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Standard Specification for Loadbearing Concrete Masonry Units[1]

This standard is issued under the fixed designation C90; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This specification covers hollow and solid (see 5.3 and 5.4) concrete masonry units made from hydraulic cement, water, and mineral aggregates with or without the inclusion of other materials. There are three classes of concrete masonry units: Normal Weight, Medium Weight, and Lightweight. These units are suitable for both loadbearing and nonloadbearing applications.

1.2 Concrete masonry units covered by this specification are made from lightweight or normal weight aggregates, or both.

NOTE 1—The requirements of this specification have been researched, evaluated, and established for over a century, resulting in the physical properties and attributes defined here. These requirements are uniquely and solely applicable to concrete masonry units manufactured on equipment using low or zero slump concrete and the constituent materials defined herein. Many performance attributes of concrete masonry units are indirectly accounted for, or inherently reflected within, the requirements of this specification without direct measurement, assessment, or evaluation. Applying the requirements of this specification to products that may be similar in appearance, use, or nature to those covered by this specification may not address all pertinent physical properties necessary to ensure performance or serviceability of the resulting construction in real-world applications under typical exposure environments. Products manufactured using alternative materials, manufacturing methods, or curing processes not covered by this specification should not be evaluated solely using the requirements in this specification; however, developers of new products can consider the property requirements of this specification as a beginning benchmark for unit performance. It is reasonable to test new products for system performance as well as unit performance.

1.3 The text of this specification references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.4 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

NOTE 2—When particular features are desired such as surface textures for appearance or bond, finish, color, or particular properties such as density classification, higher compressive strength, fire resistance, thermal performance or acoustical performance, these features should be specified separately by the purchaser. Suppliers should be consulted as to the availability of units having the desired features.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C33/C33M Specification for Concrete Aggregates
C140/C140M Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
C150/C150M Specification for Portland Cement
C331/C331M Specification for Lightweight Aggregates for Concrete Masonry Units
C426 Test Method for Linear Drying Shrinkage of Concrete Masonry Units
C595/C595M Specification for Blended Hydraulic Cements
C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
C979/C979M Specification for Pigments for Integrally Colored Concrete
C989/C989M Specification for Slag Cement for Use in Concrete and Mortars
C1157/C1157M Performance Specification for Hydraulic Cement
C1232 Terminology of Masonry
C1240 Specification for Silica Fume Used in Cementitious Mixtures
C1314 Test Method for Compressive Strength of Masonry Prisms

[1] This specification is under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.03 on Concrete Masonry Units and Related Units.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard**

E519/E519M Test Method for Diagonal Tension (Shear) in Masonry Assemblages
E72 Test Methods of Conducting Strength Tests of Panels for Building Construction

3. Terminology

3.1 Terminology defined in Terminology C1232 shall apply for this specification.

4. Materials

4.1 *Cementitious Materials*—Materials shall conform to the following applicable specifications:
4.1.1 *Portland Cement*—Specification C150/C150M.
4.1.2 *Modified Portland Cement*—Portland cement conforming to Specification C150/C150M, modified as follows:
(1) Limestone—If calcium carbonate is added to the cement, the $CaCO_3$ content shall not be less than 85 %.
(2) Limitation on Insoluble Residue—1.5 %.
(3) Limitation on Air Content of Mortar—Volume percent, 22 % max.
(4) Limitation on Loss on Ignition—7 %.
4.1.3 *Blended Hydraulic Cements*—Specification C595/C595M.
4.1.4 *Hydraulic Cement*—Specification C1157/C1157M.
4.1.5 *Pozzolans*—Specification C618.
4.1.6 *Blast Furnace Slag Cement*—Specification C989/C989M.
4.1.7 *Silica Fume*—Specification C1240.

4.2 *Aggregates*—Aggregates shall conform to the following specifications, except for the grading requirements:
4.2.1 *Normal Weight Aggregates*—Specification C33/C33M.
4.2.2 *Lightweight Aggregates*—Specification C331/C331M.

NOTE 3—The grading requirements of Specifications C33/C33M and C331/C331M may not be suitable for concrete masonry production. Because of this, producers are allowed to modify grading to meet their needs and the requirements of this specification.

4.3 *Pigments for Integrally Colored Concrete*—Specification C979/C979M.

4.4 *Other Constituents*—Air-entraining agents, integral water repellents, and other constituents shall be previously established as suitable for use in concrete masonry units and shall conform to applicable ASTM standards or shall be shown by test or experience not to be detrimental to the durability of the concrete masonry units or any material customarily used in masonry construction.

5. Physical Requirements

5.1 At the time of delivery to the purchaser, units shall conform to the physical requirements prescribed in Table 1 and Table 2. All units shall be sound and free of cracks or other defects that interfere with the proper placement of the unit or significantly impair the strength or permanence of the construction. Minor cracks, incidental to the usual method of manufacture or minor chipping resulting from customary methods of handling in shipment and delivery, are not grounds for rejection.

NOTE 4—Higher compressive strengths than those listed in Table 2 may be specified where required by design. Consult with suppliers to determine availability of units of higher compressive strength.

NOTE 5—Oven-dry densities of concrete masonry units generally fall within the range of 85 to 145 lbf/ft^3 (1360 to 2320 kg/m^3). Because available densities will vary, suppliers should be consulted before specifying project requirements.

5.1.1 When higher compressive strengths than those listed in Table 2 are specified, the tested average net area compressive strength of three units shall equal or exceed the specified compressive strength, and the tested individual unit net area compressive strength of all three units shall exceed 90 % of the specified compressive strength. Compressive strength shall be tested in accordance with 8.2.

TABLE 1 Minimum Face Shells and Web Requirements[A]

Nominal Width (W) of Units, in. (mm)	Face Shell Thickness (t_{fs}), min, in. (mm)[B,C]	Webs	
		Web Thickness[C] (t_w), min, in. (mm)	Normalized Web Area (A_{nw}), min, in.^{2}/ft^2 (mm^2/m^2)[D]
3 (76.2) and 4 (102)	¾ (19)	¾ (19)	6.5 (45,140)
6 (152)	1 (25)	¾ (19)	6.5 (45,140)
8 (203) and greater	1¼ (32)	¾ (19)	6.5 (45,140)

[A] Average of measurements on a minimum of 3 units when measured as described in Test Methods C140/C140M.
[B] When this standard is used for units having split surfaces, a maximum of 10 % of the split surface is permitted to have thickness less than those shown, but not less than ¾ in. (19.1 mm). When the units are to be solid grouted, the 10 % limit does not apply and Footnote C establishes a thickness requirement for the entire faceshell.
[C] When the units are to be solid grouted, minimum face shell and web thickness shall be not less than ⅝ in. (16 mm).
[D] Minimum normalized web area does not apply to the portion of the unit to be filled with grout. The length of that portion shall be deducted from the overall length of the unit for the calculation of the minimum web cross-sectional area.