

MASONRY

Association

of Florida



# Masonry is a Proud Profession

COMPONENT 4



# Jerry Painter, FASTM

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Jerry Painter, is the principle of Jerry Painter Masonry Consulting, LLC. He serves on the Board of the Masonry Association of Florida and is a Past Chairman of MAF. Mr. Painter is a member of ASTM committees C12, C15, C27, E06 and E54. He is the immediate past chair of committee C12 (Mortars and Grouts) and subcommittee C15.05 (Masonry Assemblies) as well as a Board member of C15 (Masonry Units). Mr. Painter is the immediate Past President of The Masonry Society and is on the TMS 402/602 committee (previously known as MSJC). He is a member of Mason Contractors of America Association and is chair of the Technical Committee. Mr. Painter is a nationally recognized masonry industry speaker, seminar instructor and columnist.



**MASONRY  
WORKSHOP  
Component 4**

**WHAT IS THE  
ROLE OF THE  
MASON?**

# COMPONENTS OF THE MASONRY SYSTEM



DESIGN



MATERIALS



INSTALLATION

# THEREFORE

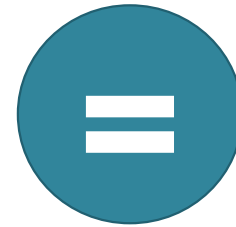
Perfect Design



Perfect Materials



Perfect Installation



Perfect  
MASONRY

**WRONG!**



**Perfection is  
an imperfect  
expectation!**

# IN REALITY

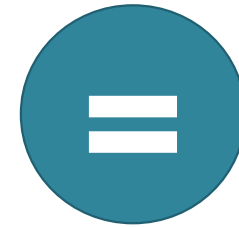
Quality Design



Quality Material



Quality Installation



**A Quality  
Masonry  
System**



# WHAT IS GOOD MASONRY?

- ✓ **Looks Good**
- ✓ **Functional**
- ✓ **Economical**
- ✓ **Durable**

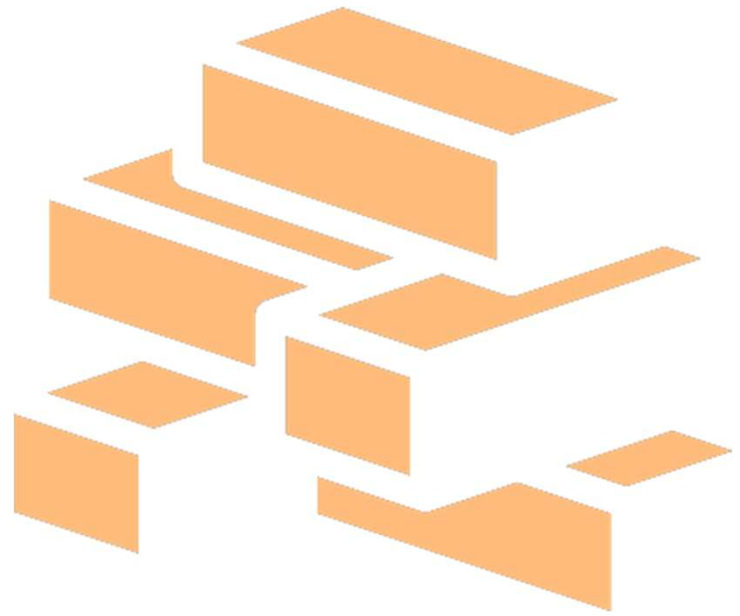


# MASONRY MORASS

**“More than 100 discrete architectural decisions with more than 1,000 options are necessary to design a simple masonry cavity wall, If stainless steel ties are required for stone, why not for brick? If the architect doesn’t know, he can hire one of 50 or more former bricklayers, died-again contractors, struggling architects, hired-gun engineers, and assorted chemists, ceramists, and petrographers all of whom call themselves masonry experts.”**

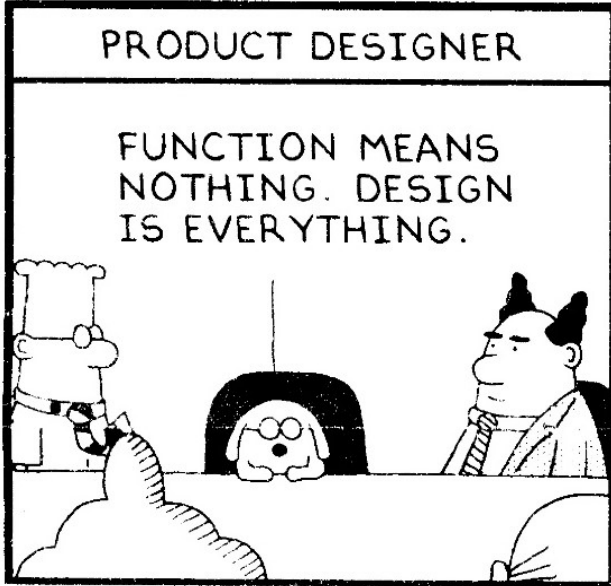
**-Clayford T. Grimm, P.E., Austin Texas**

**FORM  
FOLLOWS  
FUNCTION**



DILBERT

Scott Adams





# Designing for constructability

Don't jeopardize a building's structural integrity: Consider the shape and nature of masonry materials and accessories, the placement of openings, and current construction practices

By Carolyn Schierhorn

**W**hen architects and engineers lack practical knowledge of masonry construction, their designs that look great on paper may be unworkable in the field. Similarly, when masons don't appreciate the engineering and aesthetic considerations involved in a design, they may improvise, unwittingly

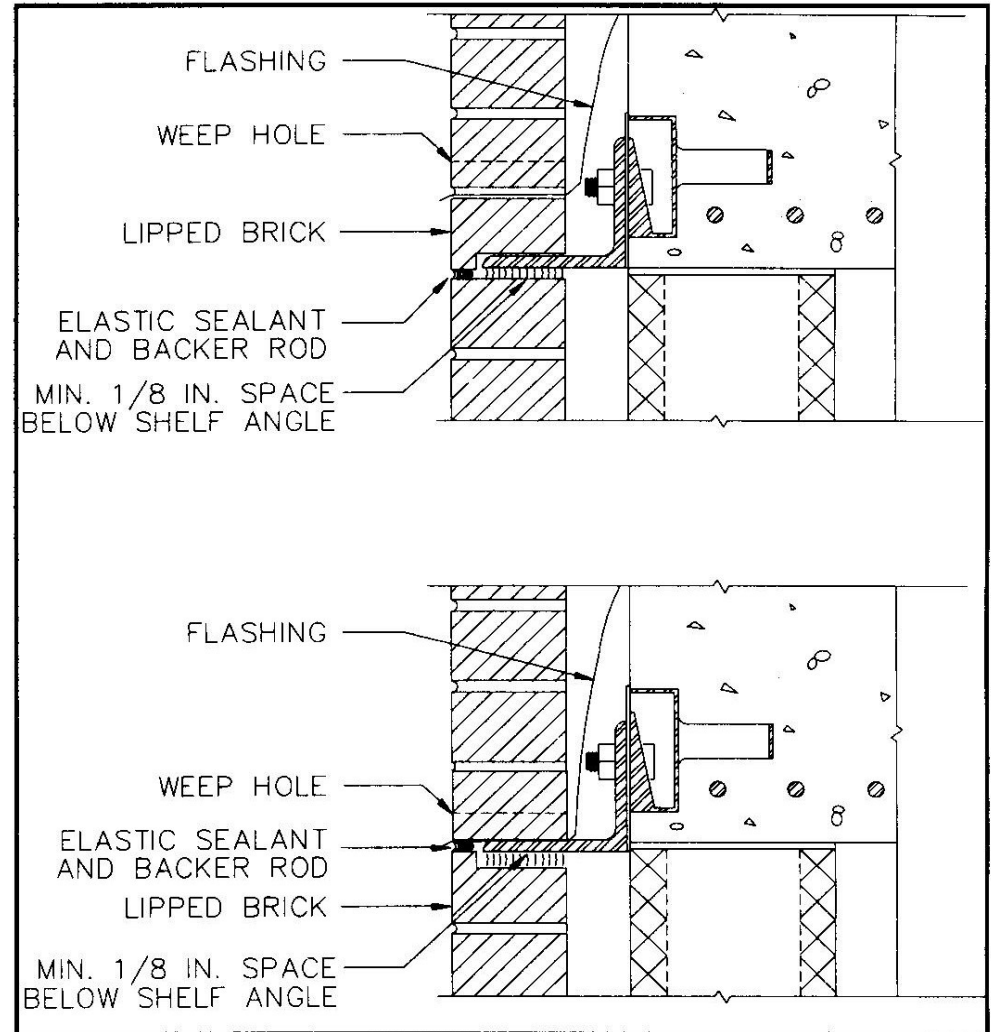
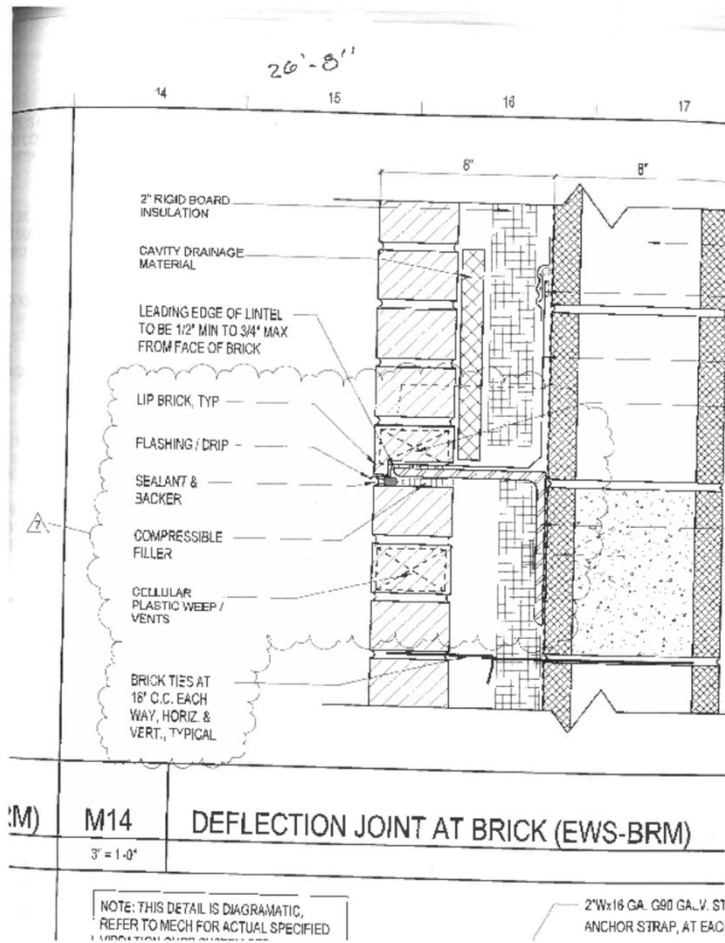
compromising a building's structural integrity.

If architects don't inspect their work in progress, completed buildings not only may bear little resemblance to their plans, but also may develop serious performance problems over time.

It's unrealistic to expect architects, engineers, masonry contrac-

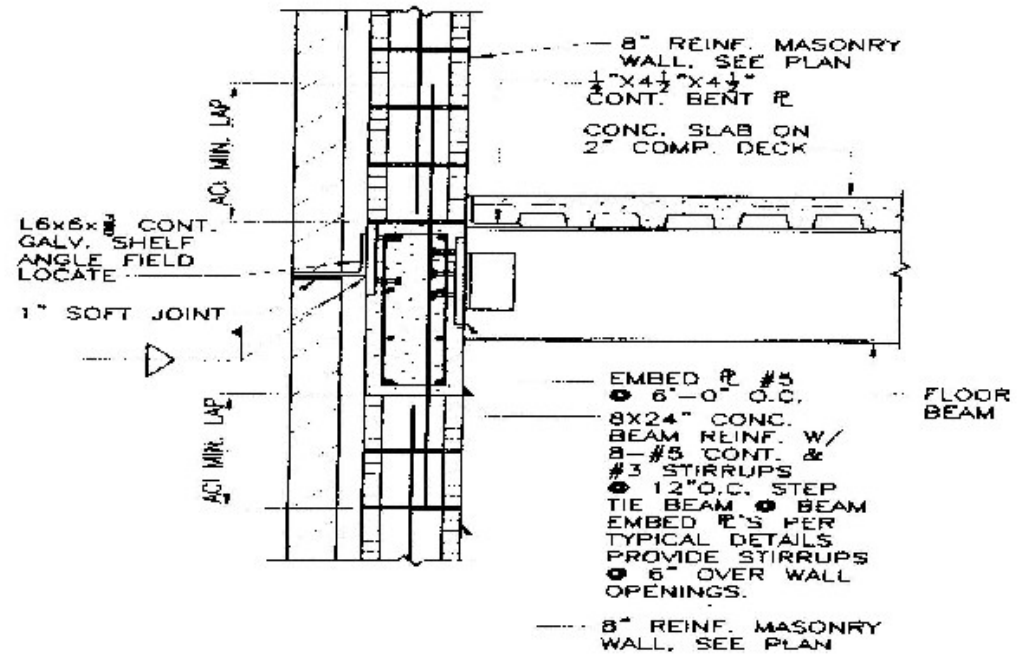


The plans call for continuous reinforcement 4 feet on center, which may not be practicable on walls with windows. Note how masons bent the rebar and changed spacing at openings.



**Figure 2.**

# NEED A TITLE





**TMS**  
**402/602**





# TMS 402/602

## 3.2 – Construction Considerations

### 3.2.1 *Grouting, minimum spaces*

The minimum dimensions of spaces provided for the placement of grout shall be in accordance with Table 3.2.1. Grout pours with heights exceeding those shown in Table 3.2.1, cavity widths, or cell sizes smaller than those permitted in Table 3.2.1 or grout lift heights exceeding those permitted by Article 3.5 D of TMS 602/ACI 530.1/ASCE 6 are permitted if the results of a grout demonstration panel show that the grout spaces are filled and adequately consolidated. In that case, the procedures used in constructing the grout demonstration panel shall be the minimum acceptable standard for grouting, and the quality assurance program shall include inspection during construction to verify grout placement.



## TMS 402/602

# 3.2 – Construction Considerations

### *3.2.2 Embedded conduits, pipes, and sleeves*

Conduits, pipes, and sleeves of any material to be embedded in masonry shall be compatible with masonry and shall comply with the following requirements.

**3.2.2.1** Conduits, pipes, and sleeves shall not be considered to be structural replacements for the displaced masonry. The masonry design shall consider the structural effects of this displaced masonry.



## TMS 402/602

### 3.2 – Construction Considerations

**3.2.2.2** Conduits, pipes, and sleeves in masonry shall be no closer than 3 diameters on center. Minimum spacing of conduits, pipes or sleeves of different diameters shall be determined using the larger diameter.

**3.2.2.3** Vertical conduits, pipes, or sleeves placed in masonry columns or pilasters shall not displace more than 2 percent of the net cross section.

**3.2.2.4** Pipes shall not be embedded in masonry, unless properly isolated from the masonry, when:

(a) Containing liquid, gas, or vapors at temperature higher than 150° F (66°C).

(b) Under pressure in excess of 55 psi (379 kPa).

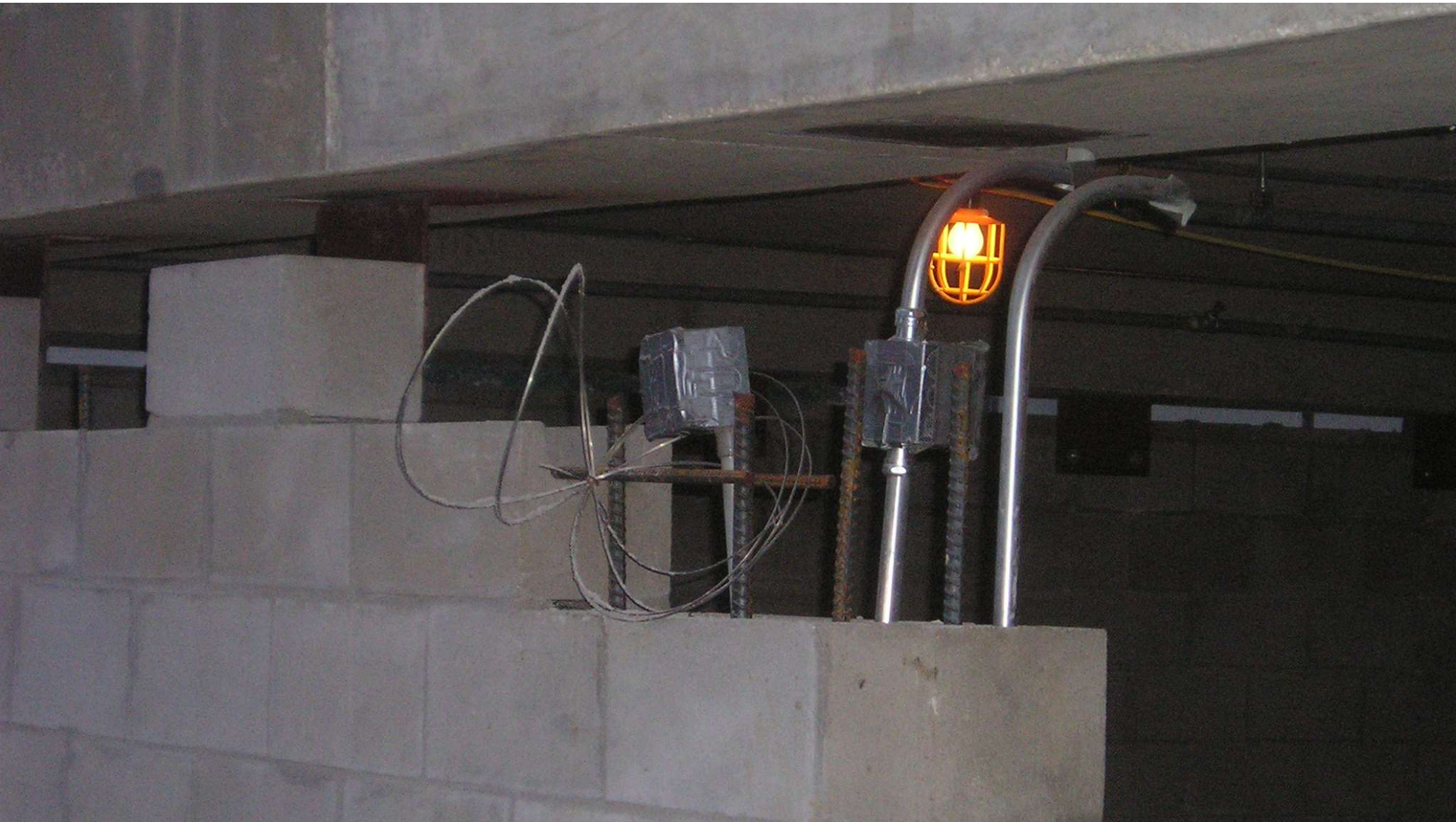
(c) Containing water or other liquids subject to freezing.



**How do you fit  
10lbs. of sugar  
in a 5 lb. bag???**


















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**GET YOUR  
\*#@%^!?!@#%&\*  
STUFF OUT OF  
MY WALL!!!**

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**MANDATORY REQUIREMENTS CHECKLIST (Continued)**


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Section/Part/Article	Notes to the Architect/Engineer
2.4 H     Prestressing anchorages, couplers, and end blocks	Specify the anchorages and couplers and their corrosion protection.
2.5 E     Joint fillers	Specify size and shape of joint fillers.
2.7 B     Prefabricated masonry	Specify prefabricated masonry and requirements in supplement of those of ASTM C901.
<b><u>PART 3 — EXECUTION</u></b>	
3.3 D.2-4     Pipes and conduits	Specify sleeve sizes and spacing.
3.3 D.5     Accessories	Specify accessories not indicated on the project drawings.
3.3 D.6     Movement joints	Indicate type and location of movement joints on the project drawings.
3.4 B.11     Placement tolerances	Indicate <i>d</i> distance for beams on drawings or as a schedule in the project specifications.
3.4 E     Veneer anchors	Specify type of anchor required.



ELIMINATE MASONRY CRACKS:  
WEAR SUSPENDERS



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**OPTIONAL REQUIREMENTS CHECKLIST**


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Section/Part/Article	Notes to the Architect/Engineer
<b><u>PART 1 — GENERAL</u></b>	
1.5 B	Specify additional required submittals.
1.6      Quality assurance	Define who will retain the Testing Agency and Inspection Agency, if other than the Owner.
<b><u>PART 2 — PRODUCTS</u></b>	
2.2	Specify grout requirements at variance with TMS 602/ACI 530.1/ASCE 6. Specify admixtures.
2.5 A      Movement joint and 2.5 B	Specify requirements at variance with TMS 602/ACI 530.1/ASCE 6.
2.5 D      Masonry cleaner	Specify where acid or caustic solutions are allowed and how to neutralize them.
2.6 A      Mortar	Specify if hand mixing is allowed and the method of measurement of material.
2.6 B.2      Grout consistency	Specify requirements at variance with TMS 602/ACI 530.1/ASCE 6

**PART 3 — EXECUTION**

3.2 C	Wetting masonry units	Specify when units are to be wetted.
3.3 A	Bond pattern	Specify bond pattern if not running bond.
3.3 B.2	Bed and head joints	Specify thickness and tooling differing from TMS 602/ACI 530.1/ASCE 6.
3.3 B.3	Collar joints	Specify the filling of collar joints less than $\frac{3}{4}$ in. (19.1 mm) thick differing from TMS 602/ACI 530.1/ASCE 6.
3.3 B.4	Hollow units	Specify when cross webs are to be mortar bedded.
3.3 B.5	Solid units	Specify mortar bedding at variance with TMS 602/ACI 530.1/ASCE 6.
3.3 B.7	Glass units	Specify mortar bedding at variance with TMS 602/ACI 530.1/ASCE 6.
3.3 B.9.b	AAC Masonry	Specify when mortar may be omitted from AAC running bond masonry head joints that are less than 8 in. (200 mm) (nominal) tall.
3.3 D.2	Embedded items and accessories	Specify locations where sleeves are required for pipes or conduits.
3.4 B.10	Joint reinforcement	When joint reinforcement is used as shear reinforcement, specify a lap length of $48d_b$ instead of 6 inches.
3.4 C.2, 3, and 4		Specify requirements at variance with TMS 602/ACI 530.1/ASCE 6.



# Specifications for Masonry Structures and Commentary

**3.5 G.** *Alternate grout placement* — Place masonry units and grout using construction procedures employed in the accepted grout demonstration panel.



# Specifications for Masonry Structures and Commentary

## 3.1 — Inspection

3.1 A. Prior to the start of masonry construction, the Contractor shall verify:

1. That foundations are constructed within a level alignment tolerance of  $\pm 1/2$  in. (12.7 mm).
2. That reinforcing dowels are positioned in accordance with the Project Drawings.

3.1 B. If stated conditions are not met, notify the Architect/Engineer.





## **S57 - BED JOINTS AT FOUNDATIONS**

In the starting course on foundations and other supporting members, construct bed joints so that the bed joint thickness is at least  $\frac{1}{4}$ in. (6.4 mm) and not more than:

- $\frac{3}{4}$  in. (19.1 mm) when the masonry is ungrouted or partially grouted.
- $1\frac{1}{4}$  in. (31.8 mm) when the first course of masonry is solid grouted and supported by a concrete foundation.

J2

Format

JerryPainter, 9/15/2014











### ASTM C15.05.07 - Tolerances

Location	MSJC	CMS	Master Spec	Proposed ASTM Standard	Proposed ASTM Precision	BIA
Ext. Corners & Consp. Lines & Levels	$\pm 1/4''/10'$ $\pm 1/2''$ max	$\pm 1/2''$	$\pm 1/4''/20'$ $\pm 1/2''$ max	$\pm 3/8''$	$\pm 1/4''$	$\pm 1/4''/10'$ $\pm 3/8''/20'$ $\pm 1/2''$
Centerline of Sealant Jt.				$\pm 1/2''$	$\pm 3/8''$	
Cross-Section Dimension	$-1/4''$ to $+1/2''$	$-1/4''$ to $+1/2''$		$-3/8''$ to $+1/2''$	$-1/4''$ to $+3/8''$	
Adjacent Unit Faces in Plane				$\pm 1/8''$	$\pm 1/16''$	
Mortar Jt(Bed) Thickness	$\pm 1/8''$	$\pm 1/8''$	$\pm 1/8'' / 1/2''$ max	$-1/8''$ to $+1/4''$	$\pm 1/8''$	$\pm 1/8''$
Mortar Jt(Head) Thickness	$-1/4''$ to $+3/8''$	$\pm 1/8''$	$\pm 1/8''$	$-1/4''$ to $+3/8''$	$-1/8''$ to $+1/4''$	$-1/4''$ to $+3/8''$
Corresp. Head Jt. Not Stack Bond		$\pm 1/2''$		$\pm 5/8''$	$\pm 3/8''$	
Vert. Alignment Not to Exceed 30'0"			$\pm 1/4''/10'$ $\pm 1/2''$ max	$\pm 2''$	$\pm 1''$	
Corresp. Head Jt. Stack Bond				$\pm 1/8''$	$\pm 1/16''$	
Vert. Alignment Stack Bond 30'0"				$\pm 1''$	$\pm 1/2''$	

A photograph of a brick wall with a single yellow brick highlighted. The wall is made of dark brown and reddish-brown bricks with visible mortar joints. The lighting is dramatic, with the left side in shadow and the right side brightly lit. A single brick in the middle row is painted a bright yellow, standing out from the rest of the wall. On the left side of the image, there is a dark blue vertical bar containing a small green horizontal line at the top and the text 'MASONRY TOLERANCES' in white, bold, sans-serif font. A thin white horizontal line is positioned below the text.

# MASONRY TOLERANCES

## **A. Dimensions and Locations of Elements**

1. For dimensions in cross section or elevation, do not vary by more than plus  $1/2$  inch or minus  $1/4$  inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus  $1/2$  inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus  $1/4$  inch in a story height or  $1/2$  inch total.

## B. Lines and Levels

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.



## **B. Lines and Levels (continued)**

1. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
2. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
3. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

## C. Joints

1. For bed joints, do not vary from thickness indicated by more than plus or minus  $1/8$  inch, with a maximum thickness limited to  $1/2$  inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than  $1/8$  inch.
3. For collar joints, do not vary from thickness indicated by more than plus  $3/8$  inch or minus  $1/4$  inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus  $1/8$  inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than  $1/16$  inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than  $1/16$  inch from one masonry unit to the next.

A photograph of a brick wall with a single yellow brick highlighted. The wall is made of dark brown bricks with light-colored mortar. The yellow brick is located in the middle-right section of the wall. The left side of the image is a dark blue gradient with white text and a white underline.

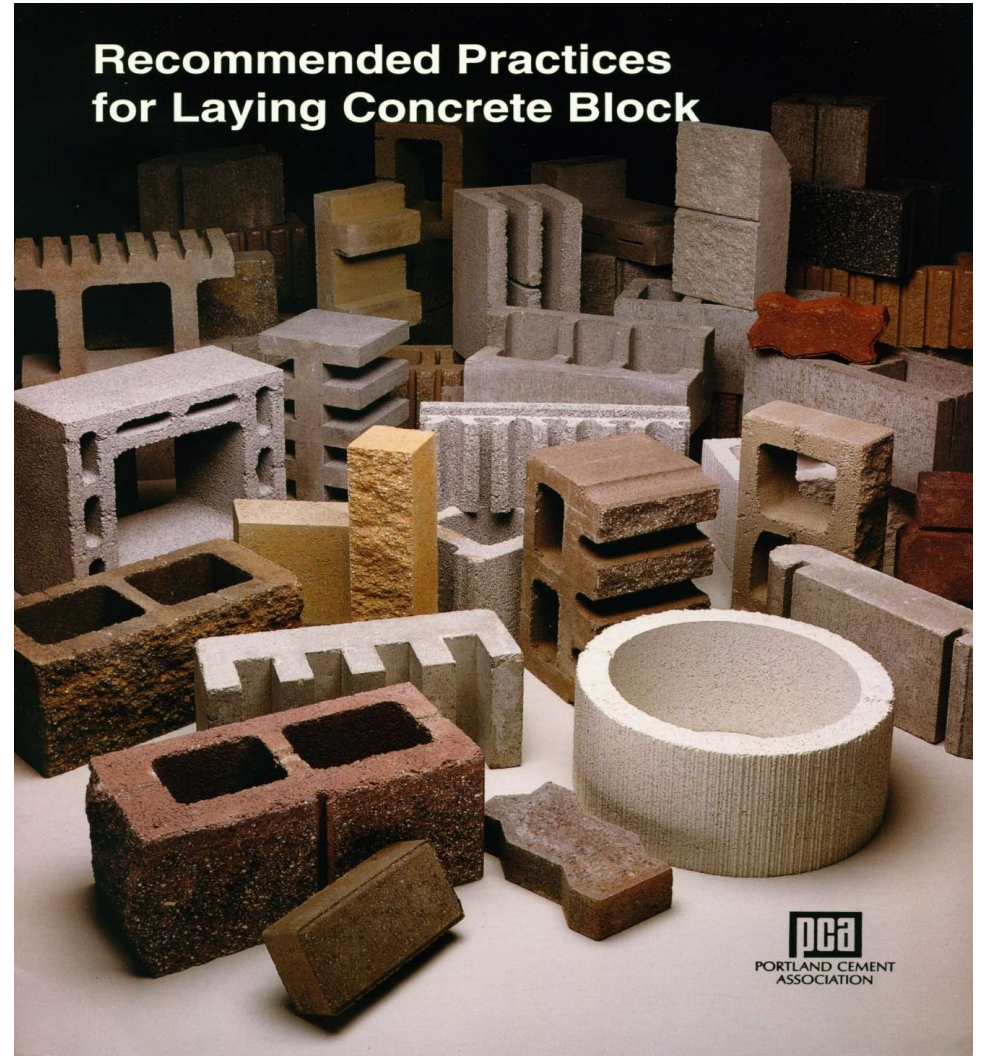
# MASONRY TOLERANCES

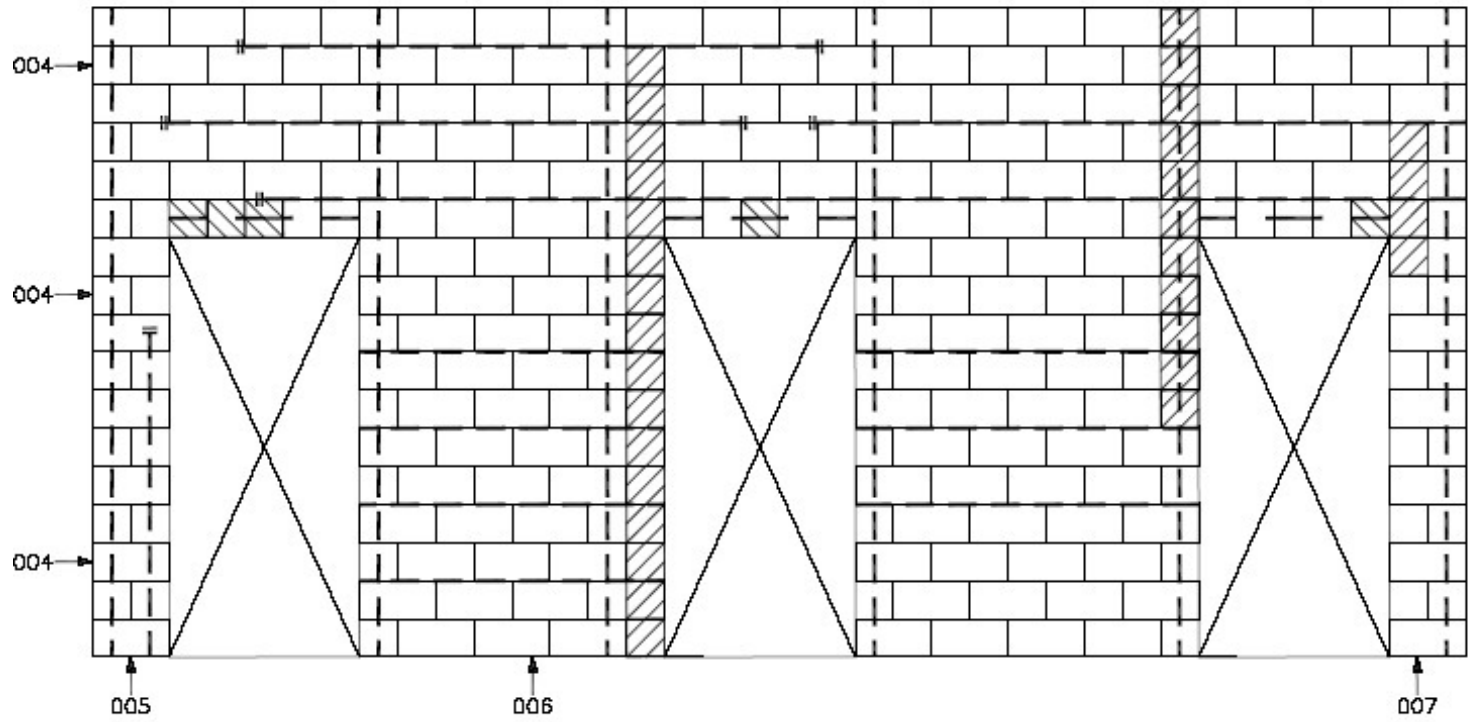
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America's Cement Manufacturers™

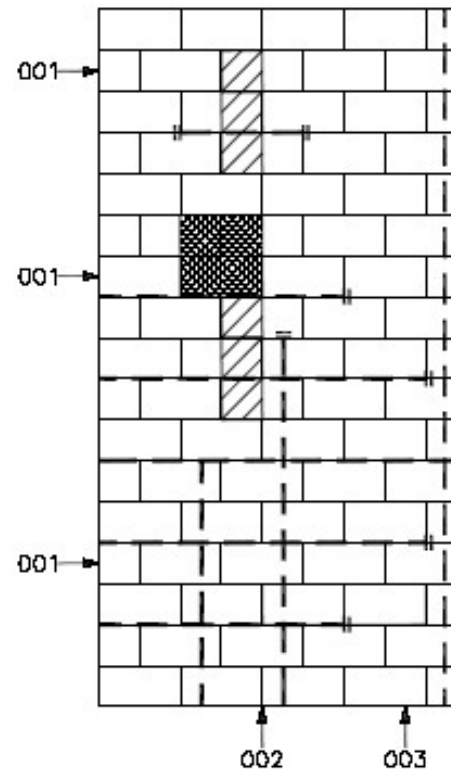
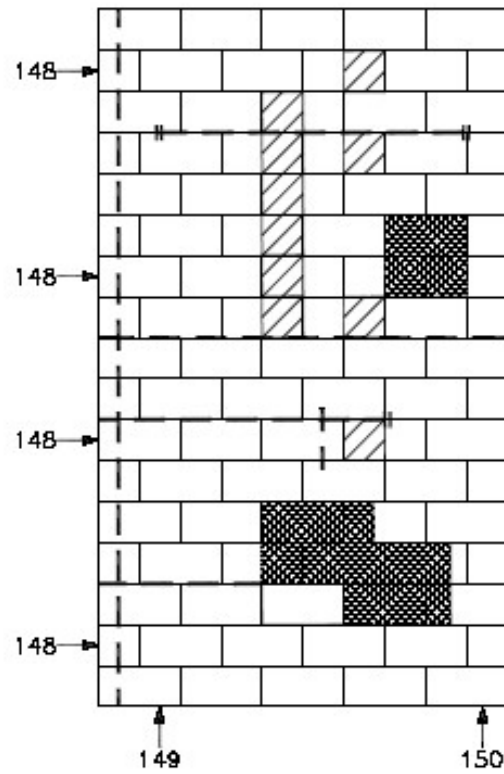
## Recommended Practices for Laying Concrete Block





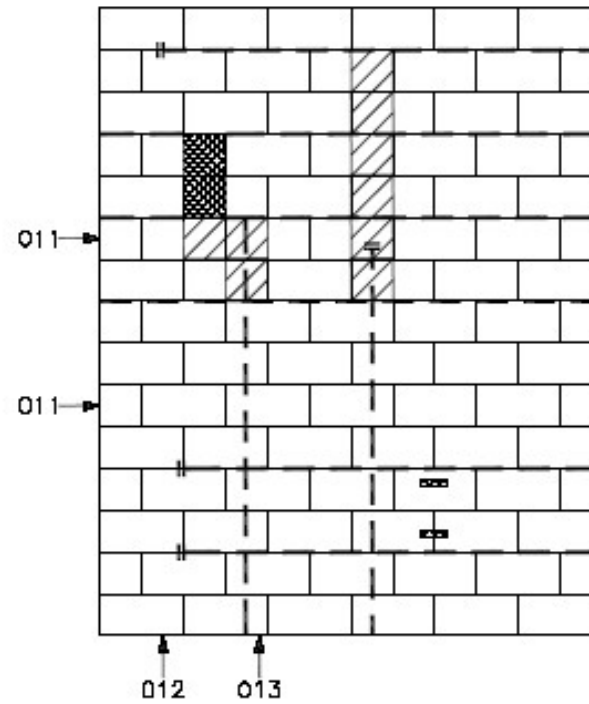
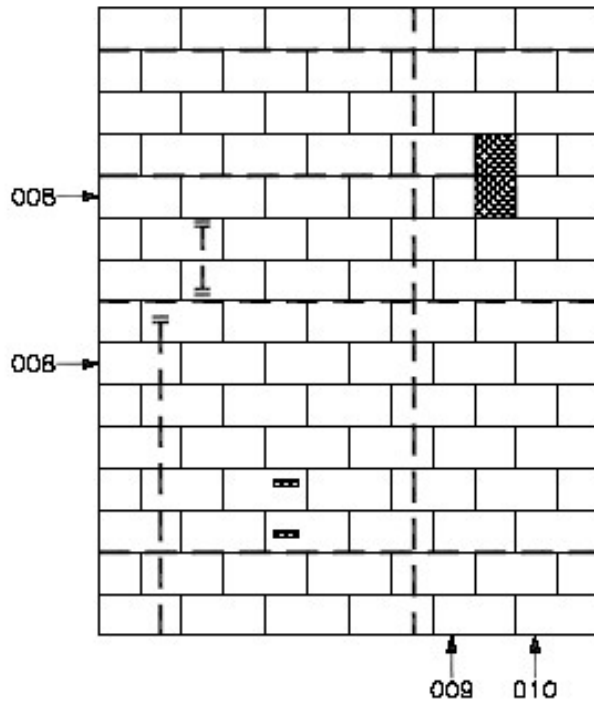
KEY

	VERTICAL REINFORCEMENT		GROUT VOID IN VERTICAL REINF.	X HATCHING REPRESENTS AN OBSTRUCTION THAT ALLOWED FOR LIMITED INVESTIGATION ACCESS. OBSTRUCTIONS INCLUDE; SIGNS, DOWNSPOUTS, CONDUIT, ETC.
	BOND BEAM REINFORCEMENT		GROUT VOID IN BOND BEAM REINF.	
	HORIZONTAL JOINT REINFORCEMENT	001 →	HORIZONTAL RADAR SCAN	
	VERTICAL REINF. TERMINATION	↑ 001	VERTICAL RADAR SCAN	
	HORIZONTAL REINF. TERMINATION	⊕ 3.5"	VERTICAL REINF. DEPTH	














### KEY

	VERTICAL REINFORCEMENT		GROUT VOID IN VERTICAL REINF.	X HATCHING REPRESENTS AN OBSTRUCTION THAT ALLOWED FOR LIMITED INVESTIGATION ACCESS. OBSTRUCTIONS INCLUDE; SIGNS, DOWNSPOUTS, CONDUIT, ETC.
	BOND BEAM REINFORCEMENT		GROUT VOID IN BOND BEAM REINF.	
	HORIZONTAL JOINT REINFORCEMENT	001 →	HORIZONTAL RADAR SCAN	
=	VERTICAL REINF. TERMINATION	↑ 001	VERTICAL RADAR SCAN	
	HORIZONTAL REINF. TERMINATION	⊕ 3.5'	VERTICAL REINF. DEPTH	



### KEY

	VERTICAL REINF.		GROUT VOID IN VERTICAL REINF.	 X HATCHING REPRESENTS AN OBSTRUCTION THAT ALLOWED FOR LIMITED INVESTIGATION ACCESS. OBSTRUCTIONS INCLUDE; SIGNS, DOWNSPOUTS, CONDUIT, ETC.
	BOND BEAM REINFORCEMENT		GROUT VOID IN BOND BEAM REINF.	
	HORIZONTAL JOINT REINFORCEMENT		HORIZONTAL RADAR SCAN	
	VERTICAL REINF. TERMINATION		VERTICAL RADAR SCAN	
	HORIZONTAL REINF. TERMINATION		VERTICAL REINF. DEPTH	

**TMS**  
**402/602**







# TMS 402/602 Code & Commentary C-192

## **12.2.2.6** *Masonry veneer anchored to wood backing*

**12.2.2.6.1** Veneer shall be attached with any anchor permitted in Section 12.2.2.5.

**12.2.2.6.2** Attach each anchor to wood studs or wood framing with a corrosion-resistant 8d common nail, or with a fastener having equivalent or greater pullout strength. For corrugated sheet-metal anchors, locate the nail or fastener within 1/2 in. (12.7 mm) of the 90-degree bend in the anchor.



# TMS 402/602 Code & Commentary C-192

**12.2.2.6.3** When corrugated sheet metal anchors are used, a maximum distance between the inside face of the veneer and outside face of the solid sheathing of 1 in. (25.4 mm) shall be specified. When other anchors are used, a maximum distance between the inside face of the veneer and the wood stud or wood framing of 4½ in. (114 mm) shall be specified. A 1-in. (25.4-mm) minimum air space shall be specified.



# TMS 402/602 Code & Commentary C-192

## *12.2.2.7 Masonry veneer anchored to steel backing*

**12.2.2.7.1** Attach veneer with adjustable anchors.

**12.2.2.7.2** Attach each anchor to steel framing with at least a No. 10 corrosion-resistant screw (nominal shank diameter of 0.190 in. (4.8 mm)), or with a fastener having equivalent or greater pullout strength.

**12.2.2.7.3** Cold-formed steel framing shall be corrosion resistant and have a minimum base metal thickness of 0.043 in. (1.1 mm).

**12.2.2.7.4** A 4½ in. (114-mm) maximum distance between the inside face of the veneer and the steel framing shall be specified. A 1 in. (25.4 mm) minimum air space shall be specified.



# TMS 402/602 Code & Commentary C-192

## **12.2.2.8** *Masonry veneer anchored to masonry or concrete backing*

**12.2.2.8.1** Attach veneer to masonry backing with wire anchors, adjustable anchors, or joint reinforcement. Attach veneer to concrete backing with adjustable anchors.

**12.2.2.8.2** A 4½ in. (114-mm) maximum distance between the inside face of the veneer and the outside face of the masonry or concrete backing shall be specified. A 1 in. (25.4 mm) minimum air space shall be specified.



# TMS 402/602 Code & Commentary C-192

## 12.2.2.9 *Veneer not laid in running bond* —

Anchored veneer not laid in running bond shall have joint reinforcement of at least one wire, of size W1.7 (MW11), spaced at a maximum of 18 in. (457 mm) on center vertically.







E-mail: BobThaves@aol.com  
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www.comics.com

6-12  
THAVES



D&#%  
Who slammed  
the  
Door???







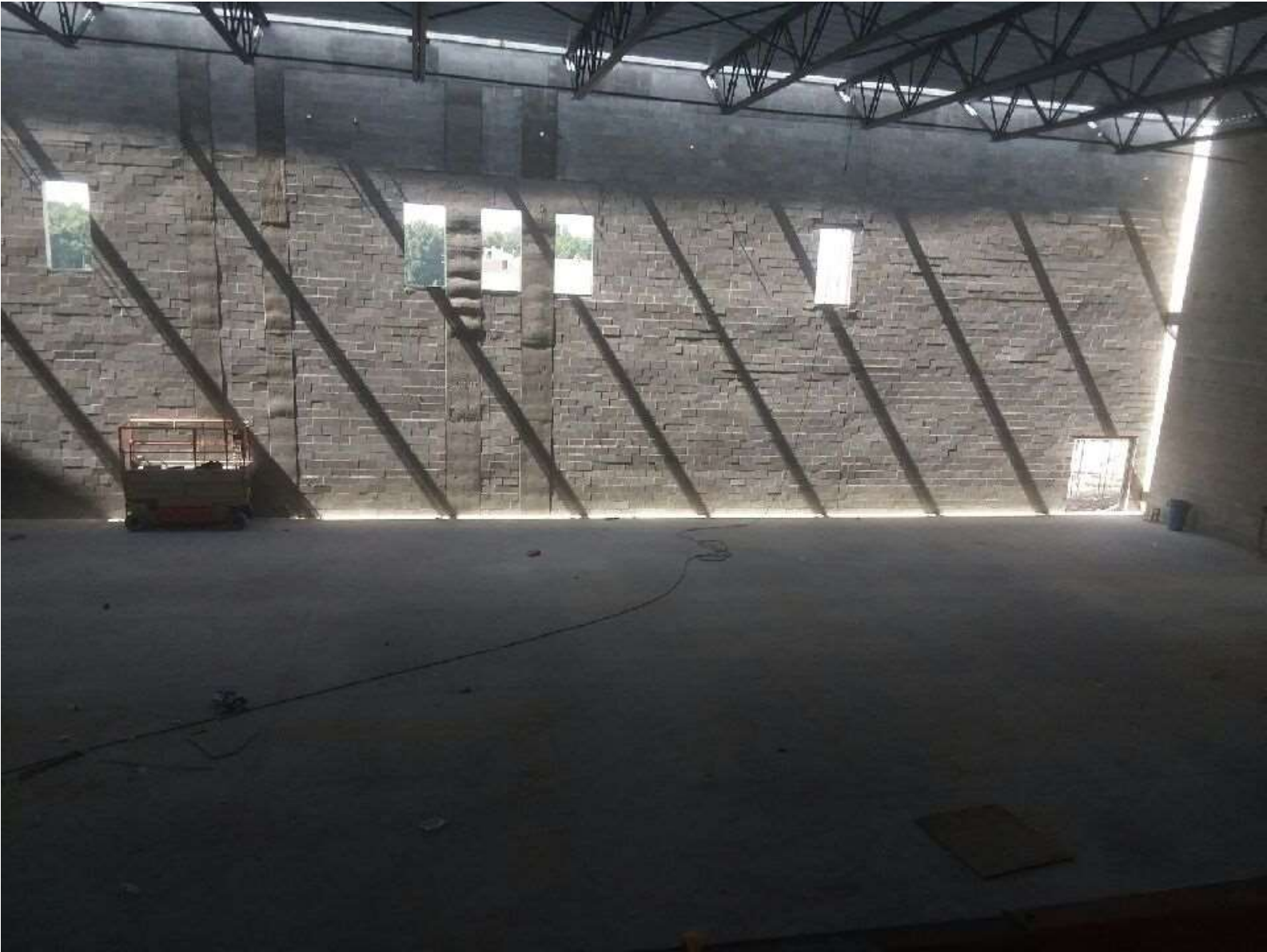




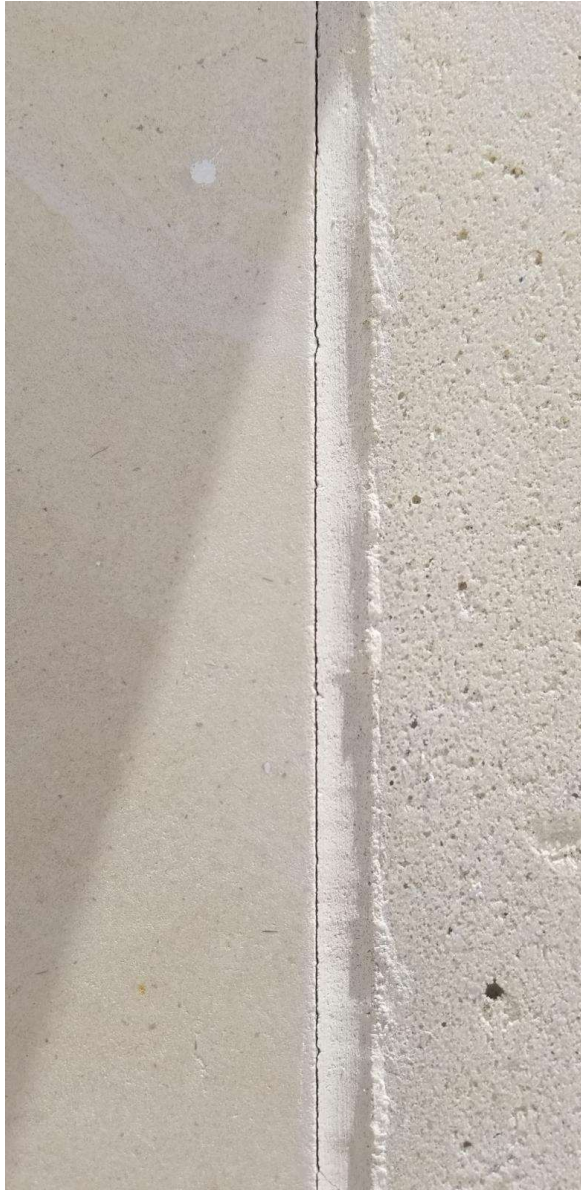
# Quality Assurance

Inspection, if done by knowledgeable inspectors with good judgment and an understanding of the masonry system is good for the mason and the mason contractor.

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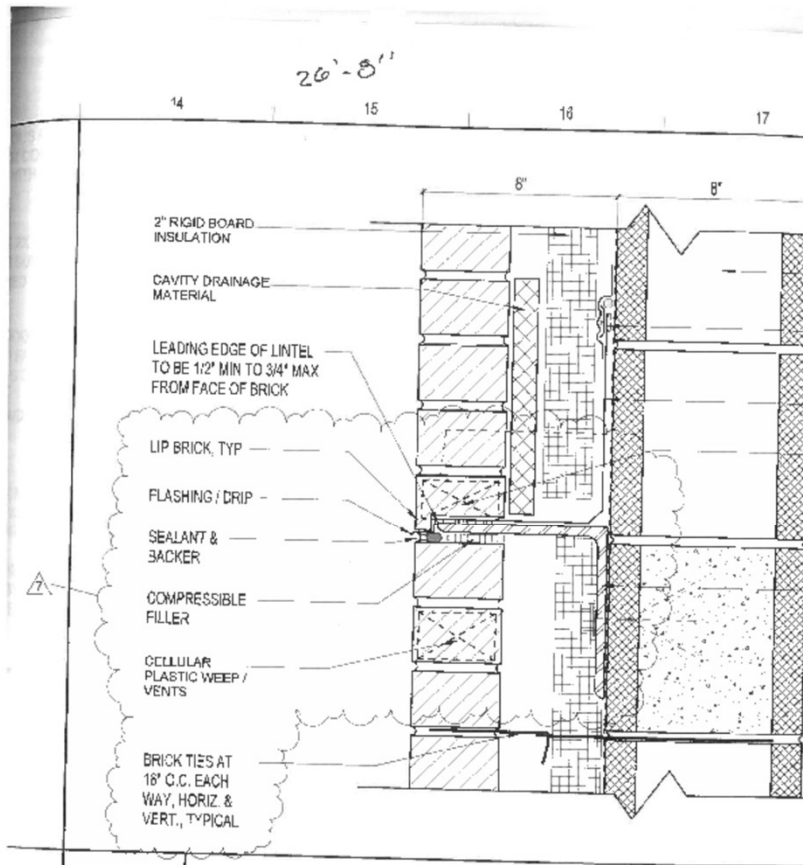












(M)

M14

DEFLECTION JOINT AT BRICK (EWS-BRM)

3" = 1'-0"

NOTE: THIS DETAIL IS DIAGRAMATIC,  
REFER TO MECH FOR ACTUAL SPECIFIED

2"Wx16 GA. G90 GALV. ST  
ANCHOR STRAP, AT EAC





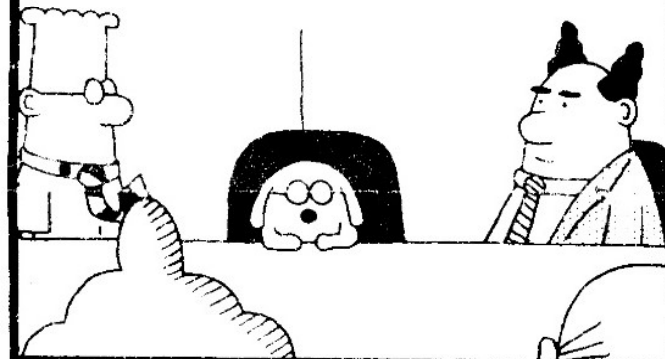






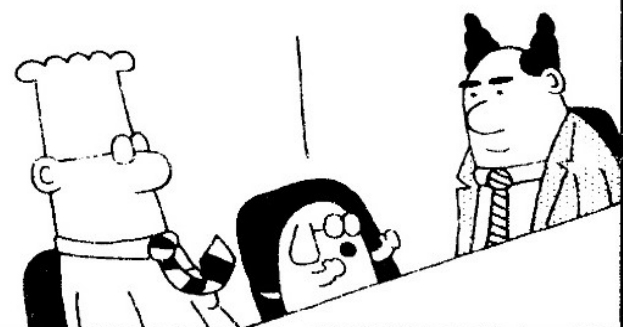
PRODUCT DESIGNER

FUNCTION MEANS NOTHING. DESIGN IS EVERYTHING.



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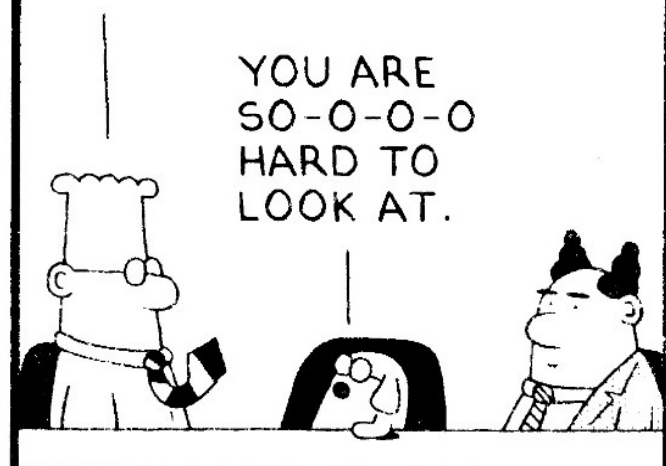
QUALITY IS YESTER-DAY'S NEWS. TODAY WE FOCUS ON THE EMOTIONAL IMPACT OF THE PRODUCT.



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BUT IT STILL NEEDS QUALITY, RIGHT?

YOU ARE SO-O-O-O HARD TO LOOK AT.





# MSJC CODE TABLE 1.14.1.1-Level 1 QUALITY ASSURANCE

Minimum Tests and Submittals	Minimum Inspection
Certificates for materials used in masonry construction indicating compliance with the contract documents	Verify compliance with the approved submittals

# MINIMUM TESTS

# MINIMUM SPECIAL INSPECTION

MINIMUM TESTS				
Verification of Slump flow and Visual Stability Index (VSI) as delivered to the project site in accordance with Article 1.5 B.1.b.3 for self-consolidating grout				
Verification of $f'_m$ and $f'_{AAC}$ in accordance with Article 1.4 B prior to construction, except where specifically exempted by the Code.				
MINIMUM SPECIAL INSPECTION				
Inspection Task	Frequency <sup>(a)</sup>		Reference for Criteria	
	Continuous	Periodic	TMS 402/ ACI 530/ ASCE 5	TMS 602/ ACI 530.1/ ASCE 6
1. Verify compliance with the approved submittals		X		Art. 1.5
2. As masonry construction begins, verify that the following are in compliance:				
a. Proportions of site-prepared mortar		X		Art. 2.1, 2.6 A
b. Construction of mortar joints		X		Art. 3.3 B
c. Grade and size of prestressing tendons and anchorages		X		Art. 2.4 B, 2.4 H
d. Location of reinforcement, connectors, and prestressing tendons and anchorages		X		Art. 3.4, 3.6 A
e. Prestressing technique		X		Art. 3.6 B
f. Properties of thin-bed mortar for AAC masonry	X <sup>(b)</sup>	X <sup>(c)</sup>		Art. 2.1 C
3. Prior to grouting, verify that the following are in compliance:				
a. Grout space		X		Art. 3.2 D, 3.2 F
b. Grade, type, and size of reinforcement and anchor bolts, and prestressing tendons and anchorages		X	Sec. 6.1	Art. 2.4, 3.4
c. Placement of reinforcement, connectors, and prestressing tendons and anchorages		X	Sec. 6.1, 6.2.1, 6.2.6, 6.2.7	Art. 3.2 E, 3.4, 3.6 A
d. Proportions of site-prepared grout and prestressing grout for bonded tendons		X		Art. 2.6 B, 2.4 G.1.b
e. Construction of mortar joints		X		Art. 3.3 B

MINIMUM SPECIAL INSPECTION				
Inspection Task	Frequency <sup>(a)</sup>		Reference for Criteria	
	Continuous	Periodic	TMS 402/ ACI 530/ ASCE 5	TMS 602/ ACI 530.1/ ASCE 6
4. Verify during construction:				
a. Size and location of structural elements		X		Art. 3.3 F
b. Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction		X	Sec. 1.2.1(e), 6.1.4.3, 6.2.1	
c. Welding of reinforcement	X		Sec.8.1.6.7.2, 9.3.3.4 (c), 11.3.3.4(b)	
d. Preparation, construction, and protection of masonry during cold weather (temperature below 40°F (4.4°C)) or hot weather (temperature above 90°F (32.2°C))		X		Art. 1.8 C, 1.8 D
e. Application and measurement of prestressing force	X			Art. 3.6 B
f. Placement of grout and prestressing grout for bonded tendons is in compliance	X			Art. 3.5, 3.6 C
g. Placement of AAC masonry units and construction of thin-bed mortar joints	X <sup>(b)</sup>	X <sup>(c)</sup>		Art. 3.3 B.9, 3.3 F.1.b
5. Observe preparation of grout specimens, mortar specimens, and/or prisms		X		Art. 1.4 B.2.a.3, 1.4 B.2.b.3, 1.4 B.2.c.3, 1.4 B.3, 1.4 B.4

(a) Frequency refers to the frequency of Special Inspection, which may be continuous during the task listed or periodic during the listed task, as defined in the table.

(b) Required for the first 5000 square feet (465 square meters) of AAC masonry.

(c) Required after the first 5000 square feet (465 square meters) of AAC masonry.

**Table 5 — Level C Quality Assurance**

<b>MINIMUM TESTS</b>				
Verification of $f'_m$ and $f'_{AAC}$ in accordance with Article 1.4 B prior to construction and for every 5,000 sq. ft (465 sq. m) during construction				
Verification of proportions of materials in premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout as delivered to the project site				
Verification of Slump flow and Visual Stability Index (VSI) as delivered to the project site in accordance with Article 1.5 B.1.b.3 for self-consolidating grout				
<b>MINIMUM SPECIAL INSPECTION</b>				
Inspection Task	Frequency <sup>(a)</sup>		Reference for Criteria	
	Continuous	Periodic	TMS 402/ ACI 530/ ASCE 5	TMS 602/ ACI 530.1/ ASCE 6
1. Verify compliance with the approved submittals		X		Art. 1.5
2. Verify that the following are in compliance:				
a. Proportions of site-mixed mortar, grout, and prestressing grout for bonded tendons		X		Art. 2.1, 2.6 A, 2.6 B, 2.6 C, 2.4 G.1.b
b. Grade, type, and size of reinforcement and anchor bolts, and prestressing tendons and anchorages		X	Sec. 6.1	Art. 2.4, 3.4
c. Placement of masonry units and construction of mortar joints		X		Art. 3.3 B
d. Placement of reinforcement, connectors, and prestressing tendons and anchorages	X		Sec. 6.1, 6.2.1, 6.2.6, 6.2.7	Art. 3.2 E, 3.4, 3.6 A
e. Grout space prior to grouting	X			Art. 3.2 D, 3.2 F
f. Placement of grout and prestressing grout for bonded tendons	X			Art. 3.5, 3.6 C
g. Size and location of structural elements		X		Art. 3.3 F

g. Size and location of structural elements		X		Art. 3.3 F
h. Type, size, and location of anchors including other details of anchorage of masonry to structural members, frames, or other construction	X		Sec. 1.2.1(e), 6.1.4.3, 6.2.1	
i. Welding of reinforcement	X		Sec. 8.1.6.7.2, 9.3.3.4 (c), 11.3.3.4(b)	
j. Preparation, construction, and protection of masonry during cold weather (temperature below 40°F (4.4°C)) or hot weather (temperature above 90°F (32.2°C))		X		Art. 1.8 C, 1.8 D
k. Application and measurement of prestressing force	X			Art. 3.6 B
l. Placement of AAC masonry units and construction of thin-bed mortar joints	X			Art. 3.3 B.9, 3.3 F.1.b
m. Properties of thin-bed mortar for AAC masonry	X			Art. 2.1 C.1
3. Observe preparation of grout specimens, mortar specimens, and/or prisms	X			Art. 1.4 B.2.a.3, 1.4 B.2.b.3, 1.4 B.2.c.3, 1.4 B.3, 1.4 B.4

(a) Frequency refers to the frequency of Special Inspection, which may be continuous during the task listed or periodic during the listed task, as defined in the table.

# ASTM C-1019


## Standard Test Method for Sampling and Testing Grout

### 1. Scope

1.1 This test method covers procedures for both field and laboratory sampling and compression testing of grout used in masonry construction.

Note 1—The testing agency performing this test method should be evaluated in accordance with Practice C 1093.

This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

 Designation: C1019 – 16

**Standard Test Method for Sampling and Testing Grout<sup>1</sup>**

This standard is issued under the fixed designation C1019; the number immediately following the designation indicates the year of original approval or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last approval. A superscript option (s) indicates an editorial change since the last revision or approval.

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

**1. Scope\***

1.1 This test method covers procedures for both field and laboratory sampling and compression testing of grout used in masonry construction. Grout for masonry is specified under Specification C476.

Norm 1—The testing agency performing this test method should be evaluated in accordance with Practice C1093.

1.2 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.

1.3 *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:*<sup>2</sup>

- C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens
- C143/C143M Test Method for Slump of Hydraulic-Cement Concrete
- C476 Specification for Grout for Masonry
- C511 Specification for Mixing Rooms, Moist Cabinets, Moist Rooms, and Water Storage Tanks Used in the Testing of Hydraulic Cements and Concretes
- C617 Practice for Capping Cylindrical Concrete Specimens
- C1064/C1064M Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
- C1093 Practice for Accreditation of Testing Agencies for Masonry

**3. Significance and Use**

3.1 Grout used in masonry is a fluid mixture of cementitious materials and aggregate with a high water content for ease of placement.

3.1.1 During construction, grout is placed within or between absorptive masonry units. Excess water must be removed from grout specimens in order to provide compressive strength test results more nearly indicative of the grout strength in the wall. In this test method, molds are made from masonry units having the same absorption and moisture content characteristics as those being used in the construction.

3.2 This test method is used to either help select grout proportions by comparing test values or as a quality control test for uniformity of grout preparation during construction.

3.3 The physical exposure condition and curing of the grout are not exactly reproduced, but this test method does subject the grout specimens to absorption conditions similar to those experienced by grout in the wall.

Norm 2—Test results of grout specimens taken from a wall should not be compared to test results obtained with this test method.

**4. Apparatus**

4.1 *Maximum-Minimum Thermometer.*

4.2 *Straightedge,* a steel straightedge not less than 6 in. (152.4 mm) long and not less than 1/8 in. (1.6 mm) in thickness.

4.3 *Tamping Rod,* a round, straight, steel rod with a diameter of 3/8 ± 1/16 in. (10 ± 2 mm) and a length of 12 ± 4 inches. (300 ± 100 millimetres). The rod shall have the tamping end or both ends rounded to a hemispherical tip of the same diameter as the rod.

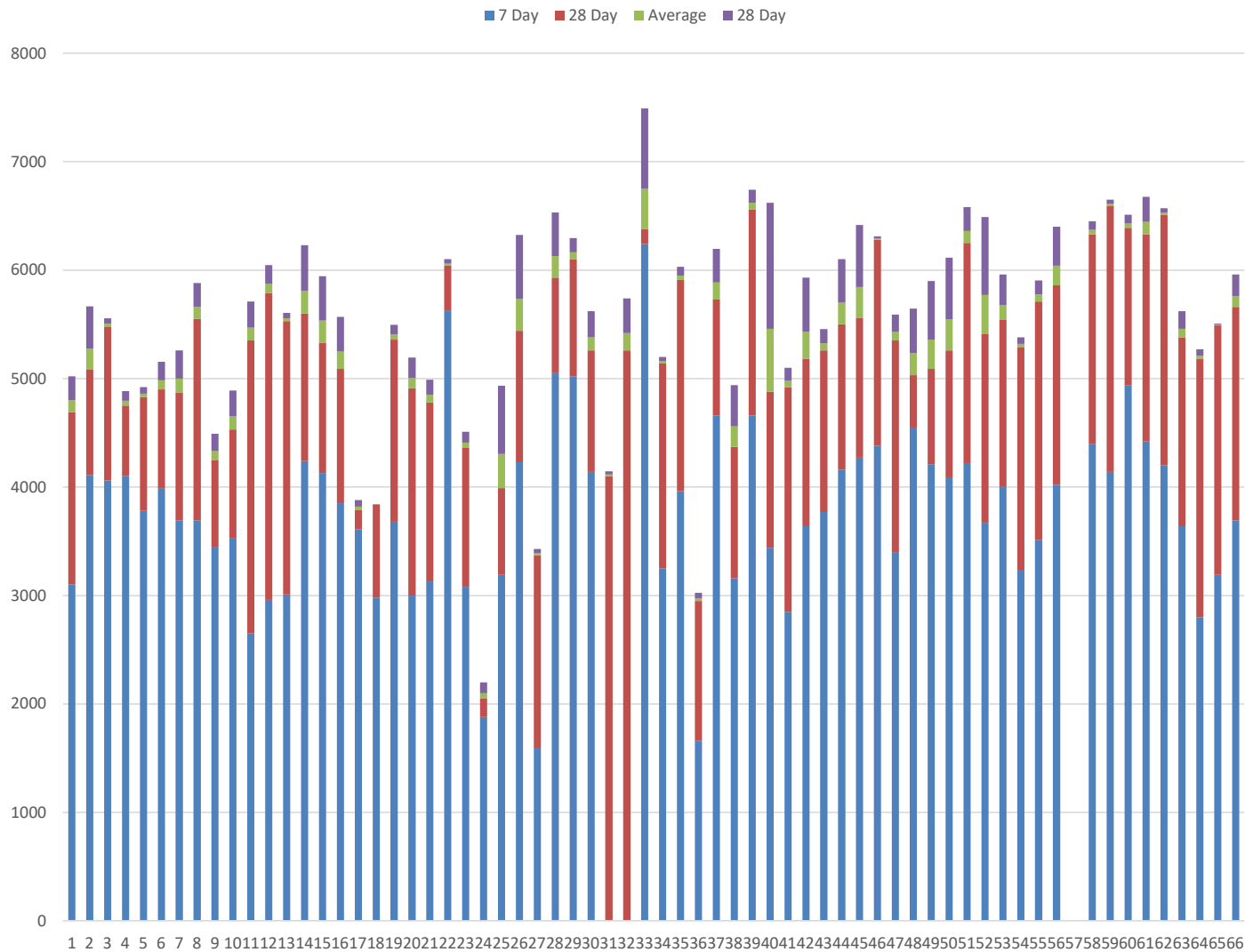
4.4 *Nonabsorbent Blocks and Spacers,* nonabsorbent, rigid squares and rectangles with side dimensions so as to achieve the desired grout specimen side dimensions and of sufficient quantity or thickness to yield the desired grout specimen height, as shown in Fig. 1, Fig. 2, and Fig. 3.

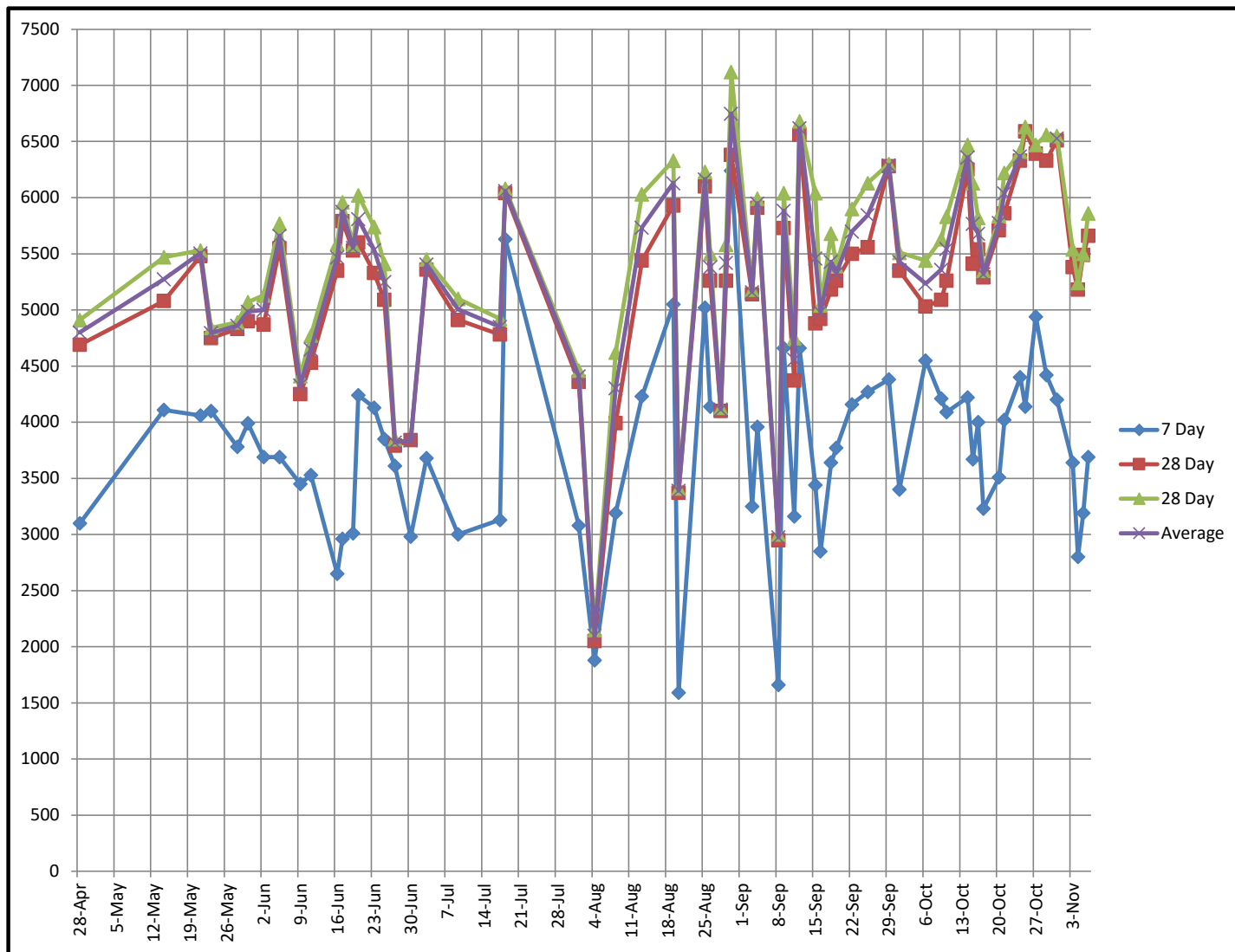
Norm 3—Nonabsorbent blocks may be of plastic, wood, or other

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

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# ASTM 1093-19 STANDARD PRACTICE FOR ACCREDITATION OF TESTING AGENCIES FOR UNIT MASONRY

## 1. Scope

- 1.1 This practice covers the minimum requirements for laboratory personnel, for establishing and maintaining a quality system, and it establishes minimum qualifications for agencies engaged in the testing of masonry materials.
- 1.2 Criteria are provided for evaluating the capability of an agency to properly perform designated tests on masonry materials, and for establishing guidelines pertaining to an agency's organization, personnel, facilities, and quality system. This practice may be supplemented by more specific criteria and requirements for particular projects.
- 1.3 This practice can be used as a basis to evaluate testing agencies, and it is intended for use for the qualifying or accrediting of testing agencies, or both, public or private, engaged in the testing of masonry materials.

This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.



Designation: C1093 – 19

## Standard Practice for Accreditation of Testing Agencies for Masonry<sup>1</sup>

This standard is issued under the fixed designation C1093, 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 notation (s) indicates an editorial change since the last revision or reapproval.

### 1. Scope\*

1.1 This practice covers the minimum requirements for laboratory personnel, for establishing and maintaining a quality system, and it establishes minimum qualifications for agencies engaged in the testing of masonry materials.

1.2 Criteria are provided for evaluating the capability of an agency to properly perform designated tests on masonry materials, and for establishing guidelines pertaining to an agency's organization, personnel, facilities, and quality system. This practice may be supplemented by more specific criteria and requirements for particular projects.

1.3 This practice can be used as a basis to evaluate testing agencies, and it is intended for use for the qualifying or accrediting of testing agencies, or both, public or private, engaged in the testing of masonry materials.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.

1.5 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

C67/C67M Test Methods for Sampling and Testing Brick and Structural Clay Tile  
C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee C15 on Manufactured Masonry Units and is the direct responsibility of Subcommittee C15.07 on Standards for Laboratory Accreditation.

Current edition approved Dec. 15, 2019. Published January 2020. Originally approved in 1998. Last previous edition approved in 2015 as C1093 – 15a<sup>1</sup>. DOI: 10.1520/C1093-19

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

C117 Test Method for Materials Finer than 75- $\mu$ m (No. 200) Sieve in Mineral Aggregates by Washing  
C136/C136M Test Method for Sieve Analysis of Fine and Coarse Aggregates  
C140/C140M Test Methods for Sampling and Testing Concrete Masonry Units and Related Units  
C143/C143M Test Method for Slump of Hydraulic-Cement Concrete  
C173/C173M Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method  
C185 Test Method for Air Content of Hydraulic Cement Mortar  
C230/C230M Specification for Flow Table for Use in Tests of Hydraulic Cement  
C231/C231M Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method  
C270 Specification for Mortar for Unit Masonry  
C305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency  
C470/C470M Specification for Molds for Forming Concrete Test Cylinders Vertically  
C780 Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry  
C1019 Test Method for Sampling and Testing Grout for Masonry  
C1072 Test Methods for Measurement of Masonry Flexural Bond Strength  
C1232 Terminology for Masonry  
C1314 Test Method for Compressive Strength of Masonry Prisms  
C1506 Test Method for Water Retention of Hydraulic Cement-Based Mortars and Plasters  
C1552 Practice for Capping Concrete Masonry Units, Related Units and Masonry Prisms for Compression Testing  
E4 Practices for Force Verification of Testing Machines  
E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *quality system*—the organizational structure, responsibilities, procedures, processes, capabilities, and resources for implementing quality management.

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

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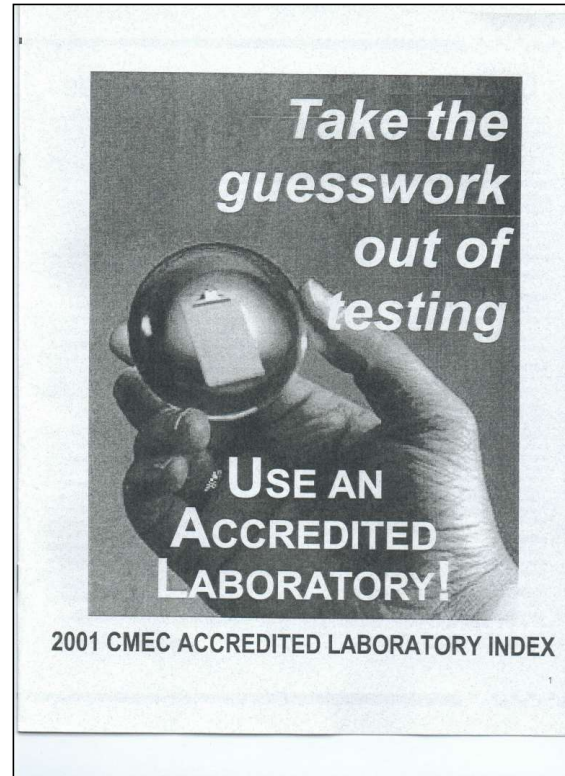
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April 16, 2019

Why Use an Accredited Laboratory?

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The Benefits of Laboratory Accreditation

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# TMS 402/602 Code & Commentary C-18

## **1.15 -- Quality assurance program**

The quality assurance program shall comply with the requirements of this section, depending on the facility function, as defined in the legally adopted building code or ASCE 7-02. The quality assurance program shall itemize the methods used to verify conformance of material composition, quality, storage, handling, preparation and placement with the requirements of ACI 530.1/ASCE 6/TMS602.



# SHOULD MASON CONTRACTORS BE CERTIFIED?

Voluntary certification or mandatory licensing could help improve workmanship and ensure the craft's survival

**REMEMBER!**



**MASONRY IS A  
HANDCRAFTED  
SYSTEM**



**ALWAYS  
ALLOW FOR VARIATIONS  
IN MATERIALS AND  
INSTALLATION**

# IN CONCLUSION



**Masonry is Forever - so get it right the first time!!**



**“Promote and do good Masonry” - MAF**



# WORKMANSHIP

**Design-Constructability**

**Material-Compatibility**

**Preparation-Organization**

**Conditions-More than just Weather**

**Craftsmanship-Say What?**



EMERSON  
ALUMNI HALL





Are there any  
questions?

**ASTM  
REFERENCE  
DOCUMENTS**



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# ASTM C270

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



Designation: C270 - 14a

## Standard Specification for Mortar for Unit Masonry<sup>1</sup>

This standard is issued under the fixed designation C270; 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 approval. A superscript symbol (°) indicates an editorial change since the last revision or approval.  
This standard has been approved for use by agencies of the U.S. Department of Defense.

### 1. Scope

1.1 This specification covers mortars for use in the construction of non-reinforced and reinforced unit masonry structures. Four types of mortar are covered in each of two alternative specifications: (1) proportion specifications and (2) property specifications.

Note 1.—When the property specification is used to qualify masonry mortars, the testing agency performing the test methods should be evaluated in accordance with Practice C1093.

1.2 The proportion or property specifications shall govern as specified.

1.3 When neither proportion or property specifications are specified, the proportion specifications shall govern, unless data are presented to and accepted by the specifier to show that mortar meets the requirements of the property specifications.

1.4 This standard is not a specification to determine mortar strengths through field testing (see Section 3).

1.5 The text of this footnotes which provide footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.6 The terms used in this specification are identified in Terminologies C1180 and C1232.

1.7 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.

1.8 The following safety hazards caveat pertains only to the test methods section of this specification: *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.*

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C12 on Mortar and Grout for Unit Masonry and is the direct responsibility of Subcommittee C12.01 on Specifications for Mortar.  
Current edition approved Dec. 15, 2014. Published December 2014. Originally approved in 1991. Last previous edition approved in 2014 as C270 - 14. DOI: 10.1533/C270-14A.

### 2. Referenced Documents

2.1 *ASTM Standards*<sup>2</sup>

- C5 Specification for Quicklime for Structural Purposes
- C91 Specification for Masonry Cement
- C109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
- C110 Test Methods for Physical Testing of Quicklime, Hydrated Lime, and Limestone
- C128 Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
- C144 Specification for Aggregate for Masonry Mortar
- C150 Specification for Portland Cement
- C188 Test Method for Density of Hydraulic Cement
- C207 Specification for Hydrated Lime for Masonry Purposes
- C305 Practice for Mechanical Mixing of Hydraulic Cement Pastes and Mortars of Plastic Consistency
- C511 Specification for Mixers—Rooms, Moist Cabinets, Rooms or Hydraulic Cements and Concretes
- C595 Specification for Blended Hydraulic Cements
- C780 Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
- C952 Test Method for Bond Strength of Mortar to Masonry Units
- C979 Specification for Pigments for Integrally Colored Concrete
- C1072 Test Methods for Measurement of Masonry Flexural Bond Strength
- C1093 Practice for Accreditation of Testing Agencies for Masonry
- C1157 Performance Specification for Hydraulic Cement
- C1180 Terminology of Mortar and Grout for Unit Masonry
- C1232 Terminology of Masonry
- C1324 Test Method for Examination and Analysis of Hardened Masonry Mortar

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> A Summary of Changes section appears at the end of this standard.

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ASTM INTERNATIONAL

# ASTM C270

## 1. Scope

1.1 This specification covers mortars for use in the construction of non-reinforced and reinforced unit masonry structures. Four types of mortar are covered in each of two alternative specifications: (1) proportion specifications and (2) property specifications.

1.3 When neither proportion or property specifications are specified, the proportion specifications shall govern, unless data are presented to and accepted by the specifier to show that mortar meets the requirements of the property specifications.



ASTM INTERNATIONAL

# ASTM C270

## 3. Specification Limitations

3.1 Laboratory testing of mortar to ensure compliance with the property specification requirements of this specification shall be performed in accordance with 5.3. The property specification of this standard applies to mortar mixed to a specific flow in the laboratory.

3.2 Property specifications requirements in Table 1 shall not be used to evaluate construction site-produced mortars.

NOTE 2—Refer to X1.5.3.1 for further explanation.

3.3 Since the compressive strength values resulting from field tested mortars do not represent the compressive strength of mortar as tested in the laboratory nor that of the mortar in the wall, physical properties of field sampled mortar shall not be used to determine compliance to this specification and are not intended as criteria to determine the acceptance or rejection of the mortar (see Section 8 and Guide C1586).



ASTM INTERNATIONAL

# ASTM C270

8.1.1 Implementation and observation of appropriate procedures for proportioning and mixing approved materials, as described in Section 7.

8.1.2 Test Method C780 Annex 4, Mortar Aggregate Ratio to determine the aggregate to cementitious material ratio of mortars while they are still in a plastic state.

8.2 Guide C1586 is suitable for developing quality assurance procedures to determine compliance of mortars to this standard.

8.3 Test Method C780 is suitable for the evaluation of masonry mortars in the field. However, due to the procedural differences between Specification C270 and C780, the compressive strength values resulting from field sampled mortars are not required nor expected to meet the compressive strength requirements of the property specification of Specification C270, nor do they represent the compressive strength of the mortar in the wall.






ASTM INTERNATIONAL

# ASTM C780

This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

 Designation: C780 – 20

**Standard Test Method for  
Preconstruction and Construction Evaluation of Mortars for  
Plain and Reinforced Unit Masonry<sup>1</sup>**

This standard is issued under the fixed designation C780; 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 approval. A superscript option (s) indicates an editorial change since the last revision or approval.  
This standard has been approved for use by agencies of the U.S. Department of Defense.

**INTRODUCTION**

This test method provides a standard procedure for sampling and testing mortars for composition and plastic and hardened properties, either before or during actual construction. The procedures outlined in the Annexes are considered applicable for evaluating various combinations of portland cement, lime, and masonry cement for mortars common to plain and reinforced unit masonry construction.

The test procedures describe methods for the measurement of mortar composition and mortar properties. No attempt is made to claim or substantiate specific correlations between the measured properties and mortar performance in the masonry. However, data from these test methods can be combined with other information to formulate judgments about the quality of the masonry.

Testing using these procedures is limited to the preconstruction evaluation of masonry mortars within the laboratory, to the evaluation of masonry mortars at the construction site, and in establishing the degree of quality control exercised during mortar production at the construction site.

**1. Scope\***

1.1 This test method covers procedures for the sampling and testing of mortars for composition and for their plastic and hardened properties, either before or during their actual use in construction.

NOTE 1—Guide C1386 provides guidance on evaluating mortar and clarifies the purpose of both this test method and Specification C270.

NOTE 2—The testing agency performing this test method should be evaluated in accordance with Practice C1093.

1.2 **Preconstruction Evaluation**—This test method permits comparisons of mortars made from different materials under simulated field conditions. It is also used to establish baseline values for comparative evaluation of field mortars.

1.3 **Construction Evaluation**—Use of this method in the field provides a means for quality assurance of field-mixed mortar. It includes methods for verifying the mortar mix proportions, comparing test results for field mortars to preconstruction testing, and determining batch-to-batch uniformity of the mortar.

1.4 The test results obtained under this test method are not required to meet the minimum compressive values in accordance with the property specifications in Specification C270.

1.5 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.

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

1.7 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use. For specific hazards statements, see Section 8.

1.8 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the

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

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ASTM INTERNATIONAL

## ASTM C780

1.4 The test results obtained under this test method are not required to meet the minimum compressive values in accordance with the property specifications in Specification **C270**.

5.2.4 Mortar aggregate ratio testing (**Annex A4**) provides a method for determining the ratio of aggregate-to-cementitious materials. The sieving operation employed during this test is incapable of separating an individual cementitious material when more than one such material is used, but can accurately establish the aggregate-to-cementitious materials ratio of the mixture.



ASTM INTERNATIONAL

# ASTM C476

This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.



Designation: C476 – 19

## Standard Specification for Grout for Masonry<sup>1</sup>

This standard is issued under the first designate C476; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

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

### 1. Scope<sup>\*</sup>

1.1 This specification covers two types of grout, fine and coarse grout, for use in the construction of masonry structures. Each type (fine and coarse) is further classified as conventional grout (requiring mechanical consolidation by puddling or vibration when placed) and self-consolidating grout (not requiring mechanical consolidation when placed). Conventional grout is specified by (1) proportions or (2) strength requirements. Self-consolidating grout is specified by strength requirements.

1.2 The text of this specification references notes and footnotes that provide explanatory material. These notes and footnotes (including those in tables and figures) shall not be considered as requirements of this specification.

1.3 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.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

### 2. Referenced Documents

- 2.1 ASTM Standards:<sup>2</sup>
  - C5 Specification for Quicklime for Structural Purposes
  - C29C29M Test Method for Bulk Density ("Unit Weight") and Voids in Aggregate
  - C143C143M Test Method for Slump of Hydraulic-Cement Concrete

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C12 on Mortar and Grout for Unit Masonry and is the direct responsibility of Subcommittee C12.01 on Grout & Grout Admixtures for Masonry. Current edition approved Dec. 1, 2019. Published December 2019. Originally approved in 1961. Last previous edition approved in 2018 as C476 – 18. DOI: 10.1520/C0476-19.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

- C150C150M Specification for Portland Cement
- C207 Specification for Hydrated Lime for Masonry Purposes
- C260C260M Specification for Air-Entraining Admixtures for Concrete
- C684 Specification for Aggregates for Masonry Grout
- C494C494M Specification for Chemical Admixtures for Concrete
- C595C595M Specification for Blended Hydraulic Cements
- C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
- C989C989M Specification for Slag Cement for Use in Concrete and Mortars
- C1019 Test Method for Sampling and Testing Grout
- C1157C1157M Performance Specification for Hydraulic Cement
- C1602C1602M Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
- C1614C1614M Test Method for Slump Flow of Self-Consolidating Concrete

### 3. Materials

- 3.1 Materials used as ingredients in grout shall conform to the requirements specified in 3.1.1.1 – 3.1.5.
  - 3.1.1 **Cementitious Materials**—Cementitious materials shall conform to one of the following specifications:
    - 3.1.1.1 **Portland Cement**—Type I, IA, II, IIIA, III, and IIIA of Specification C150C150M.
    - 3.1.1.2 **Blended Cements**—Type II, IS<70, IP, IT(S)<70, or blended cements with special properties designated by (A), (MS), or (HS), or a combination of (A) and (MS) or (HS), as appropriate, of Specification C595C595M.
    - 3.1.1.3 **Hydraulic Cements**—Types GU, HE, MS, or HS of Specification C1157C1157M.
    - 3.1.1.4 **Quicklime**—Specification C5.
    - 3.1.1.5 **Hydrated Lime**—Type S of Specification C207.
    - 3.1.1.6 **Coal Fly Ash or Raw Calcined Natural Pozzolan**—Specification C618. Addition rates shall be in an amount governed by the portland-pozzolan cement category of Specification C595C595M. The grout produced with blends of portland cement and fly ash or raw calcined natural pozzolan shall have the compressive strength specified (4.2.2.1 or 4.2.2.1).

<sup>\*</sup>A Summary of Changes section appears at the end of this standard



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## 4. Grout Type and Proportions

4.1 *Type*—Grout type shall be specified as fine or coarse.

4.1.1 Fine grout shall be manufactured with fine aggregates.

4.1.2 Coarse grout shall be manufactured with a combination of coarse and fine aggregates.

NOTE 7—Building code provisions and grout space dimensions should be reviewed when selecting grout type or types.

4.2 *Proportions of Ingredients*—Proportions shall be determined as follows:

4.2.1 *Conventional Grout*—Proportions shall be determined by one of the following methods:

4.2.1.1 Requirements of **Table 1**.

4.2.1.2 *Specified Compressive Strength*—Proportions established by 28-day compressive strength tests in accordance with Test Method **C1019** that equal or exceed the specified compressive strength. The grout shall be mixed to a slump of 8 to 11 in. (200 to 280 mm) as determined by Test Method **C143/C143M** and shall have a minimum compressive strength of 2000 psi (14 MPa) at 28 days.