

SECTION 04 23 00
REINFORCED UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies requirements for construction of reinforcement for masonry unit walls.

1.2 RELATED WORK

- A. Unit Masonry: Section 04 20 00, UNIT MASONRY.
- B. Refer to Section 01 45 29 TESTING LABORATORY SERVICES for Testing laboratory facilities and qualifications of its principals and key personnel to perform tests.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Mill Certificates: Submit steel producer's certificates of mill analysis, tensile and bend tests for reinforcement steel required for project.
- C. 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. Manufacturer's Literature and Data:
 - 1. Strip reinforcement.
 - 2. Reinforcing bars.

1.4 DESIGN REQUIREMENTS

Design all elements with the latest published version of applicable codes.

1.5 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. Refer to the latest edition of all referenced Standards and codes.
- B. American Concrete Institute (ACI):
 - 315.....Details and Detailing of Concrete Reinforcement
- C. American Society for Testing and Materials (ASTM):
 - A82.....Standard Specification for Steel Wire, Plain,
for Concrete Reinforcement

A615/A615M.....Standard Specification for Deformed and Plain
Billet-Steel Bars for Concrete Reinforcement
A675/A675M.....Standard Specification for Steel Bars, Carbon,
Hot-Wrought, Special Quality, Mechanical
Properties
C476.....Standard Specification for Grout for Masonry

PART 2 - PRODUCTS

2.1 MATERIALS

General: Refer to Section 04 20 00, UNIT MASONRY for masonry materials and accessories not included in this section.

2.2 REINFORCEMENT

- A. Steel Reinforcing Bars: ASTM A615, deformed bars, 420 MPa (Grade 60) for bars No. 10 to No. 57 (No. 3 to No. 18), except as otherwise indicated.
- B. Shop-fabricate reinforcement bars which are shown to be bent or hooked.
- C. Strip Reinforcement:
 - 1. Form from wire complying with ASTM A82.
 - 2. Galvanized after fabrication.
 - 3. Width of strip reinforcement 40 mm (1 5/8-inches) less than nominal width of masonry wall or partition.
 - 4. Cross wires welded to longitudinal wires.
 - 5. Strip reinforcing at least 3000 mm (10 feet) in length.
 - 6. Strip reinforcing in rolls is not acceptable.
 - 7. Strip reinforcing that is crimped to form drip is not acceptable.
 - 8. Maximum spacing of cross wires 400 mm (16 inches) to longitudinal wires.
 - 9. Ladder Design:
 - a. Longitudinal wires deformed 5 mm (0.1875 inch) diameter wire.
 - b. Cross wires 4 mm (0.1483 inch) diameter.
 - 10. Trussed Design:
 - a. Longitudinal and cross wires not less than 4 mm (0.1483 inch nominal) diameter.
 - b. Longitudinal wires deformed.
 - 11. Multiple Wythes and Cavity wall ties:
 - a. Longitudinal wires 4 mm (0.155 inch) with U shape 2.6 mm (0.1055 inch) rectangular ties extending into other wythe not less than 75 mm (3 inches) spaced 400 mm o.c. (16 inches). Adjustable type with U shape tie designed to receive 4 mm (0.155 inch) pintle projecting into other wythe 75 mm (3 inches).

PART 3 - EXECUTION

3.1 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. For columns, piers and pilasters, provide a clear distance between vertical bars as indicated, but not less than 1 1/2 times the nominal bar diameter or 38 mm (1-1/2 inches), whichever is greater. Provide lateral ties as indicated.
- D. Splice reinforcement bars where shown; do not splice at other places unless accepted by the Resident Engineer. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
- E. Provide not less than minimum lap as indicated on shop drawings, or if not indicated, as required by governing code.
- F. 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.
- G. 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 units not less than 150 mm (6 inches) at ends. Use prefabricated "L" and "T" units to provide continuity at corners and intersections. Cut and bend units as recommended by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
- H. Anchoring: Anchor reinforced masonry work to supporting structure as indicated.
- I. Anchor reinforced masonry walls to non-reinforced masonry where they intersect.

3.2 INSTALLATION, GENERAL

- A. Refer to Section 04200, UNIT MASONRY, for general installation requirements of unit masonry.
- B. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

- C. 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.
- D. 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.
- E. Allow not less than the following minimum time to elapse after completion of members before removing shores or forms, provided suitable curing conditions have been obtained during the curing period.
 - 1. 10 days for girders and beams.
 - 2. 7 days for slabs.
 - 3. 7 days for reinforced masonry soffits.

3.3 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

- A. Do not wet concrete masonry units (CMU), unless temperature and low humidity conditions require moistening to reduce rapid suction of moisture from mortar while placing units.
- 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 bond beam units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh, galvanized, 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. If solid bottom units are used, cut out bottom where necessary to allow vertical reinforcement and/or dowels to pass through.

E. Columns, Piers and Pilasters:

1. Use CMU units of the size, shape and number of vertical core spaces shown. If not shown, use units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.
2. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.

F. 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. Refer to Structural drawings for areas to be grouted using concrete fill.
3. Grouting Technique: At the Contractor's option, use either low-lift or high-lift grouting techniques subject to requirements which follow.

G. Low-Lift Grouting:

1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 mm² (8 square inches) in vertical cores to be grouted.
2. Place vertical reinforcement prior to laying 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 at course below bond beam.
4. Pour grout using chute or container with spout. 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.

H. High-Lift Grouting:

1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 75 mm (3 inches) and 6450 mm² (10 square inches), respectively.
2. Provide cleanout holes in first course at all vertical cells which are to be filled with grout.
3. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
4. Construct masonry to full height of maximum grout pour specified, prior to placing grout.
5. Limit grout lifts to a maximum height of 1.5 m (5 feet) and grout pour to a maximum height of 7.3 m (24 feet), for single wythe hollow concrete masonry walls, unless otherwise indicated.
6. Place vertical reinforcement before grouting. Place before or after laying masonry units, as required by job conditions. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 3 m (10 feet).
7. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosed before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.
8. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.
9. Place horizontal beam reinforcement as the masonry units are laid.
10. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing shown.
11. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as shown, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide not less than 4.1 mm diameter (8 gage) wire ties spaced 400 mm (16 inches) o.c. for members with 500 mm (20 inches) or less side dimensions, and 200 mm (8 inches) o.c. for members with side dimensions exceeding 500 mm (20 inches).
12. Preparation of Grout Spaces: Prior to grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean

- reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
13. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
 14. Place grout by pumping into grout spaces unless alternate methods are acceptable to the Owner's Representative.
 15. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts which do not exceed 1.5 m (5 feet). Allow not less than 30 minutes, nor more than one hour between lifts of a given pour. Rod or vibrate each grout lift during pouring operation.
 16. Place grout in lintels or beams over openings in one continuous pour.
 17. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 25 mm (1 inch) of vertically reinforced cavities, during construction of masonry.
 18. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 38 mm (1-1/2 inches) of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

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