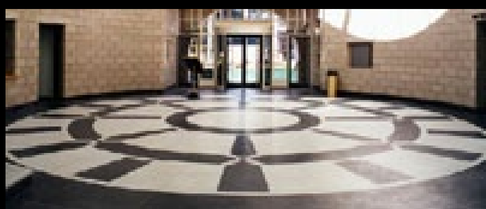
LIGNACITE
Sustainable Masonry

The Lignacite Technical Handbook
on

Design Guidance





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www.lignacite.co.uk

DESIGN GUIDANCE - Section 1

Appearance and Colour

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Appearance and Colour - An introduction

The Lignacite range of Facing Masonry blocks has continually evolved so that today distinctive buildings can be created to suit both classical and contemporary designs.
The range of subtle and bold colours and textures enables buildings to be created in harmony with their surroundings. Products are available to blend with traditional local materials, such as natural stone, or to enable bold individual statements.

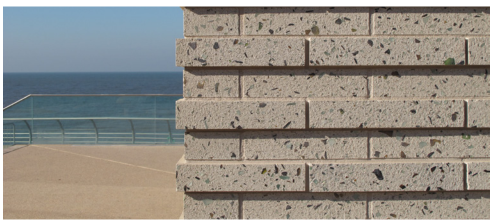
Appearance

Architectural considerations and the distances from which the walls will be viewed will determine the choice of size, colour and texture of the Facing Masonry products, as well as the treatment of joints.

Where the viewing distance is limited, the use of textured finishes will create interest and relief, irrespective of joint treatment. As viewing distances increase, there is much scope to create buildings with great character and a distinctive appearance. The scale of blockwork, compared to conventional brickwork, lends itself to larger size buildings. The effectiveness of specifying Facing Masonry can be exploited in many ways.

- Using blocks of different colour and texture, to accentuate, contrast or compliment aspects of the design.
- Introducing band courses with different height units, or feature courses using plinth blocks or similar.
- Selecting a coloured mortar, or a particular joint finish, so as to emphasise the size of the Facing Masonry units, or subdue it.

The Roman Brick has been developed as an alternative to the conventional brick module. With a length of 440mm and a height of 65mm, Roman Brick provides the opportunity to specify a material that will result in a bold and contemporary appearance.



Tower of Love - Blackpool

Vertical movement joints can be used to good effect in breaking up large expanses of walling. The visual appearance of the movement joint can be subdued using a sealant of similar colour to the mortar, alternatively a contrasting coloured sealant can be used.

Sikh Temple - Leamington Spa

The Manufacturing Process

Our production processes are controlled through a BS EN ISO 9001 certified Quality Management System.

Standard size blocks are produced by machine using a highly automated process. Special shapes are cut, cut and bonded or cast by hand in purpose-made moulds. While every effort is made to match handmade special units and goods which are machine produced, variations in colour and texture may result.

Consideration should be given at the design stage as to the type of special shapes that are to be incorporated and we would welcome discussions to help define your requirements.

Carleton Community School, Pontefract

Appearance and Colour

Bond Patterns

Blocks can be laid in a wide choice of bond pattern. These include:

- Full block stretcher bond (Fig. 1.1). This is the most commonly used bonding pattern.
- Half block stretcher bond (Fig. 1.2). This bond is particularly suited to the creation of curved walls.
- Full block stack bond (Fig. 1.3). A visually striking appearance can be obtained but because vertical and horizontal joint lines are continuous, workmanship must be precise. Horizontal bed joint reinforcement is always required when using stack bond. The structural design of walls using this bond pattern should be verified by a project engineer.

In addition, bond patterns can be created using Facing Masonry units of different coursing heights to give an appearance of random ashlar bond.

In selecting the bond pattern, it is essential to avoid unnecessary cutting of facing blocks by considering the dimensions of the blockwork panel and the effect of any openings in it. Windows and doors should be positioned so that they align with the joints in the blockwork, and any lintels should be of such dimensions that they fit into the specified bonding.

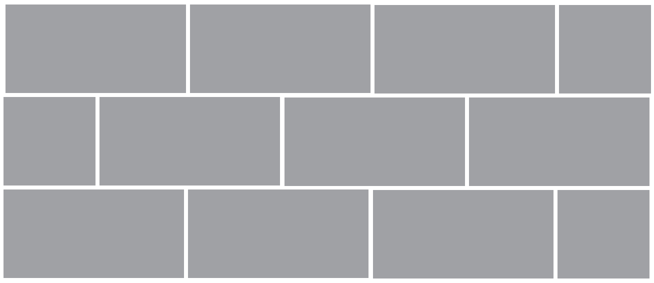


Figure 1.1 - Full block stretcher bond

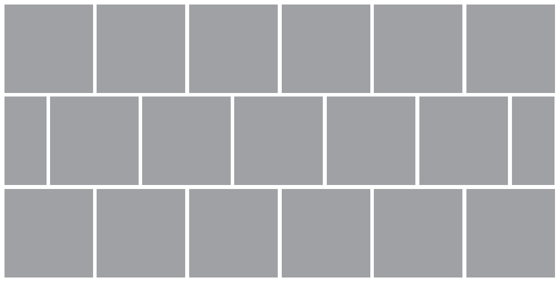


Figure 1.2 - Half block stretcher bond

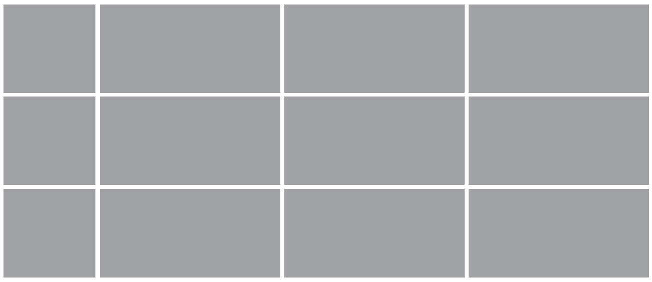


Figure 1.3 - Full block stack bond

Joints

There are several joint profiles which can be considered, including concave (bucket handle), weathered, flush, raked or recessed.

Concave joints are the most widely used and are very good for weather resistance. If blocks have irregular edges, care should be taken to avoid mortar smears which may be difficult to remove from the face of the units.

For further advice on the selection of mortar and jointing, refer to the appropriate section of this Design Guide.

For guidance on the use of mortar in relation to exposure conditions, reference should be made to Published Document PD 6697.

Sandwell Academy, West Bromwich

Mortar Matching

For facing masonry from Lignacite Ltd, use Ordinary Portland Cement (OPC), except where White Portland Cement (WPC) is recommended (see below). The colour of sand used will affect precise colour matching.

Original Facing Masonry Range

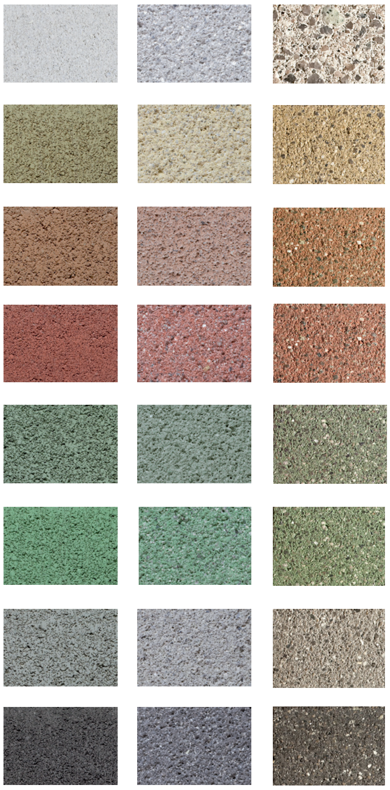
Weathered Split Polished Planished

Block Colour And Type	Cemex Mortar	Tarmac Mortar
Snowstorm Weathered, Split, Polished, Planished	White with WPC	Y101 with WPC
Pearl Weathered, Split, Polished, Planished	White with WPC	Y101 with WPC
Oyster Weathered, Split, Polished, Planished	White with OPC	Y101
Pale Cream Weathered, Split, Polished, Planished	Yellow Light	Y35 with WPC
Barley Weathered, Split, Polished, Planished	Yellow Light	Y35 with WPC
Cream Weathered, Split, Polished, Planished	Yellow Light	Y35 with WPC
Sandstone Weathered, Split, Planished Polished	Marigold Medium Light Brown	Y119 with WPC
Rose Weathered, Split, Planished Polished	Red Light Red Medium	Y119 with WCP Y119
Blackberry Weathered, Split, Polished, Planished	Red Light	Y119 with WCP
Pale Jade Weathered, Split, Polished, Planished	Olive Green Medium with WPC	
Jade Weathered, Split, Polished, Planished	Olive Green Medium with WPC	
Evergreen Weathered, Split, Polished, Planished	Olive Green Medium with WPC	
Silver Grey		
Weathered	Black Light	Y1
Split	Black Medium	Y2
Polished	Black Medium	Y14
Planished	Black Medium	Y14
Blackstone		
Weathered	Black Dark	Y14
Split	Black Dark	Y14
Polished	Black Dark	Y14
Planished	Black Dark	Y14

Appearance and Colour

Premier Facing Masonry Range

Natural Textured Planished



Block Colour And Type	Cemex Mortar	Tarmac Mortar
Pearl Natural, Textured, Planished	White with WPC	Y101 with WPC
Cream Natural, Textured, Planished	Yellow Light	Y35 with WPC
Sandstone Natural, Textured, Planished	Marigold Medium	Y119 with WPC
Rose Natural, Textured, Planished	Red Light	Y119 with WCP
Pale Jade Natural, Textured, Planished	Olive Green Medium with WPC	
Pale Jade Natural, Textured, Planished	Olive Green Medium with WPC	
Oyster Natural, Textured, Planished	White with OPC	Y101
Silver Grey Natural Textured Planished	Black Light Black Medium Black Medium	Y1 Y2 Y14

Riverbed Facing Masonry Range

Fairface Weathered Split

Block Colour And Type	Cemex Mortar	Tarmac Mortar
Amber Weathered, Split, Fairface	Yellow with WPC	Y35 or Natural
Carmine Weathered, Split,	Terracotta Medium	Y119
Charcoal Weathered, Split	Black Medium	Y2 or Y14
Coral Weathered, Split	Terracotta Medium	Y99
Terracotta Weathered, Split	Terracotta Medium	Y119

Sahara Facing Masonry Range

Fairface

Block Colour And Type	Cemex Mortar	Tarmac Mortar
Sahara Dune Natural	Yellow with WPC	Natural or Y35

Weathering

All building materials will change in appearance as they age. But how much change is acceptable and how can it be controlled? In highly polluted atmospheres dirt will be deposited on all types of walls. The severity of the likely effects of pollution can be established by viewing adjacent buildings. The action of rain on facades will clean the upper elevations, but will cause a build up on the lower parts.

C Brewers Ltd, Redhill

Strongly articulated features such as eaves and string courses, and the use of different materials at upper and lower levels will help to mask the uneven effects of the weathering process. Overhanging roofs (minimum 250-300mm) will protect walls to some extent, depending on the direction of the weather and the nature of the overhang. Rainwater can cause unsightly localised streaking, e.g., between jambs and cills and parapets.

Our Facing Masonry blocks include an integral water repellent to reduce permeability and help prevent lime bloom. In areas of severe exposure an additional surface applied water repellent treatment is recommended. This should be applied to the relevant walls after construction to improve the impermeability of the wall.

Spinnaker House, Basingstoke

The outer Leaf of masonry walls cannot be considered watertight, however, good practice construction combined with a minimum 50mm clear cavity should prevent moisture penetrating to the inner leaf. On very severe exposed sites, external finishes, such as a render, may be required to the masonry.

As a guide, in external situations we recommend Facing Masonry blocks with a Weathered, Split, Polished or Planished finish because they are better at maintaining their appearance over a prolonged period of time. Blocks with a smooth fairface finish e.g. Natural, can be used externally however they are better suited to more protected applications.

Samples and Sample Panels

For initial selection, sample slips are available for all colours and finishes. These measure 170mm x 90mm and provide a good indication of the colours and textures available.

The scale and appearance of the completed construction is not readily appreciated from individual product samples. Good workmanship is also important in determining the final appearance. It is therefore essential to build a sample panel before blockwork commences to satisfy the designer, client and contractor that colour, texture and workmanship are all as required. The sample panel is also used to assess the mortar joint profile.

St. Paul's School, Barnes

Lignacite will provide 1m^2 of blocks free of charge with the first delivery to site. These blocks will act as *control* samples from the specific production run made for the project.

Special features, such as shapes should be inlcuded in this exercise. We recommend those block laying contactors who are members of the Association of Bricklaying Contractors. For more information, go to www.brickworkcontractors.info

Attention to Detail

Walsall Academy, West Midlands

The successful outcome of a project using Facing Masonry is dependent on a number of factors. The following is a summary of the key points affecting design and specification, which if followed should lead to the creation of buildings that combine inherent durability with high visual appeal.

- Specify an appropriate bond pattern.
- Use quoin blocks at external corners and other returns.
- Plan movement joints to coincide with vertical (perpend) joints. Where possible conceal movement joints behind rainwater pipes and other features.
- Position and size openings to suit the block module - Refer to *Dimensional Co-Ordination and Setting Out.*
- Construct lintels using our Beam Lintels or using Trough Lintel Blocks.
- Specify special shaped units, such as cill and plinth units, to suit the requirements of the project.
- Ensure the blockwork specification requires a sample panel to be built prior to construction.

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DESIGN GUIDANCE - Section 2
Dimensional Co-ordination, Setting Out and Curved Walls

Design Considerations - An introduction

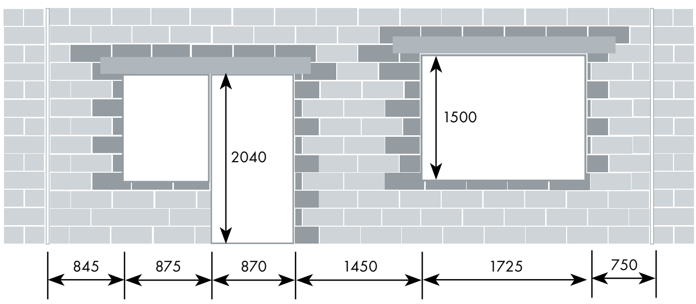
The size of a block sets the scale and pattern of coursing on a wall which is bold and dominant - but which will show up any mismatches between coursing and openings. A window or door opening which does not relate to blockwork dimensions looks very unsightly, wastes time and money on site, and may even be impossible to build.

Setting Out and Co-ordination

Where possible, the blockwork should be set out to co-ordinate with the size of the block module - that is the unit size plus mortar joint. Not only is this aesthetically pleasing, particularly if specifying fair face blockwork, it can also help minimise the need for cut blocks saving time and money. Fig 2.1, highlights the effects of an unco-ordinated and co-ordinated approach, based on 440 x 215mm face size blocks.

Setting out in the walls in a co-ordinated manner will also apply to the position and size of openings within the wall The following tables and diagrams provide advice on the setting out of Lignacite walls including data on the formation of curved walls. Their use will be invaluable in the planning of horizontal and vertical dimensions, overall or between openings.

Unplanned approach



Planned approach

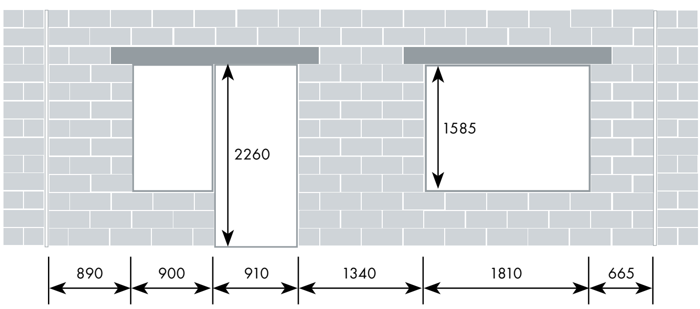


Fig 2.1 - Setting Out

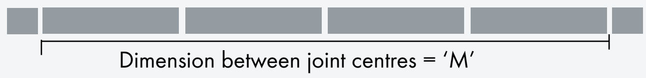
Co-ordinating Dimensions

Assuming full blocks laid in stretcher bond.
Co-ordinating Dimension 'M' = actual blocks size + 10mm mortar joints.

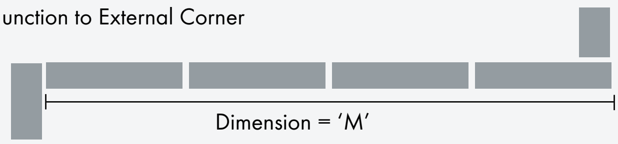
<u>*Example*</u>: 440mm long block plus 10mm joint, M = 450mm
Or 215mm height blocks plus 10mm joint, M = 225mm.

Movement joint recommended at 6m centres and horizontal dimension should accordingly be adjusted to suit movement joint detail.

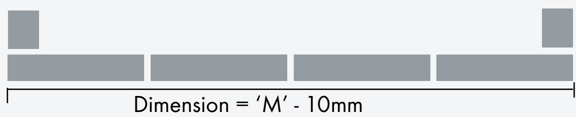
Running Facework



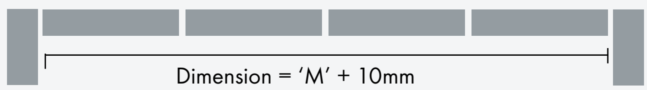
Junction to External Corner



External Corner to External Corner



Junction to Junction



Vertical Wall between Junctions

Dimension = 'M' + 10mm

Freestanding Vertical Wall

From foot to top of wall = 'M'

Dimensional Co-ordination, Setting Out and Curved Walls

Table 2.1 - Horizontal blockwork co-ordinating dimensions

Co-ordinating dimension 'M'

Horizontal number of blocks	440mm length blocks	390mm length blocks
1/2	225	200
1	450	400
1 1/2	675	600
2	900	800
2 1/2	1125	1000
3	1350	1200
3 1/2	1575	1400
4	1800	1600
4 1/2	2025	1800
5	2250	2000
5 1/2	2475	2200
6	2700	2400
6 1/2	2925	2600
7	3150	2800
7 1/2	3375	3000
8	3600	3200
8 1/2	3825	3400
9	4050	3600
9 1/2	4275	3800
10	4500	4000
10 1/2	4725	4200
11	4950	4400
11 1/2	5175	4600
12	5400	4800
12 1/2	5625	5000
13	5850	5200
13 1/2	6075	5400
14	6300	5600
14 1/2	6525	5800
15	6750	6000
15 1/2	6975	6200
16	7200	6400
16 1/2	7425	6600
17	7650	6800
17 1/2	7875	7000
18	8100	7200
18 1/2	8325	7400
19	8550	7600
19 1/2	8775	7800
20	9000	8000
20 1/2	9225	8200
21	9450	8400
21 1/2	9675	8600
22	9900	8800
22 1/2	10125	9000
23	10350	9200
23 1/2	10575	9400
24	10800	9600
24 1/2	11025	9800

Note: The co-ordinating dimensions referred to are based on one 10mm joint between blocks.

Table 2.2 - Vertical blockwork co-ordinating dimensions

Co-ordinating dimension 'M'

Vertical number of courses	215mm high blocks	190mm high blocks
1	225	200
2	450	400
3	675	600
4	900	800
5	1125	1000
6	1350	1200
7	1575	1400
8	1800	1600
9	2025	1800
10	2250	2000
11	2475	2200
12	2700	2400
13	2925	2600
14	3150	2800
15	3375	3000
16	3600	3200
17	3825	3400
18	4050	3600
19	4275	3800
20	4500	4000

Note: The co-ordinating dimensions referred to are based on one 10mm joint between blocks.

The Block Module

Horizontal runs of blockwork

Where using only whole block modules is difficult, cut blocks are used to adjust dimensions to suit particular requirements. Their position needs to be carefully planned, kept to a minimum and positioned so as to be visually acceptable.

It is best to avoid closing the bond using small infill pieces. Instead cut blocks of a reasonable length should be inserted so that small bond overlaps do not occur. (See Fig 2.2).

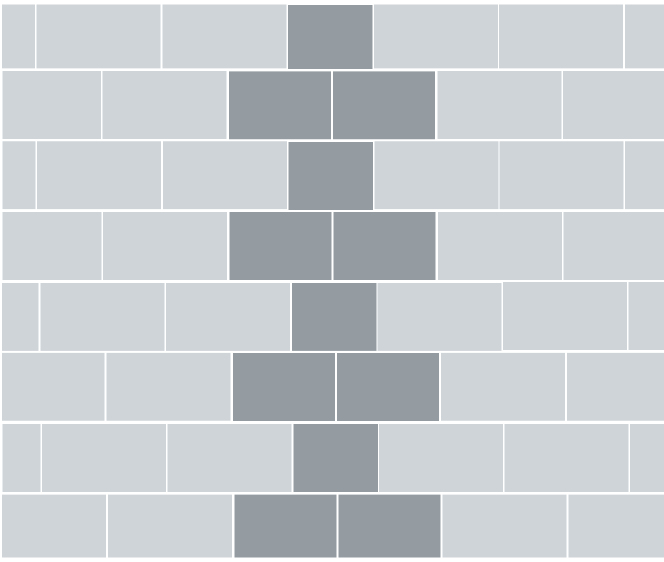


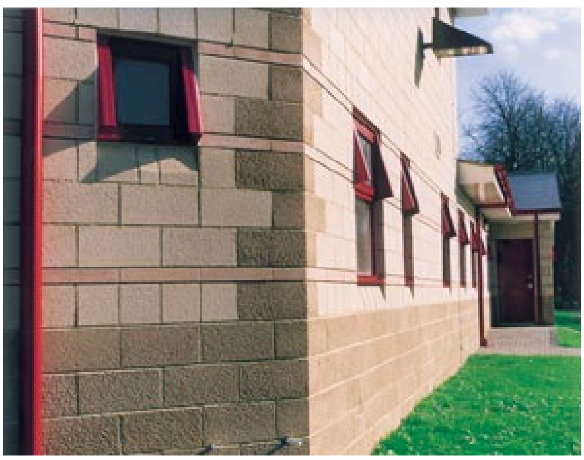
Fig 2.2 - Half bond joint using cut blocks

Keep cutting to a minimum and ensure cut units are fully dry before incorporating into the work. Cut blocks can effloresce due to the addition of water in the cutting process.

Cutting blocks may also change their appearance. We strongly recommend that blocks are factory cut, to minimise any adverse effects.

Wall Heights

Overall wall heights can be adjusted by using blocks with alternate course heights e.g. 65mm, 140mm. These can be used at plinth, head, string or at leaves level.



Corners

Unplanned bonding at corners will detract from the overall appearance of facing blockwork. Quoin (L-shaped) blocks are recommended to maintain the bond pattern around corners.

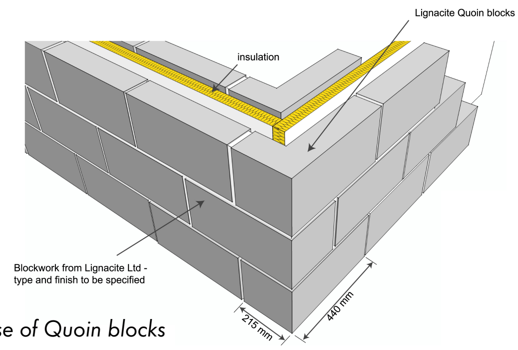


Fig 2.3 Use of Quoin blocks

If cut blocks have to be used to form corners, quarter length cut blocks, often inserted into the wall as an unplanned and 'cheap' solution, should be avoided. A more acceptable solution, using cut blocks, is shown in Fig. 2.4. In this example 325mm cut blocks are used in conjunction with a 100mm return end.

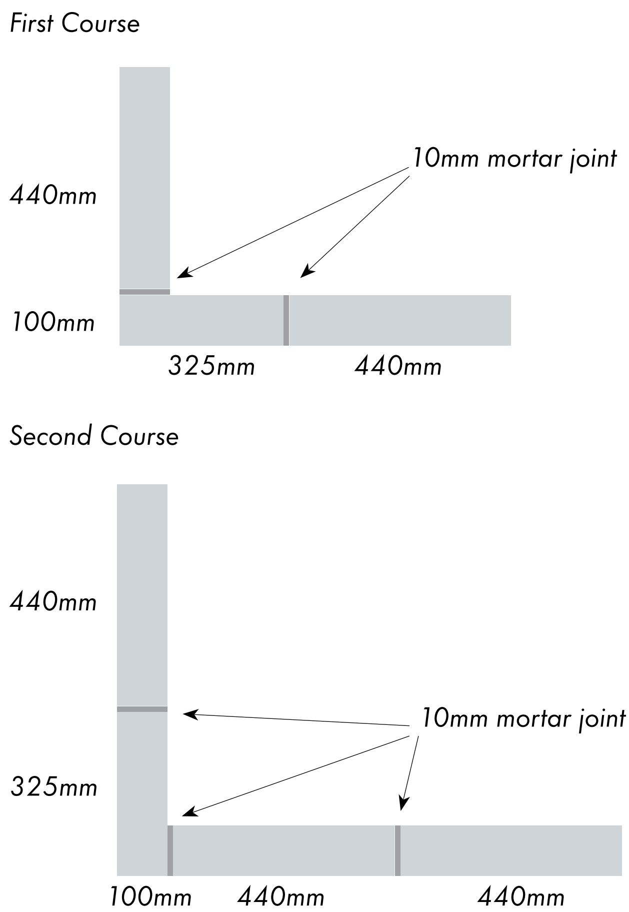


Fig 2.4 - Corner using cut blocks

Standard reveal blocks are also available to close the cavity at jambs and at cavity wall ends. The relationship between both leaves, the cavity and the reveal should be pre-planned to avoid unnecessary cutting.

Curved Walls

To create curved blockwork with Lignacite standard format blocks, the mortar joints need to be tapered. This results in a degree of faceting, depending on the curvature required. Areas of over hanging blockwork will also cast shadow on the courses below. The acceptability of appearance hinges on how pronounced the overhang looks with the desired radius. The block texture will also affect visual acceptability. Blocks with a textured finish eg. weathered, are more likely to soften the effect compared to straight arrissed smooth finishes. See Fig 2.5.

The effect of the overhang and perpend width can be reduced significantly by using half length blocks, eg. 215 x 215mm work face. For fair face walls, such units should be machine cut and we can offer a cutting service to avoid this operation on the building site.

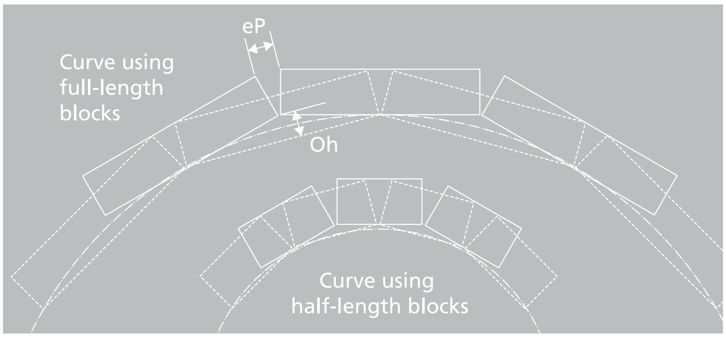


Fig 2.5 - Radius Walls

Table 2.3 indicates the size of overhang and the perpend joint width, dependent upon the wall radius and the block thickness.

For fairfaced work, overhangs of 2mm and below are acceptable, except for polished masonry, where ideally no overhang should be present.

Where walls are to be plastered/rendered or drylined, a minimum of 6mm overhang is suggested.

For true radius plan walls, cast curved blocks are recommended.

Table 2.3 - Overhang and Perpend Joint Widths in mm for Radius Walls

	Work Size: 440 x 215mm				Work Size: 215 x 215mm				Work Size: 390 x 190mm				Work Size: 190 x 190mm			
Thick-ness	100		140		100		140		100		140		100		140	
Wall Radius	Oh Over hang	eP Perpend Joint	Oh Over hang	eP Perpend Joint	Oh Over hang	eP Perpend Joint	Oh Over hang	eP Perpend Joint	Oh Over hang	eP Perpend Joint	Oh Over hang	eP Perpend Joint	Oh Over hang	eP Perpend Joint	Oh Over hang	eP Perpend Joint
600	44	86	46	120	10	50	11	68	35	78	36	109	8	46	8	62
800	32	68	33	93	8	40	8	53	25	62	26	84	6	36	6	48
1000	25	56	26	76	6	34	6	44	20	51	20	69	5	31	5	40
1200	21	48	21	65	5	29	5	29	17	44	17	59	4	27	4	35
1400	18	43	18	57	4	27	4	34	14	39	14	52	3	25	3	31
1600	16	39	16	51	4	24	4	31	12	36	12	46	3	23	3	28
1800	14	36	14	46	3	23	3	28	11	33	11	42	3	21	3	26
2000	12	33	13	42	3	22	3	26	10	30	10	39	2	20	2	24
2500	10	28	10	36	2	19	2	23	8	26	8	33	2	18	2	22
3000	8	25	8	31	2	18	2	21	6	24	6	29	2	17	2	20
3500	7	23	7	28	2	17	2	19	6	22	6	26	1	16	1	18
4000	6	21	6	26	1	16	1	18	5	20	5	24	1	15	1	17
4500	5	20	5	24	1	15	1	17	4	19	4	23	1	14	1	16
5000	5	19	5	23	1	15	1	16	4	18	4	21	1	14	1	16
5500	4	18	4	22	1	14	1	16	3	17	3	20	1	14	1	15
6000	4	18	4	21	1	14	1	15	3	17	3	19	1	13	1	15
7000	4	17	4	19	0.8	13.3	0.8	14.6								
8000	3	15	3	18	0.7	12.8	0.7	14								
9000	3	15	3	17	0.6	12.5	0.7	13.6								
10000	2	15	2	16	0.6	12.3	0.6	13.2								
11000	2	14	2	16	0.5	12.1	0.5	12.9								
12000	2	14	2	15	0.5	11.9	0.5	12.7								

Fire Resistance - An introduction

The following Tables of fire resistance are based upon 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 thicknesses given in the Tables below are for masonry alone, excluding finishes. For each specification, the top rows of figures are for walls without applied finishes or just a thin render/parge coat.

The values in brackets are for walls having an applied finish of gypsum premixed plaster to BS EN 13279-1 or plaster type LW or T, in accordance with BS EN 998-1.

Plaster is assumed to 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.

Lightweight aggregate units include Ashlite, Fibo 850, and Lignacite.

Dense aggregate units include Lignacrete and products in the Facing Masonry ranges (Original, Premier, Sahara, etc).

Group 1 units – all Lignacite Ltd solid units and 100mm cellular units.

Group 2 units – all Lignacite Ltd cellular units of 140mm width and above, all hollow units.

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

*Table 3.1 - Dense and lightweight aggregate concrete masonry: minimum thickness of **non-loadbearing separating walls** (criteria E1) for fire resistance classifications.*

Material properties: gross density p (kg/m³)	Minimum wall thickness t_F (mm) for fire resistance classification E1 for time $t_{fi,d}$ (mins) of :					
	30	60	90	120	180	240
Group 1 units						
Mortar: general purpose						
Lightweight aggregate: 400 ≤ p ≤ 1700 (Ashlite, Fibo 800, Houseblock 1100, Lignacite)	50	70	75	75	90	100
	(50)	(50)	(60)	(70)	(75)	(75)
Dense aggregate: 1200 ≤ p ≤ 2400 (Lignacrete and Facing Masonry ranges)	50	70	90	90	100	100
	(50)	(50)	(70)	(75)	(90)	(100)
Group 2 units						
Mortar: general purpose						
Lightweight aggregate: 240 ≤ p ≤ 1300 (Lignacite)	50	70	75	100	115	125
	(50)	(50)	(70)	(75)	(90)	(100)
Dense aggregate: 720 ≤ p ≤ 1800 (Lignacrete and Facing Masonry ranges)	90	100	125	140	140	140
	(70)	(80)	(90)	(100)	(125)	(125)

Note: This Table is based on data from the National Annex to EC6 Part 1-2

Table 3.2 - Dense and lightweight aggregate concrete masonry: minimum thickness of ***separating loadbearing single-leaf walls*** *(criteria RE1) for fire resistance classifications.*

Material properties: gross density p (kg/m³)		**Minimum wall thickness t_F (mm) for fire resistance classification RE1 for time $t_{fi,d}$ (mins) of**					
		30	60	90	120	180	240
Group 1 units							
Mortar: general purpose							
Lightweight aggregate: 400 ≤ p ≤ 1700 (Ashlite, Fibo 800, Houseblock 1100, Lignacite)	a ≤ 1.0	90	90	100	100	140	150
		(90)	(90)	(90)	(90)	(100)	(100)
	a ≤ 0.6	70	75	90	90	100	100
		(60)	(60)	(75)	(75)	(90)	(90)
Dense aggregate: 1200 ≤ p ≤ 2400 (Lignacrete and Facing Masonry ranges)	a ≤ 1.0	90	90	90	100	140	150
		(90)	(90)	(90)	(90)	(100)	(100)
	a ≤ 0.6	75	75	90	90	100	140
		(60)	(75)	(75)	(75)	(90)	(100)
Group 2 units							
Mortar: general purpose							
Lightweight aggregate: 240 ≤ p ≤ 1300 (Lignacite)	a ≤ 1.0	90	100	100	100	140	150
		(90)	(90)	(90)	(100)	(140)	(140)
	a ≤ 0.6	75	90	90	100	125	140
		(75)	(75)	(75)	(90)	(100)	(125)
Dense aggregate: 720 ≤ p ≤ 1800 (Lignacrete and Facing Masonry ranges)	a ≤ 1.0	100	100	140	140	140	190
		(90)	(100)	(100)	(140)	(140)	(150)
	a ≤ 0.6	90	100	100	140	140	150
		(75)	(90)	(90)	(125)	(125)	(140)

Note:

(i) This Table is based on data from the National Annex to EC6 Part 1-2.
(ii) a ≤ 0.6 applies when the vertical load capacity is only 0.6 of the permitted design vertical resistance being used.
(iii) a ≤ 1.0 applies when more than 0.6 of the permitted capacity is being used.

Table 3.3 - Dense and lightweight aggregate concrete masonry: minimum thickness of each leaf of ***separating loadbearing cavity walls*** *with one leaf loaded (criteria RE1) for fire resistance classifications.*

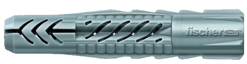
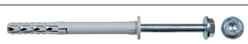
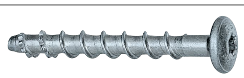
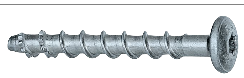
Material properties: gross density p (kg/m³)		Minimum wall thickness t_F (mm) for fire resistance classification RE1 for time $t_{fi,d}$ (mins) of					
		30	60	90	120	180	240
Group 1 units							
Mortar: general purpose							
Lightweight aggregate: 400 ≤ p ≤ 1700 (Ashlite, Fibo 800, Houseblock 1100, Lignacite)	a ≤ 1.0	90	90	100	100	140	150
		(90)	(90)	(90)	(100)	(100)	(100)
	a ≤ 0.6	70	75	90	90	100	100
		(60)	(60)	(75)	(75)	(90)	(90)
Dense aggregate: 1200 ≤ p ≤ 2400 (Lignacrete and Facing Masonry ranges)	a ≤ 1.0	90	90	100	100	140	150
		(90)	(90)	(90)	(90)	(100)	(100)
	a ≤ 0.6	75	75	90	90	100	140
		(60)	(75)	(75)	(75)	(90)	(125)
Group 2 units							
Mortar: general purpose							
Lightweight aggregate: 240 ≤ p ≤ 1300 (Lignacite)	a ≤ 1.0	90	100	100	100	140	150
		(90)	(90)	(90)	(100)	(140)	(140)
	a ≤ 0.6	70	90	90	100	125	140
		(70)	(70)	(70)	(90)	(100)	(125)
Dense aggregate: 720 ≤ p ≤ 1800 (Lignacrete and Facing Masonry ranges)	a ≤ 1.0	90	100	100	100	140	190
		(90)	(90)	(100)	(100)	(140)	(150)
	a ≤ 0.6	90	100	100	100	140	150
		(70)	(90)	(90)	(100)	(125)	(140)

Note:

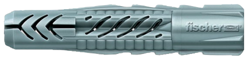
(i) This Table is based on data from the National Annex to EC6 Part 1-2.
(ii) a ≤ 0.6 applies when the vertical load capacity is only 0.6 of the permitted design vertical resistance being used.
(iii) a ≤ 1.0 applies when more than 0.6 of the permitted capacity is being used.
(iv) The tabulated thicknesses are for the loaded leaves of cavity walls where the loaded leaf is subjected to fire.
(v) The non-loaded leaf may be of a dissimilar material to the loaded leaf, but should otherwise confirm to the relevant material specifications. In such cases the respective thickness of each leaf should conform to that specified in the appropriate material table.

Fixings - An introduction

Our products can provide a strong background and good pull-out strength, allowing light, medium and heavy weight fixtures to be global safely supported. Consideration should be given to the use of solid blocks wherever heavy duty equipment is required to be fixed to the blockwork. The following table provides a selection of pull-out values for various block types using products from Fischer Fixings Ltd. The allowable load includes a global safety appropriate to the fixing type.

Block Type	Description of Fixing		Fixing Tested	Average ultimate load kN	Allowable load kN
100mm solid Lignacite 3.6N/mm^2	Nylon plug and wood screw		Fischer SX 10 x 50	2.74	0.26
100mm solid Lignacite 3.6N/mm^2	Resin anchor		RGM 10 x 130 stud set with FIS V 360 S Resin	10.94	3.31
100mm solid Lignacite 3.6N/mm^2	Self-tapping concrete screw		FBS - 8/15 S	7.6	1.37
100mm solid Lignacite 7.3N/mm^2	Resin anchor		RGM 10 x 130 Threaded rod + FIS V 360 S Resin	15.46	3.0
100mm solid Lignacite 7.3N/mm^2	Nylon plug and Screw		FSXS 10 x 60 FUS	5.96	0.77
100mm solid Lignacite 7.3N/mm^2	Nylon plug and Powerfast Screw		SX 10 x 50 Nylon Plug (With 8 x 80 Powerfast Screw)	3.0	0.28
140mm solid Lignacite SP 7.3N/mm^2	Nylon plug and wood screw		UX 10 x 60 Nylon Plug + 7mm Woodscrew	2.06	0.46
140mm solid Lignacite SP 7.3N/mm^2	Nylon plug and wood screw		SX 10 x 50 Nylon Plug + 7mm Woodscrew	4.2	0.60
140mm solid Lignacite SP 7.3N/mm^2	Self-tapping concrete screw		FBS 6/25 P Concrete Screw	3.92	0.49
140mm solid Lignacite SP 7.3N/mm^2	Special screw for door and window installation		FFS 7.2 x 72 Frame Fixing Screw	3.4	0.34
140mm solid Lignacite SP 7.3N/mm^2	Resin Anchor		FTR M10 x 130 BZP + FIS V 360 S	14.0	3.53
140mm solid Lignacite SP 7.3N/mm^2	Nylon plug and wood screw		SXR 10 x 80 FUS	6.1	0.61
140mm cellular Lignacite 3.6N/mm^2	Nylon plug and wood screw		SXSXR 10 x 60 FUS	1.94	0.15
140mm cellular Lignacite 3.6N/mm^2	Special screw for door and window fixing		FFS 7.5 x 72 Frame Fixing	1.28	0.22
140mm cellular Lignacite 3.6N/mm^2	Resin Anchor		FIS V 360 S + FIS H 18 x 85 N + M10 Threaded rod	6.56	1.47
140mm cellular Lignacite 3.6N/mm^2	Frame fixing		FUR 10 x 80 FUS Art No: 93572	3.2	0.30
140mm solid Lignacrete 7.3N/mm^2	Self-tapping concrete screw		FBS 8/15 S concret screw.	9.8	1.49
100mm solid Lignacrete 20.0N/mm^2	Self-tapping concrete screw		FBS 8/15 S concrete screw.	19.80	4.92

Fixings

Block Type	Description of Fixing		Fixing Tested	Average ultimate load kN	Allowable load kN
100mm solid Lignacrete 20.0N/mm^2	Nylon plug and wood screw		UX 10 x 60 Universal Nylon Plug + 8mm Woodscrew.	1.90	0.26
100mm solid Lignacrete 20.0N/mm^2	Resin anchor		FIS V 360 S + M10 Threaded Rod	26	6.0
190mm solid Lignacrete 73.0N/mm^2	Resin anchor		FIS V 360 S + M10 x 30 Stud	8.4	2.16
190mm solid Lignacrete 73.0N/mm^2	Frame fixing		SXS 10 x 80 FUS	4.3	0.56

Notes: A global safety factor (V) of 5 has been applied to the Characteristic Resistance NRk1 for fixings using a plastic plug. To other fixings a global safety factor (V) of 3 has been applied.

Good practice for fixings

- For heavy duty applications, fixings to solid blocks are recommended wherever possible.
- Avoid locating the fixing within 50mm of the wall edge or the top of a wall.
- Where possible, avoid fixings into mortar joints.
- For proprietary fixings, always following the manufacturer’s instructions with particular regard to hole diameter and dept.

Further advice

For fixing applications outside the scope of the tabulated data, we suggest contact is made with the Technical Department at Fischer Fixings Ltd. Telephone 01491 827920.

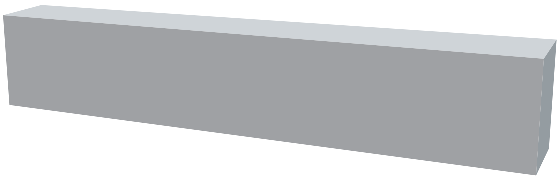
Lintels - Reinforced Beam and Trough Lintels

Lignacite Ltd produces two distinct types of lintel - the conventional reinforced Beam Lintel and the Trough Lintel Block which is infilled with reinforced concrete on site. Both are available in most of our product ranges.

Beam Lintels

Description

Conventional reinforced Beam Lintels are hand cast in a mould box using semi-dry mixes. The types available are intended to provide a close match to the facing blocks that we produce including Lignacite, Lignacrete and the various Facing Masonry ranges. Due to the manufacturing method, the maximum clear spans achievable are limited by the shear resistance of the semi-dry concrete.



Standards

Beam Lintels conform to BS EN 845-2. Quality is controlled at every stage with procedures assessed and certified to BS EN ISO 9001.

Lintel Range

Beam Lintels are manufactured using the same materials as those used in the production of our blocks. Please refer to separate data sheets on these products. Although we aim to achieve the closest possible match between our blocks and Beam Lintels, some variation in colour and texture will occur. This is a result of the different methods of manufacture used to produce these products.

Dimensions

Lintel height is 215mm.
Lintel widths 75mm to 215mm.
Lintel lengths: for 75mm to 100mm width, lengths up to 2240mm. For 140mm width and above, lengths up to 2690mm.

When determining the overall length of Beam Lintels, please ensure to add the length of the bearings at each end to the structural opening size. We generally recommend that a 215mm end bearing is provided at each end.

Design

Beam Lintels are intended to span openings in masonry walls where no point load or openings occur within the 60° load triangle (Fig.5.1). Please refer to the Product Data sheets on Beam Lintels for structural properties.

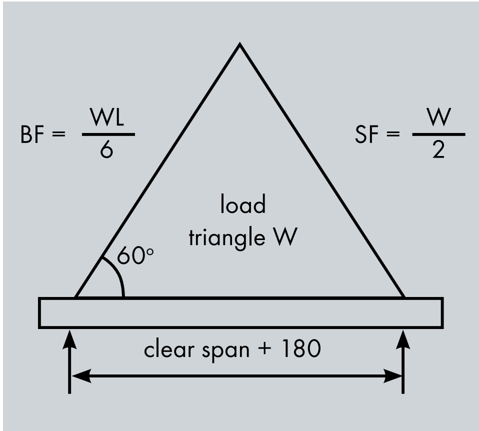


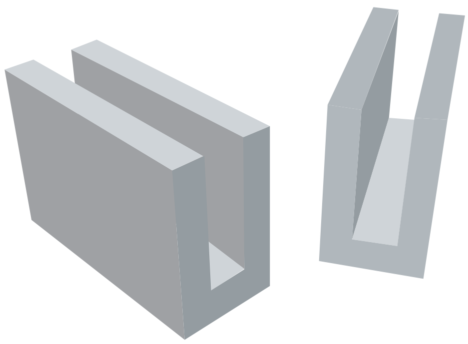
Figure 5.1 - Triangular Load

Carbon steel reinforcement is used in the manufacture of our Beam Lintels. This specification is suitable for use in exposure class MX1 as indicated in the National Annex to BS EN 1996-1-1. For higher exposure conditions please contact Lignacite Ltd for advice.

Trough Lintel Blocks

Description

Trough lintels are intended to span openings in walls whilst maintaining the appearance of the surrounding masonry. They are constructed using Trough Lintel Blocks, which are cut from the same blocks produced on the block machine enabling a close colour and texture match. The open core is filled on site with horizontal reinforcement and concrete infill. Trough Lintel Blocks can be produced in Lignacite, Lignacrete and the Facing Masonry ranges.



Standards

Trough lintels should be designed in accordance with BS 5628-2 "Code of Practice for the Use of Reinforced Masonry" or equivalent European design standards.

Lintel Range

Trough Lintel Blocks are produced to provide a close colour and texture match to blocks in the following ranges:
Commodity ranges - Lignacite and Lignacrete
Facing Masonry ranges - Original, Premier, Riverbed and Sahara.
Please refer to separate data sheets on these products.

Dimensions

Trough Lintel Block height is 215mm	
Trough Lintel Block widths:	100mm and 140mm
Trough Lintel Block lengths:	100mm width units - 215mm or 440mm lengths
	140mm width units - 215mm in length when cut from cellular blocks or 215mm and 440mm lengths when cut from solid blocks.

Design

The design of trough lintels should be entrusted to the Project Engineer. However for guidance, the safe uniformly distributed loads for various block widths and span of openings are provided in Table 5.1. The concrete infill is assumed to be a minimum strength of 40 N/mm² with a nominal maximum size of 10mm aggregate. The safe working loads within the tables assume a partial safety factor on loading of 1.5 to convert the lintel's ultimate strength to the safe working loads. The span of the lintel is taken as the distance between the centre line of the bearings.

The type of reinforcement and its concrete cover should be suitable for the appropriate Exposure situation. As a guide, the use of carbon steel reinforcement, with the specified concrete cover, is suitable for MX1 Exposure situations as indicated in the National Annex to BS EN 1996-1-1. For higher exposure conditions, consideration should be given to the use of austenitic stainless steel in accordance with BS EN 10088.

The end bearing of the lintel must be calculated by the designer taking into account the compressive strength of the blockwork at the bearings and the anchorage requirements of the reinforcement.

Table 5.1 - Structural Performance of Reinforced Trough Lintels 215mm high.

Lintel Size		Reinforcement	ULS	ULS	Safe UDL in kN/m for clear span (mm)						
Width mm	Depth mm	High Yield	Moment kNm	Shear kN	600	900	1200	1500	1800	2100	2400
100	215	1 T8	1.8	3.1	6.0	4.2	3.2	2.6	2.2	1.9	1.6
		1 T10	2.2	3.6	7.0	4.9	3.7	3.0	2.5	2.2	1.9
140	215	1 T8	2.4	3.9	7.5	5.3	4.0	3.3	2.7	2.4	2.1
		1 T10	2.7	4.6	8.7	6.1	4.7	3.8	3.2	2.7	2.4
190	215	2 T8	3.5	5.9	11.0	7.9	6.1	4.9	4.2	3.6	3.1
		2 T10	4.1	6.9	13.1	9.2	7.1	5.7	4.8	4.1	3.6
215	215	2 T8	3.9	6.5	12.4	8.6	6.6	5.4	4.5	3.9	3.4
		2 T10	4.5	7.5	14.3	10	7.7	6.2	5.2	4.5	4.0

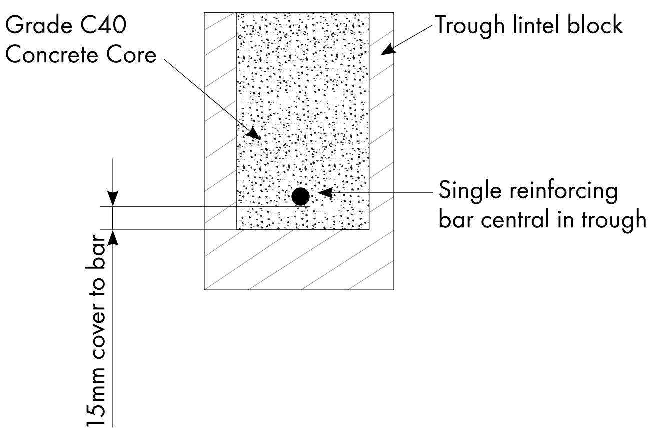


Figure 5.2 - Typical detail of Lintel with Single Reinforcing Bar.

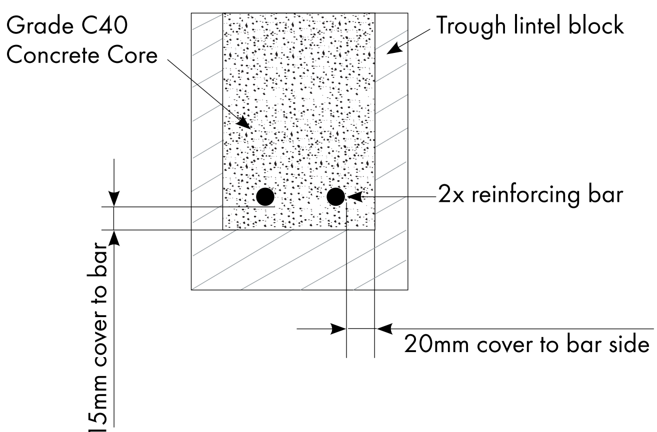


Figure 5.3 - Typical detail of Lintel with Double Reinforcing Bar.

Cover for reinforcement

Please note that BS 5628-2 requires the cover for durability to be measured from the in situ concrete only, whereas cover for fire resistance can include the thickness of the trough unit.

Sequence of construction

The sequence of Trough Lintel Block construction is as follows:

- Build the facing masonry to the soffit height of the lintel.
- Provide temporary propping to the Trough Lintel Blocks.
- Lay the Trough Lintel Blocks with a 10mm wide x 20mm deep temporary spacer in each joint. Temporary joint spacers can be of any material which provides adequate retention of the concrete infill and can be removed for pointing (e.g. polystyrene).
- Place the specified concrete fill in the bottom of the trough units.
- Fit plastic spacers to the reinforcement to ensure correct concrete cover.
- Place reinforcement as appropriate.
- Complete in-situ filling, tamping by hand.
- After a curing period, strip propping, remove temporary joint spacers and point joints carefully to match surrounding facing masonry.

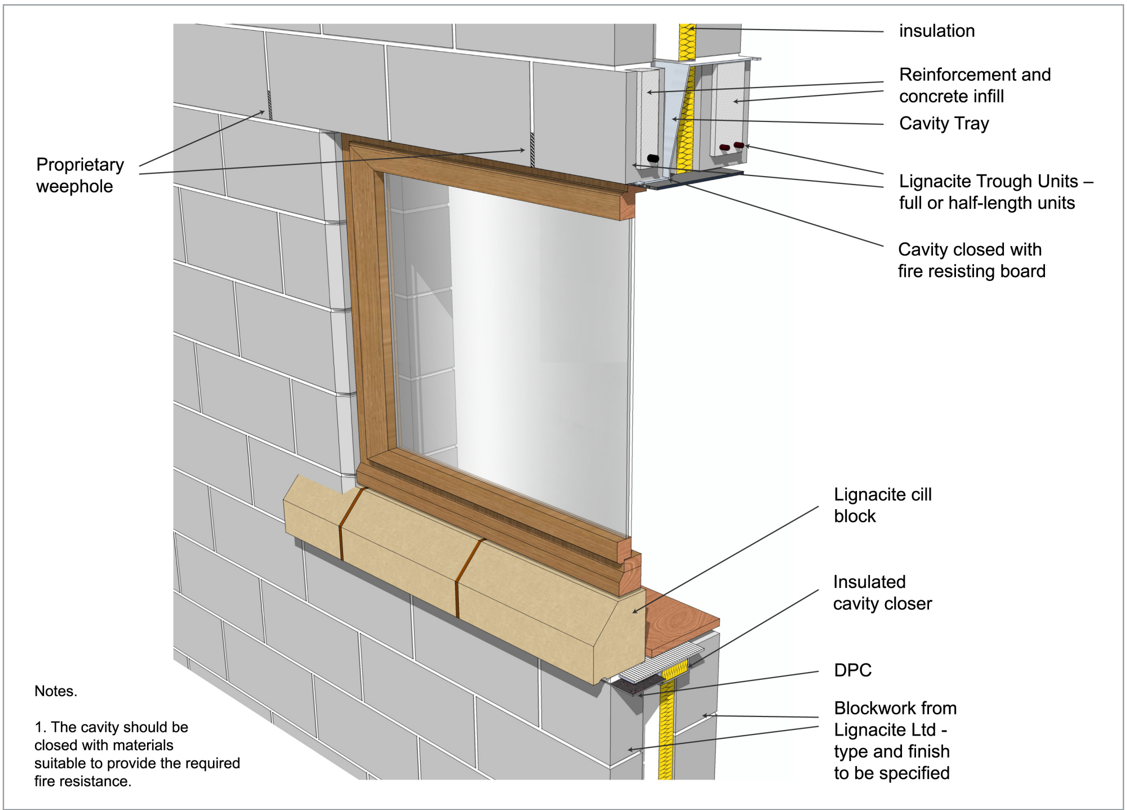


Figure 5.4 - Lintel Block Construction

Masonry Specification - An Introduction

To assist in compiling a specification for Lignacite's masony products, the following tools are available.

NBS Plus

Product information from the NBS Plus library of product clauses is available in NBS specification products. It has been created by NBS for Lignacite Ltd. The clause is authored in NBS format and is intended for inclusion in project specifications. The clause can be copied and pasted into your project specification document. To find out more about producing specifications for building projects visit www.theNBS.com/solutions.

Lignacite's Specification Builder

Available on our web site www.lignacite .co.uk, the Specification Builder provides product specification clauses for our entire product range. These are available in PDF and word format, the latter allowing you to modify the clause to suit a particular application. The Specification Builder can be accessed on our web site via the *Technical Centre* tab.

Typical Specification Clauses

Normally, the use of concrete blocks can be categorised by the following descriptions:

- Common block – Not intended to be seen i.e. plastered, rendered, dry lined or concealed
- Paint-Grade block – To be built fair to receive a paint finish
- Facing block – to be built and left fair, with a high degree of colour and texture consistency (all facing work requires a sample panel to be built and approved prior to commencement of work).

The following are typical specification clauses taken from the Specification Builder. They cover typical specifications for products used in common, paint-grade and facing blockwork applications. They can be easily adapted to suit other sizes of products, or alternative products from Lignacite's range.

Common blockwork specification

Masonry Specifications:

The concrete blocks to.. [*state location*] ... shall be **Ashlite** medium density blocks manufactured by Lignacite Ltd (tel 01842 810678) or other equal approved, in accordance with BS EN 771-3, built to a standard suitable to receive plaster / dry lining.

Configuration: **Group 1, solid units**

Compressive strength:

- **Mean value 3.6 N/mm²**
- **Category 1 units**

Average dry density: **1450 kg/m³**

Work sizes (length x width x height): **440 x 100 x 215 mm**

Tolerance category: **D1**

Colour/Finish: **N/A**

Thermal Resistance: **0.212 m² K/W**

Mortar mix: **Class M4**

Mortar colour: **N/A**

Joint profile: **Flush or shallow bucket handle**

Bond: **Half lap stretcher**

Sound Insulation: **42 Rw,dB**

Fire Resistance (loadbearing): **2 Hrs**

Building - Norwich Housing Project

Masonry Specification

Paint-Grade blockwork specification

Masonry Specifications:

The concrete blocks to... [*state internal location*]... shall be **Lignacite Paint-Grade** manufactured by Lignacite Ltd (tel 01842 810678) or other equal approved, in accordance with BS EN 771-3, built to a standard suitable for direct decoration.

Configuration: **Group 1, solid units**

Compressive strength:

- **Mean value 7.3 N/mm^2**
- **Category 1 units**

Average dry density: **1570 kg/m^3**

Work sizes (length x width x height): **440 x 100 x 215 mm**

Tolerance category: **D1**

Colour/Finish: **Paint Grade**

Thermal Resistance: **0.111 m^2 K/W**

Mortar mix: **Class M4**

Mortar colour: **N/A**

Joint profile: **(Bucket handle, flush, struck or weathered, recessed)**

Bond: **Half lap stretcher**

Sound Insulation: **46 Rw,dB**

Fire Resistance (loadbearing): **2 Hrs**

Facing blockwork specification

Masonry Specifications:

The concrete facing blocks to... [*state location*]... shall be **Lignacite Roman Brick** manufactured by Lignacite Ltd (tel 01842 810678) or other equal approved, in accordance with BS EN 771-3, built fair-face.

Configuration: **Group 1, solid units**

Compressive strength:

- **Mean value 17.5 N/mm^2**
- **Category 1 units**

Average dry density: **2100 kg/m^3**

Work sizes (length x width x height): **440 x 100 x 65 mm (Roman Brick)**

Tolerance category: **D1**

Colour/Finish: **Snowstorm / Planished**

Thermal Resistance: **0.111 m^2 K/W**

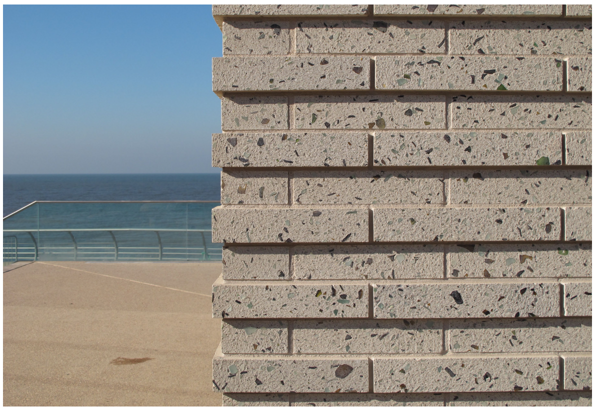
Mortar mix: **Class M4**

Mortar colour: **TBA**

Joint profile: **(Bucket handle, flush, struck or weathered, recessed)**

Bond: **Half lap stretcher**

Fire Resistance (loadbearing): **2 Hrs**



Mortar - An Introduction

The selection of mortar for an application is very important and should take into consideration structural requirements, the type of construction, position in the building and degree of exposure. In addition, when specifying Lignacite Facing Masonry, the designer will need to select the appropriate colour of mortar in relation to the colour and texture of the facing units.

Guidance for the specification of mortar for durability can be assessed in accordance with Published Document PD 6697. This provides recommendations for the quality of masonry units and mortar designations for various conditions of use, such as work below or above the external ground level.

Mortars can be specified as design mixes (Strength Performance) or prescribed mixes (Recipe). Mortars can be either factory made or mixed on site. Traditionally, prescribed mixes have been used in the UK and have a proven durability. Design mixes are likely to be increasingly used as a result of designing masonry to the Eurocode.

Where coloured mortars are specified, to avoid inconsistencies, it is advisable to use dry silo mortar or alternatively, retarded ready-to-use mortars.

Eurocode 6 categorises the exposure class by the use of MX numbers. In most cases in the UK the most severe exposure "S" relates to class MX 3.2 - exposure to severe wetting and freeze thaw cycles, but not exposed to external sources or significant levels of sulphates or aggressive chemicals.

Generally the stronger the mortar, the more durable it is. Conversely the weaker the mortar, the greater is its ability to accommodate movement. Where a high strength mortar is required for structural reasons, special consideration should be given to the accommodation of movement. In general terms, for work above DPC, excluding parapet walls, a designation (iii) mortar is suitable for most masonry unit types. However, a degree of caution should be exercised when specifying a designed mortar, as a M4 mortar may well have strength well in excess of 4.0N/mm² and as such, is not suitable for masonry units of 3.6N/mm² strength. For work below DPC level, mortars of designation (ii) (1:½:4 cement:lime:sand) particularly where there is a risk of freeze/thaw, or (iii) may be used, according to soil conditions.

In the selection of mortars, as a general guide, cement:lime:sand mortars give a stronger bond than plasticised mortars of a similar compressive strength. Incorporating lime into the mix is also beneficial in terms of the mortar's ability to accommodate movement.

Details of the relevant mortar designations are provided in the table below:

Table 7.1 - Masonry mortars

	Mortar designation	Compressive strength class	Prescribed mortars (proportion or materials by volume) (see notes a and b)				Compressive strength at 28 days (N/mm^2)
			Cement[c] lime: sand with or without air entrainment	Cement[c:] sand with or without air entrainment	Masonry cement[d] sand	Masonry cement[e] sand	
Increasing ability to accommodate movement, e.g. due to settlement, temperature and moisture changes ↓	(i)	M12	1:0 to ¼:3	1:3	Not suitable	Not suitable	12
	(ii)	M6	1:½:4 to 4½	1:3 to 4	1:2½ to 3½	1:3	6
	(iii)	M4	1:1:5 to 6	1:5 to 6	1:4 to 5	1:3½ to 4	4
	(iv)	M2	1:2:8 to 9	1:7 to 8	1:5½ to 6½	1:4½	2

Notes

a) *Proportioning by mass will give more accurate batching than proportioning by volume, provided that the bulk densities of the materials are checked on site.*
b) *When the sand portion is given as, for example, 5 to 6, the lower figure should be used with sands containing a higher portion of fines whilst the higher figure should be used with sands containing a lower proportion of fines.*
c) *Cement conforming to BS EN 197-1 Notation CEM 1(Portland cement). Cement conforming to BS EN 197-1. Notation CEM II/A-S or CEM II B-S (Portland slag cement); or CEM II/A-L or CEM II/A-LL (Portland Limestone cement); or CEM II/B-V (Portland fly ash cement); or a combination, with equivalent proportions and properties to one of these cements:*
- *Combinations prodcued in the mortar mixer from Portland cement CEM 1 conforming to BS EN 197-1 and ground granulated blast furnace slag conforming to BS 6699 where the proportions and properties confirm to CEM II/A-S or CEM II B-S of BS EN 197-1:2000, except Clause 9 of that standard.*
- *Combinations produced in the mortar mixer from Portland cement CEM 1 conforming to BS EN 197-1 and limestone fines conforming to BS 7979 where the proportions and properties conform to CEM II/A-L or CEM II/A-LL of BS EN 197-1:2000, except Clause 9 of that standard.*
- *Combinations produce in the mortar mixer from Portland cement CEM 1 confirming to BS EN 197-1 and pulverized fuel ash conforming to BS 3892-1, or to BS EN 450-1, where the proportions and properties conform to CEM IIA-V or CEM II/B-V or BS EN 197-1:20000 except Clause 9 of that standard.*

d) *Masonry cement conforming to BS EN 413-1, Class MC 12.5 (inorganic filler other than lime), not less than 65% by mass of Portland Cement clinker as defined in BS EN 197-1.*
e) *Masonry cement confirming to BS EN 413-1, Class MC 12.5 (lime), not less than 65% by mass of Portland cement clinker as defined in BS EN 197-1.*
f) *Table 7.1 is based on data from EC6 and the National Annex.*

Bedding and jointing

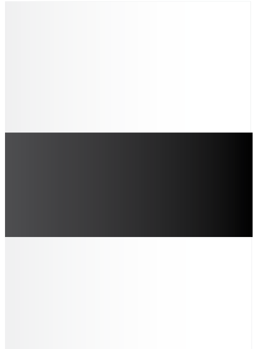
Solid, cellular or hollow units should be laid on a full bed of mortar. Cellular units should be laid with the closed end uppermost to allow for a full bed of mortar to be applied. All perpend joints should be solidly filled with mortar to maintain the built strength, weather resistance and airtightness of the structure.

The joint profile should be specified, taking into account the appearance required and the degree of exposure. Tooled and non-recessed joints provide the greatest resistance to rain penetration. Recessed joints should not generally be specified to exposed walls.

Flush jointing is not normally recommended for fair face blockwork, as a quality finish is difficult to achieve, especially with textured blocks and can result in mortar smears to the block face.

Flush or bagged joint

This finish can provide the greatest loadbearing area. However flush jointing is not normally recommended for fair face work as a good quality finish is difficult to achieve and can often result in mortar smears to the block face.



Concave (bucket handle)

This joint usually provides an improved appearance over a flush joint. It is comparatively easy to achieve and is recommended for both internal and external fair face blockwork. Owing to the compressing of the joint and the improved bond, it has good weather resistance and is suitable for all grades of exposure.

Struck or weathered

Weathered bed joints produce an interplay of light and shadow on the blockwork. Such joints when correctly made have excellent strength and weather resistance.

Square recessed

This joint when used with durable masonry units, can produce a very pleasing effect, but its weather resistance and strength will be considerably less than struck, flush or curved recess joints. Recommended in sheltered exposure conditions. The recess should not exceed 3-4mm and is not recommended with full fill cavity insulation.

Movement Control - An introduction

All buildings and building components move during their lifetime. The movement considered here is not the serious, structurally damaging kind, but the sort usually caused by changes in temperature or moisture which can lead to cracks which are unsightly and which may let in water.

Causes of movement

Movement in masonry can be attributed to variations in the environmental conditions and include:

- Changes in the moisture content of the blockwork.
- Changes in temperature.
- Movement of the adjoining structure.
- Chemical changes such as carbonation.
- Movement between dissimilar materials.

The types of movement will often act in combination to supplement or oppose one another. It is for this reason that it is very difficult to predict the amount of movement that is likely to occur in a given situation. Nevertheless, designers should try to anticipate the type and extent of movement and the effect it is likely to have on the building.

Generally, concrete masonry will contract as it dries to equilibrium moisture content. Conversely, clay masonry expands as the masonry matures and absorbs water.

Design for movement

Suitable precautions to control movement in masonry will include:

- Introduction of movement joints at suitable spacings.
- Use of localised bed joint reinforcement to areas of raised stress, e.g. above and below openings.
- Avoidance of over strong mortar.
- Protection of blocks and partially complete construction from the adverse effects of weather.

Movement joints

Movement joints are vertical separations built into the blockwork and positioned at locations where excessive stress can be predicted to occur. Typical vertical movement joint detail are shown in Figs. 8.1 and 8.2.

Generally movement joints are of 10mm width to co-ordinate with the standard block module. The joint is filled with a precompressed filler such as a polyethylene strip and, for fair face work, sealed with a suitable mastic. Where required, the joint material may need to achieve a specified fire resistance period, and there are many products available, such as flexible intumescent seals, to achieve this. Movement joints should be made continuous through any applied rigid finishes such as plaster or rendering.

Horizontal movement joints may need to be considered in very tall walls.

Horizontal joints are usually required when design codes recommended limiting the uninterrupted height of walls. BS 5628-1 recommends that the outer leaf should be supported at intervals not exceeding 9m or every third storey, whichever is less. However, the outer may be uninterrupted for its full height in buildings not exceeding four storeys or 12m in height, whichever is less.

Horizontal movement joints are normally formed in conjunction with a masonry support system.

Movement joint to internal wall

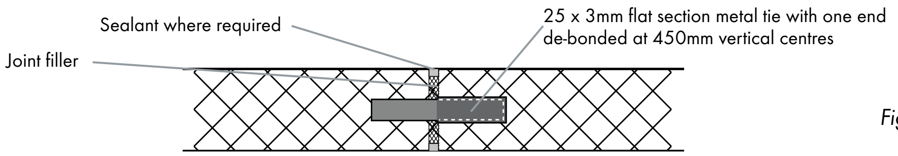


Figure 8.1

Movement joint to an internal wall with a plaster finish

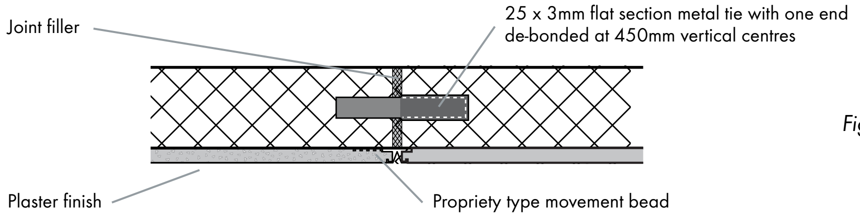


Figure 8.2

Positioning of movement joints

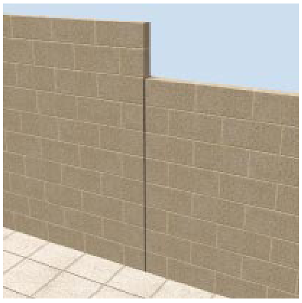
As a guide, movement joints should be spaced at approximately 6.0m intervals. However, for dense products, such as Lignacrete and products from the Facing Masonry ranges, movement joint spacings can be extended to 7.0m.

Movement joint spacings should be halved within 3.0 to 3.5m of a bonded corner/return/pier.

Special attention should be provided to panels whose length typically exceeds its height by a ratio of 3:1. This aspect ratio is often exceeded below a long window. The additional risk of movement can be controlled by introducing more frequent movement joints and/or including bed joint reinforcement.

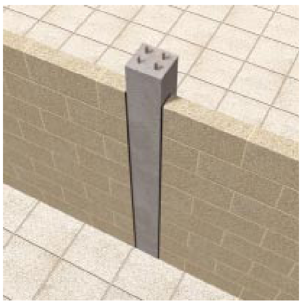
Movement joints should also be considered at the following locations:

- At a change in wall height or wall width.

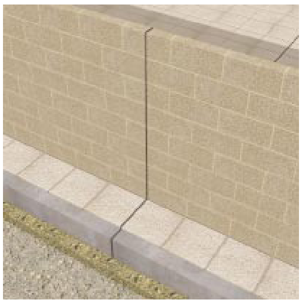


- Changes in loading conditions.

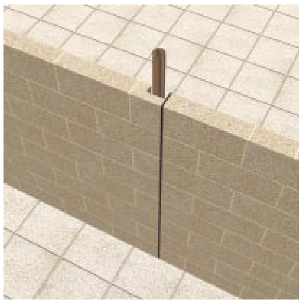
- At abutments with concrete columns or steel stanchions.



- At expansion joints in floors, or a expansion joint through the building.



- At deep chases or recesses.



- Junctions with dissimilar materials.

The spacing of movement joints can be increased by introducing ladder type bed joint reinforcement as advised in the table below. Bed joint reinforcement will not eliminate completely the risk of cracking, but should limit the extent so that only micro cracks will occur which will not affect the structural integrity of the walls.

Table 8.1 - Use of bed joint reinforcement to extend movement joint spacings.

		Continuous ladder type bed joint reinforcement at the following vertical centres		
	Unreinforced wall	675mm	450mm	215mm
Movement joint intervals	6.0m	9.0m	11.00m	13.0m

Where stack bonded masonry is specified, bed joint reinforcement should be installed at 225mm vertical spacings and movement joints should be spaced at approximately 6m intervals.

Bed joint reinforcement

Bed joint reinforcement can be used to assist in controlling movement in masonry, and can be considered for the following applications.

- Above and below openings.
- Differential movement control.
- To increase the frequency of movement joints beyond that for unreinforced walls.

The use of bed joint reinforcement above and below openings can be very effective in controlling movement to these areas of raised stress. Typically, two courses of reinforcement should be installed immediately above/below the openings and extend at least 600mm beyond the sides of the openings.

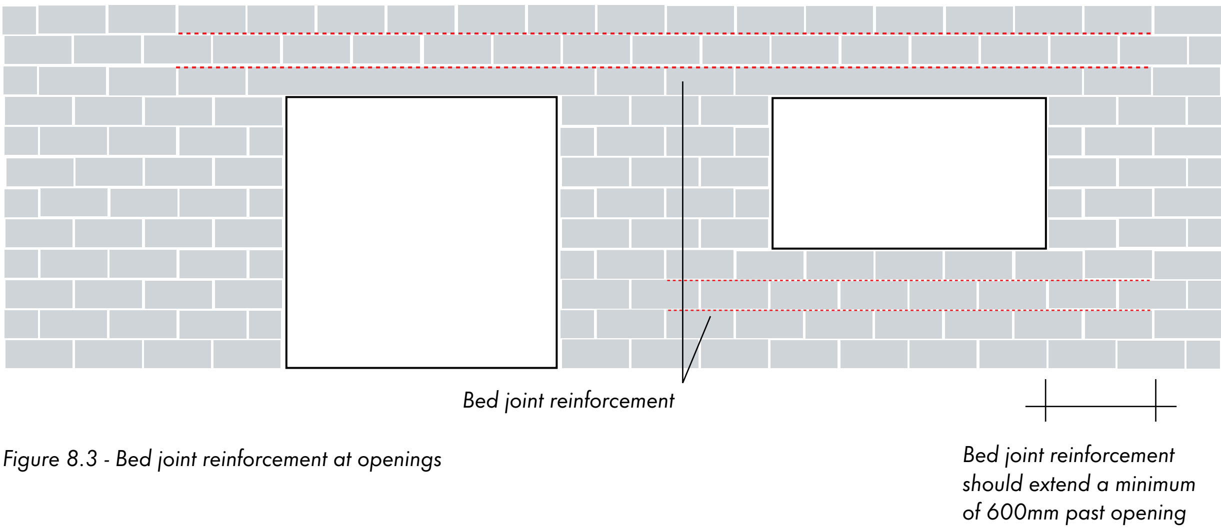


Figure 8.3 - Bed joint reinforcement at openings

Brick and Facing Masonry bonding

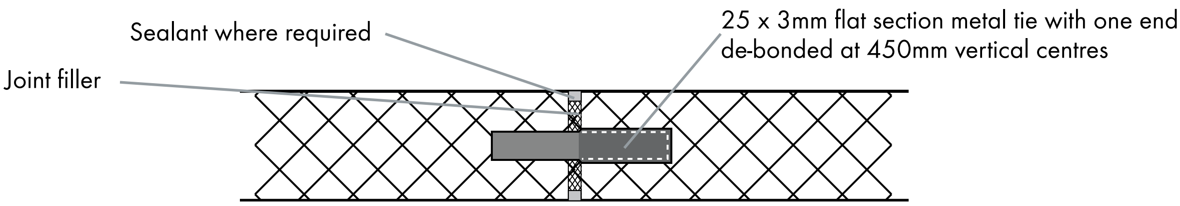
Sometimes facing masonry walls will incorporate feature band courses of dissimilar materials e.g. clay and concrete facing blocks. In such cases, measures should be taken to accommodate the differential movement that is likely to occur.

It is usually impractical to introduce slip planes between the two dissimilar materials. Instead, bed joint reinforcement should be used to tie the different materials together – see Figure xx. This has the effect of reinforcing the interface, which is normally sufficient to control the stresses attributed by differential movement.

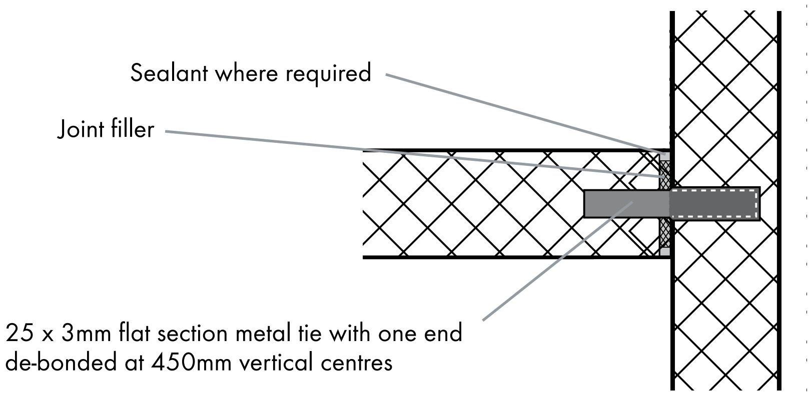
It is advisable to consider movement joints at 6.0 – 7.0m spacings.

Figure 8.4 - Bed joint reinforced used to control movement between different walling materials.

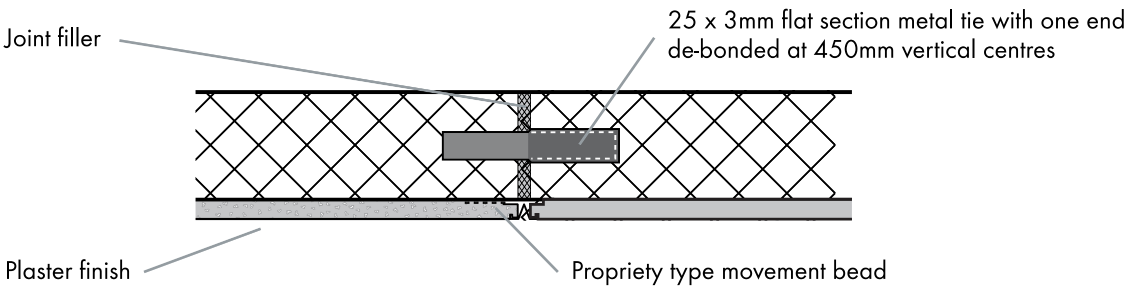
Movement joint to internal wall



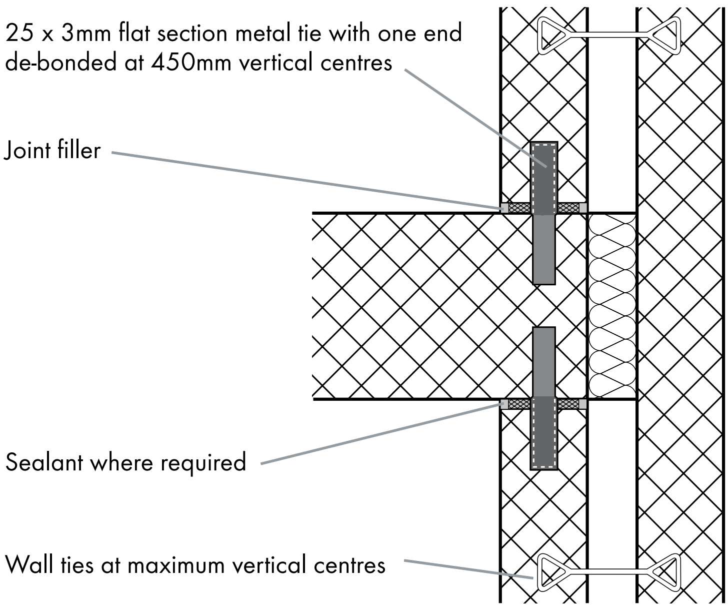
Movement joint to an internal wall



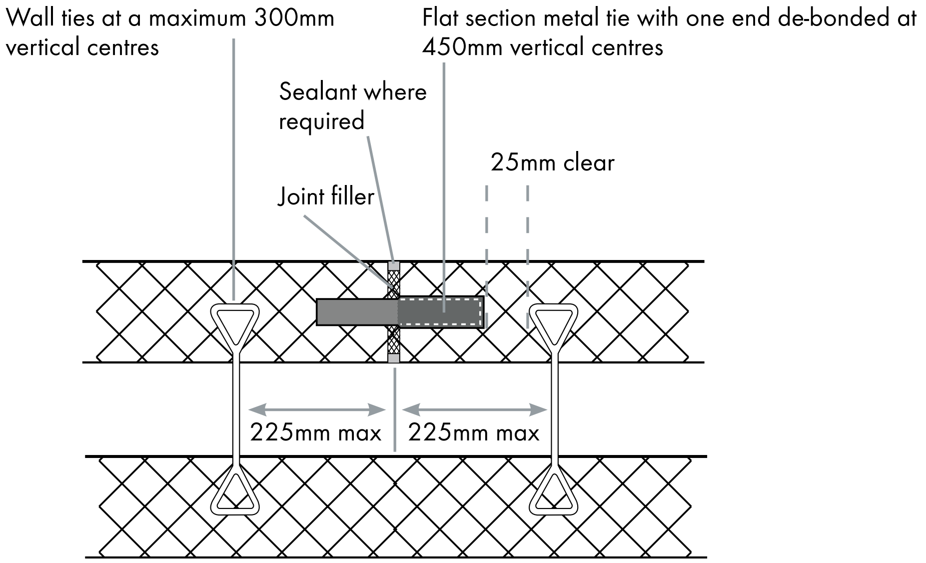
Movement joint to an internal wall with a plaster finish



Movement joint to an internal wall junction with a separating wall

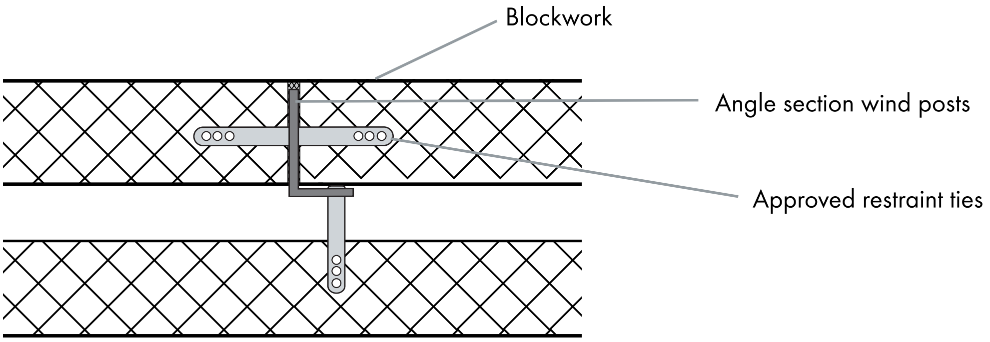


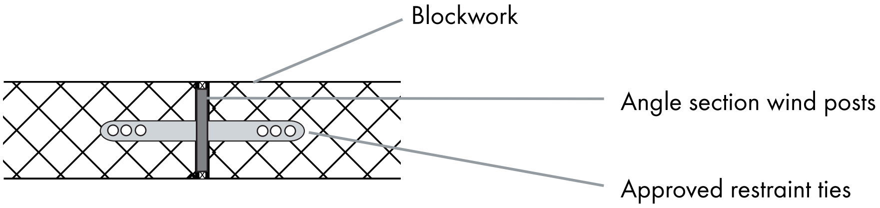
Movement joint inner leaf of external cavity wall



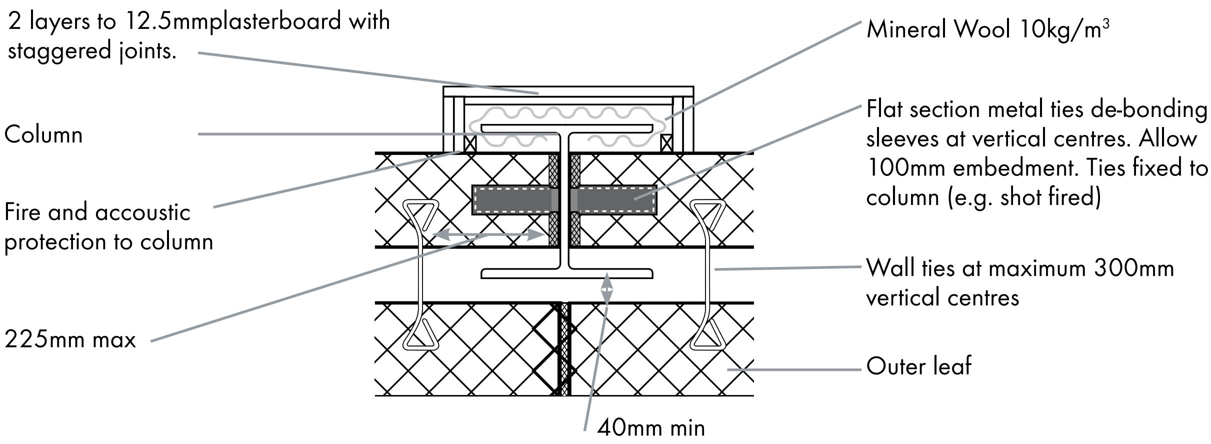
Windposts

Windposts can be used to divide blockwork into suitable panel sizes to suit the anticipated design wind loading. They can also be used to provide lateral edge restraint to internal walls where no other type of vertical support is available. Wind posts are available in various profiles to suit loadings, cavity width etc. Leading manufacturers of windposts can provide a windpost design service.

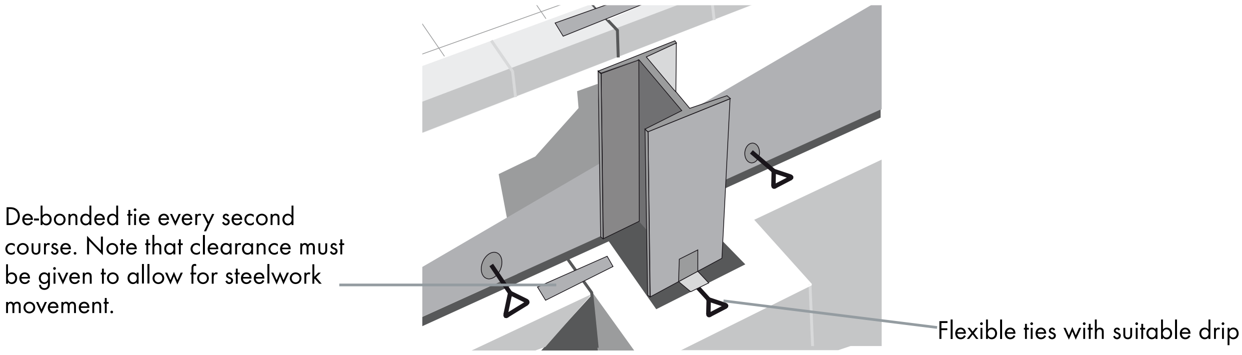




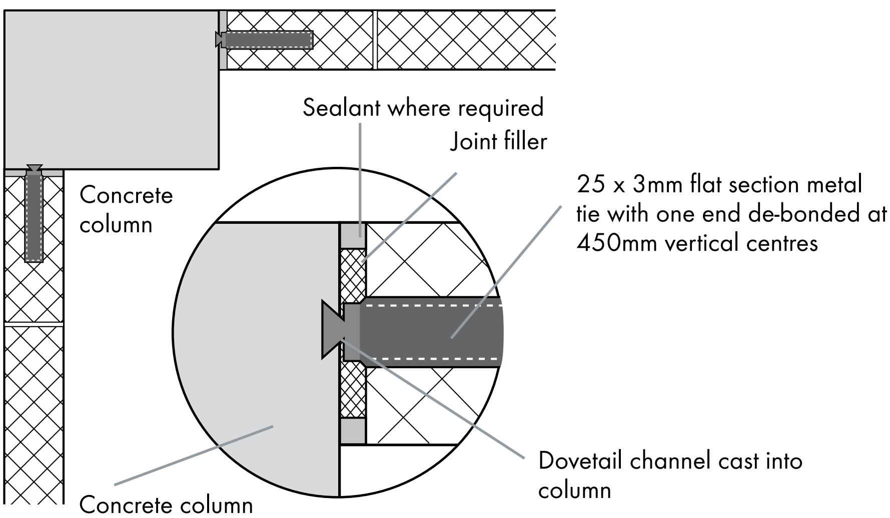
Movement joint to blockwork at steel column in cavity wall



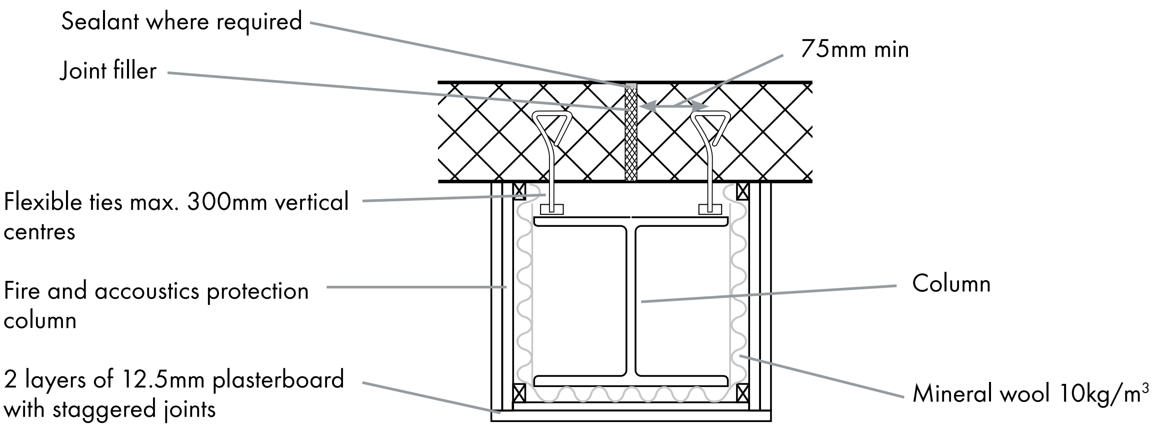
Movement joint to blockwork at steel column in blockwork encasing column



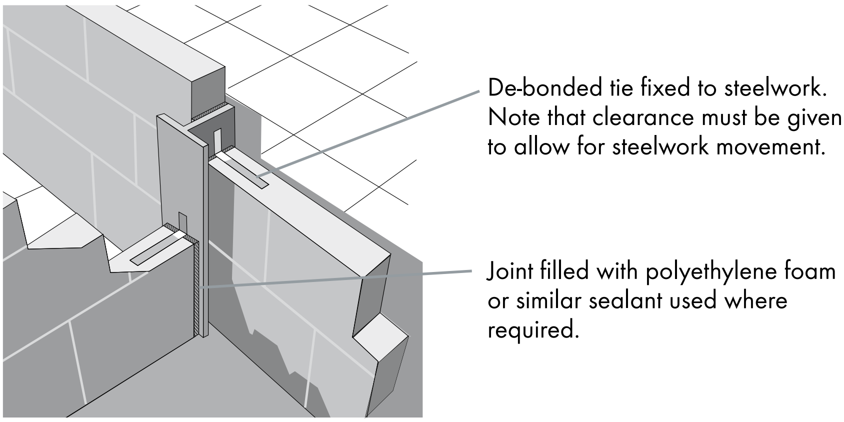
Movement joint at concrete column



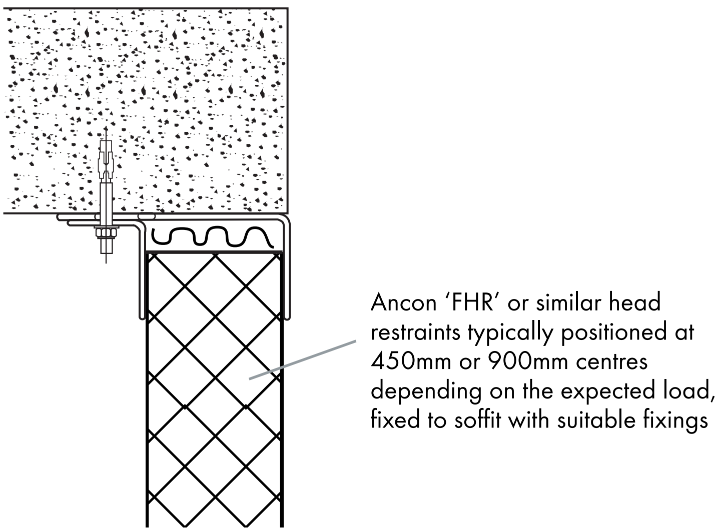
Movement joint to blockwork at internal steel column



Internal blockwork butting steel frame



Typical head restraint to internal wall



LIGNACITE
Sustainable Masonry

DESIGN GUIDANCE - Section 9

Part L - Energy Efficiency Standards from April 2014

Introduction - Energy Efficiency Standards from 2014

Building Regulations Part L 2013 is intended to deliver a further improvement to the energy efficiency of new buildings. This guidance is focused on the changes that affect new dwellings as well as non-domestic buildings. It provides a commentary on the new changes and compliant wall solutions using Lignacite Limited products.

The new changes took effect from the 6th April 2014.

Dwellings

Key Changes

- A new requirement has been introduced that requires new dwellings to achieve or better a fabric energy efficiency target in addition to the carbon dioxide target.
- The notional dwelling used to determine carbon dioxide and fabric energy efficiency targets is the same size and shape as the actual dwelling, constructed to a concurrent specification. The Part L 2013 standards have been improved to deliver a 6% carbon dioxide saving across the new homes build mix relative to Part L 2010.

- A summary of the Part L 2013 notional dwelling is shown in Table 9.2 with the full detail in SAP 2012 Appendix R. If the actual dwelling is constructed entirely to the notional dwelling specifications, it will meet the carbon dioxide and fabric energy efficiency targets and the limiting values for individual fabric elements and building services. Developers can of course vary the specification, provided that the same overall level of carbon dioxide emissions and fabric energy performance is achieved or bettered.
- The amendments made in 2012 requiring a feasibility of high-efficiency alternative systems to be taken into account before construction commences, have been consolidated.
- There are no changes in the fabric energy efficiency standards for extensions to existing homes.

Demonstrating Compliance

Compliance continues to be based on meeting five criteria which are focussed on the design of the dwellings as well as confirming the 'as-built' performance.

Table 9.1 - Compliance with the Regulations (L1A)

Compliance Criteria	What is required	Comments
Criterion 1	The rate of CO_2 emissions from the dwelling (the dwelling emission rate, DER) must not be greater than the target emission rate (TER). In addition, the Dwelling Fabric Energy Efficiency (DFEE) rate must not be greater that the target Fabric Energy Efficiency (TFEE) rate. All efficiency rates should be calculated in accordance with SAP 2012.	The Dwelling Fabric Energy Efficiency (DFEE) rate is a new addition to the compliance criteria. Its purpose is to ensure that a design has good levels of fabric insulation and is not over reliant on renewable energy sources as the main route to compliance with a relatively poorly insulated fabric.
Criterion 2	The performance of the individual fabric elements and the fixed building services should achieve reasonable overall standards of energy efficiency .	Compliance is based on meeting limiting fabric standards and limiting system efficiencies.
Criterion 3	The dwelling should have appropriate passive control measures to limit the effect of heat gains on indoor temperatures in summer, irrespective of whether the dwelling has mechanical cooling.	SAP 2012 Appendix P includes a procedure which can be used to check whether solar gains are excessive. Further guidance is available from CIBSE TM36 Climate Change and the Indoor Environment.
Criterion 4	The performance of the dwelling as built should be consistent with the DER and DFEE rate.	The insulation should be reasonably continuous over the whole building envelope and the air permeability should be within the SAP design limits. Other factors that are relevant include: - Party walls and other thermal bypasses - Thermal bridge. - Air permeability and pressure testing. - Commissioning of heating and hot water systems.
Criterion 5	Provisions for the energy efficient operation of the dwelling should be put in place.	This requires a suitable set of operating and maintenance instructions aimed at assisting the occupiers of the dwelling to achieve the expected level of energy efficiency.

Target CO_2 Emission Rate(TER) and Target Fabric Energy Efficiency (TFEE) Rate

The Target CO_2 Emission Rate (TER) and Target Fabric Energy Efficiency (TFEE) Rates are the minimum energy performance requirements for a new dwelling. The TER is expressed as the mass of CO_2 emitted in kg/m^2 of floor area per year. The TFEE Rate is expressed as the amount of energy consumed in units of kilowatt/hours per m^2 of floor area per year. The results are based on the provision and standardised use of specified fixed building services when assessed using SAP 2012. The TER and the TFEE are calculated from the CO_2 emissions of a notional dwelling of the same size and shape as the actual dwelling with specific performance criteria set to the reference values summarised in Table 9.2.

Table 9.2 - Summary of reference values for notional dwelling

Element or System	Values
Opening areas (windows and doors)	Same as actual dwelling up to a maximum proportion of 25% of total floor area
External walls (including opaque elements of curtain walls)	0.18 W/m^{2}K
Party walls	0.0 W/m^{2}K
Floor	0.13 W/m^{2}K
Roof	0.13 W/m^{2}K
Windows, glazed roof lights and glazed doors	1.4 W/m^{2}K (Whole window U-value)
Opaque doors	1.0 W/m^{2}K
Semi-glazed doors	1.2 W/m^{2}K
Air tightness	5.0m^3/h.m^2 at 50 Pa
Lineal thermal transmittance	Standardised psi values – see SAP Appendix R. Alternatively use y = 0.05 W/m^2 K if the default value of y = 0.15 W/m^{2}K is used in the actual dwelling
Note: The full set of reference values also provides requirements for ventilation, space and water heating systems and now energy lighting	

Limits on Design Flexibility

Although some design flexibility is permitted this should be within specified limits. Table X sets out the limiting standards for the fabric building elements. Each specified value represents the area-weighted average for all elements of that type. In practice, to achieve the TER and TFEE rate, a significantly better fabric performance than that set out in Table 9.3 is likely to be required.

Table 9.3 - Limiting fabric parameters

Element	Performance
Roof	0.20 W/m^{2}K
Wall	0.30 W/m^{2}K
Floor	0.25 W/m^{2}K
Party wall	0.20 W/m^{2}K
Swimming pool basin	0.25 W/m^{2}K
Windows, roof lights, doors	2.0 W/m^{2}K
Air permeability	10.0m^3/h.m^2 at 50 Pa

Thermal bridging

A major factor in the performance of the building fabric is not simply the amount of insulation you install, but how it interconnects with other components and the other insulated elements within the design.

Building junctions where building elements meet, such as at corners, cills or reveals, are usually less well insulated than the main element. It has been estimated that up to 30% of the heat loss in a well insulated house is through these 'Non Repeating Thermal Bridges' at wall/floor junctions, corners, reveals, ceiling junctions heads and sills etc.

Building Regulations require, through the SAP energy assessment calculations, that heat loss from thermal bridges is accounted for and minimized. Appendix K of SAP 2012 gives a procedure based on a linear thermal transmittance value, (Greek letter ψPsi – pronounced "si").

Use of Lignacite's products can reduce the effects of thermal bridging, particularly if adopting enhanced thermal bridging details developed on behalf of members of the Concrete Block Association.

Designers can elect to assess thermal bridging in the following ways:

(a) The Concrete Block Association, of which Lignacite Ltd is a member, has commissioned a comprehensive set of thermal bridging ψ - values for common junction details for cavity walls insulated with full and partial cavity fill. The results of these show that the use of concrete aggregate blocks at various densities, can improve thermal bridge losses significantly over both the Accredited Construction Details or default values. For details go to www.cba-blocks.org.uk.

(b) Adopt standard junction details based on DCLG Accredited Construction Details (ACD's, or other details formally recognised by DCLG).

(c) Use junction details that have been calculated by a competent person based on the guidance in BRE Report 497 Conventions for calculating linear thermal transmit tance and temperature factors.

(d) Use the values for linear thermal bridging in the 'default' column of Table KI in SAP 2012. Given the significance of thermal bridging in limiting heat loss and in improving fabric energy efficiency, very few designs will be able to adopt this approach.

Enhanced thermal bridging ψ values for Lignacite's product range have also been calculated based on the use of Xtratherm 'CaviTherm' full cavity fill. These details also show an improvement over Accredited Construction Details and will therefore be beneficial in meeting the required Target Fabric Energy Efficiency (TFEE) standard. Please contact Lignacite Ltd for details.

Party Walls and other Thermal Bypasses

To limit heat loss through party walls, it is recommended that cavity walls are fully insulated. There are a number of Robust Detail specifications which permit the use of full cavity fill without detriment to the acoustic performance of the wall. If in doubt, please contact our Technical Services for advice. Alternatively, solid walls can be specified between dwellings using Lignacrete blocks and their use avoids a thermal bypass condition.

Table 9.4 - U values for Party Walls

Party Wall construction	U-value (W/m²K)
Solid (e.g. 215mm Lignacrete wall)	0.0
Unfilled cavity with no effective edge sealing	0.5
Unfilled cavity with effective sealing around all exposed edges and in line with insulation layers in abutting elements	0.2
A fully filled cavity with effective sealing around all exposed edges and in line with insulation layers in abutting elements, eg using a suitable Robust Detail specification	0.0

Figure 9.1 - Fully filled cavities provide zero heat loss for party walls

Non-Domestic Buildings

The main changes to Approved Document L2A are:

- The notional building reference values have been updated to provide an average 9% reduction in CO_2 emissions across the new build mix for non-domestic buildings.
- Separate notional buildings are defined for Top-lit, side-lit (heated only) and side-lit (heated and cooled) buildings.
- Notional building air permeability is sub-divided by size.
- Target based on fabric and services only.

As for previous editions, it is required that the Building Emission Rate (BER) is no worse than the Target Emission Rate (TER). The TER is based on a building of the same size and shape as the proposed building, constructed to a concurrent specification (see Table 9.5 below) and no improvement factor to be applied. Therefore, if the actual building is constructed in accordance with this concurrent specification, it will meet the TER and therefore pass Criterion 1. However, the guidance is not prescriptive and the BER can be based on any other solution, provided the TER is not exceeded and the guidance from other parts of the Approved Document are met.

Table 9.5 - Reference values for non-domestic buildings

Element or System		Side lit or unlit (heating only)	Side-lit or unlit (includes cooling)	Top-lit
External walls		0.26W/m²K	0.26W/m²K	0.26W/m²K
Floor		0.22W/m²K	0.22W/m²K	0.22W/m²K
Roof		0.18W/m²K	0.18W/m²K	0.18W/m²K
Windows		1.60W/m²K g-value = 0.40 Light transmittance = 71%	1.60W/m²K g-value = 0.40 Light transmittance = 71%	Not applicable
Rooflights		N/A	N/A	1.80W/m²K g-value = 0.55 Light transmittance = 60%
Airtightness	Floor area ≤ 250m² 250 – 3500 m² Floor area≤ 250m² 3500 – 10,000 m² 10,000 m² ≤ floor area	5.0m³ / hr / m² 3.0m³ / hr / m² 3.0m³ / hr / m² 3.0m³ / hr / m²	5.0m³ / hr / m² 3.0m³ / hr / m² 3.0m³ / hr / m² 3.0m³ / hr / m²	7.0m³ / hr / m² 7.0m³ / hr / m² 5.0m³ / hr / m² 3.0m³ / hr / m²

Part L - Energy Efficiency Standards

Wall U Values

Meeting Part L thermal standards demands a high level of energy performance from the building fabric. This trend will continue with projected changes to Part L of the Building Regulations and as well as additional energy targets imposed through the Planning system, such as the London Plan.

Presented are an extensive number of wall solutions featuring Lignacite's products in conjunction with the latest and most thermally efficient insulation products available. This combination allows walls to be selected to meet a range of performance values. In most cases the U-value requirement for a project will be set by the energy calculation for the building, such as SAP for new dwellings. In this case it will be straightforward to select a construction to match the required U-value.

Solutions are presented for cavity walls with partial and full fill cavity insulation as well as internally applied insulation as summarised below.

For constructions that are not featured please contact our Technical Services team who will be pleased to assist and provide supporting calculations.

Ref:	Type of insulation	Outer leaf	Inner leaf
Table A	Partial cavity fill	Facing brick or Lignacite Facing Masonry	Ashlite, Fibo 850, Houseblock 1100, Lignacite, Lignacrete
Table B	Partial cavity fill	16mm render applied to Lignacrete block	
Table C	Full cavity fill	Outer leaf facing brick or Lignacite Facing Masonry	
Table D	Full cavity fill	16mm render applied to Lignacrete block	
Table E	Clear cavity with internal insulation	Outer leaf facing brick or Lignacite Facing Masonry	
Table F	Full cavity fill and internal insulation	Outer leaf facing brick or Lignacite Facing Masonry	

Thermal Bridging

Minimising heat loss through bridged areas is as important as the U-values in achieving a cost effective building design. The SAP procedure requires this aspect to be accounted for.

Heat loss through thermal bridges (known as non–repeating or linear thermal bridges) occur at junctions between elements or where the continuity of the external fabric insulation is interrupted (e.g. at junctions with external walls, floors and roof). As thermal standards continue to improve, the relative effect of thermal bridging becomes more significant as U-values are driven down.
Lignacite's range of aggregate blocks have reduced heat loss when compared to the Government's Accredited Construction Details and default values shown in Appendix K of SAP 2012.

This is as a result of collaborative work with the Concrete Block Association (CBA) and has resulted in a comprehensive set of junction details that have been independently assessed.

This information will be of prime interest to designers and SAP assessors as well as builders who will have the responsibility for correctly constructing the various junctions.

The following links show the different junctions details available:

Junction ψ-values and f-values (walls with fully filled cavities)

http://www.cba-blocks.org.uk/tech/junction-values-fully.html

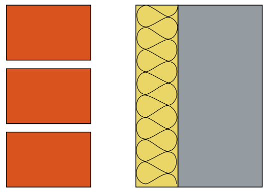
Junction ψ-values and f-values (walls with partially filled cavities)

http://www.cba-blocks.org.uk/tech/junction-values-partially.html

Junction ψ-values and f-values (walls with cavities fully filled with Xtratherm CavityTherm)

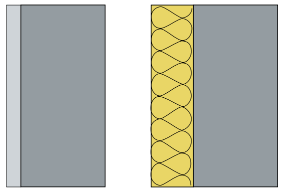
http://www.cba-blocks.org.uk/tech/junction-values-fully-xtratherm.html

Table A - Partial cavity fill - Outer leaf facing brick or Lignacite Facing Masonry



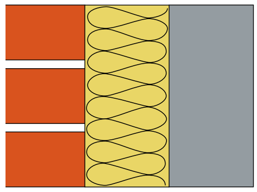
U-values (W/m²K)						
Insulation Option	Internal Finish	100mm Inner Leaf				
		Lignacrete	Lignacite	Ashlite	Fibo 850	Houseblock 1100
100mm cavity						
50mm Celotex CG5000	None e.g. Paint Grade block	0.29	0.29	-	-	-
	13mm Lightweight plaster	0.28	0.28	0.27	0.26	0.27
	12.5mm Plasterboard on dabs	0.27	0.27	0.26	0.25	0.26
	Typical wall width 302mm					
50mm Kingspan Kooltherm K108	None e.g. Paint Grade block	0.26	0.26	-	-	
	13mm Lightweight plaster	0.26	0.26	0.25	0.24	0.24
	12.5mm Plasterboard on dabs	0.25	0.25	0.24	0.23	0.24
	Typical wall width 302mm					
50mm Recticel Eurowall Cavity	None e.g. Paint Grade block	0.30	0.30	-	-	
	13mm Lightweight plaster	0.30	0.29	0.29	0.27	0.28
	12.5mm Plasterboard on dabs	0.29	0.28	0.28	0.26	0.27
	Typical wall width 302mm					
125mm cavity						
75mm Celotex CG5000	None e.g. Paint Grade block	0.22	0.21	-	-	-
	13mm Lightweight plaster	0.21	0.21	0.21	0.20	0.20
	12.5mm Plasterboard on dabs	0.21	0.21	0.20	0.20	0.20
	Typical wall width 327mm					
75mm Kingspan Kooltherm K108	None e.g. Paint Grade block	0.19	0.19	-	-	-
	13mm Lightweight plaster	0.19	0.19	0.19	0.18	0.18
	12.5mm Plasterboard on dabs	0.19	0.18	0.18	0.18	0.18
	Typical wall width 327mm					
75mm Recticel Eurowall Cavity	None e.g. Paint Grade block	0.23	0.22	-	-	-
	13mm Lightweight plaster	0.22	0.22	0.22	0.21	0.21
	12.5mm Plasterboard on dabs	0.22	0.21	0.21	0.20	0.21
	Typical wall width 327mm					
150mm cavity						
100mm Kingspan Kooltherm K108	None e.g. Paint Grade block	0.15	0.15	-	-	-
	13mm Lightweight plaster	0.15	0.15	0.15	0.14	0.15
	12.5mm Plasterboard on dabs	0.15	0.15	0.15	0.14	0.14
	Typical wall width 352mm					
100mm Recticel Eurowall Cavity	None e.g. Paint Grade block	0.18	0.18	-	-	-
	13mm Lightweight plaster	0.18	0.18	0.17	0.17	0.17
	12.5mm Plasterboard on dabs	0.17	0.17	0.17	0.17	0.17
	Typical wall width 352mm					

Table B - Partial cavity fill - Outer leaf 16mm render on100mm Lignacrete block



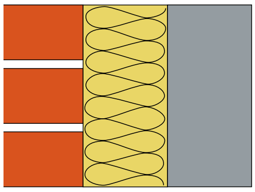
U-values (W/m²K)						
Insulation Option	Internal Finish	100mm Inner Leaf				
		Lignacrete	Lignacite	Ashlite	Fibo 850	Houseblock 1100
100mm cavity						
50mm Celotex CG5000	None e.g. Paint Grade block	0.29	0.29	-	-	-
	13mm Lightweight plaster	0.28	0.28	0.27	0.26	0.27
	12.5mm Plasterboard on dabs	0.27	0.27	0.26	0.25	0.26
	Typical wall width 316mm					
50mm Kingspan Kooltherm K108	None e.g. Paint Grade block	0.26	0.26	-	-	-
	13mm Lightweight plaster	0.26	0.26	0.25	0.24	0.24
	12.5mm Plasterboard on dabs	0.25	0.25	0.24	0.23	0.24
	Typical wall width 316mm					
50mm Recticel Eurowall Cavity	None e.g. Paint Grade block	0.30	0.30	-	-	-
	13mm Lightweight plaster	0.30	0.29	0.29	0.27	0.28
	12.5mm Plasterboard on dabs	0.29	0.28	0.28	0.26	0.27
	Typical wall width 316mm					
125mm cavity						
75mm Celotex CG5000	None e.g. Paint Grade block	0.22	0.21	-	-	-
	13mm Lightweight plaster	0.21	0.21	0.21	0.20	0.21
	12.5mm Plasterboard on dabs	0.21	0.21	0.20	0.20	0.20
	Typical wall width 341mm					
75mm Kingspan Kooltherm K108	None e.g. Paint Grade block	0.19	0.19	-	-	-
	13mm Lightweight plaster	0.19	0.19	0.19	0.18	0.18
	12.5mm Plasterboard on dabs	0.19	0.18	0.18	0.18	0.18
	Typical wall width 341mm					
75mm Recticel Eurowall Cavity	None e.g. Paint Grade block	0.23	0.22	-	-	-
	13mm Lightweight plaster	0.22	0.22	0.22	0.21	0.21
	12.5mm Plasterboard on dabs	0.22	0.21	0.21	0.20	0.21
	Typical wall width 341mm					
150mm cavity						
100mm Kingspan Kooltherm K108	None e.g. Paint Grade block	0.15	0.15	-	-	-
	13mm Lightweight plaster	0.15	0.15	0.15	0.14	0.15
	12.5mm Plasterboard on dabs	0.15	0.15	0.15	0.14	0.14
	Typical wall width 366mm					
100mm Recticel Eurowall Cavity	None e.g. Paint Grade block	0.18	0.18	-	-	-
	13mm Lightweight plaster	0.18	0.18	0.17	0.17	0.17
	12.5mm Plasterboard on dabs	0.17	0.17	0.17	0.17	0.17
	Typical wall width 366mm					

Table C - Full cavity fill - Outer leaf facing brick or Lignacite Facing Masonry



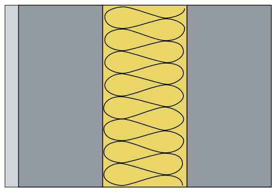
U-values (W/m²K)						
Insulation Option	Internal Finish	100mm Inner Leaf				
		Lignacrete	Lignacite	Ashlite	Fibo 850	Houseblock 1100
100mm cavity						
97mm Celotex CF5000	None e.g. Paint Grade block	0.20	0.20	-	-	-
	13mm Lightweight plaster	0.20	0.20	0.19	0.19	0.19
	12.5mm Plasterboard on dabs	0.19	0.19	0.19	0.18	0.19
	Typical wall width 302mm					
100mm CavityTherm CT/PIR	None e.g. Paint Grade block	0.20	0.20	-	-	-
	13mm Lightweight plaster	0.20	0.20	0.19	0.19	0.19
	12.5mm Plasterboard on dabs	0.19	0.19	0.19	0.18	0.18
	Typical wall width 302mm					
90mm Kingspan Kooltherm K106	None e.g. Paint Grade block	0.18	0.18	-	-	-
	13mm Lightweight plaster	0.18	0.18	0.18	0.17	0.17
	12.5mm Plasterboard on dabs	0.18	0.17	0.17	0.17	0.17
	Typical wall width 302mm					
90mm Recticel Eurowall +	None e.g. Paint Grade block	0.21	0.21	-	-	-
	13mm Lightweight plaster	0.20	0.20	0.20	0.19	0.20
	12.5mm Plasterboard on dabs	0.20	0.20	0.19	0.19	0.19
	Typical wall width 302mm					
100mm Dritherm Cavity Slab 32 Ultimate	None e.g. Paint Grade block	0.29	0.28	-	-	-
	13mm Lightweight plaster	0.28	0.28	0.27	0.26	0.26
	12.5mm Plasterboard on dabs	0.27	0.27	0.26	0.25	0.26
	Typical wall width 302mm					
100mm Platinum EcoBead (injected)	None e.g. Paint Grade block	0.29	0.29	-	-	-
	13mm Lightweight plaster	0.29	0.29	0.28	0.27	0.27
	12.5mm Plasterboard on dabs	0.28	0.28	0.27	0.26	0.26
	Typical wall width 302mm					
125mm cavity						
125mm CavityTherm CT/PIR	None e.g. Paint Grade block	0.16	0.15	-	-	-
	13mm Lightweight plaster	0.16	0.16	0.16	0.15	0.15
	12.5mm Plasterboard on dabs	0.16	0.16	0.15	0.15	0.15
	Typical wall width 327mm					
115mm Kingspan Kooltherm K106	None e.g. Paint Grade block	0.15	0.14	-	-	-
	13mm Lightweight plaster	0.14	0.14	0.14	0.14	0.14
	12.5mm Plasterboard on dabs	0.14	0.14	0.14	0.14	0.14
	Typical wall width 327mm					
115mm Recticel Eurowall +	None e.g. Paint Grade block	0.17	0.17	-	-	-
	13mm Lightweight plaster	0.17	0.17	0.16	0.16	0.16
	12.5mm Plasterboard on dabs	0.16	0.16	0.16	0.16	0.16
	Typical wall width 327mm					

Table C - Full cavity fill - Outer leaf facing brick or Lignacite Facing Masonry (cont)



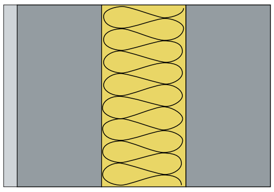
U-values (W/m²K)						
Insulation Option	Internal Finish	100mm Inner Leaf				
		Lignacrete	Lignacite	Ashlite	Fibo 850	Houseblock 1100
125mm cavity						
125mm Dritherm Cavity Slab 32 Ultimate	None e.g. Paint Grade block	0.23	0.23	-	-	-
	13mm Lightweight plaster	0.23	0.23	0.22	0.22	0.22
	12.5mm Plasterboard on dabs	0.22	0.22	0.22	0.21	0.21
	Typical wall width 327mm					
125mm Platinum EcoBead (injected)	None e.g. Paint Grade block	0.24	0.24	-	-	-
	13mm Lightweight plaster	0.24	0.23	0.23	0.22	0.22
	12.5mm Plasterboard on dabs	0.23	0.23	0.22	0.22	0.22
	Typical wall width 327mm					
150mm cavity						
150mm CavityTherm CT/PIR	None e.g. Paint Grade block	0.14	0.13	-	-	-
	13mm Lightweight plaster	0.13	0.13	0.13	0.13	0.13
	12.5mm Plasterboard on dabs	0.13	0.13	0.13	0.13	0.13
	Typical wall width 352mm					
140mm Recticel Eurowall +	None e.g. Paint Grade block	0.14	0.14	-	-	-
	13mm Lightweight plaster	0.14	0.14	0.14	0.13	0.14
	12.5mm Plasterboard on dabs	0.14	0.14	0.14	0.13	0.13
	Typical wall width 352mm					
150mm Dritherm Cavity Slab 32 Ultimate	None e.g. Paint Grade block	0.20	0.20	-	-	-
	13mm Lightweight plaster	0.20	0.19	0.19	0.19	0.19
	12.5mm Plasterboard on dabs	0.19	0.19	0.19	0.18	0.18
	Typical wall width 352mm					
150mm Platinum EcoBead (injected)	None e.g. Paint Grade block	0.20	0.20	-	-	-
	13mm Lightweight plaster	0.20	0.20	0.20	0.19	0.19
	12.5mm Plasterboard on dabs	0.20	0.20	0.19	0.19	0.19
	Typical wall width 352mm					

Table D - Full cavity fill - Outer leaf 16mm render on 100mm Lignacrete



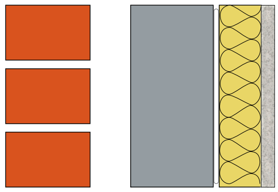
U-values (W/m²K)						
Insulation Option	Internal Finish	100mm Inner Leaf				
		Lignacrete	Lignacite	Ashlite	Fibo 850	Houseblock 1100
100mm cavity						
97mm Celotex CF5000	None e.g. Paint Grade block	0.20	0.20	-	-	-
	13mm Lightweight plaster	0.20	0.20	0.19	0.19	0.19
	12.5mm Plasterboard on dabs	0.19	0.19	0.19	0.18	0.19
	Typical wall width 302mm					
100mm CavityTherm CT/PIR	None e.g. Paint Grade block	0.20	0.20	-	-	-
	13mm Lightweight plaster	0.20	0.20	0.19	0.19	0.19
	12.5mm Plasterboard on dabs	0.19	0.19	0.19	0.18	0.18
	Typical wall width 302mm					
90mm Kingspan Kooltherm K106	None e.g. Paint Grade block	0.18	0.18	-	-	-
	13mm Lightweight plaster	0.18	0.18	0.18	0.17	0.17
	12.5mm Plasterboard on dabs	0.18	0.17	0.17	0.17	0.17
	Typical wall width 302mm					
90mm Recticel Eurowall +	None e.g. Paint Grade block	0.21	0.21	-	-	-
	13mm Lightweight plaster	0.20	0.20	0.20	0.19	0.20
	12.5mm Plasterboard on dabs	0.20	0.20	0.19	0.19	0.19
	Typical wall width 302mm					
100mm Dritherm Cavity Slab 32 Ultimate	None e.g. Paint Grade block	0.29	0.28	-	-	-
	13mm Lightweight plaster	0.28	0.28	0.27	0.26	0.26
	12.5mm Plasterboard on dabs	0.27	0.27	0.26	0.25	0.26
	Typical wall width 302mm					
100mm Platinum EcoBead (injected)	None e.g. Paint Grade block	0.29	0.29	-	-	-
	13mm Lightweight plaster	0.29	0.29	0.28	0.27	0.27
	12.5mm Plasterboard on dabs	0.28	0.28	0.27	0.26	0.26
	Typical wall width 302mm					
125mm cavity						
125mm CavityTherm CT/PIR	None e.g. Paint Grade block	0.16	0.15	-	-	-
	13mm Lightweight plaster	0.16	0.16	0.16	0.15	0.15
	12.5mm Plasterboard on dabs	0.16	0.16	0.15	0.15	0.15
	Typical wall width 327mm					
115mm Kingspan Kooltherm K106	None e.g. Paint Grade block	0.15	0.14	-	-	-
	13mm Lightweight plaster	0.14	0.14	0.14	0.14	0.14
	12.5mm Plasterboard on dabs	0.14	0.14	0.14	0.14	0.14
	Typical wall width 327mm					
115mm Recticel Eurowall +	None e.g. Paint Grade block	0.17	0.17	-	-	-
	13mm Lightweight plaster	0.17	0.17	0.16	0.16	0.16
	12.5mm Plasterboard on dabs	0.16	0.16	0.16	0.16	0.16
	Typical wall width 327mm					

Table D - Full cavity fill - Outer leaf 16mm render on 100mm Lignacrete (cont)



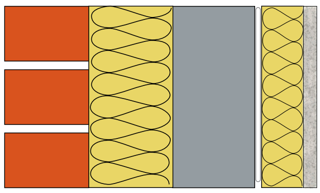
U-values (W/m²K)						
Insulation Option	Internal Finish	100mm Inner Leaf				
		Lignacrete	Lignacite	Ashlite	Fibo 850	Houseblock 1100
125mm cavity						
125mm Dritherm Cavity Slab 32 Ultimate	None e.g. Paint Grade block	0.23	0.23	-	-	-
	13mm Lightweight plaster	0.23	0.23	0.22	0.22	0.22
	12.5mm Plasterboard on dabs	0.22	0.22	0.22	0.21	0.21
	Typical wall width 327mm					
125mm Platinum EcoBead (injected)	None e.g. Paint Grade block	0.24	0.24	-	-	-
	13mm Lightweight plaster	0.24	0.23	0.23	0.22	0.22
	12.5mm Plasterboard on dabs	0.23	0.23	0.22	0.22	0.22
	Typical wall width 327mm					
150mm cavity						
150mm CavityTherm CT/PIR	None e.g. Paint Grade block	0.14	0.13	-	-	-
	13mm Lightweight plaster	0.13	0.13	0.13	0.13	0.13
	12.5mm Plasterboard on dabs	0.13	0.13	0.13	0.13	0.13
	Typical wall width 352mm					
140mm Recticel Eurowall +	None e.g. Paint Grade block	0.14	0.14	-	-	-
	13mm Lightweight plaster	0.14	0.14	0.14	0.13	0.14
	12.5mm Plasterboard on dabs	0.14	0.14	0.14	0.13	0.13
	Typical wall width 352mm					
150mm Dritherm Cavity Slab 32 Ultimate	None e.g. Paint Grade block	0.20	0.20	-	-	-
	13mm Lightweight plaster	0.20	0.19	0.19	0.19	0.19
	12.5mm Plasterboard on dabs	0.19	0.19	0.19	0.18	0.18
	Typical wall width 352mm					
150mm Platinum EcoBead (injected)	None e.g. Paint Grade block	0.20	0.20	-	-	-
	13mm Lightweight plaster	0.20	0.20	0.20	0.19	0.19
	12.5mm Plasterboard on dabs	0.20	0.20	0.19	0.19	0.19
	Typical wall width 352mm					

Table E - Clear cavity with internal insulation - Outer leaf facing brick or Lignacite Facing Masonry



U-values (W/m²K)					
Thermal plasterboard laminate	100mm Inner Leaf				
	Lignacrete	Lignacite	Ashlite	Fibo 850	Houseblock 1100
60mm Gyproc Thermaline Super (R=2.56m² K/W)	0.31	0.31	0.30	0.28	0.29
Typical wall width	327mm				
70mm Gyproc Thermaline Super (R=3.06m² K/W)	0.27	0.27	0.26	0.25	0.25
Typical wall width	337mm				
80mm Gyproc Thermaline Super (R=3.56m² K/W)	0.24	0.23	0.23	0.22	0.22
Typical wall width	347mm				
90mm Gyproc Thermaline Super (R=4.06m² K/W)	0.21	0.21	0.21	0.20	0.20
Typical wall width	357mm				
62.5mm Kingspan Kooltherm K118 (R=2.84m² K/W)	0.29	0.29	0.28	0.27	0.27
Typical wall width	329mm				
72.5mm Kingspan Kooltherm K118 (R=3.35m² K/W)	0.25	0.25	0.25	0.24	0.24
Typical wall width	339mm				
82.5mm Kingspan Kooltherm K118 (R=3.95m² K/W)	0.22	0.22	0.21	0.21	0.21
Typical wall width	349mm				
92.5mm Kingspan Kooltherm K118 (R=4.50m² K/W)	0.20	0.20	0.19	0.19	0.19
Typical wall width	359mm				

Table F - Full cavity fill and internal insulation (Thermal plasterboard laminate) Outer leaf facing brick or Lignacite Facing Masonry.



In situations where a low wall U-value is required and it is not possible to increase the cavity width, a possible solution is to use cavity insulation in conjunction with a thermal plasterboard laminate. Some examples are shown in Table 6 and assume 100mm cavity insulation. If required a narrower cavity can be specified, or partial cavity fill used in lieu of full cavity fill. Other sizes of thermal plasterboard laminates are available.

U-values (W/m²K)						
Cavity fill - 100mm cavity	Thermal Plasterboard Laminate	100mm Inner Leaf				
		Lignacrete	Lignacite	Ashlite	Fibo 850	Houseblock 1100
97mm Celotex CF5000 plus	62.5mm Kingspan Kooltherm K118 (R=2.84m² K/W)	0.13	0.13	0.13	0.12	0.12
100mm CavityTherm CT/PIR	62.5mm Kingspan Kooltherm K118 (R=2.84m² K/W)	0.13	0.13	0.12	0.12	0.12
90mm Kingspan Kooltherm K106	62.5mm Kingspan Kooltherm K118 (R=2.84m² K/W)	0.12	0.12	0.12	0.12	0.12
90mm Recticel Eurowall +	62.5mm Kingspan Kooltherm K118 (R=2.84m² K/W)	0.13	0.13	0.13	0.13	0.13
100mm Dritherm Cavity Slab 32 Ultimate	62.5mm Kingspan Kooltherm K118 (R=2.84m² K/W)	0.16	0.16	0.15	0.15	0.15
100mm Platinum EcoBead (injected)	62.5mm Kingspan Kooltherm K118 (R=2.84m² K/W)	0.16	0.16	0.16	0.15	0.15
Notes: The typical wall width of the above constructions is 379mm.						

Notes to tables:

1. The U-values shown are based on the use of various proprietary insulation products described. Alternative products can be used, provided they can achieve an equivalent thermal resistance (m^2K/W) of the product and, where applicable, enhanced low emissivity values of the airspace in cavity walls.

2. The U-values shown have been calculated using Lignacite's concrete blocks with a face size of 440 x 215mm and with mortar joints assumed to be 10mm wide. Wall ties are assumed to be stainless steel with a cross-sectional area of no more than $12.5mm^2$ for structural cavities up to 175mm wide. Above 175mm, the cross-sectional area of wall ties is assumed to be $25mm^2$.

3. The typical wall widths shown are for illustrative purposes only. They do not include the thickness of any internal finishes except for wall solutions with thermal insulation laminates. Thermal laminates are assumed to have a minimum 15mm airspace between the laminate and the blockwork. Traditional renders are assumed to be 16mm thick.

The wall widths shown for Lignacite's blocks in conjunction with partial cavity fill assume that a residual clear cavity of 50mm will be maintained. In some cases it may be possible to reduce the cavity width to a minimum of 25mm. The insulation manufacturer should be consulted for guidance.

The U-values given in this Brochure are correct at the time of going to press and are based on manufacturers' details available at that time. Details of insulation products featured in the constructions solutions can be obtained as follows:

Insulation product	Manufacturer	Contact details
Cavitytherm	Xtratherm Ltd	www.cavitytherm.co.uk
Celotex CG 5000	Celotex Ltd	www.celotex.co.uk
Dritherm Cavity Slab 32 Ultimate	Knauf Insulation Ltd	www.knaufinsulation.co.uk
Gyproc Thermaline Super	British Gypsum	www.british-gypsum.com
Ecobead injected cavity fill	Springvale EPS Ltd	www.springvale.com
Gyproc Thermaline Super	British Gypsum	www.british-gypsum.com
Recticel Eurowall full and partial fill	Recticel Insulation Products	www.recticelinsulation.co.uk
Kingspan full and partial fill, insulated plasterboard	Kingspan Insulation Ltd	www.kingspaninsulation.co.uk

Sound Insulation - An Introduction

Our product ranges provide an extensive number of block solutions for walls, to satisfy the performance standards of Part E of the Building Regulations, as well as the specific needs of builders and designers.

The solutions presented offer high levels of performance and can achieve compliance through Robust Details and pre-completion testing.

Performance standards are also imposed by other guidance documents such as Building Bulletin 93' 'Acoustic Design of Schools – A Design Guide'.

Background

The move towards higher density housing developments, coupled with a growing expectation from occupiers that reasonable standards of sound insulation will be provided, led to the widespread changes introduced to Approved Document E (AD E) in 2003 and amended in 2010. The result is a much more rigorous specification for sound resisting elements as well as for workmanship on site. Compliance is enforced through on site pre-completion testing of separating floors and walls, although for housing the Robust Detail programme was developed to allow specifications that are sufficiently robust to be built without the need for pre-completion testing. Such specifications, known as Robust Details, are subject to ongoing monitoring to ensure the integrity of the scheme is maintained.

AD E applies to dwellings and to rooms for residential purposes. The latter is defined as a room, or a suite of rooms, which is not a dwelling house or flat and which is used by one or more persons to live and sleep. This will therefore include a room in a hostel, a hall of residence, an hotel, or a residential home. It will not include rooms in a hospital or other similar establishment used for patient care.

The scope of AD E also covers reverberation in the common areas of blocks of flats and acoustic requirements for schools.

Performance Requirements

The following regulations are specified in AD E:

E1 Protection against Sound from other parts of the building and adjoining buildings
Houses, flats and rooms for residential use shall be designed and constructed in such a way that they provide reasonable resistance to sound from other parts of the same building and from adjoining buildings.

E2 Protection against sound within a dwelling – house, etc
Houses, flats and rooms for residential use shall be designed and constructed in such a way that:

a) Internal walls between a bedroom or a room containing a water closet and any other rooms;
and
b) Internal floors,

provide reasonable resistance to sound.

Limitations
Requirement E2 does not apply to:

a) An internal wall which contains a door.
b) An internal wall which separates an en suite toilet from the associated bedroom.
c) Existing walls and floors in the building which are subject to a material change of use.

E3 Reverberation in the common internal parts of buildings containing flats or rooms for residential purposes

The common internal parts of buildings which contain flats or rooms for residential use shall be designed and constructed in such a way as to prevent more reverberation around the common parts than is reasonable.

Limitations
Requirement E3 only applies to corridors, stairwells, hallways and entrance halls which provide access to the flat or room for residential use.

E4 – Acoustic conditions in schools

1. Each room or other space in a school shall be designed and constructed in such a way that it has the acoustic conditions and insulation against disturbance by noise appropriate to its intended use.
2. For the purpose of this part – 'school' has the same meaning as in Section 4 of the Education Act 1966 and 'school building' means any building forming a school or part of a school.

Performance Standards

The performance standards applicable to dwellings and to rooms for residential purposes are shown in Tables 10.1 and 10.2 respectively.

Table 10.1 - Performance requirements for dwelling

	Airborne sound insulation ($D_{nT,w} + C_{tr}$) dB (minimum values)	Impact sound insulation ($L'_{nT,w} + C_{tr}$) dB (maximum values)
Purpose built dwelling-houses and flats		
Separating walls	45	-
Separating floors and stairs	45	62
Dwelling-houses and flats formed by material change of use		
Separating walls	43	-
Separating floors and stairs	43	64

Table 10.2 - Performance requirements for rooms for residential purposes

	Airborne sound insulation ($D_{nT,w} + C_{tr}$) dB (minimum values)	Impact sound insulation ($L'_{nT,w} + C_{tr}$) dB (maximum values)
Purpose built rooms for residential purposes		
Separating walls	43	-
Separating floors and stairs	45	62
Rooms for residential purposes formed by material change of use		
Separating walls	43	-
Separating floors and stairs	43	64

Solutions for Separating Walls - New Dwellings

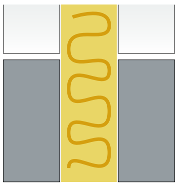
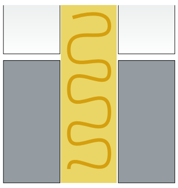
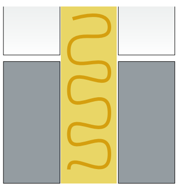
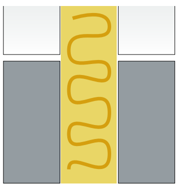
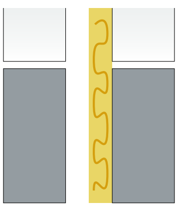
Compliance can be based on one of a growing number of Robust Detail specifications whose use will avoid the need for pre-completion testing provided each plot is registered with Robust Details Limited.

Alternatively, AD E provides a number of compliant specifications for separating walls and floors in dwellings. These include solid and cavity separating walls which can be constructed using various block types. Use of these specifications will be subject to pre-completion testing.

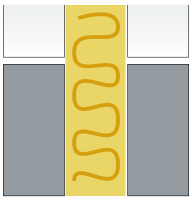
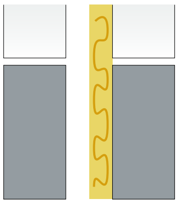
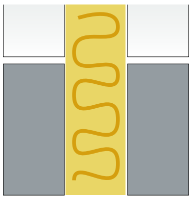
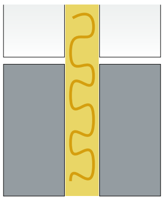
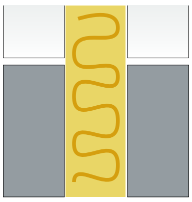
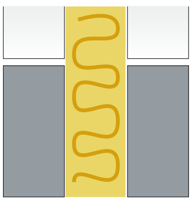
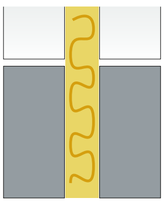
Whichever specification is selected, it is essential that the surrounding flanking elements are constructed in accordance with the guidance given in the relevant Robust Detail specification or guidance in accordance with AD E.

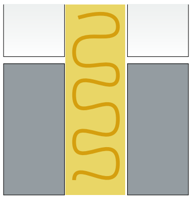
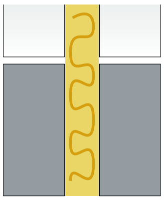
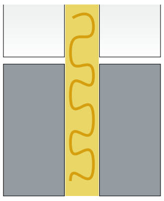
Robust Detail separating walls Pre-completion not required

Table 10.3 - Robust Detail separating walls (housing and flats)

Robust Detail ref.	Suitable products 100mm minimum width, solid units	Minimum cavity width	Internal Finish - to both sides
E-WM-1 	Lignacrete	75mm The cavity can be insulated using mineral wool with a maximum density of 40 kg/m^3	13mm lightweight or dense plaster (minimum mass 10kg/m^2).
E-WM-2 	Ashlite or Lignacite GP	75mm The cavity can be insulated using mineral wool with a maximum density of 40 kg/m^3	13mm lightweight or dense plaster (minimum mass 10kg/m^2).
E-WM-3 	Lignacrete	75mm The cavity can be insulated using mineral wool with a maximum density of 40 kg/m^3	Plasterboard (nominal 10kg/m^2), on dabs on cement:sand render coat (nominal 8mm) with scratched finish.
E-WM-4 	Ashlite or Lignacite GP	75mm The cavity can be insulated using mineral wool with a maximum density of 40 kg/m^3	Plasterboard (nominal 10kg/m^2), on dabs on cement:sand render coat (nominal 8mm) with scratched finish.
E-WM-8 	Ashlite or Lignacite GP	75mm cavity with Saint Gobain Isover RD35	Plasterboard (nominal 9.8kg/m^2)on dabs.

Sound Insulation

Robust Detail ref.	Suitable products 100mm minimum width, solid units	Minimum cavity width	Internal Finish
E-WM-11 	Ashlite or Lignacite GP	100mm The cavity can be insulated using mineral wool with a maximum density of 40 kg/m^3	Plasterboard (nominal 8kg/m^2), on dabs on cement:sand render coat (nominal 8mm) with scratched finish.
E-WM-14 	Ashlite or Lignacite GP	Minimum 75mm Saint Gobain Isover RD Party Wall Roll or Isover Round The House Roll	Plasterboard (nominal 9.8kg/m^2), on dabs.
E-WM-16 	Lignacrete	100mm The cavity can be insulated using mineral wool with a maximum density of 40 kg/m^3	Plasterboard (nominal 9.8kg/m^2), on dabs on cement:sand render coat (nominal 8mm) with scratched finish.
E-WM-17 	Ashlite or Lignacite GP	Minimum 75mm Saint Gobain Isover RD Party Wall Roll or Isover Round The House Roll	Plasterboard (nominal 9.8kg/m^2), on dabs.
E-WM-18 	Lignacrete	100mm The cavity can be insulated using mineral wool with a maximum density of 40 kg/m^3	13mm lightweight or dense plaster (minimum mass 10kg/m^2),both sides.
E-WM-19 	Ashlite or Lignacite GP or Lignacrete	100mm with Monarfloor® Bridgestop® system. The cavity can be insulated using mineral wool with a maximum density of 40 kg/m^3	Plasterboard (nominal 8kg/m^2), on dabs on cement:sand render coat (nominal 8mm) with scratched finish.
E-WM-20 	Ashlite or Lignacite GP	Minimum 75mm Saint Gobain Isover RD Party Wall Roll or Isover Round The House Roll	Plasterboard (nominal 9.8kg/m^2), on dabs.

Robust Detail ref.	Suitable products 100mm minimum width, solid units	Minimum cavity width	Internal Finish
E-WM-21 	Ashlite or Lignacite GP	100mm The cavity can be insu-lated using mineral wool with a maximum density of 40 kg/m^3	13mm lightweight or dense plaster (minimum mass 10kg/m^2), both sides
E-WM-22 	Ashlite or Lignacite GP	100mm with Knauf Insulation's Earthwool Masonry Party Wall Slab or 100mm Superglass Party Wall Roll	Plasterboard (nominal 10kg/m^2), on dabs.
E-WM-27 	Ashlite or Lignacite GP	75mm Superglass Party Wall Roll	Plasterboard (nominal 8kg/m^2), on dabs.

Notes

1. *Refer to the Robust Detail Handbook for details of suitable wall ties, flanking walls construction and suitable RD separating floors which can be used in conjunction with the wall specifications shown in the table.*
2. *As a guide, Ashlite, Lignacite GP and Lignacrete blocks of minimum 100mm width can be used to the inner leaf flanking any of Robust Detail concrete separating floors, as they all achieve the minimum specified density for aggregate blocks of 1350kg/m^3.*
3. *Full fill insulation can be used to aid compliance with Part L1A of the Building Regulations to certain RD specifications which are shown as clear cavity – refer to the Robust Detail Handbook.*

Approve Document E Guidance Constructions

Alternative compliance can be met by using suitable Lignacite constructions that satisfy the guidance specifications given in AD E to the Building Regulations. These constructions are shown in Tables 10.4 and 10.5 and performance will have to be confirmed by pre-completion testing.

*Table 10.4 - AD E **cavity** separating walls (housing and flats)*

AD ref.	Suitable products - 100mm minimum width, solid units	Minimum cavity width	Internal Finish
Wall type 2.1	Lignacrete	50mm	13mm lightweight or dense plaster
Wall type 2.2	Ashlite or Lignacite GP	75mm	13mm lightweight or dense plaster
Wall type 2.3*	Ashlite or Lignacite GP	75mm	Plasterboard (nominal 10kg/m^2
*For use with a step or stagger of at least 300mm.			

Notes

1. *Refer to the AD E for details of suitable wall ties, flanking walls construction and suitable separating floors which can be used in conjunction with the wall specifications shown in the table.*
2. *As a guide, Ashlite, Lignacite GP and Lignacrete blocks of minimum 100mm width can be used to the inner leaf flanking any of AD E compliant concrete separating floors, as they all achieve the minimum specified mass of 120kg/m^2.*

*Table 10.5 - AD E **solid** separating walls (housing and flats)*

AD ref.	Suitable products	Construction	Internal Finish
Wall type 1.1	100mm Lignacrete solid units	100mm Lignacrete blocks laid flat to form a 215mm wall	13mm lightweight or dense plaster
	190mm Lignacrete PW units	190mm Lignacrete PW blocks (440mm x 65mm face size)	13mm lightweight or dense plaster

Notes

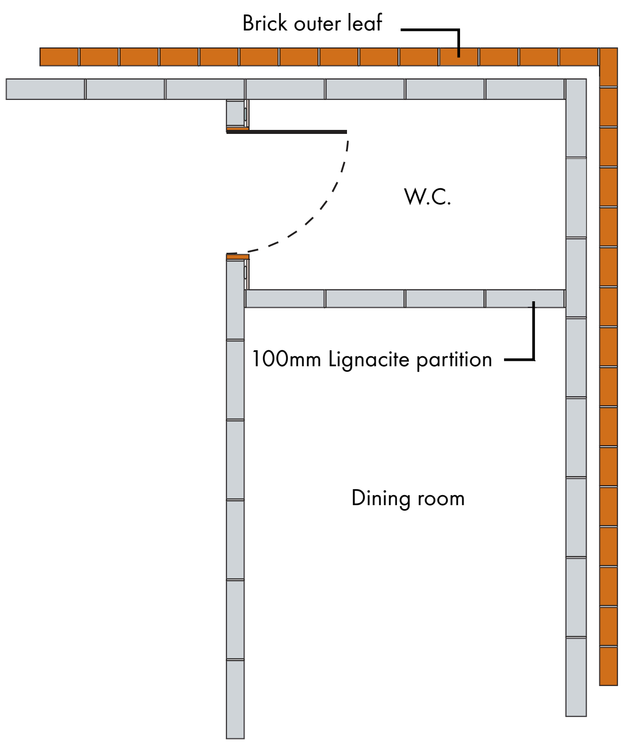
1. *Refer to the AD E for details of suitable flanking construction walls and suitable separating floors which can be used in conjunction with the wall specifications shown in the table.*
2. *As a guide, Ashlite, Lignacite GP and Lignacrete blocks of minimum 100mm width can be used to the inner leaf flanking any of AD E compliant concrete separating floors, as they all achieve the minimum specified mass of 120kg/m^2.*

Solutions for Separating Walls - Rooms for residential purposes and dwellings formed by material change of use

The performance standard for separating walls for rooms for residential purposes and dwellings formed by material change of use, is 2dB lower than the standard for new build dwellings. Therefore any of the constructions recommended for new build dwellings can be used with confidence. In addition, solid Lignacrete walls (Table 10.6) can also be used with a plaster-board (10kg/m^2) finish to both faces.

Protection against sound within a dwelling house, etc.

Regulation E2 requires dwelling-houses, flats and rooms for residential purposes to be designed and constructed in such a way that internal walls between a bedroom or a room containing a water closet and other rooms, and internal floors, provide reasonable resistance to sound.



Limits on application

Requirement E2 does not apply to:

a) An internal wall which contains a door.
b) An internal wall which separates an en suite toilet from the associated bedroom.
c) Existing walls and floors in a building which is subject to a material change of use.

Internal walls and floors are not subject to pre-completion testing but do have to meet the laboratory sound insulation values in Table xx.

Where Robust Details are not employed, the mass per unit area of any load-bearing internal wall or any internal wall rigidly connected to a separating floor should be at least 120kg/m^2 excluding finish. As a guide this can be achieved using medium or dense units e.g Ashlite, Lignacite GP or Lignacrete, of 100mm width.

Where Robust Details are employed, the internal wall should have a minimum mass per unit area of 120kg/m^2 including the finish OR at least that of the approved flanking wall inner leaf, if this is less. Again, this requirement can be met using medium or dense units e.g Ashlite, Lignacite GP or Lignacrete, of 100mm width.

Table 10.6 - Laboratory values for new internal walls and floors within dwelling-houses, flats and rooms for residential purposes, whether purpose built or formed by material change of use.

	Airborne sound insulation R_w dB (minimum values)
Interal walls	40
Internal floors	40

The 40R_w dB requirement for partition walls can be met using any of the of the constructions described above. Alternatively, the Product Data Sheets provide a comprehensive listing of the sound reduction values applicable to each block width. For many of our products the minimum thickness block to satisfy this requirement is 75mm.

Sound Insulation

Reverberation in the common internal parts of buildings containing flats or rooms for residential purposes

To satisfy requirement E3 the common internal parts of buildings which contain flats or rooms for residential purposes shall be designed and constructed in such a way as to prevent more reverberation around the common parts than is reasonable.

Limits on application

Requirement E3 only applies to corridors, stairwells, hallways and entrance halls which give access to the flat or room for residential purposes.

To satisfy requirement E3, sound absorption measures detailed in section 7 of AD E should be employed.

Acoustic conditions in schools

1. Each room or other space in a school shall be designed and constructed in such a way that it has the acoustic conditions and the insulation against disturbance by noise appropriate to its intended use.

2. For the purpose of this Part - 'school' has the same meaning as in section 4 of the Education Act 11996 and 'school building' means any building forming a school or part of a school.

To satisfy requirement E4, refer to Building Bulletin 93' Acoustic Design of Schools' produced by the DFES and published by the Stationery Office. Because of the complexity of the design process, BB93 states, 'In all but the simplest cases, it is advisable to appoint a suitably qualified acoustic consultant, who would normally be a corporate member of The Institute of Acoustics'.

BRE's Acoustics Centre has developed an Excel spreadsheet to help designers carry out calculations of façade insulation and reverberation times in rooms. This can be downloaded from: http://projects.bre.co.uk/envdiv/school_acoustics.

Sound Insulation of Partition Walls

For project specific sound insulation requirements, our Product Data sheets provide a comprehensive listing of Weighted Sound Reduction Index values, Rw, for all product sizes. Data sheets are available from www. lignacite.co.uk.

The Weighted Sound Reduction Index, Rw, is a single-number quantity which characterises the airborne sound insulation of a material or building element over a range of frequencies. This is a laboratory based measurement, so Rw may be used to compare building elements.

Structural Design - An introduction

Structural information is provided for the design of loadbearing and non-loadbearing walls in accordance with Eurocode 6, as well as information on the use of cellular and hollow blocks and the design of stack bonded masonry walls.

Loadbearings walls

The Lignacite range of masonry units will cater for low, medium and high capacity loadbearing walls. With compressive strengths up to 30N/mm^2, unit widths from 90mm to 215mm, and produced to Category 1 manufacturing control, our products will help you to achieve the most economic masonry design possible.

Designing to Eurocode 6

Normalised Strengths

When designing to Eurocode 6, normalised strengths are used, taking into account the shape factor and bringing the unit strength back to a100mm cube equivalent.
As the UK quote actual block strengths as opposed to a cube strength, the tables below show the shape factor conversion and the equivalent normalised strength, in accordance with BS EN 772-1, table A.1

Table 11.1 - (a)– Shape Factor correction factor (based on a 215mm height block)

Block width (mm)	75	90	100	140	190	215
215mm height blocks	1.43	1.40	1.38	1.30	1.20	1.16

Table 11.2 - (b) - Interpolated shape factors for other Lignacite masonry unit sizes.

	Unit widths					
Unit Height	75mm	90mm	100mm	140mm	190mm	215mm
65mm	0.90	0.87	0.85	0.77	0.71	0.69
100mm*(1)	-	-	-	-	0.82 (2)	0.79 (3)
140mm	1.22	1.18	1.16	1.08	0.98	0.94
190mm	1.37	1.34	1.32	1.24	1.14	1.10
215mm	1.43	1.40	1.38	1.30	1.20	1.16

Notes:

(1) 100mm high units are units laid flat. Unit strengths are usually given for units laid in their normal aspect and not laid flat. Laid flat strengths are usually several times greater than the normal aspect strength. The laid flat air dry strength should be multiplied by the appropriate shape factor from table 11.2.

(2) Shape factor for units 190mm high in normal aspect when laid flat.

(3) Shape factor for units 215mm high in normal aspect when laid flat.

Table 11.3 - (c) - Shape factors for Roman brick format unit sizes.

	Unit widths		
Unit height	75mm	100mm	140mm
50mm	0.80	0.75	0.71
65mm	0.90	0.85	0.77

Table 11.4 - Normalised strengths for 215mm high units.

Unit strength to BS EN 771-3	Normalised strengths for unit widths of					
	75mm	90mm	100mm	140mm	190mm	215mm
3.6	5.1	5.0	5.0	4.7	4.3	4.2
7.3	10.4	10.2	10.1	9.5	8.8	8.5
10.4	-	14.6	14.3	13.5	12.5	12.1
17.5	-	24.5	24.1	22.7	21.0	20.3
22.5	-	31.5	31.0	29.2	27.0	26.1
30.0	-	42.0	41.4	39.0	36.0	34.8

Table 11.5 - Normalised strengths for 190mm high units.

Unit strength to BS EN 771-3	Normalised strengths for unit widths of		
	90mm	140mm	190mm
3.6	4.8	4.5	4.1
7.3	9.8	9.0	8.3
10.4	13.9	12.9	11.9
17.5	23.4	21.7	19.9
22.5	30.1	27.9	25.7

Table 11.6 - Normalised strengths for 140mm high units.

Unit strength to BS EN 771-3	Normalised strengths for unit widths of
	140mm
7.3	7.9
10.4	11.2
17.5	18.9
22.5	24.3

Table 11.7 - Normalised strengths for 65mm high units, e.g., Roman brick.

Unit strength to BS EN 771-3	Normalised strengths for unit widths of		
	75mm	100mm	140mm
10.4	9.36	8.84	8.00
17.5	15.75	14.87	13.47
10.4	13.9	12.9	11.9

Vertical and Horizontal Chases

Without calculation

Chases and recesses can be made to masonry walls, providing that they do not impair the stability of the wall. The values for the maximum depth of vertical and horizontal chases allowed without calculation are shown in Tables 11.8 and 11.9.

Table 11.8 - sizes of vertical chases and recesses in masonry, allowed without calculation.

	Chases and recesses formed after construction of masonry		Chases and recesses formed after construction of masonry	
Thickness of wall t (mm)	Max depth $t_{ch,h}$ (mm)	Max width W_c (mm)	Minimum wall thickness remaining t_r (mm)	Max width W_c (mm)
75 - 89	30	75	60	300
90 - 115	30	100	70	300
116 - 175	30	125	90	300
176 - 225	30	150	140	300
226 - 300	30	175	175	300
> 300	30	200	215	300

Notes:

(1) The maximum depth of the chase should include the depth of any hole reached when forming the chase.

(2) Vertical chases which do not extend more than one third of the storey height above floor level may have a depth of up to 80mm and a width of up to 120mm, if the thickness of the wall is 225mm or more.

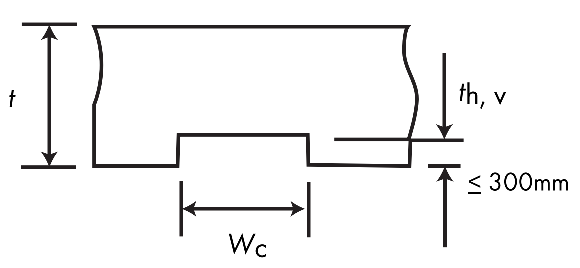
(3) The horizontal distance between adjacent chases or between a chase and recess or an opening should not be less than 225mm.

(4) The horizontal distance between any 2 adjacent recesses, whether they occur on the same side or on opposite sides of the wall, or between a recess and an opening, should not be less than twice the width of the wider of the two recesses.

(5) The cumulative width of vertical chases and recesses should not exceed 0.13 times the length of the wall.

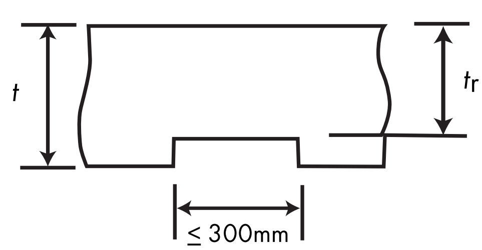
(6) This table is based on the National Annexe to EC6 Part 1-1.

Formed after construction



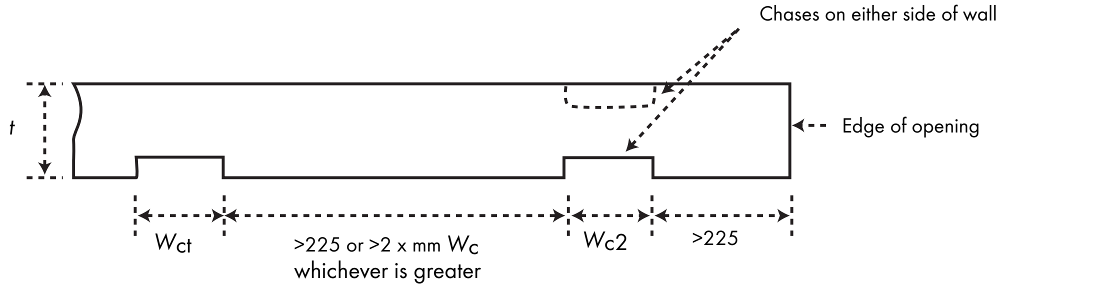
Plan

Formed during construction



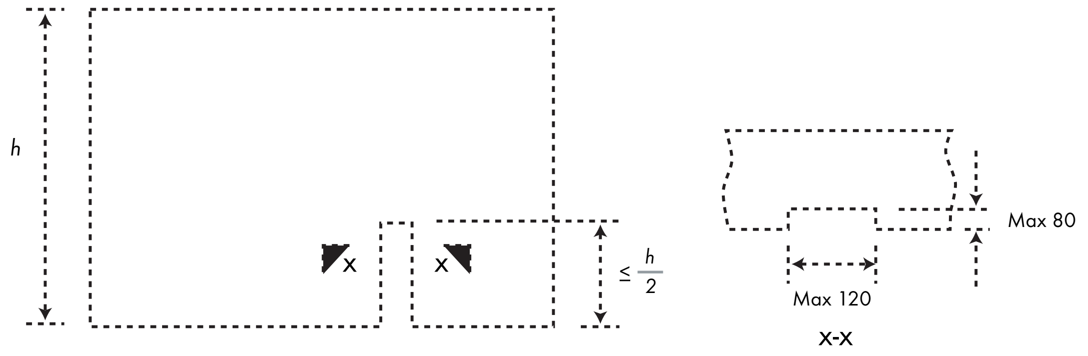
Plan

Spacing of chases



Plan

Chases in bottom section of wall, in walls ≥ 225mm thick



Wall elevation

Note: The cumulative width of vertical chases ≤ 0.13 times length of wall.

Table 11.9 - Sizes of horizontal and inclined chases in masonry, allowed without calculation.

Thickness of wall t (mm)	Max depth $t_{ch,h}$ (mm)	
	Unlimited length l_{ch}	length $l_{ch} \leq$ 1250mm
75 - 84	0	0
85 - 115	0	0
116 - 175	0	15
176 - 225	10	20
226 - 300	15	25
over 300	20	30

Notes:

(1) The maximum depth of the chase should include the depth of any hole reached when forming the chase.

(2) The horizontal distance between the end of a chase and an opening should not be less than 500mm.

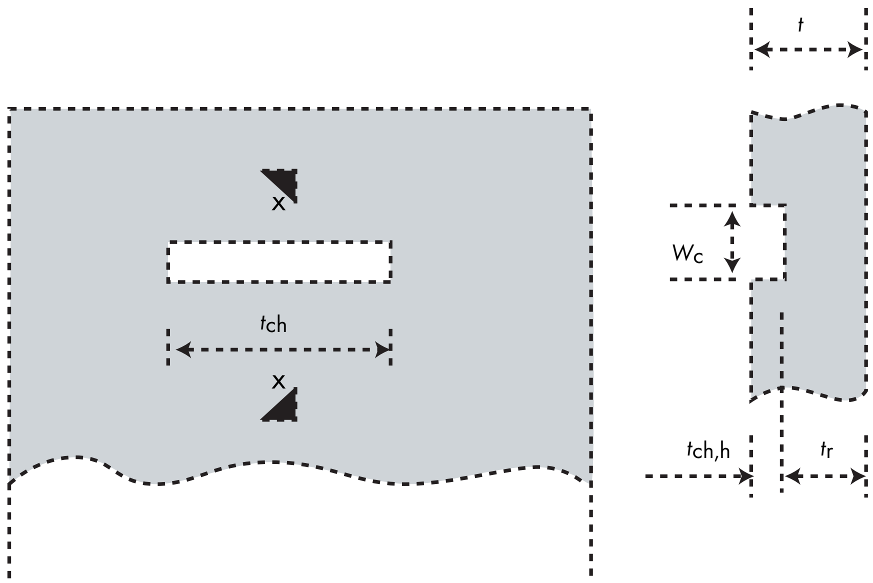
(3) The horizontal distance between adjacent chases of limited length, whether they occur o the same side or on opposite sides of the wall, should be not less than twice the length of the longest chase.

(4) In walls of thicknesses greater than115mm, the permitted depth of the chase may be increased by 10mm if the chase is machine cut accurately to the required depth. If machine cuts are used, chases up to 10mm deep may be cut in both sides of walls of thickness not less than 225mm.

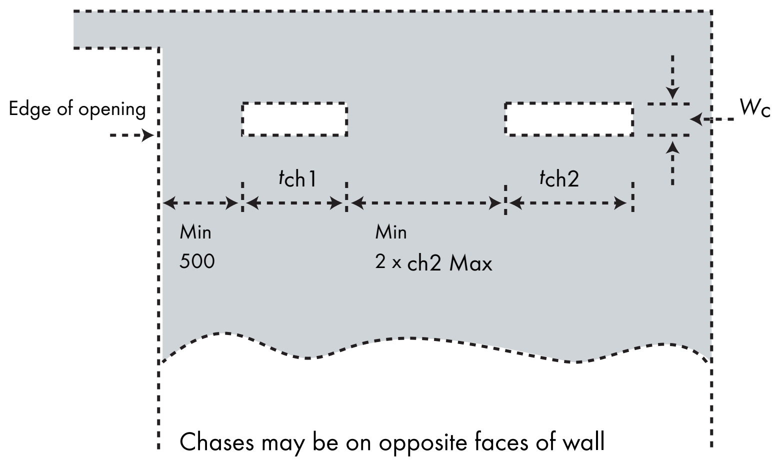
(5) The width of chase should not exceed the residual thickness of the wall.

(6) This table is based on the National Annexe to EC6 Part 1-1.

Wall elevation



Wall elevation



$W_c \leq \frac{t_r}{2}$ (see above)

Notes:

(1) For walls thicker than 175mm, $t_{ch,h}$ may be increased by10mm if accurate machine cutting is used.

(2) Horizontal chases should be positioned within one eight of the clear height of the wall (above or below a floor).

(3) The rules for horizontal chases also apply to inclined chases.

Structural Design

Use of Cellular and Hollow units

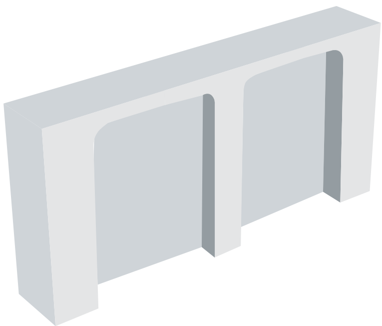
Cellular and hollow units can be used in loadbearing walls. For designs to Eurocode 6, the designer will need to know what configuration the units conform to, i.e. Group 1 or 2. The following diagrams provide this data, together with the dimensions of the wall thicknesses for each size of unit.

Hollow units are particularly suitable where walls require strengthening to withstand high lateral forces, such as basement and freestanding retaining walls. The vertical cores can be reinforced with steel bar and infill concrete.

If used on the external leaf of a cavity wall, cellular and hollow units should be protected by a suitable cladding or rendering.

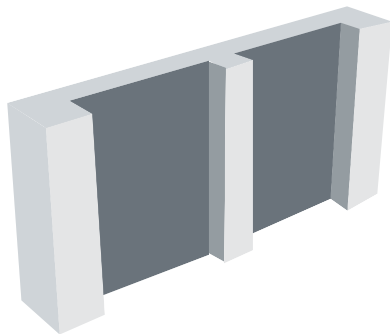
The maximum depth of chases/recesses in hollow and cellular blocks, should not exceed half the shell thickness of the unit unless verified by calculation.

Cellular



A sectional perspective

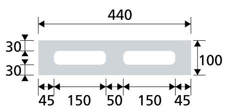
Hollow



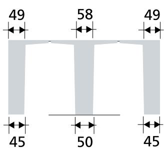
A sectional perspective

100mm width Group 1 unit, to BS EN 1996-1-1

Horizontal section

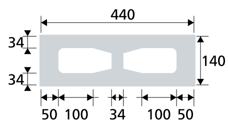


Vertical section

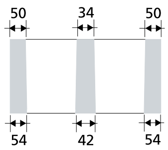


140mm width Group 2 unit, to BS EN 1996-1-1

Horizontal section



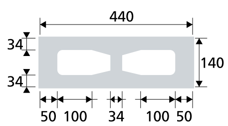
Vertical section



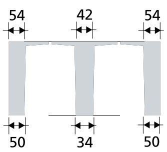
Note: 10mm mean base thickness
Core taper of 4mm from top to bottom

140mm Group 2 unit, to BS EN 1996-1-1

Horizontal section

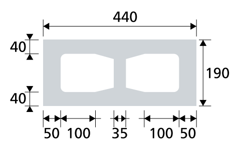


Vertical section

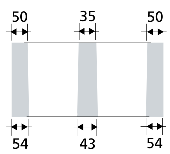


190mm width Group 2 unit, to BS EN 1996-1-1

Horizontal section

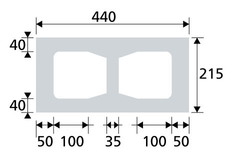


Vertical section

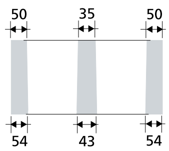


215mm width Group 2 unit, to BS EN 1996-1-1

Horizontal section



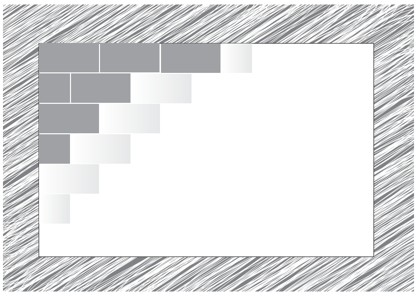
Vertical section



Design of Non-loadbearing Walls

The following tables provide limiting dimensions for internal non loadbearing walls and have been developed in accordance with EN 1996- 1-1(Annex F). These provide limiting height and length to block width ratios. They are applicable to all Lignacite block types and are based on walls that are unplastered. For practical considerations e.g. the provision of movement joints, the maximum wall length has been limited to 9.0m. Wall lengths above 9.0m are permissible under EN 1996- 1-1, but designers will need to ensure that adequate precautions are taken to limit the adverse effects of movement.

Limiting sizes of internal non-loadbearing walls



Walls strained at both ends and top

Minimum block thickness (mm)				
Length (m)				
Height (m)	100	140	190	215
2.4	9.0	9.0	9.0	9.0
2.7	9.0	9.0	9.0	9.0
3.0	9.0	9.0	9.0	9.0
3.3	9.0	9.0	9.0	9.0
4.0	8.0	9.0	9.0	9.0
5.0	4.0	9.0	9.0	9.0
6.0	3.5	9.0	9.0	9.0

Walls restrained at both ends

Minimum block thickness (mm)				
Length (m)				
Height (m)	100	140	190	215
2.4	5.4	9.0	9.0	9.0
2.7	5.2	7.7	9.0	9.0
3.0	5.2	7.6	9.0	9.0
3.3	5.0	7.5	9.0	9.0
4.0	4.7	7.2	9.0	9.0
5.0	4.3	6.7	9.0	9.0
6.0	4.0	6.3	9.0	9.0

Walls with lateral support top and bottom

	Minimum block thickness (mm)			
	100	140	190	215
Maximum wall height (m)	3.0	4.2	5.7	6.4

Notes:

(1) For details of suitable lateral restraints, see EN 1996-1-1.

(2) In determining the appropriate thickness of blockwork walls, consideration should also be given to the accommodation of movement and the effect on stability of openings, chases, etc.

(3) Where upper floors are subject to deflection or thermal movement, suitable precautions should be taken to avoid accidental load transfer or excessive differential movement from taking place.

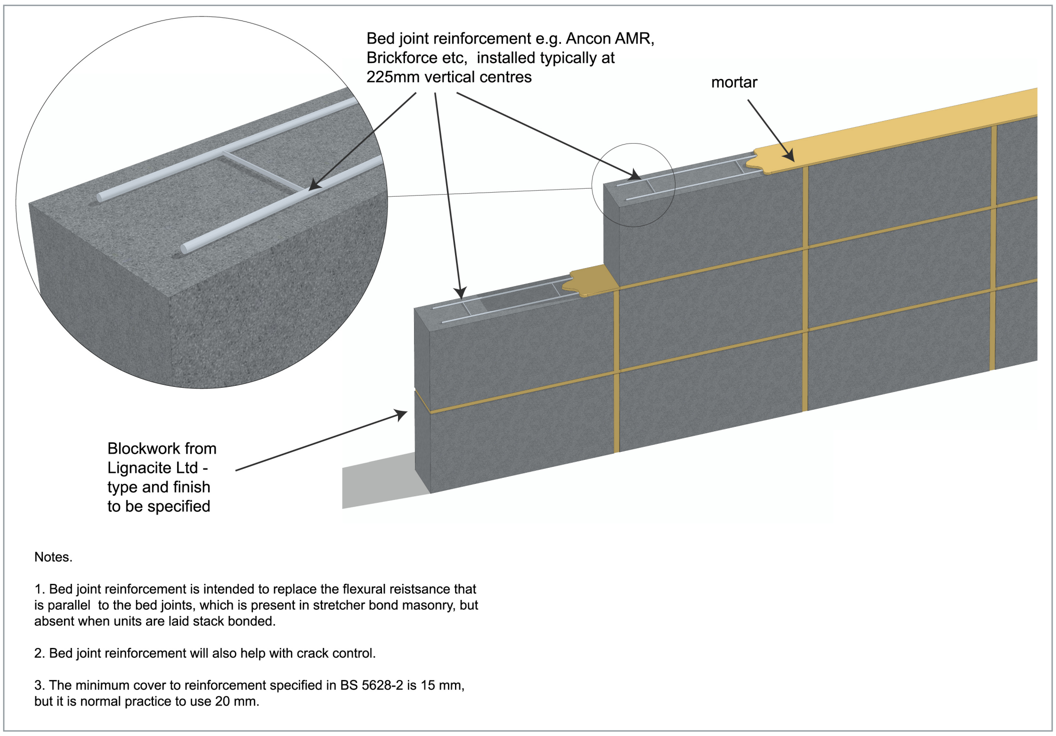
Stack bonded masonry

Stack bonding has a strong clean appearance as a result of a uniform bond pattern. This is particularly suitable for panels in framed structures as well as for internal walls. Stack bonding is also economical to lay as it eliminates the need for cutting blocks.

However, the lack of bonding between blocks will greatly reduce the overall flexural strength of the panel and the ability of the wall to spread vertical loads. It is for this reason that masonry codes do not recognise stack bonding as a "normal masonry bond pattern" when indicating calculation values for use by the designer or engineer. Introducing masonry reinforcement in the bed joints will increase the panel's flexural strength and improve the capacity to resist lateral loads and spread vertical loads. Several manufactures of reinforcement have developed products for this application e.g Ancon AMR Masonry Reinforcement. As a guide, reinforcement should be installed at maximum 450mm centres (every second course using conventional height blocks) for the full height of the stack bonded panel, and also for the width of the panel between columns or movement joints.

Care should be taken to ensure the reinforcement does not bridge the movement joints.

It is important that when using this form of construction technique, a structural engineer is consulted.



Reinforced Stack Bonded Masonry

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