JBLM DESIGN STANDARDS

DIVISION 04

SECTION 04 20 00

UNIT MASONRY
07/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 216.1	(2014) Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies
ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)
ACI 318M	(2014; ERTA 2015) Building Code Requirements for Structural Concrete & Commentary
ACI SP-66	(2004) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2016) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A167	(2011) Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A185/A185M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A615/A615M	(2016) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A641/A641M	(2019) Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
ASTM A653/A653M	(2019) Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron

	Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A951/A951M	(2011) Standard Specification for Steel Wire for Masonry Joint Reinforcement
ASTM A996/A996M	(2016) Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM A1008/A1008M	(2016) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM B370	(2012; R 2019) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM C27	(1998; R 2008) Fireclay and High-Alumina Refractory Brick
ASTM C55	(2017) Standard Specification for Concrete Building Brick
ASTM C62	(2017) Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C67/C67M	(2020) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C90	(2016) Standard Specification for Loadbearing Concrete Masonry Units
ASTM C126	(2019) Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units
ASTM C129	(2017) Standard Specification for Nonloadbearing Concrete Masonry Units
ASTM C207	(2018) Standard Specification for Hydrated Lime for Masonry Purposes
ASTM C216	(2019) Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C270	(2019) Standard Specification for Mortar for Unit Masonry

ASTM C315	(2007; R 2011) Clay Flue Linings
ASTM C476	(2019) Standard Specification for Grout for Masonry
ASTM C494/C494M	(2019) Standard Specification for Chemical Admixtures for Concrete
ASTM C586	(2011) Standard Test Method for Potential Alkali Reactivity of Carbonate Rocks as Concrete Aggregates (Rock-Cylinder Method)
ASTM C616/C615M	(2011) Standard Specification for Granite Dimension Stone
ASTM C616/C616M	(2010) Standard Specification for Quartz-Based Dimension Stone
ASTM C641	(2017) Standard Test Method for Iron Staining Materials in Lightweight Concrete Aggregates
ASTM C652	(2019b) Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)
ASTM C744	(2016) Prefaced Concrete and Calcium Silicate Masonry Units
ASTM C780	(2019) Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C979/C979M	(2016) Standard Specification for Pigments for Integrally Colored Concrete
ASTM C1019	(2019) Standard Test Method for Sampling and Testing Grout
ASTM C1314	(2014) Standard Test Method for Compressive Strength of Masonry Prisms
ASTM C1384	(2012a) Standard Specification for Admixtures for Masonry Mortars
ASTM C1405	(2015) Standard Specification for Glazed Brick (Single Fired, Brick Units)
ASTM C1611/C1611M	(2014) Standard Test Method for Slump Flow of Self-Consolidating Concrete
ASTM C1634	(2011) Standard Specification for Concrete Facing Brick
ASTM D2000	(2018) Standard Classification System for Rubber Products in Automotive Applications

ASTM D2287	(2019) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM E514/E514M	(2014a) Standard Test Method for Water Penetration and Leakage Through Masonry

THE MASONRY SOCIETY (TMS)

TMS MSJC	(2016) Masonry Standard Joint Committee's (MSJC) Book - Building Code Requirements and Specification for Masonry Structures, Containing TMS 402/ACI 530/ASCE 5, TMS 602/ACI 530.1/ASCE 6, and Companion Commentaries

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the [Sustainability eNotebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING][Environmental Records Binder, in conformance with Section 01 57 19.01 20 SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS]. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Recycled Content of Concrete Units and Cementitious Materials; S

Recycled Content of Insulation; S

VOC Content for Interior Sealants; S

SD-02 Shop Drawings

Cut CMU Drawings; G[, [_____]]

Reinforcement Detail Drawings; G[, [_____]]

SD-03 Product Data

Hot Weather Procedures; G[, [_____]]

Cold Weather Procedures; G[, [_____]]

Clay or Shale Brick; G[, [_____]]

Glazed Structural Clay Facing Tile; G[, [_____]]

Glazed Brick; G[, [_____]]

Salvaged Brick; G[, [_____]]

Cement; G[, [_____]]

Cementitious Materials; G[, [_____]]

Insulation; G[, [_____]]

SD-05 Design Data

Masonry Compressive Strength; G[, [_____]]

Fire-Rated Concrete Masonry Units

Bracing Calculations; G[, [_____]]

SD-06 Test Reports

Efflorescence Test

Fire-Rated Concrete Masonry Units

Field Testing of Mortar

Prism Tests

Single-Wythe Masonry Wall Water Penetration Test

SD-07 Certificates

Special Masonry Inspector Qualifications

Clay or Shale Brick

Glazed Structural Clay Facing Tile

Glazed Brick

Concrete Masonry Units (CMU)

Concrete Brick

Precast Concrete Units

Cementitious Materials

Admixtures for Masonry Mortar

Admixtures for Grout

Anchors, Ties, and Bar Positioners

Joint Reinforcement

Insulation

Insulation

SD-10 Operation and Maintenance Data

Take-Back Program

SD-11 Closeout Submittals

Recycled Content of Clay Units; S

Recycled Content of Concrete Units and Cementitious Materials; S

Recycled Content of Insulation; S

VOC Content for Interior Sealants; S

1.3 QUALITY ASSURANCE

1.3.1 Masonry Mock-Up Panels

1.3.1.1 Mock-Up Panel Location

After material samples are approved and prior to starting masonry work, construct a mock-up panel for each type and color of masonry required. At least 48 hours prior to constructing the panel or panels, submit written notification to the Contracting Officer. Do not build-in mock-up panels as part of the structure; locate mock-up panels where directed. Construct portable mock-up panels or locate in an area where they will not be disrupted during construction.

1.3.1.2 Mock-Up Panel Configuration

Construct mock-up panels L-shaped or otherwise configured to represent all of the wall elements. Construct panels of the size necessary to demonstrate the acceptable level of workmanship for each type of masonry represented on the project. Provide a straight panel or a leg of an L-shaped panel of minimum size 2.5 m (8 feet) long by [1.2] [1.8] m ([4] [6] feet) high.

1.3.1.3 Mock-Up Panel Composition

Show full color range, texture, and bond pattern of the masonry work. Demonstrate mortar joint tooling; grouting of reinforced vertical cores, collar joints, bond beams, and lintels; positioning, securing, and lapping of reinforcing steel; positioning and lapping of joint reinforcement (including prefabricated corners); and cleaning of masonry work during the construction of the panels. Also include installation or application procedures for anchors, wall ties, CMU control joints, brick expansion joints, insulation, flashing, brick soldier, row lock courses and weeps. Include a [a masonry bonded corner] [a stacked bond corner] [a bond beam corner] [and] [parging] [and] [installation of electrical boxes and conduit]. When the panel represents reinforced masonry, include a 610 by 610 mm (2 by 2 foot) opening placed at least 610 mm (2 feet) above the panel base and 610 mm (2 feet) away from all free edges, corners, and control joints. Provide required reinforcing around this opening as well as at wall corners and control joints.

1.3.1.4 Mock-Up Panel Construction Method

Where anchored veneer walls or cavity walls are required, demonstrate and receive approval for the method of construction; i.e., either bring up the two wythes together or separately, with the insulation and appropriate ties placed within the specified tolerances across the cavity. Demonstrate provisions to preclude mortar or grout droppings in the cavity and to provide a clear open air space of the dimensions shown on the drawings. Where masonry is to be grouted, demonstrate and receive approval on the method that will be used to bring up the masonry wythes; support the reinforcing bars; and grout cells, bond beams, lintels, and collar joints using the requirements specified herein. When water-repellent is specified to be applied to the masonry, apply the approved product to the mock-up panel. Construct panels on a properly designed concrete foundation.

1.3.1.5 Mock-Up Panel Purpose

The completed panels is used as the standard of workmanship for the type of masonry represented. Do not commence masonry work until the mock-up panel for that type of masonry construction has been completed and approved. Protect panels from the weather and construction operations until the masonry work has been completed and approved. Perform cleaning procedures on the mockup and obtain approval of the Contracting Officer prior to cleaning the building. After completion of the work, completely remove the mock-up panels, including all foundation concrete, from the construction site.

1.3.2 Special Masonry Inspector Qualifications

Refer to Section 01 45 35 SPECIAL INSPECTIONS for qualifications and responsibilities of the masonry special inspector.

1.4 DELIVERY, STORAGE, AND HANDLING

Deliver, store, handle, and protect material to avoid chipping, breakage, and contact with soil or contaminating material. Store and prepare materials in already disturbed areas to minimize project site disturbance and size of project site.

1.4.1 Masonry Units

Cover and protect masonry units from precipitation. Conform to handling and storage requirements of TMS MSJC.

a. Pack glazed brick, glazed structural clay tile, and prefaced concrete masonry units in the manufacturer's standard paper cartons, trays, or shrink wrapped pallets with a divider between each unit. Do not stack pallets. Do not remove units from cartons until cartons are placed on scaffolds or in the location where units are to be laid.

b. Mark prefabricated lintels on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

1.4.2 Reinforcement, Anchors, and Ties

Store steel reinforcing bars, coated anchors, ties, and joint reinforcement above the ground. Maintain steel reinforcing bars and uncoated ties free of loose mill scale and loose rust.

1.4.3 Cementitious Materials, Sand and Aggregates

Deliver cementitious and other packaged materials in unopened containers, plainly marked and labeled with manufacturers' names and brands. Store cementitious material in dry, weathertight enclosures or completely cover. Handle cementitious materials in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Store sand and aggregates in a manner to prevent contamination and segregation.

1.5 PROJECT/SITE CONDITIONS

Conform to TMS MSJC for hot and cold weather masonry erection.

1.5.1 Hot Weather Procedures

When ambient air temperature exceeds 38 degrees C (100 degrees F), or exceeds 32 degrees C (90 degrees F) and the wind velocity is greater than 13 km/h (8 mph), comply with TMS MSJC Article 1.8 D for: preparation prior to conducting masonry work; construction while masonry work is in progress; and protection for newly completed masonry.

1.5.2 Cold Weather Procedures

When ambient temperature is below 4 degrees C (40 degrees F), comply with TMS MSJC Article 1.8 C for: preparation prior to conducting masonry work; construction while masonry work is in progress; and protection for newly completed masonry.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Design - Specified Compressive Strength of Masonry

The specified compressive strength of masonry, f'm, is [_____] [as indicated for each type of masonry] [indicated in a schedule in this Specification].

2.1.2 Performance - Verify Masonry Compressive Strength

Verify specified compressive strength of masonry using the "Unit Strength Method" of TMS MSJC. Submit calculations and certifications of unit and mortar strength.

Verify specified compressive strength of masonry using the "Prism Test Method" of TMS MSJC when the "Unit Strength Method" cannot be used. Submit test results.

2.2 MANUFACTURED UNITS

2.2.1 General Requirements

Do not change the source of materials, which will affect the appearance of the finished work, after the work has started except with Contracting Officer's approval. Submit test reports from an approved independent laboratory. Certify test reports on a previously tested material as the same materials as that proposed for use in this project. Submit

certificates of compliance stating that the materials meet the specified requirements.

2.2.2 Clay or Shale Brick

2.2.2.1 General

2.2.2.1.1 Sample Submittal

Submit brick samples as specified, showing the color range and texture of clay or shale brick. Limit units used on the project to those that conform to the approved sample. Submit sample of colored mortar with applicable masonry unit and color samples of three stretcher units and one unit for each type of special shape.

2.2.2.1.2 Uniformity

[Manufacture bricks at one time and from the same run.] Deliver clay or shale brick units factory-blended to provide a uniform appearance and color range in the completed wall.

[2.2.2.1.3 Recycled Content

Provide clay units containing a minimum of [0] [5] [_____] percent post-consumer recycled content, and a minimum of [10] [20] [_____] percent post-industrial recycled content.

]2.2.2.1.4 Efflorescence Test

Test clay brick that will be exposed to weathering for efflorescence in accordance with ASTM C67/C67M. Schedule tests far enough in advance of starting masonry work to permit retesting if necessary. Units meeting the definition of "effloresced" are subject to rejection.

2.2.2.2 Solid Clay or Shale Brick

Provide solid clay or shale brick that conforms to [ASTM C216, Type [FBS] [FBA] [FBX]] [ASTM C62]. [Provide brick with minimum compressive strength of [_____] MPa (psi).] Where brick cores, recesses, or deformation would be exposed to view, provide 100 percent solid units. Provide brick with texture and color tange to match the brick [on display at [_____]] [indicated].

Provide brick with specified sizes.

[a. Modular size, 92 mm (3-5/8 inches) thick, 57 mm (2-1/4 inches) high, and 194 mm (7-5/8 inches) long.

][b. Closure size, 92 mm (3-5/8 inches) thick, 92 mm (3-5/8 inches) high, and 194 mm (7-5/8 inches) long.

][c. Utility size, 92 mm (3-5/8 inches) thick, 92 mm (3-5/8 inches) high, and 295 mm (11-5/8 inches) long.
]

2.2.2.3 Glazed Brick and Glazed Structural Clay Facing Tile

Provide [ceramic glazed brick] [glazed facing tile] indicated as [_____], conforming to ASTM C1405 [ASTM C126], Type I, Grade [SS] [S], glaze as indicated. In two-faced walls, Type II units may be used for the base course. Provide all shapes and sizes for a complete installation. Use bullnose units along sills and caps and at vertical external corners including door jambs, window jambs, and other such openings. Provide coved base units to meet finished floor surfaces where ceramic tile floor occurs.

a. Where backs of units will be exposed in unfinished rooms, provide smooth backs, free from glaze. Where backs of units will receive plaster, provide scored, combed, or otherwise roughened backs.

b. Provide unit surfaces, to receive mortar, reasonably free from glaze and suitable for receiving mortar.

c. Provide tile for fire rated walls with the percent of solid required for that rating.

d. Structural Clay Facing Tile Schedule

Location	Nominal Face Dimensions	Color of Field	Color of Base
[_____]	[_____]	[_____]	[_____]

2.2.2.6 Salvaged Brick

Use [lead-free] salvaged bricks and other masonry units in place of new bricks or masonry units as indicated. [Wash bricks salvaged from foundries or industrial buildings with appropriate metal-dust removing cleaner.] When using salvaged brick, select salvaged exterior face bricks from exterior locations.

Provide salvaged bricks that meet standards of new bricks otherwise used in application, and cleaned of all mortar prior to use. Submit documentation certifying products are from salvaged/recovered sources. Indicate relative dollar value of salvaged content products to total dollar value of products included in project.

2.2.2.7 Flue Linings and Thimbles

Provide units that comply with ASTM C315, and are free from fractures. Provide sizes and shapes as indicated.

2.2.3 Concrete Units

Provide materials and documentation meeting the requirements at Section [01 33 29 SUSTAINABILITY REPORTING][01 57 19.0 20 SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS] paragraph RECYCLED CONTENT. See https://sftool.gov/greenprocurement/green-products/1/construction-materials/29/cement-concrete/0?addon=False for more information.

2.2.3.1 Aggregates

Test lightweight aggregates, and blends of lightweight and heavier aggregates in proportions used in producing the units, for stain-producing iron compounds in accordance with ASTM C641,visual classification method. Do not incorporate aggregates for which the iron stain deposited on the filter paper exceeds the "light stain" classification.

Use industrial waste by-products (air-cooled slag, cinders, or bottom ash), ground waste glass and concrete, granulated slag, and expanded slag in aggregates.

2.2.3.2 Concrete Masonry Units (CMU)

[2.2.3.2.1 Cement

Use only cement that has a low alkali content and is of one brand.

]2.2.3.2.2 Recycled Content

[Provide units with a minimum of [5] [10] [_____] percent post-consumer recycled content, or a minimum of [20] [40] [_____] percent post-industrial recycled content, based on mass, cost, or volume.][Units may contain post-consumer or post-industrial recycled content.]

2.2.3.2.3 Size

Provide units with specified dimension of [_____] mm (inches) wide, [_____] mm (inches) high, and [_____] mm (inches) long.

2.2.3.2.4 Surfaces

[For units that are to be plastered or stuccoed, provide surfaces that are sufficiently rough to provide bond.] [[Elsewhere, provide][Provide] units with exposed surfaces that are smooth and of uniform texture.]

2.2.3.2.5 Weather Exposure

Provide concrete masonry units with water-repellant admixture added during manufacture where units will be exposed to weather.

2.2.3.2.6 Unit Types

a. Hollow Load-Bearing Units: ASTM C90, lightweight [or medium weight] [or normal weight]. Provide load-bearing units for exterior walls, foundation walls, load-bearing walls, and shear walls.

b. Hollow Non-Load-Bearing Units: ASTM C129, lightweight [or medium weight] [or normal weight]. Load-bearing units may be provided in lieu of non-load-bearing units.

c. Solid Load-Bearing Units: ASTM C90, lightweight [or medium weight] [or normal weight] units. Provide solid units as indicated.

2.2.3.2.7 Jamb Units

Provide jamb units of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved.

Provide sash jamb units with a 19 by 19 mm (3/4 by 3/4 inch) groove near the center at end of each unit.

2.2.3.3 Architectural Units

Provide architectural units with patterned face shell: [fluted] [vertical scored] [split ribbed] [_____].

Provide units that are integrally colored during manufacture, with color [_____].

2.2.3.4 Patterned, Decorative Screen Units

Provide patterned, decorative screen units that conform to [ASTM C90] [ASTM C129]. Provide units that have uniform through-the-wall pattern, color, and texture.

2.2.3.5 Fire-Rated Concrete Masonry Units

For indicated fire-rated construction, provide concrete masonry units of minimum equivalent thickness for the fire rating indicated and the corresponding type of aggregates indicated in TABLE I. Units containing more than one of the aggregates listed in TABLE I will be rated by linear interpolation based on the percent by dry-rodded volume of each aggregate used in manufacturing the units.

TABLE IFIRE-RATED CONCRETE MASONRY UNITS

Aggregate Type	Minimum Equivalent Thickness for Fire-Resistance Rating, mm inch						
	1/2 hour	3/4 hour	1 hour	1-1/2 hour	2 hours	3 hours	4 hours
Calcareous or siliceous gravel (other than limestone)	50.82.0	70.02.4	71.12.8	91.43.6	106.74.2	134.65.3	157.56.2
Limestone, cinders, or air-cooled slag	48.31.9	58.42.3	68.62.7	86.43.4	101.64.0	1275.0	149.95.9
Expanded clay, expanded shale, or expanded slate	45.71.8	55.92.2	66.02.6	83.83.3	91.43.6	111.84.4	129.55.1
Expanded slag or pumice	38.11.5	48.31.9	53.32.1	68.62.7	81.33.2	101.64.0	119.44.7

Determine equivalent thickness in accordance with ACI 216.1. Where walls are to receive plaster or be faced with brick, or otherwise form an assembly; include the thickness of plaster or brick or other material in the assembly in determining the equivalent thickness. Submit calculation results.

2.2.3.6 Prefaced Concrete Masonry Units

Prefaced concrete masonry units [may] [may not] be provided in lieu of ceramic glazed structural clay facing tile units. Where prefaced concrete masonry units are provided, concrete masonry unit backing may be omitted when the nominal thickness of the prefaced concrete masonry units is the same as the total indicated nominal thickness of the facing tile plus the backing.

a. Provide prefaced concrete masonry units conforming to ASTM C744 using masonry units conforming to ASTM C90, with the facing turned over the edges and ends of the unit at least 9.5 mm (3/8 inch) in the direction of the thickness of the unit to form a lip at least 1.6 mm (1/16 inch) thick. Limit variation in color and texture to that in the approved sample.

b. Provide all shapes and sized for a complete installation. Use bullnose units along sills and caps and at vertical external corners including door jambs, window jambs, and other such openings with a bullnose radius of 25 mm (1 inch). Cove base units to meet finished floor surfaces where ceramic tile floor occurs.

2.2.3.7 Concrete Brick

2.2.3.7.1 Common Concrete Brick

Provide common concrete brick conforming to ASTM C55. Common concrete brick may be used where necessary for filling out in concrete masonry unit construction.

2.2.3.7.2 Concrete Brick for Facing

Provide concrete brick for exposed applications that conforms to ASTM C1634. Submit samples as specified.

2.2.4 Precast Concrete Units

2.2.4.1 General

a. Provide precast concrete trim, lintels, copings, splashblocks and sills that are factory-made units in a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, provide precast concrete with minimum [28] [20] MPa ([4,000] [3000] psi) compressive strength, conforming to Section 03 30 00 CAST-IN-PLACE CONCRETE using 13 mm (1/2 inch) to No. 4 nominal-size coarse aggregate, and with reinforcement required for handling of the units. Maintain minimum clearance of 19 mm (3/4 inch) between reinforcement and faces of units.

b. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 827 kPa (120 psi) for at least 5 hours, either damp-cure for 24 hours or steam-cure and then age under cover for 28 days or longer. In precast concrete members weighing over 35 kg (80 pounds) provide built-in loops of galvanized wire or other approved provisions for lifting and anchoring.

c. Fabricate units with beds and joints at right angles to the face, with sharp true arises and with drip grooves on the underside where units overhang walls. Form exposed-to-view surfaces free of surface voids, spalls, cracks, and chipped or broken edges and with uniform appearance and color. Unless otherwise specified, provide units with a smooth dense finish.

d. Prior to installation, wet and inspect each unit for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

e. Submit specified factory certificates.[

f. Provide architectural cast stone masonry trim, copings, heads, and sills that are manufactured in a plant by a producer regularly engaged in producing cast stone. Provide cast stone units that comply with ASTM C1364. Submit test reports and three exemplars of the same cast stone product installed in similar projects in similar climatic conditions.]

2.2.4.2 Precast Concrete Lintels

Provide precast concrete lintels, unless otherwise shown, of a thickness equal to the wall and reinforced with minimum two No. 4 bars for the full length. Provide top and bottom bars for lintels over 914 mm (36 inches) in length. Provide at least 200 mm (8 inches) bearing at each end. Label the top of lintels and clearly mark each lintel to show location in the structure. Design reinforced lintels in conformance with ACI 318M (ACI 318) for flexural and shear strength, using concrete with a minimum 28 day compressive strength of [_____] MPa (psi). Limit lintel deflection due to dead plus live load to L/600 or 7.6 mm (0.3 inches).

2.2.4.3 Precast Concrete Sills and Copings

Cast sills and copings washes. For windows having mullions, cast sills in sections with head joints at mullions and a 6 mm (1/4 inch) allowance for mortar joints. Roughen the ends of sills, except a 19 mm (3/4 inch) wide margin at exposed surfaces, for bond. Provide rounded nosings on treads of door sills. [Reinforce sills with not less than two No. 15 (No. 4) bars.]

2.2.5 DIMENSION STONE UNITS

Provide dimension stone for trim, sills, lintels, and copings cut to the design shown and conforming to:

Limestone	ASTM C586	Standard buff color with a smooth machine finish free from tool marks
Sandstone	ASTM C616/C616M	Standard grade, buff, gray, or buff brown, with a smooth finish free from clay pits and tool marks
Granite	ASTM C616/C615M	Commercial grade of medium or moderately coarse grain, with a light or medium gray or light pink color

Provide a smooth machine finish on washes, 4-cut finish on treads, and 6-cut or equivalent machine finish on other exposed surfaces. Except when supported by a steel member, provide lintels 100 mm (4 inches) or more in thickness from face to back edge and of the depth required to support the masonry over the opening. Fabricate stone with beds and joints at right angles to the face, and with sharp, true arises. Provide copings and sills with washes, and where overhanging the walls, with drips cut on the underside. Submit samples as specified.

2.3 EQUIPMENT

2.3.1 Vibrators

Maintain at least one spare vibrator on site at all times.

2.3.2 Grout Pumps

Pumping through aluminum tubes is not permitted.

2.4 MATERIALS

2.4.1 Mortar Materials

2.4.1.1 Cementitious Materials

Provide cementitious materials that conform to those permitted by ASTM C270. Provide materials and documentation meeting the requirements at Section [01 33 29 SUSTAINABILITY REPORTING][01 57 19.0 20 SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS] paragraph RECYCLED CONTENT. See https://sftool.gov/greenprocurement/green-products/1/construction-materials/29/cement-concrete/0?addon=False for more information.

2.4.1.2 Hydrated Lime and Alternates

Provide lime that conforms to one of the materials permitted by ASTM C207 for use in combination with portland cement, hydraulic cement, and blended hydraulic cement. Do not use lime in combination with masonry cement or mortar cement.

2.4.1.3 Colored Mortar

Use mortar pigment that conforms to ASTM C979/C979M. Add pigment to mortar to produce a uniform color matching [_____]. Furnish pigments in accurately pre-measured and packaged units that can be added to a measured amount of cementitious materials or supply pigments via preblended cementitious materials or dry mortar mix.

a. In masonry cement or mortar cement, do not exceed [5][_____] percent of cement weight for mineral oxide pigment; do not exceed [1][_____] percent of cement weight for carbon black pigment.

b. In cement-lime mortar mix, do not exceed [10][_____] percent of cementitious materials' weight for mineral oxide pigment; do not exceed [2][_____] percent of cementitious materials' weight for carbon black pigment.

2.4.1.4 Admixtures for Masonry Mortar

In cold weather, use a non-chloride based accelerating admixture that conforms to ASTM C1384, unless Type III portland cement is used in the mortar.

In showers and kitchens, use mortar that contains a water-repellent admixture that conforms to ASTM C1384. Provide a water-repellent admixture, conforming to ASTM C1384 and of the same brand and manufacturer as the block's integral water-repellent, in the mortar used to place concrete masonry units that have an integral water-repellent admixture.

2.4.1.5 Aggregate and Water

Provide aggregate (sand) and water that conform to materials permitted by ASTM C270.

2.4.2 Grout and Ready-Mix Grout Materials

Hydraulic Cements for Masonry Grout Construction in ASTM C476				
Cement specification*	General Purpose	High early strength	Moderate sulfate resistance	High sulfate resistance
ASTM C150 portland cements	I	III	II	-
ASTM C595 blended hydraulic cements**	IS(<70)IP	-	IS(<70)(MS)	-
ASTM C1157 hydraulic cements	GU	HE	MS	HS
* Air-entrained counterparts for these cements listed are also allowed in masonry grout. However, use of air-entrainment is not recommended when the grout will be used to bond reinforcement to the masonry units.				
**				

2.4.2.1 Cementitious Materials for Grout

Provide cementitious materials that conform to those permitted by ASTM C476.

2.4.2.2 Admixtures for Grout

Water-reducing admixtures that conform to ASTM C494/C494M Type F or G and viscosity-modifying admixtures that conform to ASTM C494/C494M Type S are permitted for use in grout. Other admixtures require approval by the Contracting Officer.

In cold weather, a non-chloride based accelerating admixture may be used subject to approval by the Contracting Officer; use accelerating admixture that is non-corrosive and conforms to ASTM C494/C494M, Type C.

2.4.2.3 Aggregate and Water

Provide fine and coarse aggregates and water that conform to materials permitted by ASTM C476.

2.5 MORTAR AND GROUT MIXES

2.5.1 Mortar Mix

a. Provide mortar Type [N] [S] [M] unless specified otherwise herein. [Do not use masonry cement in the mortar.] [Do not use air-entrainment in the mortar.]

b. Use ASTM C270 Type [S] [M] cement-lime mortar or mortar cement mortar for seismic-force-resisting elements indicated.[

c. Provide mortar that conforms to ASTM C270. Use Type [M] [S] [N] mortar [for foundation walls] [, basement walls,] [and in piers].][

d. Provide Type N or S mortar for non-load-bearing, non-shear-wall interior masonry.][

e. Provide approved commercial fire clay mortar or refractory cement (calcium-aluminate) mortar for fire brick and flue liners.]

[c][d][e][f]. For field-batched mortar, measure component materials by volume. Use measuring boxes for materials that do not come in packages, such as sand, for consistent batching. Mix cementitious materials and aggregates between 3 and 5 minutes in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency. Do not hand mix mortar unless approved by the Contracting Officer. Maintain workability of mortar by remixing or retempering. Discard mortar that has begun to stiffen or is not used within 2-1/2 hours after initial mixing.

[d][e][f][g]. For preblended mortar, follow manufacturer's mixing instructions.

2.5.2 Grout and Ready Mix Grout Mix

Use grout that conforms to ASTM C476, [fine] [coarse]. Use conventional grout with a slump between 203 and [279] mm (8 and [11] inches). Use self-consolidating grout with slump flow of 610 to 762 mm (24 to 30 inches) and a visual stability index (VSI) not greater than 1. Provide minimum grout strength of [14][_____] MPa ([2000][_____] psi) in 28 days, as tested in accordance with ASTM C1019. Do not change proportions and do not use materials with different physical or chemical characteristics in grout for the work unless additional evidence is furnished that grout meets the specified requirements. Use ready-mixed grout that conforms to ASTM C476.

2.6 ACCESSORIES

2.6.1 Grout Barriers

Grout barriers for vertical cores that consist of fine mesh wire, fiberglass, or expanded metal.

2.6.2 Anchors, Ties, and Bar Positioners

Exposure	Finish	Wt. of Coating in Gram Per Sq. Meter Oz. Per Sq. Foot
Joint reinforcement, interior walls	ASTM A641/A641M	31 0.1
Wire ties or anchors	ASTM A53/A153M	458 1.50
Steel plates and bars	ASTM A153/A153M Class B or ASTM A123/A123M as applicable to size and form	
Joint reinforcement in exterior walls or interior walls exposed to moist environments (e.g. natatoria and food processing)	ASTM A153/A153M	458 1.50
Sheet metal ties or anchors in masonry exposed to weather	ASTM A153/A153MClass B	458 1.50
Sheet metal ties or anchors	ASTM A653/A653M (Class G60)	180 .60

2.6.2.1 General

a. Fabricate anchors and ties without drips or crimps. Size anchors and ties to provide a minimum of 16 mm (5/8 inch) mortar cover from each face of masonry.

b. Fabricate steel wire anchors and ties shall from wire conforming to ASTM A1064/A1064M and hot-dip galvanize in accordance with ASTM A153/A153M.

c. Fabricate joint reinforcement in conformance with ASTM A951/A951M. Hot dip galvanize joint reinforcement in exterior walls and in interior walls exposed to moist environment in conformance with ASTM A153/A153M. Galvanize joint reinforcement in other interior walls in conformance with ASTM A641/A641M; coordinate with paragraph JOINT REINFORCEMENT below.

d. Fabricate sheet metal anchors and ties in conformance with ASTM A1008/A1008M. Hot dip galvanize sheet metal anchors and ties in exterior walls and in interior walls exposed to moist environment in compliance with ASTM A153/A153M Class B. Galvanize sheet metal anchors and ties in other interior walls in compliance with ASTM A653/A653M, Coating Designation G60.

e. Submit two anchors, ties and bar positioners of each type used, as samples.

2.6.2.2 Wire Mesh Anchors

Provide wire mesh anchors of 6 mm (1/4 inch) mesh galvanized hardware cloth, conforming to ASTM A185/A185M, with length not less than 305 mm (12 inches), at intersections of interior non-bearing masonry walls.

2.6.2.3 Wall Ties for Multi-Wythe Masonry Construction

Provide rectangular-shaped wall ties, fabricated of hot-dipped galvanized [MW11(W1.7)][MW18(W2.8)] diameter steel wire. Provide rectangular wall ties no less than 100 mm (4 inches) wide.

Provide adjustable type wall ties, if approved for use, that consist of two essentially U-shaped elements fabricated of minimum MW18 (W2.8) diameter steel wire or pintle type ties that are inserted to eyes of horizontal joint reinforcement, hot-dip galvanized. Provide adjustable ties with double pintle legs and allows a maximum offset of 32 mm (1-1/4 inch) between each element of the tie and maximum distance between connecting parts no more than 2 mm (1/16 inch). Form the pintle and eye elements shall be formed so that both can be in the same plane. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT.

2.6.2.4 Dovetail Anchors

Provide dovetail anchors of 5 mm (3/16 inch) diameter steel wire, triangular shaped, and attached to a 12 gauge (12 gauge) or heavier steel dovetail section. Use these anchors to connect the exterior masonry wythe as it passes over the face of concrete columns, beams, or walls. Fill cells immediately above and below these anchors unless solid units are used. Furnish dovetail slots, which are specified to be installed by others, in accordance with Section 03 30 00 CAST-IN-PLACE CONCRETE.

2.6.2.5 Adjustable Anchors

2.6.2.5.1 Anchorage to Structural Steel

Provide [hot-dip galvanized] [stainless steel] adjustable anchors for connecting masonry walls to the structural steel frame [as detailed on the drawings] [that have [_____] kg (pounds) capacity in both tension and compression for the span indicated when placed at [_____] mm (inches) on center; submit test data to verify compliance]. [Provide zinc-rich paint for touching up paint after welding galvanized anchors to structural steel.]

2.6.2.5.2 Anchorage of Veneer to Light Gauge Steel or Concrete Backing

Use one of the following types of adjustable anchors to connect veneer to light gauge steel or concrete backing:

a. sheet metal at least 22 mm (7/8 inch) wide, 1.5 mm (0.06 inch) thick, and with corrugations having a wavelength of 7.6 to 12.7 mm (0.3 to 0.5 inch) and an amplitude of 1.5 to 2.5 mm (0.06 to 0.10 inch) or bent, notched or punched to provide equivalent performance;

b. wire anchors of minimum size MW11 (W1.7) with ends bent to form a minimum 50 mm (2 inches) extension and without drips;

c. or wire pintle anchors used in conjunction with joint reinforcement.

Do not exceed 1.6 mm (1/16 inch) clearance between connecting parts of the tie. Assemble adjustable anchors to prevent disengagement. Provide pintle anchors with one or more pintle legs of wire size MW18 (W2.8) and an offset not exceeding 32 mm (1-1/4 inch).

2.6.2.6 Veneer Anchor Screws

Provide screws for attachment of veneer anchors to cold-formed steel framing members of size [No. 12] [as indicated] [as required by design to provide the needed pullout load capacity but not less than No. 12]. Provide length of screws such that the screws penetrate the holding member by not less than 16 mm (5/8 inch).

2.6.2.7 Bar Positioners

Factory-fabricate bar positioners, used to prevent displacement of reinforcing bars during the course of construction, from 9 gauge steel wire or equivalent, and hot-dip galvanized. Bar positioners must be suitable for intended use and be corrosion resistant steel. Bar positioners not fully contained within the wythe must be hot-dip galvanized.

2.6.3 Joint Reinforcement

	Long. wires	Cross wires
Standard	3.8 mm9 gauge (0.1483 inch)	3.8 mm9 gauge (0.1483 inch)
Heavy Duty	4.8 mm3/16 inch (0.1875 inch)	3.8 mm9 gauge (0.1483 inch)

	Long. wires	Cross wires
Extra Heavy Duty	4.8 mm3/16 inch (0.1875 inch)	4.8 mm3/16 inch (0.1875 inch)

Factory fabricate joint reinforcement in conformance with ASTM A951/A951M, welded construction. Provide ladder type joint reinforcement, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units and with all wires a minimum of [9][_____] gauge. Size joint reinforcement to provide a minimum of 16 mm (5/8 inch) cover from each face. Space crosswires not more than 400 mm (16 inches). Provide joint reinforcement for straight runs in flat sections not less than 3 m (10 feet) long. Provide joint reinforcement with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features. Submit one piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

2.6.4 Reinforcing Steel Bars

Reinforcing steel bars and rods shall conform to ASTM A615/A615M or ASTM A996/A996M, Grade 60.

2.6.5 Concrete Masonry Control Joint Keys

Provide control joint keys of a factory fabricated solid section of natural or synthetic rubber (or combination thereof) conforming to ASTM D2000 M2AA-805 with a minimum durometer hardness of 80 or polyvinyl chloride conforming to ASTM D2287 Type PVC 654-4 with a minimum durometer hardness of 85. Form the control joint key with a solid shear section not less than 16 mm (5/8 inch) thick and 10 mm (3/8 inch) thick flanges, with a tolerance of plus or minus 1.5 mm (1/16 inch), to fit neatly, but without forcing, in masonry unit jamb sash grooves.

2.6.6 Clay Masonry Expansion-Joint Materials

Provide backer rod and sealant, adequate to accommodate joint compression and extension equal to 50 percent of the width of the joint. Provide the backer rod of compressible rod stock of closed cell polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Provide sealant in conformance with Section 07 92 00 JOINT SEALANTS and paragraph REDUCE VOLATILE ORGANIC COMPOUNDS (VOC) (LOW EMITTING MATERIALS)in Section [01 33 29 SUSTAINABILITY REPORTING][01 57 19.01 20 SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS].

Submit one piece of each type of material used.

2.6.7 Through Wall Flashing and Weeps

2.6.7.1 General

Provide coated copper, copper or stainless steel sheet, self-adhesive rubberized sheet, or reinforced membrane sheet flashing [except that

flashing indicated to terminate in reglets shall be metal or coated-metal flashing] [and] [except that the material shall be one which is not adversely affected by dampproofing material.]

2.6.7.2 Coated-Copper Flashing

Provide 0.2 kg (7 ounce), electrolytic copper sheet, uniformly coated on both sides with acidproof, alkaliproof, asphalt impregnated kraft paper or polyethylene sheets.

2.6.7.3 Copper or Stainless Steel Flashing

Provide copper sheet, complying with ASTM B370, minimum 450 kg (16 ounce) weight; or stainless steel, ASTM A167, Type 304 or 316, 0.4 mm (0.015 inch) thick, No. 2D finish. [Where indicated, provide with factory-fabricated deformations that mechanically bond flashing against horizontal movement in all directions, where deformations consist of dimples, diagonal corrugations, or a combination of dimples and transverse corrugations.]

[2.6.7.4 Reinforced Membrane Flashing

Provide polyester film core with a reinforcing fiberglass scrim bonded to one side. Provide membrane that is impervious to moisture, flexible, is not affected by caustic alkalis, and after being exposed for not less than 1/2 hour to a temperature of 0 degrees C (32 degrees F), shows no cracking when, at that temperature, it is bent 180 degrees over a 2 mm (1/16 inch) diameter mandrel and then bent at the same point over the same size mandrel in the opposite direction 360 degrees.

]2.6.7.5 Rubberized Flashing

Provide self-adhesive rubberized asphalt sheet flashing consisting of 0.8 mm (32-mil) thick pliable and highly adhesive rubberized asphalt compound bonded completely and integrally to 0.2 (8-mil) thick, high density, cross-laminated polyethylene film to produce an overall thickness of 1 mm (40 mils). Provide rubberized, asphalt-based mastic and surface conditioner that are each approved by flashing manufacturer for use with flashing material.

2.6.7.6 Weep Ventilators

Provide weep ventilators that are prefabricated from stainless steel or plastic. Provide inserts with grill or louver-type openings designed to allow the passage of moisture from cavities and to prevent the entrance of insects, and with a rectangular closure strip to prevent mortar droppings from clogging the opening. Provide ventilators with compressible flanges to fit in a standard 10 mm (3/8 inch) wide mortar joint and with height equal to the nominal height of the unit.

2.6.7.7 Single-Wythe Exterior Wall CMU Flashing System

In single-wythe exterior CMU walls, provide a system of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. For exterior CMU walls, provide a flashing/weep system in open cores that do not receive grout. Cell flashing pans are to have integral weep spouts built into mortar bed joints that extend into the cell to prevent clogging with mortar.

2.6.7.8 Metal Drip Edge

Provide stainless steel drip edge, 0.4 mm (15-mil) thick, hemmed edges, with down-turned drip at the outside edge and upturned dam at the inside edge for use with membrane flashings.

2.6.8 RIGID BOARD-TYPE INSULATION

Provide rigid board-type insulation as specified in Section 07 21 13 BOARD AND BLOCK INSULATION. Provide materials and documentation meeting the requirements at Section [01 33 29 SUSTAINABILITY REPORTING][01 57 19.0 20 SUPPLEMENTAL TEMPORARY ENVIRONMENTAL CONTROLS] paragraph[s] RECYCLED CONTENT [and REDUCE VOLATILE ORGANIC COMPOUNDS (VOC) (LOW EMITTING MATERIALS)]. See https://sftool.gov/greenprocurement/green-products/1/construction-materials/22/building-insulation/0?addon=False for more information.

PART 3 EXECUTION

3.1 EXAMINATION

Prior to start of work, verify the applicable conditions as set forth in TMS MSJC, inspection.

3.2 PREPARATION

3.2.1 Stains

Protect exposed surfaces from mortar and other stains. When mortar joints are tooled, remove mortar from exposed surfaces with fiber brushes and wooden paddles. Protect base of walls from splash stains by covering adjacent ground with sand, sawdust, or polyethylene.

3.2.2 Loads

Do not apply uniform loads for at least 12 hours or concentrated loads for at least 72 hours after masonry is constructed. Provide temporary bracing as required.

3.2.3 Concrete Surfaces

Where masonry is to be placed, clean concrete of laitance, dust, dirt, oil, organic matter, or other foreign materials and slightly roughen to provide a surface texture with a depth of at least 3 mm (1/8 inch). Sandblast, if necessary, to remove laitance from pores and to expose the aggregate.

3.2.4 Shelf Angles

Adjust shelf angles as required to keep the masonry level and at the proper elevation.

3.2.5 Bracing

Provide bracing and scaffolding necessary for masonry work. Design bracing to resist wind pressure as required by OSHA and local codes and submit bracing calculations, sealed by a registered professional engineer. Do not remove bracing in less than 10 days.

3.3 ERECTION

3.3.1 General

a. Coordinate masonry work with the work of other trades to accommodate built-in items and to avoid cutting and patching. Lay masonry units in [running] [stacked] [the indicated] bond pattern. Lay facing courses level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances is plus or minus 13 mm (1/2 inch). Adjust each unit to its final position while mortar is still soft and has plastic consistency.

b. Remove and clean units that have been disturbed after the mortar has stiffened, and relay with fresh mortar. Keep air spaces, cavities, chases, expansion joints, and spaces to be grouted free from mortar and other debris. Select units to be used in exposed masonry surfaces from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work.

c. When necessary to temporarily discontinue the work, step (rack) back the masonry for joining when work resumes. Toothing may be used only when specifically approved by the Contracting Officer. Before resuming work, remove loose mortar and thoroughly clean the exposed joint. Cover the top of walls subjected to rain or snow with nonstaining waterproof covering or membrane when work is not in process. Extend the covering a minimum of(610 mm)(2 feet) down on each side of the wall and hold securely in place.

d. Ensure that units being laid and surfaces to receive units are free of water film and frost. Lay solid units in a nonfurrowed full bed of mortar. Bevel mortar for veneer wythes and slope down toward the cavity side. Shove units into place so that the vertical joints are tight. Completely fill vertical joints between solid units with mortar, except where indicated at control, expansion, and isolation joints. Place hollow units so that mortar extends to the depth of the face shell at heads and beds, unless otherwise indicated. Mortar will be permitted to protrude up to 13 mm (1/2 inch) into the space or cells to be grouted. Provide means to prevent mortar from dropping into the space below or clean grout spaces prior to grouting.

e. In multi-wythe construction with collar joints no more than 20 mm (3/4 inch) wide, bring up the inner wythe not more than 400 mm (16 inches) ahead of the outer wythe. Fill collar joints with mortar during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by back-buttering each unit as it is laid.

3.3.1.1 Jointing

Tool mortar joints when the mortar is thumbprint hard. Tool horizontal joints after tooling vertical joints. Brush mortar joints to remove loose and excess mortar.

3.3.1.1.1 Tooled Joints

Tool mortar joints in exposed exterior and interior masonry surfaces [concave] [_____], using a jointer that is slightly larger than the joint width so that complete contact is made along the edges of the unit. Perform

tooling so that the mortar is compressed and the joint surface is sealed. Use a jointer of sufficient length to obtain a straight and true mortar joint. No exterior joints are to be left un-tooled.

3.3.1.1.2 Flush Joints

Flush cut mortar joints in concealed masonry surfaces and joints at electrical outlet boxes in wet areas. Finish flush cut joints by cutting off the mortar flush with the face of the wall. Point joints in unparged masonry walls below grade tight. For architectural units, such as fluted units, completely fill both the head and bed joints and flush cut.

3.3.1.1.3 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm (3/8 inch). On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm (3/8 inch).

3.3.1.1.4 Joint Widths

a. Construct brick masonry with mortar joint widths equal to the difference between the specified and nominal dimensions of the unit, within tolerances permitted by TMS MSJC.

b. Provide 10 mm (3/8 inch) wide mortar joints in concrete masonry, except for prefaced concrete masonry units.

c. Provide 10 mm (3/8 inch) wide mortar joints on unfaced side of prefaced concrete masonry units and not less than 5 mm (3/16 inch) nor more than 6 mm (1/4 inch) wide on prefaced side.

d. Maintain mortar joint widths within tolerances permitted by TMS MSJC

3.3.1.2 Cutting and Fitting

Use full units of the proper size wherever possible, in lieu of cut units. Locate cut units where they would have the least impact on the architectural aesthetic goals of the facility. Perform cutting and fitting, including that required to accommodate the work of others, by masonry mechanics using power masonry saws. Concrete masonry units may be wet or dry cut. Before being placed in the work, dry wet-cut units to the same surface-dry appearance as uncut units being laid in the wall. Provide cut edges that are clean, true and sharp.

a. Carefully make openings in the masonry so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Provide reinforced masonry lintels above openings over 300 mm (12 inches) wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

b. Do not reduce masonry units in size by more than one-third in height and one-half in length. Do not locate cut products at ends of walls, corners, and other openings.

3.3.1.3 Unfinished Work

Rack back unfinished work for joining with new work. Toothing may be resorted to only when specifically approved by the Contracting Officer. Remove loose mortar and thoroughly clean the exposed joints before laying new work.

3.3.1.4 Clay Masonry Expansion Joints

Provide clay masonry expansion joints as indicated. Construct by [leaving a gap] [filling with a compressible foam pad]. Ensure that no mortar or other noncompressible materials are within the joint. Install backer rod and sealant in accordance with Section 07 92 00 JOINT SEALANTS.

3.3.1.5 Control Joints

Provide control joints in concrete masonry as indicated. Construct by [raking out mortar within the head joint] [using special control-joint units] [using sash jamb units with control joint key] [using open end stretcher units placed with the closed end at the joint] in accordance with the details shown on the Drawings. Form a continuous vertical joint at control joint locations, including through bond beams, by utilizing half blocks in alternating courses on each side of the joint. Interrupt the control joint key in courses containing continuous bond beam reinforcement. [Do not interrupt the horizontal reinforcement and grout at the control joint.] [Interrupt the horizontal reinforcement and grout in bond beams at the control joint except in bond beams at the floor and roof diaphragms.]

Where mortar was placed in the joint, rake both faces of the control joints to a depth of 19 mm (3/4 inch). Install backer rod and sealant on both faces in accordance with Section 07 92 00 JOINT SEALANTS.

3.3.1.6 Decorative Architectural Units

Place decorative masonry units with the patterned face shell properly aligned in the completed wall.

3.3.2 Clay or Shale Brick Masonry

3.3.2.1 Brick Placement

Blend all brick at the jobsite from several cubes to produce a uniform appearance when installed. An observable "banding" or "layering" of colors or textures caused by improperly mixed brick is unacceptable. Lay brick facing with the better face exposed. Lay brick in running bond with each course bonded at corners, unless otherwise indicated. Lay molded brick with the frog side down. Do not lay brick that is cored, recessed, or has other deformations in a manner that allows those deformations to be exposed to view; lay 100 percent solid units in these areas. Completely fill head and bed joints of solid units with mortar. Lay hollow units with mortar joints as specified for concrete masonry units. [Lay fire brick by dipping each brick in a soft mixture of fire clay and water and then rubbing the brick into place with joints as thin as practicable or provide refractory mortar with joints not more than 10 mm (3/8 inch) thick.]

Place exterior face of salvaged bricks towards the exterior.

3.3.2.2 Wetting of Units

Wetting of clay, shale brick, or hollow brick units having an initial rate of absorption of more than 0.155 gm per minute per square cm (1 gram per minute per square inch) of bed surface shall be in conformance with ASTM C67/C67M. Ensure that each unit is nearly saturated when wetted but surface dry when laid.

Test clay or shale brick daily on the job, prior to laying, as follows: Using a wax pencil, draw a circle the size of a quarter on five randomly selected bricks. Apply 20 drops of water with a medicine dropper to the surface within the circle on each brick. If the average time that the water is completely absorbed in the five bricks is less than 1-1/2 minutes, wet bricks represented by the five bricks tested.

3.3.2.3 Brick Sills

Lay brick on edge, slope not less than 19 mm (3/4 inch) downward to the outside, and project not less than 13 mm (1/2 inch) beyond the face of the wall to form a wash and drip. Fill all joints solidly with mortar and tool.

3.3.2.4 Reinforced Brick Walls

Provide two wythes of brick separated by a [_____] mm (inch) wide continuous space filled with [grout] [bricks "floated" in grout] and reinforced as indicated. Bevel mortar beds away from grout space to prevent projection into grout space when bricks are shoved in place. Deeply furrowed bed joints will not be permitted. Lay exterior wythe of brick to the height of each grout pour in advance of interior wythe. Clean grout space and set reinforcing before laying interior wythe. Provide metal ties to prevent spreading of the wythes and to maintain vertical alignment of walls. Place reinforcement and grout in accordance with paragraph BAR REINFORCEMENT INSTALLATION and paragraph PLACING GROUT in this Section.

3.3.2.6 Partitions

a. Construct partitions continuous from floor to underside of floor or roof deck where shown. Fill openings in firewalls around joists and other structural members as indicated or approved. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 100 mm (4 inches) above the ceiling level. Construct an isolation joint in the intersection between partitions and structural or exterior walls.

b. Tie interior partitions having 100 mm (4 inch) nominal thickness units to intersecting partitions of 100 mm (4 inch) units, 125 mm (5 inches) into partitions of 150 mm (6 inch) units, and 175 (7 inches) into partitions of 200 mm (8 inch) or thicker units. Cells within vertical plane of ties shall be filled solid with grout for full height of partition or solid masonry units may be used. Tie interior partitions over 100 mm (4 inches) thick together with joint reinforcement. Provide joint reinforcement with prefabricated pieces at corners and intersections of partitions.

c. Double-Faced Bases or Partitions: Construct double-faced clay unit bases and partitions of two-unit construction. Bond units by overlapping from opposite faces of the wall, 50 mm for 150 mm (2 inches for 6 inch) thick partitions and 100 mm for 200 mm (4 inches for 8 inch) thick or greater. A single wythe prefaced concrete masonry base or partition may be made with double faced units.

3.3.3 Anchored Veneer Construction

Maximum Spacing and Wall Area for Veneer Anchors					
Masonry Design Approach	Unit Anchor Type and Size				
	Adjustable	Non-Adjustable	Non-Adjustable	Joint Reinforcement	Sheet Metal
	MW18W2.8 Wire	MW11W1.7 Wire	MW18W2.8 Wire	MW11W1.7 Wire	> 1.5mm0.06 inch
Anchored Veneer - prescriptive requirements where qz does not exceed 1.92 kPa 40 psf					
Maximum Area per Tie	0.25 m22.67 ft2	0.25 m22.67 ft2	0.33 m23.50 ft2	0.25 m22.67 ft2	0.33 m23.50 ft2
Maximum Horizontal Spacing	813 mm32 inch	813 mm32 inch	813 mm32 inch	406 mm16 inch	813 mm32 inch
Maximum Vertical Spacing	635 mm25 inch	635 mm25 inch	635 mm25 inch	635 mm25 inch	635 mm25 inch
Anchored Veneer - prescriptive requirements where qz exceeds 1.92 kPa 40 psf but does not exceed 2.63 kPa 55 psf and the building's mean roof height does not exceed 18.3 m 60 feet					
Maximum Area per Tie	0.18 m21.87 ft2	0.18 m21.87 ft2	0.23 m22.45 ft2	0.18 m21.87 ft2	0.23 m22.45 ft2
Maximum Horizontal Spacing	457 mm18 inch	457 mm18 inch	457 mm18 inch	457 mm18 inch	457 mm18 inch
Maximum Vertical Spacing	457 mm18 inch	457 mm18 inch	457 mm18 inch	457 mm18 inch	457 mm18 inch
Anchored Veneer - prescriptive requirements in SDC D, E, and F**					
Maximum Area per Tie	0.19 m22.00 ft2	0.19 m22.00 ft2	0.25 m22.63 ft2	0.19 m22.00 ft2	0.25 m22.63 ft2
Maximum Horizontal Spacing	813 mm32 inch	813 mm32 inch	813 mm32 inch	406 mm16 inch	813 mm32 inch
Maximum Vertical Spacing	635 mm25 inch	635 mm25 inch	635 mm25 inch	635 mm25 inch	635 mm25 inch

**In Seismic Design Categories E and F, a continuous single wire joint reinforcement of wire size MW 11 W1.7 at a maximum vertical spacing of 457 mm 18 inch is required.

a. Construct exterior masonry wythes to the thickness indicated on the drawings. Provide a minimum [_____] mm (inch) air space behind the masonry veneer. Provide means to ensure that the cavity space and flashings are kept clean of mortar droppings and other loose debris. Maintain chases and raked-out joints free from mortar and debris.

b. Place masonry [in running bond pattern.] [in stacked bond pattern.] [Place longitudinal reinforcement, consisting of at least one continuous hot-dip galvanized MW11 (W 1.7 (9gauge)) steel wire, in the veneer wythe when laid in stack bond.]

c. For veneer over stud framing, do not install veneer until the exterior sheathing, moisture barrier, veneer anchors and flashing have been installed on the backing. Take extreme care to avoid damage to the moisture barrier and flashing during construction of the masonry veneer. Repair or replace portions of the moisture barrier and flashing that are damaged prior to completion of the veneer. Provide a continuous cavity as indicated.

d. For veneer with a masonry backup wythe, lay up both the inner and the outer wythes together except when adjustable joint reinforcement assemblies are approved for use. When both wythes are not brought up together, install through-wall flashings with the exterior wythe, securing the top edge of the flashing with a termination bar and sealant, or protect flashings that are installed with the interior wythe from damage until they are fully enclosed in the wall.

e. Provide anchors (ties) to connect the veneer to its backing in sufficient quantity to comply with the following requirements: maximum wall area per anchor {tie) of [_____], and maximum vertical spacing of [_____], and maximum horizontal spacing of [_____]. Provide additional anchors around openings larger than 406 mm (16 inch) in either direction. Space anchors around perimeter of opening at a maximum of [0.91 m(3 feet)][610 mm(24 inches)] on center. Place anchors within 305 mm (12 inches) of openings. Anchors with drips are not permitted.

f. With solid units, embed anchors in mortar joint and extend into the veneer a minimum of 38 mm (1-1/2 inch), with at least 16 mm (5/8 inch) mortar cover to the outside face.

g. With hollow units, embed anchors in mortar or grout and extend into the veneer a minimum of 38 mm (1-1/2 inch), with at least 16 mm (5/8 inch) mortar or grout cover to outside face.

3.3.4 Composite Walls

Tie masonry wythes together with joint reinforcement or with unit wall ties. Embed wall ties at least 38 mm (1-1/2 inch) into mortar of solid units and at least 13 mm (1/2 inch) into the mortar of the outer face shell of hollow units. Provide at least one tie every 0.25 square m (2.67 square feet) for wire size MW11 (W1.7) and at least one tie every 0.42 square m (4.50 square feet) for wire size MW18 (W2.8). Space ties at a maximum of 900 mm (36

inches) horizontally and 610 mm (24 inches) vertically. Do not cross expansion joints or control joints with ties. Fill collar joints between masonry facing and masonry backup solidly with grout.

3.3.5 Reinforced, Single Wythe Concrete Masonry Units Walls

3.3.5.1 Concrete Masonry Unit Placement

a. Fully bed units used to form piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout in mortar under both face shells and webs. Provide mortar beds under both face shells for other units. Mortar head joints for a distance in from the face of the unit not less than the thickness of the face shell.

b. Solidly grout foundation walls below grade.

c. Stiffen double walls 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 each wall within the double wall. Adequately reinforce walls and partitions for support of wall-hung plumbing fixtures when chair carriers are not specified.

d. Submit drawings showing elevations of walls exposed to view and indicating the location of all cut CMU products.

3.3.5.2 Preparation for Reinforcement

Lay units in such a manner as to preserve the unobstructed vertical continuity of cores to be grouted. Remove mortar protrusions extending 13 mm (1/2 inch) or more into cells before placing grout. Position reinforcing bars accurately as indicated before placing grout. Where vertical reinforcement occurs, fill cores solid with grout in accordance with paragraph PLACING GROUT in this Section.

3.3.6 Cavity Walls (Multi-Wythe Noncomposite Walls

Maximum Spacing and Wall Area for Veneer Anchors					
Masonry Design Approach	Unit Anchor Type and Size				
	Adjustable	Non-Adjustable	Non-Adjustable	Joint Reinforcement	Sheet Metal
	All Sizes	MW11W1.7 Wire	MW18W2.8 Wire	MW11W1.7 Wire	> 1.5mm0.06 inch
Allowable Stress Design, Strength Design and Prestressed Design					
Maximum Area per Tie	0.16 m21.77 ft2	0.25 m22.67 ft2	0.42 m24.50 ft2	Same as non-adjustable unit ties of same wire size	Not permitted

Maximum Horizontal Spacing	406 mm16 inch	914 mm36 inch	914 mm36 inch	406 mm16 inch	
Maximum Vertical Spacing	406 mm16 inch	610 mm24 inch	610 mm24 inch	610 mm24 inch	

Provide a continuous cavity as indicated. Bevel mortar beds away from cavity to prevent projection into cavity when bricks are shoved in place. Keep cavities clear and clean of mortar droppings. [At the bottom of cavity walls, in the course immediately above the through-wall flashing, temporarily omit one brick every 1200 mm (4 feet). Clean mortar droppings and debris out of the cavity through the temporary openings at least once each day masonry is laid, and more often when required to keep the cavities clean. Fill in the openings with bricks and mortar after the wall is complete and the cavity has been inspected and found clean.] [Dampproof cavity face of interior wythe in accordance with Section 07 11 13 BITUMINOUS DAMPPROOFING.]

Securely tie the two wythes together with horizontal joint reinforcement, or provide ties to connect the masonry wythes in sufficient quantity to comply with the following requirements: maximum wall area per tie of [_____], and maximum vertical spacing of [_____], and maximum horizontal spacing of [_____]. Provide additional ties around openings larger than 405 mm (16 inches) in either direction. Space ties around perimeter of opening at a maximum of 910 mm (3 feet) on center. Place ties within 305 mm (12 inches)of openings. Ties with drips are not permitted.

3.3.7 ANCHORAGE

3.3.7.1 Anchorage to Concrete

Anchorage of masonry to the face of concrete columns, beams, or walls shall be with dovetail anchors spaced not over 400 mm (16 inches) on centers vertically and 600 mm (24 inches) on center horizontally.

3.3.7.2 Anchorage to Structural Steel

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 400 mm (16 inches) on centers vertically, and if applicable, not over 600 mm (24 inches) on centers horizontally.

3.3.7.3 Anchorage at Intersecting Walls

Provide wire mesh anchors at maximum 400 mm (16 inches) spacing at intersections of interior non-bearing masonry walls.

Anchor structural masonry walls with [reinforced bond beams spaced no more than [_____] mm (feet) on center] [horizontal joint reinforcement spaced no more than [_____] mm (feet) on center] [overlapping masonry units] [strap anchors of minimum size 6 mm (1/4 inch) x 38 mm (1-1/2 inch) x 710 mm (28 inches) including 50 mm (2 inch)) 90 degree bends at each end to form U or Z shape at maximum spacing 1220 mm (48 inches), grouted into the wall], unless the drawings indicate a movement joint at the intersection.

3.3.8 Lintels

3.3.8.1 Masonry Lintels

Construct masonry lintels with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated. Extend lintel reinforcement beyond each side of masonry opening 40 bar diameters or 600 mm (24 inches), whichever is greater. Support reinforcing bars in place prior to grouting and locate 13 mm (1/2 inch) above the bottom inside surface of the lintel unit.

3.3.8.2 Precast Concrete and Steel Lintels

Provide precast concrete and steel lintels as shown on the Drawings. Set lintels in a full bed of mortar with faces plumb and true. Provide steel and precast lintels with a minimum bearing length of 200 mm (8 inches) unless otherwise indicated. In partially grouted masonry, provide fully grouted units under the full lintel bearing length, unless otherwise indicated.

3.3.9 Sills and Copings

Set sills and copings in a full bed of mortar with faces plumb and true. Slope sills and copings to drain water. Mechanically anchor copings and sills longer than 1200 mm (4 feet) as indicated.

3.4 INSTALLATION

3.4.1 Bar Reinforcement Installation

3.4.1.1 Preparation

Submit detail drawings showing bar splice locations. Identify bent bars on a bending diagram and reference and locate such bars on the drawings. Show wall dimensions, bar clearances, and wall openings. Utilize bending details that conform to the requirements of ACI SP-66. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, resubmit the approved shop drawings with the additional openings shown along with the proposed changes. Clearly highlight location of these additional openings. Provide wall elevation drawings with minimum scale of 1 to 50 (1/4 inch per foot). Submit drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; lintels; and wall openings.

Clean reinforcement of loose, flaky rust, scale, grease, mortar, grout, and other coatings that might destroy or reduce its bond prior to placing grout. Do not use bars with kinks or bends not shown on the approved shop drawings. Place reinforcement prior to grouting. Unless otherwise indicated, extend vertical wall reinforcement to within 50 mm (2 inches) of tops of walls.

3.4.1.2 Positioning Bars

a. Accurately place vertical bars within the cells at the positions indicated on the drawings. A minimum clearance of 13 mm (1/2 inch) shall be maintained between the bars and masonry units. Provide minimum clearance between parallel bars of13 mm (1/2 inch) between the bars and masonry units for coarse grout and a minimum clearance of 6 mm (1/4 inch) between the bars and masonry units for fine grout. Provide minimum clearance between parallel bars of 25 mm (1 inch) or one diameter of the reinforcement, whichever is greater. Vertical reinforcement may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement or by other means to prevent displacement beyond permitted tolerances. As masonry work progresses, secure vertical reinforcement to prevent displacement beyond allowable tolerances.

b. Wire column and pilaster lateral ties in position around the vertical reinforcing bars. Place lateral ties in contact with the vertical reinforcement and do not place in horizontal mortar bed joints.

c. Position horizontal reinforcing bars as indicated. Stagger splices in adjacent horizontal bars, unless otherwise indicated.

d. Form splices by lapping bars as indicated. Do not cut, bend or eliminate reinforcing bars. Foundation dowel bars may be field-bent when permitted by TMS MSJC.

3.4.1.3 Splices of Bar Reinforcement

Lap splice reinforcing bars as indicated. When used, provide welded or mechanical connections that develop at least 125 percent of the specified yield strength of the reinforcement.

3.4.2 Placing Grout

3.4.2.1 General

Fill cells containing reinforcing bars with grout. Solidly grout hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces. Solidly grout cells under lintel bearings on each side of openings for full height of openings. Solidly grout walls below grade, lintels, and bond beams. Units other than open end units may require grouting each course to preclude voids in the units.

Discard site-mixed grout that is not placed within 1-1/2 hours after water is first added to the batch or when the specified slump is not met without adding water after initial mixing. Discard ready-mixed grout that does not meet the specified slump without adding water other than water that was added at the time of initial discharge. Allow sufficient time between grout lifts to preclude displacement or cracking of face shells of masonry units. Provide a grout shear key between lifts when grouting is delayed and the lower lift loses plasticity. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, tear down the wall and rebuild.

3.4.2.2 Vertical Grout Barriers for Multi-Wythe Composite Walls

In multi-wythe composite walls, provide grout barriers in the collar join not more than 9 m (30 feet) apart, or as required, to limit the horizontal flow of grout for each pour.

3.4.2.3 Horizontal Grout Barriers

Embed horizontal grout barriers in mortar below cells of hollow units receiving grout.

3.4.2.4 Grout Holes and Cleanouts

3.4.2.4.1 Grout Holes

Provide grouting holes in slabs, spandrel beams, and other in-place overhead construction. Locate holes over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Provide additional openings spaced not more than 400 mm (16 inches) on centers where grouting of hollow unit masonry is indicated. Fom such openings not less than 100 mm (4 inches) in diameter or 75 by 100 mm (3 by 4 inches) in horizontal dimensions. Upon completion of grouting operations, plug and finish grouting holes to match surrounding surfaces.

3.4.2.4.2 Cleanouts for Hollow Unit Masonry Construction

For hollow masonry units. provide cleanout holes at the bottom of every grout pour in cores containing vertical reinforcement when the height of the grout pour exceeds 1.6 m (5 feet 4 inches). Where all cells are to be grouted, construct cleanout courses using bond beam units in an inverted position to permit cleaning of all cells. Provide cleanout holes at a maximum spacing of 800 mm (32 inches) where all cells are to be filled with grout.

Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Provide cleanouts not less than 75 by 75 mm (3 by 3 inch) by cutting openings in one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Do not cleanout holes until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

3.4.2.4.3 Cleanouts for Multi-Wythe Composite Masonry Construction

Provide cleanouts for construction of walls that incorporate a grout filled cavity between solid masonry wythes, provide cleanouts at the bottom of every pour by omitting every other masonry unit from one wythe. Establish a new series of cleanouts if grouting operations are stopped for more than 4 hours. Do not plug cleanout holes until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, close cleanout holes in an approved manner to match surrounding masonry.

3.4.2.5 Grout Placement

A grout pour is the total height of masonry to be grouted prior to erection of additional masonry. A grout lift is an increment of grout placement within a grout pour. A grout pour is filled by one or more lifts of grout.

a. Lay masonry to the top of a pour permitted by TMS MSJC Table 7, based on the size of the grout space and the type of grout. Prior to grouting, remove masonry protrusions that extend 13 mm (1/2 inch) or more into cells or spaces to be grouted. Provide grout holes and cleanouts in accordance with paragraph GROUT HOLES AND CLEANOUTS above when the grout pour height exceeds 1.6 m (5 feet 4 inches). Hold reinforcement, bolts, and embedded connections rigidly in position before grouting is started. Do not prewet concrete masonry units.

b. Place grout using a hand bucket, concrete hopper, or grout pump to fill the grout space without segregation of aggregate. Operate grout pumps to produce a continuous stream of grout without air pockets, segregation, or contamination.

c. If the masonry has cured at least 4 hours, grout slump is maintained between 250 and 275 mm (10 to 11 inches), and no intermediate reinforced bond beams are placed between the top and bottom of the pour height, place conventional grout in lifts not exceeding 3.9 m (12 feet 8 inches). For the same curing and slump conditions but with intermediate bond beams, limit conventional grout lift to the bottom of the lowest bond beam that is more than 1.6 m (5 feet 4 inches) above the bottom of the lift, but do not exceed 3.9 m (12 feet 8 inches). If masonry has not cured at least 4 hours or grout slump is not maintained between 250 and 275 mm (10 to 11 inches), place conventional grout in lifts not exceeding 1.6 m (5 feet 4 inches).

d. Consolidate conventional grout lift and reconsolidate after initial settlement before placing next lift. For grout pours that are 300 mm (12 inches) or less in height, consolidate and reconsolidate grout by mechanical vibration or puddling. For grout pours that are greater than 300 mm (12 inches) in height, consolidate and reconsolidate grout by mechanical vibration. Apply vibrators at uniformly spaced points not further apart than the visible effectiveness of the machine. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation. If previous lift is not permitted to set, dip vibrator into previous lift. Do not insert vibrators into lower lifts that are in a semi-solidified state. If lower lift sets prior to placement of subsequent lift, form a grout key by terminating grout a minimum of 38 mm (1-1/2 inch) below a mortar joint. Vibrate each vertical cell containing reinforcement in partially grouted masonry. Do not form grout keys within beams.

e. If the masonry has cured 4 hours, place self-consolidating grout (SCG) in lifts not exceeding the pour height. If masonry has not cured for at least 4 hours, place SCG in lifts not exceeding 1.6 m (5 feet 4 inches). Do not mechanically consolidate self-consolidating grout. Place self-consolidating grout in accordance with manufacturer's recommendations.

f. Upon completion of each day's grouting, remove waste materials and debris from the equipment, and dispose of outside the masonry.

3.4.3 Joint Reinforcement Installation

Install joint reinforcement at 400 mm (16 inches) on center unless otherwise indicated. Lap joint reinforcement not less than [150][_____] mm ([6][_____] inches). Install prefabricated sections at corners and wall

intersections. Place the longitudinal wires of joint reinforcement in mortar beds to provide not less than 16 mm (5/8 inch) cover to either face of the unit.

3.4.4 Bond Beams

Reinforce and grout bond beams as indicated and as described in paragraphs above. Install grout barriers under bond beam units to retain the grout as required, unless wall is fully grouted or solid bottom units are used. For high lift grouting in partially grouted masonry, provide grout retaining material on the top of bond beams to prevent upward flow of grout. Ensure that reinforcement is continuous, including around corners, except through control joints or expansion joints, unless otherwise indicated.

3.4.5 Flashing and Weeps

a. Install through-wall flashing at obstructions in the cavity and where indicated on Drawings. Ensure continuity of the flashing at laps and inside and outside corners by splicing in a manner approved by the flashing manufacturer. Ensure that the top edge of the flashing is sealed by [turning the flashing 13 mm (1/2 inch) into the mortar bed joint of backup masonry] [attaching a termination bar and applying compatible sealant at the top edge of the termination bar] [lapping a minimum of 150 mm (6 inches) under the weather resistive barrier] [securing the sheet metal flashing into a reglet cast into the concrete backup]. Terminate the horizontal leg of the flashing [by extending the sheet metal 13 mm (1/2 inch) beyond the outside face of masonry and turning downward with a hemmed drip] [terminating the fabric flashing 13 mm (1/2 inch) short of the outside face of masonry and adhering the flashing to a sheet metal drip edge] [extending the fabric flashing beyond the outside face of masonry and, when construction is complete, cutting the flashing flush with the face of masonry]. Provide sealant below the drip edge of through-wall flashing.

b. Wherever through-wall flashing occurs, provide weep holes to drain flashing to exterior at acceptable locations as indicated. Provide weeps of [open head joints][weep ventilators]. Locate weeps not more than 600 mm (24 inches) on centers in mortar joints of the exterior wythe directly on the horizontal leg of through-wall flashing over foundations, bond beams, and any other horizontal interruptions of the cavity. Place weep holes perfectly horizontal or slightly canted downward to encourage water drainage outward and not inward. Other methods may be used for providing weeps when spacing is reduced to406 mm (16 inches) on center and approved by the Contracting Officer. Maintain weeps free of mortar and other obstructions.

[c. Install single-wythe CMU flashing system in bed joints of CMU walls where CMU cells are open. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall on the exterior side. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

]3.5 APPLICATION

3.5.1 Insulation

Insulate cavity walls (multi-wythe noncomposite masonry walls), where shown, by installing board-type insulation on the cavity side of the inner wythe. Apply board type insulation directly to the masonry or thru-wall flashing with adhesive. Neatly fit insulation between obstructions without impaling insulation on ties or anchors. Apply insulation in parallel courses with vertical joints breaking midway over the course below and in moderate contact with adjoining units without forcing. Cut to fit neatly against adjoining surfaces. [Tape or seal the joints between the boards.]

3.5.2 Interface with Other Products

3.5.2.1 Built-In Items

Fill spaces around built-in items with mortar. Point openings around flush-mount electrical outlet boxes in wet locations with mortar. Embed anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in as the masonry work progresses. Fully embed anchors, ties and joint reinforcement in the mortar. Fill cells receiving anchor bolts and cells of the first course below bearing plates with grout, unless otherwise indicated.

3.5.2.2 Door and Window Frame Joints

On the exposed interior and exterior sides of exterior frames, rake joints between frames and abutting masonry walls to a depth of 10 mm (3/8 inch).

3.5.2.3 Bearing Plates

Set bearing plates for beams, joists, joist girders and similar structural members to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Provide bedding mortar and non-shrink grout s specified in Section 03 30 00 CAST-IN-PLACE CONCRETE.

3.5.3 Tolerances

Lay masonry plumb, true to line, with courses level within the tolerances of TMS MSJC, Article 3.3 F.

3.6 FIELD QUALITY CONTROL

3.6.1 Tests

3.6.1.1 Field Testing of Mortar

Perform mortar testing at the following frequency: [_____] times per [_____]. For each required mortar test, provide a minimum of three mortar samples. Perform initial mortar testing prior to construction for comparison purposes during construction.

Prepare and test mortar samples for mortar aggregate ratio in accordance with ASTM C780 Appendix A4. [Prepare and test mortar compressive strength specimens in accordance with ASTM C780 Appendix A6.]

[3.6.1.3 Clay Brick Efflorescence Test

Test clay brick that will be exposed to weathering for efflorescence in accordance with ASTM C67/C67M. Schedule tests far enough in advance of starting masonry work to permit retesting if necessary. Units meeting the definition of "effloresced" are subject to rejection.

][3.6.1.4 Prism Tests

Perform at least one prism test sample for each 465 square meters (5,000 square feet) of wall but not less than three such tests for any building. Evaluate three prisms in each test. Fabricate, store, handle, and test prisms in accordance with ASTM C1314.

Seven-day tests may be used provided the relationship between the 7- and 28-day strengths of the masonry is established by the tests of the materials used. If the compressive strength of any prism falls below the specified value by more than 3.5 MPa (500 psi), take steps to assure that the load-carrying capacity of the structure is not jeopardized. If the likelihood of low-strength masonry is confirmed and computations indicate that the load-carrying capacity may have been significantly reduced, tests of cores drilled, or prisms sawed, from the area in question may be required. In such case, take three specimens for each prism test more than 3.5 MPa (500 psi) below the specified value. Masonry in the area in question will be considered structurally adequate if the average compressive strength of three specimens is equal to or exceeds the specified value. Additional testing of specimens extracted from locations represented by erratic core or prism strength test results will be permitted.

]3.6.1.5 Single-Wythe Masonry Wall Water Penetration Test

Prior to start of field construction of the single-wythe concrete masonry wall, perform masonry wall water penetration test on mock-up wall assemblies consisting of the identical design, materials, mix, and construction methods as the actual wall construction and in accordance with ASTM E514/E514M. Prepare a minimum of three specimens and cure for minimum 28 days prior to testing. Construct panels by the same methods, processes, and applications to be used on the project's construction site. Spray test for 6 hours on each specimen. If water is visible on back of test panels during the test and areas of dampness on the backside of the test panels do not exceed 25 percent of the wall area, the panels will be considered to have passed. Dampness is defined as any area of surface darkening or discoloration due to moisture penetration or accumulation below the observed surface.

Construct additional test panels for each failed test performed until three test panels pass the test. Factors that can affect test performance include materials, mixing, and quality of application and workmanship. Materials, mixing, and methods adjustments may be necessary in order to provide construction that passes the water penetration test. Document and record the test specimen construction materials and application and provide written test report in accordance with ASTM E514/E514M, supplemented by a detailed discussion of the specifics of test panel construction, application methods and processes used, quality of construction, and any variances or deviations that may have occurred between test panels during test panel construction. For failed test panels, identify in the supplemental report the variances, deficiencies or flaws that contributed to test panel failure and itemize the precautions to be taken in field construction of the masonry wall to prevent similar deficiencies and assure the wall construction replicates test panel conditions that pass the water penetration test. Submit the complete,

certified test report, including supplemental report, to the Contracting Officer prior to start of single-wythe concrete masonry wall construction. Significant changes to materials, proportions, or construction techniques from those used in the passing water penetration test are grounds for performing new tests, at the discretion of the Contracting Officer.

3.6.2 Special Inspection

Perform special inspections and testing in accordance with Section 01 45 35 SPECIAL INSPECTIONS.

3.7 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, completely remove mortar and grout daubs and splashings from masonry-unit surfaces that will be exposed or painted. Before completion of the work, rake out defects in joints of masonry to be exposed or painted, fill with mortar, and tool to match existing joints. Immediately after grout work is completed, remove scum and stains that have percolated through the masonry work using a low pressure stream of water and a stiff bristled brush. Do not clean masonry surfaces, other than removing excess surface mortar, until mortar in joints has hardened. Leave masonry surfaces clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Do not use metal tools and metal brushes for cleaning.

3.7.1 Dry-Brushing Concrete Masonry

Dry brush exposed concrete masonry surfaces at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

3.7.2 Clay Brick Surfaces

Clean exposed clay brick masonry surfaces to obtain surfaces free of stain, dirt, mortar and grout daubs, efflorescence, and discoloration or scum from cleaning operations. Perform cleaning in accordance with the approved cleaning procedure demonstrated on the mockup.

After cleaning, examine the sample panel of similar material for discoloration or stain as a result of cleaning. If the sample panel is discolored or stained, change the method of cleaning to ensure that the masonry surfaces in the structure will not be adversely affected. Water-soak exposed masonry surfaces and then clean with a proprietary masonry cleaning agent specifically recommended for the color and texture by the clay brick manufacturer and manufacturer of the cleaning product. Apply the solution with stiff fiber brushes, followed immediately by thorough rinsing with clean water. Use proprietary cleaning agents in conformance with the cleaning product manufacturer's printed recommendations. Remove efflorescence in conformance with the brick manufacturer's recommendations.

3.8 CLOSE-OUT TAKE-BACK PROGRAM

Collect information from manufacturer for take-back program options. Set aside [masonry units, full and partial] [scrap] [packaging] [_____] to be returned to manufacturer for recycling into new product. When such a service is not available, seek local recyclers to reclaim the materials. Submit documentation that includes contact information, summary of

procedures, and the limitations and conditions applicable to the project. Indicate manufacturer's commitment to reclaim materials for recycling and/or reuse.

3.9 PROTECTION

Protect facing materials against staining. Cover top of walls with nonstaining waterproof covering or membrane to protect from moisture intrusion when work is not in progress. Continue covering the top of the unfinished walls until the wall is waterproofed with a complete roof or parapet system. Extend covering a minimum of 600 mm (2 feet) down on each side of the wall and hold securely in place. Before starting or resuming work, clean top surface of masonry in place of loose mortar and foreign material.

-- End of Section --