[BLOCK BITE]

PROPERTIES AND CHARACTERISTICS
In Concrete Masonry Construction

THE BEAUTY OF BLOCK

A concrete masonry unit may, on the surface, appear to be an unassuming construction product cast of simple concrete, but the technology behind this fundamental building block incorporates more than a century of research, evaluation, and evolution behind it that yields the basic properties and characteristics inherent in what is commonly referred to as CMU.

ASTM C90 – STANDARD SPECIFICATION

ASTM INTERNATIONAL

Designation: C90

Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units

All loadbearing concrete masonry units, whether hollow or solid, are required to meet the requirements of ASTM C90. Many performance attributes of concrete masonry units are indirectly accounted for, or inherently reflected within, the requirements of ASTM C90. For example, ASTM C90 only permits CMU to be produced using nonorganic mineral constituent materials, which in turn ensures the resulting CMU is inherently noncombustible.

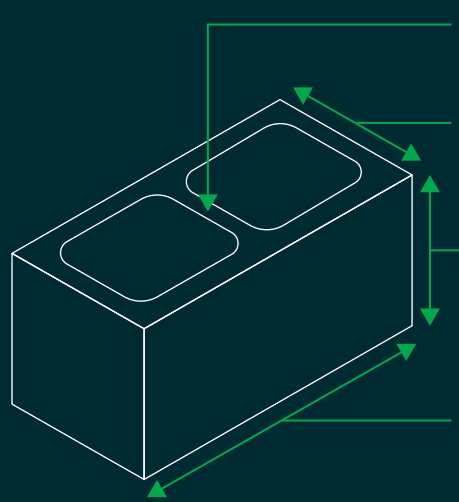
DIMENSIONS

The dimensions of concrete masonry units are expressed two different ways:

- **Specified Dimensions** – the overall width, height and length of a unit used in design calculations, which are 3/8-inch smaller than nominal dimensions.
- **Nominal Dimensions** – the overall width, height and length of a unit including a standard 3/8-inch mortar joint thickness for modular layout.

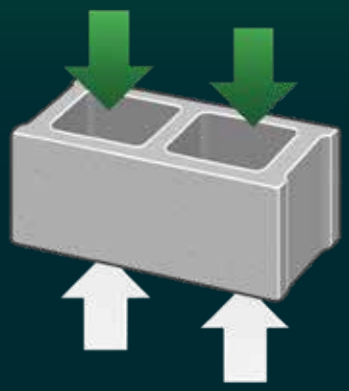
Overall unit dimensions are always specified in the order of Width x Height x Length. Concrete masonry units are manufactured to fixed modular dimensions with nominal widths of 4, 6, 8, 10, 12, 14 and 16 inches. Nominal face dimensions are commonly 8 inches in height by 16 inches in length, but can vary from as small as 4 inches in height up to 32 inches in length.

Nominal and Specified CMU Dimensions for 8 in. CMU



COMPRESSIVE STRENGTH

The minimum average compressive strength for CMU is 2,000 lb/in², which is appropriate for most common applications of concrete masonry construction. There are, however, scenarios when a higher compressive strength may be necessary to resist design loads. All loadbearing CMU must meet this minimum requirement regardless of the configuration of the CMU, its compressive strength, density or other attributes.



DENSITY

Concrete masonry units are classified in three different densities: normal weight, medium weight and lightweight. Structurally, the design of all unit density classes is identical, other than the weight of the individual units changing with changes in density. There are, however, implications for other performance attributes. As the density of a CMU decreases, the fire-resistance rating and energy efficiency increases. However, the sound transmission class of the assembly decreases.

Effect of decreasing unit density

DENSITY ↓
Structural Capacity —
Fire-Resistance Rating ↑
Energy Efficiency ↑
Sound Transmission ↓
Construction Efficiency ↑

Strength Absorption and Density Classification Requirements

Density Classification	Oven-Dry Density of Concrete, lb/ft³ (Average of 3 Units)	Maximum Water Absorption, lb/ft³	Minimum Net Area Compressive Strength, lb/in²
Lightweight	Less than 105	18	2000
Medium Weight	105 to less than 125	15	2000
Normal Weight	125 or more	13	2000

Key Resources:

[1] ASTM C90-24a, Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units, ASTM International, www.astm.org.

[2] CMHA CMU-TEC-001-23, Concrete Masonry Unit Shapes, Sizes, Properties, and Specifications, Concrete Masonry & Hardscapes Association, www.masonryandhardscapes.org.

[3] TMS 402/602-22, Building Code Requirements and Specification for Masonry Structures, The Masonry Society, www.masonrysociety.org.

[4] CMHA TEK 07-01D, Fire Resistance Ratings of Concrete Masonry Assemblies, Concrete Masonry and Hardscapes Association, www.masonryandhardscapes.org.

[5] CMHA TEK 06-01C, R-Values of Multi-Wythe Concrete Masonry Walls, Concrete Masonry and Hardscapes Association, www.masonryandhardscapes.org.

[6] CMHA TEK 06-02C, R-Values and U-Values for Single Wythe Concrete Masonry Walls, Concrete Masonry & Hardscapes Association, www.masonryandhardscapes.org.

[7] CMHA TEK 13-01D, Sound Transmission Class Rating for Concrete Masonry Walls, Concrete Masonry & Hardscapes Association, www.masonryandhardscapes.org.

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