the drawings.
- B. Apply ["medium" or other definition] sandblasting to precision masonry walls at indicated areas, as demonstrated on approved samples, in uniform and consistent texture.

An application of water repellent is a critical component of the masonry wall and may be included here for emphasis, coordinated with Section 071900 Water Repellents.

### 3.12 WATER REPELLENT APPLICATION

- A. Cleaning shall be complete and accepted by the Architect, and wall surfaces shall be thoroughly dry.
- B. Apply water repellent in strict accordance with Section 071900 and the water repellent manufacturer's instructions.

END OF SECTION 042713