



Canadian Concrete Masonry Producers' Association Fire Properties & Design Details

FIRE PERFORMANCE PROPERTIES

Introduction

Fire ratings for CCMPA metric concrete masonry units are derived from the Supplementary Guidelines to the 1997 Ontario Building Code and the National Building Code of Canada. The ratings given in the Guidelines are based on those that would be obtained from standard laboratory methods of test, essentially a means of comparing the fire performance of one building component with another.

The fire endurance of concrete masonry units varies by type of aggregate and equivalent thickness of the unit.

Equivalent Thickness

The equivalent thickness of a cored unit is equal to the actual overall thickness of the unit multiplied by the net volume and divided by the gross volume.

For example: 25 cm Hollow Unit

$$\text{Actual Thickness} \times \frac{\text{Net Volume}}{\text{Gross Volume}} \\ 240\text{mm} \times \frac{9.43\text{mm}^3 \times 10^6}{17.784\text{mm}^3 \times 10^6} \\ = 127.26 \text{ mm say } 127 \text{ mm}$$

Types of Concrete

The available types of concrete mix for O.C.B.A. block are as follows:

NORMAL WEIGHT CONCRETE

- *Type N Concrete*
The coarse aggregate is limestone, calcareous gravel, or similar dense aggregate material.
- *Type S Concrete*
The coarse aggregate is granite, quartzite, siliceous gravel or similar dense material.

LIGHTWEIGHT CONCRETE

- *Type L²⁰S*
The coarse aggregate is expanded slag, and the fine aggregate is sand and lightweight aggregate in which the sand does not exceed 20% of the total volume of all of the aggregates.

It should be noted that lightweight units exhibit better fire performance and therefore a higher resistance rating is assigned than for the same equivalent thickness of normal weight block.

Fire Endurance Ratings

Fire endurance ratings of standard hollow, 75% solid, and 100% solid metric concrete masonry units in different aggregate types can be found in Table 5.0. The values are typical for CCMPA Members. This section can be used by designers in conjunction with The Supplement to the National Building Code.

EQUAL FIRE RATINGS DON'T GUARANTEE EQUAL PERFORMANCE

The ASTM-E 119 (ref. 1) test procedure used to determine fire ratings of wall assemblies can allow significant differences in performance among partitions with the same rating. This test consists of two parts:

1. *The fire endurance test, in which a test specimen must withstand a controlled fire for a specific time period (1 hour, 2 hours etc.) and*
2. *The hose stream test, in which the specimen must withstand the impact of a controlled stream of water after fire exposure.*

When a masonry assembly is tested, the hose stream test normally is performed on the specimen that has completed the fire endurance test. For a 2-hour rating, the test wall is exposed to fire for 2h, then subjected to the hose stream.

However, the test need not be conducted this way for a wall assembly to achieve a specific rating. The hose stream test may be performed on a second specimen that has withstood the fire endurance test for one-half the desired rating period.

The result: some 2-hour-rated walls may not maintain integrity but masonry walls withstand the hose stream test after the full 2 hours of exposure to fire. When selecting consider the system's fire resistance characteristics, not just its fire rating.

Reference

ASTM E 119, Standard Methods of Fire Tests of Building Construction & Materials, ASTM, 1916 Race St., Philadelphia PA 19103

Fire Performance Properties

**TABLE 5.0
FIRE RESISTANCE RATING OF
CONCRETE BLOCK IN HOURS**

CCMPA HOLLOW UNITS

SIZE CODE	EQUIVALENT THICKNESS mm	NORMAL WEIGHT	LIGHT WEIGHT
		N or S	L ₂ 20s
		HOURS	
10	66	0.8	1.1
15	81	1.1	1.5
20	106	1.8	2.5
25	127	2.4	3.5
30	148	3.2	4+

CCMPA 75% SOLID

SIZE CODE	EQUIVALENT THICKNESS mm	NORMAL WEIGHT	LIGHT WEIGHT
		N or S	L ₂ 20s
		HOURS	
10	74	1.1	1.3
15	112	2.0	2.8
20	148	3.2	4+
25	187	4+	4+
30	227	4+	4+

CCMPA SOLID PIER

SIZE CODE	EQUIVALENT THICKNESS mm	NORMAL WEIGHT	LIGHT WEIGHT
		N or S	L ₂ 20s
		HOURS	
10	74	1.1	1.3
10	90	1.4	1.8
15	140	2.9	4+
20	190	4+	4+
25	240	4+	4+
30	290	4+	4+

Contribution of Plaster and Wallboard Finish

Improved fire separation endurance can be achieved in concrete masonry walls by the use of plaster or gypsum wallboard, applied directly to the masonry wall. Reference should be made to the Supplementary Guidelines for pertinent details.

For requirements not covered in this section consult a local CCMPA Producer.

Fire Resistance Protection For Steel Columns

The minimum equivalent thickness of concrete masonry protection for steel columns is given in Table 2.6.1.A of the Guidelines.

**TABLE 5.1
EQUIVALENT THICKNESS OF
CONCRETE MASONRY REQUIRED
FOR STEEL COLUMNS (mm)**

CONCRETE TYPE	FIRE RESISTANCE PROTECTION (IN HOURS)			
	0-1.5	2.0	3.0	4.0
S	50	64	89	115
N OR L ₂ 20s	50	50	77	102

An additional requirement when using concrete masonry units as fire protection for steel columns is for joint reinforcement of at least 5.20 mm wire to be laid in every second course. The space between the masonry protection and the steel column need not be filled.

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