



Designation: ~~C90-08~~ Designation: C 90 - 09

## Standard Specification for Loadbearing Concrete Masonry Units<sup>1</sup>

This standard is issued under the fixed designation C 90; 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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

*This standard has been approved for use by agencies of the 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: (1) normal weight, (2) medium weight, and (3) 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.

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 1—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:<sup>2</sup>

C 33 Specification for Concrete Aggregates

C 140 Test Methods for Sampling and Testing Concrete Masonry Units and Related Units

C 150 Specification for Portland Cement

C 331 Specification for Lightweight Aggregates for Concrete Masonry Units

C 426 Test Method for Linear Drying Shrinkage of Concrete Masonry Units

C 595 Specification for Blended Hydraulic Cements

C 618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

C 989 Specification for Slag Cement for Use in Concrete and Mortars

C 1157 Performance Specification for Hydraulic Cement ~~C 1209 Terminology of Concrete Masonry Units and Related Units~~

C 1232 Terminology of Masonry

C 1314 Test Method for Compressive Strength of Masonry Prisms

E 519 Test Method for Diagonal Tension (Shear) in Masonry Assemblages

E 72 Test Methods of Conducting Strength Tests of Panels for Building Construction

### 3. Terminology

~~3.1 Terminology defined in Terminology C 1209 and Terminology C 1232~~

3.1 Terminology defined in Terminology C 1232 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 C 150.

4.1.2 *Modified Portland Cement*—Portland cement conforming to Specification C 150, modified as follows:

(1) *Limestone*—If calcium carbonate is added to the cement, the  $\text{CaCO}_3$  content shall not be less than 85 %.

<sup>1</sup> 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.

Current edition approved November 1, 2008-2009. Published November 2008-June 2009. Originally approved in 1931. Last previous edition approved in 2006-2008 as ~~C 90-06~~ C 90 - 08

<sup>2</sup> 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.

- (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 C 595.

4.1.4 *Hydraulic Cement*—Specification C 1157.

4.1.5 *Pozzolans*—Specification C 618.

4.1.6 *Blast Furnace Slag Cement*—Specification C 989.

4.2 *Aggregates*—Aggregates shall conform to the following specifications, except that grading requirements shall not necessarily apply:

4.2.1 *Normal Weight Aggregates*—Specification C 33.

4.2.2 *Lightweight Aggregates*—Specification C 331.

4.3 *Other Constituents*—Air-entraining agents, coloring pigments, integral water repellents, finely ground silica, 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.

~~NOTE 2—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.~~  
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~~NOTE 3—Oven-dry densities of concrete masonry units generally fall within the range of 85 to 145 lbf/ft<sup>3</sup> (1360 to 2320 kg/m<sup>3</sup>). Because available densities will vary, suppliers should be consulted before specifying project requirements.~~  
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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.

5.2 At the time of delivery to the purchaser, the linear shrinkage of units shall not exceed 0.065 %.

~~NOTE 4—The purchaser is the public body or authority, association, corporation, partnership, or individual entering into a contract or agreement to purchase or install, or both, concrete masonry units. The time of delivery to the purchaser is FOB plant when the purchaser or the purchaser's agent transports the concrete masonry units, or at the time unloaded at the worksite if the manufacturer or the manufacturer's agent transports the concrete masonry units.~~  
 NOTE 4—The purchaser is the public body or authority, association, corporation, partnership, or individual entering into a contract or agreement to purchase or install, or both, concrete masonry units. The time of delivery to the purchaser is FOB plant when the purchaser or the purchaser's agent transports the concrete masonry units, or at the time unloaded at the worksite if the manufacturer or the manufacturer's agent transports the concrete masonry units.

### 5.3 Hollow Units:

5.3.1 Face shell thickness ( $t_{fs}$ ) and web thickness ( $t_w$ ) shall conform to the requirements prescribed in Table 1.

~~NOTE 4—Web thickness ( $t_w$ ) not conforming to the requirements prescribed in Table 1 may be approved, provided equivalent structural capability has been established when tested in accordance with the applicable provisions of Test Methods E 72, C 1314, E 519, or other applicable tests and the appropriate design criteria developed is in accordance with applicable building codes.~~  
 NOTE 4—Web thickness ( $t_w$ ) not conforming to the requirements prescribed in Table 1 may be approved, provided equivalent structural capability has been established when tested in accordance with the applicable provisions of Test Methods E 72, C 1314, E 519, or other applicable tests and the appropriate design criteria developed is in accordance with applicable building codes.

**TABLE 1 Minimum Thickness of Face Shells and Webs<sup>A</sup>**

Nominal Width (W) of Units, in. (mm)	Face Shell Thickness ( $t_{fs}$ ), min, in. (mm) <sup>B,C</sup>	Web Thickness ( $t_w$ )	
		Webs <sup>B,D,C</sup> min, in. (mm)	Equivalent Web Thickness, min, in./linear ft <sup>E</sup> (mm/linear m)
3 (76.2) and 4 (102)	3/4 (19)	3/4 (19)	1 5/8 (136)
6 (152)	1 (25)	1 (25)	2 1/4 (188)
8 (203)	1 1/4 (32)	1 (25)	2 1/4 (188)
10 (254) and greater	1 1/4 (32)	1 1/8 (29)	2 1/2 (209)

<sup>A</sup> Average of measurements on a minimum of 3 units when measured as described in Test Methods C 140.

<sup>B</sup> 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 3/4 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.

<sup>C</sup> When the units are to be solid grouted, minimum face shell and web thickness shall be not less than 5/8 in. (16 mm).

<sup>D</sup> The minimum web thickness for units with webs closer than 1 in. (25.4 mm) apart shall be 3/4 in. (19.1 mm).

<sup>E</sup> Equivalent web thickness 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 equivalent web thickness.