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Fire Resistance

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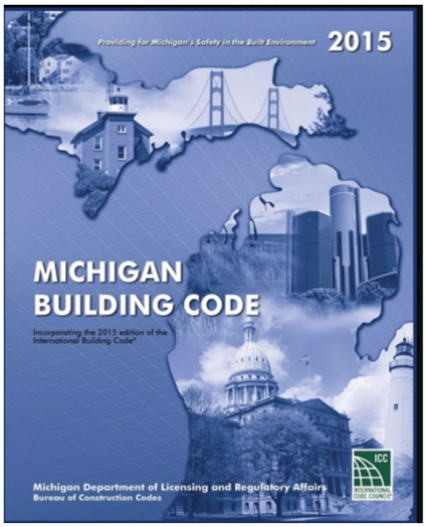
Michigan Building Code 2015

MASONRY Institute of Michigan

Chapter 7: Fire and Smoke Protection Features



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Michigan Building Code 2015

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703.3 Methods for Determining Fire Resistance

1. Fire-resistance designs documented
2. Prescriptive designs, Section 721
3. Calculations, Section 722
4. Engineering analysis, ASTM E119 or UL 263
5. Alternative protection methods, Section 104.11
6. Fire-resistance designs certified

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Calculated Fire Resistance

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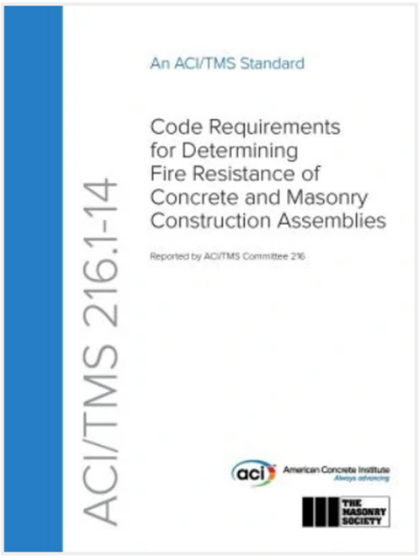
MBC 722.1 General

- The provisions of this section contain procedures by which the fire resistance of specific materials or combinations of materials is established by calculations.
- In accordance with ACI/TMS 216.1



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ACI/TMS 216.1

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1.1 Scope

The provisions of this standard establish fire resistance based on calculations. The fire resistance associated with an element or assembly shall be deem acceptable when established by the calculation procedures in this standard or when established in accordance with 1.2.

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1.2 Alternative methods

- Qualification by testing
- Approval through past performance
- Other methods

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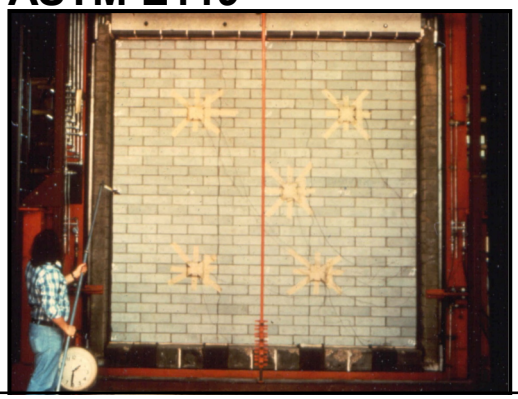
1.2 Qualification by testing

- **Materials and assemblies tested in accordance with the requirements set forth in ASTM E119**



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ASTM E119

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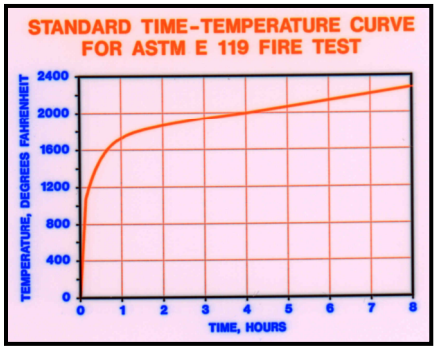
Basic End Point Criteria

1. **250°F average temperature rise**
2. **Ignite cotton waste**
3. **Maintain structural integrity**



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Concrete Masonry: A Foundation for Safety

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ACI/TMS 216.1

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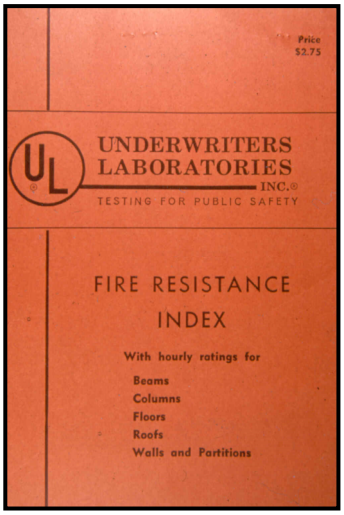
1.2 Qualification by testing



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Michigan Masonry Council (1977)

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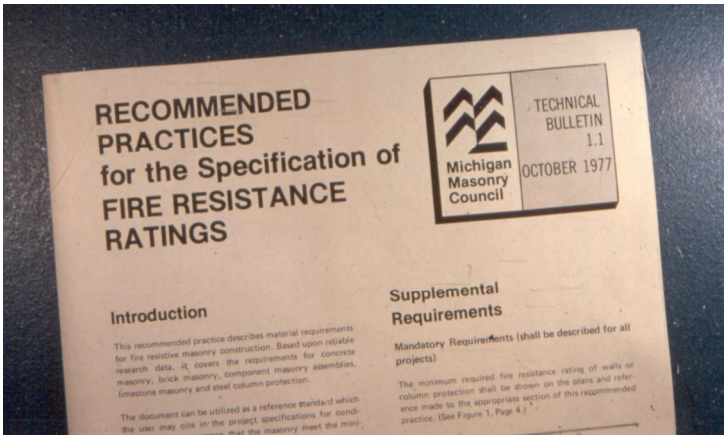

RECOMMENDED PRACTICES for the Specification of FIRE RESISTANCE RATINGS

Michigan Masonry Council

TECHNICAL BULLETIN 1.1 OCTOBER 1977

Introduction

This recommended practice describes material requirements for fire resistive masonry construction. Based upon reliable research data, it covers the requirements for concrete masonry, brick masonry, component masonry assemblies, limestone masonry and steel column protection.

The document can be utilized as a reference standard which the user may cite in the project specifications for condi-

Supplemental Requirements

Mandatory Requirements (shall be described for all projects)

The minimum required fire resistance rating of walls or column protection shall be shown on the plans and reference made to the appropriate section of this recommended practice. (See Figure 1, Page 4.)

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Michigan Masonry Council (1977)

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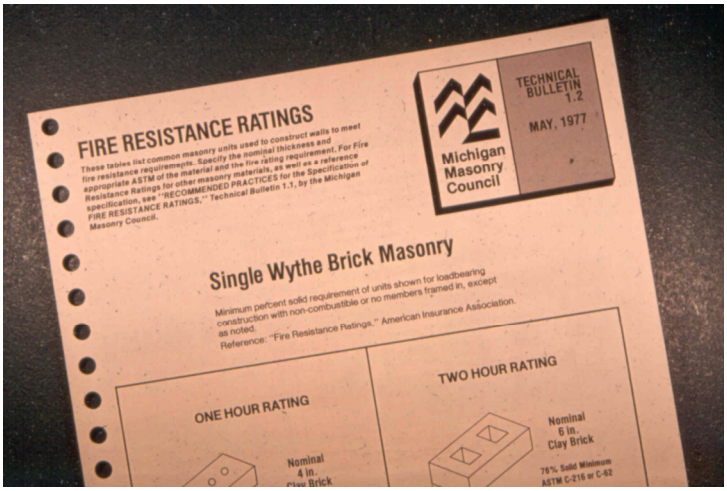

FIRE RESISTANCE RATINGS

These tables list common masonry units used to construct walls to meet fire resistance requirements. Specify the nominal thickness and appropriate ASTM of the material and the fire rating requirement. For Fire Resistance Ratings for other masonry materials, as well as a reference specification, see "RECOMMENDED PRACTICES for the Specification of FIRE RESISTANCE RATINGS," Technical Bulletin 1.1, by the Michigan Masonry Council.

Michigan Masonry Council

TECHNICAL BULLETIN 1.2 MAY, 1977

Single Wythe Brick Masonry

Minimum percent solid requirement of units shown for loadbearing construction with non-combustible or no members framed in, except as noted.

Reference: "Fire Resistance Ratings," American Insurance Association.

ONE HOUR RATING

Nominal 4 in. Clay Brick

TWO HOUR RATING

Nominal 6 in. Clay Brick

75% Solid Minimum ASTM C-216 or C-62

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Michigan Masonry Council

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TO: All Designers and Suppliers of Fire Resistive Masonry Materials

Gentlemen:

The attached copy of Michigan Masonry Council Technical Bulletin 1.1 has been reviewed by the State Fire Marshal's Office. It is in accord with the principals of fire safety and will be accepted by this office where fire resistive construction is required by the applicable laws and rules for which the State Fire Marshal is responsible.

The work of the Michigan Masonry Council is to be commended. It is hoped that they will continue to accumulate and distribute pertinent information concerning fire resistive materials and assemblies for the good of the people of the State of Michigan.

Very truly yours,

CAPT. WILLIAM R. RUCINSKI, Chief
Fire Marshal Division

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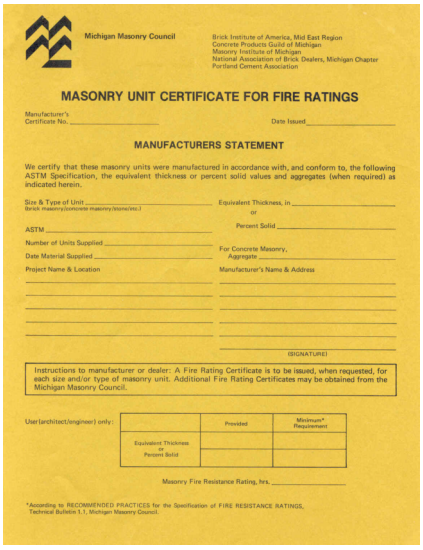

Michigan Masonry Council

Brick Institute of America, Mid East Region
Concrete Products Guild of Michigan
Masonry Institute of Michigan
National Association of Brick Dealers, Michigan Chapter
Portland Cement Association

MASONRY UNIT CERTIFICATE FOR FIRE RATINGS

Manufacturer's Certificate No. _____ Date Issued _____

MANUFACTURERS STATEMENT

We certify that these masonry units were manufactured in accordance with, and conform to, the following ASTM Specification, the equivalent thickness or percent solid values and aggregates (when required) as indicated herein.

Size & Type of Unit _____ (brick masonry/concrete masonry/stone/etc.)
ASTM _____
Number of Units Supplied _____
Date Material Supplied _____
Project Name & Location _____

Equivalent Thickness, in _____
or
Percent Solid _____
For Concrete Masonry, Aggregate _____
Manufacturer's Name & Address _____

(SIGNATURE)

Instructions to manufacturer or dealer: A Fire Rating Certificate is to be issued, when requested, for each size and/or type of masonry unit. Additional Fire Rating Certificates may be obtained from the Michigan Masonry Council.

User (architect/engineer) only:

	Provided	Minimum* Requirement
Equivalent Thickness or Percent Solid		

Masonry Fire Resistance Rating, hrs. _____

*According to RECOMMENDED PRACTICES for the Specification of FIRE RESISTANCE RATINGS, Technical Bulletin 1.1, Michigan Masonry Council.

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ACI/TMS 216.1

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2.2 Definitions

Fire resistance rating

- Legal term defined in building codes
- Assigned by building codes
- Usually in half-hour or hourly increments

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ACI/TMS 216.1

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5.2 Equivalent thickness

The equivalent thickness of concrete masonry assemblies, Tea, shall be calculated as the sum of the equivalent thickness of the concrete masonry unit,Te, as determined by 5.2.1, 5.2.2, or 5.2.3, plus the equivalent thickness of finishes, Tef.

$$Tea = Te + Tef \quad (5.2a)$$

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Equivalent Thickness

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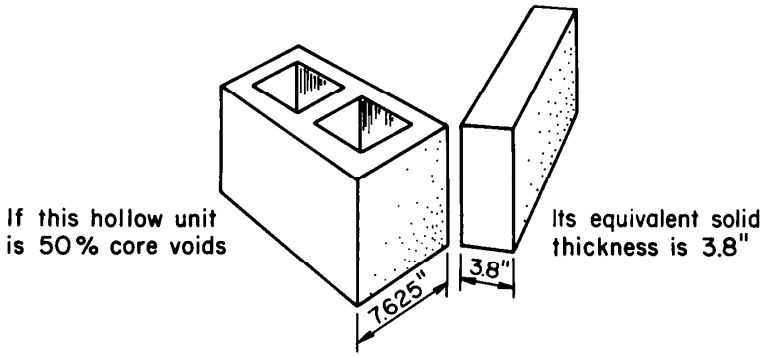
CONCRETE MASONRY UNITS



- Percent solid can be obtained from manufacturer
- Equivalent thickness is actual thickness multiplied by percent solid T_e= .50 x 7.625in. = 3.81in.

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1. Single wythe concrete masonry walls, Section 5.3.1
2. Steel columns protected by concrete masonry, Section 5.6
3. Single wythe clay masonry walls, Section 6.3.2
4. Steel columns protected by clay masonry, Section 6.7
5. Multi-wythe masonry walls, Sections 5.3.2 and 6.3.3
6. Masonry columns, Sections 5.4 and 6.4
7. Masonry beams/lintels, Sections 5.5 and 6.5
8. Movement joints, Sections 5.3.3 and 6.6

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Single Wythe Concrete Masonry Walls

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5.2.1 Ungrouted or partially grouted construction - The equivalent thickness Te of an ungrouted or partially grouted concrete masonry assemblage shall be taken equal to the value determined by Eq. (5.2b)

$$Te = Vn/LH \qquad (5.2b)$$

Vn, L, and H determined by ASTM C140

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ACI/TMS 216

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5.2.2 Solid grouted construction

- **Equivalent thickness, T_e, is the thickness of the unit determined in accordance with ASTM C140**

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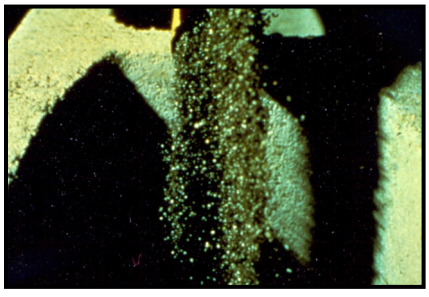
5.2.3 Air spaces and cells filled with loose fill material

- **Equivalent thickness T_e is the thickness of the unit determined in accordance with ASTM C140 when hollow concrete masonry units are completely filled:**
  - **Sand**
  - **Pea gravel**
  - **Crushed stone or slag, ASTM C33**
  - **Pumice**
  - **Scoria**
  - **Expanded shale**
  - **Expanded clay**
  - **Expanded slate**
  - **Expanded slag**
  - **Expanded fly ash or cinders, ASTM C331**
  - **Perlite, ASTM C549**
  - **Vermiculite, ASTM C516**



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Single Wythe Walls

Table 5.1a – Fire-resistance rating of concrete masonry assemblies

Aggregate Type	Minimum equivalent thickness T_{ea} for fire-resistance rating, in. [A,B]						
	½ hr	¾ hr	1 hr	1 ½ hr	2 hr	3 hr	4 hr
Calcareous or siliceous gravel (other than limestone)	2.0	2.4	2.8	3.6	4.2	5.3	6.2
Limestone, cinders, or air-cooled slag	1.9	2.3	2.7	3.4	4.0	5.0	5.9
Expanded clay, expanded shale or expanded slate	1.8	2.2	2.6	3.3	3.6	4.4	5.1
Expanded slag or pumice	1.5	1.9	2.1	2.7	3.2	4.0	4.7

A. Fire resistance rating between the hourly fire-resistance rating periods listed shall be determined by linear interpolation based on the equivalent thickness value of the concrete masonry assembly.

B. Minimum required equivalent thickness corresponding to the fire-resistance rating for units made with a combination of aggregates shall be determined by linear interpolation based on the percent by dry-rodded volume of each aggregate used in the manufacturing the units.

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Steel Columns Protected By Concrete Masonry

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5.6 Structural steel columns protected by concrete masonry

- Determine the fire resistance by using the following equation (5-6a):

$$R=0.401(A_{st}/p_s)^{0.7}+[0.285(T_{ea}^{1.6}/k_{cm}^{0.2})]$$
$$[1.0+42.7\{(A_{st}/w_{cm}T_{ea})/(0.25p+T_{ea})\}^{0.8}]$$

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- Fig. 5.6 – Structural steel shapes protected by concrete masonry

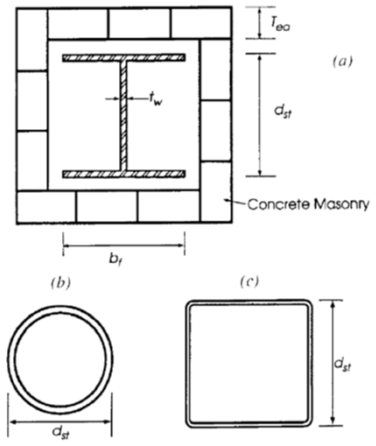

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Table 5.6—Fire resistance of concrete-masonry-protected steel columns

Square structural tubing						Steel pipe					
Nominal tube size, in.	Concrete masonry density, lb/ft³	Minimum equivalent thickness for fire-resistance rating of concrete masonry protection assembly T_e, in.				Column size	Concrete masonry density, lb/ft³	Minimum equivalent thickness for fire-resistance rating of concrete masonry protection assembly T_e, in.			
		1 hour	2 hours	3 hours	4 hours			1 hour	2 hours	3 hours	4 hours
4 x 4-1/2 wall thickness	80	0.93	1.90	2.71	3.43	Four double extra-strong 0.674 wall thickness	80	0.80	1.75	2.56	3.28
	100	1.08	2.13	2.99	3.76		100	0.95	1.99	2.85	3.62
	110	1.16	2.24	3.13	3.91		110	1.02	2.10	2.99	3.78
	120	1.22	2.34	3.26	4.06		120	1.09	2.20	3.12	3.93
4 x 4-3/8 wall thickness	80	1.05	2.03	2.84	3.57	Four extra strong 0.337 wall thickness	80	1.12	2.11	2.93	3.65
	100	1.20	2.25	3.11	3.88		100	1.26	2.32	3.19	3.95
	110	1.27	2.35	3.24	4.02		110	1.33	2.42	3.31	4.09
	120	1.34	2.45	3.37	4.17		120	1.40	2.52	3.43	4.23
4 x 4-1/4 wall thickness	80	1.21	2.20	3.01	3.73	Four standard 0.237 wall thickness	80	1.26	2.25	3.07	3.79
	100	1.35	2.40	3.26	4.02		100	1.40	2.45	3.31	4.07
	110	1.41	2.50	3.38	4.16		110	1.46	2.55	3.43	4.21
	120	1.48	2.59	3.50	4.30		120	1.53	2.64	3.54	4.34
6 x 6-1/2 wall thickness	80	0.82	1.75	2.54	3.25	Five double extra-strong 0.750 wall thickness	80	0.70	1.61	2.40	3.12
	100	0.98	1.99	2.84	3.59		100	1.85	1.86	2.71	3.47
	110	1.05	2.10	2.98	3.75		110	0.91	1.97	2.85	3.63
	120	1.12	2.21	3.11	3.91		120	0.98	2.02	2.99	3.79
6 x 6-3/8 wall thickness	80	0.96	1.91	2.71	3.42	Five extra-strong 0.375 wall thickness	80	1.04	2.01	2.83	3.54
	100	1.12	2.14	3.00	3.75		100	1.19	2.23	3.09	3.85
	110	1.19	2.25	3.13	3.90		110	1.26	2.34	3.22	4.00
	120	1.26	2.35	3.26	4.05		120	1.32	2.44	3.34	4.14
6 x 6-1/4 wall thickness	80	1.14	2.11	2.92	3.63	Five standard 0.258 wall thickness	80	1.20	2.19	3.00	3.72
	100	1.29	2.32	3.18	3.93		100	1.34	2.39	3.25	4.00
	110	1.36	2.43	3.30	4.08		110	1.41	2.49	3.37	4.14
	120	1.42	2.52	3.43	4.22		120	1.47	2.58	3.49	4.28
8 x 8-1/2 wall thickness	80	0.77	1.66	2.44	3.13	Six double extra-strong 0.864 wall thickness	80	0.59	1.46	2.23	2.92
	100	0.92	1.61	2.75	3.49		100	0.73	1.71	2.54	3.29
	110	1.00	2.02	2.89	3.66		110	0.80	1.82	2.69	3.47
	120	1.07	2.14	3.03	3.82		120	0.86	1.93	2.83	3.63
8 x 8-3/8 wall thickness	80	0.91	1.84	2.63	3.33	Six extra-strong 0.432 wall thickness	80	0.94	1.90	2.70	3.42
	100	1.07	2.08	2.92	3.67		100	1.10	2.13	2.98	3.74
	110	1.14	2.19	3.06	3.83		110	1.17	2.23	3.11	3.89
	120	1.21	2.29	3.13	3.87		120	1.24	2.34	3.24	4.04
8 x 8-1/4 wall thickness	80	1.10	2.06	2.86	3.57	Six standard 0.280 wall thickness	80	1.14	2.12	2.93	3.64
	100	1.25	2.28	3.19	3.98		100	1.29	2.33	3.19	3.94
	110	1.32	2.38	3.25	4.02		110	1.36	2.43	3.31	4.08
	120	1.39	2.48	3.38	4.17		120	1.42	2.53	3.43	4.22

Note: Tabulated values assume 1 in. air gap between masonry and steel section.

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Single Wythe Clay Masonry Walls

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ACI/TMS 216.1

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6.2.5 Air spaces and cells filled with loose fill material

- **Equivalent thickness T_e is the thickness of the unit when hollow clay masonry units are completely filled:**
  - **Sand**
  - **Pea gravel**
  - **Crushed stone or slag, ASTM C33**
  - **Pumice**
  - **Scoria**
  - **Expanded shale**
  - **Expanded clay**
  - **Expanded slate**
  - **Expanded slag**
  - **Expanded fly ash or cinders, ASTM C331**
  - **Perlite, ASTM C549**
  - **Vermiculite, ASTM C516**

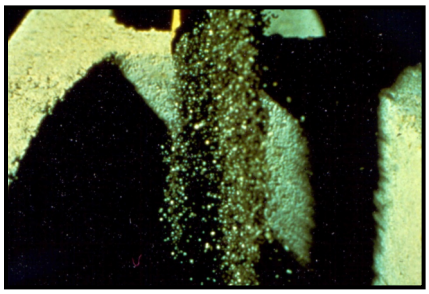

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Table 6.3.1—Fire resistance of clay masonry walls

Material type	Minimum equivalent thickness for fire resistance, in.[1][2]			
	1 hour	2 hours	3 hours	4 hours
Solid brick of clay or shale[3]	2.7	3.8	4.9	6.0
Hollow brick or tile of clay or shale, unfilled	2.3	3.4	4.3	5.0
Hollow brick or tile of clay or shale, grouted or filled with materials specified in 6.2.3	3.0	4.4	5.5	6.6

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Steel Columns Protected By Clay Masonry

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ACI/TMS 216.1

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Table 6.7.1—Fire resistance of clay-masonry-protected steel columns

		Square structural tubing						Steel pipe			
Nominal tube size, in.	Clay masonry density, lb/ft³	Minimum equivalent thickness for fire-resistance rating of clay masonry protection assembly T_e, in.				Column size	Clay masonry density, lb/ft³	Minimum equivalent thickness for fire-resistance rating of clay masonry protection assembly T_e, in.			
		1 hour	2 hours	3 hours	4 hours			1 hour	2 hours	3 hours	4 hours
4 x 4-1/2 wall thickness	120	1.44	2.72	3.76	4.68	Four double extra-strong 0.674 wall thickness	120	1.26	2.55	3.60	4.52
	130	1.62	3.00	4.12	5.11		130	1.42	2.82	3.96	4.95
4 x 4-3/8 wall thickness	120	1.56	2.84	3.88	4.78	Four extra-strong 0.337 wall thickness	120	1.60	2.89	3.92	4.83
	130	1.74	3.12	4.23	5.21		130	1.77	3.16	4.28	5.25
4 x 4-1/4 wall thickness	120	1.72	2.99	4.02	4.92	Four standard 0.237 wall thickness	120	1.74	3.02	4.05	4.95
	130	1.89	3.26	4.37	5.34		130	1.92	3.29	4.40	5.37
6 x 6-1/2 wall thickness	120	1.33	2.58	3.62	4.52	Four double extra-strong 0.750 wall thickness	120	1.17	2.44	3.48	4.40
	130	1.50	2.86	3.98	4.96		130	1.33	2.72	3.84	4.83
6 x 6-3/8 wall thickness	120	1.48	2.74	3.76	4.67	Four extra-strong 0.375 wall thickness	120	1.55	2.82	3.85	4.76
	130	1.65	3.01	4.13	5.10		130	1.72	3.09	4.21	5.18
6 x 6-1/4 wall thickness	120	1.66	2.91	3.94	4.84	Four standard 0.258 wall thickness	120	1.71	2.97	4.00	4.90
	130	1.83	3.19	4.30	5.27		130	1.88	3.24	4.35	5.32
8 x 8-1/2 wall thickness	120	1.27	2.50	3.52	4.42	Six double extra-strong 0.864 wall thickness	120	1.04	2.28	3.32	4.23
	130	1.44	2.78	3.89	4.86		130	1.19	2.60	3.68	4.67
8 x 8-3/8 wall thickness	120	1.43	2.67	3.69	4.59	Six extra-strong 0.432 wall thickness	120	1.45	2.71	3.75	4.67
	130	1.60	2.95	4.05	5.02		130	1.62	2.99	4.10	5.08
8 x 8-1/4 wall thickness	120	1.62	2.87	3.89	4.78	Six standard 0.280 wall thickness	120	1.65	2.91	3.94	4.84
	130	1.79	3.14	4.24	5.21		130	1.82	3.19	4.30	5.27

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Multi-Wythe Masonry Walls

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ACI/TMS 216.1

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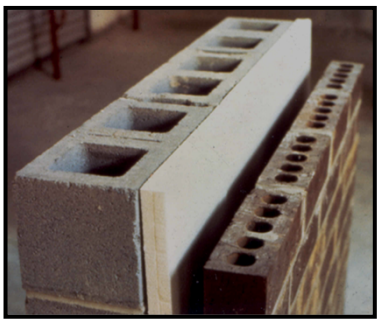
5.3.2 and 6.3.3 Multi-wythe walls



- Multi-wythe clay masonry walls with dimensionally dissimilar wythes
- Multi-wythe walls with dissimilar materials
- Continuous air spaces

$$R=(R_1^{0.59}+R_2^{0.59}+\ldots+R_n^{0.59}+A_1+A_2+\ldots+A_n)^{1.7}$$

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Multi-Wythe Masonry

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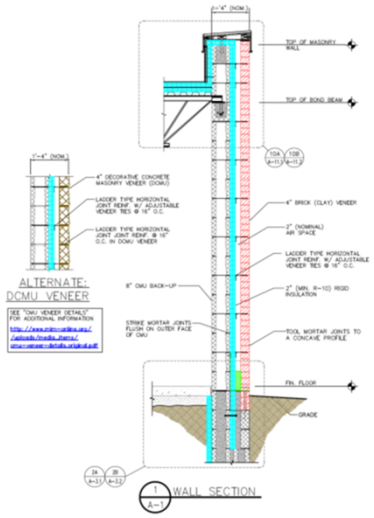

Given:

- 8” CMU & 4” brick veneer
- 50% solid
- Equivalent Thickness = 3.81 inches
- Normal weight 125 pcf
  - 33% sand
  - 33% gravel
  - 34% limestone

Answer:

- Block = 1.74 hours
- Brick = 1.00 hours
- Fire Resistance = 5.37 hours
- Fire Resistance Rating = 4.00 hours

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Masonry Columns

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Table 5.1b—Reinforced masonry columns

Fire resistance, h	1	2	3	4
Minimum nominal column dimensions, in.	8	10	12	14

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Masonry Beams/Lintels

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ACI/TMS 216.1

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Table 5.1c—Reinforced masonry lintels

Nominal lintel width, in.	Minimum longitudinal reinforcement cover for fire-resistance rating, in.			
	1 hour	2 hours	3 hours	4 hours
6	1-1/2	2	NP	NP
8	1-1/2	1-1/2	1-3/4	3
10 or more	1-1/2	1-1/2	1-1/2	1-3/4

Note: NP = Not permitted without a more detailed analysis.

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Movement Joints

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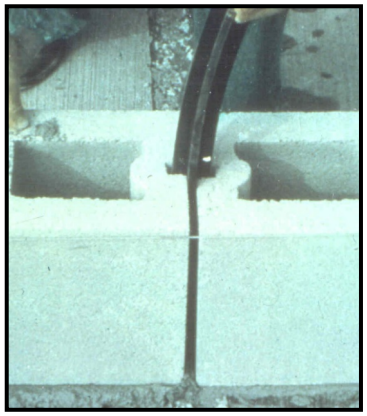
5.3.3 and 6.6 Expansion or contraction joints

- Shall be in accordance with Fig. 5.3.3



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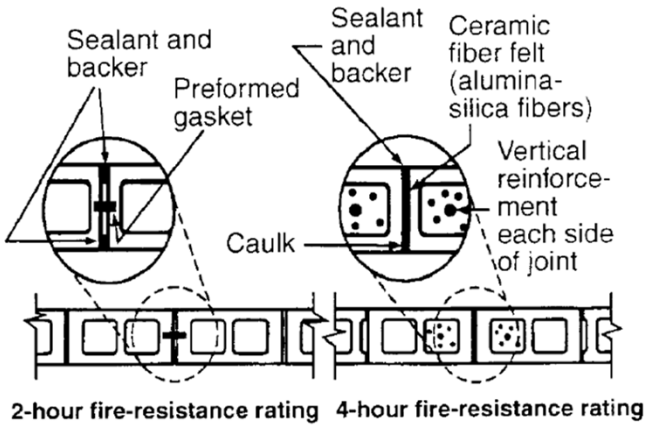
- Fig. 5.3.3 – Expansion or contraction joints in masonry walls



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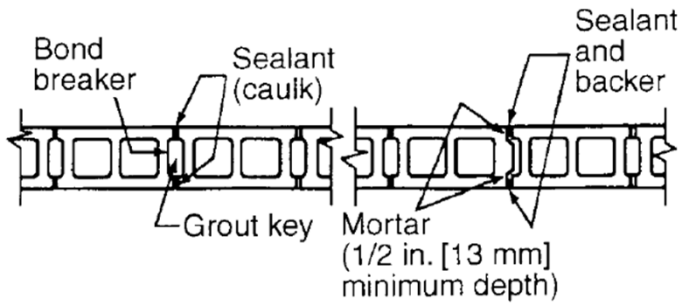
- **Fig. 5.3.3 – Expansion or contraction joints in masonry walls**



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NFPA 285

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- Generic Wall Design – Jan. 21, 2016
  - Architectural
    - Head Details NFPA 285 Compliant

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NFPA 285 History

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- Energy crisis 1970 (OPEC – oil embargo)
- Plastics industry encouraged the building industry to use foam plastic insulation
- Proposal was rejected due to noncombustible requirements for types of construction
- Society of the Plastics Industry was charged to design a test
- UBC 1988 adopted the test method
- UBC 1992 adopted an indoor test
- In 1998 NFPA 285

Navigating Wall Assembly Fire Testing, DuPont Building Innovations, Barbara Horwitz-Bennett, Architectural Record, March 2013

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Beyond Foam Plastic Requiring NFPA 285 Testing

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- **International Building Code**
  - **Exterior insulation finishing systems (EIFS) – 2000**
  - **Metal composite materials (MCM) – 2003**
  - **Fiber-reinforced plastics (FRP) – 2009**
  - **High-pressure laminates (HPL) – 2012**
  - **Water-resistive barriers (WRB) – 2012**

Navigating Wall Assembly Fire Testing, DuPont Building Innovations, Barbara Horwitz-Bennett, Architectural Record, March 2013

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Foam Plastic Insulation

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- **Rigid Board**
  - **Expanded polystyrene**
  - **Extruded polystyrene**
  - **Polyisocyanurate**

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Foam Plastic Insulation

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- Open cell and closed cell spray applied or foamed-in-placed

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Foam Plastic Insulation

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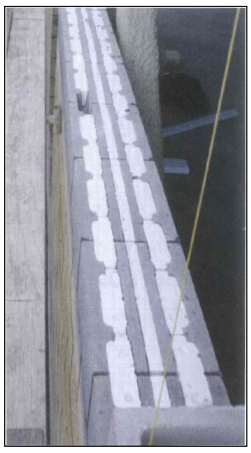
- Interior, exterior or in the cores
  - Single wythe walls



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NFPA 285 Test with Brick Veneer: Passed

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DOW Building Solutions

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NFPA 285 Test with Brick Veneer: Passed

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JENSEN HUGHES

October 15, 2015

Dow Building Solutions
The Dow Chemical Company
1605 Joseph Drive
Midland, MI 48642

RE: Analysis and Extension of NFPA 285 Tests – STYROFOAM™ XPS
Project No.1JJB05306.011

To Whom It May Concern:

This letter provides a summary of NFPA 285 tests that incorporated extruded polystyrene foam plastic insulation (XPS) and the extension of those results to Dow Chemical's STYROFOAM™ XPS and to include other various exterior wall configurations which will meet the requirements of NFPA 285.

Section 2603.5.5 of the 2006, the 2009, and the 2012 Editions of the International Building Code (IBC) requires that exterior wall systems that incorporate foam plastic insulation shall meet the requirements of NFPA 285 "Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components."

Several NFPA 285 tests that incorporated XPS have been conducted under the auspices of the Extruded Polystyrene Foam Association (XPSA). These tests were successful and met the requirements of NFPA 285. The results of the tests do apply to STYROFOAM™ XPS, and XPSA has given authorization to Dow Chemical to use these tests and reports. These tests are reported in the following test reports:

1. Southwest Research Institute, Final Report No. 01.06440.01.001, dated May 2003;
2. Underwriters Laboratories, Inc, Final Report 05CA2541, NC2690, dated January 10, 2005; and,
3. Southwest Research Institute, Final Report No. 01.13537.01.106, dated September 26, 2008.

Based on the results of these tests, additional NFPA 285 testing by Sto Corp. and Dryvit Systems, Inc., as well as additional small-scale tests of the weather-resistive barriers, and my experience with the NFPA 285 fire test, it is my judgment that the various configurations of exterior walls described in the attached figures will meet the performance requirements of NFPA 285.

This analysis is based on the specific construction materials installed in the manner described in the referenced test report(s). Changes or modifications to the construction and/or materials used in the tested assembly may result in a different fire performance and may change this analysis.

This analysis does not address performance characteristics such as weatherability, durability, or structural issues. If you have any questions, please feel free to contact me.

Sincerely,

Jesse J. Beitel
Senior Scientist/Principal

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Baltimore, MD 21227 USA
jensenhughes.com

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Table I – Walls Containing STYROFOAM™ XPS Insulation

Wall Component	Materials
Base wall system – Use either 1, 2, or 3	1 – Concrete wall 2 – Concrete Masonry wall 3 – 1 layer – ⅝-inch thick, Type X, Gypsum wallboard on interior, installed over steel studs; minimum 3⅝-inch depth, minimum 20-gauge at a maximum of 16-inch OC with lateral bracing every 4 ft, vertically
Floorline Firestopping	4 lb./cu ft. mineral wool (e.g. Thermafiber) in each stud cavity and at each floorline – attached with Z-clips or equivalent
Cavity Insulation – Use either 1, 2, or 3	1 – None 2 – Fiberglass batt insulation (faced or unfaced) 3 – Any noncombustible insulation (faced or unfaced)
Exterior sheathing – Use either 1, 2, or 3	1 – None 2 – ½-inch thick, exterior type gypsum sheathing 3 – ⅝-inch thick, Type X, exterior type gypsum sheathing
Weather-resistive barrier applied to gypsum sheathing – Use either 1 or 2	1 – None 2 – Any shown in Table II
Exterior insulation	1 – STYROFOAM™ Type IV or Type X per ASTM C578 – Total thickness to be a minimum of 1½ inch to maximum of 3 inches when installed using Special Conditions (see below)
Sealing of exterior insulation	Optional, seal all exterior insulation joints and as an option veneer tie penetrations with either: a) Dow LIQUIDARMOR™ - CM Flashing and sealant – max. 60-mil wet thickness, max. 5-inch width b) Acrylic, asphalt or butyl-based sealing tape – max. 4-inch width c) Dow Great Stuff Pro™ - Use on joints that are ≤ ¼-inch, vertical joints must be staggered & remove significant excess from the face of the XPS
Weather-resistive barrier applied to exterior insulation – Use either 1 or 2	1 – None 2 – Any shown in Table III
Exterior Veneer – Use either 1, 2, 3, 4, 5, 6, 7 or 8	1 – Brick – Standard nominal 4-inch thick clay brick. Brick veneer anchors – standard types – installed maximum 24 inches OC vertically, on each stud. Maximum 2-inch air gap between exterior insulation and brick. 2 – Concrete – 2 inches thick or greater. Maximum 2-inch air gap between exterior insulation and concrete. Any standard non-open-joint installation technique can be used. 3 – Concrete masonry units – 4 inches thick or greater. Maximum 2-inch air gap between exterior insulation and CMU. 4 – Stone Veneer – Minimum 2-inch thick. Limestone or natural stone veneer or minimum 1-1/2 inch thick cast artificial stone veneer. Any standard non-open-joint installation technique such as ship-lap, etc. can be used. 5 – Terracotta cladding – Use any terracotta cladding system in which terracotta is minimum 1-1/4 inch thick. Any non-open-joint installation technique such as ship-lap, etc. can be used. 6 – Stucco – Minimum ⅞-inch thick, 2- or 3-coat stucco and lath. This wall construction shall be as described in Table IV. 7 – StoTherm® ci XPS System. This wall construction shall be as described in Table V. 8 – Dryvit Outsulation X™ System. This wall construction shall be as described in Table VI
Special Conditions	Use any header treatment shown in Figures 1.1-1.11 for all window and door openings in wall
Flashing of window, door and other exterior wall penetrations.	As an option, flash window, door and other exterior penetrations with either: a) Dow LIQUIDARMOR™ - CM Flashing and Sealant – max. 60-mil wet thickness, max. 12-inch width. b) Limited amounts of acrylic, asphalt or butyl-based flashing tape – max. 12-inch width.

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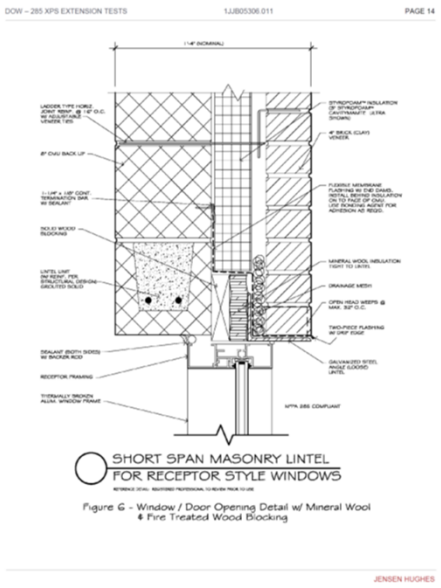

Figure 6 - Window / Door Opening Detail w/ Mineral Wool & Fire Treated Wood Blocking

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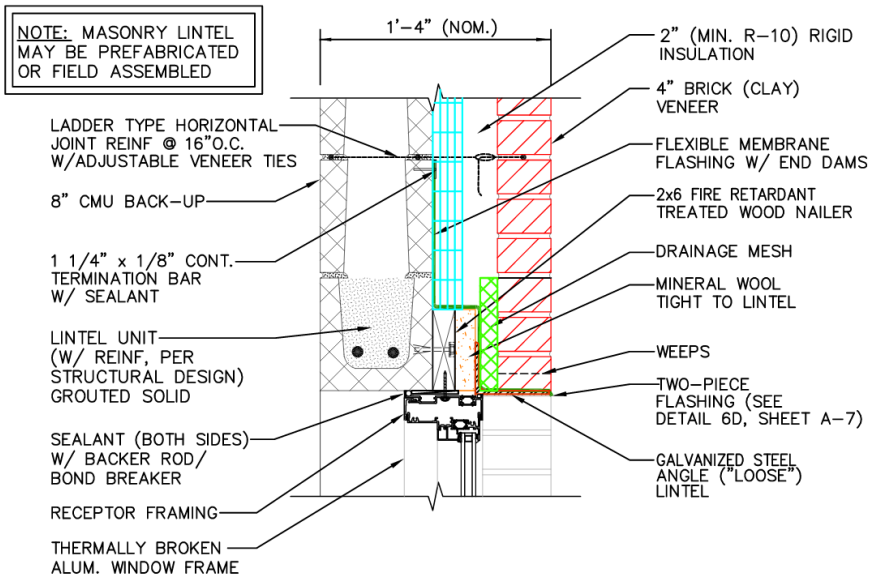

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Fire Resistance Guide, FAQs, Table and Calculator

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MIM Fire Resistance Wall Guide

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	FIRE RESISTANCE RATING WALL GUIDE			
units	**1-hour**	**2-hour**	**3-hour**	**4-hour**
8" CMU	**1. NW/MW** **2. LW**	**1. NW/MW** **2. LW**	**1. NW/MW with cell fill** **2. LW with cell fill**	**1. NW/MW with cell fill** **2. LW with cell fill**
10" CMU	**1. MW/LW** **2. NW**	**1. MW/LW** **2. NW**	**1. MW/LW** **2. NW**	**1. LW** **2. MW** **3. NW with cell fill**
12" CMU	**1. MW/LW** **2. NW**	**1. MW/LW** **2. NW**	**1. MW/LW** **2. NW**	**1. LW** **2. MW** **3. NW with cell fill**

Notes:

1. Units meet ASTM C90 (8" and 12" units more widely used)
2. NW - normal weight (125 pcf or more)
3. MW - medium weight (105 pcf to less than 125 pcf)
4. LW - lightweight (less than 105 pcf)
5. cell fill - solid grouted, sand, pea gravel, crushed stone, slag, pumice, scoria, expanded shale, expanded clay, expanded slate, expanded slag, expanded fly ash, cinders perlite, and
6. The numbering order (1, 2, or 3) is by preference

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MIM FAQs, masonryinfo.org

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Fire (F)

II-F-1 How does one determine the fire resistance rating of an existing, single wythe, hollow concrete masonry wall?

II-F-2 Can the fire resistance rating of an existing, single wythe concrete masonry wall be improved by adding wall finishes?

II-F-3 Can the fire resistance rating of an existing, single wythe, hollow concrete masonry wall be improved by filling the cells?

II-F-4 How does one determine the fire resistance rating of a single wythe concrete masonry wall when only some of the cells are grouted?

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NCMA TEK 07-01D Table 2

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Table 2—Equivalent Thicknesses of Concrete Masonry Units, in. (mm)

Nominal width, in. (mm)	Based on typical hollow units[A]		Based on percent solid (75%)	(100%)
4 (102)	2.7 (69)	[73.8]	2.7 (69)	3.6 (91)
6 (152)	3.1 (79)	[55.0]	4.2 (107)	5.6 (142)
8 (203)	4.0 (102)	[53.0]	5.7 (145)	7.6 (193)
10 (254)	4.5 (113)	[46.3]	7.2 (183)	9.6 (244)
12 (305)	5.1 (129)	[44.0]	8.7 (221)	11.6 (295)
14 (356)	5.5 (139	[40.2]	10.2 (259)	13.6 (345)
16 (406)	6.0 (152)	[38.4]	11.7 (297)	15.6 (396)

[A] Values in brackets [ ] are percent solid values based on typical two-core concrete masonry units.

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NCMA Fire Calculator

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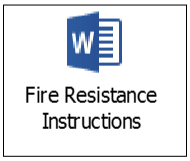
NCMA Fire Resistance Calculator

This spreadsheet provides section properties for CMU walls that are either vertically or horizontally grouted.

1. Orange cells are for user input
2. Grey cells with orange text are interim calculations with pertinent information.
3. Units must conform to a 2 faceshell configuration
4. Depending on user input, cells may appear or vanish based on what is needed. Leave no cells blank.
5. For a more detailed instruction, double-click the link below to be directed to a PDF (will open in Adobe Acrobat)
6. If you feel the need or desire to edit or alter the calculations in this sheet, the protection password is as follows:

bloxrox



NATIONAL CONCRETE MASONRY ASSOCIATION

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Fire Resistance

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Questions

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