



# Masonry in Hawaii

## How do you calculate the fire rating for cmu walls, that are not fully grouted but is grouted every 32 or 48 inches on center?

By referencing TEK Bulletin 7-1A, we can check the table 1 as to what fire rating you will get by using cmu blocks. Since most of the blocks that are made in Hawaii are from calcareous limestone and silica gravel, we can look at the first row to see how much equivalent thickness you need to achieve a 4 hour, 3hour, or a 2 hour fire rating. Sometimes the plant could make blocks out of cinder (volcanic cinder from Maui or the Big Island) and this will allow you to go to the second line.

**Table 1—Fire Resistance Rating Period of Concrete Masonry Assemblies (ref. 1)**

Aggregate type in the concrete masonry unit <sup>2</sup>	Minimum required equivalent thickness for fire resistance rating, in. (mm) <sup>1</sup>							
	4 hours	3 hours	2 hours	1.5 hours	1 hour	0.75 hours	0.5 hours	
Calcareous or siliceous gravel	6.2 (157)	5.3 (135)	4.2 (107)	3.6 (91)	2.8 (71)	2.4 (61)	2.0 (51)	
Limestone, cinders or slag	5.9 (150)	5.0 (127)	4.0 (102)	3.4 (86)	2.7 (69)	2.3 (58)	1.9 (48)	
Expanded clay, shale or slate	5.1 (130)	4.4 (112)	3.6 (91)	3.3 (84)	2.6 (66)	2.2 (56)	1.8 (46)	
Expanded slag or pumice	4.7 (119)	4.0 (102)	3.2 (81)	2.7 (69)	2.1 (53)	1.9 (48)	1.5 (38)	

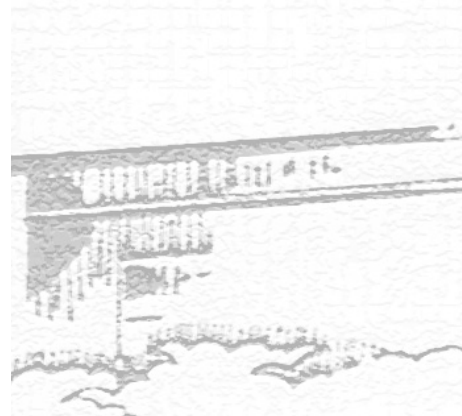
1. Fire resistance rating between the hourly fire resistance rating periods listed may be determined by linear interpolation based on the equivalent thickness value of the concrete masonry assembly.
2. Minimum required equivalent thickness corresponding to the hourly fire resistance rating for units made with a combination of aggregates shall be determined by linear interpolation based on the percent by volume of each aggregate used in the manufacture.

Once we determine what equivalent thickness we need, we can go to table 2 to check what equivalent thickness is for an 8 inch block or a 10 inch block. On an 8 inch block, the equivalent thickness is 4.0 so if we look in table 1, we see that we need an equivalent thickness of 4.2 to achieve a 2 hour fire rating. If we fully grouted the 8 inch block, the equivalent thickness would jump to 9.6 and this far exceeds the 4.2 requirement for a 2 hour fire rating.

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

Nominal width, in. (mm)	Based on typical hollow units <sup>1</sup>		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)	5.0(127)	[51.7]	7.2 (183)	9.6 (244)
12 (305)	5.7(145)	[48.7]	8.7 (221)	11.6 (295)

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





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What happens if you grout every other cell or grout 32 inches or 48 inches on center?  
Does this give you an equivalent thickness greater than 4.0 on an 8 inch block?

The wall assembly is only as strong as the weakest link. Even if you were to grout the cells every 48 inches or 32 inches, the equivalent thickness will remain at 4.0 where the un-grouted cell is and it will not increase the equivalent thickness of the overall assembly unless all the cells were filled. "A fire rating thickness is based on either an equivalent solid thickness of ungrouted units or solid grouted walls (partially grouted walls are considered as ungrouted for fire ratings)." This excerpt is taken from Reinforced Masonry Engineering Handbook written by James E. Amrhein.

