

Building Envelope Tolerance *Series 3 of 5 – Masonry & Limestone*

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Building Envelope Tolerance

Masonry & Limestone

List of References:

Handbook of Construction Tolerances 2ed
by David Kent Ballast, AIA, CSI

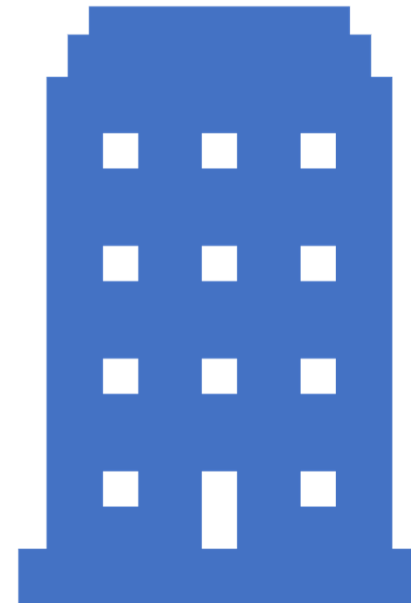
ASTM C55, ASTM C90, ASTM C129, ASTM 744
– CMU

ASTM C62, ASTM C216, ASTM 652, ASTM
C1088 - Masonry

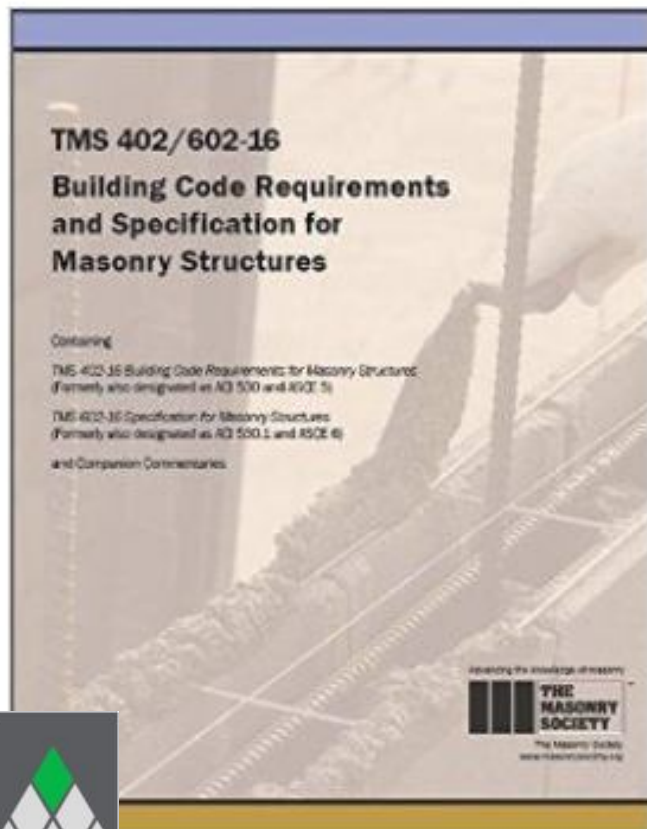
ACI 530.1/ASCE 6/TMS 602 – Specifications for
Masonry Structures Dimension Stone

Design Manual VI

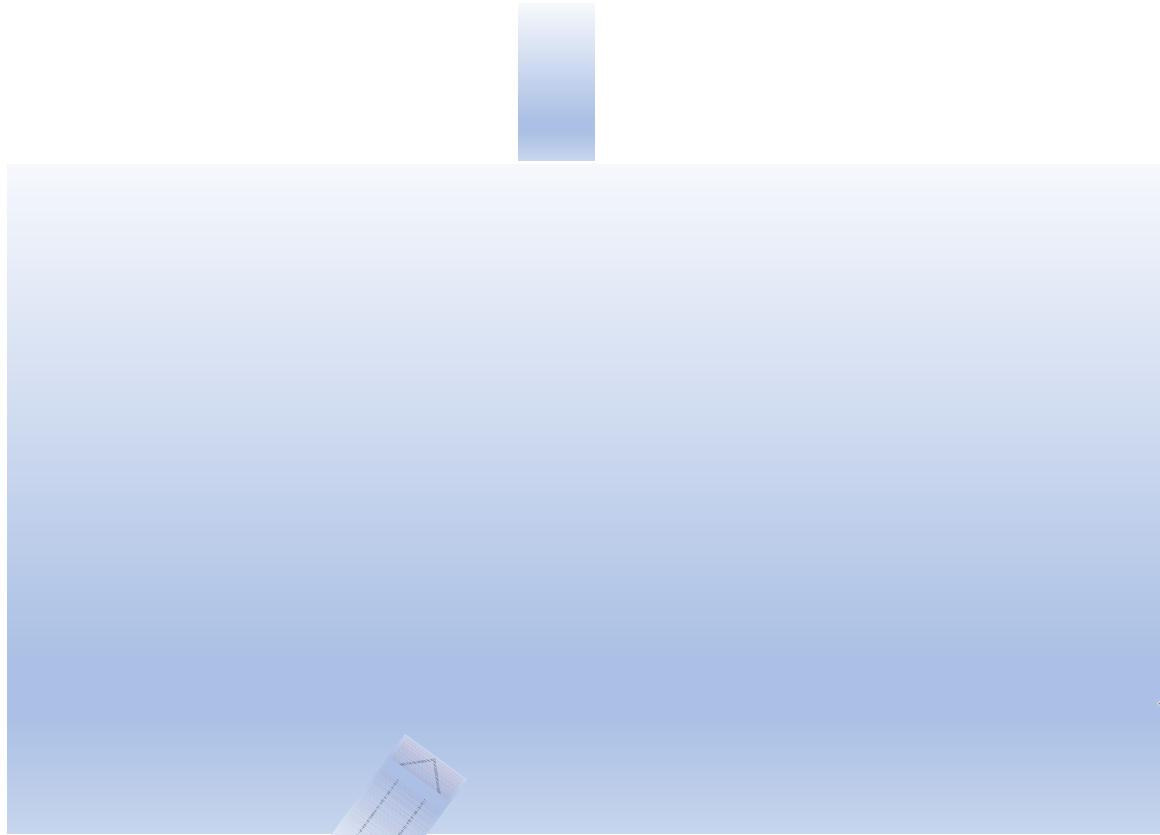
Indiana Limestone Institute 21st ed.



MASONRY



HEAD JOINT THICKNESS = (3/8") -1/4" to +3/8"



**BED JOINT
THICKNESS =
(3/8") ±1/8"**

**INITIAL BED
THICKNESS =
1/4" min to 1
1/4" max**

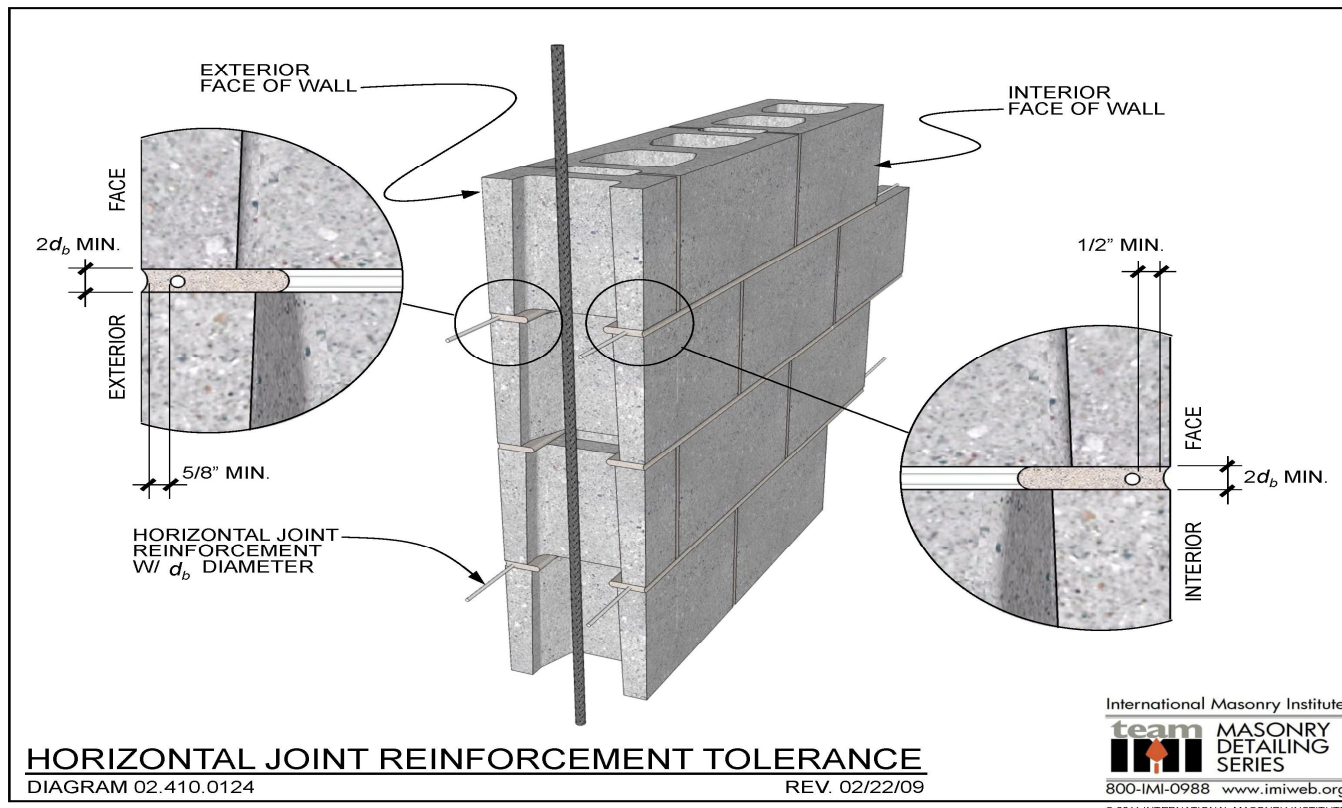
Footing Allowable Tolerance ± 1/2"
(ACI 117)



Note: TMS 402-6.1.2.3...Max wire size = 1/2 joint thickness

HORIZONTAL JOINT REINFORCEMENT

Note: TMS 402-6.1.2.3...Max wire size = 1/2 joint thickness

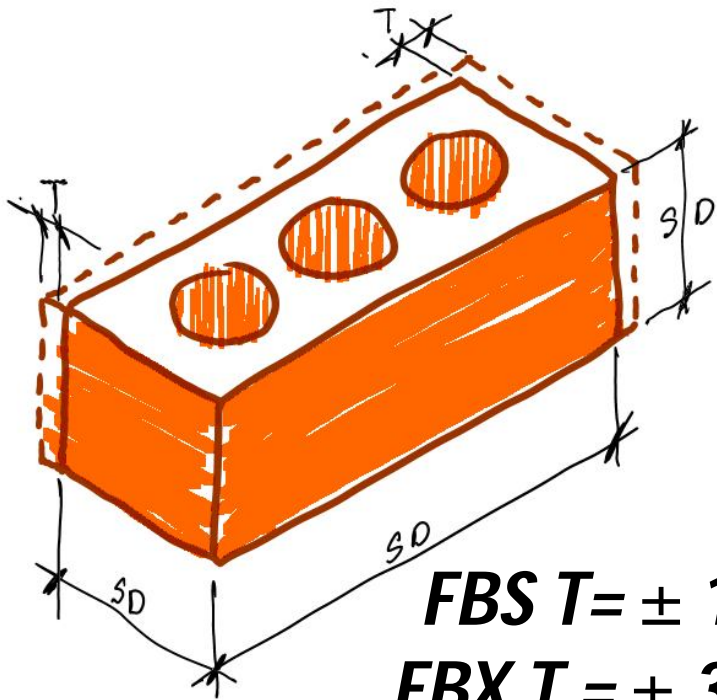


So, based on the Code and allowable tolerances...

Does a 3/16" wire size truly work?

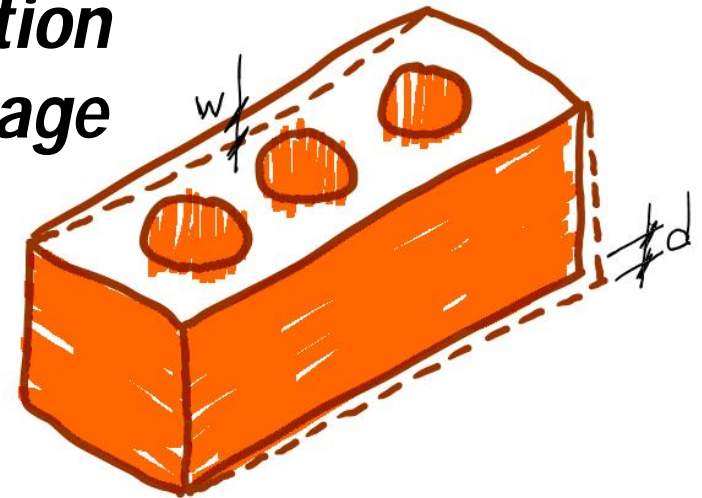


MASONRY TOLERANCE *ASTM C216 – FBX & FBS*



FBS $T = \pm 1/8''$
FBX $T = \pm 3/32''$

d = Distortion
w = Warpage



FBS $w = \pm 3/32''$
FBX $w = \pm 1/16''$

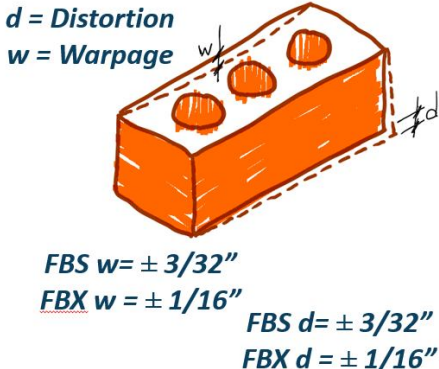
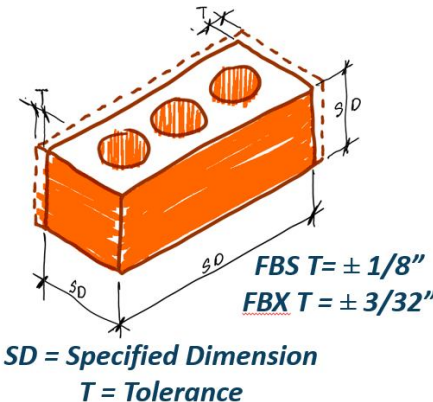
SD = Specified Dimension
T = Tolerance

FBS $d = \pm 3/32''$
FBX $d = \pm 1/16''$



The joint tolerance is to take the masonry tolerance into account

HEAD JOINT THICKNESS = (3/8") -1/4" to +3/8"



BED JOINT THICKNESS = (3/8") ± 1/8"

INITIAL BED THICKNESS = 1/4" min to 1 1/4" max

So... we need to take the masonry unit tolerance into account

Footing Allowable Tolerance ± 1/2" (ACI 117)

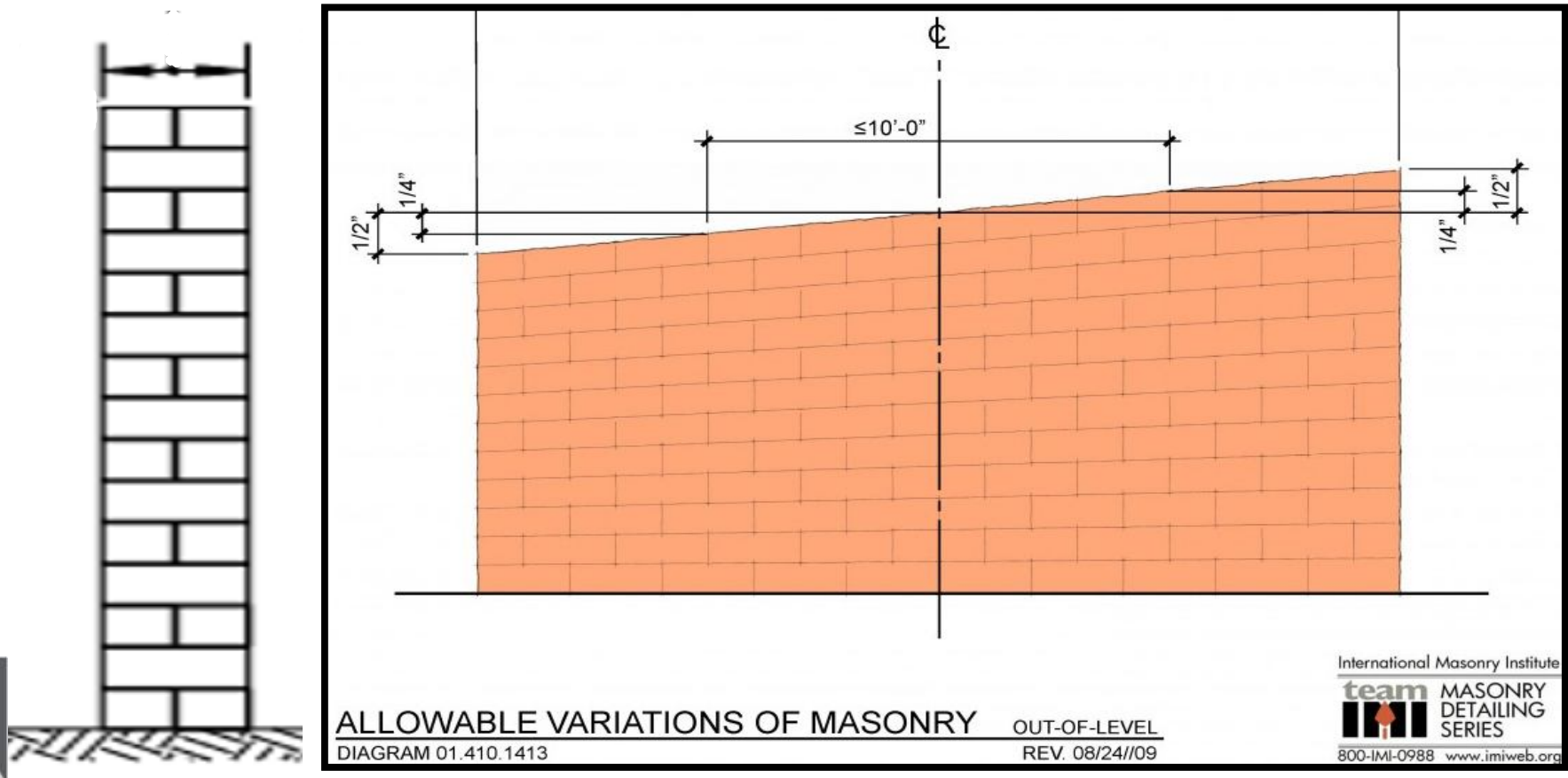


MASONRY WALL TOLERANCE

ELEVATION

CROSS
SECTIONAL
- 1/4" to + 1/2"

Load Bearing : $\pm 1/4''$ in 10' (Max 1/2'')
Non-Load Bearing : $\pm 1/4''$ per story (Max $\pm 3/4''$)



VARIATION IN PLUMB

H = Wall Height

D = Allowable Variation

When $H < 10'-0''$

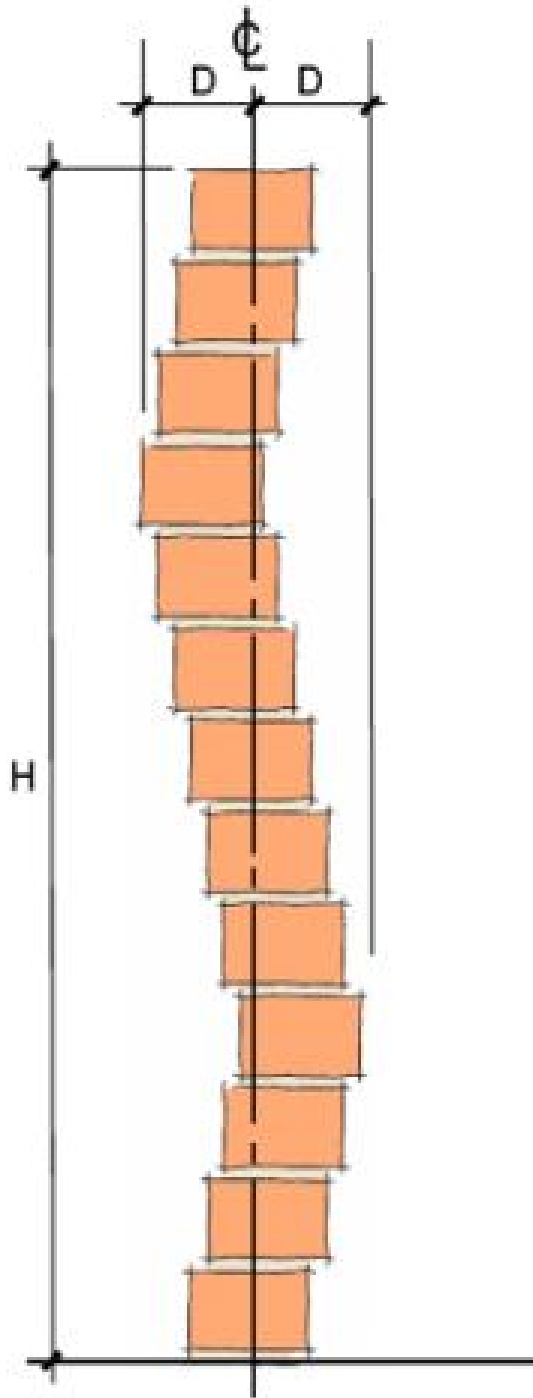
$D < \frac{1}{4}''$

When $H < 20'-0''$

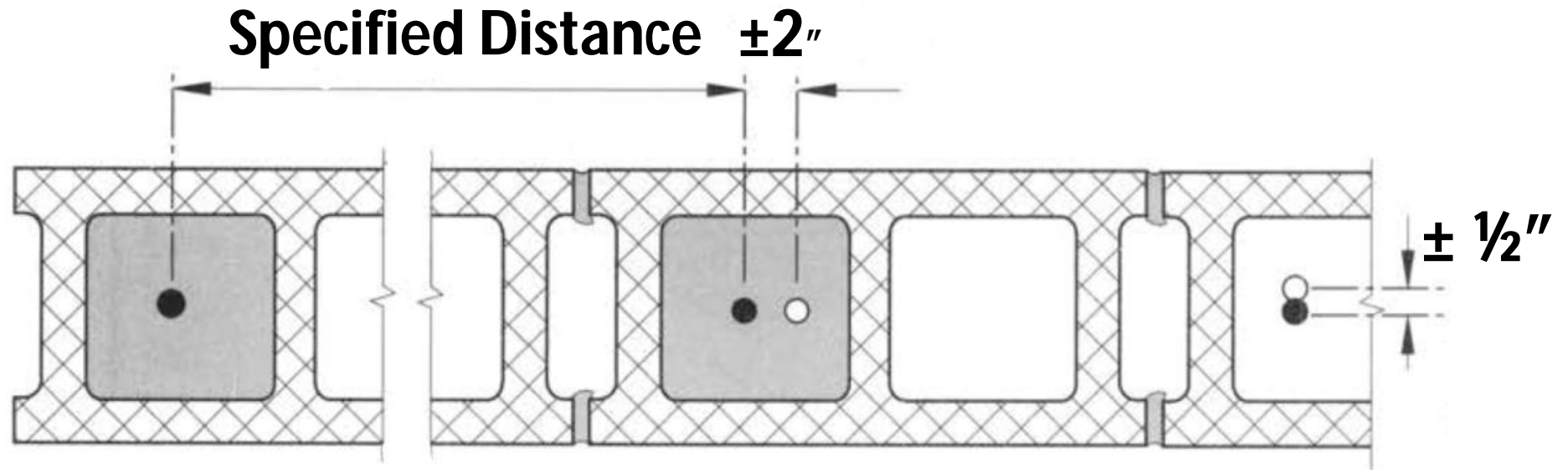
$D < \frac{3}{8}''$

When $H > 20'-0''$

$D < \frac{1}{2}''$



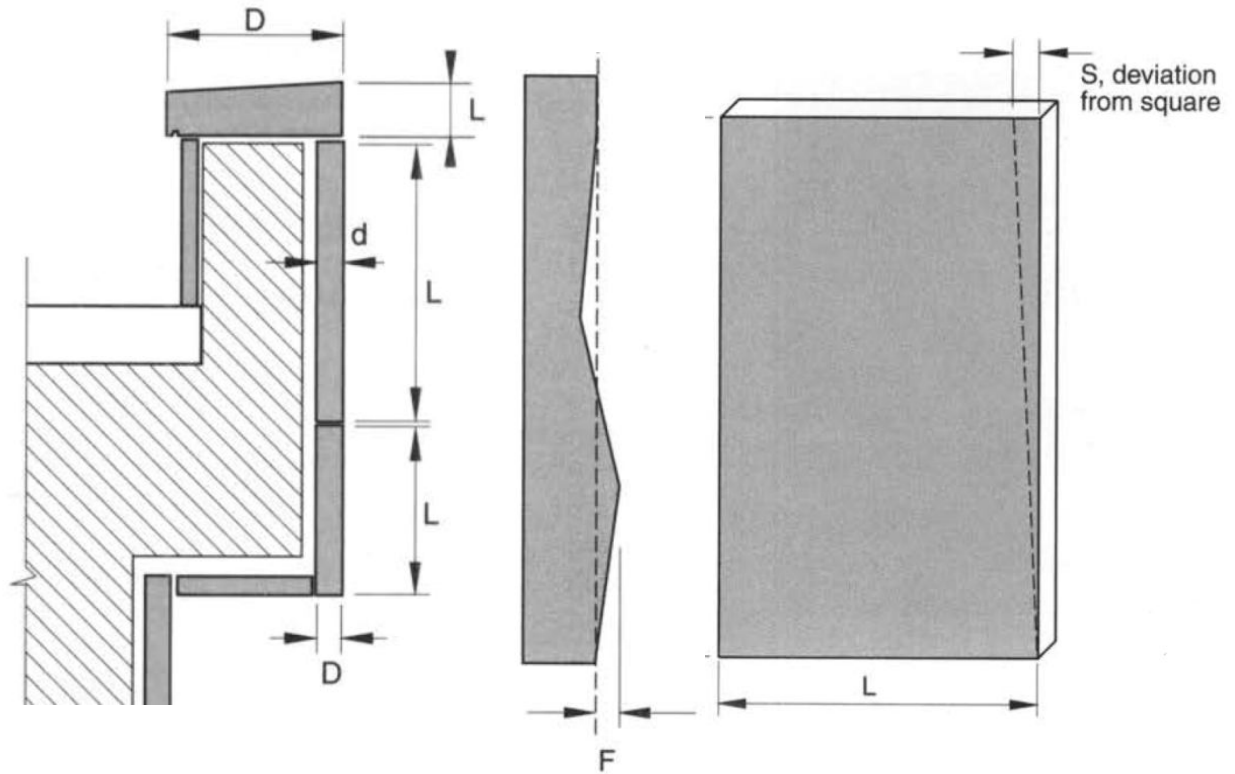
MASONRY REBAR TOLERANCE



ACI 530

LIMESTONE FABRICATION TOLERANCES

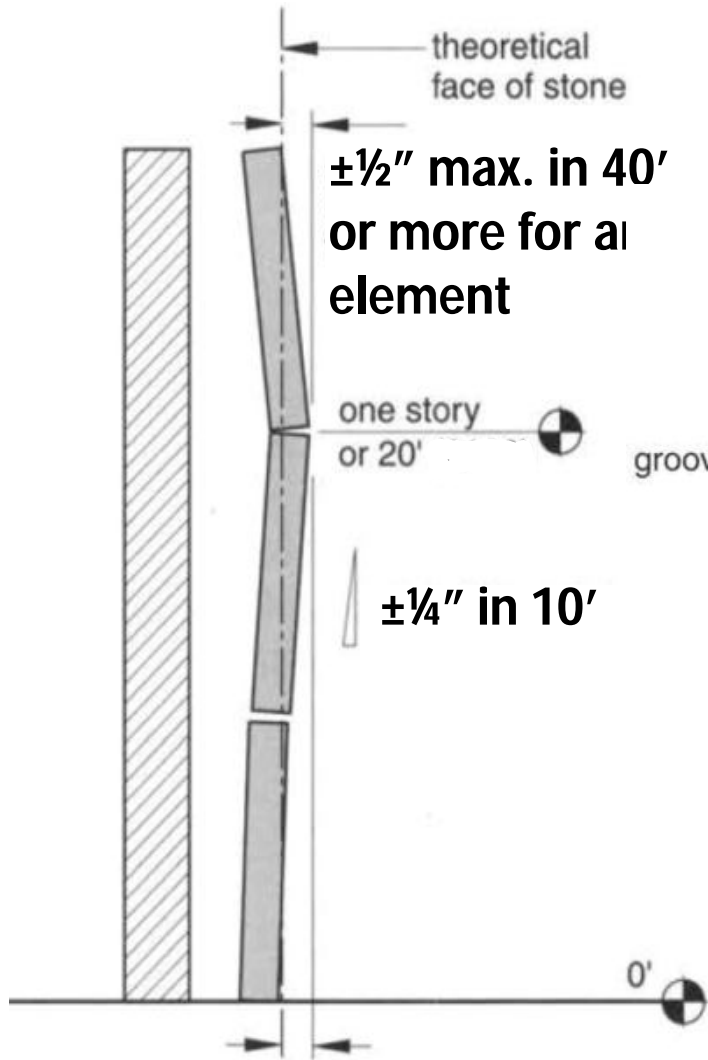
Specifying how the limestone is cut is important for tolerances.



Finish type	Length, L, in (mm)	Deviation from flat surface, F, in (mm)	Critical depth, D, in (mm)	Non-critical depth, d, in (mm)	Deviation from square, S, in (mm)
Smooth machine finish	$\pm^{1/16}$ (2)	$\pm^{1/16}$ (2)	$\pm^{1/16}$ (2)	$\pm^{1/2}$ (13)	$\pm^{1/16}$ (2)
Diamond gang finish	$\pm^{1/16}$ (2)	$\pm^{1/4}$ (6)	$\pm^{1/8}$ (3)	$\pm^{1/2}$ (13)	$\pm^{1/16}$ (2)
Chat sawed finish	$\pm^{1/16}$ (2)	$\pm^{1/4}$ (6)	$\pm^{1/8}$ (3)	$\pm^{1/2}$ (13)	$\pm^{1/16}$ (2)
Shot sawed finish	$\pm^{1/16}$ (2)	$\pm^{1/2}$ (13)	$\pm^{1/4}$ (6)	$\pm^{1/2}$ (13)	$\pm^{1/16}$ (2)

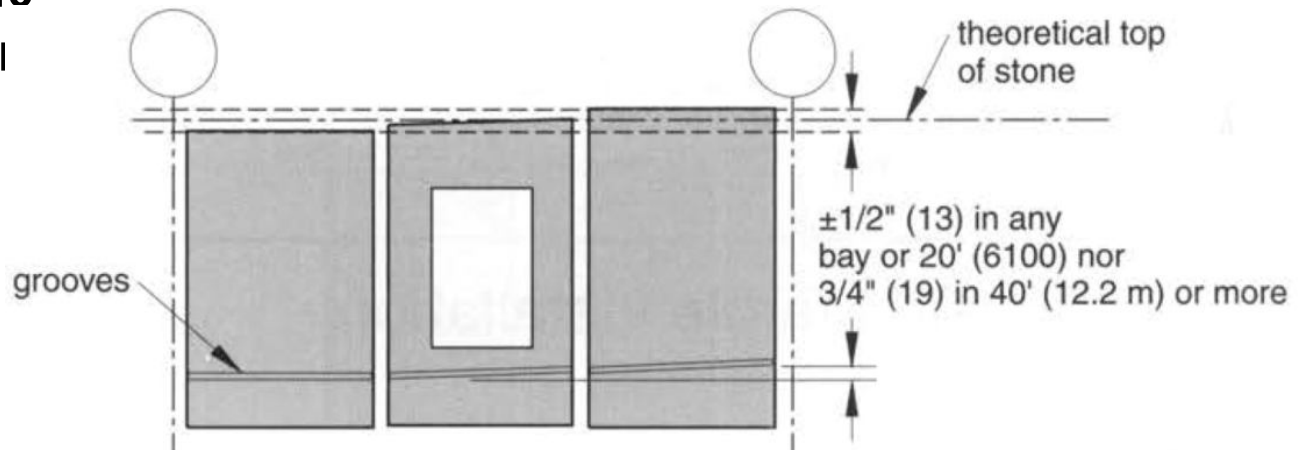
Source: Indiana Limestone Handbook, 21st ed. Indiana Limestone Institute of America, Inc.

LIMESTONE INSTALLATION

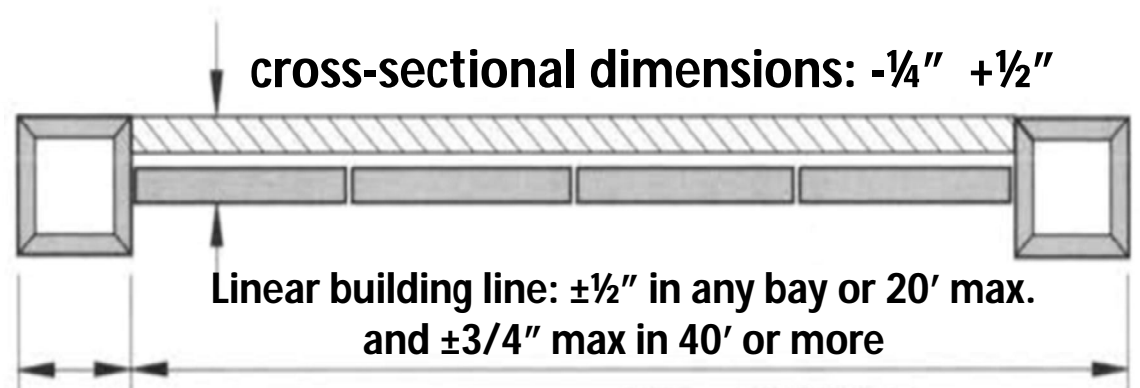


$\pm\frac{3}{8}''$ for one story or 20' max for lines & surfaces of col & walls

$\pm\frac{1}{4}''$ for one story or 20' max for external corners, expansion joints, and other conspicuous lines



Tolerance for Level



Tolerances for Plan & Cross-Section