

Identifying the Fire Resistance of Concrete Masonry Walls

The National Construction Code requires walls to meet certain Fire Resistance Levels (FRL), to protect properties from the risk of fire.

FRLs are expressed as a measure of structural adequacy (minimum time wall can remain standing), integrity (ability of the member to prevent flames/hot gases passing through), and insulation (a measure of its ability to resist the passage of heat through the wall),

When determining the FRL of concrete masonry walls, the type of building, height and size, proximity to adjacent wall structure and whether it would be load/non-load bearing must all be specified.

This method for determining the FRL of the concrete masonry component of a wall is based on part B chapter 4 'Fire' of the CMAA Manual MA55 57-2016 'Design and Construction of Concrete Masonry Buildings'.

STRUCTURAL ADEQUACY

Structural adequacy is dictated by the slenderness ratio of the wall, which depicts its stability. It is calculated by:

1. identifying the length, height, and thickness of the wall, and the type of support used;
2. selecting the relevant structural adequacy chart on pages 10-46 of MA55 Bo4 'Design requirements-Fire' that matches the wall's type of reinforcement, unit thickness, material composition and type of support;
3. finding the structural adequacy by tracking the point at which the values for 'height of wall between the supports' (y-axis) and 'length of wall between supports' (x-axis) intersect; and
4. reading to the nearest line above the intersection point in order to determine the structural adequacy of the wall.

INTEGRITY

For the purposes of design, the fire resistance for integrity can be assumed to be the lesser of the values determined for structural adequacy and insulation.

INSULATION

The insulation of a concrete masonry wall is established by aligning the material unit thickness of the wall with the material density, using the tables below from MA 55:

Masonry Unit Thickness (mm) and Type	Material Thickness (mm)	INSULATION FIRE RESISTANCE LEVEL (minutes)		Material Thickness (mm)	INSULATION FIRE RESISTANCE LEVEL (minutes)		
		> 1800 kg/m ³	≤ 1800 kg/m ³		> 1800 kg/m ³	≤ 1800 kg/m ³	
90 cored or solid ⁽¹⁾	90	60	90	190 hollow ⁽²⁾ (ET ⁽³⁾ ≥ 90)	90	60	90
90 cored or solid ⁽¹⁾ + 12 mm cement render each face	102	90	90	190 hollow ⁽²⁾ (ET ⁽³⁾ ≥ 100)	100	90	90
110 cored or solid ⁽¹⁾	110	90	120	190 hollow fully grouted	190	240	240
110 cored or solid ⁽¹⁾ + 12 mm cement render each face	122	120	120	190 hollow ⁽²⁾ (ET ⁽³⁾ ≥ 90)+ 12 mm cement render each face	102	90	90
140 hollow ⁽²⁾ (ET ⁽³⁾ ≥ 80)	80	60	60	190 hollow ⁽²⁾ (ET ⁽³⁾ ≥ 100)+ 12 mm cement render each face	112	90	120
140 hollow (ET ⁽³⁾ ≥ 98)	140	120	180	90 cored or solid + 90 cored or solid ⁽¹⁾ cavity wall	180	240	240
140 hollow ⁽²⁾ fully grouted	140	120	180	90 cored or solid + 110 cored or solid ⁽¹⁾ cavity wall	200	240	240
140 hollow ⁽²⁾ (ET ⁽³⁾ ≥ 88)+ 12 mm cement render each face	100	90	90	110 cored or solid + 110 cored or solid ⁽¹⁾ cavity wall	220	240	240
140 hollow ⁽²⁾ (ET ⁽³⁾ ≥ 110)+ 12 mm cement render each face	152	180	180				

NOTES:

- 1 Cores less than 30% of the unit volume
(For 90 mm and 110 mm units, material thickness will be 90 mm and 110 mm respectively, irrespective of how the units are bedded)
- 2 Cores greater than 30% of the unit volume
- 3 Equivalent thickness of the masonry unit (net volume divided by face area)

WORKED EXAMPLE

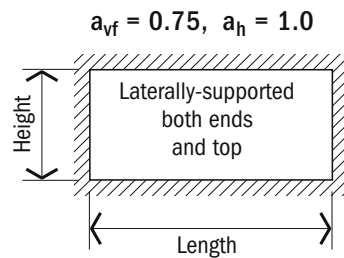
The FRL for an unreinforced masonry wall with a thickness of 90 mm and material composition less than 45% basalt, supported on all four sides, would be calculated as follows:

1. identify the length between walls (2.5 m), height (2 m), thickness (90 mm), and type of support (simply supported on all four sides) for the wall.
2. refer to the relevant chart (see below) and intersect the value of 2 m on the y-axis with 2.5 m on the x-axis results in a point lying between the first and second FRL lines from the bottom of the chart.
3. read up from the point to get a structural adequacy of 180 minutes.
4. at less than 45% basalt, the material density of the block would be below 1800 kg/m³, so according to the table shown earlier; this would give a result of 90 minutes for insulation.
5. the integrity measure would be the lesser of structural adequacy and insulation, namely 90 minutes.

Therefore, the FRL would be 180/90/90.

UNREINFORCED MASONRY

90-mm leaf <45% basalt



Fire-resistance level, FRL (minutes), for Structural Adequacy

