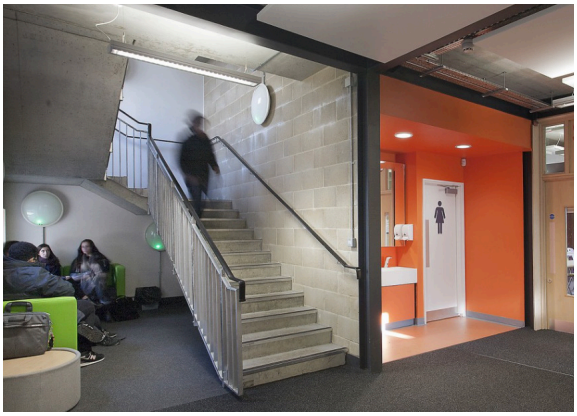
Fire Resistance - An introduction

Traditionally, buildings formed from masonry have proven over time to be among the safest and most reliable fire-resistant building methods available. This applies to both the construction phase and for the entire lifetime of the structure.



Concrete blockwork can provide outstanding fire performance and this is due chiefly to its constituent materials (cement and various types aggregates) which, when chemically combined, form a material that is essentially inert and, crucially for fire safety design, has relatively low thermal conductivity. It is this slow rate of conductivity (heat transfer) that allows concrete blockwork to act as an effective fire shield not only between adjacent spaces, but also to protect itself from fire damage. With its fire-resisting properties, blockwork can provide more than just life-safety protection, but can also provide reduction to the damage done to the building as a result of fire.

Fire Resistance

The following Tables of fire resistance are based upon the National Annex to BS EN 1996-1-2: 2005. The Tables are only valid for walls complying with BS EN 1996 Part 1-1, Part 2 and Part 3. For walls designed in accordance with BS 5628, fire resistance values can be confirmed with our Technical Department.

Under BS EN 1996-1-2 masonry members must be considered against various criteria in relation to their fire resistance for standard fire exposure, these being:

R – Mechanical resistance
E – Integrity
I - Insulation
M – Mechanical impact (not relevant in the UK)

The form and function of the masonry walls in relation to their nominal fire exposure criterion, are as follows:

Loadbearing only – Criterion R
Separating only – Criterion E1
Separating and Loadbearing - Criterion REI

The fire resistance values presented are for unfinished walls. Plastering walls will show a small improvement in the fire periods shown - please refer to the Lignacite Technical Department for details. The plaster should be a gypsum premixed plaster to BS EN 13279-1 or plaster type LW or T, in accordance with BS EN 998-1, The plaster should be at least 10mm thick, and in the case of a single leaf wall this is required to both sides, or in the case of a cavity wall, it is assumed to be on the fire exposed face.
Note - A cement/sand render is not considered to increase the fire resistance of the wall.

The fire periods given in BS EN 1996-1-2 are based on the whether the blocks are lightweight or dense aggregate and the configuration on the units.

The configuration is based on the descriptions in the product standard BS EN 771-3
Group 1 units - all blocks described as 'solid'.
Group 2 units - all blocks described as 'cellular' or 'hollow'.

Please note that the minimum wall thickness shown in the tables may not always correspond to an available block size, so it is advisable to check the relevant Product Data sheet for size availability.

Table 3.1 - Fire resistance of non-loadbearing separating walls (criteria E1).

Block Type	Wall thickness (mm)			
	100	140	190	215
Solid blocks (Group 1 units)				
Fibo 850/950, LignaLite	2 hours	4 hours	4 hours	4 hours
Ash GP, Lignacite, Lignacrete dense	2 hours	4 hours	4 hours	4 hours
Hollow & Cellular blocks (Group 2 units)				
Lignacite, Lignacrete dense	1 hour	4 hours	4 hours	4 hours

Note: This Table is based on data from the National Annex to EC6 Part 1-2 with adjustments when supported by fire specific data.

Table 3.2 - Fire resistance of separating loadbearing single-leaf walls (criteria RE1).

Block Type	Wall thickness (mm)			
	100	140	190	215
Solid blocks (Group 1 units)				
Fibo 850/950, LignaLite	2 hours	3 hours	4 hours	4 hours
Ash GP, Lignacite, Lignacrete dense	2 hours	3 hours	4 hours	4 hours
Hollow & Cellular blocks (Group 2 units)				
Lignacite, Lignacrete dense	1 hour	3 hours	4 hours	4 hours

Note:

(i) This Table is based on data from the National Annex to EC6 Part 1-2.
(ii) For loadbearing walls the National Annex provides fire resistance periods depending on whether the walls are fully loaded ($\alpha \leq 1.0$) or partially loaded ($\alpha \leq 0.6$). The fire periods shown assume 'worst case' values.

Table 3.3 - Fire resistance of separating loadbearing cavity walls with one leaf loaded (criteria RE1).

Block Type	Wall thickness (mm)			
	100	140	190	215
Solid blocks (Group 1 units)				
Fibo 850/950, LignaLite	2 hours	3 hours	4 hours	4 hours
Ash GP, Lignacite, Lignacrete dense	2 hours	3 hours	4 hours	4 hours
Hollow & Cellular blocks (Group 2 units)				
Lignacite, Lignacrete dense	2 hour	3 hours	4 hours	4 hours

Note:

(i) This Table is based on data from the National Annex to EC6 Part 1-2.

(ii) For loadbearing walls the National Annex provides fire resistance periods depending on whether the walls are fully loaded ($a \leq 1.0$) or partially loaded ($a \leq 0.6$). The fire periods shown assume 'worst case' values.

(iii) The tabulated thicknesses are for the loaded leaves of cavity walls where the loaded leaf is subjected to fire. The non-loaded leaf may be of a dissimilar material to the loaded leaf, but should otherwise conform to the relevant material specifications. In such cases the respective thickness of each leaf should conform to that specified in the appropriate material table.

Using the Tables – Example

Determining the fire resistance for a 140mm Lignacrete dense wall with a non-loadbearing and separating function.

Assumptions

- Wall thickness - 140 mm unplastered finish
- Masonry unit type - Lignacrete solid blocks are Group 1 dense aggregate concrete
- BS EN 1996-1-2, gross dry density, $\rho = 2000$ kg/m^3 - within 1200 – 2400 kg/m^3 compliance category
- Mortar type - General Purpose

From Table 3.1, the standard fire resistance period for an unplastered wall is 4 hours EI, **therefore 140mm Lignacrete dense blockwork wall will provide 4 hour EI standard fire resistance as an unplastered construction**.

(Note: this fire resistance period is directly comparable with UK building regulations requirements in respect of the separating and non-loadbearing function).

Reaction to fire

	Reaction to Fire Classification
Lignacite - all block types	A1

Concrete blockwork will achieve a Class A1 (Non-combustible) rating without the addition of any surface finishes and therefore surpasses the minimum requirements that would otherwise be required for linings shown in Table 6.3 to Approved Document B: Volume 2.

Service Penetrations

The performance of a fire-separating element, such as a wall, should not be compromised by the need to accommodate building services, such as pipes and ventilation systems. Every opening for services should be sealed. Fire-stopping delays the spread of fire and, generally, the spread of smoke as well. This is a key part of fire strategy and is covered by Approved Document B to the Building Regulations.

Openings for pipes

Pipes passing through a fire-separating element, unless in a protected shaft, should comply with one of the alternatives A, B or C.

Alternative A: Proprietary seals (any pipe diameter)

Provide a proprietary, tested sealing system that will maintain the fire resistance of the wall, floor or cavity barrier.

Alternative B: Pipes with a restricted diameter

Where a proprietary sealing system is not used, fire-stop around the pipe, keeping the opening for the pipe as small as possible. The nominal internal diameter of the pipe should not exceed the relevant dimension given in Table 10.1 of Approved Document B.

Alternative C: Sleeving

A pipe with a maximum nominal internal diameter of 160mm may be used with a sleeve made out of a high melting point metal, as shown in Diagram 10.1 to the Approved Document, if the pipe is made of one of the following:

a. Lead
b. Aluminium
c. Aluminium alloy
d. Fibre-cement
e. uPVC (pipes should also comply with either BS 4514 or BS 5255)

A high melting point metal means any metal (such as cast iron, copper or steel) which, if exposed to a temperature of 800°C, will not soften or fracture to the extent that flame or hot gas will pass through the wall of the pipe.

Fire stopping of services using proprietary fire sleeving.