

MASONRY FIRE-RESISTANCE RATED CONSTRUCTION CODE REFERENCES

- 2016 CBC – Chapter 7

DEFINITIONS

- 702 | **FIRE RESISTANCE.** That property of materials or their assemblies that prevents or retards passage of excessive heat, hot gasses or flames under conditions of use.
FIRE-RESISTANCE RATING. The period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both, as determined by the tests, or the methods based on tests, prescribed in Section 703.

FIRE-RESISTANCE RATINGS

- 703.2 | **Fire-resistance ratings.** The fire-resistance rating shall be determined by testing per ASTM E119, or in accordance with Section 703.3.
- 703.3(2.) | **Methods for determining fire resistance.** Fire resistance may be established by prescriptive designs of fire-resistance-rated building elements per Section 721 [Prescriptive Fire Resistance].
- 703.3(3.) | Fire resistance may be established by calculations per Section 722 [Calculated Fire Resistance].

PRESCRIPTIVE FIRE RESISTANCE

- 721.1 | **General.** Materials listed in Tables 721.1(2) shall be assumed to have the fire-resistance ratings prescribed therein.
- 721.1.2 | **Unit masonry protection.** Where unit masonry is used for the protection of steel columns, required ties must be embedded in the bed joints of the masonry.

Table 721.1(2)
3-1.1 – 3-1.4

RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS

Item Numbers	Construction	Min. Finished Thickness Face-to-Face ^b (in.)			
		4 hr	3 hr	2 hr	1 hr
3-1.1 ^{f,g}	Expanded slag or pumice.	4.7	4.0	3.2	2.1
3-1.2 ^{f,g}	Expanded clay, shale or slate.	5.1	4.4	3.6	2.6
3-1.3 ^f	Limestone, cinders or air-cooled slag.	5.9	5.0	4.0	2.7
3-1.4 ^{f,g}	Calcareous or siliceous gravel.	6.2	5.3	4.2	2.8

- b. Thickness for concrete masonry is equivalent thickness defined in Section 722.3.1 [Calculated Fire Resistance]. Where all cells are solid grouted or filled with silicone-treated perlite loose-fill insulation; vermiculite loose-fill insulation; or expanded clay, shale or slate lightweight aggregate, the equivalent thickness shall be the thickness of the block using specified dimensions as defined in Chapter 21. Equivalent thickness may also include the thickness of applied plaster and lath or gypsum wallboard, where specified.
- f. The fire-resistance time period for concrete masonry units meeting the equivalent thicknesses required for a 2-hour fire-resistance rating, and having a thickness of not less than 7 5/8 inches is 4 hours when cores which are not grouted are filled with silicone-treated perlite loose-fill insulation; vermiculite loose-fill insulation; or expanded clay, shale or slate lightweight aggregate, sand or slag having a maximum particle size of 3/8 inch.
- g. The fire-resistance rating of concrete masonry units composed of a combination of aggregate types or where plaster is applied directly to the concrete masonry shall be determined in accordance with ACI 216.1/TMS 0216. [Calculate combinations of aggregate types by linear interpolation.]

CALCULATED FIRE RESISTANCE

- 722.3.1.1 **Concrete masonry. Equivalent thickness. Concrete masonry unit plus finishes.** The equivalent thickness of concrete masonry assemblies is the sum of the equivalent thickness of the cmu plus the equivalent thickness of finishes:
- $$T_{ea} = T_e + T_{ef} \quad \text{where: } T_e = \text{Equivalent thickness of cmu}^*$$
- $$T_{ef} = \text{Equivalent thickness of finishes}$$
- 722.3.1.2 *For partially grouted construction, T_e is the cmu value as determined by ASTM C140.
- 722.3.1.3 *For solid grouted construction, T_e is the actual thickness of the unit.
- 722.3.1.4 *For airspaces and cells filled with loose-fill materials below, the equivalent thickness is the actual thickness of the hollow cmu:
- Sand, pea gravel, crushed stone, or slag meeting ASTM C33
 - Pumice, scoria, expanded shale, expanded clay, expanded slate, expanded slag, expanded fly ash, or cinders meeting ASTM C331
 - Perlite meeting ASTM C549
 - Vermiculite meeting ASTM C516
- 722.3.2.1 **Concrete masonry walls. Finish on nonfire-exposed side.** Concrete masonry walls and partitions with plaster or gypsum wallboard applied to the NON-fire-exposed side:
- Equivalent thickness of plaster or gypsum wallboard corrected by factor from Table 722.2.1.4(1) and added to the equivalent thickness of the masonry.
- That sum is used to determine the rating from Table 722.3.2.
- 722.3.2.2 **Finish on fire-exposed side.** Concrete masonry walls and partitions with plaster or gypsum wallboard applied to the fire-exposed side:
- The time assigned to the finish per Table 722.2.1.4(2) is added to the rating for the concrete masonry alone, or to the sum of the concrete masonry and finish on the nonfire-exposed side per 722.3.2.1.
- 722.3.2.3 **Nonsymmetrical assemblies.** Where a wall may have no finish on one side, or different types of finishes on each side, perform calculations for each as a fire-exposed side and use the lower value. **Exception:** Exterior walls with more than 5 feet of horizontal separation, only the interior side will be assumed to be the fire-exposed side.
- 722.3.2.4 **Minimum concrete masonry fire-resistance.** Where the finish applied to a concrete masonry wall contributes to the fire-resistance rating, the masonry must provide at least half the total rating.
- 722.3.3 **Multiwythe masonry walls.** Fire-resistance rating based on rating period of each wythe and the continuous airspace between them, calculated per Equation 7-7.
- 722.3.4 **Concrete masonry lintels.** Fire-resistance ratings for lintels are based on the nominal thickness of the lintel and the minimum cover of the main reinforcing bars, per Table 722.3.4.
- 722.3.5 **Concrete masonry columns.** Fire-resistance ratings for columns are based on the least plan dimension of the column, per Table 722.3.5.
- 722.5.1.4.5 **Steel assemblies. Structural steel columns. Masonry protection.** For masonry protection of structural steel columns, the fire-resistance rating is determined by Equation 7-16 and its supporting tables.
- 722.5.1.4.6 **Equivalent concrete masonry thickness.** The equivalent thickness of concrete masonry used to protect steel columns is per Table 722.5.1(5).

Note: As shown above, 2016 CBC Table 721.1(2) has four material ("construction") categories for concrete masonry walls:

- 3-1.1 Expanded slag or pumice
- 3-1.2 Expanded clay, shale or slate
- 3-1.3 Limestone, cinders or air-cooled slag
- 3-1.4 Calcareous or siliceous gravel

However, nearly all cmu in Southern California are blends of one or more of these material categories. The following shows fire-resistance periods for typical aggregate blends used in cmu produced in this region.

		Partial Grouted			Solid Grouted ¹		
CMU ASTM C90 Wt. Classification		NW	MW	LW	NW	MW	LW
Nominal Width	4	< 1 Hour	< 1 Hour	1 Hour	1 Hour	1 Hour	1 Hour
	6	1 Hour	1 Hour	1 Hour	3 Hours	3 Hours	3 - 4 Hours ²
	8	1 Hour	1 - 2 Hours ²	2 Hours	4 Hours	4 Hours	4 Hours
	10	2 Hours	2 Hours	2 Hours	4 Hours	4 Hours	4 Hours
	12	2 Hours	2 Hours	3 Hours	4 Hours	4 Hours	4 Hours

¹4-inch wide cmu are solid.

²May depend on manufacturing location or product specified. Consult your representative for more information.