SECTION 04 2220

REINFORCED UNIT MASONRY

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LANL MASTER SPECIFICATION SECTION

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| --- |
| New in this revision: Updated for compliance with earthquake loads in ESM Ch. 5 Sect. II R11 (i.e., new accelerations for SDC D and new SDC C and its accelerations) |

This template must be edited for each project.  In doing so, specifier must add job-specific requirements.  Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.  Once the choice is made or text supplied, remove the brackets.  The specifications must also be edited to delete specification requirements for processes, items, or designs that are not included in the project -- and specifier’s notes such as these.  To seek a variance from requirements in the specifications that are applicable, contact the Engineering Standards Manual Structural [POC](http://engstandards.lanl.gov/POCs.shtml). Please contact POC with suggestions for improvement as well.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General requirements.

This specification section is for use with LANL ESM Chapter 5, Section II; therefore it is applicable to ML-4 projects. For ML-1, 2, and 3 applications, additional requirements and independent reviews should be added if increased confidence in procurement or execution is desired; see ESM Chapter 1 Section Z10 Specifications and Quality sections.

ESM Chapter 5, Sect. II, para. 6.0, references the International Building Code (IBC), Chapter 21, Masonry, for guidance on design requirements for masonry building structures, and components therein. IBC Chapter 21 also provides general guidance, and guidance on materials, construction and quality assurance. It is the intent of this Section to comply with all of guidance in Chapter 21; however, only the more salient points, as well as additional points/items LANL deems important enough to address, are mentioned.

The focus of this section includes (non-prestressed) steel-reinforced, structural and load-bearing (non-autoclaved-aerated) concrete masonry, typically with grout-filled cores, and horizontal bond beams and lintels. However, the section can also be used for nonstructural concrete masonry such as interior, non-load-bearing partitions with necessary editing and provided that the title and number is changed (to Unit Masonry 04 2000, e.g.).

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1. GENERAL
	1. SUMMARY
		1. Section includes concrete masonry units, reinforcement, anchorage, mortar, grout, and accessories; and quality control.
			1. Quality Assurance is addressed in the Engineer of Record’s Statement of Special Inspections (EOR’s SSI).
		2. Related Sections:
			1. Section 01 4000 - *Quality Requirements*: General LANL quality requirements.
			2. Section 05 0520 - *Post Installed Concrete and Grouted-Masonry Anchors –Normal Confidence*: Product requirements for nonstructural-component anchorage to grouted masonry.
			3. Section 05 1000 - *Structural Metal Framing*: Product requirements for steel anchors for [\_\_\_\_\_\_\_\_] for placement by this Section.
			4. Section 05 2100 - *Steel Joist Framing*: Product requirements for steel bearing pads for joists for placement by this section.
			5. Section 05 5000 - *Metal Fabrications*: Product requirements for [loose steel lintels,] [fabricated steel items,] [and] [\_\_\_\_\_\_\_\_] for placement by this section.
			6. Section 07 1113 - *Bituminous Dampproofing*: Dampproofing [parged] masonry surfaces.

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Coordinate first subparagraph below with referenced Section. Metal flashing and reglets are included in Section 07 6200, *Sheet Metal Flashing and Trim*; however, installation of through-wall flashing and reglets are only in this Section (04 2220).

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* + - 1. Section 07 6200 - *Sheet Metal Flashing and Trim*: Except for installation of through-wall flashing and reglets, all requirements for sheet metal flashing and reglets to be installed in masonry joints.
			2. Section 07 8400 - *Firestopping*: Firestopping at penetrations of masonry work.
			3. Section 07 9200 - *Joint Sealants*: Sealant and backing material at joints.
			4. Section [\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_]: Execution requirements for special anchors specified by this section.
			5. Section [\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_]: Product requirements for window anchors for placement by this section.
			6. Section [\_\_\_\_\_\_-\_\_\_\_\_\_\_\_\_\_\_\_\_]: Product requirements for fabricated steel items for placement by this section.
	1. REFERENCES

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List reference standards included within text of this section. Edit for Project conditions.

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* + 1. ASTM International:
			1. ASTM A36 – Standard Specification for Carbon Structural Steel.
			2. ASTM A82 – Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
			3. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
			4. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
			5. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod, 60 000 psi Tensile Strength.
			6. ASTM A480 - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
			7. ASTM A580 - Standard Specification for Stainless Steel Wire.
			8. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
			9. ASTM A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
			10. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
			11. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
			12. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
			13. ASTM A951 - Standard Specification for Steel Wire for Masonry Joint Reinforcement.
			14. ASTM A1008 - 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.
			15. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
			16. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
			17. ASTM C143 - Slump of Hydraulic-Cement Concrete.
			18. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
			19. ASTM C150 - Standard Specification for Portland Cement.
			20. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
			21. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
			22. ASTM C331 - Standard Specification for Lightweight Aggregates for Concrete Masonry Units.
			23. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
			24. ASTM C476 - Standard Specification for Grout for Masonry.
			25. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
			26. ASTM C549 - Standard Specification for Perlite Loose Fill Insulation.
			27. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
			28. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.
			29. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Unit Masonry.
			30. ASTM C1329 - Standard Specification for Mortar Cement.
			31. ASTM C1623 - Standard Specification for Manufactured Concrete Masonry Lintels.
			32. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
			33. ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
			34. ASTM D2000 - Classification System for Rubber Products in Automotive Applications.
			35. ASTM D2287 - Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.
			36. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
			37. ASTM E514 - Standard Test Method for Water Penetration and Leakage Through Masonry.
		2. International Code Council
			1. IBC – International Building Code.
		3. The Masonry Society
			1. TMS 602 - Specification for Masonry Structures (formally known as TMS 602/ ACI 530.1/ ASCE 6)

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Regarding the next two Articles (i.e., Action and Informational Submittals), only request submittals needed to ensure the required level of quality and to verify compliance with project requirements.

If project requires higher level of quality, consider adding an additional submittal(s). For example, sample specimens of certain products in Action Submittals (and sample panels and/or mockups in the “Quality Control and Quality Assurance” Article); test results for masonry units, and mortar in Informational Submittals, etc.

If project will include self-consolidating grout, TMS 602 para. 1.5.B.2 requires submission of a material certificate (in subparagraph within Informational Submittals below). And there are many other 602 requirements that aren’t included in this template: Refer to paras.1.5.B.1.b.3, 2.2.C, 2.6.B.3, 3.5.D.2, and 3.5.E.2.

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* 1. ACTION SUBMITTALS
		1. Product Data: For each type of product.
		2. Shop Drawings: For the following:
			1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
			2. Reinforcing Steel: Show sizes, grades, and elevations of reinforced walls. Detail bending, lap lengths and placement of masonry reinforcing bars. Indicate quantities, supporting and spacing devices, [accessories], [reinforcing bars to be welded and welding procedures], [and] [\_\_\_\_\_\_\_\_].
		3. Per the requirements of 01 4444 *Offsite Welding and Joining Requirements* and/or 01 4455 *Onsite Welding and Joining Requirements*, submit

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When offsite only, delete submittals below regarding onsite welding. For high risk applications such as ML-1 or ML-2, add submittals for “Weld Filler Material Control Procedures” and “Filler Material Certified Material Test Reports (CMTRs)” when required. Add “Post-Weld Heat Treatment Procedures” when required.

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* + 1. Welding Procedure Specification (WPS) and supporting Procedure Qualification Record (PQR). [Note: For Onsite welding use of LANL WPS/PQR is the default; coordinate usage with the LANL CWI; no submittal required]
		2. Welder Performance Qualification Records (WPQR) including continuity [Note: For Onsite, welders are tested by LANL who will produce WPQR and track continuity; this includes brazing, bonding and fusing; no submittal required]
		3. Inspector qualification records
		4. Inspection procedures
		5. Shop drawings with weld details/symbols
	1. INFORMATIONAL SUBMITTALS

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Coordinate first paragraph below with qualification requirements in the “Quality Assurance” Article of Section 01 4000, *Quality Requirement*s, and as supplemented in "Quality Control and Quality Assurance" Article herein.

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* + 1. Qualification Data: For subcontractor’s testing agency (for quality control).
		2. Obtain written acceptance of submittals prior to the use of mix designs, materials, [and] construction procedures [, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_].

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Determination and verification the compressive strength of masonry herein is based on the unit strength method (USM), which is conservative compared to the alternative, the prism test method (PTM). This conservatism may cause the masonry to be slightly more expensive. On the other hand, the USM offers cost savings (vs. the PTM) in that the expense of prism tests is eliminated. While it is permissible for the PTM to be used instead of the UTM, the pros & cons must be weighed/evaluated before editing this template accordingly.

As indicated in “Mix Designs” paragraph below, mortar is based on specification by proportion (vs. property). The reason being similar to that indicated above. For further detail/guidance, refer to the “Mortar and Grout Mixes” Article, specifically Author Note #4.

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* + 1. Material Certificates: Certify that each type and size of the following meet or exceed specified requirements:
			1. Masonry units

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If the project requires greater quality (i.e., RC IV structure) then retain the second option in the following subparagraph.

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* + - * 1. Include [data on material properties] [material test reports substantiating compliance with requirements].

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If PTM (vs. UTM) is used, delete following subparagraph.

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* + - * 1. For masonry units, include data and calculations establishing average net-area compressive strength.

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Numerous types of applied coatings, such as conventional dampproofing and waterproofing in below-grade applications and masonry paints and water repellents in above-grade applications, are used on exterior masonry to increase water resistance. Materials and wall construction methods can affect resistance to water penetration of uncoated exterior masonry walls. Integral water repellents are often used in decorative concrete masonry, and field-applied water repellents are also used.

Delete the following subparagraph if project doesn’t include exterior masonry, or if an alternative water-resistance measure(s) is to be used. Coordinate this action/choice with option in “Concrete Masonry Units” and “Mortar and Grout Materials” Articles.

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* + - 1. Integral water repellant used in CMUs
			2. Cementitious materials. Include name of manufacturer, brand name, and type.
			3. Mortar admixtures.
			4. Grout mixes. Include description of type and proportions of ingredients.
			5. Reinforcing bars.
			6. Joint reinforcement.
			7. Anchors, ties, fasteners, and metal accessories.
		1. Mix Designs:
			1. For each mortar mix, mix design indicating type and proportions of ingredients in compliance with the proportion specification of ASTM C270.
			2. For each grout mix, mix design indicating type and proportions of ingredients according to the proportion requirements of ASTM C476 paragraph 4.2.1.2. Include test reports in accordance with ASTM C 1019.

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If PTM (vs. UTM) is used, delete following para.

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* + 1. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602.

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TMS 402 para. 9.1.9.3.1 stipulates that the actual yield strength/specified yield strength < 1.3 for ASTM A615 or A996 reinforcement for in-plane flexural tension and flexural tension perpendicular to bed joints.

Retain para. below if this applies to project. If this applies to only some reinforcing bars then edit option accordingly, and/or indicate on drawings the bars to which this provision applies.

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* + 1. [Test Reports for Reinforcing Bars: For each material type (e.g., ASTM A615, etc.), provide test report indicating that the actual yield strength does not exceed the specified yield strength by more than 30%.]
		2. Weather-Related Construction Procedures: For each of the following, detailed description of methods, materials, and equipment to be used to comply with requirements contained in the “Project Conditions” Article herein:
			1. Cold weather construction procedures.
			2. Hot weather construction procedures.
	1. SUSTAINABLE DESIGN SUBMITTALS
		1. Manufacturer's Certificate: Certify that following products meet or exceed specified sustainable design requirements.

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Insert material certifications list below to suit products specified in this Section and Project sustainable design requirements.

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* + - 1. Materials Resources Certificates:
				1. Certify source and origin for [salvaged] [and] [reused] products.
				2. Certify recycled material content for recycled content products.
				3. Certify source for regional materials and distance from Project Site.
		1. Product Cost Data: Submit cost of products to verify compliance with Project sustainable design requirements. Exclude cost of labor and equipment to install products.
			1. Provide cost data for following products:

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Edit list of material cost data below to suit products specified in this Section and Project sustainable design requirements.

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* + - * 1. Salvaged, refurbished, and reused products.
				2. Products with recycled material content.
				3. Regional products.
				4. [\_\_\_\_\_\_\_\_.]
	1. QUALITY CONTROL AND QUALITY ASSURANCE

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In TMS 402 & 602 quality control (QC) is included in quality assurance (QA); however, for consistency with other LANL engineering standards/documents, it’s necessary to distinguish between QC and QA this Section/template. Refer to “Summary” Article (above), and related paras (below).

The ‘QC para.,’ in conjunction with other requirements in this Section, meets the minimum requirements of the IBC, which, for most LANL projects, is TMS 602 Level B QA (i.e., RC I – III structures).

If the project requires greater quality (i.e., RC IV structure) then edit the following in accordance with TMS 602 Level C QA.

Level A QA is applicable only for LANL projects that include prescriptive design of glass unit masonry, or of masonry veneer, in RC I–III structures.

Retain the following para. if Subcontractor selects testing agency for QC. If this para. is retained, ensure the “Quality Assurance” Article of Section 01 4000, *Quality* *Requirements* is edited accordingly.

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* + 1. Subcontractor’s Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
		2. Quality Control: Perform work in accordance with TMS 602, [Level B Quality Assurance]. In case of conflict with this Section, notify the EOR/Structural POC.
		3. Quality Assurance: As required in EOR’s SSI.
		4. Fire Rated [Wall] [ ] Construction:
			1. Rating: [As indicated on Drawings] [\_\_\_\_\_\_\_\_] hour].
			2. Tested Rating: Determined in accordance with ASTM E119.

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Refer to IBC Tables 721.1(2) for fire resistance ratings for walls and partitions. The Table uses item numbers to identify each material.

If this table isn’t suitable for Project then the following subparagraph must be edited.

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* + - 1. Prescriptive Rating: IBC Table 721.1(2), Item Number [ ].
	1. DELIVERY, STORAGE, AND HANDLING
		1. Section 01 6000 *Product Requirements*: General LANL requirements for transporting, handling, storing, and protecting products.
		2. TMS 602, Section 1.7 – Delivery, storage, and handling: ‘Masonry-specific’ requirements for same.
	2. PROJECT CONDITIONS
		1. Comply with all applicable requirements of TMS 602, Section 1.8 (i.e., paragraphs 1.8.A – 1.8.D)**\***.

**\*** Since this Section does not include autoclaved aerated concrete (AAC), AAC masonry, AAC units, etc., requirements in Article 1.8 associated with AAC are never applicable.

* 1. COORDINATION
		1. Coordinate masonry work with [[\_\_\_\_\_\_\_\_] veneer,] [installation of window and door anchors,] [\_\_\_\_\_\_\_\_].
1. PRODUCTS
	1. MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

* 1. PERFORMANCE REQUIREMENTS

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1. TMS 402 defines compressive strength of masonry as follows: “Maximum compressive force resisted per unit of net cross-sectional area of masonry, determined by testing masonry prisms or a function of individual masonry units, mortar, and grout, in accordance with the provisions of [TMS 602].” This template is based on the latter option (i.e., USM vs. PTM as indicated in author note in “Informational Submittals” Article).

2. The specified value(s) of the compressive strength of masonry (i.e., f ’m) at stated ages for which masonry is designed, for each part of the structure, shall appear on the drawings per TMS 402 para. 1.2.1(c).

3. For Strength Design (vs. Allowable Stress Design), per ‘402,’ 9.1.9.1, 1500 < f 'm < 4000 psi.

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* + 1. Provide concrete unit masonry that develops indicated net area compressive strength[s] at [28 days] [indicated age[s]], f ‘m.
			1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602, Table 2.
	1. SUSTAINABILITY CHARACTERISTICS

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Insert sustainable design characteristics in this Article to suit content of this Section and Project sustainable design requirements.

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* + 1. Material and Resource Characteristics:
			1. Recycled Content Materials: Furnish materials with maximum available recycled content [including:] [.]

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Insert list of materials specified in this Section required to have recycled content.

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* + - * 1. [\_\_\_\_\_\_\_.]
			1. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of Project Site [including:] [.]

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Insert list of materials specified in this Section required to be regional materials.

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* + - * 1. [\_\_\_\_\_\_\_.]
	1. CONCRETE UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602 except as modified by requirements in the Contract Documents.

B. Damaged/Defective Units: Use of damaged/defective units (e.g., chipped, cracked, etc.) is prohibited without prior approval of LANL STR. If/when requesting such approval, provide LANL STR with the applicable portion of a ‘national masonry standard’ that addresses the issue (e.g., allowance of a certain percentage of units containing damage/defects similar to that on the Project, etc.). If approval is given, do not use the units in question where the damage/ defects are exposed in the completed Work [and will be within 20 feet vertically and horizontally of a walking surface].

C. Fire-Resistance Ratings: Where fire-resistance-rated construction is indicated, provide the following:

1. Units listed and labeled by a qualified testing agency for a specific listed design assembly tested in accordance with ASTM E119 by a nationally recognized testing laboratory acceptable to the LANL STR.
2. Calculated rating determined by IBC Table 722.3.2, including percent volume of all aggregate types and equivalent thickness determined by ASTM C140 for all blocks to be used in fire-rated assemblies.
	1. Concrete Masonry Units (CMU)
		1. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
			1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
			2. Provide [square-edged] [bullnose] units for outside corners unless otherwise indicated.

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Retain "Integral Water Repellent" paragraph below for increased water resistance of units if required. If retaining, also retain water-repellent mortar admixture.

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* + 1. Integral Water Repellent: Provide units made with integral water repellent [for exposed units] [and] [where indicated].
			1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
		2. Insulated CMUs: Where indicated, units shall contain rigid, specially shaped, cellular thermal insulation units complying with ASTM C 578, Type I, designed for installing in cores of masonry units.
		3. CMUs: ASTM C 90.

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In the subparagraph below, either select a weight classification -- lightweight units < 105 pcf, 105 < medium-weight units < 125 pcf, normal-weight units > 125 pcf -- or retain last option for default requirement if using more than one weight.

Unit weight can be a factor in determining physical properties. In general, increases in weight have the following effects: Higher compressive strength, reduced chippage, lower water absorption, lower manufacturing cost but higher shipping cost, lower productivity in laying units and higher labor cost, lower fire-resistance rating, lower thermal resistance but higher heat-storage capacity, and better resistance to sound penetration.

Before specifying a particular weight classification, verify local availability, particularly of medium- and normal-weight units.

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* + - 1. Density Classification: [normal-] [medium-] [light] weight [unless otherwise indicated].
			2. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.

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Retain "Exposed Faces" subparagraph below if color and texture of faces are critical. ASTM C 90 requires at least four units for sample, representing the range of color and texture permitted. If retained then “Action Submittals” Article must be edited to include a “Samples for Verification” subparagraph that contains appropriate/applicable requirements.

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* + - 1. Exposed Faces: Provide color and texture matching the range represented by EOR's sample.

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Retain "Faces to Receive Plaster" subparagraph below if using direct application of Portland cement or gypsum plaster.

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* + - 1. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

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Insert other forms of block (e.g., decorative, pre-faced, sound absorbing, pre-insulated, etc.) where required. Some of these other forms of block are typically accompanied by other requirements not included herein (e.g., pigmented mortar, colored aggregate, various installation provisions, etc.).

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* 1. [CONCRETE] [AND] [MASONRY] LINTELS

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Retain paragraph below if retaining more than one of the remaining paragraphs in article.

Regardless of the paragraph(s) selected, and/or if lintels will be of structural steel, the drawings shall indicate location(s), type(s) and details of lintels.

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* + 1. General: Provide one of the following:

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Retain one or more of three paragraphs below, depending on appearance desired. The first option is manufactured, flexurally-reinforced, solid concrete (i.e., despite the use of the word “masonry” in the title of its ASTM). The third option includes the ‘conventional/typical’ masonry lintel (e.g., consisting of U-shaped CMU units, etc.).

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* + 1. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. [Provide lintels with net-area compressive strength not less than that of CMUs.]
		2. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 03 3001 *Reinforced Concrete*, and with reinforcing bars indicated.
		3. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.
	1. MORTAR AND GROUT MATERIALS

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Coordinate requirements in this article with those in "Mortar and Grout Mixes" Article.

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* + - * 1. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

Requirement in subparagraph below can help reduce the likelihood of efflorescence.

* + - * 1. Hydrated Lime: ASTM C 207, Type S.

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It can be difficult to control the color of Portland cement-lime mortar that is job-mixed; packaged mixes allow better control. If the packaged mix (in para. below) is retained, also retain the previous two paras (i.e., Portland Cement and Hydrated Lime), and the subsequent one – Preblended, Dry Mortar Mix – in the “Mortar and Grout Mixes” Article.

Use of preblended, dry mortar mix for small projects is inappropriate.

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Mix in "Portland Cement-Lime Mix" Paragraph below allows better control of color than job-mixed, portland cement-lime mortar. If retaining below, also retain "Portland Cement" and "Hydrated Lime" paragraphs above.

* + - * 1. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.
				2. Mortar Cement: ASTM C 1329.

Retain "Mortar Pigments" Paragraph below for colored cement or for pigments added at Project site.

* + - * 1. Aggregate for Mortar: ASTM C 144.

For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

White-Mortar Aggregates: Natural white sand or crushed white stone.

* + - * 1. Aggregate for Grout: ASTM C 404.

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Delete "Epoxy Pointing Mortar" Paragraph below if not needed for pre-faced CMUs, glazed brick, or glazed structural clay facing tile.

"Cold-Weather Admixture" paragraph below is an example of a requirement for a concrete admixture often used in cold weather as an antifreeze. It is generally recommend not using admixtures unless they are known to have no adverse effects. Before approving the use of cold-weather admixtures, verify their acceptability by laboratory testing with mortar mix used. \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + - * 1. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

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Retain "Water-Repellant Admixture" paragraph if integral water repellent is used in CMUs.

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* + - * 1. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

I. Water: Potable.

* 1. REINFORCEMENT

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Retain paragraph below for reinforcing bars in grouted cells, lintels, etc. Revise if another grade of steel is required. Revise to specify epoxy-coated, stainless-steel, or galvanized bars if required.

Per TMS 402 8.1.6.7.2, specify ASTM A706 reinforcing steel when project includes/could include welded splicing, or else require the submittal referred to therein (by editing the “Reinforcing bars” subparagraph of the “Material Certificates” para. within the “Informational Submittals” Article).

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* + - * 1. Uncoated Steel Reinforcing Bars: ASTM A 615 [ASTM A706], Grade 60.
				2. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

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Paragraph below includes requirements for mill-galvanized carbon steel, hot-dip galvanized carbon steel, and stainless steel. Specifying these materials separately in unnecessary.

Joint reinforcement must be stainless steel or otherwise corrosion-protected when used in masonry exposed to earth or weather, and in interior walls exposed to a mean relative humidity > 75%. Mill or hot-dip galvanized, or stainless steel joint reinforcement may be used when such conditions don’t apply. Refer to TMS 402 para. 6.1.4 for more detail and other ‘protection’ requirements.

Use the thinner side rods for ¼ < joint-thickness < 3/8, and use the thicker option for 3/8 < jt.-th. < ½.

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 C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951.

1. Mill-galvanized coating is not as thick as hot-dip galvanized coating. According to ASTM A 951/A 951M, mill-galvanized coating may be applied to wire before fabricating, but hot-dip galvanized coating must be applied after fabricating.

Interior Walls: [Mill-] [Hot-dip] galvanized carbon steel.

Exterior Walls: [Hot-dip galvanized carbon] [Stainless] steel.

Wire Size for Side Rods: [0.148-inch] [0.187-inch] diameter.

Wire Size for Cross Rods: [0.148-inch] [0.187-inch] diameter.

Spacing of Cross Rods: Not more than 16 inches o.c.

Provide in lengths of not less than 10 feet [, with prefabricated corner and teeunits].

* 1. TIES AND ANCHORS
		1. General: Ties and anchors shall extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.
		2. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

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Retain *subparagraphs* below only for those materials referenced in subsequent *paragraphs* (i.e., those with “Anchors” in their titles). “Anchor” is not to be confused with “anchor bolt.”

Metal accessories must be stainless steel or otherwise corrosion-protected when used in masonry exposed to earth or weather, and in interior walls exposed to a mean relative humidity > 75%. Mill or hot-dip galvanized, or stainless steel wall ties, anchors and inserts may be used when such conditions don’t apply. Anchor bolts, steel plates, and bars not exposed to earth, weather, nor exposed to a mean relative humidity > 75 %, need not be coated.

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Mill-Galvanized, Carbon-Steel Wire: ASTM A 82, with ASTM A 641, Class 1 coating.

Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82, with ASTM A 153, Class B-2 coating.

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Retain ‘304 option’ in subparagraph below unless higher corrosion resistance is required.

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Stainless-Steel Wire (for ties and anchors): ASTM A 580, [Type 304] [Type 316].

Galvanized-Steel Sheet: ASTM A 653, Commercial Steel, G60 zinc coating.

Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, with ASTM A 153, Class B coating.

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For the next two subparagraphs, retain ‘304 option’ unless higher corrosion resistance is required.

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Stainless-Steel Sheet-metal Anchors and Ties: ASTM A 480 and ASTM A 240, [Type 304] [Type 316].

Stainless-Steel Plate and Bent-bar Anchors): ASTM A 480 and ASTM A 666, [Type 304] [Type 316].

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Retain subparagraph below if required for rigid anchors.

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Steel Plates, Shapes, and Bars: ASTM A 36.

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The following ‘Anchors paragraphs’ are for securing masonry to structural supports. Regarding the material options in these paras., refer to previous author note, and TMS 6.1.4, for ‘corrosion- protection requirements.’

Adjustable anchors allow for differential movement between the masonry and the structure to which it is attached. These anchors require an open space, with no mortar or rigid material between the masonry and the structure.

If rigid anchors are used, they must be detailed on the Drawings.

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* + - * 1. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

Anchor Section for Welding to Steel Frame: Crimped 1/4-inch-diameter, [hot-dip galvanized steel] [stainless-steel] wire.[ Mill-galvanized wire may be used at interior walls unless otherwise indicated.]

Tie Section: Triangular-shaped wire tie made from [0.187-inch-] [0.25-inch-] diameter, [hot-dip galvanized steel] [stainless-steel] wire.[ Mill-galvanized wire may be used at interior walls unless otherwise indicated.]

* + - * 1. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

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Retain "Connector Section" and "Tie Section" subparagraphs below; otherwise, retain "Corrugated-Metal Ties" Subparagraph below.

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Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from [0.060-inch-thick steel sheet, galvanized after fabrication] [0.105-inch-thick steel sheet, galvanized after fabrication] [0.062-inch-thick, stainless-steel sheet] [0.109-inch-thick, stainless-steel sheet].

1. [0.064-inch-] [0.108-inch-] thick, galvanized-steel sheet may be used at interior walls unless otherwise indicated.

Tie Section: Triangular-shaped wire tie made from [0.187-inch-] [0.25-inch-] diameter, [hot-dip galvanized steel] [stainless-steel] wire.[ Mill-galvanized wire may be used at interior walls unless otherwise indicated.]

Corrugated-Metal Ties: Metal strips not less than 7/8-inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from [0.060-inch-thick steel sheet, galvanized after fabrication] [0.075-inch-thick steel sheet, galvanized after fabrication] [0.105-inch-thick steel sheet, galvanized after fabrication] [0.062-inch- thick, stainless-steel sheet] [0.078-inch-thick, stainless-steel sheet] [0.109-inch-thick, stainless-steel sheet] with dovetail tabs for inserting into dovetail slots in concrete.

[0.064-inch-] [0.079-inch-] [0.108-inch-] thick, galvanized sheet may be used at interior walls unless otherwise indicated.

* + - * 1. Partition Top Anchors: 0.105-inch-thick metal plate with a 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from [steel, hot-dip galvanized after fabrication] [stainless steel].

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Rigid anchors can be used to connect T-intersections of CMU shear walls in lieu of masonry bonding or bond beams. They are also often used at T-intersections of other CMU walls, although masonry bonding and T-shaped masonry-joint reinforcement may be used.

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* + - * 1. Rigid Anchors: Fabricate from steel bars [1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated] [bent to configuration indicated].

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Retain one of three options in "Corrosion Protection" Subparagraph below. Rigid anchors may not be fully embedded in mortar or grout and therefore require a coating for corrosion protection. TMS 602/ACI 530.1/ASCE 6 requires hot-dip galvanized or epoxy coating.

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Corrosion Protection: [Hot-dip galvanized to comply with ASTM A 153, Class B] [Epoxy coating 0.020-inch thick] [Rust-inhibitive paint].

* + - * 1. Headed Anchor Bolts: ASTM A307; Grade A [hooked]; [complete with washers and heavy hex nuts]; [galvanized finish].

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In the subparagraph below, Class C applies to bolt diameters > 3/8”, and Class D to < 3/8”.

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Hot-Dipped Galvanizing: ASTM A153, [Class C] [Class D].

Mechanical Galvanizing: ASTM B695, Class 55.

* 1. MISCELLANEOUS MASONRY ACCESSORIES

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In accordance with TMS 402 1.2.1 (h), drawings shall indicate location and detail of each type of movement joint. Also show isolation joints between masonry and concrete and between masonry and steel framing if any. Finally, show details of control and expansion joints at ends of lintels if applicable.

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* + 1. Contraction (Control, Shrinkage) Joint Materials:

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Subparagraph below pertains to shear keys used in vertical joints. A sash block is a CMU which has an end slot to receive joint material.

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* + - 1. Preformed Control-Joint Gaskets: Made from [styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805] [or] [PVC, complying with ASTM D 2287, Type PVC-65406] and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
		1. Expansion Joint Material:
			1. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from [neoprene] [urethane] [or] [PVC].

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Bond-breaker stripsare often required in vertical control joints. They are also often required to be positioned horizontally between masonry and floor or roof slabs, to allow differential movements if positive anchorage is not required. Bond-breaker strips used as slip planes may be necessary at lintels bearing on masonry.

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* + 1. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226, Type I (No. 15 asphalt felt).
	1. MASONRY CELL FILL
		1. Loose-Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).
		2. Lightweight-Aggregate Fill: ASTM C 331.
	2. MORTAR AND GROUT MIXES

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Mortar is specified throughout this template by proportion.

If/when analysis indicates that project is large enough for the savings in the respective constituent materials to make up for the additional costs of the mortar testing required to verify compliance, the property specification should be used instead of proportion specification. Note that such change will requiring editing this template, to include the “Mix Designs” paragraph within the “Informational Submittals” Article per TMS 602 para. 1.5.B.1.a.

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* + 1. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
			1. Do not use calcium chloride in mortar or grout.

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Retain one or more of first three subparagraphs below to indicate acceptable mortar types.

TMS 402, 7.4.4.2.2 requires use of Type M or S mortar in fully-grouted participating elements (i.e., walls that are part of the seismic-force-resisting system) in SDC D.

And the same goes for ‘partially-grouted,’ except the mortar types are limited to cement lime and mortar cement (i.e., masonry cement mortar can’t be used).

Since masonry cement mortar is prohibited from use used in certain instances, it is not included as a mortar option below.

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* + - 1. Use [Portland cement-lime] [or] [mortar cement] mortar unless otherwise indicated.
			2. For exterior masonry, use [Portland cement-lime] [or] [mortar cement] mortar.
			3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
		1. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

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Type N mortar shall only be used if SDC = C.

Although Type M mortar is stronger than Type S, Type S appears as the first option (in brackets, below) since that’s the ‘order of presentation’ in TMS 402, 7.4.4.2.2 (i.e., SDC D), and since use of stronger mortar than required is not the ‘industry standard.’ As indicted above, Type N mortar isn't applicable to SDC D.

Specify Type M only for masonry below grade and in contact with earth.

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* + 1. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.
			1. Mortar shall be Type [S] [M] [N].
		2. Grout for Unit Masonry: Comply with ASTM C 476.

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Regarding the choice between fine and coarse grout in the subparagraph below, course grout should be used if grout spaces are large enough to permit its placement (because it contains more aggregate and will therefore shrink less than fine grout); however, TMS 402 para 3.2.1 requires larger spaces for its placement (vs. fine grout).

Whichever type of grout is chosen, ensure ‘3.2.1’ will be complied with (i.e., min. dimensions, lift heights and, if applicable, demonstration panel).

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* + - 1. Grout shall be [fine] [coarse] type, and its use shall comply with the dimensions of grout spaces and pour height(s) stipulated by TMS 602.

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TMS 402, 9.1.9.1 (Strength Design) requires the following for specified grout compressive strength, f 'g: f 'm < f ‘g < 5,000 psi. Per TMS 602 para. 2.2.B, f ‘g > f 'm only for f 'm > 2000 psi. In order to ensure ‘402’ provision is never violated, the “Grout” subparagraph (below) is written conservatively (i.e., f ‘g > f ‘m always).

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* + - 1. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 such that grout compressive strength > f ‘m; however, regardless of the value of f ‘m, grout compressive strength shall not exceed 5,000 psi.
			2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.
1. EXECUTION
	1. EXAMINATION
		1. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
			1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
			2. Verify that foundations are within tolerances specified.
			3. Verify that reinforcing dowels are properly placed.
			4. Verify that substrates are free of substances that would impair mortar bond
		2. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
		3. Proceed with installation only after unsatisfactory conditions have been corrected.
	2. INSTALLATION, GENERAL
		1. Build chases and recesses to accommodate items specified in this and other Sections.
		2. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
		3. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
	3. ERECTION TOLERANCES

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For more information on tolerances, specifically factors that affect construction/erection tolerances (e.g., masonry manufacturing, adjoining construction, modular coordination and human limitations), refer to pp. E23 of *MasterSpec – Evaluations, Section 04 2000 Unit Masonry*.

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* + 1. Dimensions and Locations of Elements:
			1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
			2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
			3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 3/4 inch maximum.
		2. Lines and Levels:
			1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
			2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
			3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
			4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
			5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
			6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum
			7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.
		3. Plus or minus 2 inches from location along face of wall joints:
			1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
			2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
			3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
			4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.
	1. LAYING MASONRY WALLS
		1. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

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Although TMS 402 allows masonry not laid in running bond, there are ‘strings attached.’ If it’s desired/required to use ‘non-running bond,’ then the following paragraph must be edited, and the design must be checked for compliance with the related ‘402’ requirements (contained in its Parts 2 and 3).

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* + 1. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
		2. Lay concealed masonry with all units in a wythe in running bond. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
		3. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
		4. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

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Revise paragraph below if flexible perimeter joint or thermal break is required.

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* + 1. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
		2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
		3. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
	1. MORTAR BEDDING AND JOINTING
		1. Lay hollow CMUs as follows:
			1. Units shall be placed while mortar is soft and plastic.
			2. Bed face shells in mortar and make head joints of depth equal to bed joints.
			3. Bed webs in mortar in all courses of piers, columns, and pilasters.
			4. Bed webs in mortar in grouted masonry, including starting course on footings.
			5. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
			6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace
		2. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
		3. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
		4. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

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Retain Article below if Project includes (or could include) such embedments.

The contents of the Article ensure compliance with TMS 402 para. 3.3.2; and TMS 602 para. 3.3 D, and items related to 3.3. D in its Checklists.

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* 1. CONDUITS, PIPES AND SLEEVES EMBEDED IN MASONRY
		1. Comply with the applicable requirements of TMS 602, as well as the following ones:
			1. Do not embed conduits, pipes and sleeves that are indicated as being prohibited from embedment.
			2. Embed (non-prohibited) conduits, pipes and sleeves at spacing(s) indicated.
			3. Sleeves for pipes and conduits shall be embedded at the location(s) indicated, and shall be of the size(s) indicated.
	2. MASONRY-CELL FILL
		1. Pour [loose-fill insulation] [lightweight-aggregate fill] into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than 20 feet.
		2. Install molded-polystyrene insulation units into masonry unit cells before laying units.
	3. MASONRY-JOINT REINFORCEMENT

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The option pertaining to lap length in paragraph below is applicable if joint reinforcement is used as shear reinforcement. TMS 402 para. 9.3.3.4(e) requires min. 48db for such. Using the wire-size options herein (in Part 2, in the Reinforcement Article), 48db = 7.1 and 9”, respectively.

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* + 1. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of [6 inches] [\_\_\_\_\_\_].

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Revise three subparagraphs below if different spacing is required; delete if shown on Drawings.

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* + - 1. Space reinforcement not more than 16 inches o.c.
			2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
			3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings [in addition to continuous reinforcement].
		1. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

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Paragraph below can be deleted if rigid anchors are used to bond walls at intersections.

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* + 1. Provide continuity at wall intersections by using prefabricated T-shaped units.
		2. Provide continuity at corners by using prefabricated L-shaped units.

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Retain last paragraph above or option in paragraph below.

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* + 1. Cut and bend reinforcing units as directed by manufacturer for continuity at [corners,] returns, offsets, column fireproofing, pipe enclosures, and other special conditions.
	1. ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE
		1. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
			1. Provide an open space not less than [1/2 inch] [1 inch] [2 inches] wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
			2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
			3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally
	2. CONTROL AND EXPANSION JOINTS
		1. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall movement.

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Show locations of joints on Drawings.

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* + 1. Form control joints in concrete masonry [as follows] [using one of the following methods]:

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Retain one or more of four subparagraphs below.

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* + - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
			2. Install preformed control-joint gaskets designed to fit standard sash block.
			3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
			4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.
	1. LINTELS

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Locations of lintels shall be indicated on Drawings and appropriately detailed.

For concrete or masonry lintels, detailing shall include the depth, d, of reinforcing bars. For guidance on this for masonry, refer to TMS 602 Commentary to para. 3.4.B.11 and the related figure (SC-16).

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* + 1. Provide [loose steel] [concrete] [or] [masonry] lintels where shown [and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels].

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Delete paragraph below if bearing is shown on Drawings \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

* + 1. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.
	1. FLASHING
		1. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.
		2. Install flashing as follows unless otherwise indicated:

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Retain option in subparagraph below for manufactured flashing; delete if only metal flashing is used.

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* + - 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape [as recommended by flashing manufacturer].
			2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
			3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 9200 *Joint Sealants* for application indicated.
			4. Install metal [drip edges] [and] [sealant stops] with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 9200 *Joint Sealants* for application indicated.
		1. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. 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. 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.
		2. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
	1. REINFORCED UNIT MASONRY INSTALLATION

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Usually retain paragraph below only if reinforced masonry beams, slabs, soffits, and similarly formed elements are required.

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* + 1. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
			1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
			2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction

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Regarding paragraph below, in order for subcontractor to comply with the tolerances stipulated TMS 602 for placing reinforcing bars in masonry beams, EOR must indicate distance/dimension “d” on drawings, or in a schedule herein.

For guidance on this, refer to TMS 602 Commentary to para. 3.4.B.11 and the related figure (SC-16).

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* + 1. Placing Reinforcement: Comply with requirements in TMS 602.
		2. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
			1. Comply with requirements in TMS 602 for cleanouts and for grout placement.

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Retain Article below if Project includes below-grade masonry walls. Such walls are parged for surface preparation for subsequent application of dampproofing, waterproofing coating, membrane, rigid wall insulation, etc.

Regarding the option in the second paragraph, determine whether or not the “subsequent application” requires something other than steel-trowel finish. For example, some waterproofing requires steel-trowel finish, while some dampproofing requires wood-float finish.

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* 1. PARGING
		1. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.
		2. Use a [steel-trowel] finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.
		3. Damp-cure parging for at least 24 hours and protect parging until cured.
	2. REPAIRING, POINTING, AND CLEANING
		1. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
		2. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
		3. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

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Depending on the visual importance of surfaces, additional/different requirements for Final Cleaning may be required. For example, if surfaces are to be painted, routine dry-brush cleaning will probably be adequate. For unpainted surfaces where a uniform visual appearance is required, mild acid cleaning of CMUs may be required.

TMS 602 only requires use of potable water and detergents.

If more elaborate/extensive cleaning is required, not only must the para. below be edited accordingly, but previous portions of this Section will require editing as well. For example, add sample wall panels to Part 1 (for testing of cleaning methods in Final Cleaning), add specific cleaner(s) to Part 2 (for use in Final Cleaning).

For more information on cleaning new CMU, refer to recommendations in NCMA TEK 8-4A, *Cleaning Concrete Masonry*.

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* + 1. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry by removing large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels, and by complying with requirements of TMS 602.
	1. MASONRY WASTE DISPOSAL
		1. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

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Retain paragraph below if clean masonry waste can be used as fill in footing trenches, etc. This diverts some material from waste stream, conserving landfill space and energy required to haul waste away.

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* + 1. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
			1. Crush masonry waste to less than 4 inches in each dimension.
			2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 2000 *Earth Work.*

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Generally retain subparagraph below. If required, increase limit if acid-soil plants are used for foundation plantings.

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* + - 1. Do not dispose of masonry waste as fill within 18 inches of finished grade.
		1. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
		2. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off LANL property.

END OF SECTION

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Do not delete the following reference information.

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THE FOLLOWING STATEMENT IS FOR LANL USE ONLY

This Project Specification is based on LANL Master Specification Section 04 2220, Rev. 4, dated May 10, 2021.