CMU Basics & Glossary

CMU Basics

Angelus BLOCK CO., INC. Since 1946

Carbon Kind™

CMU Basics

Dimensions and Sizes

Three terms are used in referring to dimensions: specified, actual, and nominal. Variations in dimensions are governed by ASTM C90 Standard Specification for Loadbearing Concrete Masonry Units. C90 includes exceptions for split and slump textures.

Specified dimensions are those specified for the manufacture of masonry units or the construction of masonry. Design calculations are based on specified dimensions.

Actual dimensions are the measured dimensions of the unit. ASTM Standards allow the actual overall dimensions a permissible variation of + or - 1/8 inch. from the specified dimension.

Nominal dimensions are those used in stating the unit size. They are equal to the specified dimensions plus the thickness of the mortar joint.

Permissible Variations in Dimensions

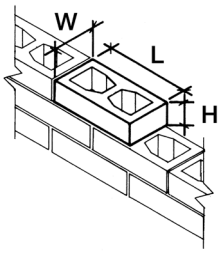
For standard precision units, no overall actual dimension (width, height, and length) may differ by more than + or - 1/8-inch from the specified dimension.

For split face and slump units, overall dimensions will vary.

Split face: only the non-split overall dimensions may not vary by more than + or - 1/8-inch from the specified non-split dimension.

Slumpstone™: only the height dimension may not vary by more than + or - 1/8-inch from the specified height dimension.

Dimensions have a proper order - width, height, and length (WHL). For example, an 8-inch wide, 16-inch long, 4-inch high unit is termed an 8x4x16. Reversing any two dimensions will describe a completely different unit. Using that same unit, but referring to it as 4x8x16 would then indicate a unit 4 inches wide and 8 inches high.



See Dimensions and Sizes at www.AngelusBlock.com for more information and a download for ASTM C140 reporting.

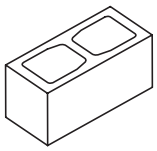
Configurations

CMU are either solid or hollow. By definition a solid unit is 75% or more in net area. Hollow units are most commonly used in structural applications. Solid units are used in composite masonry and for veneers. The basic configurations shown below are common to hollow blocks in various sizes.

Additional elements may be added to some units for design effects, including vertical scores, deep scores, flutes, and projections.

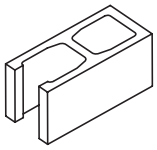
Standard (or, Regular)

Full face shells and webs.



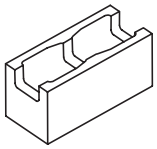
Open End Standard

Open one end only. Commonly used for structural applications.



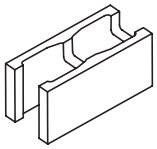
Bond Beam

A formed or pressed channel for horizontal reinforcement or grout.



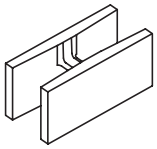
Open End Bond Beam

Combination of above.



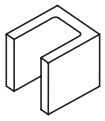
Double Open End Bond Beam

For 8 inch o.c. vertical reinforcement.



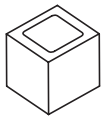
U-Lintel

For lintel beams and continuous reinforcement.



Half

Refers to half the length.



Sash

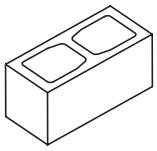
For control joint construction.

Textures

Manufactured textures include:

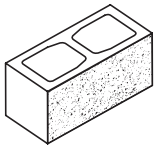
Precision

Smooth, as-molded finish.



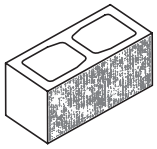
Burnished

Precision faces ground to expose aggregates.



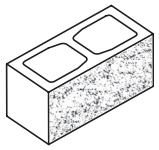
Combed

Precision with a "broomed" appearance.



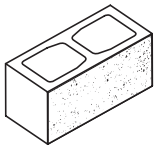
Split Face

Rough face with exposed aggregates.



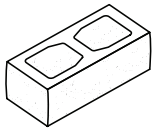
Shotblast

Precision faces shotblast to roughen the surface for textural effects.



Slumped

Adobe-like, our Slumpstone™.



Variations of texture are inherent in CMU and create the warmth and character indicative of a masonry wall.

Colors

Angelus Block offers an extensive selection of standard and special order integral colors. (See the Colors & Textures at www.AngelusBlock.com.) Your representative can offer samples and specific information to assist in color specifications.

CMU manufactured by Angelus Block are of the highest quality and uniformity available. However, variations may occur in color and shade, in natural gray or integral color, as a result of color ranges in raw materials over which we have no control. A statement of color, then, refers to a range of color. Further, exact color duplication from run to run cannot be guaranteed.

Color will be affected by differences in weight (density) or strength. A weight classification will require a specific aggregate mix, which will create its own natural gray and have an effect on any added coloring agent. For example, a color in mediumweight will differ somewhat from the same color in lightweight. Similarly, High-Stress units have a different mix design; as a result, their color will not be exactly the same as non-High-Stress units. Contact your representative should the weight or strength to be specified differ from that indicated on a given sample.

Occasionally, new construction may be required to match an existing wall or structure, dictating the color of new CMU match the color of existing CMU. This circumstance raises a host of considerations such as the age and extent of weathering of the “old” CMU, possible differences in aggregate from the time of its manufacture to the present, and the fact that a good match now may not last as the “new” CMU weathers.

We strongly suggest that specifications for such a project avoid the simplicity of the “match existing” statement. Instead, we recommend consulting your Angelus Block representative to determine the availability and/or feasibility of current materials to reasonably match the existing wall and whether the best solution would be integral color or staining natural gray to best match existing CMU. It is advantageous for everyone involved if this is specified in advance of the masonry bid, much more masonry work, thereby avoiding last minute scrambling for suitable materials.

Sources of raw materials may differ from plant to plant. So, too, will color differ from plant to plant. One location’s gray or color will not match another location’s gray or color. Even if they bear an identical color name, product from one plant should not be mixed with another’s if *it is intended they match.* Consult your representative for color compatibility from plant to plant.

White CMU in particular are dependent upon aggregates to achieve its appearance. Though we strive to obtain raw materials from stable sources, such light-colored materials are subject to changes in color and in general availability.

Note: As extensive as our color palette is, you can extend it further by combining two or more colors in the same wall for a variegated or "blended" look. Separate, individual colors installed together gives you more control over final effect, and results in rich, intense colors.

CMU Basics

Standards

Angelus Block manufactures its products to meet or exceed applicable standards of the American Society for Testing and Materials (ASTM). Their standards define characteristics of strength, tolerances, and quality.

All hollow and solid CMU comply with:

> **ASTM C90 Standard Specification for Loadbearing Concrete Masonry Units**

Weights

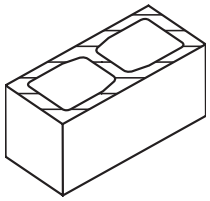
Standards applicable to CMU contain three classifications of weight, expressed in pounds per cubic foot: Normal Weight, Medium Weight, and Lightweight.

> **Normal Weight** is 125 lbs./cu. ft. and over. Units stocked in Normal Weight include Slumpstone™ units and fence units (stucco block, Catalina, Balboa, etc.). Certain colors are stocked only in Normal Weight - all Slumpstone™ colors, and precision colors such as Fawn, Mission Tan, and #500 (yellow).
>
> **Medium Weight** is less than 125 to 105 lbs./cu.ft. "Structural" types and sizes are stocked most extensively in Medium Weight. In addition to precision and split face gray, a scored split and standard color are normally available.
>
> **Lightweight** is less than 105 lbs./cu. ft. Special order.
>
> Note: both Medium Weight and Lightweight units are made with "lightweight" aggregates. To specify a CMU solely on the statement that it be made with lightweight aggregates does not provide adequate definition.

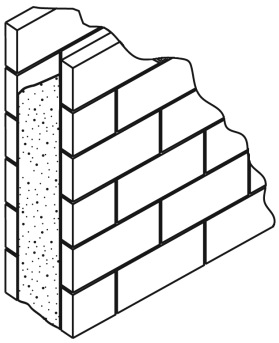
Of the three weights, Normal Weight is the least expensive and Lightweight is the most expensive. Medium Weight is most popular (and therefore has greatest availability) for structural applications as its moderate weight and cost generally offer the best labor production to material cost ratio. For examples of weights per units and wall area, please see charts in Technical Articles, Average Weights.

Strengths

Strength is expressed in two distinct ways:



CMU compressive strength is the psi calculated from the net area of the individual unit. The minimum average net compressive strength per ASTM C90, as of the 2014 edition, is 2000 net psi.



f'_m, specified compressive strength of masonry, is the value used in design of the masonry wall. This is the strength specification that really matters, as it is the strength upon which the structural design is based. Notice it is the strength of masonry, not units. It is the compressive strength of the assemblage of masonry units, mortar, and grout.

Verification of f'_m is by one of two methods (not both): 1) unit strength method or 2) prism test method.

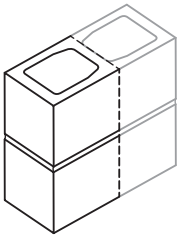
Unit Strength Method

Code allows an "assumed" value of f'_m to be selected based upon specifying the net compressive strength of the masonry unit. (TMS 602 Table 2.) Unit strength relies on individual CMU and masonry grout strengths, and the type of mortar. For example, specifying a high-stress unit at 3250 net psi, an f'_m of 2500 net psi would be allowed without substantiation by prism test.

> ***Note: CBC Section 2105A.2 does not allow the unit strength method for design strengths over 2000 net psi. Prism testing must be used.***

Prism Testing

Although prism tests may require a bit more coordination in project management, compression testing of prisms does offer the most accurate verification of f'_m. A prism is a sample assemblage of masonry units, mortar joints, and grout similar to the one shown.



When the f'_m value exceeds 2000 net psi, we recommend specifying the f'_m as required by design and verifying compliance by means of prism testing. In this way, testing more reliably portrays actual construction, and full values are realized in design and materials.

Prism testing also allows the contractor to submit and supply products most advantageous for the project schedule. The conservatively high CMU values utilized by the unit strength method may force materials to be made on special order with significant lead times.

Availability

Standard Items

Items referred to as standard or stock units and/or colors are normally available, meaning such units are subject to occasional fluctuations in inventory levels which may affect availability from time to time. Not all standard items are stocked at every location; some units are only manufactured at one or two plants. Status of a unit or color as a standard item is subject to change without notice. Please check with your representative for current information.

Special Order Items

Certain configurations or colors are available only on a special order basis. Such units are typically identified as "special order only", but such listings are subject to change; please verify with your representative.

When special order units are desired, consulting an Angelus Block representative is strongly recommended and will be of great benefit to the specifier and the project.

Though the variety of configurations and colors available by special order offer tremendous design variety, manufacturing and scheduling constraints may impose limitations. **Special orders are subject to minimum quantities and mold change charges.** (A mold change charge defrays a portion of the cost of mold set-ups and machine down-time while molds are changed for special order configurations and/or the material batching/handling system is cleaned of special order color.)

Whenever a special order unit is required, the construction (and contract) schedule must reflect sufficient lead time for ordering, manufacture, and cure. Although Angelus Block will make every effort to minimize the effects of insufficient lead time, job schedules may be adversely affected, or, readily available units may have to be substituted.

Further, some units may only be manufactured at a specific plant or have other characteristics for consideration. Again, please consult your representative for specific information regarding special order units or colors.

Glossary

ADMIXTURES - Materials added to cement, aggregate and water such as water repellents, air-entraining or plasticizing aids, pigments, or aids to retard or speed up setting.

AGGREGATES - Inert particles such as sand, gravel, rock, which when bound together with cement and water, form concrete.

ANCHOR TIES - Any type of fastener used to secure masonry veneer to a support backing, such as another wall, usually for tension value.

ASTM - American Society for Testing and Materials.

AREAS -

Bedded Area - The area of the surface of a masonry unit which is in contact with mortar in the plane of the joint.

Gross Area - The total cross-sectional area of any plane encompassed by the outer periphery of any specified section.

Net Area - The gross cross-sectional area at any plane minus the area of ungrouted cores, notches, cells, unbedded areas, etc. Net area is the actual surface area of a cross-section of masonry.

BOND -

Adhesion Bond - The adhesion between masonry units and mortar or grout.

Mechanical Bond - Units laid so that they lap over each other in successive courses. Includes quarter bond, third bond and half or common bond.

Running Bond - Lapping of units in successive courses so that the vertical head joints lap. Placing vertical mortar joints centered over the unit below is called center bond, or half bond, while lapping 1/3 or 1/4 is called third or quarter bond.

Stack Bond - A bonding pattern where no unit overlaps either the one above or below. All head joints form a continuous vertical line. Also called plumb joint bond, straight stack, jack bond, jack on jack, and checker board bond.

BOND BEAM - One or more courses of masonry units poured solid and reinforced with longitudinal reinforcing bars. (See Bond Beam Block under CONCRETE MASONRY UNIT.)

CELL (Core) - The molded open space in a concrete masonry unit.

CHASE - A continuous recess built into a wall to receive pipes, ducts, etc.

CLEANOUT - An opening at the bottom of a grout space of sufficient size and spacing to allow the removal of debris.

CMACN - Concrete Masonry Association of California and Nevada.

COLLAR JOINT - The vertical longitudinal joint between wythes of masonry.

COMPOSITE MASONRY - Multiwythe masonry members acting together as a single member in resisting loads.

COMPRESSIVE STRENGTH - The maximum load required to fracture the masonry unit by applying a compressive force to the upper and lower surface of the unit. Expressed as either gross compressive strength, or net compressive strength. (See *Strengths*, *CMU Basics*, page CMUB-5.)

CONCRETE MASONRY UNIT - (See *Configurations*, *CMU Basics*, page CMUB-2.)

A-Block - A hollow unit with one end closed and the opposite end open. Term often used for fence unit as a support for 4 inch wide wall. Also called open end block.

Bond Beam Block - A hollow unit with portions of end and cross webs formed to permit a continuous channel for horizontal reinforcing steel and grout. Also called channel block.

Concrete Block - A concrete masonry unit made from portland cement and suitable aggregates with or without the inclusion of other materials.

H-Block - A hollow unit with a single cell in center of unit with both ends open. Used as a fence pilaster to support 4 inch wide wall.

Hollow Masonry Unit - A masonry unit whose net cross-sectional area in every plane parallel to the bearing surface is less than 75 percent of the gross cross-sectional area in the same plane.

Lintel Block - A hollow unit to permit the forming of a continuous channel for reinforcing steel and grout.

Open End Block - A hollow unit with one end closed and the opposite end open. A **Double Open End** unit has both ends open.

Pilaster Block- Concrete masonry units designed for use in construction of plain or reinforced concrete masonry pilasters and columns.

Sash Block - Concrete masonry unit which has an end slot for use in openings to receive metal window frames and pre- molded expansion joint material.

Scored Block - Block with grooves to provide patterns, as for example, to simulate raked joints.

Sill Block - A solid concrete masonry unit used for sills or openings.

Solid Masonry Unit - Refers to concrete masonry units in which the vertical cores are less than 25 percent of the cross-sectional area.

COURSE - A continuous horizontal layer of masonry units.

DIMENSIONS - (See *Dimensions and Sizes*, *CMU Basics*, page CMUB-2)

Actual Dimensions - The measured dimensions of a designated item; for example, a designated masonry unit or wall, as used in the structure. The actual dimension shall not vary from the specified masonry unit or wall,as used in the structure. The actual dimension shall not vary from the specified dimension by more than the amount in the appropriate material standard.

Nominal Dimensions - Generally equal to its specified dimensions plus the thickness of the joint with which the unit is to be laid.

Glossary

Specified Dimension - The dimensions specified for the manufacture or construction of masonry, masonry units, joints or any other component of a structure. Unless otherwise stated, all calculations shall be made using or based on specified dimensions.

EFFLORESCENCE - A whitish powder resulting from the deposition of soluble salts on the surface of masonry, concrete, or soil.

FACE SHELL - The side wall of a hollow concrete masonry unit.

FACED WALL - A wall in which the facing and backing are so bonded or otherwise tied as to act as a composite element. As opposed to VENEER.

f'_m - the specified compressive strength of masonry at the age of 28 days. (See *Strengths*, *CMU Basics*, Page CMUB-5.)

GROUT - A concrete mixture of sand, pea gravel (usually), water and sometimes admixture, which is poured or pumped into the vertical cells and bond beams. Grout encases the reinforcing steel and adds to the strength and fire rating of a block wall.

GROUT LIFT - The height to which grout is placed in a cell, collar joint, or wythe without intermission.

GROUT POUR - The total height of masonry wall to be poured prior to the erection of additional masonry. A pour may consist of one or more lifts.

JOINTS -

Bed Joint - The mortar joint that is horizontal at the time the masonry units are placed.

Dry Joint - A mortarless joint.

Head Joint - The mortar joint between units in the same wythe, usually vertical.

Struck Joint - Any mortar joint which has been finished with the trowel.

JOINT REINFORCEMENT - Steel wire, bar or prefabricated reinforcement which is placed in mortar bed joints.

JOINTING - The process of finishing mortar joints with a tool. Also called tooling.

LIME -

Hydrated Lime - Quicklime treated with only enough water to satisfy its chemical demand. Packaged in powdered form, does not require slaking.

MASONRY - Construction of building units bonded together with mortar, grout, or other accepted methods.

Reinforced masonry - Masonry construction in which reinforcement acts in conjunction with the masonry to resist forces.

MODULAR DIMENSION - A dimension based on a given module, usually eight (8) inches in the case of concrete block masonry.

MORTAR - A plastic mixture of cementitious materials, fine aggregate and water, with or without the inclusion of other specified materials.

PILASTER - An integral portion of the wall which projects on one or both sides and acts as a vertical beam, a column, an architectural feature, or any combination thereof.

POINTING - Filling mortar into a joint after the masonry unit is laid.

PRISM - Units mortared together, generally in stack bond, forming a wallette or assemblage to simulate “in wall construction”, grouted per specification requirements. This is the standard test sample for determination of f'_m.

REBAR - Reinforcing steel bars of various sizes and shapes used to strengthen masonry.

SHELL - The outer portion of a hollow masonry unit as placed in masonry.

TEMPER - To moisten mortar and re-mix to the proper consistency for use. Also called retempering.

TOOLING - See JOINTING.

TUCK POINTING - The filling in with fresh mortar of cut-out or defective mortar joints.

VENEER - A masonry facing which is attached to the backup but not so bonded as to act with it under load. As opposed to FACED WALL.

WALLS -

Bonded Walls - A wall in which two or more of its wythes of masonry are adequately bonded together to act as a structural unit.

Hollow-Unit Masonry Wall - That type of construction made with hollow masonry units in which the units are laid and set in mortar.

WALL TIE - A mechanical fastener which connects wythes of masonry to each other or to other materials.

WEB - An interior solid portion of a hollow masonry unit as placed in masonry.

WYTHE - The portion of a wall which is one masonry unit in thickness. Also called a tier. A collar joint is not considered a wythe.

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