AGGREGATE
INDUSTRIES

Bradstone walling

Technical manual

Contents

Technical manual for Bradstone walling range

Performance

Authority

Except for size tolerances, the Bradstone range of reconstructed stone walling complies with the general manufacturing requirements of BS EN 771-5 (specification for reconstructed stone masonry units).

Aggregate Industries is a member of the British Precast Concrete Federation. Bradstone walling range is manufactured under the quality procedures of BS EN ISO 9001:2000.

Mechanical strength

The compressive strength of the Bradstone walling range:

Bradstone range of reconstructed stone walling

40.0 N/mm^2 at 28 days

Fire protection

All Aggregate Industries walling and facing blocks, which normally form the external leaf of a cavity wall, will contribute to the required fire resistance for the external wall construction as an element.

Drying shrinkage

The moisture movement of Aggregate Industries reconstructed stone walling is in accordance with BS EN 771-5.

Bradstone range of reconstructed stone walling

< 0.8mm/m

Water absorption by capillarity

Bradstone range of reconstructed stone walling

< 9.0g/m^2.s$^{0.5}$

Dry density

Bradstone range of reconstructed stone walling

2125kg/m^3

Sound control

As a high-density material, Bradstone walling range provides effective acoustic insulation. Calculations below are based on the mass law curve:

Bradstone range of reconstructed stone walling

44 Rw dB in single skin construction.

Durability

Provided that Aggregate Industries walling products are installed correctly, they will provide a long, low-maintenance service life under normal conditions of use.

During winter months, there may be a risk to concrete masonry from the increasing use of de-icing salts from roads and pavements in close proximity. Moisture movement and the migration of soluble salts makes frost action more aggressive to concrete and may result in degradation.

Weathering

The nature, extent and visible effects of weathering will depend upon the location, degree of exposure and prevailing weather conditions and the effectiveness of the architectural detailing. Bradstone walling range will weather much the same as indigenous natural stone exposed to the same conditions.

Block co-ordination and setting out

Ideally, buildings should be set out in block co-ordination (unit size + mortar joint) to provide the best aesthetics and reduced costs due to minimising the amount of cut units onsite. Setting out the building will include the position and size of the openings within the length and height of the wall. The following diagrams and tables gives advice regarding the setting out and use of masonry units.

Block module tolerances

Aggregate Industries facing masonry range is manufactured to BS EN 771-3, tolerance category D1

Length +3mm, - 5mm

Width +3mm, - 5mm

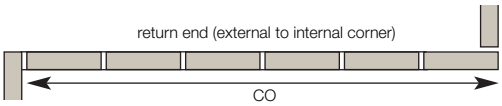
Height +3mm, -5mm

Bradstone walling range of products is manufactured to BS EN 771-5 tolerance category D1

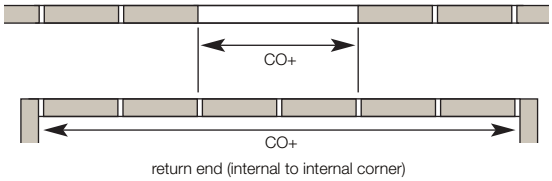
Co-ordinated dimensions.

The co-ordinated dimension (CO) is the nominal block size + the mortar joint, typically 10mm.

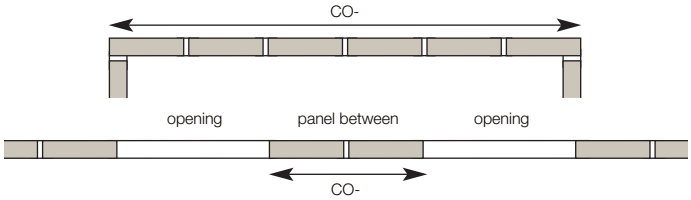
Co-ordinated size (CO)
i.e. block panels with opposite return ends or quoin



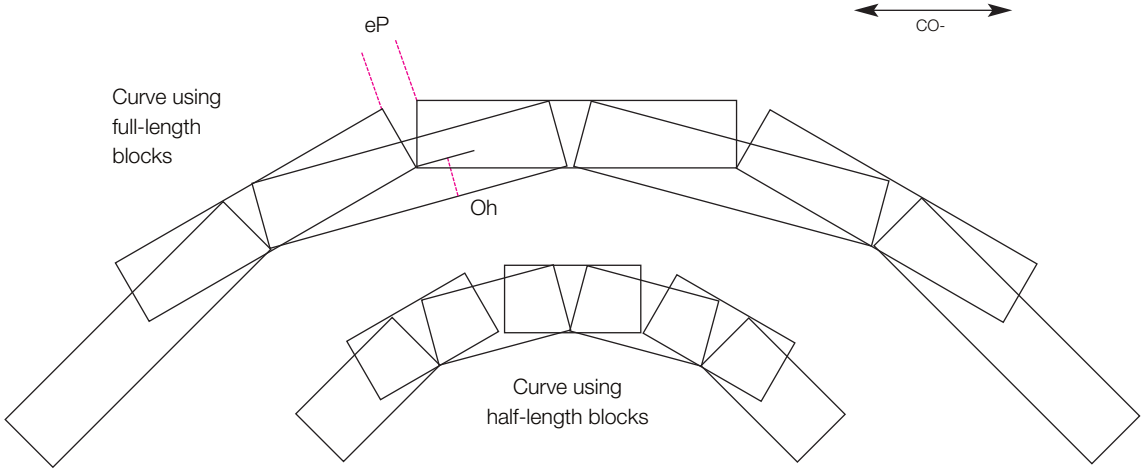
Co-ordinated size plus a joint (CO+)
i.e. door an window openings



Co-ordinated size minus a joint (CO-)
i.e. block piers or panels between openings



Radial walls



Block co-ordination and setting out

Overhang and perpend joint width for radius walls

The table (below) gives the relevant overhang and increased perpend joint size, dependent upon wall radius and block thickness. For Fairfaced work overhangs of 2mm and below are acceptable.

Where the blockwork is being plastered/rendered or plasterboard on dabs is being used, a maximum of 6mm overhang is recommended.

	Face size 440 x 215mm				Face size 215 x 215mm			
Block thickness (mm)	**100**		**140**		**100**		**140**	
Wall radius (mm)	**Oh**	**eP**	**Oh**	**eP**	**Oh**	**eP**	**Oh**	**eP**
600	44	86	44	120	10	50	10	68
800	32	68	32	93	8	40	8	53
1000	25	56	25	76	6	34	6	44
1200	21	48	21	65	5	29	5	29
1400	18	43	18	57	4	27	4	34
1600	16	39	16	51	4	24	4	31
1800	14	36	14	46	3	23	3	28
2000	12	33	12	42	3	22	3	26
2500	10	28	10	36	2	19	2	23
3000	8	25	8	31	2	18	2	21
3500	7	23	7	28	2	17	2	19
4000	6	21	6	26	1	16	1	18
4500	5	20	5	24	1	15	1	17
5000	5	19	5	23	1	15	1	16
6000	4	18	4	21	1	14	1	15
7000	4	17	4	19	0.8	13	0.8	15
8000	3	15	3	18	0.7	13	0.7	14
9000	3	15	3	17	0.6	12	0.6	14
10000	2	15	2	16	0.6	12	0.6	13

Masonry bonds

The horizontal distance between cross joints/perpends in successive masonry courses should normally be not less than one-quarter of the length of the masonry unit, but in no case less than 50mm for brick size units or 75mm for block size units.Unless specified to the contrary, units should be laid half lap stretcher bond with a nominal 10mm joint.

Height of lifts

No leaf or raked back corner should be higher than 1.2m above the general blockwork level. Except where permitted by a proprietary system, do not carry up any leaf higher than 1.5m in any day. Where dense low absorption units are concerned, this lift height per day may have to be reduced to less than 1.2m.

Permissible deviations in built blockwork

The table (right) is based upon guidance given in BS 8000 pt 3, Code of practice for masonry.

NOTE 1: These deviations are generally derived from BS 5606:1990 and represent the level which can be reasonably expected for general brick and block masonry.

NOTE 2: These deviations should be measured in accordance with the methods described in BS 5606:1990. Annex D.

Table: Permissible deviations in masonry (other than stone masonry)

Dimensions	Permissible deviation (mm)
Position in plan of any point or face in relation to the specified building reference line and/or point at the small level	±10
Straightness in any 5mm length	±5
Verticality up to 3m height	±10
Verticality up to 7m height	±14
Overall thickness of walls	±10
Level of bed joints up to 5m for brick masonry	±11
Level of bed joints up to 5m for block masonry	±13

Mortars
bonding and coursing

Masonry mortars may be specified as designed mixes (Strength Performance) or prescribed mixes (Recipe), both types of mortar can be either factory made or site made. Traditionally, prescribed mixes have been used in the UK and have a proven durability.

PD 6678 : 2005 (Guide to the specification of masonry mortar), gives guidance on the specification of mortar and although BS EN 998-2 applies to factory made mortars,it can be referred to for site made mortars.

Where coloured mortars are used, to avoid inconsistencies it is now common practice to use dry silo mortar or alternatively retarded ready to use mortars. When specifying mortars, consideration should be given to minimising the number of different mortar mixes to be used on a single project to reduce the risk of confusion arising onsite.

Euro-code 6 categorises the exposure levels by MX numbers and in most cases in the UK, the most severe exposure S, relates to exposure category level MX 3.2 'exposed to severe wetting and freeze thaw cycles, but not exposed to external sources of significant levels of sulfates or aggressive chemicals', in this instance mortar designation II is required.

In most locations in the UK, masonry above dpc (excluding parapets walls and copings), a designation III mortar is suitable for most masonry unit types.

In general, the stronger the mix designation (ie i) the greater the strength and durability, however the weaker the mix designation (ie IV) the least strong it is however it has the greatest ability to accommodate thermal and moisture movement. The use of mortar mixes stronger than the masonry unit strength can result in cracking in the built wall, causing the actual masonry unit to crack.

Typically in the UK a designation III mortar is suitable for most locations and masonry units, however a degree of caution has to be taken when specifying a designed mortar, as a M4 mortar may well have a strength well in-excess of 4.0N/mm^2 and as such is not suitable for masonry units of a 3.6 N/mm^2 strength and may not be suitable even for a 7.3N/mm^2 masonry unit.

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

Table: Masonry mortars

	Mortar designation	Compressive strength class	Prescribed mortars (proportion of 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 1/4:3	1:3	Not suitable	Not suitable	12
	(ii)	M6	1:1/2:4 to 4 1/2	1:3 to 4	1:2 1/2 to 3 1/2	1:3	6
	(iii)	M4	1:1:5 to 6	1:5 to 6	1:4 to 5	1:3 1/2 to 4	4
	(iv)	M2	1:2:8 to 9	1:7 to 8	1:5 1/2 to 6 1/2	1:4 1/2	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 proportion 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 I (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/A-V or CEM II/B-V (portland fly ash cement); or a combination, with equivalent proportions and properties to one of these cements:

- Combinations produced in the mortar mixer from Portland cement CEM I conforming to BS EN 197-1 and ground granulated blast furnace slag conforming to BS 6699 where the proportions and properties conform 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 I 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 produced in the mortar mixer from Portland cement CEM I conforming 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 confirm to CEM II/A-V or CEM II/B-V or BS EN 197-1:2000, 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 conforming 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 3.3 is based on data from EC6 and the National Annex.

Mortars

Bedding and jointing

Where solid or cellular units are being used, these should be laid on a full bed of mortar and in the case of cellular units, the solid end should be laid upwards to allow for a full bed of mortar to be applied. Perpend joints should be fully filled as failure to do so will effect the built strength, weather and air tightness of the structure.

The choice of joint profile will depend upon the appearance required and the degree of exposure. Tooled and non recessed joints provide the best resistance to rain penetration in comparison with non tooled joints.

Recessed joints increase the risk of water penetration and as such, when used external facades, they should have a minimal recess (typically 5mm) and wherever possible this should be tooled.

Flush jointing can be difficult to achieve, especially with textured blocks and can result in mortar smears on the face and as such is not recommended for blockwork to be built fair.

Flush or bag rubbed joint

This finish gives maximum bearing area and is often favoured when coarse textured units are used. With some masonry unit types the finish may appear a little irregular.

Curved recessed (bucket handle)

This joint can give an improved appearance over a flush joint with negligible reduction in strength. It is generally considered that this joint gives the best weather resistance due to the smoothing of the joint and the superior bond this achieves. It is perhaps the most commonly used joint.

Struck or weathered

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

Overhung struck

This finish gives a slightly different appearance of light and shade to struck weathered jointing. Unfortunately it allows rain to lodge on the horizontal faces of the masonry units and thus to penetrate the units and joints causing discolouration and possible front damage. For these reasons it should be confined to lightly stressed interior walls and external walls using appropriate quality units.

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. With heavily perforated units where the perforations occur near to the face, a recessed joint may be inadvisable because resistance to water penetration may be impaired.

Co-ordinating mortars

Product range	Colour	CPI Mortar Ref	Tarmac
Facing masonry	Grey	M3ANHLE021	
Facing masonry	Buff	M3ANHLE180	

Product range	Colour	CPI Mortar Ref	Tarmac
Bradstone walling	Southwold	E090	Y87
Bradstone walling	Weathered Cotswold	E090	Y87
Bradstone walling	Buff	E180	Y111
Bradstone walling	Pennine	E090	Y87
Bradstone walling	North Cerney	E090	Y146
Bradstone walling	Keinton	E020	Y4
Bradstone walling	Iron Ham	E071	Y12
Bradstone walling	Brecon	E121	N/A
Bradstone walling	Limestone Buff	E070	Y35
Bradstone walling	Silver Grey	E020	Y4

Product range	Colour	CPI Mortar Ref	Tarmac
StoneMaster walling	Ebony	M3ANHLE999	
StoneMaster walling	Portland	M3WLK06	
StoneMaster walling	Bathstone	M3ANHLE180	
StoneMaster walling	St Bees Red	M3ANHLE042	

Complementary products

Product range	Colour	CPI Mortar Ref	Tarmac
Cast stone	Bathstone	E182	Y115
Cast stone	Portland	E000 (white)	Y101*
Cast stone	Slate Grey	E091	Y88
Cast stone	Yorkstone	E090	Y87
Cast stone	Limestone	E180	Y111
Cast stone	Brecon	E112	Y183

Bonding/coursing patterns

Bradstone walling range

Coursed

The simplest design option. Some finishes allow for using either the same course height throughout, or exploiting the range of block course heights within the bradstone ranges - others have a coursing detail recommendation.

Suitable for Traditional, Rough Dressed, Squared Coursed Rubble (small or large module), and Square Dressed. Uses a combination of 75, 100, 125 and 150mm course heights.

Random brought to course

The simplest method for creating a random appearance, using 225mm nominal course height jumper blocks. The higher the percentage of jumper blocks within the total wall area, the more random the appearance, between 10-15% is recommended.

Suitable for Traditional, Rough Dressed, Squared Coursed Rubble, (small module) and Square dressed. Uses a combination of 75, 100, 125, 150 and 225mm course heights.

Coursed Work

Below dpc on a level site, the use of two courses at 75mm and 150mm nominal height is suggested. On stoping sites or any building where the dpc is stepped, it is suggested that the course heights below dpc should mirror those above.

Fully random pattern

Using 225mm nominal course height jumper blocks. the higher the percentage of jumper blocks within the total wall area, the more random the appearance, between 15-20% is recommended.

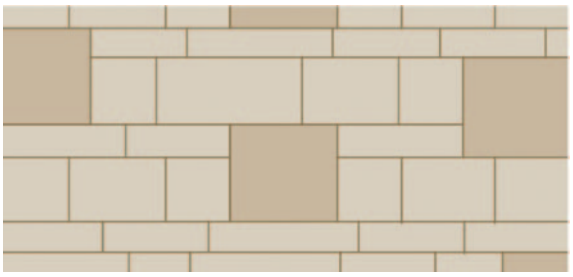
Suitable for Traditional, Rough Dressed, Squared Coursed Rubble, (small module) and Square dressed. Uses a combination of 75, 100, 125, 150 and 225mm course heights.

Masonry block walling

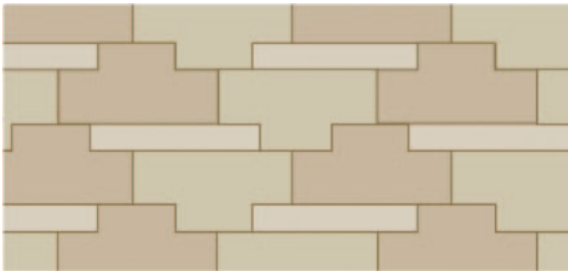
This reproduces the appearance of random rubble walling using just two block components - the 'T'-shaped multi-stone walling black and an infill block.

Coursed

Random brought to course

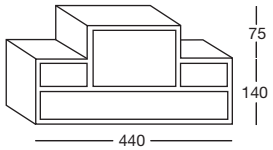


Fully random course

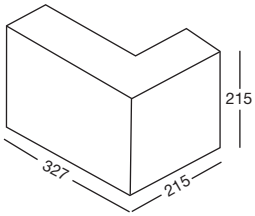


Masonry block walling

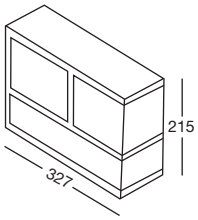
Masonry block construction



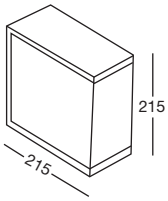
215 x 440 Masonry ‘T’ block



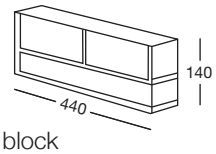
Plain cast stone ‘L’ quoin



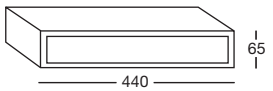
Dressed end
or masonry end



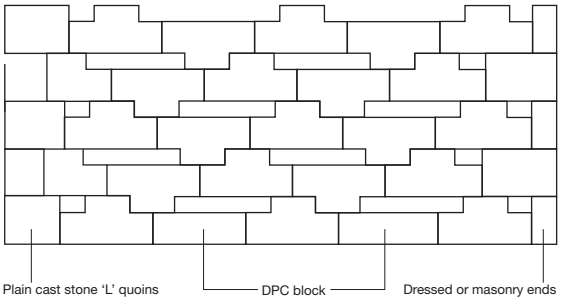
Dressed end
or masonry end



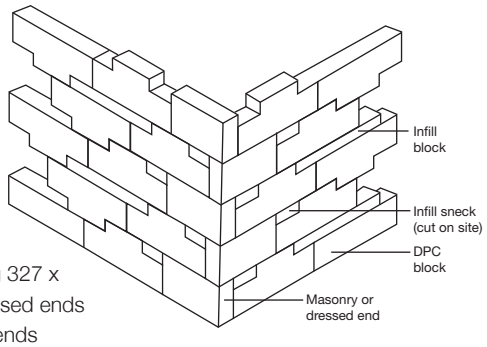
DPC block



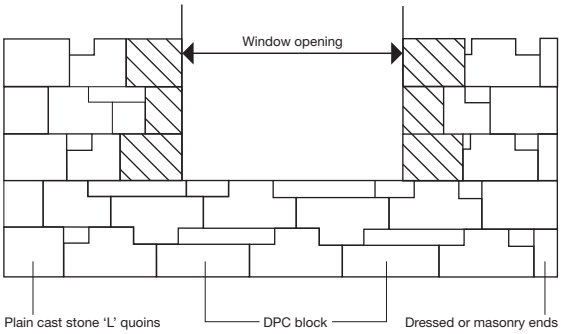
215 x 440 Masonry infill block



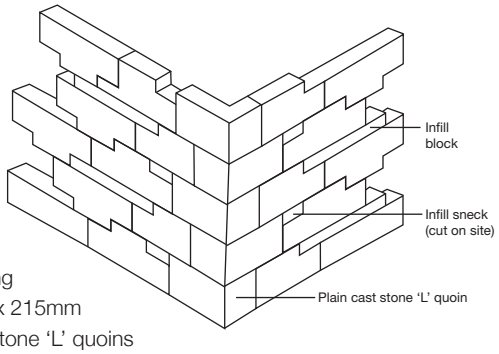
Recommended masonry block walling construction -
1 up, 1 down principle



Corner using 327 x
215mm dressed ends
or masonry ends



Typical window/door openings using masonry ends 215 x 215 and
215 x 327mm. Masonry blocks will need to be cut to suit opening



Corner using
327 x 215 x 215mm
plain cast stone ‘L’ quoins

Structural stability of non load-bearing panels

The following tables are based upon BS EN 1996 :1:1, walls subject to lateral loads only.

All walls are assumed to be a minimum 100mm thick and in the case of cavity walls, one leaf of the cavity wall has to be at least 100mm thick.

The wall thickness t, in the case of a single leaf wall should be taken as the block thickness, in the case of a cavity wall, this should be taken as the effective thickness **tef** which should be calculated as below.

***t*ef = $\sqrt[3]{t_1^3 + t_2^3}$ using the UK National Annex**

Panels with lateral restraint top and bottom only

	Block thickness (mm)			
	100	**140**	**190**	**219**
Maximum wall height (metres)	3.0	4.2	5.7	6.45

Panels with lateral restraint on all four ages

	Block thickness (mm)			
Wall length (metres)	**100**	**140**	**190**	**215**
2.8	8.0	11.2	15.2	17.2
3.0	8.0	11.2	15.2	17.2
4.2	4.9	11.2	15.2	17.2
5.7	4.6	6.86	15.2	17.2
6.4	4.3	6.73	11.4	17.2
7.0	4.2	6.58	10.83	13.76
8.0	4.0	6.44	9.12	11.18
9.0	3.7	6.0	9.0	10.5
10.0	3.5	5.7	8.9	10.3
11.0	3.2	5.5	8.6	10.0
12.0	3.0	5.3	8.2	9.7
13.0		5.0	8.0	9.4
14.0		4.8	7.8	9.0
15.0		4.5	7.6	8.8
16.0		4.3	7.3	8.6
17.0		4.2	7.0	8.4
18.0			6.7	8.3
19.0			6.5	8.1
20.0			6.2	7.8
21.0			5.9	7.5
22.0			5.7	7.3
23.0				7.0
24.0				6.8
25.0				6.6
26.0				6.4

Structural stability of non load-bearing panels

Panels with lateral restraint, top, bottom and one vertical edge

	Block thickness (mm)			
Wall length (metres)	100	140	190	215
1.0	7.0	9.8	13.3	15.0
2.0	7.0	9.8	13.3	15.0
3.0	6.0	9.5	13.3	15.0
4.0	5.0	8.5	13.0	15.0
5.0	4.0	7.5	11.9	14.2
6.0	3.0	6.5	11.0	13.3
7.0	3.0	5.5	10.0	12.3
8.0	3.0	4.5	9.0	11.5
9.0	3.0	4.2	8.0	10.3
10.0	3.0	4.2	7.0	9.3
11.0	3.0	4.2	6.0	8.3
12.0		4.2	5.7	7.3
13.0		4.2	5.7	6.4
		4.2	5.7	6.4

Panels with lateral restraint bottom and two sides

	Block thickness (mm)			
Wall length (metres)	100	140	190	215
3.0	8.0	11.2	15.2	17.2
4.0	8.0	11.2	15.2	17.2
5.0	3.3	11.2	15.2	17.2
6.0	1.9	7.3	15.2	17.2
7.0	1.8	4.6	15.2	17.2
8.0	1.8	2.7	10.3	17.2
9.0	1.7	2.6	7.6	11.8
10.0	1.6	2.5	5.0	9.1
11.0	1.5	2.5	3.7	6.4
12.0	1.5	2.4	3.7	4.3
13.0	N/A	2.3	3.5	4.1
14.0		2.3	3.5	4.0
15.0		2.2	3.4	3.9
16.0		2.1	3.3	3.9
17.0		N/A	3.2	3.8
18.0			3.1	3.7
19.0			3.1	3.6
20.0			3.0	3.6
21.0			2.9	3.5
22.0			2.8	3.5
23.0			N/A	3.4
24.0				3.3
25.0				3.2
26.0				N/A

Structural stability of non load-bearing panels

The tables below, give the maximum sizes of chases and recesses which are permitted in masonry, without further calculation, as permitted in the UK national Annex to BS EN 1996-1-1.

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

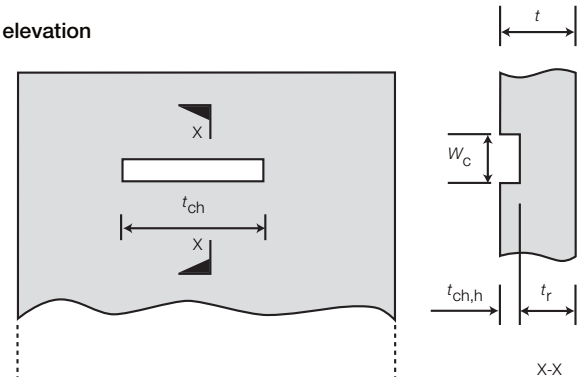
Sizes of horizontal and inclined chases in masonry, allowed without calculation

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

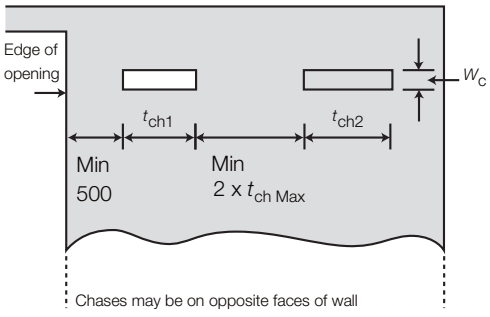
NOTES:

a) The maximum depth of the chase should include the depth of any hole reached when forming the chase.
b) The horizontal distance between the end of a chase and an opening should not be less than 500mm.
c) The horizontal distance between adjacent chases of limited length, whether they occur on the same side or on opposite sides of the wall, should be not less than twice the length of the longest chase.
d) In walls of thickness greater than 115mm, 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.
e) The width of chase should not exceed the residual thickness of the wall.
f) This table is based on data from NA to EC6 Part 1-1.

Wall elevation



Wall elevation



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

NOTES:

a For walls thicker than 175mm, $t_{ch,h}$ may be increased by 10mm if accurate machine cutting is used.
b Horizontal chases should be positioned within one eighth of the clear height of the wall (above or below a floor).
c The rules for horizontal chases also apply to inclined chases.

Fig 6.3 Horizontal and inclined chases in loading masonry walls - limitations (read with table 6.2)

Structural stability of non load-bearing panels

Sizes of vertical chases and recesses in masonry, allowed without calculation

	Chases and recesses formed after construction of masonry		Chases and recesses formed during 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:

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

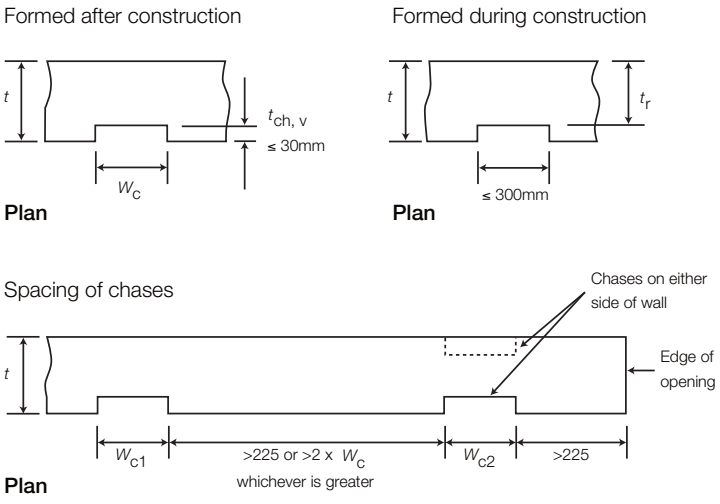
b) Vertical chases that do not extend more than one third of the storey height above floor level may have a depth of up to 80mm and a width of up to 120mm, if the thickness of the wall is 225mm or more.

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

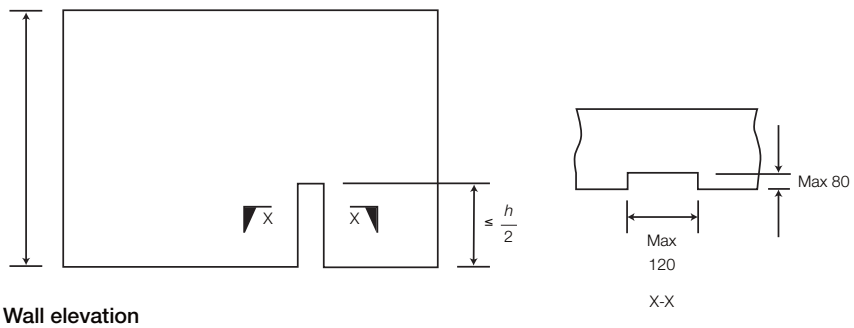
d) The horizontal distance between any two adjacent recesses, whether they occur on the same side or on opposite sides of the wall, or between a recess and an opening, should not be less than twice the width of the wider of the two recesses.

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

f) This table is based on data from NA to EC6 Part 1-1.



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.

Fig 6.2 Vertical chases in load-bearing masonry

Movement control

All structures move during their lifetime, either due to settlement, loading, thermal movement, changes in moisture movement and even chemical changes. Irrespective of the cause, this can lead to cracking, which can effect the structural integrity, weather-tightness or purely aesthetics of the structure. With structures designed in accordance with BS 5628 or Eurocode 6 moisture movement of concrete blocks typically has the greatest movement characteristics. Here we are considering how to control this movement and to minimise its impact.

Materials react in different ways to changes in temperature and moisture, clay bricks tend to expand, due to moisture take up and thermal expansion, whilst concrete blocks tend to shrink, due to drying shrinkage.

As blocks shrink, this puts the structure/product into tension, as apposed to expanding bricks which put the product into compression.

Masonry as a whole, has a fraction of compressive strength, when put into tension and as such, requires more frequent spacing of movement joints.

Positioning

Lateral movement control

General Advice

- As a general rule of thumb, movement joints in unreinforced blockwork should be spaced at approximately 6 metre centres in any linear run
- Movement joints should also be positioned within 3 metres of any corner/return/pier
- Inclusion of ladder type bed joint reinforcement should be included in two courses above and below all openings, extending at least 600mm either side.

Detailed location

- Movement joint spacing should not exceed 3x the height of the panel (note, this aspect ratio is frequently exceeded below long windows)
- Changes in wall height or wall thickness
- Changes in loading
- Abutments to walls and columns
- Expansion joints in floors/foundations
- Deep chases or recesses
- Junctions with dissimilar materials (especially clay bricks)
- Along the side of large openings.

The spacing of movement joints can be increased by the inclusion of ladder type bed joint reinforcement as detailed below.

It should however be noted that the inclusion of bed joint reinforcement does not guarantee that there will be no cracking in the built masonry, but it will be limited to hairline cracks which will not effect the structural integrity of the wall.

		Continuous Ladder type BJR at the following vertical centres		
	Un-reinforced	675mm	450mm	215mm
Spacing of movement joints	6mm	9mm	11mm	13mm

- NOTE: Bed joint reinforcement should never bridge the movement joint
- Where Stackbonded blockwork is being built, BJR should be at 225mm vertical centres and movement joints at 6m centres.

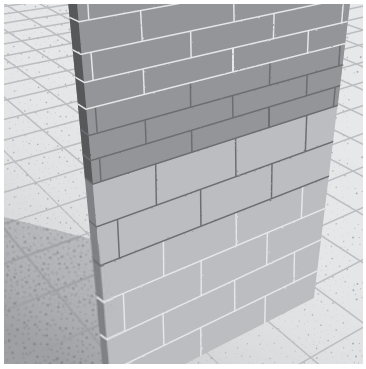
Joint Detail

Ideally the joint should be 10mm wide (to co-ordinate with block/mortar joint module). The joint should be filled with a pre compressed filler such as a polyethelene foam strip with a bond breaker, to prevent the mastic/sealer bonding to it. Note this is a contraction joint (the joint will open up).

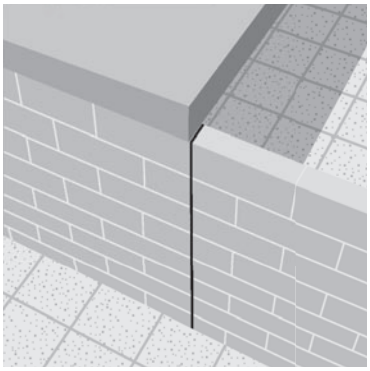
Vertical movement control

The limitation on the uninterrupted height of a masonry wall, in accordance with BS 5628 pt 1 : 2005 clause 25.3.2.1, states that the outerleaf should be supported at intervals not exceeding every third storey or every 9 metres, whichever is the less. However if the building does not exceed four storeys or 12 metres height, whichever is the less, the outer leaf may be uninterrupted for its full height.

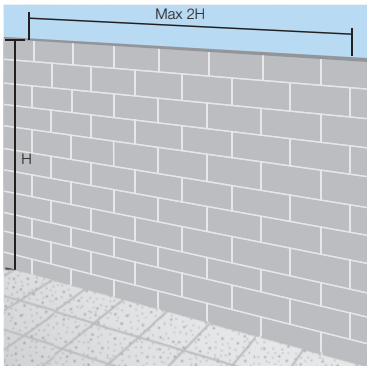
Movement control



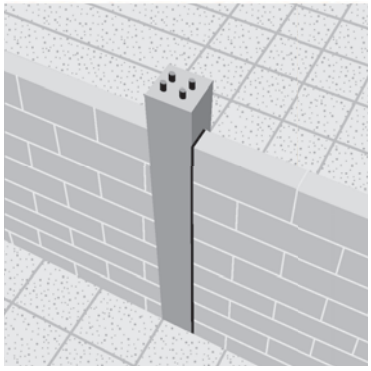
Dissimilar materials



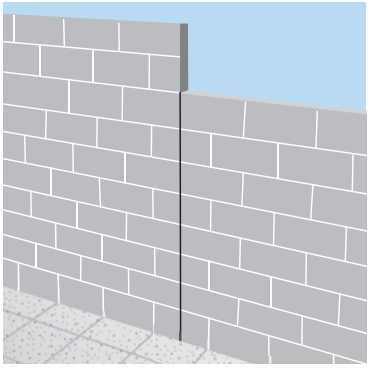
Change of loading



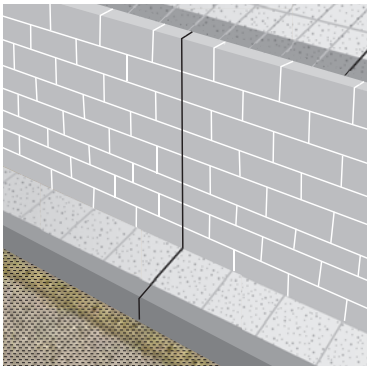
Aspect ratio



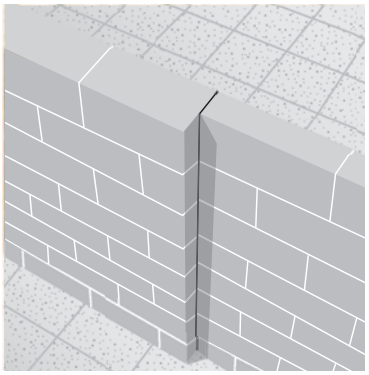
Junctions with columns



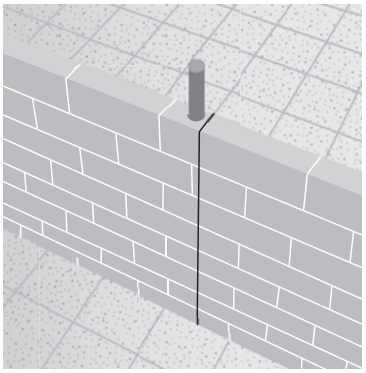
Change of height



Movement joint in floor slab



Change in thickness

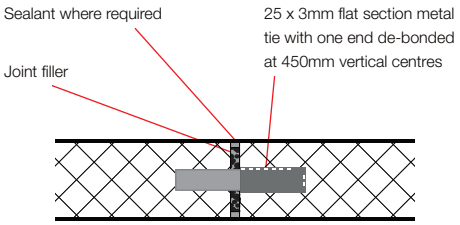


Deep chases/recesses

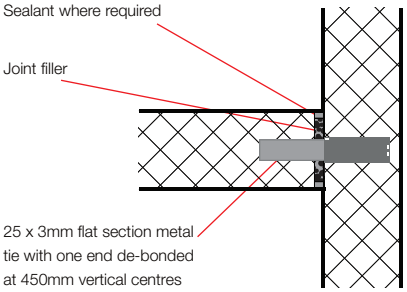
Movement control

Junction details

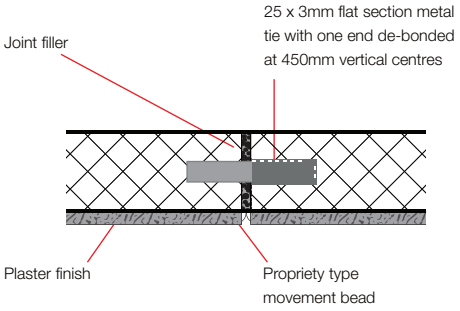
Movement joint to internal wall



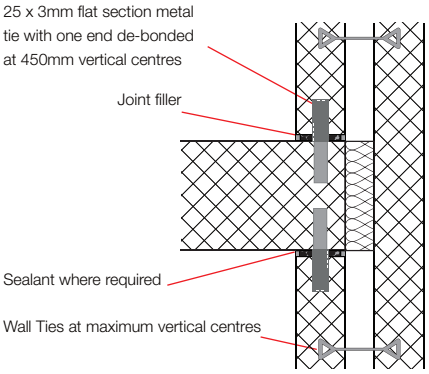
Movement joint to internal wall



Movement joint to internal wall

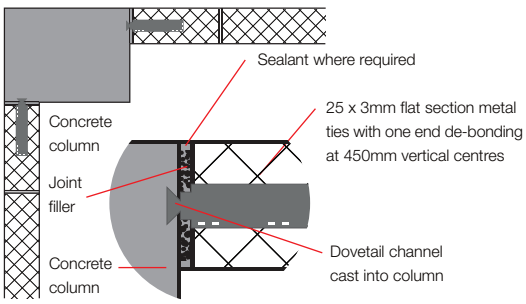


Movement joint to internal wall

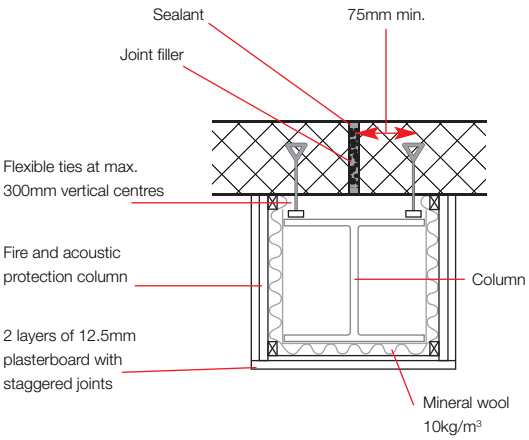


Junction details - junctions at columns

Movement joint at concrete column

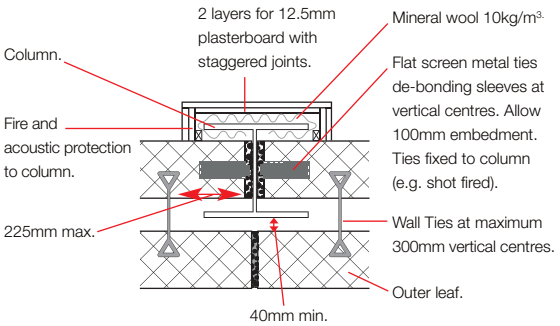


Movement joint to blockwork at internal steel column

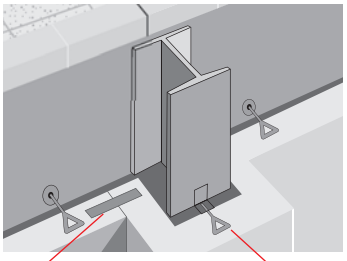


Movement control

Movement joint to blockwork at steel column in cavity wall



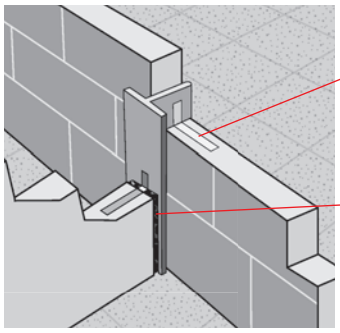
Movement joint to blockwork at steel frame - blockwork encasing column



De-bonded tie every second course. Note that clearance must be given to allow for steelwork movement.

Flexible ties with suitable drip.

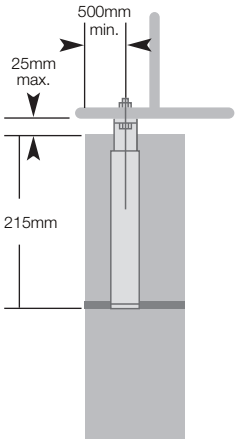
Internal blockwork butting steel frame

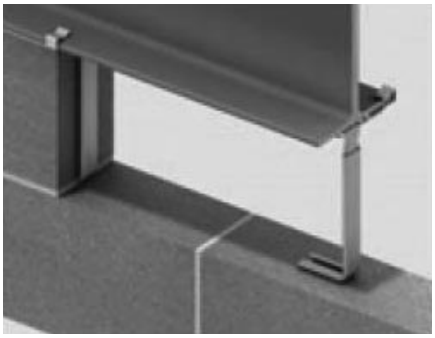


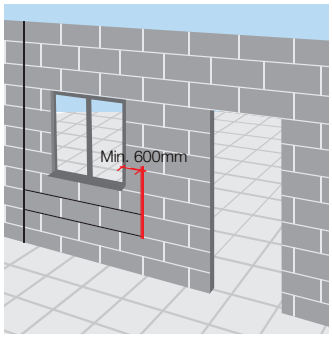
De-bonded tie fixed to steelwork. Note that clearance must be given to allow for steelwork movement.

Joint filled with polyethylene foam or similar sealant used where required.

Head restraint







Thermal 2010

The revised Conservation of Fuel and Power regulations for England and Wales and the approved documents:

L1A (New Dwellings)

L1B (Existing Dwellings)

L2A (New non Dwellings)

L2B (Existing non Dwellings)

Came into effect on 1st October 2010, the key changes are as follows (ADL1A).

- 25% reduction of the buildings CO2 output in relation to the 2006 regulations, in addition to the loss taken into account by the party wall
- Separating wall/party wall heat loss to be taken into account (see table)
- Importance of linear bridging becoming of greater importance note each linear thermal bridge has now to be taken into account, the use of a default y of 0.08 W/m^2 when using accredited construction details is no longer allowed (See table K1 for appropriate psi values when using accredited construction details). Unless values are provided by a government approved Accredited Details Scheme, the psi value should be degraded by either 25% or 0.02W/mK, whichever is the greater
- Air permeability testing requirement increased and lower values are required, however backstop remains at 10m3/ hour/m2@ 50 pascals. Note if the dwelling has not been tested a confidence factor of + 2.0m3 similar in principle to that required in psi values has to be applied, therefore a target 8.0 has to be achieved
- A minimum 75% low energy light fittings must be installed, extra will contribute to the TER
- Assumption of 10% of heating is provided by a secondary heating appliance has been withdrawn unless a chimney or flue and no appliance is installed.

Tables 1 and 2 below show indicative element values required to meet the 25% CO2 reduction requirements, however trade-offs can be made between different elements to achieve the required DER figure.

Tables 7 to 10 give indicative wall U value based upon different constructions and insulant types.

Tables 1 and 2

The Tables below show indicative details required to meet the relevant approved documents.

Table 1

Domestic building specifications - Flat 25% option

	Detached	Semi detached	Mid terrace	Electric flat
Roof (U-value)	0.18	0.18	0.19	0.16
Walls (U-value)	0.23	0.24	0.23	0.18
Party walls (U-value)	N/A	0.00	0.00	0.00
Floor (U-Value)	0.21	0.21	0.21	0.19
Windows and door (U-value)	1.7	1.7	1.6	1.3
Gas boilers (seasonal efficiency)	90%	90%	90%	N/A
Electric heat emitters (seasonal efficiency)	N/A	N/A	N/A	100%
Secondary heating	None	None	None	N/A
Air permeability (m^3hm^{-2})	5	5	5	5
Thermal bridging (y)	0.04	0.04	0.04	0.04
Hot water cylinder insulation (mm)	100	100	100	100
Ventilation system	Natural	Natural	Natural	Natural
Lighting - CFLs	100%	100%	100%	100%

Table 2

Specifications for aggregate 25% approach - non-domestic building

	"Roof-lit"	"Side-lit"
Roofs (U-value)	0.18	0.18
Walls (U-value)	0.26	0.26
Floors (U-value)	0.22	0.22
Windows, doors and rooflights (U-value)	1.8	1.8
Air permeability	5	5
Lighting (lm/W)*	55	55
Multiburner radiant system (thermal/radiant efficiency)	86%/65%	-
Central mechanical ventilation (SFP)	1.8	1.8
Fan coil units (SFP)	-	0.5
Gas boilers (seasonal efficiency)	90%	88%
Cooling (SEER)**	4.5	4.5
DX Cooling (SEER)	-	3.5

Values of ¥ (psi) for different types of junctions conforming with Accredited Construction Details

	Junction detail	¥ (W/m.K)
Junctions with an external wall	Steel lintel with perforated steel base plate	0.50
	Other lintels (including other steel lintels)	0.30
	Sill	0.04
	Jamb	0.05
	Ground floor	0.16
	Intermediate floor within a dwelling	0.07
	Intermediate floor between dwellings (in blocks of flats) [a]	0.07
	Balcony within a dwelling [b]	0.00
	Balcony between dwellings [a] [b]	0.02
	Eaves (insulation at ceiling level)	0.06
	Eaves (insulation at rafter level)	0.04
	Gable (insulation at ceiling level)	0.24
	Gable (insulation at rafter level)	0.04
	Flat roof	0.04
	Flat roof with parapet	0.28
	Corner (normal)	0.09
	Corner (inverted - internal area greater than external area)	-0.09
	Party wall between dwellings [a]	0.06
Junctions with a party wall [a]	Ground floor	0.08
	Intermediate floor within a dwelling	0.00
	Intermediate floor between dwellings (in blocks of flats)	0.00
	Roof (insulation at ceiling level)	0.12
	Roof (insulation at rafter level)	0.02

a) Value of ¥ is applied to each dwelling

b) This is an externally supported balcony (the balcony slab is not a continuation of the floor slab) where the wall insulation is continuous and not bridged by the balcony slab.

The table (left) gives the relevant psi values to be used when calculating the relevant linear thermal bridging, when using the Accredited Construction details, available from **www.planningportal.gov.uk/england/professionals/en/1115314255826.**

Thermal 2010

Compliance to satisfy Part L can be demonstrated by following five criteria as shown. The appropriate Approved Document provides guidance and procedures for satisfying each of the criteria.

Demonstrating compliance

	Dwellings	Buildings other than dwellings
Criterion 1	The calculated rate of CO_2 emissions from the dwelling (the Dwelling Emission Rate, DER) must not be greater than the Target Emission Rate (TER).	The calculated CO_2 emission rate for the building (the Building Emission Rate, BER) must not be greater than the Target CO_2 emission rate (TER).
Criterion 2	The performance of the building fabric and the fixed building services should achieve reasonable overall standards of energy efficiency following procedures given in the Approved Document (See 'Limits on Design Flexibility').	The performance of the building fabric and the heating, hot water and fixed lighting systems should achieve reasonable overall standards of energy efficiency.
Criterion 3	The dwelling should have appropriate passive control measures to limit the effect of solar gains on indoor temperatures in summer, irrespective of whether or not the dwelling has mechanical cooling.	Demonstrate that the building has appropriate passive control measures to limit solar gains.
Criterion 4	The performance of the dwelling, as built, should be consistent with the DER.	The performance of the building, as built, should be consistent with the BER.
Criterion 5	The necessary provisions for energy efficient operation of the dwelling should be put in place.	The necessary provisions for enabling energy-efficient operation of the building should be put in place.

For design purposes the limiting U-values shown should not be exceeded. The values stated are area-weighted average values for all elements of that type. In practice the envelope standards would need to be considerably better than the limiting values.

Limits on design flexibility - limiting fabric parameters

Element	Dwellings	Buildings other than dwellings
Roof	0.20 W/m^2K	0.25 W/m^2K
Wall	0.30 W/m^2K	0.35 W/m^2K
Floor	0.25 W/m^2K	0.25 W/m^2K
Party wall	0.20 W/m^2K	-
Windows, roof windows, glazed roof lights, curtain walling and pedestrian doors	2.00 W/m^2K	2.2 W/m^2K
Vehicle access and similar large doors	-	1.5 W/m^2K
High-usage entrance doors	-	3.5 W/m^2K
Roof ventilators (inc. smoke vents)	-	3.5 W/m^2K
Air permeability	10.00$m^3/h.m^2$ at 50 Pa	10.00$m^3/h.m^2$ at 50 Pa

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U Values for party walls

Party wall construction	U-value (W/m²K)
Solid, e.g. Masterdenz RD	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 at all exposed edges and in line with insulation layers in abutting elements	0.0

L1B (New extensions)

Wall to be 0.28 w/m²K area weighted or better, or use SAP for compliance. Glazing up to 25% of the floor area, without further proof of compliance.

L2A (New non dwellings)

BER (Building Emission Rate) to be no worse than TER building fabric backstop limits

Wall 0.35W/m²K

Air Permeability 10m³/m²/h@50pascals

L2B (Extensions)

Wall to be 0.28W/m²K area weighted or better

U value
summary tables

Description above the table indicates the external leaf construction and insulation type.

Table indicates insulation thickness and the relevant U value, dependent upon inner leaf block type and internal finish

NOTE: Full fill cavities assume air-gap correction level 0 and cavities > 100mm, assumes a 50mm² stainless steel wall tie @ 2.96/m²

Partial Cavity fill assumes a air-gap correction level 1 and cavities > 100mm, assumes a 50mm² stainless steel wall tie @ 2.96/m²

Full cavity fill

Bradstone range and Dritherm 32

Insulation thickness	Masterlite Pro			Masterlite Ultra			Masterdenz		
	P/G	P on D	Plaster	P/G	P on D	Plaster	P/G	P on D	Plaster
85	0.33	0.31	0.33	N/A	0.30	0.31	0.34	0.32	0.34
100	0.29	0.27	0.29	N/A	0.26	0.27	0.29	0.28	0.29
115	0.27	0.25	0.26	N/A	0.25	0.26	0.27	0.26	0.27
130	0.24	0.23	0.24	N/A	0.22	0.23	0.24	0.23	0.24
150	0.21	0.21	0.21	N/A	0.20	0.21	0.22	0.21	0.21
175	0.19	0.19	0.19	N/A	0.19	0.19	0.20	0.19	0.20
200	0.17	0.17	0.17	N/A	0.17	0.17	0.18	0.17	0.18

NOTES:
P/G = Paint grade
P on D = Plasterboard on dabs
Plaster = Sand cement

Bradstone range and Xtratherm Cavity Therm

Insulation thickness	Masterlite Pro			Masterlite Ultra			Masterdenz		
	P/G	P on D	Plaster	P/G	P on D	Plaster	P/G	P on D	Plaster
75	0.26	0.25	0.26	N/A	0.24	0.25	0.27	0.26	0.27
100	0.20	0.20	0.20	N/A	0.19	0.20	0.21	0.20	0.20

Partial cavity fill

Bradstone range and Kingspan K8

Insulation thickness	Masterlite Pro			Masterlite Ultra			Masterdenz		
	P/G	P on D	Plaster	P/G	P on D	Plaster	P/G	P on D	Plaster
45	0.33	0.31	0.32	N/A	0.29	0.31	0.34	0.32	0.33
50	0.30	0.29	0.30	N/A	0.28	0.29	0.31	0.29	0.31
55	0.29	0.28	0.29	N/A	0.27	0.28	0.30	0.29	0.30
60	0.28	0.27	0.28	N/A	0.26	0.27	0.28	0.27	0.28
65	0.26	0.25	0.26	N/A	0.25	0.26	0.27	0.26	0.27
75	0.23	0.22	0.23	N/A	0.22	0.22	0.23	0.23	0.23
100	0.19	0.18	0.19	N/A	0.18	0.18	0.19	0.18	0.19

NOTES:
P/G = Paint grade
P on D = Plasterboard on dabs
Plaster = Sand cement

U value
summary tables

Bradstone range and Xtratherm Thin R Plus

Insulation thickness	Masterlite Pro			Masterlite Ultra			Masterdenz		
	P/G	P on D	Plaster	P/G	P on D	Plaster	P/G	P on D	Plaster
50	0.30	0.28	0.30	N/A	0.27	0.29	0.31	0.39	0.31
60	0.28	0.26	0.28	N/A	0.26	0.27	0.38	0.27	0.28
70	0.25	0.24	0.25	N/A	0.23	0.24	0.25	0.24	0.25
75	0.24	0.23	0.24	N/A	0.22	0.23	0.24	0.23	0.24
80	0.23	0.22	0.23	N/A	0.21	0.22	0.23	0.22	0.23
100	0.19	0.19	0.19	N/A	0.18	0.19	0.20	0.19	0.20

Construction - Facing masonry and Kingspan K8

Insulation thickness	Enviroblock Lightweight		Enviroblock Dense	
	P on D	Plaster	P on D	Plaster
40	0.35	0.37	0.36	0.38
45	0.31	0.33	0.32	0.33
50	0.3	0.32	0.31	0.32
55	0.28	0.3	0.29	0.3
60	0.27	0.28	0.27	0.28
65	0.26	0.27	0.26	0.27
75	0.22	0.23	0.23	0.23
100	0.18	0.19	0.18	0.19

Construction - Facing masonry and Xtratherm Thin R Plus

Insulation thickness	Enviroblock Lightweight		Enviroblock Dense	
	P on D	Plaster	P on D	Plaster
50	0.29	0.30	0.29	0.31
60	0.27	0.28	0.27	0.28
70	0.24	0.25	0.24	0.25
80	0.22	0.23	0.22	0.23
90	0.20	0.21	0.21	0.21
100	0.19	0.19	0.19	0.2

NOTES:
P/G = Paint grade
P on D = Plasterboard on dabs
Plaster = Sand cement

U value
summary tables

Facing masonry and Kingspan K8

Insulation thickness	Masterlite Pro			Masterlite Ultra			Masterdenz		
	P/G	P on D	Plaster	P/G	P on D	Plaster	P/G	P on D	Plaster
40	0.37	0.35	0.37	N/A	0.33	0.35	0.38	0.36	0.38
45	0.33	0.31	0.32	N/A	0.29	0.31	0.34	0.32	0.33
50	0.30	0.29	0.30	N/A	0.28	0.29	0.31	0.29	0.31
55	0.29	0.28	0.29	N/A	0.27	0.28	0.30	0.28	0.29
60	0.28	0.27	0.28	N/A	0.26	0.27	0.28	0.27	0.28
65	0.26	0.25	0.26	N/A	0.25	0.25	0.27	0.26	0.27
75	0.23	0.22	0.23	N/A	0.22	0.22	0.23	0.23	0.23
100	0.19	0.18	0.19	N/A	0.18	0.18	0.19	0.18	0.19

Facing masonry and Xtratherm Thin R Plus

Insulation thickness	Masterlite Pro			Masterlite Ultra			Masterdenz		
	P/G	P on D	Plaster	P/G	P on D	Plaster	P/G	P on D	Plaster
50	0.30	0.28	0.30	N/A	0.27	0.29	0.31	0.29	0.31
60	0.28	0.26	0.28	N/A	0.26	0.27	0.28	0.27	0.28
70	0.25	0.24	0.25	N/A	0.23	0.24	0.25	0.24	0.25

NOTES:
P/G = Paint grade
P on D = Plasterboard on dabs
Plaster = Sand cement

Assumes Wall Ties at 2.96/m² on cavities > 100mm and assumes air-gap correction level 1

Fire resistance

The following tables 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, see individual product data sheets.

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.

Load-bearing only - Criterion R

Separating only - Criterion EI

Separating and Load-bearing - Criterion REI.

The thickness given in the tables below is for masonry alone, excluding finishes. For each specification, the top row of figures is for walls without applied finishes or just a thin render/parge.

The values in brackets are for walls having a 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 both sides, or in the case of a cavity wall, it is assumed to be on fire exposed face.

Note - Sand Cement render is not considered to increase the fire resistance of the wall.

Lightweight aggregate units include (Masterlite Pro, Masterlite Ultra, Masterlite ProAcoustic, Enviroblock lightweight and Masterlite Pro Fairfaced).

Dense aggregate units include (StoneMaster, Bradstone walling range, Ashlar, Masterdenz, Masterdenz Fairfaced, Enviroblock Dense).

Group 1 Units All solid unitsand 100mm Cellular (Check with Sales Office)

Group 2 Units All Cellular, Multicell and Hollow units of 140mm thickness and higher (Check with Sales Office).

Table: Dense and lightweight aggregate concrete masonry: minimum thickness of separating non load-bearing separating walls (criteria EI) for fire resistance classifications

Material properties: gross density ρ (kg/m^3)	**Minimum wall thickness t_F (mm) for fire resistance classification EI for time $t_{fi,d}$ (mins) of:**					
	30	60	90	120	180	240
Group 1 units						
Mortar: general purpose, thin layer, lightweight						
Lightweight aggregate: 400 ≤ ρ ≤ 1700	50	70	75	75	90	100
	(50)	(50)	(60)	(70)	(75)	(75)
Dense aggregate: 1200 ≤ ρ ≤ 2400	50	70	90	90	100	100
	(50)	(50)	(70)	(75)	(90)	(100)
Group 2 units						
Mortar: general purpose, thin layer, lightweight						
Lightweight aggregate: 240 ≤ ρ ≤ 1300	50	70	75	100	115	115
	(50)	(50)	(70)	(75)	(90)	(100)
Dense aggregate: 720 ≤ ρ ≤ 1800	90	100	125	140	140	140
	(70)	(80)	(90)	(100)	(125)	(125)

NOTE: This table is based on data from NA to EC6 Part 1-2.

Fire resistance

Table: Dense and lightweight aggregate concrete masonry: minimum thickness of separating load-bearing single-leaf walls (criteria REI) for fire resistance classifications

Material properties: gross density ρ (kg/m³)		Minimum wall thickness t_F (mm) for fire resistance classification EI for time $t_{fi,d}$ (mins) of:					
		30	60	90	120	180	240
Group 1 units							
Mortar: general purpose, thin layer, lightweight							
Lightweight aggregate: 400 ≤ ρ ≤ 1700	$a \leq 1.0$	90	90	100	100	140	150
		(90)	(90)	(90)	(90)	(100)	(100)
	$a \leq 0.6$	70	75	90	90	100	100
		(60)	(60)	(75)	(75)	(90)	(90)
Dense aggregate: 1200 ≤ ρ ≤ 2400	$a \leq 1.0$	90	90	90	100	140	150
		(90)	(90)	(90)	(90)	(100)	(100)
	$a \leq 0.6$	75	75	90	90	100	140
		(60)	(75)	(75)	(75)	(90)	(100)
Group 2 units							
Mortar: general purpose, thin layer, lightweight							
Lightweight aggregate: 240 ≤ ρ ≤ 1300	$a \leq 1.0$	50	70	75	100	115	115
		(50)	(50)	(70)	(75)	(90)	(100)
	$a \leq 0.6$	90	100	125	140	140	140
		(70)	(80)	(90)	(100)	(125)	(125)
Dense aggregate: 720 ≤ ρ ≤ 1800	$a \leq 1.0$	100	100	140	140	140	190
		(90)	(100)	(100)	(140)	(140)	(150)
	$a \leq 0.6$	90	100	100	140	140	150
		(75)	(90)	(90)	(125)	(125)	(140)

NOTES: This table is based on data from NA to EC6 Part 1-2.

a < 0.6 should be used when the vertical load capacity is only 0.6 that of the permitted design vertical resistance is being used

a < 1.0 should be used when more than o.6 of the permitted capacity is being used.

Fire resistance

Table: Dense and lightweight aggregate concrete masonry: minimum thickness of each leaf of separating load-bearing cavity walls with one leaf loaded (criteria REI) for fire resistance classifications

Material properties: gross density ρ (kg/m³)		Minimum wall thickness t_F (mm) for fire resistance classification EI for time $t_{fi,d}$ (mins) of:					
		30	60	90	120	180	240
Group 1 units							
Mortar: general purpose, thin layer, lightweight							
Lightweight aggregate: 400 ≤ ρ ≤ 1700	$a \leq 1.0$	90	90	100	100	140	150
		(90)	(90)	(90)	(100)	(100)	(100)
	$a \leq 0.6$	70	75	90	90	100	100
		(60)	(60)	(75)	(75)	(90)	(90)
Dense aggregate: 1200 ≤ ρ ≤ 2400	$a \leq 1.0$	90	90	100	100	140	150
		(90)	(90)	(90)	(90)	(100)	(100)
	$a \leq 0.6$	75	75	90	90	100	140
		(60)	(75)	(75)	(75)	(90)	(125)
Group 2 units							
Mortar: general purpose, thin layer, lightweight							
Lightweight aggregate: 240 ≤ ρ ≤ 1300	$a \leq 1.0$	90	100	100	100	140	150
		(90)	(90)	(90)	(100)	(140)	(140)
	$a \leq 0.6$	70	90	90	100	125	140
		(70)	(70)	(70)	(90)	(100)	(125)
Dense aggregate: 720 ≤ ρ ≤ 1800	$a \leq 1.0$	90	100	100	100	140	190
		(90)	(90)	(100)	(100)	(140)	(150)
	$a \leq 0.6$	90	100	100	100	140	150
		(70)	(90)	(90)	(125)	(125)	(140)

NOTES: The tabulated thicknesses are for the loaded leaves of cavity walls where the loaded leaf is subjected to fire.
The non-loaded leaf may be of a dissimilar material to the loaded leaf, but should otherwise conform to the relevant material specifications.
In such cases, the respective thickness of each leaf should conform to that specified in the appropriate material table.
This table is based on data from NA to EC6 Part 1-2.
a < 0.6 should be used when the vertical load capacity is only 0.6 that of the permitted design vertical resistance is being used
a < 1.0 should be used when more than o.6 of the permitted capacity is being used.

Health and safety

Manual handling

Handling Building Blocks

This guidance by the Construction Industry Advisory Committee (CONIAC) covers the safe handling of building blocks, by which the committee means all masonry units and blocks, including those made of clay, concrete, reconstituted stone or any similar man-made or natural material.

Handling of heavy building blocks can give rise to a wide range of injuries, including serious injuries where the damage is gradual and progressive over a substantial period of time.

To reduce the risk of injury the blockwork design, site conditions and the way in which the work is organised should be properly planned. Practical advice on these matters should help designers, specifiers and those managing work on site as well as those handling the blocks.

Risk Assessment

1. To minimise the risk of injury:

- All hazards involved need to be identified
- The significant risks estimated
- Suitable precautions to avoid or reduce these risks incorporated into safe systems of work.

2. The main hazards are:

- Heavy loads and poor posture: excessive stress and strain causing injury to muscles and tendons, particularly where handling involves bending, twisting or other difficult postures;
- Slips, trips and falls: including damage caused by ‘dropped blocks’;
- Sharp edges: cuts and abrasions to the skin;
- Skin hazards: dermatitis, burns and similar conditions caused by contact with mortar (see HSE construction information sheet No. 26 Cement).

3. With block handling, the risk of injury is largely determined by the weight of the block - the heavier the block, the higher the risk of injury.

4. After taking account of expert opinion and the long history of complaints over handling heavy blocks, CONIAC has concluded that there is a high risk of injury in the single-handed, repetitive manual handling of blocks heavier than 20kg (44 lbs).

5. If single person handling is needed, either blocks of 20kg or lighter should be specified and used or as a last resort, where special units are necessary over 20kg, such as quion blocks the laying rate should reduced to less than 15 units/hour and restricted to a maximum of 2 hours/day.

The work area should be organised to restrict the amount of bending and stretching, especially below knee high and above shoulder height.

6. With blocks weighing less than 20kg. Manual handling risks are still significant and suitable precautions should be taken to minimise these risks as much as possible.

Precautions

Designers and specifiers should take the weight guideline into account at the design and specification stage of the project.

Where special units such as pad stones, quoins are required that are over 20 kg, measures to provide intermediate staging should be specified to ensure bending and stretching is minimised.

Project planners and contractors should follow the weight guidelines and ensure that the precautions listed opposite are taken into account when planning the work and when devising safe systems of work.

Contractors should also give instruction and exercise supervision to ensure that workers follow these plans and systems of work.

The Task

Handle and lay building blocks in accordance with the following:

- Plan to stack blocks close to where they will be used
- Stack on a level, firm base and wherever possible without double stacking of block packs
- Keep manhandling of blocks to a minimum and use mechanical lifting and handling aids as much as possible, such as cranes, fork-lift trucks with pallets, trolleys and telescopic handlers.

NOTE: ensure that the landing area of scaffolding is adequate for the temporary loading of blocks.

- Always use mechanical lifting and handling or operate a two person system for blocks weighting more than 20kg
- Arrange work to avoid over-reaching or twisting when handling blocks
- Ensure good grip and secure foot placement in the working area when handling blocks.

Arrange the work so that blocks only need to be handled up to shoulder height. Go higher by using staging, for instance.

NOTE: further protection against falls may be necessary if the effective height of guard rails is reduced. Particular care and attention is needed for higher risk block laying such as when head room is restricted, under soffits or below working platform level.

Health and safety

The Working Environment

Prepare roads and hard standing first and before blocks are on site. In areas where blocks are carried or handled, keep the site clear of obstacles or tripping hazards, such as discarded block wrappings or stack ties. Uneven, slippery or unstable ground conditions increase the risk of injury. Blocks should be protected from the weather to avoid them getting wet and increasing in weight.

Training

Workers should be given information and training on the systems of work and procedures to be used on that site to ensure safe manual handling of blocks. Suitable training will also be necessary for designers, specifiers and those managing contracts.

Personal Protective Equipment

When handling blocks the normal protective equipment needed for use on building sites should be provided by employers and worn by individual workers; in particular, safety helmets, safety footwear with protective toe caps and suitable gloves.

Wall Ties

Serious injuries have occurred during blockwork when building double skin walls due to contact with the sharp ends and edges of some types of Wall Ties. The exposed sharp edges should be covered or safer Wall Ties used.

References and Reading List

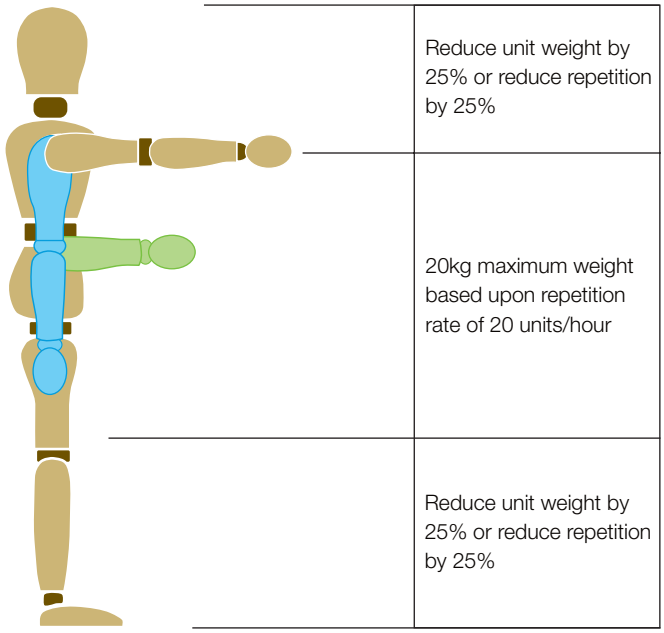
Manual Handling Guidance L23 HMSO 1992 ISBN 0 11 886335 5.

BS EN 1996 Design of Masonry Structures.

BS 5628: 1985: Code of Practice for use of masonry BSI.

Contemporary Ergonomics 1989: Block laying in the construction industry Tracy M F and Gray M I.

Proceedings of the Ergonomics Society's 1989 Annual Conference: Ergonomics - designing progress E D, Taylor and Francis 1989 ISBN 085 066 484.



The above diagram gives the typical repetitive weight limits for the laying of masonry units, based upon good site practice with adequate clean dry working areas.
Special units above 20kg can be used, however their use will be subject to a specific risk assessment.

Safe handling and use of concrete blocks

Consideration of the points listed below will contribute significantly to safe working and manual handling.

- Minimise manual handling by delivering units as close to the place of use as safety considerations permit
- Move units in packs and by mechanical means whenever possible
- Load units out to above knee height
- Ensure that normal protective equipment appropriate to construction sites is both provided and used
- Ensure that appropriate eye protection and dust suppression or extraction measures are provided when mechanically cutting or chasing units.

Health and safety

Additional considerations include:

- Manual Handling Operations. Regulations require employers to carry out a risk assessment on all manual handling tasks
- The Construction (Design and Management). Regulations place duties in the form of a mandatory Health and Safety system on clients/designers/contractors.

In an attempt to provide practical guidance for meeting the requirements of these two regulations the Health and Safety Executive (HSE) has issued Construction Sheet 37 'Handling Building Blocks' which advises that:

- There is a risk of injury in the singlehanded repetitive manual handling of blocks heavier than 20kg

The HSE guidance does not prevent an individual handling manually small numbers of units of greater than 20kg. In particular, ancillary units such as quoins or reveals would fall into this category and would not be expected to be handled by a two person team.

The guidance given in Construction Sheet 37 is not mandatory, but gives a method of meeting the requirements of the regulations.

Where previously units greater than 20 kg would have been specified, consideration should be given to using either less dense units or smaller unit sizes or alternative masonry wall constructions. The appropriate choice from the options available will depend on the unit or wall properties dictated by the application.

Choices include:

- Using lighter solid units having sufficiently similar properties
- Using cellular/hollow units instead of solid units (having almost identical properties to solid units)
- Using alternative construction techniques such as:
  i) Laying units flat to form a 190 or 215mm width wall (suitable for finishes such as plastering or drylining)
  ii) Collar joining* units to form a 190 or 215mm width wall (particularly suited to facing applications).

Whenever making the choice of units it is essential to ensure that the desired performance characteristics of the finished wall are not compromised.

*Collar jointing is laying units back to back in normal aspect with a 10-15mm mortar joint between the adjoining faces of the units. The two leaves may be tied together. If tied either normal ties or bed joint reinforcement may be used. Collar jointed walls are not suitable for separating walls in dwellings.

Good site practice
Introduction

Facing masonry units as supplied by Aggregate Industries, are designed to be hard-wearing and durable. However there are specific procedures that MUST be adhered to, to ensure that damage to the face does not occur, prior to the blocks being installed in the building, or before the completion of the building.

Facing masonry units are delivered shrink wrapped to site banded on pallets.

- These pallets must be stored on level ground free from flooding.
- Packs should not be stored on top of one another
- Do not stack Facing masonry units on their face.
- Always lift the units, do not drag it along the ground.

The four problems which are met repeatedly on site and which cause the greatest damage to the faces are:

a. Delay in installation of down-pipes, leading to rain water cascading down the face of blockwork and resulting in serious efflorescence.

b. Scraping the face while transporting around the site.

c. Inadequate protection of built blockwork.

d. Pressure/power washes being used to clean down built blockwork on completion. Under no circumstances do we recommend the use of pressure washes for cleaning (see page 37, Cleaning of Facing masonry).

Good site practice notes

1. Protection/Ventilation

Facing masonry units will be delivered shrink wrapped, banded to pallets and when received the packs should be stored on level ground free from flooding. Pallets should not be stacked on top of each other.

The material should be inspected on delivery and checked against specification and approved standard by the designer/customer.

Shrink wrapping to sides of packs should be pierced to facilitate ventilation. It is preferable to completely remove the shrink wrap once on site, and cover with a tarpaulin, allowing a through flow of air, enabling the blocks to breathe and dry out.

2. Handling on Site

The blocks must be transported on block trolleys that have adequate protection to the trolley supports by use of timber board or similar. Facing masonry units must not be stacked on their faces on site. They should always be stacked on beds as in the laid condition. Blocks should always be lifted, not dragged along the ground.

3. Cutting of Blocks

Aggregate Industries, strongly recommends cutting of blocks at the factory and not on site. The biggest problem of cutting on site is the availability of sufficient clean water to ensure the slurry from the cutting process is fully removed from the face of the block.

If left on, the slurry hardens on the face turning the block white. If left longer than three or four weeks the slurry becomes virtually impossible to remove. Following cutting, the blocks must be allowed to dry fully before being built in, to ensure a colour match.

4. Fair Face (Smooth) Blockwork

Fair Face (smooth) blockwork is particularly susceptible to damage on site, any marks showing up more obviously on a smooth surface than a textured (weathered/split) face.

Fair Face blocks are normally supplied on the basis of 'Fair Face one face and one end', and if one face is marked the bricklayer must turn the block so that the unmarked face is showing. In the case of StoneMaster walling, only one face is supplied as fairfaced and return ends have to be specified where required.

5. Mortar Mix

In most instances it is recommended to use a M4 / Type III / 1:1:6 mortar. It must have a workable consistency without excess water. Excess mortar at beds and perps should be left to dry 'thumb-print hard' before it is lifted away with the trowel edge. If a mortar run is created on the face of the block, this should be dabbed clean with a moist/dry sponge.

If a block has a texture (i.e. weathered, split) the latter should be avoided, and the affected area should instead be allowed to dry completely, followed by careful application of a stiff dry brush. Under no circumstances should steel wool or other abrasive material be used.

6. Height of Wall Lifts (Number of Courses)

This will vary on conditions whether external or internal etc. A general rule is that for 90mm/100mm thickness four courses are practical. If profiles are used, five to seven courses are possible, provided inner and external leaves rise at the same rate.

Weather conditions will affect the setting of the mortar hence the comment above. In reality the number of courses achieved depends on skill of layers and an average five to seven courses is not unusual.

7. Finished Built Walls

All Facing masonry units built-in walls should be adequately protected by sheeting. At cessation of work the tops of the walls should be covered against wet weather or frost, and faces sheeted if necessary in winter working conditions.

N.B. The four problems which are met time and again on site are:

a. Delay in installation of down-pipes, leading to rain water cascading down the face of blockwork and resulting in serious efflorescence.

b. Scraping the face of blocks while transporting around the site.

c. Inadequate protection of built blockwork.

d. Pressure/power washes should never be used to clean down built blockwork on completion.

Cleaning of facing masonry/cast stone

Hazards

Cutting can create dust and flying fragments.

Dust created could contain particles of a respiratory size, which may contain silica (COSHH Data sheet).

Personal Equipment Protection (PPE)

Ensure appropriate Personal Protection Equipment is used at all times, especially gloves, goggles, respiratory protection and ear defenders.

Wet Cutting

Provided this is carried out correctly, this is the preferred method of cutting.

Ensure there is an adequate supply of clean water to wash away all cutting debris.

Thoroughly wash off all slurry deposits adhering to the block and stack vertically, ensuring none of the run-off water is allowed to run onto other blocks.

Dry Cutting

Special precautions have to be taken due to dust emissions. Engineering control measures may have to be adopted, especially when being cut indoors.

Do not cut near completed blockwork, dust from the cutting process can be deposited on the completed block work, which may alter the colour and texture of the units.

General

Ensure blade diameter is great enough to ensure only one cut is required.

It is normal practice to cut blocks face up as the lower face has a potential to be plucked as the blade cuts through the block.

Never cut slips less than 100mm long.

Cleaning of facing masonry/cast stone

This method statement sets out the procedures to be followed for cleaning each type of concrete facing masonry block and Caststone units.

Cleaning of masonry blockwork is no substitute for maintenance of high standards of site work practice such as careful block handling and laying, use of mortar and adequate protection of the finished work. Prevention is better than cure.

The cleaning of Facing masonry blockwork using cleaning agents inevitably requires a reasonable element of skill and should be carried out on a trial area first under supervision. Appropriate PPE equipment (gloves and goggles) must be worn. Cleaning the face of the material may need more than one application. This will depend on the extent of the problem, the deposits and the texture or profile of the block involved.

All the following cleaning methods should be carried out on an inconspicuous area first to establish suitability and the effect of the process.

Fair Faced Blocks

1. Mortar and Plaster 'Snots'

Where there is a build up of dry set mortar, it should be removed by placing the edge of a block of wood next to it and tapping the block sideways to lift the mortar off the face.

2. Mortar and Plaster Smears

Where dried mortar smears or stains occur the residue can be cleaned by use of a cleaning agent. Those generally used contain Hydrochloric Acid. The cleaning agent should never be used undiluted, and needs to be diluted in accordance with the manufacturer's recommendations.

Using acid cleaners can affect the colour and texture of the block and it may require the whole wall treating, to give a uniform appearance.

Using a bristle brush or mist sprayer, with water, then apply the dilute cleaner. The mortar will be seen to dissolve and, when judged to be clean, the area must be flushed with clean water again using a brush or mist sprayer.

Where wall surfaces have multiple smears and mortar deposits over the whole face of the wall, initially treat any particularly heavy deposits as described above. Subsequently dampen the area and apply the cleaning agent over the whole face using a mist sprayer, subsequently thoroughly flushing down.

Provided these recommendations are followed, mortar joints will be no more affected than the surface of the blockwork, always provided a cement, lime, sand mortar has been used. If a plasticiser has been incorporated in the mortar mix, a check should be made on the constituents for salt content as cleaning agents can be detrimental to some plasticisers.

NOTE
Hydrochloric Acid based cleaners can attack other surfaces such as galvanised steel and care should therefore be taken in their application.

3. Paint

It is essential that the type of paint and its solvent is identified - this is likely to be water, benzene, turpentine (pure), acetone or similar thinners. The solvent is applied to the affected area, whether splashes or drips, using an appropriate sized brush, it should be left for a little time to soften the paint. When softened, the area being cleaned is 'mopped' with the moist brush used for application of the solvent, the brush being squeezed after each mopping to clean it.

When most of the paint is cleaned from the surface of the blockwork, it must be allowed to dry. When dry, a further application of the cleaning agent, in accordance with point 2 above, may be necessary finally to clean the blockwork. Proprietary paint removers such as Polycell Advanced paint stripper / Less Mess paint stripper. This gel, can remove most paint types, however the gel may have to be left in place for up to 6 hours.

NOTE
It is recommended that the paint manufacturer is contacted to advise on the most suitable solvent to use or alternatively a specialist graffiti removal company can be used to carry out any work required.

4. Oil, Grease, Bitumen and Tar Based Materials

Solvents must be identified. These may be Benzole, Carbon, Tetrachloride, Tetrachloroethylene, 'Dabit Off' or 'Gunk' de-greasant.

The technique is the same as for the paint, but a trial and error approach may be necessary depending on the extent of the contamination.

5. Finger-marks

Apply a mist spray of clean water, followed by judicious use of household detergent and a nail brush. Finally, mist spray again with clean water and allow to dry. Repeat as necessary.

Cleaning of facing masonry/cast stone

Split Blocks

As for Fair Faced blockwork above, but it will be necessary as in paragraph 1 to use a piece of hardwood shaped to a chisel point and because of the irregular face to use somewhat stiffer brushes for the treatments in paragraphs 2, 3, 4 and 5. Alternatively the careful use of a needle gun can be effective, see later.

Textured Blocks

1. Mortar and Plaster 'Snots'

Where there is a build up of dry set mortar, it should be removed by placing the edge of a block of wood next to it and tapping the block sideways to lift the mortar off the face. (Using steel implements may scratch/ mark the surface of the block). Where mortar is ingrained in product - see 2 below.

2. Mortar and Plaster Smears

Surface mortar smears and ingrained mortar can, when dried, be removed by the use of a clean bristle brush (NOT wire brush). If this fails to remove the mortar, an acid wash as outlined in section 2 should be used As a last resort, if the above treatments have not proved successful, the use of light grit blasting on site will remove all ingrained material and stains.

Efflorescence

Most efflorescence can be removed by dry brushing, water rinsing with brushing, or light sandblasting followed by flushing with clean water. If this is not satisfactory, it may be necessary to wash the surface with a dilute solution of Hydrochloric Acid (not more than a 5% solution, suitable PPE should be worn when using an acid solution). For integrally coloured concrete, not more than a 2% solution should be used. This will prevent surface etching that could change the colour and texture.

Before applying an acid solution, dampen the wall surface with clean water to prevent the acid from being absorbed into the wall and causing damage. Each application should be to areas of not more than 4 feet square. Wait 5 minutes before scouring off the salt deposit with a stiff bristle brush. The surface should be flushed immediately and thoroughly with clean water to remove all traces of acid. If the surface is to be painted, flush thoroughly with water and allow to dry.

Before any treatment is used it should be tested on a small, inconspicuous area.

Since acid and any other treatments may slightly change the appearance, the entire wall should be treated to avoid discoloration.

Pressure Washing

Never use pressure washers when cleaning down blockwork.

Anti Graffiti Coatings

Application of anti graffiti can dramatically affect the colour, sheen and weathering characteristics of the built masonry units. Aggregate Industries recommends the use of Graffi Coat 1, a near invisible micro-crystalline wax coating, which is permeable, allowing the protected surface to breath.

Aggregate Industries would recommend the use of Graffi Coat 1 on all external polished masonry walls.

Details of our approved Anti Graffiti applicator service can be obtained by contacting our sales office on **01285 646884**

Precast concrete products

COSHH

1. Identification of the substance

Concrete blocks, lintels, walling products, roofing slates, architectural dressings and bricks.

2. Composition/information on ingredients

Precast concrete products are manufactured from a mix of raw materials, including:

- Sand and gravel aggregates
- Pulverised fuel ash (PFA)
- Cement
- Limestone dust
- Crushed rock
- Inert pigments.

3. Hazards identification

There is a potential for respirable dust, including an element of respirable crystalline silica (quartz), to be released if the product is drilled, cut, sawn, crushed or accidentally broken up. This could pose a health hazard if inhaled over a prolonged period of time.

Concrete products and dust particles can also cause abrasion or irritation to skin and eyes.

The weight of the product could pose a health hazard if inappropriate manual handling techniques are employed.

For further guidance see HSE Publications EH44 Dust: General Principles of Protection, Getting to Grips with Manual Handling: a Short Guide and Information Sheet Number 26 (Revision 2) - Cement.

4. First aid measures

General

Unlikely to be hazardous if handled correctly.

Inhalation

Remove to a dust free area and seek medical attention if breathing difficulties are experienced.

Skin

Wash with soap and water. If prolonged contact causes irritation seek medical attention.

Eyes

Irrigate with plenty of water and seek medical attention if soreness continues.

Ingestion

Give water to drink and seek medical advice.

5. Fire fighting measures

No fire or explosive hazard.

6. Accidental release measures

Personal precautions

Wear a dust mask or respirator.

Environmental measures

No precautions required.

Method of cleaning

If possible, avoid dry sweeping, which generates dust. Vacuum dust where practical.

7. Handling and storage

Handling

The product should be handled in a manner that will minimise the generation of airborne dust.

Manual handling of the product should be avoided so far as is reasonably practical. Where this is not possible, an assessment should be made, taking into account the load, environment, task, and individual capability and training. Always employ good lifting techniques.

Storage

No restrictions.

8. Exposure controls/personal protection

Workplace Exposure limits

- Total Inhalable Nuisance Dust: 10.0 mg/m^3 (WEL)
- Total Respirable Nuisance Dust: 4.0 mg/m^3 (WEL)
- Respirable Crystalline Silica: 0.1 mg/m^3 (WEL).

All are given as maximum concentrations and expressed as an 8 Hour Time Weighted Average (8 Hr TWA).

Prevention measures

Use dust extraction and containment where possible.

Respiratory protection

Dust masks or respirators should be worn during handling and use of the product to accord with the relevant WEL listed above, particularly during drilling, cutting and sawing activities.

Protection of skin and eyes

Gloves or barrier cream, overalls and goggles should be worn during handling and use of the product.

Precast concrete products

9. Physical chemical properties

Appearance

Precast concrete products in a range of colours, sizes and finishes.

Other chemical properties

Not applicable

10. Stability and reactivity

Conditions and materials to avoid

Not applicable

11. Toxicological information

Natural aggregates contain a wide range of particle types and the behaviour, deposition, fate of and response to any particular particle after entry into the human respiratory system depends on their nature and size.

Respirable dust approximates to the fraction that penetrates to the gas exchange region of the lung and is associated with health effects.

12. Ecological information

No environmental hazard

13. Disposal considerations

Handling of any residues/waste products

As an inert material, an approved solid waste disposal or landfill site may be used. Do not burn shrink wrap or other packaging material.

14. Transport information

Special carriage precautions

Not applicable

15. Regulatory information

Not classified.

The following risk and safety phrases are, however, recommended:

- R48/20 Harmful: danger of serious damage to health by prolonged exposure through inhalation
- S22 Do not breathe dust.

16. Other information

Training advice

Wear and use PPE.

Employ good manual handling techniques.

Recommended uses

Industrial, domestic and public works

Further information sources

Aggregate Industries UK Limited
Charcon and Bradstone
Hulland Ward, Ashbourne
Derbyshire DE6 3ET

Tel. (01335) 372222
Fax. (01335) 372223

Sources of key data used to compile data sheet

EH40 2005 Workplace Exposure Limits (supplementary amendment 01 October 2006)

PPE Regulations 1992

Manual Handling Regulations 1992 (as amended)

COSHH Regulations 2002 (as amended)

COSHH (Amendment) Regulations 2004

Legal notice

Aggregate Industries
The complete service

Aggregate Industries is a leading player in the construction industry.
We produce and supply a wide range of construction materials including:

Aggregates

We supply crushed rock, sand and gravel, stone and fill materials for construction. These can be delivered by road, rail or marine transport. We also produce silica and specialist sands.

Tel: 01455 285200
Email: aggregates@aggregate.com

Asphalt

We are a leading supplier of a full range of coated materials with over 40 locations in the UK, serving major conurbations, including sites for collect business.

Tel: 0844 557 8396
Email: asphalt@aggregate.com

Commercial landscaping

Flag paving, block paving and kerb products are available in both concrete and natural stone. Surface water drainage products are also part of a wide ranging portfolio.

Tel: 01335 372222
Email: landscaping@aggregate.com

Overseas

Aggregate Industries Overseas supplies high quality aggregates to Europe from bases in the UK, Poland, Germany, Norway and Latvia.

Tel: 01530 512025
Email: overseas.sales@aggregate.com

Building products

We produce decorative masonry building blocks, reconstructed stone walling, architectural cast stone dressings and roofing slates.

Tel: 01285 646884
Email: building.products@aggregate.com

Contracting

We strengthen our construction materials portfolio through our involvement in infrastructure, surfacing and civil contracting works.

Tel: 01530 510066
Email: contracting@aggregate.com

Garden landscaping

Bradstone is one of the UK's leading ranges of natural and reconstituted stone paving, walling, edging and coping, block paving and decorative aggregates.

Tel: 01335 372222
Email: bradstone.garden@aggregate.com

Concrete

We offer a complete range of ready-mixed concretes and screeds, operating from over 70 sites. We also have an operation that caters for smaller collect loads.

Tel: 01283 714187
Email: concrete@aggregate.com

Cementitious materials

We import grey and white cement from Northern Europe and supply Fly Ash to ready-mixed, precast, mortar, screed and render companies.

Tel: 01530 512000
Email: cementitious@aggregate.com

Aggregate Industries, North End Farm Works,
Ashton Keynes, Wiltshire SN6 6QX

Tel: 01285 646811
Fax: 01285 646895

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