Association of Florida

CONCRETE MASONRY

COMPONENT 1

GREG MOODY FASTM, LEED AP BD + C

Greg Moody, AP BD+C, FASTM, is the Senior Technical Manager for Masonry Products for CEMEX. He is an ASTM Fellow and is active on numerous ASTM committees, include C01 - Cement, C09 - Concrete, C12 - Mortars and Grouts for Unit Masonry, C15 - Masonry Units, E54 - Homeland Security Applications, and E60 - Sustainability. Greg is very interested in seeking alternatives to current construction practices.

Senior Quality Assurance Manager, Masonry Products CEMEX

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SPECIFIERS

SPECIFIERS are usually interested in the following properties of block:

Compressiv e strength	Fire rating	Density (Class)	Dimensions
Shrinkage	Texture	Moisture content (Type)	Exposure durability (Grade)

ASTM Designation



- Letter general classification
- Sequential Number
- "M" = metric
- Year Date
- "a" first revision for the year
- "b" second revision for the year
- superscript epsilon (^e) editorial revision

NOTICE: This standard has either been superse Contact ASTM International (www.	NOTICE: This star Con		
Designation: C90 - 14		Designation: C14	
StandardSpecification for		StandardTest	
Loadbearing Concrete Mason	y Units ¹	Sampling and Units ¹	
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NOTICE: This standard has either been superseded and replaced by a new version or withdrawn. Contact ASTM International (www.astm.org) for the latest information

ASTM C90

In your ASTM Workbook, please turn to the "CONCRETE MASONRY" Section - page 3.

NOTICE: This standard has either been superseded and replaced by a new version or withdrawn. Contact ASTM International (www.aster.org) for the latest information Designation: C90 - 14 StandardSpecification for Loadbearing Concrete Masonry Units¹ This standard is instant under the funct designation (130) for surpless instructionly following the designation indicates the year of original adoptions to the case of revision, the year of last orealism. A monther is parachese to indicate the year of last supported. A superscript system (s) minimum as additional damper since the last oreations or support. This standard has been approved for our by opencies of the U.S. Department of Defense. for appearance or bond, httph, color, or particular properties such as density classification, higher compressive strongh, for residuence, bernat performance or associal performance, these fasterious should be question spaceholdy by the parchair. Suppliers should be consulted at its the availability of units having the denset fasters. L Scope" 1.1 This specification covers hollow and solid (see 5.3 and 5.4) concrete masonry units made from hydraulic consont, water, and minoral appropriates with or without the inclusion of other materials. There are three classes of concrete materiary urits: (1) revenued workst. (2) inclusion workst, and (3) failtunits: (J) normal weight, (Z) medium weight, and (3) light-weight. These units are suitable for both leadbearing and 2.1 ASTM Standards." C33 Specification for Concrete Aggregates C140 fort Methods for Sampling and Testing Concrete Manenry Units and Related Units nonloadbearing applications. 1.2 Concrete macrony units covered by this predication are made from lipple-onight or neural and of the approximation of this specification have how researched, evaluated, and enableding to reveal a entraity, resulting in the physical properties are latitude to detect how. These materians and materials are supported and independent of the constraints, and and a support of the product of the constraint on the constraint of the constraint 1.2 Concrete masonry units covered by this specification are C150 Specification for Portland Conont C331 Specification for Lightweight Aggregator for Concrete Manvery Units C426 Test Method for Linear Drying Shrinkage of Concrete Maxeery Units CMS Specification for Blendud Hydraufic Comarts C618 Specification for Coal Fly Ash and Raw or Calcined Nataral Pozzolan for Use in Concrete C979 Specification for Pigmenta for Integrally Colored Con-(39) Specification for Slag Content for Use in Controle and Mart Mortan C1157 Performance Specification for Hydraulic Cement C1232 Terminology of Maconry C1340 Specification for Silica Fune Usad in Committions C1314 Test Method for Compositive Strength of Massery 1.3 The text of this specification references notes and footnotes which provide explanatory material. These notes and E519 Test Method for Diagonal Tension (Shear) in Masonry footnotes (excluding those in tables and figures) shall not be creasidered as requirements of the standard. Assemblages E72 Test Methods of Creeducting Strength Tests of Panels 1.4 The values stated in inch-pound units are to be regarded 1.4 The values stated in inch-point units are to to regimes an standard. The values given in parentheness are mathematical conversions to SI units that are provided for information only 3. Terminology for Building Construction and are not considered standard. 3.1 Tarminology defined in Terminology C1232 shall apply New 2-When particular features are desired such as surface testance for this spacification. "This specification is unliv the jurisdiction of ANTM Committee C15 on The referenced ASTM standards, stall the ASTM websile, www.astm.org, or contact ASTM Cardinerer Service at an vice-inflationery. For Annual Book of ASTM Standards victure-information, stile to the standard's Deciment Summary page on the ASTM westile. Manifacturel Manory Units and in the direct expressibility of Subcreamline CISSE on Concess Manory Units and Related Units. Current editors approved her 1, 2014. Philited February 2014. Originally approved in 2011. Last provinse addition approved in 2013 as (200-11). ODE 211522/CU006-14. "A Summary of Changes section appears at the end of this standard Capital & ANTH International 100 Raw Hadow Dree, PO Red Circle West Constructions, PA 19409-2008 United Raise

NOTE 1 - SPECIFIC COMPONENTS

"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."

Note 1 – added in -12

It may look like a CMU, but it may not perform like a CMU

ASTM C90 Table 2 Classification

Density Classification	Oven-Dry Density
-50 MB 42 40 02 60 62 74 8 50 0 26 56 86 66 86 86 70 1	of Concrete, Ib/ft ³ (kg/m ³)
	Average of 3 Units
Lightweight	Less than 105 (1680)
Medium Weight	105 to less than 125
	(1680-2000)
Normal Weight	125 (2000) or more

For concrete, the density is determined differently than block. For normal weight concrete, the density is usually the "plastic" or "fresh" density. For lightweight concrete, the "equilibrium" density is the pivotal density. For block, density is based upon dry weight.

TYPE (OUTDATED INFORMATION)

- <u>Before 2000</u>, two type designations for concrete masonry units:
- Type I, moisture controlled
- Type II non-moisturecontrolled

		Content, max, 1 ion (Average of			
Lineer Shrinkage, %	Humidity Conditions at Job Site or Point of Use				
	Humid ^A	interme- diste®	And		
0.03 or less	45	40	35		
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0.045 to 0.065, max	35	30	25		
⁴ Average annual relative humid ⁶ Average annual relative humid ⁶ Average annual relative humid ⁹ See appendix for map of mea	Ity 50 to 75 %.				

ASTM C90 Type

"In 2000, the Type I (moisturecontrolled) and Type II (non moisturecontrolled) unit designations were removed from C90. The designations were withdrawn because they were difficult to effectively use and enforce, and because of newly developed concrete masonry crack control provisions." - NCMA TEK 1-1F - ASTM Specifications for Concrete Masonry Units NOTICE: This standard has either been superseded and replaced by a new version or withdrawn. Contact ASTM International (www.astm.org) for the latest information

StandardSpecification for Loadbearing Concrete Masonry Units¹

This standard is issued under the fixed designation C30; 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 episton (v) 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 Defonse.

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.

Designation: C90 - 14

1.2 Concrete masonry units covered by this specification are made from lightweight or normal weight aggregates, or both. Norm 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 equip-indiced brevis. Many performance attributes of concrete masonry units and infinitely applicable to concrete masonry units manufactured on equip-indirectly accounted for, or inhereally reflected which, the requirements of this appecification without direct materials defined particular of this specification to product that may be similar in appearance, use, or nature to those covered by this specifications unto a divest application substrate the requirements. Products manufactured using alternative materials, manufactured. Product solution and evaluated solely using the requirements in this specification, oneverlend to this specification as a beginning benchmark for unit performance. It is reactification as a beginning benchmark for 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.

Non: 2-When particular features are desired such as surface textures

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

CI5.09 on Concrete Mationry Units and Related Units. Current offition approved Feb. 1, 2014. Published February 2014. Originally approved in 1931. Last previous edition approved in 2013 as C90–13. DOI: 10.1520/C0900-14. for appearance or bond, finish, color, or particular properties such as density classification, higher compressive strength, fire resistance, thermal performance or accustical 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

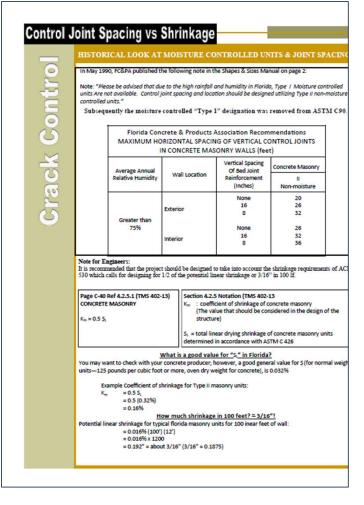
- C33 Specification for Concrete Aggregates C140 Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
- C150 Specification for Portland Cement C331 Specification for Lightweight Aggregates for Concrete
- Masonry Units C426 Test Method for Linear Drying Shrinkage of Concrete Masonry Units
- C595 Specification for Blended Hydraulic Cements C618 Specification for Coal Fly Ash and Raw or Calcined
- Natural Pozzolan for Use in Concrete C979 Specification for Piements for Integrally Colored Con-
- crete
- C989 Specification for Slag Cement for Use in Concrete and Mortars C1157 Performance Specification for Hydraulic Cement
- C1137 Performance Specification for Hydrautic Cement C1232 Terminology of Masonry
- C1240 Specification for Silica Fume Used in Cementitious Mixtures
- C1314 Test Method for Compressive Strength of Masonry Prisms E519 Test Method for Diagonal Tension (Shear) in Masonry
- Assemblages E72 Test Methods of Conducting Strength Tests of Panels for Building Construction

3. Terminology

 Terminology defined in Terminology C1232 shall apply for this specification.

² For referenced ASTM standards, visit the ASTM websile, www.astm.org, or contact ASTM Customer Service at service@astm.org, For Aenual Book of ASTM Standards volume information, refer to the standard's Document Sammary page on the ASTM websile.

*A Summary of Changes section appears at the end of this standard Copyright © ASTM International, 100 Bar Harbor Drive, PO Box C700, West Constructedows, PA 10405-2000, United Status



"BURY THE MYTH"

There are NO Type-I Block in Florida (or Georgia for that matter)

ASTM C90 GRADE (OUTDATED)

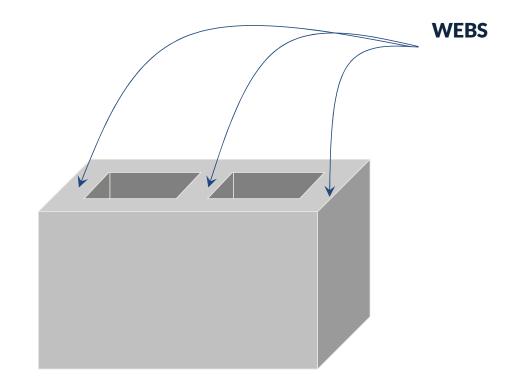
- In 1990, removing the unit grade classifications from the standard.
 - Grade N For general use
 - Grade S Limited to use above grade in exterior walls with weather protective coatings and in walls not exposed to weather.
 - Lower compressive strength and higher water absorption compared to Grade N units.



C90 WEB REVISIONS

This change only impacts the webs of units.

All other unit properties (face shells, compressive strength, etc.) remain unchanged.



ASTM C	90-14 Was 1" in C90-11	a	C90-14: Page 2 Table 1
	TABLE 1 Minimum Face	Shells and Web Requirements ^A	
Nominal Width (W) of Units, in. (mm)	Face Shell Thickness (t _{fs}), min, in. (mm) ^{<i>B,C</i>}	Web Thickness ^c (t _w), min, in. (mm)	Webs Normalized Web Area (A _{nw}), min, in. ² /ft ² (mm ² /m ²) ^D
3 (76.2) and 4 (102) 6 (152) 8 (203) and greater	3/4 (19) 1 (25) 11/4 (32)	34 (19) ∛4 (19) 34 (19)	6.5 (45,140) 6.5 (45,140) 6.5 (45,140)
^A Average of measurements on a m ^B When this standard is used for unit an ¾ in. (19.1 mm). When the units ^C When the units are to be solid gro	nimum of 3 units when measured as des s having split surfaces, a maximum of 10 are to be solid grouted, the 10 % limit doe uted, minimum face shell and web thickn as not apply to the portion of the unit to b	cribed in Test Methods C140. % of the split surface is permitted to hav s not apply and Footnote C establishes ess shall be not less than % in. (16 mm	ve thickness less than those shown, but not less a thickness requirement for the entire faceshell
	Was 1" for 8-inch 1 ¹ ⁄8" for 10-inch and greate in C90-11a	er	

ASTM C90-14

 ^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.

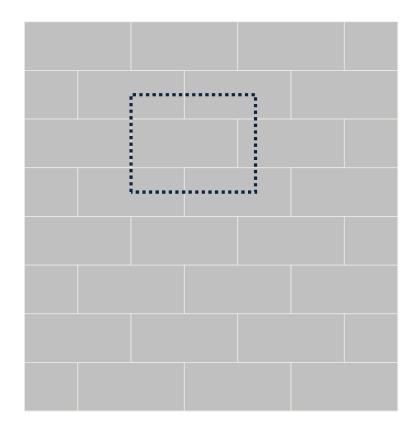
	From Table 1
	Nominal Width (W) of Units, in. (mm)
2	3 (76.2) and 4 (102) 6 (152)
<u>-</u>	8 (203) and greater

Normalized Web Area C90-14: Page 2 Table 1

C90 Web Revisions

What does this mean?

For every square foot of wall surface, no less than 6.5 in.² of web must connect the front and back face shells, with no web measuring less than 0.75 in. in thickness.





BLOCK DIMENSIONS

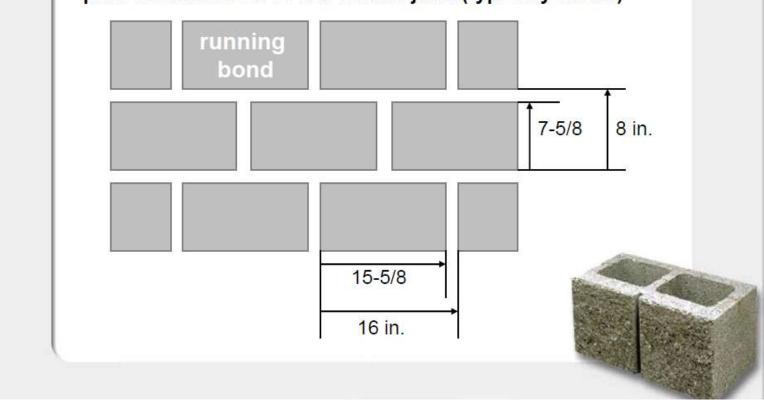
Width x Height X Length

Wookies Hate Lice



Nominal Dimensions

Nominal dimensions are equal to the standard dimensions plus the thickness of one mortar joint (typically 3/8 in.)



Permissible Variations in Dimensions

ASTM C90-14

6.1 Standard Units—For standard units, no overall dimension (width, height, and length) shall differ by more than ±1/8 in. (3.2 mm) from the specified dimensions.

6.2 Particular Feature Units—For particular feature units, dimensions shall be in accordance with the following:

6.2.1 For molded face units, no overall dimension (width, height, and length) shall differ by more than $\pm \frac{1}{8}$ in (3.2 mm) from the specified standard dimension. Dimensions of molded features shall be within $\pm \frac{1}{16}$ in. (1.6 mm) of the specified standard dimensions and shall be within $\pm \frac{1}{16}$ in. (1.6 mm) of the specified standard dimensions and shall be within $\pm \frac{1}{16}$ in. (1.6 mm) of the specified placement of the molded feature.

NOTE 7-Molded features include, but are not limited to: ribs, scores, hex-shapes, and patterns.

6.2.2 For split-faced units, all non-split overall dimensions shall differ by not more than $\pm \frac{1}{8}$ in. (3.2 mm) from the specified standard dimensions.

ASTM C-90-14

C90-14: Page 3 @ 6.2 - 6.2.1 w/note 7

6.2 Particular Feature Units—For particular feature units, dimensions shall be in accordance with the following:

6.2.1 For molded face units, no overall dimension (width, height, and length) shall differ by more than $\pm \frac{1}{8}$ in. (3.2 mm) from the specified standard dimension. Dimensions of molded features shall be within $\pm \frac{1}{16}$ in. (1.6 mm) of the specified standard dimensions and shall be within $\pm \frac{1}{16}$ in. (1.6 mm) of the specified standard dimensions and shall be within $\pm \frac{1}{16}$ in. (1.6 mm) of the specified placement of the molded feature.

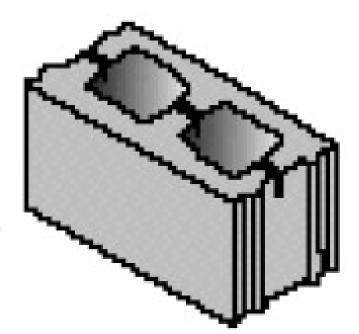
ASTM C-90-14

C90-14: Page 37.2

7.2 Where units are to be used in exposed wall construction, the face or faces that are to be exposed shall not show chips or cracks, not otherwise permitted in 7.1.2 and 7.1.3, or other imperfections when viewed from a distance of not less than 20 ft (6.1 m) under diffused lighting.

Core-Bar Cracks

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.



ASTM C90-14

C90-14: Page 3@ 7.1.1

7.1 No more than 5% of the units in the shipment shall exhibit one or more of the characteristics described in 7.1.1 through 7.1.4 and 7.2.

7.1.1 Units with <u>dimensions</u> not meeting the requirements of 6.1.

7.1.2 Units with finished face(s) <u>containing chips</u> larger than 1 in. (25.4 mm) in any direction.

7.1.3 Units with finished face(s) <u>containing cracks</u> wider than 0.02 in. (0.5 mm) and longer than 25 % of the nominal height of the unit.

7.1.4 Units that are broken.

ASTM C90-14

		C (90 06			C 90
	TABLE 2 Strengt	th, Absorption, and	Weight Classi	fication Req	uirements	
Weight Classification	Oven-Dry Density of Concrete, lb/ft ³ (kg/m ³	³) At	Maximum Wate bsorption, lb/ft ³ (kg			n Net Area ength, Ib/in²(MPa)
	Average of 3 Units	Average of	f 3 Units In	dividual Units	Average of 3 Units	Individual Uni
Lightweight	Less than 105 (1680)	18 (28	88)	20 (320)	1900 (13.1)	1700 (11.7)
Medium Weight	105 to less than 125 (1680-:	-2000) 15 (24	40)	17 (272)	1900 (13.1)	1700 (11.7)
Normal Weight	125 (2000) or more	13 (20	08)	15 (240)	1900 (13.1)	1700 (11.7)
Density Classification	TABLE 2 Strengt	h, Absorption, and I Maximur	m Water		Minimum N	et Area
Density Classification	Oven-Dry Density of Concrete, Ib/ft ³ (kg/m ³)	h, Absorption, and I Maximur Absorption, I	Density Classi m Water Ib/ft ³ (kg/m ³)	ification Red	uirements Minimum Compressive Streing	et Area ath, Ib/in ² (MPa)
	Oven-Dry Density of Concrete, Ib/ft ³ (kg/m ³) Average of 3 Units	th, Absorption, and I Maximur Absorption, I Average of 3 Units	Density Classi m Water Ib/ft ³ (kg/m ³) Individual L	fication Rec	uirements Minimum Compressive Streig Average of 3 Units	et Area ath, Ib/in ² (MPa) Individual Units
Density Classification Lightweight Medium Weight	Oven-Dry Density of Concrete, Ib/ft ³ (kg/m ³) Average of 3 Units Less than 105 (1680) 105 to less than 125	h, Absorption, and I Maximur Absorption, I	Density Classi m Water Ib/ft ³ (kg/m ³)	ification Rec Units	uirements Minimum Compressive Streing	et Area pth, Ib/in ² (MPa)
Lightweight	Oven-Dry Density of Concrete, Ib/ft ³ (kg/m ³) Average of 3 Units Less than 105 (1680)	th, Absorption, and I Maximur Absorption, I Average of 3 Units 18 (288)	Density Classi m Water Ib/ft ³ (kg/m ³) Individual U 20 (320	Units	uirements Minimum V Compressive Streng Average of 3 Units 1900 (13.1)	et Area th, Ib/in ² (MPa) Individual Units 1700 (11.7)
Lightweight Medium Weight	Oven-Dry Density of Concrete, lb/ft ³ (kg/m ³) Average of 3 Units Less than 105 (1680) 105 to less than 125 (1680–2000) 125 (2000) or more 3 Table 2	th, Absorption, and I Maximur Absorption, I Average of 3 Units 18 (288) 15 (240) 13 (208)	Density Classi m Water Ib/tt ³ (kg/m ³) Individual L 20 (320 17 (272 15 (240 90 14	Units	wirements Minimum Minimum	et Area <u>Individual Units</u> <u>1700 (11.7)</u> <u>1700 (11.7)</u> <u>1700 (11.7)</u>
Lightweight Medium Weight Normal Weight	Oven-Dry Density of Concrete, Ib/ft ³ (kg/m ³) Average of 3 Units Less than 105 (1680) 105 to less than 125 (1680–2000) 125 (2000) or more 3 Table 2 TABLE 2 Strength Oven-Dry Density	th, Absorption, and I Maximur Absorption, I Average of 3 Units 18 (288) 15 (240) 13 (208) 13 (208) (CS h, Absorption, and D Maximur	Density Classi m Water Ib/ft ³ (kg/m ³) Individual L 20 (320 17 (272 15 (240 90 14 Density Classif n Water	Units	uirements Minimum V Compressive Streig Average of 3 Units 1900 (13.1) 1900 (13.1) 1900 (13.1) ea Strength = irements Minimum Net	et Area individual Units 1700 (11.7) 1700 (11.7) 1700 (11.7) 1700 (11.7) 2000
Lightweight Medium Weight Normal Weight C90-14: Page	Oven-Dry Density of Concrete, Ib/ft ³ (kg/m ³) Average of 3 Units Less than 105 (1680) 105 to less than 125 (1680–2000) 125 (2000) or more 3 Table 2 TABLE 2 Strength Oven-Dry Density of Concrete, Ib/ft ³ (kg/m ³)	th, Absorption, and I Maximur Absorption, I Average of 3 Units 18 (288) 15 (240) 13 (208) 13 (208) Absorption, and D Maximur Absorption, Ib	Density Classi m Water Ib/tt ³ (kg/m ³) Individual L 20 (320 17 (272 15 (240 90 15 (240 90 14 Density Classif n Water b/tt ³ (kg/m ³)	(fication Red	uirements Minimum M Compressive Streig Average of 3 Units 1900 (13.1) 1900 (13.1) 1900 (13.1) ea Strength = irements Minimum Net Compressive Strengt	et Area th, Ib/in ² (MPa) Individual Units 1700 (11.7) 1700 (11.7) 1700 (11.7) 2000 Area h, Ib/in ² (MPa)
Lightweight Medium Weight Normal Weight C90-14: Page	Oven-Dry Density of Concrete, Ib/ft ³ (kg/m ³) Average of 3 Units Less than 105 (1680) 105 to less than 125 (1680–2000) 125 (2000) or more 3 Table 2 TABLE 2 Strength Oven-Dry Density of Concrete, Ib/ft ³ (kg/m ³) Average of 3 Units	th, Absorption, and I Maximur Absorption, I Average of 3 Units 18 (288) 15 (240) 13 (208) 13 (208) Absorption, and D Maximur Absorption, Ib Average of 3 Units	Density Classi m Water Ib/ft ³ (kg/m ³) Individual U 20 (320 17 (272 15 (240 90 14 Density Classif n Water o/ft ³ (kg/m ³) Individual U	(fication Red	uirements Minimum V Compressive Streng Average of 3 Units 1900 (13.1) 1900 (13.1) 1900 (13.1) Ea Strength = irements Minimum Nat Compressive Strengt Average of 3 Units	et Area th, Ib/in ² (MPa) Individual Units 1700 (11.7) 1700 (11.7) 1700 (11.7) 2000 Area h, Ib/in ² (MPa) Individual Units
Lightweight Medium Weight Normal Weight C90-14: Page	Oven-Dry Density of Concrete, Ib/ft ³ (kg/m ³) Average of 3 Units Less than 105 (1680) 105 to less than 125 (1680–2000) 125 (2000) or more 3 Table 2 TABLE 2 Strength Oven-Dry Density of Concrete, Ib/ft ³ (kg/m ³)	th, Absorption, and I Maximur Absorption, I Average of 3 Units 18 (288) 15 (240) 13 (208) 13 (208) Absorption, and D Maximur Absorption, Ib	Density Classi m Water Ib/tt ³ (kg/m ³) Individual L 20 (320 17 (272 15 (240 90 15 (240 90 14 Density Classif n Water b/tt ³ (kg/m ³)	Units	uirements Minimum M Compressive Streig Average of 3 Units 1900 (13.1) 1900 (13.1) 1900 (13.1) ea Strength = irements Minimum Net Compressive Strengt	et Area th, Ib/in ² (MPa) Individual Units 1700 (11.7) 1700 (11.7) 1700 (11.7) 2000 Area h, Ib/in ² (MPa)

Note: Most all block producers produce a block that meets **2000 psi** net area Request a certification to that effect, if desired.

AGE OF COMPRESSIVE-STRENGTH

- Concrete
 - 28 days
- Mortar
 - 28 days
- Masonry Grout
 - 28 days
- Concrete Masonry Units
 - "At the time of delivery to the purchaser"

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

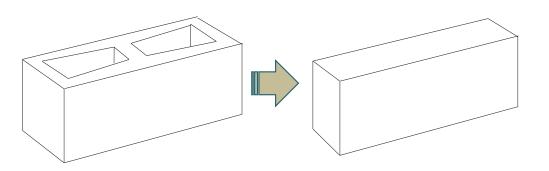
FIRE RATING

ASTM E119 "Equivalent Thickness"

Type of					Mini	mum equi	valent thio	ckness for	fire-resist	ance ratin	g, in.				
Aggregate	½ hr	¾ hr	1 hr	1¼ hr	1½ hr	1¾ hr	2 hr	2¼ hr	2½ hr	2¾ hr	3 hr	3¼ hr	3½ hr	3¾ hr	4 hr
Pumice or expanded slag	1.5	1.9	2.1	2.5	2.7	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.5	4.7
Expanded shale, clay or slate	1.8	2.2	2.6	2.9	3.3	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	4.9	5.1
Limestone, cinders or unexpanded slag	1.9	2.3	2.7	3.1	3.4	3.7	4.0	4.3	4.5	4.8	5.0	5.2	5.5	5.7	5.9
Calcareous or siliceous gravel	2.0	2.4	2.8	3.2	3.6	3.9	4.2	4.5	4.8	5.0	5.3	5.5	5.8	6.0	6.2

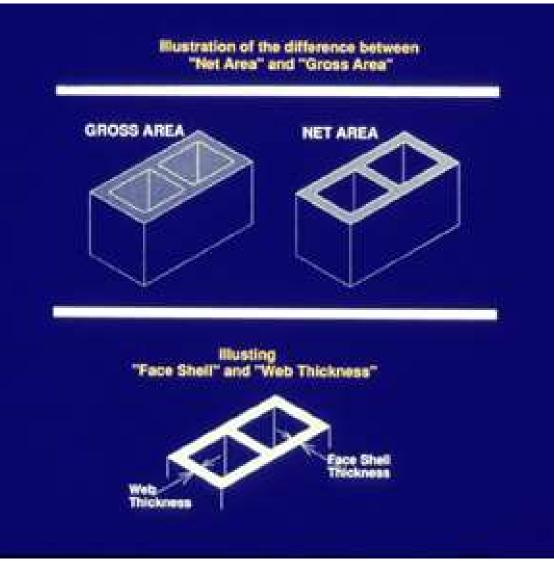
TERMINOLOGY: EQUIVALENT THICKNESS

Equivalent thickness is the theoretical thickness of the solid portion of a hollow CMU if the same amount of material was recast as a solid unit of the same height and length.



TERMINOLOGY Gross Area / Net Area

Face Shell/ Cross Webs





C90-14: Page 2@5.4

5.4 Solid Units: 5.4.1 The net cross-sectional area of solid units in every plane parallel to the bearing surface shall be not less than 75 % of the gross cross-sectional area measured in the same plane.

Solid Units \geq **75**%

ASTM C90 Specification

ASTM C140 TEST METHOD

SAMPLING

The sampling rate in ASTM changed in 2014

- from one set for every 50,000 units produced
- to one set per year
- Moved for C140 to C90

8.2 Compressive strength, absorption, density, and dimensional tolerances shall be based on tests of concrete masonry units of any configuration or dimension made with the same materials, concrete mix design, manufacturing process, and curing method, conducted in accordance with Test Methods C140 and within 12 months of production of the units.

ASTM C-140

Turn to "CONCRETE MASONRY" tab

NOTICE: This standard has either been superseded and replaced by a new version or withdrawn. Contact ASTM International (www.astm.org) for the latest information

€₽) Designation: C140/C140M - 15

StandardTest Methods for Sampling and Testing Concrete Masonry Units and Related Units¹

This standard is issued under the fitted designation C140/C140M; 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 (n) indicates an editorial change since the last revision or reapproval.

Section

10

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

1. Scope*

1.1 These test methods provide various testing procedures commonly used for evaluating characteristics of concrete masonry units and related concrete units. Methods are provided for sampling, measurement of dimensions, compressive strength, absorption, unit weight (density), moisture content, flexural load, and ballast weight. Not all methods are applicable to all unit types, however.

1.2 Specific testing and reporting procedures are included in annexes to these test methods for the following specific unit types:

- Annar A1—Concrete masony units (Specifications C90, C129) Annar A2—Concrete and caldum siticate brick (Specifications C55, C73, C1694) Annar A3—Segmental Instaining wall units (Specification C1372) Annar A4—Concrete Instaining paving units
- (Specification C936/C936M)
- (specmaaton CUREC/06M) Arrait AS—Concrete grd yeving units (Specification C1319) Arrait A6—Concrete mod pavers (Specification C1401) Arrait A6—Concrete mod pavers (Specification C1401) (Specification D4664) (Specification D4664)

1.3 The test procedures included in these test methods are also applicable to other types of units not referenced in these test methods, but specific testing and reporting requirements for those units are not included.

1.4 These test methods include the following sections:

Scope
Referenced Documents
Tarminology
Significance and Use
Sampling
Measurament of Dimensions
Compressive Strength
Absorption
Calculations
Report
Korwords

1 These lesi methods are under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and are the direct responsibility of Subcommilate C15.03 on Concrete Masonry Units and Related Units.

Current on Construct mathematics unan inclusion contains. Current edition approved July 1, 2015. Published July 2015. Originally approved in 1938. Last previous edition approved in 2014 as C140–14b. DOI: 10.1520/ C0140_C0140M-15.

Annual Text December 1	Section
Annaxas—Tast Procedures Concrete Masonry Units	Annex A1
Concrute and Calcium Silicate Brick	Arekax A2
Sogmontal Rotaining Wall Units	Annex A3
Concrete Interlocking Paving Units	Armax A4
Concrote Grid Paving Units	Annax A5
Concrate Root Payars	Armax A6
Dry-Cast Articulating Concrete Block	Annux A7
Determining Plate Thickness Requirements for Compression Testing	Annox A8
Worksheet and Test Report for Concrete Masonry Units	Appendix X1

Note: 1---The testing laboratory performing these test methods should be evaluated in accordance with Practice C1093.

1.5 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.6 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards:2

C55 Specification for Concrete Building Brick C73 Specification for Calcium Silicate Brick (Sand-Lime Brick)

C90 Specification for Loadbearing Concrete Masonry Units C129 Specification for Nonloadbearing Concrete Masonry Units

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

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ASTM C140-15 - Page 1 1.2

Annex A1-Concrete masonry units (Specifications C90, C129) Annex A2-Concrete and calcium silicate brick (Specifications C55, C73, C1634) Annex A3-Segmental retaining wall units (Specification C1372) Annex A4-Concrete interlocking paving units (Specification C936/C936M) Annex A5-Concrete grid paving units (Specification C1319) Annex A6-Concrete roof pavers (Specification C1491) Annex A7-Dry-cast articulating concrete block (Specification D6684)

Designation: C140/C14	10M – 15		
StandardTest Meth Sampling and Tes Units ¹		e Masonry Units and Rela	ated
This standard is issued under the fixed of original adoption or, in the case of A superscript epsilon (n) indicates an	revision, the year of last revi	he number immediately following the designation indica- tion. A sumber in parentheses indicates the year of last at revision or reapproval.	iles the year reapproval.
This standard has been approved for t	use by agencies of the U.S. I	Department of Defense.	
1. Scope*			Saction
1.1 These test methods provide various	testing procedures	Annaxas-Tast Procedures	
commonly used for evaluating characte		Concrute Masonry Units Concrute and Calcium Silicate Brick	Annax A1 Annax A2
masonry units and related concrete units. M		Segmental Retaining	Annax A3
for sampling, measurement of dimens		Wall Units	
strength, absorption, unit weight (density)		Concrate Interfocking Paving Units Concrate Grid Paving	Armax A4 Annax A5
flexural load, and ballast weight. Not all		Units	
cable to all unit types, however.		Concrete Roof Pavers Dry-Cast Articulating	Annax A6 Annax A7
1	the back of the standard line	Concrete Block	PARENT PUT
1.2 Specific testing and reporting proced annexes to these test methods for the foll		Determining Plate Thickness	Annax AB
types:	owing specific data	Requirements for Compression Testing	
		Workshoot and Test Report for	Appandix X1
Annex A1—Concrete masonry units (Specification Annex A2—Concrete and calcium silicate brick	s C90, C129)	Concrete Masonry Units	
(Specifications C55, C73, C1634)		Non: 1-The testing laboratory performing	
Annex A3—Segmental retaining wait units (Specif Annex A4—Concrete Interlocking paving units	loation C1372)	be evaluated in accordance with Practice C10	93.
(Specification C936/C936M)		1.5 The values stated in either SI un	its or inch-pound uni
Annax A5-Concrete grid paying units (Specificat		are to be regarded separately as standar	rd. The values stated
Annex A6—Concrete roof payers (Specification C Annex A7—Dry-cast articulating concrete block	1491)	each system may not be exact equiv	
(Specification D6684)		system shall be used independently of	
1.3 The test procedures included in the	se test methods are	values from the two systems may resu	ilt in non-conformant
also applicable to other types of units not		with the standard.	
test methods, but specific testing and repu		1.6 This standard does not purport	
for those units are not included.		safety concerns, if any, associated w	
1.4 These test methods include the follo	wine sections:	responsibility of the user of this stand	
	Section	priate safety and health practices and	
Scope	1	bility of regulatory limitations prior to	use.
Reteranced Documents	2		
Tarminology Significance and Use	3 4	2. Referenced Documents	
Sampling	5	2.1 ASTM Standards. ²	
Measurement of Dimensions Compressive Strength	67	C55 Specification for Concrete Build	
Absorption	8	C73 Specification for Calcium Silic	ate Brick (Sand-Lin
Calculations	0	Brick)	10 10-2
Report Keywords	10	C90 Specification for Loadbearing C	
		C129 Specification for Nonloadbear	

1 These lesi methods are under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and are the direct responsibility of Subcommittee C15.03 on Concrete Masonry Units and Related Units.

² For referenced ASTM standards, visit the ASTM websile, www.astm.org, or CL303 on Concrete Macordy Units and Retated Units. Current edition approved in y 2015. Originally approved in 1998. Last previous atlinoi approved in 2014 as CH40 – I4b. DOE 10.1520 CH40_COH404-J5.

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C140-15: Page 2@5-5.1.15.1.2

"LOT"

5.1.2 The term "lot" refers to any number of concrete masonry units of any configuration or dimension manufactured by the producer using the same materials, concrete mix design, manufacturing process, and curing method.

Designation: C140/C140M	- 15						
StandardTest Methods Sampling and Testin Units ¹		e Masonry Units and Rel	ated				
	, the year of last revi	he number immediately following the designation indi- tation. A number in parentheses indicates the year of las et revision or reapproval.					
This standard has been approved for use by a	agencies of the U.S. I	Department of Defense.					
Scope*							
and the second		Annexos-Test Procedures	Section				
 These test methods provide various testing 		Concrete Masonry Units	Annex A1				
mmonly used for evaluating characteristics asonry units and related concrete units. Method		Concrete and Calcium Silicate Brick Segmental Retaining	Annax A2 Annax A3				
r sampling, measurement of dimensions,		Wall Units					
ength, absorption, unit weight (density), moi		Concrete Intertocking Paving Units Concrete Grid Paving	Annox A4 Annox A5				
xural load, and ballast weight. Not all meth		Units					
ble to all unit types, however.		Concrete Roof Pavers Dry-Cast Articulating	Annax AS Annax A7				
1.2 Specific testing and reporting procedures a	included in	Concrete Block					
nexes to these test methods for the following		Determining Plate Thickness Regultements for	Annax AS				
es:	s opective unit	Compression Testing					
Annax A1-Concrete masonry units (Specifications C90,	C1293	Workshoet and Test Report for Concrete Masonry Units	Appendix X1				
Annax A2-Concrete and calcium silicate brick	Gillej						
(Specification C56, C73, C1634) Arrea A.– Segmental intaining wal units (Specification C1372) Arrea A.– Concretal protocoling painty units Arrea A.– Concretal proto painty units (Specification C1310) Arrea A.– Concretal proto painty units (Specification C1401) Arrea A.– Concretal proto painty (Specification C1401) Arrea A.– Concretal proto painty (Specification C1401) Arrea A.– Concretal proto painty (Specification C1401) Arrea A.– Concretal protocol painty (Specification C1401) Arrea A.– Concretal painty (Specification C1401) Arrea A.– Concreta		Nors: 1.—The testing laboratory performing these test methods shoul be evaluated in accordance with Practice C1093.					
		1.5 The values stated in either SI units or inch-pound unit are to be regarded separately as standard. The values stated i each system may not be exact equivalents; therefore, eac system shall be used independently of the other. Combinin values from the two systems may result in non-conformance					
				Iso applicable to other types of units not referenced in these		with the standard.	
				t methods, but specific testing and reporting		1.6 This standard does not purpor	t to address all of th
				for those units are not included.		safety concerns, if any, associated with its use. It is th	
				1.4 These test methods include the following sections:		responsibility of the user of this stand	lard to establish appro
1.4 These less mentions mention are removing	Section	priate safety and health practices and determine the application					
Scope	1	bility of regulatory limitations prior to	o use.				
Referenced Documents	2	2. Referenced Documents					
Terminology Significance and Use	3 4						
Sampling	5	2.1 ASTM Standards. ²					
Measurament of Dimensions Compressive Strength	7	C55 Specification for Concrete Buil					
Absorption Calculations	8	C73 Specification for Calcium Sili Brick)	cate Brick (Sand-Lim				
Report	10	C90 Specification for Loadbearing (Concrete Masonry Lloit				
Køywords	11	C129 Specification for Nonloadbea					

C0140 C0140M-15

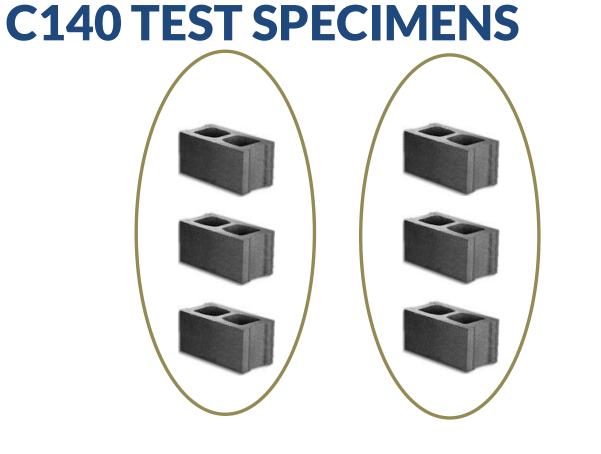
Standards volume information, refer to the standard's Document Summary page on the ASTM website

C140-15 Test Specimens

C140-15: Page 2@5.2

5.2 Number of Specimens:
 5.2.1 Unless specified otherwise in the applicable annex, a set of units shall consist of six full-size units.

6 units: 3 for compression & 3 for absorption



3 for Compressive Strength 3 for Absorption Maybe 3 More for Shrinkage

ASTM C140-15

C140-15: Page 2 @ 5-5.1.1

5. Sampling

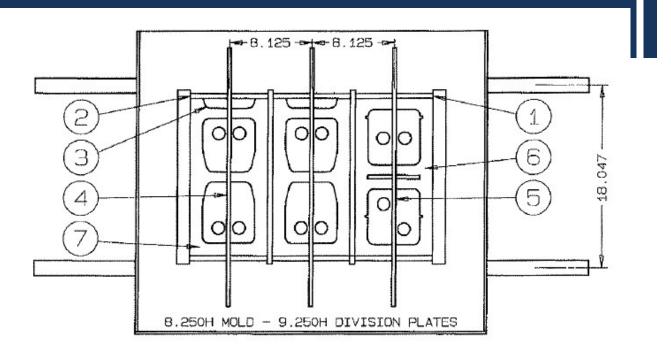
5.1 Selection of Test Specimens:

5.1.1 For purposes of testing, <u>full-sized units</u> shall be selected by the purchaser or authorized representative. The selected specimens shall be <u>of similar configuration</u> and dimensions. Specimens shall be representative of the whole lot of units from which they are selected.

Normally – Full Size Units

ALL SAME SHAPE

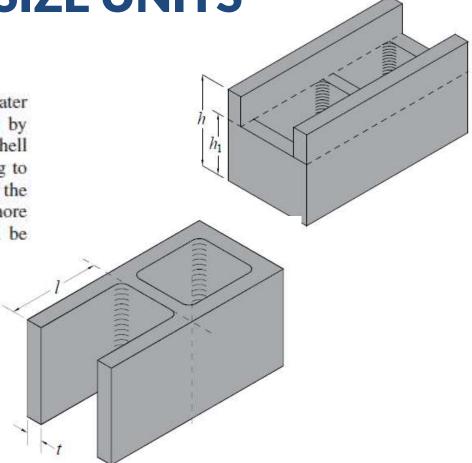
C140 5.1.1



NORMALLY – FULL SIZE UNITS

C140-15: Page 5 @ A1.3.1.1

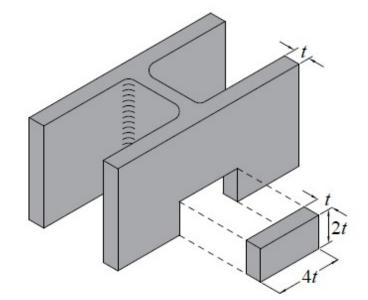
A1.3.1.1 Unsupported projections having a length greater than the thickness of the projection shall be removed by saw-cutting. For units with recessed webs, the face shell projecting above the web shall be removed by saw-cutting to provide a full bearing surface over the net cross section of the unit. Where the resulting unit height would be reduced by more than one-third of the original unit height, the unit shall be coupon tested in accordance with A1.3.1.3.



NORMALLY – FULL SIZE UNITS

C140-15: Page 5 @ A1.3.1.1

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ASTM C140-15

W ... AS RECEIVED



MEASUREMENT ASTM C140 Section 6 and A1.2

A1.2 Measurement

A1.2.1 For each unit, measure and record the width (W) across the top and bottom bearing surfaces at mid-length, height (H) at mid-length of each face, and length (L) at mid-height of each face to the nearest division required to be reported.

NOTICE: This standard has either been superseded and replaced by a new version or withdrawn. Contact ASTM International (www.astm.org) for the latest information

Designation: C140/C140M - 15

StandardTest Methods for Sampling and Testing Concrete Masonry Units and Related Units¹

This standard is issued under the fixed designation C140/C140M, 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 parentitises indicates the year of last reapproval. A supercent periodic (a) indicates are addinated anges runne 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 These test methods provide various testing procedures commonly used for evaluating characteristics of concrete masonry units and related concrete units. Methods are provided for sampling, measurement of dimensions, compressive strength, absorption, unit weight (density), moisture content, flexural load, and ballast weight. Not all methods are applicable to all unit types, however.

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(Spacitization D0000) 1.3 The test procedures included in these test methods are also applicable to other types of units not referenced in these test methods, but specific testing and reporting requirements for those units are not included.

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Scope Relaranced Documents Terminology Significance and Use Sampling Measurement of Dimensions Compressive Strangth Absorption Calculations Risport Kaywords

¹These test methods are under the jurisdiction of ASTM Committee C15 on

Table 18th include and a used use provided to the larm Collimate UP on Manifactured Masory Units and are the direct exposibility of Stateomilities CLStII on Concrete Masory Units and Related Units. Current editions approved July (2015; Politikad July 2015; Originally approved in 1938; Last previous edition approved in 2014 as C140 – 14b; DOE 10.1520/ C0140_C0140M-15.

Annaxos-Test Procedures	Section
Concrete Masonry Units	Annex A1
Concrete and Calcium Silicate Brick	Annox A2
Sogmontal Rotaining Wall Units	Annex A3
Concrete Interfocking Paving Units	Armax A4
Concrote Grid Paving Units	Annex A5
Concrete Roof Pavers	Annax A6
Dry-Cast Articulating Concrate Block	Annax A7
Determining Plate Thickness Flequinements for Compression Testing	Annox AS
Worksheet and Test Report for Concrete Masonry Units	Appendix X1

Nors: 1.—The testing laboratory performing these test methods should be evaluated in accordance with Practice C1093.

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2. Referenced Documents

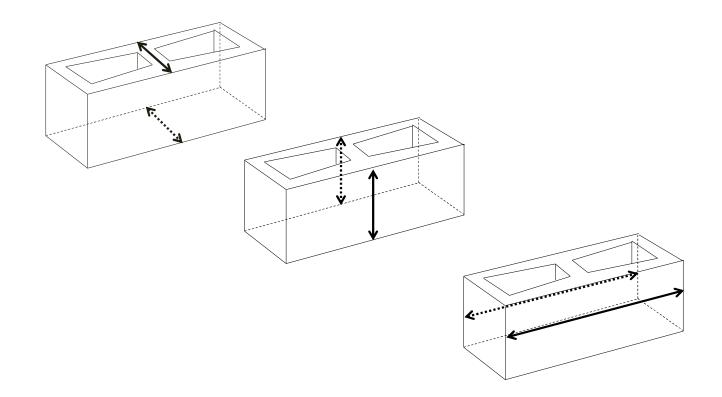
2.1 ASTM Standards.²

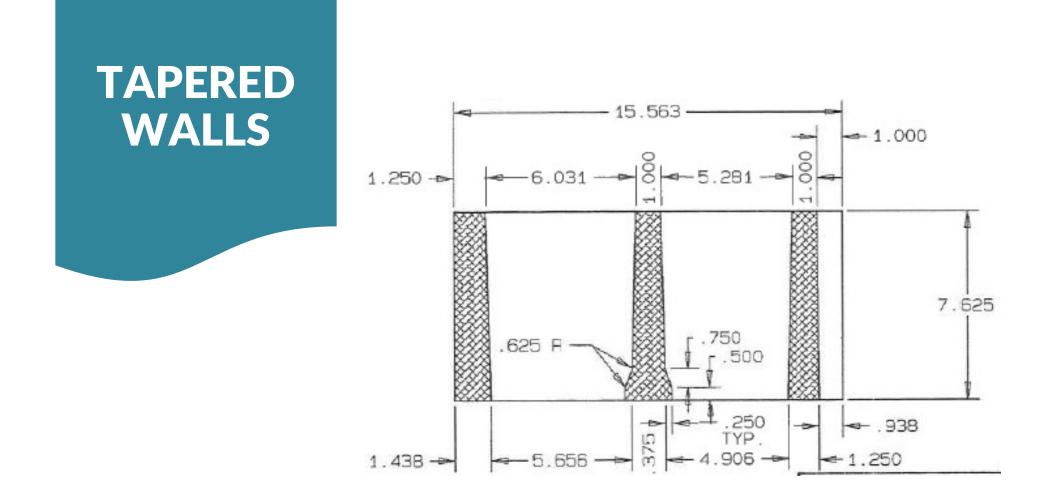
C55 Specification for Concrete Building Brick C73 Specification for Calcium Silicate Brick (Sand-Lime Brick)

C90 Specification for Loadbearing Concrete Masonry Units C129 Specification for Nonloadbearing Concrete Masonry Units

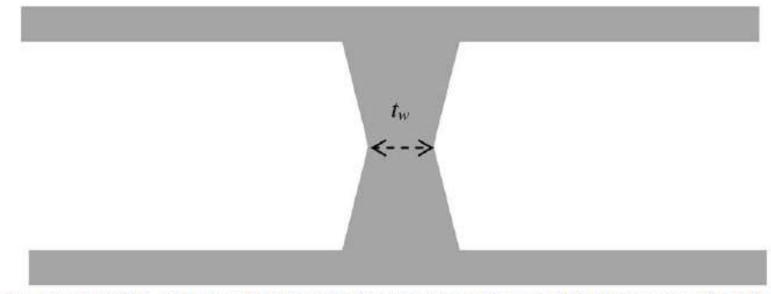
Section

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





ONLY MEASURE WEBS ³/₄" OR THICKER



Note 1—If t_w is less than 0.75 in. [19 mm] over the entire height of the web, disregard entire area of that web when determining minimum web area. FIG. A1.1 Example of Web with Irregular Cross-section—Plan View

ABSORPTION (AND VOLUME) ASTM C140 Section 8 and A1.4



BLOCK WEIGHTS



W_i - Immersed Weight



W_s – Saturated Weight



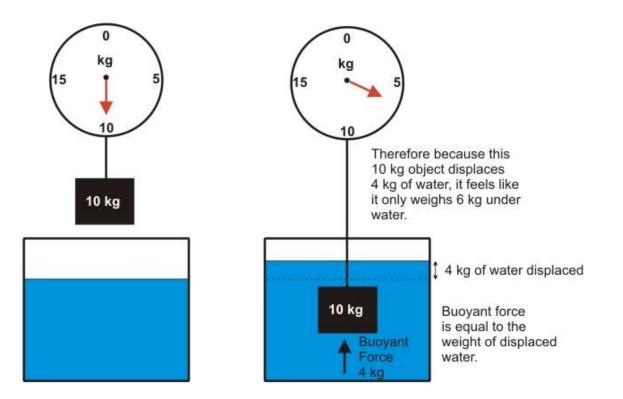
W_d - [Oven] Dry Weight



ARCHIMEDES' PRINCIPLE

UPWARD BUOYANT FORCE

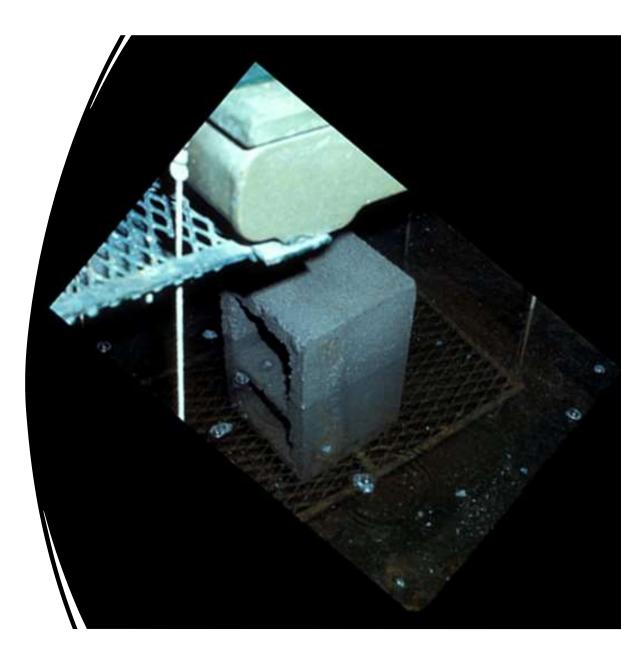
ARCHIMEDES' PRINCIPLE



W ... SATURATED, SURFACE DRY

W ... SUBMERGED -SATURATED

Completely submerged in water





W...OVENDRY

Calculations **ASTM C140** Section 9 and A1.5

NOTICE: This standard has either been superseded and replaced by a new version or withdrawn. Contact ASTM International (www.astm.org) for the latest information

Designation: C140/C140M - 15

StandardTest Methods for Sampling and Testing Concrete Masonry Units and Related Units¹

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- Annax A1-Concrolo masonry units (Specifications C90, C129)
- Annu A.—Concrete missioni y and (specification which y charge Annu A.—Concrete and calcular allicate brick (specifications C56, C73, C1634) Annu A.—Concrete interfactory and intra (specification C1372) Annu A.—Concrete interfactory gaving units (Specification C096/C0640) Annu A.S.—Concrete grid paining units (Specification C096/C0640) Annex A6-Concrola roof pavers (Specification C1491)
- Annax A7-Dry-cast articulating concrute block (Specification D6684)

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Scope Reteranced Documents Terminology Significance and Use Sampling Measurement of Dimensions Compressive Strength Absorption Calculations Report Kaywords

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	Section
Annaxas—Tast Procedures	Annex A1
Concrete Masonry Units	
Concrute and Calcium Silicate Brick	Arenax A2
Segmental Retaining Wall Units	Annax A3
Concrete Interfocking Paving Units	Armax A4
Concrete Grid Paving Units	Annex A5
Concrate Roof Pavars	Annax A6
Dry-Cast Articulating Concrete Block	Annax A7
Determining Plate Thickness Requirements for Compression Testing	Annax AB
Worksheet and Test Report for Concrete Masonry Units	Appendix X1

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2. Referenced Documents

2.1 ASTM Standards.²

C55 Specification for Concrete Building Brick C73 Specification for Calcium Silicate Brick (Sand-Lime Brick)

C90 Specification for Loadbearing Concrete Masonry Units C129 Specification for Nonloadbearing Concrete Masonry Units

Section

² For referenced ASTM standards, visit the ASTM websile, www.asim.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

VOLUME BY ARCHIMEDES' PRINCIPLE

9. Calculations 9.1 Absorption—Calculate absorption as follows: Absorption, $lb/ft^3 = [(W_s - W_d)/(W_s - W_i)] \times 62.4$ (1)9.3 Density-Calculate oven-dry density as follows: Density (D), $lb/ft^3 = [W_0/(W_s - W_i)] \times 62.4$ (3) Density (D), kg/m³ = $[W_d/(W_s - W_i)] \times 1000$ 9.4 Average Net Area-Calculate average net area as fol-Id lows: Net Volume (V_n) , $ft^3 = W_d/D = (W_s - W_i)/62.4$ (4) Net Volume (V_n) , mm³ = $W_d/D = (W_s - W_i) \times 10^6$ Average Net Area (A_n) , in.² = $(V_n \times 1728)/H$ Average Net Area (A_n) , mm² = V_n/H

ASTM C140-15 CALCULATIONS C140-15: Page 4 @ 9- 9.1

9. Calculations

9.1 Absorption—Calculate absorption as follows:

Absorption, $lb/ft^3 = [(W_s - W_d)/(W_s - W_i)] \times 62.4$

(1)

Absorption, kg/m³ = $[(W_s - W_d)/(W_s - W_i)] \times 1000$

Absorption, $\% = [(W_s - W_d)/W_d] \times 100$

where:

 W_s = saturated weight of specimen, lb (kg), W_i = immersed weight of specimen, lb (kg), and W_d = oven-dry weight of specimen, lb (kg).

ASTM C140-15 ... THE W's C140-15: Page 4 @ 9.2

9.2 <u>Moisture Content</u>—Calculate the moisture content of the unit at the time it is sampled (when W_r is measured) as follows:

Moisture Content, % of total absorption = $[(W_r - W_d)/(W_s - W_d)] \times 100$ (2)

where:

 W_r = received weight of unit, lb (kg),

 W_d = oven-dry weight of unit, lb (kg), and

 W_s = saturated weight of unit, lb (kg).

NOTE 10—When determining the moisture content of a unit or set of units, the value determined is a measure of the water content of a unit based upon the received weight of the unit W_r . Thus, the moisture content calculation above is only applicable to the unit moisture content at the time the received weight, W_r , is obtained.

ASTM C140-15 C140-15: Page 4 @ 9.3

9.3 <u>Density</u>—Calculate oven-dry density as follows: Density (D), lb/ft³ = $[W_d/(W_s - W_i)] \times 62.4$ (3) Density (D), kg/m³ = $[W_d/(W_s - W_i)] \times 1000$

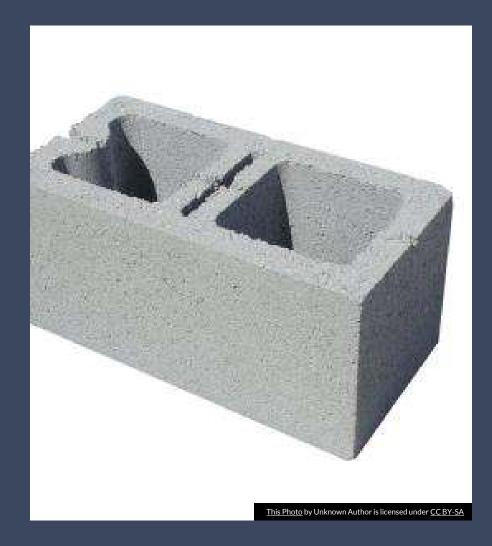
where:

 W_d = oven-dry weight of specimen, lb (kg), W_s = saturated weight of specimen, lb (kg), and W_i = immersed weight of specimen, lb (kg).

Density is mass divided by volume

Density Classification	Oven-Dry Density
	of Concrete, lb/ft ³ (kg/m ³)
	Average of 3 Units
Lightweight	Less than 105 (1680)
Medium Weight	105 to less than 125
	(1680-2000)
Normal Weight	125 (2000) or more

ASTM C90 TABLE 2 CLASSIFICATION



ASTM C140-15

Properties affected by density of concrete include:

- Wall Weight
- Building Weight
- Thermal Conductivity
- Heat Capacity
- Acoustic Properties

ASTM C140-15 ... NET AREA C140-15: Page 4 @ 9.4

9.4 Average Net Area—Calculate average net area as follows:

Net Volume
$$(V_n)$$
, ft³ = $W_d/D = (W_s - W_i)/62.4$ (4)

Net Volume (V_n) , mm³ = $W_d/D = (W_s - W_i) \times 10^6$

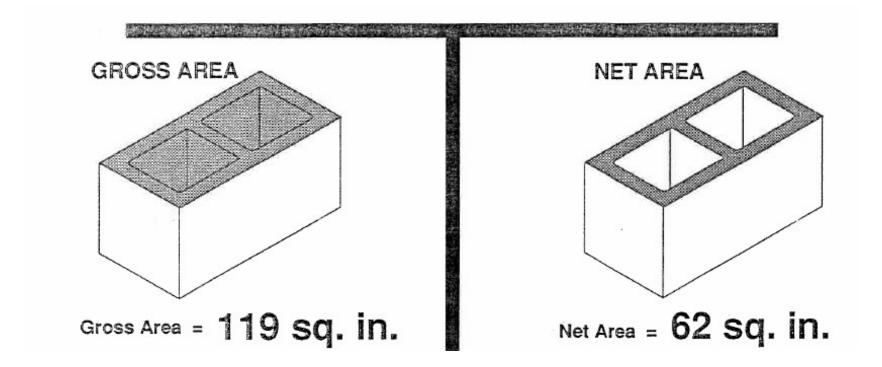
Average Net Area (A_n) , in.² = $(V_n \times 1728)/H$

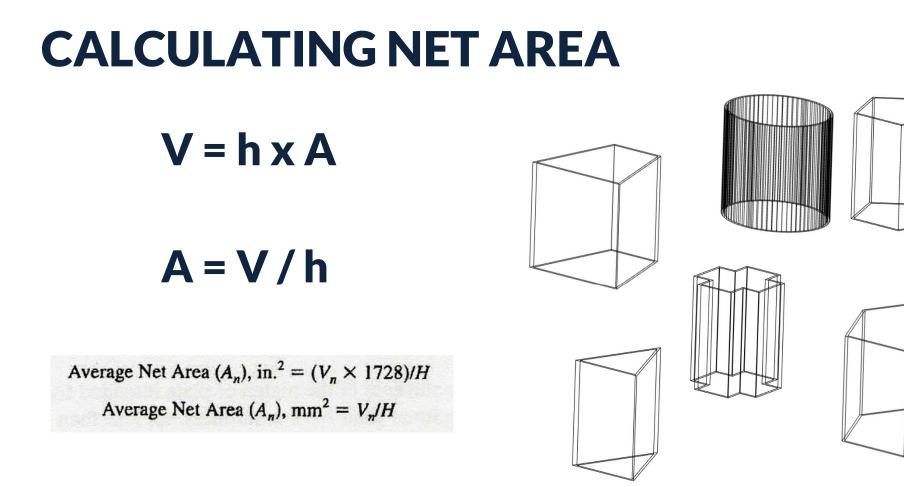
Average Net Area (A_n) , mm² = V_n/H

where:

 V_n = net volume of specimen, ft³ (mm³), W_d = oven-dry weight of specimen, lb (kg), D = oven-dry density of specimen, lb/ft³ (kg/m³), W_s = saturated weight of specimen, lb (kg), W_i = immersed weight of specimen, lb (kg), A_n = average net area of specimen, in.² (mm²), and H = average height of specimen, in. (mm).

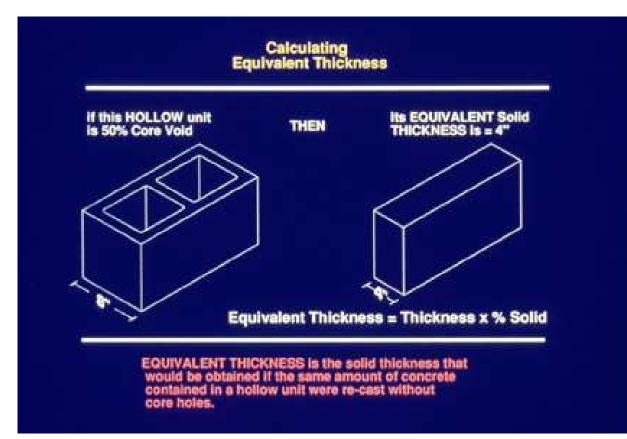
NET AREA





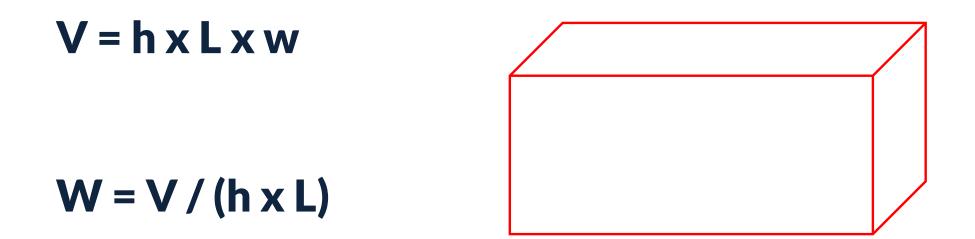
C140 GROSS AREA C140-15: Page 4 @ 9.5

9.5 <u>Gross Area</u>—Calculate gross area as follows: Gross Area (Ag), in.² (mm²) = L × W (6)
where: Ag = gross area of the specimen, in.² (mm²), L = average length of the specimen, in. (mm), and W = average width of the specimen, in. (mm).



EQUIVALENT THICKNESS

ASTM C140-15 EQUIVALENT THICKNESS C140-15: Page 6-A1.5.3 & 1.5.3.1



ASTM C140-15 EQUIVALENT THICKNESS C140-15: Page 8-A1.5.3 & 1.5.3.1

A1.5.3 *Equivalent Thickness*—Equivalent thickness for concrete masonry is defined as the average thickness of solid material in the unit and is calculated as follows:

 $T_e, \text{ in.} = [V_n/(L \times H)] \times 1728$ (A1.1)

$$T_e, mm = [V_n/(L \times H)]$$

where:

- T_e = equivalent thickness, in. (mm),
- $V_n =$ average net volume of full-size units, ft³ (mm³) (see 9.4),
- L = average length of full-size units, in. (mm) (see A1.2.1), and
- H = average height of full-size units, in. (mm) (see A1.2.1).

A1.5.3.1 Equivalent thickness shall only be calculated and reported for full-size concrete masonry units.

CALCULATIONS

A1.5.4 *Percent Solid*—Calculate the percent solid as follows:

Percent solid, ft³ (%) =
$$\left(\frac{(V_n \times 1728)}{(L \times W \times H)}\right) \times 100$$
 (A1.3)

Percent solid, mm³ (%) =
$$\left(\frac{V_n}{(L \times W \times H)}\right) \times 100$$

<u>COMPRESSIVE</u> <u>STRENGTH</u> **ASTM C140 SECTION 7 AND A1.3**

NOTICE: This standard has either been superseded and replaced by a new version or withdrawn. Contact ASTM International (www.astm.org) for the latest information



Designation: C140/C140M - 15

StandardTest Methods for

Sampling and Testing Concrete Masonry Units and Related Units¹

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Annax A6-Concrete roof payers (Specification C1491) Annex A7-Dry-cast articulating concrute block

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Scope	
Referenced Documents	
laminology	
Significance and Use	
Sampling	
Agasurament of Dimensions	
Compressive Strength	
Absorption	
Calculations	
laport	
Gaywords	

¹These test methods are under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and are the direct responsibility of Subcommittee C15.03 on Concrete Masonry Units and Related Units.

Current edition approved July 1, 2015. Published July 2015. Originally approved in 1938. Last previous edition approved in 2014 as C140 – 14b. DOI: 10.1520/ C0140_C0140M-15.

	Section
Annaxas—Tast Procedures	
Concrete Masonry Units	Annax A1
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- C73 Specification for Calcium Silicate Brick (Sand-Lime

Brick)

C90 Specification for Loadbearing Concrete Masonry Units C129 Specification for Nonloadbearing Concrete Masonry Units

² For referenced ASTM standards, visit the ASTM website, www.asim.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.

COMPRESSIVE STRENGTH

There are three common compressive strengths in testing concrete masonry units:

• Gross Area Compressive Strength of Concrete Masonry Units – no longer used under the building code, but often requested.

• Net Area Compressive Strength of Concrete Masonry Units – this strength is the result from the lab testing a single block.

• Net Area Compressive Strength of Masonry (f'_m) – this is the strength engineers use to design a building.

C140 Test Specimens-13 C140-15: Page 2@ 5.2

Note that the specimens to determine the compressive load are different than the specimens that determine the net area.









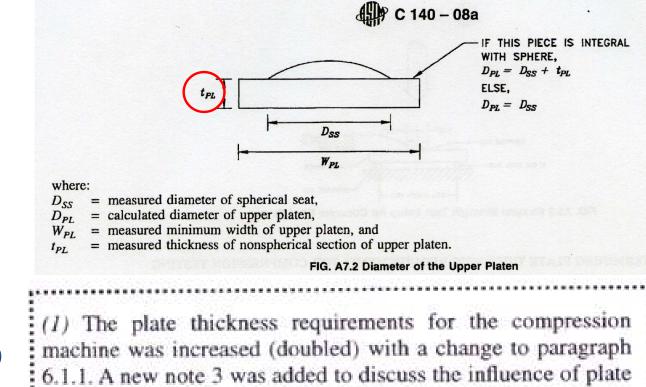


3 for Compressive Strength

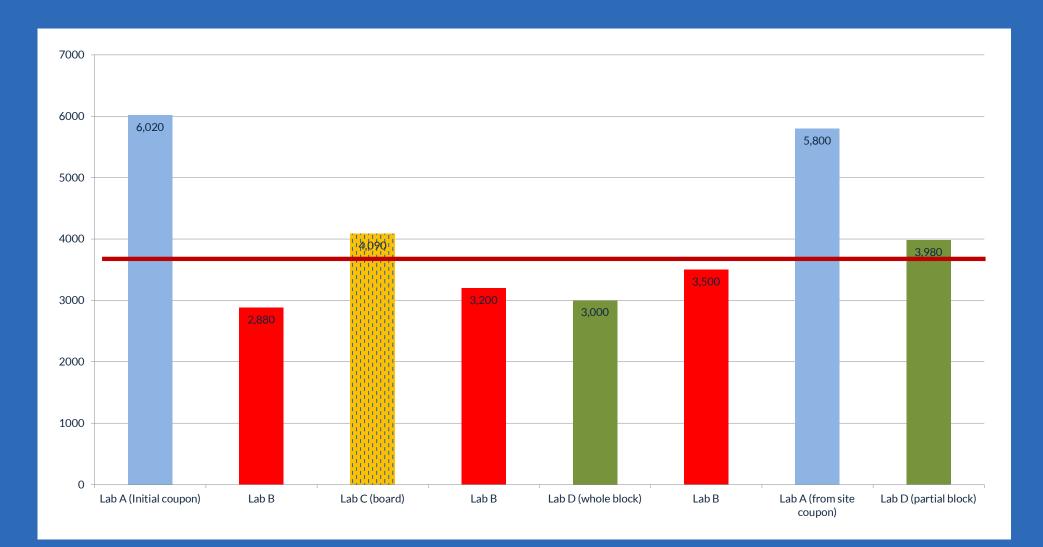
3 for Absorption

C140 PLATE THICKNESS C140-15: Page 12- Fig. A7.2

thickness.



THIS NOTE FROM THE 2000 EDITION OF C140



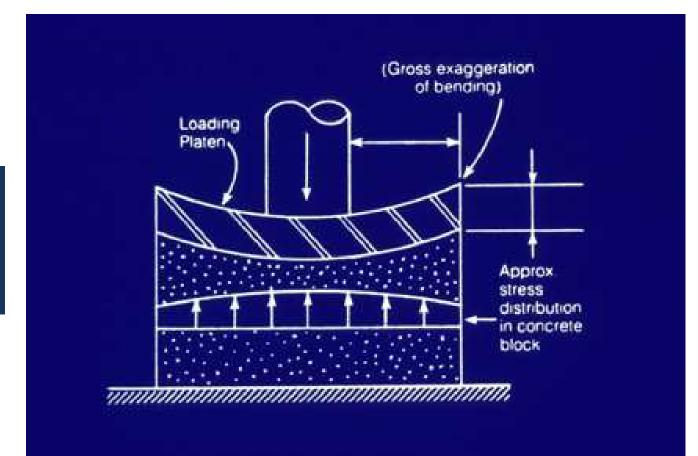
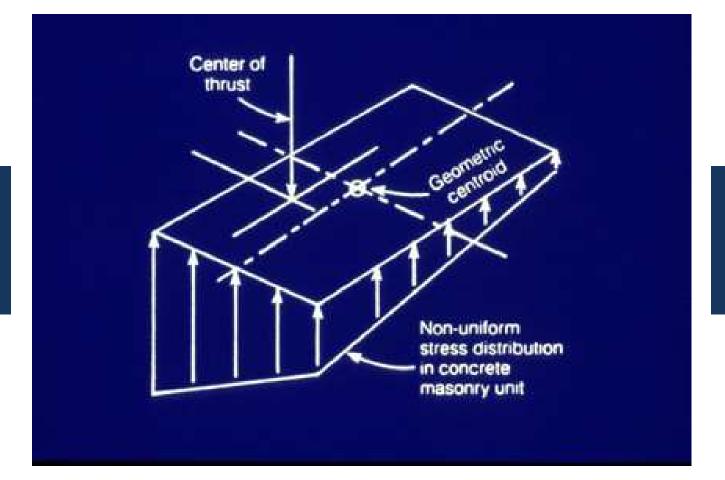


PLATE TOO THIN



CENTER OF MASS UNDER CENTER OF THRUST

ASTM C140-15 CAPS C140-15: PAGE 3@7.3

SULFUR OR GYPSUM CAPS

7.3 Capping—Cap test specimens in accordance with Practice C 1552.

NO "SOFT" CAPS ALLOWED

In plant use of fiber board In place of lab prepared Gypsum or Sulfur Cap. Soft fiber boards spread Causing internal tension

SOFT CAP (not authorized) CONCRETE BLOCK

9.6.1 Net Area Compressive Strength-Calculate the net area compressive strength of the specimen as follows:

Net Area Compressive Strength, $psi[MPa] = P_{max}/A_n$ (8)where:

 P_{max} = maximum compressive load, lb [N], and A_n = average net area of specimen, in.² [mm²].

9.6.2 Gross Area Compressive Strength-Calculate the gross area compressive strength of the specimen as follows:

> Gross Area Compressive Strength, $psi[MPa] = P_{max}/A_g$ (9)

where:

 P_{max} = maximum compressive load, lb [N], and $A_{\rm g}$ = gross area of specimen, in.² [mm²].

ASTM 140 – CALCULATING **COMPRESSIVE STRENGTH**

CONCEPTUAL ERRORS (THIS PAGE FOLLOWS C140 IN THE BINDER)

NET AREA is not measured. It is a calculated number determined as follows:

Net Area = Gross Area (x) % Solid So: First determine % Solid % Solid = Net Volume ÷ Gross Volume

- 1. Calculate Net Volume $Vn = Net Volume, ft.^3 = \frac{Ws-Wi}{62.4} = \frac{Wd}{D}$
- 2. Calculate Gross Volume Vg= Gross Volume = (L x W x H) ÷ 1728
- 3. Calculate % solid Vn/Vg =
- 4. Take Gross Area (x) % Solid = Net area = An

EQUIVALENT THICKNESS is not a measured value, it is calculated as follows:

Te= Equivalent Thickness = Thickness (Width) (x) % Solid.

EQUIVALENT THICKNESS IS REQUIRED FOR FIRE RATING CALCULATION

-	
NET AREA is not measured. lows:	It is a calculated number determined as fol-
Net Area = Gross Area (x) % Solid
	etermine % Solid
% Solid =	Net Volume ÷ Gross Volume
1. Calculate Net Volume	Vn= Net Volume, ft. ³ = $\frac{Ws-Wi}{62.4}$ = $\frac{Wd}{D}$
2. Calculate Gross Volume	Vg= Gross Volume = (L x W x H) ÷ 1728
3. Calculate % solid	Vn/Vg =
4. Take Gross Area (x) % Solic	i = Net area = An
EQUIVALENT THICKNESS is n	ot a measured value, it is calculated as follows:
Te= Equivalent Thickness = Th	nickness (Width) (x) % Solid.
Note: REF C 140-13—Section 9 for deta	

C 1314 – STANDARD TEST METHOD FOR COMPRESSIVE STRENGTH **OF MASONRY PRISMS**

C1314-14 PAGE 1 TITLE

NOTICE: This standard has either been superseded and replaced by a new version or withdrawn Contact ASTM International (www.astm.org) for the latest information



StandardTest Method for Compressive Strength of Masonry Prisms¹

This standard is issued under the fixed designation C1314; 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 (n) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This test method covers procedures for masonry prism construction and testing, and procedures for determining the compressive strength of masonry, fmi, used to determine compliance with the specified compressive strength of masonry, f' When this test method is used for research purposes, the construction and test procedures within serve as a guideline and provide control parameters.

1.2 This test method also covers procedures for determining the compressive strength of prisms obtained from fieldremoved masonry specimens

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

1.4 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards-2

- C67 Test Methods for Sampling and Testing Brick and Structural Clay Tile
- C136 Test Method for Sieve Analysis of Fine and Coarse Aggregates C140 Test Methods for Sampling and Testing Concrete

Masonry Units and Related Units

C143/C143M Test Method for Slump of Hydraulic-Cement Concrete

C144 Specification for Aggregate for Masonry Mortar C270 Specification for Mortar for Unit Masonry

¹This lest method is under the jurisdiction of ASTM Committee C15 on farufactured Masonry Units and is the direct responsibility of Subcommittee C15.04 on Research. Current edition approved July 1, 2014. Published August 2014. Origin

approved in 1995. Last previous edition approved in 2012 as C1314-12, DOI: 10.1520/01314-14 ¹⁵ For referenced ASTM standards, visit the ASTM websile, www.asim.org, or

conlact ASTM Customer Service al service@astm.org. For Annual Book of ASTM Standardr volume information, refer to the standard's Document Summary page on the ASTM webcile

C476 Specification for Grout for Masonry

C780 Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

C1019 Test Method for Sampling and Testing Grout C1093 Practice for Accreditation of Testing Agencies for

- Masonry C1532 Practice for Selection, Removal, and Shipment of Units and Masonry Specimens Manufactured Masonry Units and Masonry Specimens from Existing Construction
- C1552 Practice for Capping Concrete Masonry Units, Related Units and Masonry Prisms for Compression Testing C1587 Practice for Preparation of Field Removed Manufac-

tured Masonry Units and Masonry Specimens for Testing E105 Practice for Probability Sampling of Materials E111 Test Method for Young's Modulus, Tangent Modulus, and Chord Modulus

3. Terminology

3.1 Definitions:

3.1.1 set-a set consists of at least three prisms constructed of the same material and tested at the same age.

3.2 Notations: 3.2.1 f'_-specified compressive strength of masonry.

- 3.2.2 fee-compressive strength of masonry.
- 3.2.3 h_pprism height.
- 3.2.4 t_-least actual lateral dimension of prism.

4. Significance and Use

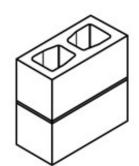
4.1 This test method provides a means of verifying that masonry materials used in construction result in masonry that meets the specified compressive strength.

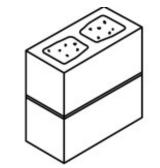
4.2 This test method provides a means of evaluating compressive strength characteristics of in-place masonry construction through testing of prisms obtained from that construction when sampled in accordance with Practice C1532. Decisions made in preparing such field-removed prisms for testing, determining the net area, and interpreting the results of compression tests require professional judgment.

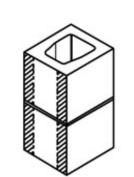
4.3 If this test method is used as a guideline for performing research to determine the effects of various prism construction or test parameters on the compressive strength of masonry,

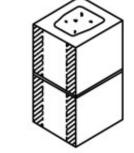
*A Summary of Changes section appears at the end of this standard Copyright © ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshchooken, PA 19425-2059. United States

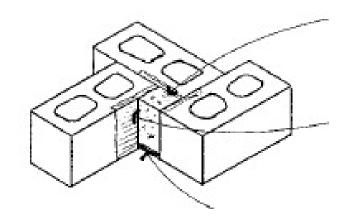
TWO TYPES OF PRISMS IN MASONRY TESTING

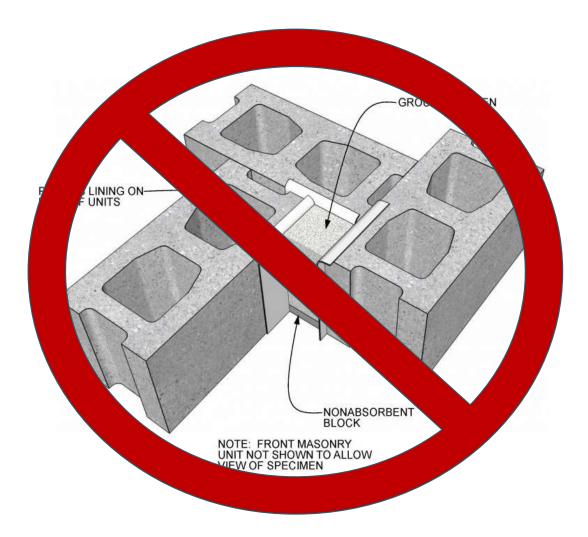












ASTM C1314-07 PRISM TESTING

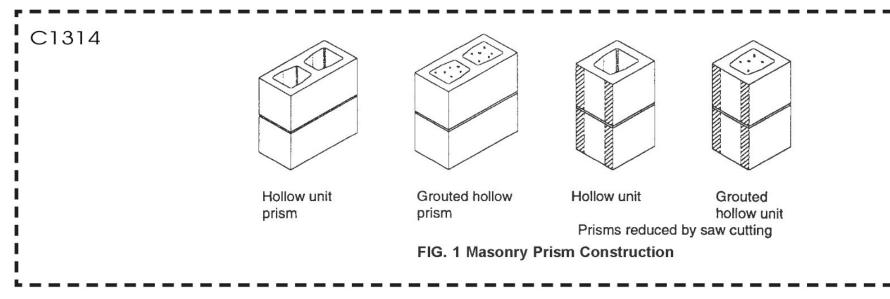
C 1314 – STANDARD TEST METHOD FOR COMPRESSIVE STRENGTH OF MASONRY PRISMS

3. TerminologyC1314-07 Page 1@3-3.13.1 Definitions:
3.1.1 set—a set consists of at least three prisms constructed
of the same material and tested at the same age.3.2 Notations:
C1314-07 Page 1@3-3.23.2 Notations:
 $3.2.1 f'_m$ —specified compressive strength of masonry.
 $3.2.2 f_{mt}$ —compressive strength of masonry.
 $3.2.3 h_p$ —prism height.
 $3.2.4 t_p$ —least actual lateral dimension of prism.

f'm - SPECIFIED COMPRESSIVE STRENGTH fmt- COMPRESSIVE STRENGTH

ASTM C 1314

C1314-14 Page 2 FIG. 1



2 BLOCK HIGH ONE JOINT



BUILDING PRISM

ASTM C1314-14

C1314-07 Page 2@5.3

5.3 Build each prism in an opened, moisture-tight bag large enough to enclose and seal the completed prism. Construct prisms on a flat, level base. Construct prisms in a location where they will remain undisturbed until transported for testing.

> 5.6 Build masonry prisms with full mortar beds (mortar all webs and face shells of hollow units). Use mortar representative of that used in the corresponding construction. Use mortar joint thickness and a method of positioning and aligning units, that are representative of the corresponding construction. Use mortar joints that are cut flush. For prisms to be grouted, remove mortar "fins" that protrude into the grout space.

FULL MORTAR BEDS FULL CROSS WEBS

6. Obtaining and Transporting Masonry Prisms

6.1 For field-removed masonry specimens, select and remove specimens in accordance with Practice C1532.

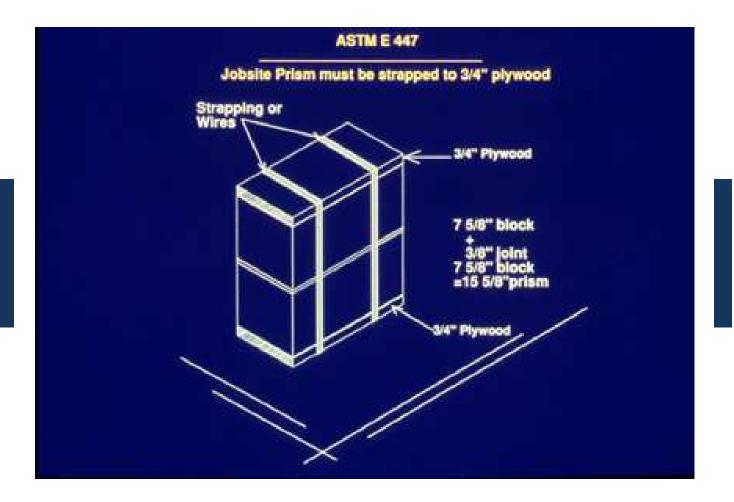
6.2 Prior to transporting constructed prisms and fieldremoved masonry specimens, strap or clamp each prism or specimen to prevent damage during handling and transportation. Secure prisms and specimens to prevent jarring, bouncing, or tipping over during transporting.

6.3 Transport prisms and masonry specimens in accordance with Practice C1532.

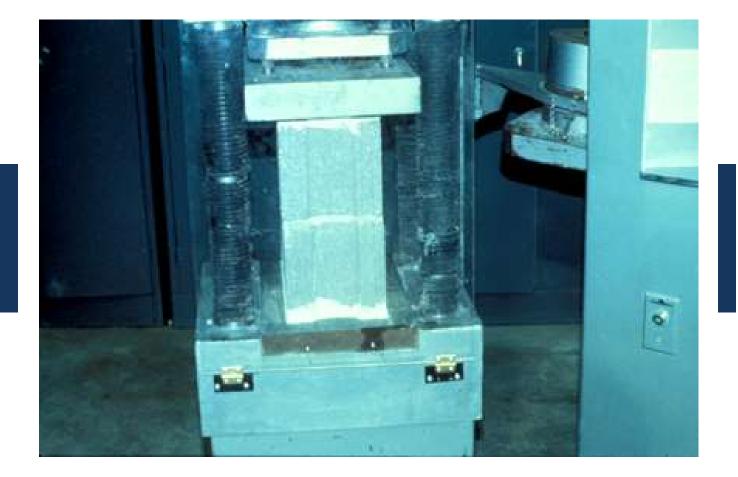
6.4 For field-removed masonry specimens, after the specimens have been transported to the laboratory, obtain prisms from the masonry specimens using procedures outlined in Practice C1587.

ASTM C1314-14 TRANSPORTING

NO JARRING, BOUNCING, TIPPINGSURE



THE PRISM



COMPRESSION TEST OF PRISM



PRISMS ARE NOT FUN.

TAKE AWAYS



IF YOU HAVE TO MAKE PRISMS, THEY NEED TO BE PROTECTED.

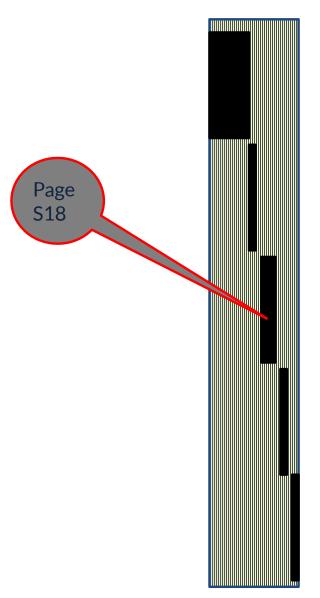


MOST IMPORTANT, THERE IS A BETTER METHOD!

LAYOUT OF MSJC

•Code •TMS 402 •ACI 530 •ASCE 5

Specification
 TMS 602
 ACI 530.1
 ASCE 6



PREVIOUS MSJC Table 2

Table 2 — Compressive strength of masonry based on the compressive strength of concrete masonry units and type of mortar used in construction

Net area compressiv concrete masonry un	0	Net area compressive strength of masonry, psi ¹ (MPa)
Type M or S mortar	Type N mortar	
_	1,900 (13.10)	1,350 (9.31)
1,900 (13.10)	2,150 (14.82)	1,500 (10.34)
2,800 (19.31)	3,050 (21.03)	2,000 (13.79)
3,750 (25.86)	4,050 (27.92)	2,500 (17.24)
4,800 (33.10)	5,250 (36.20)	3,000 (20.69)

¹ For units of less than 4 in. (102 mm) height, 85 percent of the values listed.

SPECIFICATION P. S18 - TABLE 2

Table 2 — Compressive strength of masonry based on the compressive strength of concrete masonry units and type of mortar used in construction

Net area compressive strength of	Net area compression concrete masonry	-
concrete masonry, psi (MPa)	Type M or S mortar	Type N mortar
1,700 (11.72)		1,900 (13.10)
1,900 (13.10)	1,900 (13.10)	2,350 (14.82)
2.000 (13.79)	2,000 (13.79)	2,650 (18.27)
2,250 (15.51)	2,600 (17.93)	3,400 (23.44)
2,500 (17.24)	3,250 (22.41)	4,350 (28.96)
2,750 (18.96)	3,900 (26.89)	
3,000 (20.69)	4,500 (31.03)	

¹For units of less than 4 in. (102 mm) nominal height, use 85 percent of the values listed.

COMPARING -08 TO -13

	TMS 6	02-08	TMS 6	02-13
f'm Net Area Compressive Strength of Masonry (psi)	Net Area Compressive Strength of Concrete Masonry Units (psi) with Type M or S mortar	Net Area Compressive Strength of Concrete Masonry Units (psi) with Type N mortar	Net Area Compressive Strength of Concrete Masonry Units (psi) with Type M or S mortar	Net Area Compressive Strength of Concrete Masonry Units (psi) with Type N mortar
1,350		1,900		
1,500	1,900	2,150		
1,700				1,900
1,900			1,900	2,350
2,000	2,800	3,050	2,000	2,650
2,250			2,600	3,400
2,500	3,750	4,050	3,250	4,350
2,750			3,900	
3,000	4,800	5,250	4,500	

STRENGTH SUMMARY

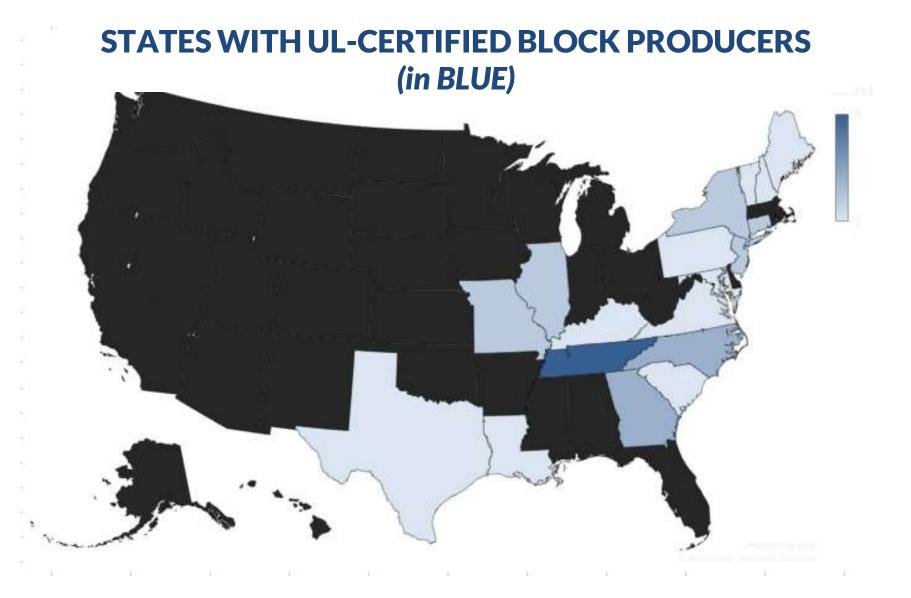
- Gross Area Compressive Strength of Concrete Masonry Units - no longer used under the building code, but often requested.
- Net Area Compressive Strength of Concrete Masonry Units - this strength is the result from the lab testing a single block.
- Net Area Compressive Strength of Masonry (f'm) this is the strength engineers use to design a building.



FIRE RATING



"UL" CMU ARE NOT READILY AVAILABLE IN FLORIDA



ASTM TEST METHODS E119

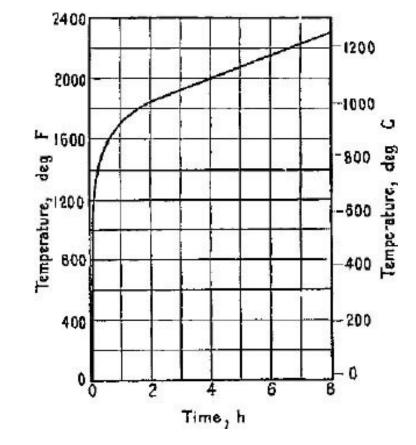


• TESTING FOR

- TRANSMISSION OF HEAT
- TRANSMISSION OF HOT GASES
 COTTON PAD ON A LONG POLE
- LOAD CARRYING ABILITY

ASTM TEST METHODS E119

FIRE EXPOSURE • GAS FURNACE • PRESCRIBED TIME-TEMPERATURE CURVE





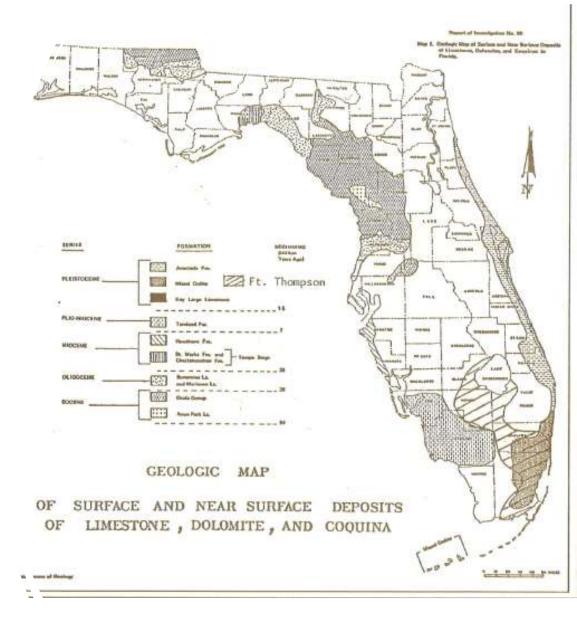
ASTM TEST METHODS E119

WATER HOSE STREAM

FIRE RATING

Type of			MIN	IMUM	EQUIV	ALENT	тніск	NESS F	OR FIR	E-RESIS	TANC	ERATIN	NG, IN.		
Aggregate	½ hr	¾ h r	1 hr	1¼ hr	1½ hr	1¾ hr	2 hr	2¼ hr	2½ hr	2¾ hr	3 hr	3¼ hr	3½ hr	3¾ hr	4 hr
Pumice or expanded slag	1.5	1.9	2.1	2.5	2.7	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.5	4.7
Expanded shale, clay or slate	1.8	2.2	2.6	2.9	3.3	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	4.9	5.1
Limestone, cinders or unexpanded slag	1.9	2.3	2.7	3.1	3.4	3.7	4.0	4.3	4.5	4.8	5.0	5.2	5.5	5.7	5.9
Calcareous or siliceous gravel	2.0	2.4	2.8	3.2	3.6	3.9	4.2	4.5	4.8	5.0	5.3	5.5	5.8	6.0	6.2

GEOLOGIC MAP



2017 Florida Building Code - Building, Sixth

Edition

CHAPTER 7 FIRE AND SMOKE PROTECTION FEATURES



MINIMUM EQUIVALENT THICKNESS (inches) OF BEARING OR NONBEARING CONCRETE MASONRY WALL S^{a,b,c,d}

<u>Two things</u> <u>determine fire rating:</u>

1. Equivalent Thickness

2. Type of Aggregate

Note that neither compressive strength nor density affect the fire rating calculation

	FIRE-RESISTANCE RATING (hours)														
TYPE OF AGGREGATE		3/4	1	1 ¹ /4	11/2	1 ³ / ₄	2	21/4	2 ¹ /2	2 ³ /4	3	31/4	31/2	3 ³ /4	4
Pumice or expanded slag	1.5	1.9	2.1	2.5	2.7	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.5	4.7
Expanded shale, clay or slate	1.8	2.2	2.6	2.9	3.3	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	4.9	5.1
Limestone, cinders or unexpanded slag	1.9	2.3	2.7	3.1	3.4	3.7	4.0	4.3	4.5	4.8	5.0	5.2	5.5	5.7	5.9
Calcareous or siliceous gravel	2.0	2.4	2.8	3.2	3.6	3.9	4.2	4.5	4.8	5.0	5.3	5.5	5.8	6.0	6.2

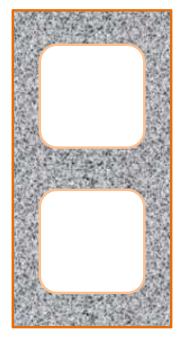
For SI: 1 inch = 25.4 mm.

a. Values between those shown in the table can be determined by direct interpolation.

b. Where combustible members are framed into the wall, the thickness of solid material between the end of each member and the opposite face of the wall, or between members set in from opposite sides, shall be not less than 93 percent of the thickness shown in the table.

c. Requirements of ASTM C55, ASTM C73, ASTM C90 or ASTM C744 shall apply.

d. Minimum required equivalent thickness corresponding to the hourly fire-resistance rating for units with a combination of aggregate shall be determined by linear interpolation based on the percent by volume of each aggregate used in manufacture.



"1.6-hour"



"2.0-hour"





"3.0-hour"

"4.0-hour"

Increasing the Fire-Resistance Rating

- INCREASE ACTUAL THICKNESS OF CMU
- INCREASE EQUIVALENT THICKNESS OF CMU
- FILL THE CORES OF THE HOLLOW CMU (SAND, GROUT, LISTED FILLS)
- USE MULTI-WYTHE MASONRY AND/OR VENEER
- APPLY WALL FINISHES OR COVERINGS

ASTM C426

NOTICE: This standard has either been superseded and replaced by a new version or withdrawn.

Designation: C426 - 15*1

StandardTest Method for Linear Drying Shrinkage of Concrete Masonry Units¹

This standard is issued under the fixed designation G426; 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 parenthese indicates the year of last responsel. A superscript quitod (o) indicates an addituid change instruction the last revision or rangeroval. This standard has been approved for use by agencies of the U.S. Department of Defonse. e¹ NOTE--Editorially corrected 3.2.1 in February 2016.

1. Scope* Scope^e
 This test method covers a routine standardized proce-dure for determining the linear drying shrinkage of concrete masony units or related concrete units under specified accel-erated drying conditions.

3.2 Definitions of Terms Specific to This Standard: 3.2.1 linear drying shrinkage, n—in this test method, the change in linear dimension of the test specimen due to drying from a saturated condition to an equilibrium weight and length under specified accelerated drying conditions.

the values stude in inch-pound units are to be regarded standard. The values size in inch-pound units are to be regarded standard. The values size in inch-pound units are to be regarded to every size in the value size in the value inch-to a real considered standard 1.3 This standard does not purport to address all of the reportibility of the size of this standard to establish appro-riate safety and health practices and determine the applica-bility of regulatory limitations prior to use. 1.3 This function of the size of this standard to establish appro-priate safety and the this tractices the applica-bility of regulatory limitations prior to use. 1.3 The size of th

2. Referenced Documents

2. Referenced Documents
2. A STAT Status dateds²
C400 Practice for Use of Apparatus for the Determination of
Length Change of Harkened Center Pate, Mortar, and
Concrete
C1009 Practice for Accreditation of Testing Agencies for
Marony
C1009 Practice for Accreditation of Testing Agencies for
Marony
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C1009 Practice for Accreditation of Testing Agencies for
Marony
C1009 Practice for Accreditation of Testing Agencies for
C1009 Practice for Acc Masonry C1232 Terminology of Masonry 2.2 ANSI Standard: B94.11M—1993 Twist Drills³

22 AVS Standard: 10411M—1073 Visus Denits³

 3. Terminology
 4. Terminology

¹This est notion is more the justicities of ATTM Committee CI3 on Manufactured Manasy Usin and is the direct impossibility of Satocomittee CI31 or Gorome Manacy Usin and a Usin the great impossibility of Satocomittee CI31 or Gorome Manacy Usin and Patter Usin Linux 1991. Work of the Manager efferance points are set carefully to position, adjust neuroparticle and the Satocomittee CI35 or 7.6 min) provides https://doi.org/10.1011/j.com/satocomittee/CI35 or 7.6 min) provides https://doi.org/10.1011/j.com/satocomittee/CI3

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NTSTCHCAS-1910. "Is restring of ATM Calabers for the Association of Model organized ATM values, when the service asian on the observed asian for the Association of the Association

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

5.1 Strain Gauge—The instruments for measuring linear drying shrinkage shall be so designed as to permit or provide the conditions described in 5.1.1 through 5.1.5.

ASTM INTERNATIONAL

ASTM C426-15e1 SHRINKAGE C426-10 Page 1 Title



Designation: C426 – 15^{ε1}

StandardTest Method for Linear Drying Shrinkage of Concrete Masonry Units¹

This standard is issued under the fixed designation C426; 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 is used to give a value to potential linear shrinkage **S** ℓ

ASTM C426-10 SHRINKAGE C426-10 Page 1 Scope

1. Scope*

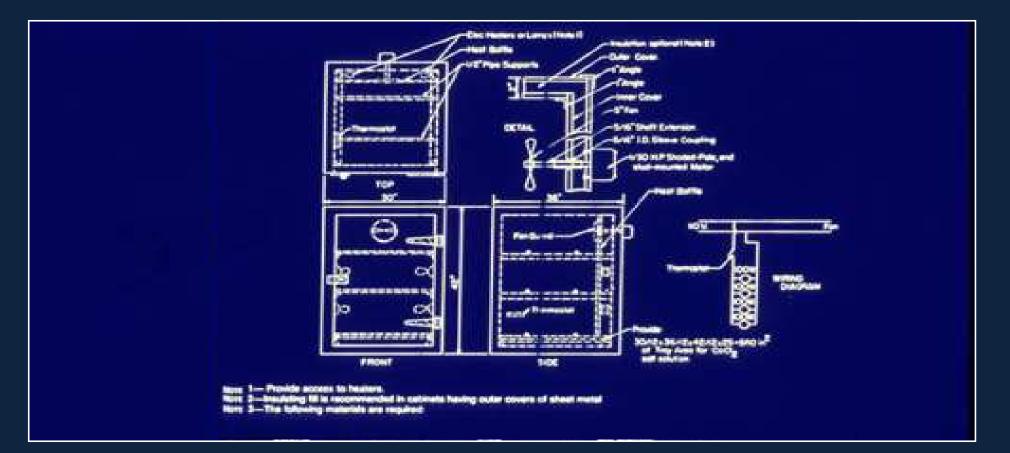
1.1 This test method covers a routine standardized procedure for determining the linear drying shrinkage of concrete masonry units or related concrete units under specified accelerated drying conditions.



ASTM C426-15 SHRINKAGE



ASTM C426-15 SHRINKAGE



ASTM C426-15 SHRINKAGE

ASTM C426-15 SHRINKAGE

CYCLE UNTIL EQUILIBRIUM

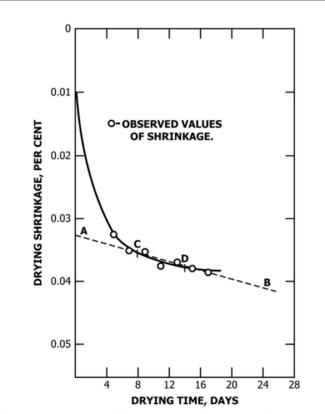
Shrinkage Equilibrium

Length change in six days of drying: 0.002 % or less

AND

Weight loss in 48 hours of drying: 0.2 % or less.

THE TEST NORMALLY TAKES ABOUT ONE MONTH.



NOTE 1—The interval *CD* is 6 days on the time scale and % shrinkage scale. Point *D* defines equilibrium shrinkage value FIG. 3 Graphical Method of Determining Equilibrium Shrin

WHAT IS A GOOD VALUE FOR "S", IN FLORIDA?

You may want to check with your concrete masonry producer, however, a good general value for S, (for normal weight units - 125 pounds per cubic foot or more, oven dry weight of concrete), is 0.032%

Example Coefficient of shrinkage for Type II masonry units:

k_m

HOW MUCH SHRINKAGE IN 100 FEET?

Potential linear shrinkage for Type II units for 100 linear feet of wall:

= 0.16% (100')(12") = 0.016% x 1200" = 0.92" = about 3/16" (3/16" = 0.1875) Provide for 3/16 inch of shrinkage in 100 ft.

NATIONAL

CONCRETE MASONRY ASSOCIATION

CONCRETE MASONRY TEK NOTES

NCMA TEK 1-4 - Glossary of Concrete Masonry Terms
NCMA TEK 2-5 - CMU Configurations
NCMA TEK 2-6 - Density-Related Properties
NCMA TEK 3-3 - Reinforced Concrete Masonry Construction
NCMA TEK 3-4 - Bracing
NCMA TEK 5-9 - CMU Corner Details
NCMA TEK 6-2 - R-Values for Single Wythe Concrete Masonry Walls
NCMA TEK 6-11 - Insulating CMU Walls
NCMA TEK 7-1 - Fire Resistance of Concrete Masonry Assemblies
NCMA TEK 8-2 - Removal of Stains from Concrete Masonry

NCMA TEK 13-1 - Sound Transmission Class Ratings for CMU Walls

SUMMARY

ASTM C90 - STANDARD SPECIFICATION FOR LOADBEARING CONCRETE MASONRY UNITS

- Limited material sources
- Do not specify Type
- Do not specify Grade
- Web requirement changed in C90-14
- Compressive strength requirement changed from 1,900 psi to 2,000-psi in C90-14.
- Dimensional tolerance is ±1/8"
- 5% of shipment allowed to have imperfections



SUMMARY

ASTM C140 - STANDARD TEST METHODS FOR SAMPLING AND TESTING CONCRETE MASONRY UNITS AND RELATED UNITS

Net area is calculated Equivalent thickness is calculated Gross area of an 8" by 8" by 16 CMU is ~119 in²

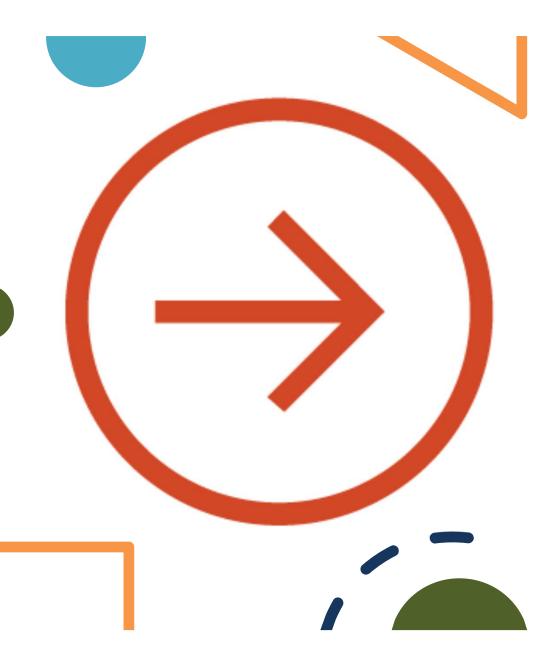
MSJC

Table 2.1 changed in -13

FIRE RATING

"UL block" is not produced in Florida Use FBC Table 722.2.3





Questions?