SECTION 4A

MASONRY

1. APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 American Society for Testing and Materials (ASTM) Publications:

A 82-79	Cold-Drawn Steel Wire for Concrete Reinforcement
A 116-81	Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
A 153-82	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A 615-82	Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
A 616-82a	Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
B 227-70 (R 1980)	Hard-Drawn Copper-Clad Steel Wire
C 90-75 (R 1981)	Hollow Load-Bearing Concrete Masonry Units
C 145-75 (R 1981)	Solid Load-Bearing Concrete Masonry Units
C 270-82	Mortar for Unit Masonry
C 476-80	Grout for Reinforced and Nonreinforced Masonry

1.2 American Society for Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) Publication:

Handbook, Fundamentals (1981 and Errata)

1.3 International Masonry Industry All-Weather Council (IMIAWC) Publication:

Recommended Practices and Guide Specifications for Cold-Weather Masonry Construction (December 1, 1970)

2. SUBMITTALS:

2.1 Certificates of Compliance: Certificates of compliance attesting that concrete masonry units, joint reinforcement and control joint key meet

the requirements specified shall be furnished in accordance with the SPECIAL PROVISIONS. Certified copies of laboratory test reports, including all test data, shall be submitted before delivery of mortar materials and mortar admixture.

2.2 Samples: Two samples of concrete masonry units shall be submitted for approval.

3. HANDLING AND STORAGE: Materials shall be handled, stored, and protected in an approved manner to avoid chipping, breakage, contact with soil or contaminating material, and exposure to the elements. Concrete masonry units shall conform to the moisture content as specified in ASTM C 90 and ASTM C 145 when delivered to the jobsite. Anchors, ties, and joint reinforcement shall be kept free of rust. Steel reinforcing bars or rods shall be free of loose scale and rust. Prefabricated lintels shall be marked on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

4. ENVIRONMENTAL REQUIREMENTS:

4.1 Hot-Weather Installation: Masonry erected when the ambient air has a temperature of more than 99 degrees F. in the shade and has a relative humidity of less than 50 percent shall be protected from direct exposure to wind and sun for 48 hours after installation.

4.2 Cold-Weather Installation: Cold-weather installation shall be in accordance with IMIAWC, Recommended Practices and Guide Specifications for Cold-Weather Masonry Construction.

5. MATERIALS: Materials shall conform to the following requirements:

5.1 Anchors and Ties: Anchors and ties shall be type as specified below for approved design and, except as otherwise specified, shall be zinc coated ferrous metal. Zinc coat shall conform to ASTM A 153. Copper cladding of steel wire shall conform to the requirements specified for Grade 30 HS wire in ASTM B 227.

5.1.1 Wire-mesh ties shall be 1/2-inch mesh of minimum 16-gage steel wire. Ties for concrete-masonry-unit partitions to intersecting masonry shall be 1 inch less in width than the actual width of the unit or wall in which placed and shall be of lengths required. Minimum lengths shall be not less than 12 inches.

5.1.2 Dovetail anchors shall be flat or flexible as required. One-inch wide flat anchors of not lighter than 16-gage sheet steel shall be used for anchoring masonry walls or partitions of square-end units to abutting concrete walls and for anchoring masonry to underside of beams and slabs. Anchors, measured from face of concrete to end, shall be 3-1/2 inches long except that anchors of 5-inch minimum length shall be used for anchoring concrete masonry-unit walls or partitions to abutting concrete walls. Dovetail slots are specified in SECTION: CONCRETE FOR BUILDING CONSTRUCTION.

5.1.3 Rigid steel anchors shall be 1-1/2 inches wide by 1/4-inch thick with ends turned in opposite directions not less than 2 inches for setting into filled cells and with not less than 24 inches between turned ends.

5.1.4 Steel strap anchors shall be 1-1/2 inches wide by 1/4-inch thick with ends turned in opposite directions not less than 2 inches and of length to span the cavity for embedment of turned ends in masonry cells.

5.1.5 Flexible anchors shall be 6-gage or heavier steel wire, triangular-shaped with one side discontinuous, and of length to extend from back of steel anchor rods shown to within 1/2-inch of exposed exterior mortar joints. Rods shall be of 1/4-inch diameter steel bars placed to provide 3/8-inch clearance between flexible anchors and structural steel columns. Anchor rods shall be secured to steel columns with steel spacers of 14 gage or heavier steel and not less than 1-inch high. Steel spacers shall be set 16 inches on centers vertically so as to permit complete embedment in horizontal mortar joints. Spacers shall be welded to rods and columns. Equivalent welded-on steel anchor rods or shapes standard with the flexible-anchor manufacturer may be furnished when approved. Welds shall be cleaned and given one coat of zinc-rich paint.

5.2 Concrete Masonry Units: Concrete masonry units shall conform to ASTM C 90, Type I, Grade N-1 for hollow-load-bearing units. Units shall be of dimensions that will lay up to 8-inch modules. Units shall include closer, jamb, header, lintel, and bond-beam units, and special shapes and sizes required to complete the work indicated. Units having a bullnose of 1-inch radius shall be used throughout interior spaces at vertical external corners of interior concrete-masonry-unit walls and partitions that will be exposed to view or painted. Exposed-to-view or painted units in any one building shall be of the same appearance.

5.3 Control Joint Keys: Control joint keys shall be factory-fabricated solid section of natural or synthetic rubber, combination thereof, plastic, or other rubber-like material. The material shall be resistant to oils and solvents. The key shall be of shape indicated and of dimensions to completely fill and fit neatly, but without forcing, in masonry-unit jamb sash grooves specified, and to provide control-joint width of 3/8-inch with tolerance of 1/16 inch. Shear section shall be 5/8-inch minimum thickness.

5.4 Grout: Grout for filling cores of hollow units shall conform to ASTM C 476, mixed to pouring consistency.

5.5 Joint Reinforcement: Joint reinforcement shall be factory-fabricated from steel wire conforming to ASTM A 82, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coat conforming to ASTM A 116, Class 1. All wires shall be a minimum of 9 gage. Reinforcement in single-wythe concrete-masonry-unit walls or partitions shall be of one design throughout, either ladder or truss design, having two or more deformed or smooth longitudinal wires. The distance between contacts of crosswires with each outermost longitudinal wire of ladder or truss designs shall not exceed 6 inches for smooth longitudinal wires and 16 inches for deformed longitudinal wires. Intersections of X-bracing shall not exceed 24 inches on centers. Joint reinforcement for straight runs shall be furnished in flat sections not

less than 10-feet long. Walls containing joint reinforcement shall be provided with factory-formed pieces at corners and intersections of walls and partitions.

5.6 Mortar:

5.6.1 Mortar for all masonry shall comply with property specification for Type N mortar set forth in ASTM C 270 and as modified herein, proportioned and tested in the laboratory. When tested for water retention, the mortar shall have a flow, after suction, of 75 percent or more when mixed to an initial flow of 125 to 140 percent. When tested for compressive strength, mortar shall be mixed to a flow of 100 to 115 percent.

5.6.2 Admixture, other than antifreeze compounds, may be used in the mortar subject to approval. The admixture shall not adversely affect mortar bond or compressive strengths of mortar designed without use of admixture. The admixture shall not contain calcium chloride, chloride salts, or any other chemical that will deleteriously affect metals embedded in mortar, including coatings.

5.7 Reinforcing Steel Bars and Rods: Reinforcing steel bars and rods shall conform to ASTM A 615 or ASTM A 616.

5.8 Shear Bars: Shear bars shall be of steel, flat, 1-inch wide, 1/4-inch thick, and not less than 12 inches long.

6. PROTECTION: Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in process. Covering shall extend a minimim of 2 feet down on each side of the wall and be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

7. ERECTION: No unit having a film of water or frost on its surface shall be laid. Cutting of individual masonry units prior to installation shall be with power masonry saw. Masonry shall be laid plumb, true to line, with level courses accurately spaced. Bond pattern shall be kept plumb throughout. Corners and reveals shall be plumb and true. Vertical joints shall be shoved tight. Each unit shall be adjusted to final position while mortar is still soft and plastic. Any unit that is disturbed after mortar has stiffened shall be removed and relaid with fresh mortar. Courses shall be so spaced that backing masonry will level off, flush with the face work at all joints where ties occur. Chases and raked-out joints shall be kept free from mortar or other debris. Spaces around metal door frames and other built-in items shall be solidly filled with mortar as each course is laid. The sizes of any two adjacent units shall be within permitted tolerances so that the difference between the vertical faces of such units shall not exceed 1/8 inch in exposed-to-view or painted walls and partitions. Units in exposed-to-view or painted walls and partitions shall be free from chipped edges or other imperfections detracting from the appearance of the finished work.

7.1 Anchorage to Concrete: Anchorage to abutting walls and columns shall be with flat sheet steel dovetail anchors spaced not over 16 inches

on centers vertically and centered in single-wythe walls. Cells within vertical planes of these anchors shall be filled solid with mortar or grout for full height of walls or partitions or solid units may be used. Anchorage to underside of slabs shall be with flat sheet steel dovetail anchors spaced not over 32 inches on centers horizontally. These anchors shall be centered in full vertical mortar joints of single-wythe walls.

7.2 Cutting and Fitting: Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics. Wherever possible, full units of the proper size shall be used in lieu of cut units. Cut edges shall be clean, true, and sharp. Cutting of units shall be with power masonry saw. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being placed in the wall. Openings shall be carefully cut, formed, or otherwise neatly made for recessed items and for electrical, plumbing, or other mechanical installations so that wall plates, cover plates, or escutcheons required by the installations will completely conceal the openings and will have bottoms in alinement with lower edge of masonry joints. Webs of hollow masonry units shall be cut the minimum required for the installation. Reinforced-masonry or structural steel lintels shall be provided as indicated above openings over 12-inches wide for pipe, ducts, and cable trays, unless steel sleeves are used.

7.3 Embedded Items: Spaces around built-in items shall be filled solidly with mortar. Openings around flush-mounted electrical outlet boxes in wet locations shall be pointed flush with mortar including flush joint above the box. Anchors, ties, wall plugs, accessories, flashings, pipe sleeves, and other items required to be built in shall be built in as the masonry work progresses. Anchors, ties, and joint reinforcement shall be fully embedded in mortar. Cells receiving anchor bolts and cells of first masonry course below bearing plates shall be filled solidly with mortar or grout.

7.4 Unfinished Work: Unfinished work shall be stepped back for joining with new work. Toothing may be resorted to only when specifically approved. Before laying new work, loose mortar shall be removed and the exposed joint shall be thoroughly cleaned.

7.5 Mortar: Mortar shall be accurately measured in laboratory-established proportions and mixed with as much water as may be necessary to produce the wettest workable consistency possible. Mortar shall be placed in final position within 2-1/2 hours after mixing. Mortar not used or that has started to set within this time interval shall be discarded. Mortar, that has stiffened within the above time interval, because of evaporation of moisture from the mortar, shall be retempered to restore its workability.

7.6 Jointing: Joints in exposed-to-view or painted walls and partitions, except control joints, joints to be pointed or calked or sealed, and openings around flush-mounted electrical outlet boxes in wet locations shall be tooled slightly concave with the mortar thoroughly compacted and pressed against the edges of the units. Tooling shall be done when the mortar is thumbprint hard. The tooled joints shall be finished to uniformly straight and true lines and surfaces, smooth and free of tool

marks. Control joints on exposed-to-view or painted interior walls or partitions shall be raked to 1/4-inch depth. Horizontal joints between top of masonry and underside of concrete slabs shall be filled with mortar unless otherwise indicated. Joint widths for concrete masonry unit joints shall be 3/8-inch wide, including initial mortar joint.

7.7 Concrete Masonry Units: Concrete masonry units shall not be wetted before laying. Units shall be laid in running bond so that vertical joints between units will be located over the center of the units in the next course below and in alinement from bottom to top of wall. Units shall be full bedded in mortar under both face shells and webs where placed on slabs and in lintels, and where cells are to be filled with grout or concrete. Other units shall be full bedded under both face shells, but mortar shall not extend through the unit on web edges except where anchors or ties occur. All headjoints, except in control joints requiring control joint key, and divided bed mortar joints shall be filled solidly with mortar for a distance in from the face of the unit or wall not less than the thickness of the longitudinal face shell. Jamb units shall be of the shapes and sizes to bond with wall units. No cells shall be left open in the face surfaces. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Small-mesh wire fabric or expanded metal lath shall be embedded in mortar below cells of hollow units receiving mortar, or concrete fill and shall extend across airspace of cavity wall where mortar, or concrete fill is required. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other spaces requiring fill shall be filled solid with mortar, or concrete. Cells under lintel bearings on each side of openings shall be filled solid with grout, mortar, or concrete for full height of openings. One cell of two-cell units and two cells of three-cell units shall be filled each side of jambs when lintel bearings are 8 inches. Solid units may be used instead of hollow units filled with mortar, or concrete, except for installations requiring embedment of anchors in cells of hollow units.

7.7.1 Each course shall be masonry bonded at exterior corners and where masonry bond is indicated. At other intersections, masonry walls or partitions shall be anchored or tied together. Interior partitions shall be tied to intersecting walls or partitions with wire-mesh ties or wire ties spaced not over 16 inches apart vertically. Ties shall be of length and placed in such manner as to extend from 12 inches or more within the partition to 7 inches into walls of 8-inch or thicker units. Cells within vertical plane of ties shall be filled solid with mortar or grout for full height of wall or partition or solid masonry units may be used. Interior partitions having masonry walls over 4-inches thick shall be tied together with rigid steel anchors spaced not over 32 inches on centers vertically with turned ends of anchors embedded in cells of units filled solid with mortar. Rigid anchors shall be located between courses containing joint reinforcement. Walls containing joint reinforcement shall be provided with factory-formed pieces at corners and intersections of walls and partitions in combination with ties or anchors.

7.7.2 Walls and partitions shall be continuous from floor to underside of roof construction above, unless otherwise specified or indicated.

7.7.3 Where constructed of concrete masonry units, lintels shall be specially formed load-bearing lintel- or U-shaped units filled solid with grout conforming to ASTM C 476 and reinforced. At control joints, lintels shall be installed over metal bond barrier. Lintels shall extend beyond each side of masonry openings at least 8 inches for openings up to 8 feet wide, 16 inches for openings over 8 feet up to 16-feet wide, and as indicated over 16-feet wide.

7.7.4 Units containing reinforcement shall be filled solid with grout conforming to ASTM C 476.

7.8 Splash Block: Splash block shall be set under each downspout shown discharging onto grade.

8. SHRINKAGE-CRACKING CONTROL: Shrinkage-cracking in concrete-masonry-unit construction shall be controlled by control joints, joint reinforcement, and bond beams, or combinations thereof, in strict accordance with the details indicated and as specified hereinafter.

8.1 Bond Beams: Bond beams shall consist of load-bearing units filled with grout conforming to ASTM C 476 and reinforced as indicated. No. 4 wire mesh or small-mesh expanded metal lath shall be embedded in mortar joints receiving open-bottom bond beam units to retain the concrete fill. Reinforcement shall be continuous, including around corners, except through control joints or expansion joints. Where splices are required, for continuity, reinforcement shall be lapped 24-bar diameters or 12 inches, whichever is greater. A minimum clearance of 1/2 inch shall be maintained between reinforcement and interior faces of units. Bond beams shall be broken at expansion joints and, where indicated, at control joints. Dummy control joints shall be formed in the bond beam where bond beam is not broken at control joint.

8.2 Joint Reinforcement: Joint reinforcement shall be installed as indicated. Reinforcement shall be placed so that longitudinal wires are centered on the wall or wythe and are fully embedded in mortar for their entire length. Reinforcement at openings shall extend not less than 24 inches beyond the end of sills or lintels or the end of the panel if the distance to the end of the panel is less than 24 inches. Reinforcement shall not be continuous through a control joint or an expansion joint. Reinforcement shall be lapped 6 inches or more for deformed longitudinal wires and 12 inches or more for smooth longitudinal wires. Factory fabricated sections shall be installed at corners and wall intersections.

8.3 Control Joints: Control joints shall be provided as indicated and shall be constructed by using either special control-joint units, open-end stretcher units, metal-sash jamb units on each side of joint and control joint key, or with shear bars. Sash jamb units shall have a 3/4- by 3/4-inch groove near the center at end of each unit. Shear bars shall be spaced 16 inches apart vertically, centered both across control joints and longitudinally over units. Shear bars shall be greased on one side of control joints and in thinner wythe of change in wall thickness. Cells within vertical plane of shear bars on both sides of and for full height of control joint shall be filled solid with mortar or grout or solid units may be used. Control joints shall be raked out on weather side and on room side of walls. Shear bars shall be fully embedded in mortar.

9. POINTING AND CLEANING:

9.1 General: Mortar daubs or splashings, before setting or hardening, shall be completely removed from masonry-unit surfaces that will be exposed or painted. Before completion of the work, all defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

9.2 Concrete-Masonry-Unit Surfaces: Concrete-masonry-unit surfaces shall be dry-brushed at the end of each day's work and after any required pointing.

TABLE I. REINFORCEMENT OF LINTELS

Nominal Width (Inches)	Nominal Height (Inches)	Reinforcement
8	8	Two No. 4 bars at bottom