WAYS OF ACHIEVING COMPLIANCE WITH THE REQUIREMENTS

The building should be designed and constructed in accordance with the guidance contained in the following appropriate documents:

**England & Wales**

Approved Document A – Structure  
Approved Document B – Fire safety  
Approved Document D – Toxic substances  
Approved Document E – Resistance to passage of sound  
Approved Document F – Ventilation  
Approved Document G – Hygiene  
Approved Document H – Drainage  
Approved Document J – Combustion appliances and fuel storage systems  
Approved Document K – Protection from falling, collision & impact  
Approved Document L – Conservation of fuel and power  
Approved Document M – Access facilities for disabled people  
Approved Document N – Glazing  
Approved Document P – Electrical safety  
Approved Document 7 – Materials and workmanship

**Scotland**

Section 0: General  
Section 1: Structure  
Section 2: Fire  
Section 3: Environment  
Section 4: Safety  
Section 5: Noise  
Section 6: Energy

**Northern Ireland**

Part A: Interpretation and general  
Part B: Materials and workmanship  
Part D: Structure  
Part E: Fire safety  
Part F: Conservation of fuel and power  
Part G: Sound insulation of dwellings  
Part H: Stairs, ramps, guarding and protection from impact  
Part J: Solid waste in buildings  
Part K: Ventilation  
Part L: Combustion appliances and fuel storage systems  
Part N: Drainage  
Part P: Unvented hot water storage systems  
Part R: Access to and use of buildings  
Part V: Glazing
6.1 General

**Building Control (Amendment) Regulations 2014 (Ireland)**

Technical Guidance Document A – Structure
Technical Guidance Document B – Fire Safety
Technical Guidance Document D – Materials and Workmanship
Technical Guidance Document E – Sound
Technical Guidance Document F – Ventilation
Technical Guidance Document G – Hygiene
Technical Guidance Document J – Heat producing Appliances
Technical Guidance Document K – Stairways, Ladders, Ramps & Guards
Technical Guidance Document M – Parts 1, 2, 3 & 4
6.2 Materials

STORAGE AND USE OF MATERIALS

Position storage areas for maximum accessibility, ease of working and security. It is helpful to keep materials in their delivery packaging until required, thereby reducing the risk of units being used in the wrong location or for the wrong purpose and to help keep them dry and secure.

Use mechanical off-loading where possible as this will reduce the risk of handling damage and enable units to remain protected in identifiable packs.

Facing quality bricks and blocks should be handled carefully to avoid damage. Damaged bricks or blocks should not be built into facing work since cracks, chips and other defects will detract from the final visual quality of the wall and possibly cause inherent defects in the waterproof envelope.

Torn or split damp-proof course (DPC) materials and cavity trays must not be used as water may be allowed into the construction causing problems of dampness and possibly affecting the durability of some components.

Ensure that:

- Materials are stored on a dry and firm level site and at a safe handling height
- Materials are not stored on proposed positions of drives or access routes to the property
- Bricks and blocks are carefully stacked and covered to prevent them becoming saturated
- Different types of cement, bricks and blocks are stored separately and are clearly identified
- The use of materials such as cement are rotated so that the ‘oldest’ bags are used first
- Sand is placed on polythene or a similar membrane to avoid contamination. Barrier boards can be used to limit wastage
- Sands are stored separately according to type and premixed lime-sand (coarse stuff) is clearly identified

Tarpaulin or polythene protection against rain is advised.

Avoid:

- Tipping units e.g. from a dump truck
- Stacking units on wet or uneven ground
- Breaking open protective wrappings prior to use
- Storage of materials which cause uneven compression of the subsoil

Materials should be selected so that corrosive deterioration is minimised. If different metals are used in combination, particularly in humid locations, they should be chosen to be as close as possible in the electro-chemical series of metals so that galvanic action is unlikely to occur (not more than two metals apart in the list) e.g. use copper or galvanised nails with copper containing preservative treated timber. Some typical metals in the order they appear in the series are:

- Stainless steel
- Copper/Cupro-nickel
- Brass/Gunmetal
- Steel
- Aluminium
- Galvanized iron
- Zinc

If metals remote from each other in the series have to be used, adequate precautions should be taken to prevent their corrosive interaction.

All materials and equipment should be installed and commissioned as specified by the manufacturer.

Where indicated elsewhere in this Manual, materials and equipment should be type tested and approved by the specified independent authority.

Appliances and equipment should be selected that are suitable for the designed thermal loads, fluid flow rates and fluid pressures.
6.2 Materials

**BRICKS AND BLOCKS**

**Selection**

Bricks and blocks should be selected for their intended use, position and exposure depending upon:

- Durability
- Type
- Mortar

**Sulphates**

Sulphates can be present in the ground and carried to the construction by ground water or they can be present in certain types of brick.

The type of brick to be used will affect the specification of the mortar where there is a risk of saturation due to the lack of protection from roofs, copings, overhanging sills to openings and for elevations exposed to exceptionally severe wind driven rain.

Due to the presence of sulphates in designation “N” clay bricks to BS EN 772 (see table 6.01 for classification), Sulphate Resisting Portland Cement (SRPC) should be specified for the mortar when subject to saturation as described above. See table 6.02 for selection of bricks and notes on mortar in sulphate bearing soils.

Designation “L” clay bricks have sufficiently limited sulphate content so that SRPC is not necessary.

Clay bricks are not affected by sulphate bearing soils. Calcium silicate bricks and concrete bricks will not contribute to sulphate attack and Ordinary Portland Cement (OPC) is therefore satisfactory for the mortar above DPC level.

**Durability**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Frost Resistance</th>
<th>Soluble Salt content</th>
</tr>
</thead>
<tbody>
<tr>
<td>FL</td>
<td>Frost Resistant (F)</td>
<td>Low (L)</td>
</tr>
<tr>
<td>FN</td>
<td>Frost Resistant (F)</td>
<td>Normal (N)</td>
</tr>
<tr>
<td>ML</td>
<td>Moderately frost resistant (M)</td>
<td>Low (L)</td>
</tr>
<tr>
<td>MN</td>
<td>Moderately frost resistant (M)</td>
<td>Normal (N)</td>
</tr>
<tr>
<td>OL</td>
<td>Not frost resistant (O)</td>
<td>Low (L)</td>
</tr>
<tr>
<td>ON</td>
<td>Not frost resistant (O)</td>
<td>Normal (N)</td>
</tr>
</tbody>
</table>

Note: calcium silicate and concrete bricks contain no soluble salts. See table 6.02 for selection of bricks for different uses.

Table 6.01: Durability designations of clay bricks
### Table 6.02 – Selection of bricks

<table>
<thead>
<tr>
<th>use</th>
<th>brick type</th>
<th>notes on mortar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundation to dpc</td>
<td>Clay</td>
<td><strong>Class 3</strong> Strength &gt;20N/mm²</td>
</tr>
<tr>
<td>Foundation to dpc Sulphates in soils</td>
<td>Calcium Silicate*</td>
<td>Where sulphate levels are class 3 or higher use SR Portland cement</td>
</tr>
<tr>
<td>Un-rendered external walls protected from saturation</td>
<td>FL,FN,ML,MN**</td>
<td>Class 3 Strength &gt;7N/mm²</td>
</tr>
<tr>
<td>Un-rendered external walls not protected from saturation</td>
<td>FL,FN</td>
<td>Use sulphate resisting cement in mortar with type N clay bricks</td>
</tr>
<tr>
<td>Rendered external walls</td>
<td>FL,FN,ML, MN</td>
<td>Use sulphate resisting cement in mortar and render base coat with type N clay bricks</td>
</tr>
<tr>
<td>Copings, cappings, sills etc</td>
<td>FL,FN</td>
<td></td>
</tr>
<tr>
<td>Internal</td>
<td>FL,FN, ML, MN, OL, ON</td>
<td></td>
</tr>
<tr>
<td>Notes</td>
<td></td>
<td>* minimum class indicates a higher class (eg upto 7) is usually acceptable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>** if the site is wet or the masonry at or near the ground level may be subject to saturation the designation FL brick with SR cement</td>
</tr>
</tbody>
</table>

### Clay Bricks

BS EN 772 classifies clay bricks according to their frost resistance and soluble salt content (see table 6.01 for durability designation).

Use designation F clay bricks to BS EN 772 where brickwork may be saturated and subject to freezing and thawing. e.g: parapets, sills and very exposed sites shown in diagram 6.04 & table 6.02.

Use designation M clay bricks to BS EN 772 in the external wall providing measures, such as roof overhang or copings, have been taken into account by the designer to prevent saturation.

Do not use designation O clay bricks to BS EN 772 in external walls.

### Concrete Bricks

The frost resistance of concrete bricks is related to their compressive strength. Concrete bricks of not less than 7 N/mm² may be used in external walling protected from saturation.

Concrete bricks with a strength of not less than 15 N/mm² are required if the work is subjected to saturation and freezing.

A strength of not less than 20 N/mm² is required for concrete bricks used below DPC.

Concrete bricks of not less than 30 N/mm² should be specified for a capping course.

### Calcium Silicate Bricks

Use Class 3 calcium silicate bricks in external walls except for sills and brick-on-edge copings, when a Class 4 or higher should be used.
6.2 Materials

Concrete Blocks

Where concrete blocks are to be used externally without a rendered finish or placed below DPC level reference should be made to the manufacturer for their suitability. Blocks should have been tested for their use in such locations.

Most blocks may also be used in the outer leaf above DPC when rendered – check with the manufacturer to ensure that the material is adequately durable. Low density aircrete units (usually less than 480 kg/m$^3$) are not usually suitable for use in the external leaf.

Colour Variation

As a matter of good practice, mix facing bricks or “all through range” (ATR) bricks from a minimum of three different packs to prevent colour banding of brickwork.

On large schemes (eg multiple units or large expanses of brickwork in high rise structurers) liaise with the manufacturer or supplier to ensure consistent colour/texture quality.

Use only fresh mortar mixed in the correct proportions and do not vary mix proportions as this will lead to incorrect strengths and colour variations. Changes in the supply of mortar materials may also lead to colour variation. Where possible utilise bulk sand/mortar storage systems and processes so as to avoid site mixing.

Avoid the use of pigments in mortar unless you are confident of consistent batching. As an alternative a coloured sand may avoid the need for pigments. Ensure that a consistent joint width is used – normally 10mm (nominal) and that the bed joints and cross joints (perps) are completely filled.

Joints

Perpends should be a minimum 5mm and a maximum 20mm, and bed joints a minimum 7mm and a maximum 13mm.

Frogs

Frogged bricks have a depression in the face of the brick. Normally they should be laid with the major depression or frog facing up so that it is fully filled with mortar during laying. This ensures optimum strength and helps to increase the mass of the wall (to give good sound insulation) and prevents the possibility of standing water within the structure which could freeze. Bricks with a directional surface texture are intended to be laid frog up.

Bricks should only be laid frog down when specified by the Designer and with the approval of BZSS’s appointed Technical Auditor.

Perforated Bricks

Care should be taken with the use of any form of perforated bricks especially where the exposure rating of the wall is high, or works stop for an extended period of time, as water retention/collection has been found to exist in the perforations.

Efflorescence

Efflorescence is a white deposit on the face of masonry brought about by water moving through the wall dissolving soluble salts and depositing them on the face of the brick when the water evaporates during drying out. Efflorescence is best prevented by:

- Keeping all units dry prior to use.
- Protecting the head of newly constructed work with some form of cover to prevent saturation (See diagram 6.03).

Protection During Construction

All new masonry work should be protected during construction by covering, so that walls are not allowed to become saturated by rainwater, dry out too quickly in hot weather and to protect against frost attack. (See diagram 6.03).

Unnecessary wetting will increase the risk of efflorescence, lime staining and movement problems. Care will need to be taken to ensure that any cover does not drape into fresh mortar or disturb the bond of the units.

It may be necessary to provide temporary propping to gable or other walls/partitions etc. prior to roof construction.

When a floor or roof slab of a building is used for the temporary storage of building materials the loading should not exceed the design loading for the element.
6.2 Materials

FROST EXPOSURE

See diagram 6.04. The shaded areas meet the meteorological criteria for severe exposure. For identification of these areas by postcode district, see table 6.05.

Buildings within these areas which are situated on top of, or on the slopes of, locally high ground or on a locally high plateau, and have an open aspect with no protection from adjacent trees, buildings or topographical features are subject to exceptionally severe exposure to frost conditions and require frost resistant brick work.

Note: Northern Ireland has been assessed as an area of normal exposure to frost attack. Therefore domestic buildings in Northern Ireland will not require frost restraint brickwork.
Diagram 6.04: Map showing areas where there is a risk of severe exposure to frost attack.
### 6.2 Materials

#### Table 6.05: showing postcode districts wholly or partially within the severe exposure from the map in table 6.04

<table>
<thead>
<tr>
<th>KW</th>
<th>KY</th>
<th>LA</th>
<th>LD</th>
<th>LL</th>
<th>MM</th>
<th>ML</th>
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<th>SA</th>
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<th>ST</th>
<th>SY</th>
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<th>TS</th>
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<td>26</td>
</tr>
</tbody>
</table>

**Part 6 Superstructure**
6.3 External Walls – Masonry

BRICKS AND BLOCKS

Straightness on Plan

± 10mm maximum deviation in any length of wall up to 5m

Level of Bed Joint

± 10mm maximum deviation for walls 5m long
± 15mm maximum deviation for walls 5-10m long
± 25mm for walls over 10m long

Thickness of Bed Joint

± 5mm (average over 8 joints)

Plumb of Wall - Overall Height

± 20mm in overall height of wall

Plumb of Wall - Storey Height

± 10mm max deviation in a storey height, approximate 2.5m
± 20mm in total height

Straightness in Section

± 10mm max deviation in any 2.5m height of wall

Mortar

Mortar type above DPCs should be chosen in accordance with guidance given in table 6.06, or otherwise as recommended by the brick or block manufacturer.

The addition of lime and/or air entraining plasticisers to cement or the use of masonry cement produces mortars with the correct balance of workability, strength and durability. Cement and sand alone should not be used unless a strong mix is specifically required by the design.

BATCHING

Keep batching and mixing equipment clean to avoid contamination with materials used previously. Mortar should be mixed by machine (e.g. tilting drum mixer) or use ready-mixed retarded mortars. Accurately proportion materials using a gauge box or buckets.

MIXING OF MORTAR

Add water with care - start with about 1/4 of estimated quantity of water needed.

When mixing by machine load about 3/4 of the sand or premixed lime/sand and water. Continue mixing and gradually add cement and/or lime if appropriate. Then load the remainder of sand or premixed lime/sand and further water to achieve required workability.

Mortar should be carefully and consistently proportioned then thoroughly mixed using a mechanical mixer, except for very small quantities. Accurately proportion materials using a gauge box or bucket. Do not use a shovel.

Where possible utilise bulk sand/mortar storage systems and processes so as to avoid site mixing.

Ensure that mortar proportions are in accordance with the manufacturer’s recommendations for the type of masonry unit to be laid and the degree of exposure.

Following initial production, nothing should be added to mortar except for clean water to maintain consistency.

Mortar should not be ‘knocked up’ after it has started to set.
Air-entraining or other admixtures should be used only when approved by the designer and then according to manufacturer’s instructions.

Do not use strong mortar for blockwork above DPC level (1:4 cement : sand or equivalent is too strong) (See table 6.06).

General purpose mortar (see BRE Digest 362) can be used internally and externally regardless of sand type. A mortar mix by volume of 1:1.5 (Portland cement/lime/sand) with an air-entraining plasticiser is deemed suitable.

Sulphate resisting cement should be used where groundwater sulphate can reach the masonry or where clay bricks with a sulphate content (N designation BS EN 772) are used externally and are likely to be subject to a high risk of saturation.

<table>
<thead>
<tr>
<th>Use</th>
<th>Designation</th>
<th>Proportions by volume</th>
<th>Minimum compressive strength of site-mixed mortars at 28 days in N/mm² (CEN standards in brackets)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortar for internal and external use above DPC</td>
<td>(iii)</td>
<td>1:1.5-6</td>
<td>1:5-6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1:4.5</td>
<td>2.5 (M 2.5)</td>
</tr>
<tr>
<td>General purpose mortar to BRE Digest 362</td>
<td></td>
<td>Air entrained with plasticiser Portland cement:lime:sand 1:1.5 by volume</td>
<td>2.5 (M 2.5)</td>
</tr>
<tr>
<td>High density mortar for:</td>
<td>(ii)**</td>
<td>1* : 5 : 4-4%</td>
<td>1* : 3-4</td>
</tr>
<tr>
<td>a. use below or near external ground level</td>
<td></td>
<td></td>
<td>1* : 2½ : 3½</td>
</tr>
<tr>
<td>b. in parapets &amp; chimneys</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. external walls with a high risk of saturation due to severe exposure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If type N clay bricks are used, or for all chimneys, use sulphate resisting cement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low permeability jointing mortar for:</td>
<td>(i)**</td>
<td>1 : 3</td>
<td>Use a Type S sand to BS1200:2005</td>
</tr>
<tr>
<td>a. coping, cappings and sills</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. jointing impervious ceramic unit in drainage systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loadbearing masonry designed to BS EN 1996-1-2:2005</td>
<td></td>
<td>Air entrained with plasticiser portland cement : lime : sand</td>
<td>As specified</td>
</tr>
</tbody>
</table>

Table 6.06: Recommended mortars for different uses

Cold Weather Working

Precautions should be taken when necessary to maintain the temperature of bricks, blocks and mortar above 3° C.

The use of anti-freeze as a frost resistant additive in mortar is not permitted.

Hot Weather Working

During prolonged periods of hot weather when masonry units can become very dry, absorbent clay bricks may be wetted to reduce suction. Low absorption bricks (e.g. engineering bricks) should not be wetted. For calcium silicate and concrete units the mortar specification may need to be changed in order to incorporate an admixture to assist with water retention. On no account should masonry units or completed work be saturated with water.
STRUCTURAL DESIGN OF EXTERNAL, SEPARATING AND COMPARTMENT WALLS

The design of an external, separating or compartment wall depends upon a number of criteria, including the following:

- Construction
- Location
- Height
- Length
- Thickness
- Strength

Table 6.07 provides a reference guide for use of masonry in domestic situations up to 3 storeys in height. (This table is based on an interpretation of Approved Document A.) Further guidance for wall design may be obtained from Approved Document A of Building Regulations and BS 8103-2:2005.

<table>
<thead>
<tr>
<th>Construction</th>
<th>Location</th>
<th>Height</th>
<th>Length</th>
<th>Thickness</th>
<th>Strength (min)***</th>
</tr>
</thead>
</table>
| Cavity* (brick/block) | External, separating and compartment walls | >3.5m | ≥12m | <190mm | 2 Storey dwelling**
| | | >3.5m ≥9m | ≥9m ≥12m | <190mm | All walls brick 5N/mm², block 2.8 N/mm² |
| | | >9m ≥12m | >9m | <190mm from the base for the full height of the storey and then <190mm onwards | 3 storey dwelling**
| | | >9m ≥12m | >9m | <190mm from the base for the full height of two storeys and then <190mm onwards | External walls: (foundations to eaves – outer leaf) brick 7N/mm², block 7N/mm² |
| | | >3.5m ≥9m | >9m | <190mm from the base for the full height of two storeys and then <190mm onwards | External walls: (foundations to u/s of first floor – inner leaf) – brick 15N/mm², block 7N/mm² |
| | Internal load bearing walls | (thickness as above) | ≥5mm but a min of 140mm on the lowest storey of a 3 storey house | 2 Storey dwelling**
| | Internal load bearing walls | ≥5mm but a min of 140mm on the lowest storey of a 3 storey house | 2 Storey dwelling**
| | Solid (coursed) | as above but at least 1/16 (0.0625) of storey height | **Where the storey heights (u/s of floor to ceiling above) exceeds 2.7m the brick/block strength shall be a min 7N/mm²**
| | Solid (uncoursed) | at least 1.33 x thickness given for solid walls above | All other load bearing walls first floor and above brick 5N/mm², block 2.8N/mm² |
| | Stone, flint etc | 2 Storey dwelling**
| | | Above first floor level-brick 7N/mm², block 7N/mm² |
| | | Internal load bearing walls (foundations to u/s of first floor) brick 7N/mm², block 7N/mm² |

Notes:
1. The minimum thickness of any leaf or single skin wall to be 90mm
2. For restrictions on openings in walls see Approved Document A of the Building Regulations
3. Cavity wall width is given by the combined thickness of the two leaves plus 10mm
4. Where the storey heights (u/s of floor to ceiling above) exceeds 2.7m the brick/block strength shall be a min 7N/mm²
5. Where the roof is of timber construction

Table 6.07: Reference guide for the use of masonry in domestic situations of up to 3 stories in height

Detached Garages and Similar Outbuildings

The guidance detailed below for avoiding disproportionate collapse applies in the following circumstances:

- The floor area is more than 10m² but does not exceed 36m²
- The walls are at least 90mm thick, solidly constructed of brick or blockwork having a mass of at least 130kg/m²
- The maximum length or width of the building does not exceed 9m
- Access to the roof is only for repair and maintenance
- The only lateral loads are wind loads.
- The height of the building does not exceed the dimensions shown on diagram 6.08
- The roof is braced at rafter level, horizontally at eaves level and at the base of any gable by roof decking, rigid sarking or diagonal bracing
- Walls should be tied to the roof structure (See diagram 6.09 and 6.13)
- One or two major openings not more than 2.1m in height are permitted in one wall only. The width of a single opening or the combined width of two openings should not exceed 5m. The only other opening permitted is for windows and single leaf doors. (See diagram 6.11)
Disproportionate Collapse

Buildings should be sufficiently robust to sustain a limited and proportionate level of damage in the event of accident or failure without causing collapse. (See diagram 6.12). The extent and limitations that should be designed for are defined by the classification and/or building type and use.

a. Determine the building class from table 6.10.

b. For Class 1 buildings - Provided the building has been designed and constructed in accordance with the rules given in Approved Document A, no additional measures are likely to be necessary.

For Class 2A buildings – Provide effective horizontal ties, or effective anchorage of suspended floors to walls, as described in the Codes and Standards for framed and load-bearing wall construction as defined in Approved Document A.

For Class 2B buildings – Provide effective horizontal and vertical ties for framed and load-bearing wall construction in all supporting columns and walls, or alternatively, check that upon the notional removal of each supporting column and each beam supporting one or more columns, or any nominal length of load-bearing wall (one at a time in each storey of the building), the building remains stable and the area of floor of any storey at risk of collapse does not exceed 15% of the floor area of that storey or 70m², whichever is smaller, and does not extend further than the immediate adjacent storeys (See diagram 6.12). Where the notional removal of such columns and lengths of walls would result in an extent of damage in excess of the above limit, then such elements should be designed as a "key element" as defined in Approved Document A.

For Class 3 buildings – A systematic risk assessment of the building should be undertaken taking into account all the normal hazards that may reasonably be foreseen, together with any abnormal hazards.

Critical situations for design should be selected that reflect the conditions that can reasonably be foreseen as possible during the life of the building. The structural form and concept and any protective measures should then be chosen and the detailed design of the structure and its elements undertaken in accordance with the recommendations given within the Technical Manual and Approved Document A.
### Table 6.10: Building types and occupancy

<table>
<thead>
<tr>
<th>CLASS</th>
<th>BUILDING TYPE AND OCCUPANCY</th>
</tr>
</thead>
</table>
| 1     | Houses not exceeding 4 storeys.  
Agricultural buildings  
Buildings into which people rarely go, provided no part of the building is closer to another building, or area(s) where people do go, than a distance of 1.5 times the building height |
| 2A    | 5 storey occupancy houses  
Hotels not exceeding 4 storeys  
Flats, apartments and other residential buildings not exceeding 4 storeys  
Offices not exceeding 4 storeys  
Industrial buildings not exceeding 3 storeys  
Retailing premises not exceeding 3 storeys of less than 2000m$^2$ floor area in each storey  
Single storey educational buildings  
All buildings not exceeding 2 storeys to which members of the public are admitted and which contain floor areas not exceeding 2000m$^2$ at each storey |
| 2B    | Hotels, flats, apartments and other residential buildings greater than 4 storeys but not exceeding 15 storeys  
Educational buildings greater than 1 storey but not exceeding 15 storeys  
Retailing premises greater than 3 storeys but not exceeding 15 storeys  
Offices not exceeding 3 storeys  
Hospitals greater than 4 storeys but not exceeding 15 storeys  
All buildings to which member of the public are admitted which contain floor areas exceeding 2000m$^2$ but less than 5000m$^2$ at each storey  
Car parking not exceeding 6 storeys |
| 3     | All buildings defined above as Class 2A and 2B that exceed the limits on area and/or number of storeys  
Grandstands accommodating more than 5000 spectators  
Buildings containing hazardous substances and/or processes |

**Note 1** For buildings intended for more than one type of use the class should be that pertaining to the most onerous type.

**Note 2** In determining the number of storeys in a building, basement storeys may be excluded provided such basement storeys fulfil the robustness requirements of Class 2B buildings.
6.3 External Walls – Masonry

Diagram 6.11: Size and location of openings

Notes
1. Major opening should be restricted to one wall only. Their aggregate width should not exceed 5.0m and their height should not be greater than 2.1m.
2. There should be no other openings within 2.0m of a wall containing a major opening.
3. The aggregate size of openings in a wall not containing a major opening should not exceed 2.4m².
4. There should not be more than one opening between piers.
5. Unless there is a corner pier the distance from a window or a door to a corner should not be less than 390mm.

Diagram 6.12: Area at risk of collapse in the event of an accident
Diagram 6.13: Lateral support at roof level
Corbelling

The extent of corbelling of masonry should not exceed that indicated in diagrams 6.14 and 6.15 unless supported or reinforced.

Diagram 6.14: Corbelling section through solid walling

Diagram 6.15: Corbelling section through cavity walling

Bonding at Internal Wall

Bonded walls in brickwork are comparatively easy to construct but with blockwork this can be more difficult. Either tooth every alternative course (See diagram 6.16) or butt and tie (See diagram 6.17).

Where blocks are of a different density a butted joint should always be used (on party walls carry the separating wall through and butt up the inner leaf using a proprietary bed joint reinforcement or suitable ties at each block course).

Diagram 6.16: Bonded walls

Diagram 6.17: Butted and tied walls
6.3 External Walls – Masonry

**Wall Ties**

**TYPES**

It is important to use ties to BS EN 845-1:2003+A1:2008 or to provide independent Third Party certificates acceptable to BZSS’s Appointed Technical Auditor to confirm that the ties used have adequate durability and are fit for purpose.

Normally it is the structural requirements of the cavity wall, the cavity width and any insulant to be used, which dictates the type of tie to be used. The main types are shown in diagram 6.19. All ties should have a minimum embedment of 50mm, ensure that the drip is in the centre of any clear cavity and the tie is laid to a slight fall to the outer leaf. (See table 6.18).

Ties fitted with retained discs or rods are used to hold partial fill insulation in place within the cavity. It is important to note that only BS EN 845-1:2008+A1:2008 type wall ties or specifically manufactured (and tested) party wall ties are permitted in cavity separating walls between dwellings to reduce the transfer of sound.

<table>
<thead>
<tr>
<th>Normal cavity width (mm) (note 1)</th>
<th>Tie length (mm) (note 2)</th>
<th>Tie shape in accordance with BS EN 845-1*</th>
<th>BS EN 845-1 tie (note 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 - 75</td>
<td>200</td>
<td>Double triangle or vertical twist</td>
<td>Types 1, 2, 3 or 4 to DD 140-2* &amp; selected on the basis of the design loading and cavity width</td>
</tr>
<tr>
<td>76 - 90</td>
<td>225</td>
<td>Double triangle or vertical twist</td>
<td>BS 1234 and DD 140-2 was withdrawn on 1/2/2005. The tie user classes (types) given in Tables 1 &amp; 3 of the documents can be used</td>
</tr>
<tr>
<td>91 - 100</td>
<td>225</td>
<td>Double triangle (note 3) or vertical twist</td>
<td></td>
</tr>
<tr>
<td>101 - 125</td>
<td>250</td>
<td>Vertical twist</td>
<td></td>
</tr>
<tr>
<td>126 – 150</td>
<td>275</td>
<td>Vertical twist</td>
<td></td>
</tr>
<tr>
<td>151 – 175</td>
<td>300</td>
<td>Vertical twist</td>
<td></td>
</tr>
<tr>
<td>176 - 300</td>
<td>(see note 2)</td>
<td>Vertical twist style</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Where face insulated blocks are used the cavity width should be measured from the face of the masonry unit.
2. The embedment depth of the tie should not be less than 50mm in both leaves. For cavities wider than 180mm calculate the length as the structural cavity width plus 125mm and select the nearest stock length.
3. Double triangle ties of this shape having a strength to satisfy Type 2 of DD 140-2*, are manufactured. Specialist tie manufacturers should be consulted if 225mm long double triangle format ties are needed for 91 to 100mm cavities.
4. Where BS N 845-1 ties are used reference needs to be additionally made to DD 140-2* for the selection of the type (i.e. types 1, 2, 3 or 4) relevant to the performance levels given in DD140-2

Table 6.18: Cavity Wall ties

**DURABILITY**

Stainless steel wall ties should always be used.

Diagram 6.19: Main types of wall ties
6.3 External Walls – Masonry

RIGIDITY

Where lightweight aggregate or autoclaved aerated concrete blocks are used in one leaf, do not use a rigid tie which will inhibit differential movement. A butterfly tie or a double triangle tie will usually be suitable in a cavity up to 75mm (a heavier grade of double triangular tie is available for cavities up to 100mm). A vertical twist tie can be used for a cavity between 75-150mm. Other ties may also be acceptable subject to the provision of independent Third Party certificates acceptable to Build-Zone.

SPACING

For walls with a structural cavity between 50 and 150mm (where neither leaf is less than 90mm thick), ties should be spaced not more than 900*mm horizontally and 450mm centres vertically and evenly distributed. Ties are placed at maximum 300mm centres vertically at reveals and movement joints. See diagram 6.19 for wall tie types and cavity width limitations.

*Note the Building Regulations require a reduced spacing of 750mm centres horizontally where cavity width exceeds 75mm.

Place cavity ties in a staggered pattern as shown in diagram 6.20. However, where a partial fill insulation system is being employed a regular pattern as shown in diagram 6.21 may be necessary, depending upon the system used.

Diagram 6.20: Normal positioning of wall ties

Diagram 6.21: Wall tie positions for a partial fill insulation board
6.3 External Walls – Masonry

**Restraint**

**STRUCTURAL CONNECTIONS**

Joist hangers should be appropriate for the strength of the masonry, the size of the joist and the load to be supported.

**JOIST HANGERS**

Joist hangers may be either of the standard joint fixing type (See diagram 6.22) or of the restraint type (See diagram 6.23).

Always support the hanger on a full masonry block not on a cut block.

![Diagram 6.22: Standard joist hanger](image)

![Diagram 6.23: Restraint type joist hanger](image)

Do not use hangers marked for use with a particular strength of block on a block of a lower strength. The joist width should be equal to the width of the hanger and not more than 10mm deeper than the hanger. Do not cut down the width of the joist to fit a hanger. (See diagram 6.24).

If the coursing requires adjustment to achieve the designed joist height make the adjustment at the course below the one supporting the hanger. The adjustment block must be of similar strength and thermal performance. Do not pack up between the joist and its bearing surface on the hanger. (See diagram 6.25).

![Diagram 6.24: Incorrect installation of joist hangers](image)

![Diagram 6.25: Installation of joist hangers](image)
6.3 External Walls – Masonry

Ensure that:

- The hanger is bedded directly on the masonry and there is no gap between the hanger back-plate and the face of the masonry
- At least 450mm of masonry should be provided above the hanger
- Hangers are spaced at centres of floor joists included in the design
- The hanger is suitable for the loadings and masonry strength

Do not:

- Apply load while the mortar is still green and has not gained sufficient strength
- Use brick courses in block walls under joist hangers - the thermal insulation of the wall may be reduced unless similar units to the blocks are used

The guidance on connections given in this Manual relates to work on site.

Floors including timber, block and beam, and roofs should provide lateral restraint to all walls running parallel to them, by means of 30 x 5mm galvanized or stainless steel restraint straps at 2.0m centres (See diagrams 6.30 and 6.31).

Straps need not be provided to floors at, or about, the same level on each side of a supported wall and at the following locations:

- Timber floors in 2 storey dwellings where:
  1. joists are at maximum 1.2m centres and have at least 90mm bearing on supported walls or 75mm bearing on a timber wall plate
  2. joists are carried by the supported wall via restraint type joist hangers as described in BS 5268-7.1:1989 (See diagram 6.23)
- Concrete floors with minimum 90mm bearing on supported wall

Diagram 6.26: The use of joist hangers with steel beam
JOIST HANGERS ON STEEL BEAMS

Use only heavy-duty hangers. If standard or restraint hangers are to be used, there must be at least 450mm of masonry above. Joists can be hung up to half their depth below the beams lower flange provided they are packed as shown.

Ensure shrinkage will not cause the packing to become dislodged (see diagram 6.26).

Stirrup hangers can be used where the load on either side is approximately equal. Masonry above is not generally required.

Vertical strapping securely fixed to a suitable wall plate at least 1.0m in length should be provided at maximum 2.0m centres at eaves level to roofs except where the roof:

- has a pitch of 15° or more and
- is tiled or slated and
- is of a type known to resist wind gusts and
- has main timber members spanning onto it at a maximum of 1.2m centres

Wall straps should be corrosion resistant, correctly positioned, blocked out and built into the masonry as the work proceeds (See diagram 6.27 & 6.31).

Where a standard hanger is used as shown in diagram 6.22 and lateral restraint is required to this wall then a strap should be installed at max 2m centres (see diagram 6.30). Where timber engineered joists are used then the strap should be fixed to the sides of the flanges (see diagram 6.28).

Straps that are only 1.2mm can be fitted to the top of joists without the need to notch (see diagram 6.29).

Diagram 6.27: 30mm x 5mm bent and twisted galvanised mild steel straps — for solid timber joists
6.3 External Walls – Masonry

Diagram 6.28: Simpson Strong Tie “hi load” two part strap – for engineered or solid timber joists

Diagram 6.29: Cullen PST (Parallel Strap Top longitudinal strap – for engineered or solid timber joists

Diagram 6.30: Lateral restraint to gable and separating wall
6.3 External Walls – Masonry

Movement Control

Vertical movement joints should be provided to the outer leaf of cavity walls as indicated in table 6.32. Where the finished ground level is 600mm or greater below the horizontal DPC then the movement joint should be continued within the external leaf of the substructure. The DPC should be lapped a minimum 100mm to accommodate any movement.

Movement joints below the DPC should also be provided at major changes in foundation levels and at changes in foundation design. Wall ties at maximum 300mm centres should be provided each side of movement joints. Slip ties in the outer leaf are not required. A compressible filler such as polyurethane foam should be used to form the joint and be sealed to prevent water penetration. Fibreboard or cork are not acceptable materials for forming movement joints in masonry.

<table>
<thead>
<tr>
<th>Material</th>
<th>Nominal Spacing</th>
<th>Joint Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay Brickwork</td>
<td>12m (spacing up to 15m may be possible if sufficient restraint is provided – consult project designer)</td>
<td>15mm</td>
</tr>
<tr>
<td>Calcium Silicate &amp; concrete brickwork</td>
<td>7.5m – 9m</td>
<td>10mm</td>
</tr>
<tr>
<td>Concrete blockwork (used in outer leaf)</td>
<td>6m</td>
<td>10mm</td>
</tr>
<tr>
<td>Stone*</td>
<td>12m</td>
<td>15mm</td>
</tr>
</tbody>
</table>

Note: for further information refer to the relevant section of this document. It is not normally necessary to provide movement joints to the internal leaf of cavity walls but should be considered where rooms occur with unbroken lengths of wall in excess of 6m.

The first joint from a return should be no more than half the dimension indicated in the table. Movement joints are not acceptable in solid party or separating walls, however where a cavity wall construction is adopted, offset movement joints with a slid rubber compressible strip or accepted fire stop may be acceptable.

Table 6.32: Spacing of vertical movement joints
**Bed Joint Reinforcement**

Tramline or similar bed joint reinforcement can be used in calcium silicate brick, concrete brick and blockwork external walls to control the risk of shrinkage cracking to resist stresses around window openings if required by design (See diagram 6.33). Stainless steel or other materials approved by Build-Zone should be used for bed joint reinforcement. To ensure suitability of the product contact the manufacturer. Elastic sealants (type E) are suitable as they allow for reversible movement.

Where a back-up material is used to control the sealant depth it will also need to provide a compressible space into which the sealant can deform. The following must be considered:

- The material is compatible with the sealant
- It will not adhere to the sealant thus preventing cracking within the sealant
- Provides sufficient density to allow the sealant to be applied
- Allows sufficient flexibility so as to not impede lateral movement (compressible to about 50% of its original thickness)

Fibreboard is not acceptable for this purpose.

![Diagram 6.33: Elevation showing typical use of bed joint reinforcement around openings in calcium silicate and concrete masonry](image)

**Lintels and beams**

**BEARING LENGTH**

Use the correct length and width of lintel for the opening and cavity width. The bearing length should be at least 150mm (this may be reduced to 100mm with some concrete lintels – check with designer/manufacturer).

Do not let masonry overhang lintels by more than 25mm (See diagram 6.34).

Continuity of masonry bond should be maintained at supports to beams and lintels (See diagram 6.35).

Ensure adequate end and intermediate (if applicable) support to hollow pressed steel lintels. This can be a problem where narrow or slender piers are proposed (See BS EN 1996-1-1:2005, BS EN 1996-2:2006 & BS EN 1996-3:2006 for further guidance).

Concrete pre-stressed lintels may need temporary strutting in the centre. Use correct size and type of pad stones to spread the load if specified in the design.

Do not:

- Support lintels and beams on short lengths of cut block and/or make up pieces
- Apply load to the lintels or beam before the masonry supporting it has hardened
TIMBER LINTELS

The use of timber lintels is not acceptable in any circumstances unless another structural lintel is provided above. To prevent the possibility of moisture ingress when the timber shrinks please refer to diagram 6.36.

Diagram 6.34: Do not let masonry overhang more than 25mm

Diagram 6.35: Lintels bearing onto masonry
Cavity Trays & Weepholes

CAVITY TRAYS

Cavity trays, associated weep holes and stop ends prevent the build up of water within a cavity wall thus allowing water to escape through the outer leaf. They are used in conjunction with lintels above openings, to protect the top surface of cavity insulation, at horizontal cavity barriers and where the cavity is bridged e.g. by projecting concrete floor units (See diagram 6.37).

- Cavity trays are to be provided:
  1. at all interruptions which are likely to direct rainwater across the cavity, such as rectangular ducts, lintels and recessed meter boxes
  2. above cavity insulation which is not taken to the top of the wall, unless that area of wall is protected by impervious cladding (See diagram 6.38)
  3. above lintels in walls in exposure zones 3 & 4 (see diagram 6.77) and in zones 1 & 2 where the lintel is not corrosion-resistant and not intended to function as its own cavity tray
  4. continuously above lintels where openings are separated by short piers (See diagram 6.40)
  5. above openings where the lintel supports a brick soldier course
- Cavity trays to rise at least 150 mm from the outer to the inner leaf, be self-supporting or fully supported, and have joints lapped and sealed. (See diagram 6.39 and 6.44).

WEEPHOLES

- Weep holes should be installed at not more than 900 mm centres to drain water from cavity trays and from the concrete cavity infill at ground level. When the wall is to be cavity filled, it is advisable to reduce this spacing.
- At least two weep holes should be provided to drain cavity trays above openings.
- Provide means of restricting the entry of wind driven rain through weep holes in walls in exposure zones 3 and 4, including at ground level.
**STOP ENDS**

Cavity trays should have watertight stop ends to prevent water from running into the adjacent cavity (See diagrams 6.40 and 6.41).

Stop ends need to be bonded to the cavity tray material or clipped to the lintel such that a stop to the structural cavity of at least 75mm high is provided. Normally the stop-end is located to coincide with the perpend nearest to the end of the cavity tray. Stop ends can be formed by sufficiently turning up the end of a DPC tray into the perpend joint.

Surplus mortar should be removed from cavities and wall ties cleared of mortar droppings and debris as the work proceeds. Mortar should be removed from the tops of insulation batts as the cavity construction is progressed.

Ring beams or floor slabs which partially bridge the cavity (e.g. when dimensional accuracy cannot be guaranteed) should be protected by a continuous cavity tray, especially when full cavity insulation is employed (See diagram 6.37).

Diagram 6.37: Use of cavity tray to protect ring beam which protrudes into the cavity

Diagram 6.38: Cavity Trays – above insulation
Steps and Staggers

Particular care is required to prevent the ingress of water at roof level in a terrace of dwellings with steps and/or staggers or any building where there is a change in height. It is preferable that a proprietary cavity tray system be used or where this is not possible, a suitable tanking system utilised.

Stepped cavity trays are required at all pitched (stepped) roof abutments with external cavity walls e.g. attached garages or staggered terraces. The bottom (last) cavity tray must be supplied with two stop ends and an associated weep hole, allowing all water to escape over the lower roof covering (See diagram 6.42). It is good practice and therefore preferable that stepped cavity trays are installed as the build progresses and not retrospectively fitted.
For brickwork, blockwork and stonework, lead cover flashings should be linked into the cavity tray (lapped in below). Small gables should be constructed with a cavity. It may be impractical to build the inner leaf in masonry. In these cases it is acceptable to provide a "timber frame" construction (see diagram 6.45 for details). With blockwork, in particular rendered blockwork, and stonework this is more difficult and care must be taken in detailing and construction to avoid a path for water ingress.

Diagram 6.42: Stepped cavity tray detail at roof/cavity wall abutment (brick/blockwork but equally applied to stone work)
Diagram 6.43: Cavity and stop end profiles above lintels

Diagram 6.44: Minimum dimensions for cavity tray
**Other Perforations/Penetrations of the Building Envelope**

Proprietary elements such as ventilators, soil pipes, etc. which perforate the building envelope should be installed and sealed to prevent ingress of moisture or vermin in accordance with the manufacturer’s instructions. Any perforation should not impact on the distribution of loads above openings such as doors and windows.

**Small Gables**

Small gables should be constructed with a cavity. It may be impractical to build the inner leaf in masonry. In these cases it is acceptable to provide a “timber frame” construction. See diagram 6.45 for details.

External meter boxes should be of a type approved by the service supply authority and provided with a cavity tray and a vertical DPC between the back of the box and the wall.

![Diagram 6.45: typical small gable timber frame](image)

**INDEX**

1. Sheathing board fixed to rafters
2. Sarking felt or breathable membrane
3. Cavity
4. Timber frame, fix wall ties to studs and rafters
5. Cavity tray
6. Weepholes

*Diagram 6.45: typical small gable timber frame*
CHIMNEYS

If a chimney is not provided with adequate support by ties or securely restrained, its height (measured to the top of the chimney) should not exceed 4.5 x its least horizontal dimension, when measured from the highest point of intersection with the roof surface (density of masonry must be minimum 1500kg/m³) (See diagram 6.52).

Chimneys and Flues

Ensure that all gas flues terminate to the open air i.e. flue blocks must terminate at an appropriate ridge vent or similar even where no appliance is fitted prior to the sale/occupancy of the property. To demonstrate that flues comply with Building Regulations, reports showing flues have passed appropriate tests need to be drawn up and made available to the Building Control Body and BZSS’s appointed Technical Auditor. A suggested checklist for these reports and detailed guidance on testing is given in Approved Document J.

Special blocks are made to accommodate gas fire flues which tend to be slightly thicker than normal units. When used in external walls, care should be taken not to reduce the clear cavity width below 50mm.

Typical chimney positions, DPC and flashing details are shown in diagrams 6.46 – 6.54.

Ensure:

- If the chimney is in a severe exposure zone the cavity should extend around the outside of the stack and be continuous up to roof level as per BS EN 1996 -1-2:2005 Part 3: 2003. Where the chimney breast is gathered in, the lower projecting masonry should be protected with a suitable capping and cavity trays.
- A 50mm cavity at the back of the chimney breast must be maintained to prevent rainwater penetration.
- Flue liners must be used as specified with sockets uppermost and jointed with fire resisting mortar. Flue liners should be:
  - non-combustible
  - reasonably smooth internally
  - correctly jointed with mortar with the space between the liners and the brickwork filled with weak insulating concrete unless the manufacturer recommends an alternative specification
  - properly jointed at the junctions with the starter block or lintel and outlet terminal.
- A notice plate containing safety information about any hearths and flues should be securely fixed in an unobtrusive but obvious position within the home.
- Where a chimney forms part of a wall, the foundation should project at least 100mm wider than the chimney base and should be the same depth as the adjacent wall foundation.
- Factory made insulated chimneys should have a life of at least 30 years and be designed in accordance with BS4543, BS EN 1859:2009 and installed in accordance with BS EN 15287-1;2007.
- Where a chimney is not directly over an appliance or opening, a soot box accessible for emptying should be formed.
- Flue pipes should be equal to the cross section of the outlet of the appliance.
- Flue pipes for solid fuel appliances should be vertical or inclined at 45° or less from vertical. A 150mm long horizontal section may be used to connect a back outlet appliance to a flue.
- The relevant HETAS certification provided on completion.
- Combustible materials close to a chimney should be:
  - At least 200mm from the inside surface of a flue, or
  - In all areas except Scotland, 40mm from the face of the chimney.
6.3 External Walls – Masonry

Note: The top of the chimney stack should terminate outside the shaded area as shown in diagram 6.46 below and be not less than 2.3m horizontally from the roof.
Corrosion of Lead Work

When free lime from say mortar comes into contact with lead trays or flashings, (due mainly to the continual saturation of the brickwork) in areas such as chimneys, the lead should be protected from corrosion by the use of a thick coat of bitumen paint covering the faces likely to be in contact with the mortar. The protection against corrosion of lead work buried in mortar is suggested in guidance issued by the Lead Sheet Association. This treatment can also reduce staining of lead and brickwork. It is unnecessary to treat flashings buried only 40 – 50mm into mortar joints (cover flashings), as this close to the drying surface carbonation of free lime is rapid and there is no risk of corrosion in such circumstances.

Chimney Tray, Low Level

Required at low level where a cavity-walled chimney with brick shoulders is built on to an external wall; the tray prevents water which may enter the shoulders from penetrating to the inner leaf of the wall (see diagram 6.47). Material: 1mm aluminium alloy sheet to BS EN 485-2:2004 ‘Aluminium and aluminium alloys. Sheet strip and plate. Mechanical properties’. This has a higher melting point than lead, so is suitable for installation close to a heat source.

Chimney Tray, High Level

Required to prevent the entry of water at high level where a chimney rises through a pitched roof; suitable for new-build or remedial work. Minimises disturbance to surrounding construction in remedial work.

Material: Lead sheet to BS 1178: 1982 'Specification for milled lead sheet for building purposes'. Code 4 as standard. Standard sizes: 800 x 800mm, 900 x 900mm, 950 x 950mm. To suit either 195mm square or 195mm diameter circular flue.

Diagram 6.50: Chimney breast details

Diagram 6.51: Details of external chimney breast with masonry inner leaf
6.3 External Walls – Masonry

Diagram 6.52: Position of DPCs in a typical chimney

Diagram 6.53: Typical chimney flashing details

Diagram 6.54: Typical detail for external chimney breast

Note:
- Mortar above roof line to be in accordance with mortar table 6.06
- Use code 4 lead sheet dpc (coated both sides with bitumen paint) for tray positions 1 & 2
- For dpc indicated at position 3 use lead, 2 course engineering brick as a dpc, or other dpc material suitable for exposure
- It is recommended that all trays should be provided with weep holes approx. 2 no at the external front of each tray.
6.3 External Walls – Masonry

FIREPLACES

General

Fireplaces should be:

- Built in level and plumb
- Securely supported and tied into the supporting structure.

Relationship of Fireplaces with Combustible Materials

To inhibit the likelihood of ignition of any part of the building by direct radiation, conduction or falling embers, an appliance must be set and positioned on a non-combustible hearth in accordance with diagrams 6.55 – 6.59.

Combustible material should not be included under a constructional hearth except:

- To support the edges of the hearth or
- Where there is an air space of at least 50mm between the material and the underside of the hearth or
- Where there is a distance of at least 250mm between the material and the top of the hearth.

Air vents and grills supplying air ventilation for combustion appliances should not be installed within the fireplace or hearth.

Diagram 6.55: Plan view of hearth in fireplace opening

Diagram 6.56: Non-combustible hearth surface surrounding a solid fuel appliance

Diagram 6.57: Constructional hearths suitable for solid fuel appliances (including open fires)

Diagram 6.58: Plan view of free standing hearth
A fireplace recess must be suitably constructed of solid non-combustible material, and the walls and jambs forming the fireplace opening lined with fireclay at least 38mm thick, except in the following circumstances:

- The appliance itself is lined with fireclay at least 38mm thick; or
- The appliance is installed in a suitably constructed purpose made appliance chamber. Guidance on how to achieve this is given in table 6.60.

### Table 6.60: Construction of fireplace recesses and thickness of appliance chamber components

<table>
<thead>
<tr>
<th>Construction of fireplace recesses</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position of recess minimum aggregate thickness of material (mm)</td>
<td></td>
</tr>
<tr>
<td>Brick or block of fire resistant composition</td>
<td>200</td>
</tr>
<tr>
<td>Other *</td>
<td>300</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Off a prefabricated chamber of solid concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position of recess minimum aggregate thickness of material (mm)</td>
</tr>
<tr>
<td>Brick or block of fire resistant composition</td>
</tr>
<tr>
<td>Other *</td>
</tr>
</tbody>
</table>

- Which is connected to a chimney or flue pipe
- Which is supplied by the same manufacturer, with pre-made jointing arrangements, assembled on site using a cement specified for the purpose by the manufacturer
- Which is of insulating concrete having a density of between 1200 & 1700 kg/m³
- Which has components of the minimum thickness shown below

<table>
<thead>
<tr>
<th>Thickness of appliance chamber component</th>
<th>Minimum thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part</td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td>50</td>
</tr>
<tr>
<td>Sides</td>
<td></td>
</tr>
<tr>
<td>Back panel and top slab</td>
<td>100</td>
</tr>
<tr>
<td>Hood and bar lintels</td>
<td></td>
</tr>
</tbody>
</table>

- Which is installed on a constructional hearth, and
- If serving an open fire, has the space between the appliance and the internal wall of the unit filled with vermiculite cement concrete

* Where the recess is constructed of solid non-combustible material, extending the full height of the fireplace opening.

### Dimensions of Fire Openings in Fireplaces

The dimensions of openings in fireplace surrounds should be as given in table 6.60 (Where fire size is related to the free opening at the front of the fireplace recess when the firebricks are in place).

### Gathers and Canopies

To minimise resistance to the proper working of flues, tapered gathers should be provided in fireplaces for open fires. Ways of achieving these gathers include:

- Using prefabricated gather components built into a fireplace recess, as shown in diagram 6.63 or
- Corbelling of masonry as shown in diagram 6.62 or
- Using a suitable canopy, as shown in diagram 6.64 or
- Using a prefabricated appliance chamber incorporating a gather.

When dry-lining around fireplace openings any gaps should be filled to prevent flue gases entering the void behind the lining.
6.3 External Walls – Masonry

**Notice Plates for Hearths and Fireplaces**

Information essential to the correct use of hearths, fireplaces, flues or chimneys should include the room location, category of flue with type, size and the manufacturer’s name including the installation date. A robust notice plate containing this information should be securely fixed in the dwelling at a prominent site i.e. next to the consumer unit, water stopcock or fireplace.

<table>
<thead>
<tr>
<th>nominal size of fire</th>
<th>dimension *</th>
<th>height **</th>
</tr>
</thead>
<tbody>
<tr>
<td>350mm</td>
<td>360mm</td>
<td>500mm</td>
</tr>
<tr>
<td>400mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>450mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>500mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Tolerances on dimensions: \*±10mm \**±5mm

Table 6.61: Dimensions of fireplace openings

Diagram 6.62: Construction of fireplace gathers

Diagram 6.63: Construction of fireplace gathers

Diagram 6.64: Canopy for an open solid fuel fire

**PARAPETS**

The minimum thickness and maximum height of parapet walls should be as given in diagram 6.65 and table 6.66.

The materials used in the construction of parapet details should be suitable for the location and exposure.

Where possible, the use of raking parapets should be avoided due to the need for high standards of detailing and workmanship required to prevent the ingress of moisture. In very severe exposure zones it is recommended that a parapet construction is avoided altogether. Where these details cannot be avoided it is essential to provide a high level of supervision and workmanship whilst following the general guidance given in diagrams 6.68 – 6.71.

It is recommended that in moderate and severe exposures any full fill cavity insulation should be stopped at the upper level of the ceiling insulation, providing a suitable cavity tray in accordance with diagram 6.67.
6.3 External Walls – Masonry

Diagram 6.65: Parapet walls: height

Table 6.66: Parapet walls/height ratios

<table>
<thead>
<tr>
<th>Wall type</th>
<th>Thickness (mm)</th>
<th>Parapet height H to be not more than (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cavity wall</td>
<td>x + y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>equal or less than 200</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>greater than 200</td>
<td>860</td>
</tr>
<tr>
<td>Solid wall</td>
<td>w = 150</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>w = 190</td>
<td>760</td>
</tr>
<tr>
<td></td>
<td>w = 216</td>
<td>860</td>
</tr>
</tbody>
</table>

Note: w should be less than W

Diagram 6.67: Cavity trays - parapets
Diagram 6.68: Raked parapet detail – coping

Diagram 6.69: Parapet detail – continuous cavity

Diagram 6.70: Section of a raked parapet detail – flashings
NATURAL STONE

General

The following additional guidance for natural stone shall be used in conjunction with any other information in this manual.

When selecting stone for cavity wall house building, it is important to consider the exposure rating for the area.

Clearly it is not recommended to use a soft, porous type stone in a severe exposure zone.

Consideration should also be given to the compatibility of different stone to prevent staining and premature decay.

Limestones and sandstones should not be mixed together.

It is also advisable to use a stone that has been quarried within a reasonable location of the development thus ensuring where possible both the weathering qualities and the visual blending with existing buildings.

Natural stone has a grain or natural bed, which is determined during its formation in the strata of the quarry.

- It is important that the stone is laid with the grain running horizontal to the bed.
- In the case of jambs and mullions the grain should be vertical.

Walls constructed with a cavity are essential where the location is likely to be of moderate exposure or worse. Stonework should be dressed where necessary to provide a clear and open cavity.

A sawn bed of 100mm minimum thickness to be used as the outer leaf of a cavity wall although Build-Zone recommends 150mm.

Where dressed stone is used and the bed falls below 90mm due to the irregularities of the stone, then the stone should be backed with either a brick or 50mm min thick block wall to maintain the structural stability (see diagram 6.72).

It is not acceptable for the stone to be packed or wedged to maintain line and level without the backing wall being in place.

All stone work should be dressed and laid by a qualified or suitably experience tradesman.

Mortar

The mortar for use with stone should comply with the relevant British Standards for sand, lime and cement as set out in BS EN 1996-1:2005.

This can vary in strength from 1:1:6 to 1:3:12 depending on the softness of the stone. It is important to use correct mortar to allow for movement and associated shrinkage.

Wall Ties

Ensure that the ties are stainless steel and of sufficient length to maintain a 50mm embedment. It may be necessary to double up the wall ties where the coursing is out of line due to the varying thickness of natural stone at the reveals e.g. every other course.

Ensure that wall ties do not slope inwards especially when used in conjunction with timber framing.
6.3 External Walls – Masonry

**Insulation**

Full fill cavity insulation should only be considered where the outer leaf is backed by brick/blockwork, although this is still dependent on exposure.

Either partial fill, leaving a residual cavity of 50mm or a clear cavity should always be the preferred option.

**Movement Control**

Where sealants are used it is important to select a non-oil-based sealant to help to prevent any staining to the stone.

**Cavity Trays**

In addition to the previous guidance for cavity trays the following shall apply:

When stone heads are being used it is advisable to double up the cavity trays one below and one above the stone head. Also, provide stop ends and additional weep holes.

**Jambs and Mullions**

Stone jambs and mullions should be fixed at the top and the bottom with stainless steel pins in accordance with the manufacturer’s instructions. Stainless steel frame type cramps can also be used to give extra stability at jambs.

![Diagram 6.72: Block backing to natural store masonry](image)

**THERMAL INSULATION**

The following text provides some guidance and an interpretation of the Approved Document (L1 2006) covering the thermal efficiency of dwellings.

**Part L Conservation Of Fuel And Power**

L1. Reasonable provision shall be made for the conservation of fuel and power in buildings by:

a. limiting heat gains and losses:
   1. through thermal elements and other parts of the building fabric; and
   2. from pipes, ducts and vessels used for space heating, space cooling and hot water services;

b. providing and commissioning energy efficient fixed building services with effective controls; and

c. providing to the owner sufficient information about the building, the fixed building services and their maintenance requirements so that the building can be operated in such a manner as to use no more fuel and power than is reasonable in the circumstances.

d. External walls should be designed to provide the required standard of thermal insulation and the correct use of insulation material to meet the requirements of the Building Regulations.

Design should avoid cold bridging at openings and at junctions of external walls with roofs, floors and internal walls.
6.3 External Walls – Masonry

Full Cavity Insulation

It is understood that in Northern Ireland, it is not permissible to fill cavities with pumped thermal insulants at the time of construction and in Scotland, it is not permissible to fill the full width of the cavity with any thermal insulant at the time of construction.

Note: Render on an external leaf of clay bricks in Severe or Very Severe exposures is not permitted where the cavity is to be fully filled with insulation. (Diagram 6.74 to be used when calculating the elemental method for conversions).

<table>
<thead>
<tr>
<th>Exposed Element</th>
<th>U-Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof</td>
<td>0.25</td>
</tr>
<tr>
<td>Wall</td>
<td>0.35</td>
</tr>
<tr>
<td>Floor</td>
<td>0.25</td>
</tr>
<tr>
<td>Windows, doors &amp; rooflights (note 4) (area weighted</td>
<td>2.2</td>
</tr>
<tr>
<td>average), glazing in metal frames (note 5)</td>
<td></td>
</tr>
<tr>
<td>Windows, doors &amp; rooflights (note 4) (area weighted</td>
<td>2.0</td>
</tr>
<tr>
<td>average), glazing in timber frames (note 5)</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Any part of a roof having a pitch of 70° or more can be considered a wall.
2. For the sloping parts of a room in the roof constructed as a material alteration, a U-value of 0.3W/mK would be reasonable.
3. Roof lights including roof windows.
4. The higher the U-value for metal framed windows allows for additional solar gain due to the greater glazed proportion.

Table 6.73 Area weighted averages: U-values (W/m²K) for construction elements

Diagram 6.74: Summary of elemental method
Sap Rating (Sap 2005)

The Approved Document sets out the Standard Assessment Procedure for calculating energy ratings. As well as producing guidance on the insulation values of the fabric, compliance with the following energy saving methods are required:

- The central heating programmer should control heating and hot water separately
- When both heating and hot water thermostats are satisfied the boiler should switch off (boiler interlock)
- All rooms shall be provided with a means of controlling heating output*
- The HWS cylinder shall be insulated and fitted with a thermostat
- All pipework outside the heated space including primary connections to the HWS cylinder for a distance of 1 metre should be insulated

* e.g. provide zone control or thermostatic radiator valves in addition to the room thermostat.

Positive measures to prevent infiltration should include:

- all windows and doors to be draught stripped
- likewise loft hatches
- service entries and dry linings to external walls should all have continuous seals

Care must also be taken to ensure that water pipes are adequately insulated (See diagram 6.75).

Provision must be made to prevent thermal bridging around windows and doors to avoid heat loss and condensation problems (See diagram 6.76).

When considering the energy efficiency of a dwelling care must be taken in the detailing at lintels, jambs and sills.

Diagram 6.75: Adequate insulation of water pipes

Diagram 6.76: Thermal bridging and heat loss paths
Air permeability and pressure testing

In accordance with Part L and regulation 7, the building fabric should be constructed to a reasonable quality of construction so that:

a. the insulation is reasonably continuous over the whole building envelope; and
b. the air permeability is within reasonable limits.

Pressure testing is a requirement for newly built dwellings, but not for dwellings created by conversion, for extensions or alterations etc.

Extent of testing is affected by:
- Number of dwellings involved; and
- The use of "approved construction details"

NEW DWELLINGS

Sites using accredited construction details:
- A test must be carried out on one example of each type of dwelling
- Dwelling to be tested to be selected by the Building Control Body (in reality it is likely to be the first completed)
- Where development includes several blocks of flats, at least one flat from each block should be tested

Sites not using accredited details:
- On sites of up to 4 dwellings, one unit of each dwelling type
- On sites of 5 -40 dwellings, two units of each type
- Over 40 dwellings, 5% of each type of dwelling, however, if the first five dwellings are satisfactory, the sample rate can be reduced to 2%
- Dwellings selected by the Building Control Body
- Where development includes several blocks of flats, at least two flats from each block should be tested

Small Sites (1 Or 2 Dwellings)
- Carry out a pressure test
- Use information from a pressure test carried out on same house type (on a different site) within past 12 months
- Use an air permeability value of 15m³/(h.m²) when calculating the design

OTHER NEW BUILDINGS

All new buildings other than dwellings need to be pressure tested on completion.

- There is a dispensation for buildings less than 500m² floor area, use air permeability rate of 15m³/(h. m²).
- A similar dispensation applies to factory made modular buildings where no site assembly work is required; it can be assumed that the standard of airtightness for module type has been achieved, provided a 3rd party accreditation had demonstrated through site based testing, that the design air permeability is routinely achieved.
- Special requirements exist for extremely large or complex buildings, where it would be impossible to pressure test the whole building.
- In connection with air leakage detection the builder can also use thermal imaging technology to detect energy loss from buildings if a building fails an air test. A thermal survey before the air leakage test allows the builder to seal any poor detail therefore avoiding a second air leakage test had the building failed. Air leakage paths can be seen in red and white in thermal images.

The Building Control Authority and Build-Zone should be consulted at the design stage to agree variable design data such as the driving rain index for the site and be consulted if deviations from the approved plans are made during the course of the works.
Compliance with Build-Zone Requirements

The following provides guidance on the interpretation of the Requirements with regard to individual elements of thermal insulation and testing covered in this section and where appropriate, propose performance or specific standards which meet these Requirements.

Where reference is made to the exposure rating of a site, these are as defined in BS EN 1996-1-2:2005, BS EN 1996-2:2006 and BE EN 1996-3:2006 and should be determined by reference to the map showing categories of exposure to wind driven rain. Diagram 6.77 represents the average case situation.

Where local knowledge or features dictate, a modification to the rating should be made:

- Where there is concern over the increased incidence of wind-driven rain, particularly with full or partial cavity fill, consider increasing the map zone value by one category, i.e. a location currently assessed as zone 3 (Severely exposed) could be considered as zone 4 (Very severely exposed). This modification should only be considered where there is increased local exposure, e.g. hillside location, urban fringe or multi-storey construction. Alternatively, provide additional protection in the form of rain screen cladding to the outer face of the wall.
- Decrease the exposure rating by one where the building does not face a prevailing wind and all walls are well protected by local features e.g. tall evergreen trees or other buildings of similar height within a close proximity.
- The contour lines shown on the map represent an approximate division between zones. For a more detailed analysis using larger maps, reference can be made to BS 8104:1992.
- It is recommended that stainless steel wall ties should always be used to all houses regardless of their location.
Diagram 6.77: Map showing categories of exposure to wind driven rain
6.3 External Walls – Masonry

**External Insulation**

- External insulation systems, which incorporate 65 mm or more of insulation or incorporate a 50 mm clear cavity and an effective external cladding, are generally suitable in all exposure categories. However, they should only be installed in exposure categories as stated by suitable Third Party accreditation acceptable to Build-Zone and in accordance with manufacturer’s recommendations.

**CAVITIES**

- Cavities to be not less than the stated width and free of obstructions which may transmit water towards the inner leaf.

**SOLID MASONRY**

- Internally insulated masonry walls to be at least 328 mm thick if of brickwork, 250 mm if of aggregate blockwork and 215 mm if of autoclaved aerated concrete blockwork with a notional cavity between the masonry and the insulation.

**MORTAR AND RENDER**

- A mortar mix whose strength is compatible with the strength and type of masonry unit must be specified to minimise cracking, especially for concrete and calcium silicate units. (See table 6.06).
- Tooled mortar joints, either bucket handle or weathered, to be used. Recessed or raked joints to be used only in exposure zone 1 with 50 mm clear cavity, or zone 2 with 100 mm clear cavity. (See table 6.80).
- Render to be appropriately specified and applied to the correct backing material to minimise cracking.

**OVERHANGS**

- Overhangs at eaves and verges to be at least 350 mm and incorporate a throating. The greater the overhang, the greater the protection (diagram 6.78).

![Diagram 6.78: Interpretation of walls and impervious cladding or render above facing masonry](image)

![Diagram 6.79: Masonry protection to overhangs](image)

Sills, copings, string courses and drips below cladding or render to project at least 50 mm and incorporate a throating or cavity tray (diagram 6.79). Flush sills and copings give no protection to the wall below.
### 6.3 External Walls – Masonry

#### Table 6.80: refer to diagram 6.78 for interpretation of cladding and render for facing masonry

<table>
<thead>
<tr>
<th>Wall construction</th>
<th>Insulation method</th>
<th>Maximum recommended exposure zone for each construction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min. width of filled or clear cavity (mm)</td>
<td>Impervious cladding Full height of wall</td>
</tr>
<tr>
<td>Built in full fill</td>
<td>50</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>125</td>
<td></td>
</tr>
<tr>
<td></td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Injected fill not UF foam</td>
<td>50</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>125</td>
<td></td>
</tr>
<tr>
<td></td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>Injected fill UF foam</td>
<td>50</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>75</td>
<td></td>
</tr>
<tr>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Partial fill: Residual 50mm cavity</td>
<td>50</td>
<td>4</td>
</tr>
<tr>
<td>Residual 75mm cavity</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Residual 100mm cavity</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Internal Insulation Clear cavity 50mm</td>
<td>50</td>
<td>4</td>
</tr>
<tr>
<td>Clear cavity 100mm</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Full Filled Cavity 50mm</td>
<td>50</td>
<td>4</td>
</tr>
<tr>
<td>Cavity 100mm</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

#### GENERAL (INCLUDING CAVITY INSULATION AND DURABILITY)

The following provisions apply when cavity fill insulation is used:

- Ensure that a clear cavity width of 50mm is maintained when partial cavity fill is used,
- Full cavity fill should be the minimum thickness for the given exposure as set out in table 6.80.
- Full cavity fill insulation should not be used in walls of rendered clay bricks of N category soluble salts content, unless sulphate resisting cement is used in mortar for jointing and backing coat for render.
- Full fill insulation should be suitable for its intended location and installed in accordance with the manufacturer’s instructions.
- Full cavity fill should not be used in moderate exposure or worse where painted fair-face masonry is proposed unless the masonry outer leaf is frost resistant.
- Full cavity fill insulation should not generally be used with random stonework unless backed up by a skin of brick or blockwork although this is still dependent on the exposure category.
- The two cavity leaves should be raised together, unless insulation comprising built-in batts is to be used, in which case it should be installed in accordance with the manufacturer’s instructions.
- Wall ties should be positioned so as to support full or partial cavity insulation batts below the DPC where this is permitted by independent Third Party certificates acceptable to Build-Zone.

#### THIRD-PARTY CERTIFICATION

- Built-in cavities fill must have third-party certification and be installed in accordance with manufacturer’s instructions.
- Injected cavity fill must have third-party certification and be installed under an approved surveillance scheme.
- External insulation must have third-party certification for use on solid walls in specified exposure zones.

Ensure that:

- All batts butt closely
- Batt are kept free from mortar droppings
- The orientation of batts is retained, e.g. vertical laminations in mineral wool allow water to drain downwards not across the cavity. (See diagram 6.85 – 6.88)
- Batt or injected fill are taken right up to the verge of a gable unless a cavity tray is fitted where the insulation finishes
- All vents are sleeved and all openings sealed when an injected insulation system is to be used
- No gaps are left - insulation materials can be cut to fit with a sharp knife or the edge of a trowel
- All new work is covered after construction (See diagram 6.03)
- Wall insulation is to be taken up high enough to link with loft insulation without blocking any cross ventilation provision.
PARTIAL FILL INSULATION

The insulation material can be either mineral wool or foamed plastics installed so that they are held against the supporting inner masonry leaf.

Fixing the insulation against the inner leaf does not hinder the progress of any water draining down the cavity, allows air movement to dry out the outer leaf and keeps cold air in the residual air space outside of the insulation layer. (See diagrams 6.81 – 6.84).

The minimum design width of the residual air space in the cavity is 50mm ie. if using 25mm thick insulation provide a total cavity width of 75mm.

Wall ties need to be provided with an appropriate retaining disc or system to keep the insulation in place. The insulation system should be suitable for its intended location and installed in accordance with the manufacturer’s instructions. Mortar droppings should be cleaned off the top of batts before the next batt is placed. Batt s where applicable should be sealed at all junctions and joints.

Do not:

- Fix damaged boards
- Leave gaps in insulation (cut boards where required)
- Stop short of the verge in a gable wall without providing a cavity tray

It is recommended that cavity insulation is continued to the top of a gable wall. Where it is not, it should be protected by a cavity tray, unless otherwise permitted by independent Third Party certificates acceptable to Build-Zone.

Cavity trays should be lapped and sealed at joints.

A cavity tray should be provided immediately below parapets, being located above any insulation and with a step down towards the outer leaf (See diagram 6.67).

A DPC should also be provided beneath the coping.
Diagram 6.82: Installation of partial fill insulation boards – avoid these practices

Diagram 6.83: Installation of partial fill insulation boards – building sequence
6.3 External Walls – Masonry

Diagram 6.84: Installation of partial fill insulation boards – as built section

FULL FILL CAVITY INSULATION

Cavity trays should be laid on a bed of fresh mortar and extend across the full width of any opening including circular or arched openings. (See diagrams 6.85 – 6.88).

The following design points should be noted:

- Stop ends should be provided to cavity trays or combined lintels.
- Weep holes should be provided at 450mm (maximum) centres with at least two per opening.
- Mortar should not be recessed.
- Paint finishes on brick or render are not acceptable if they are likely to cause frost damage or sulphate attack or other damage.

Diagram 6.85: Installation of full fill insulation batts – start correctly
6.3 External Walls – Masonry

Diagram 6.86: Installation of full fill insulation batts – vertical DPCs and wall tie detailing

Diagram 6.87: Installation of full fill insulation batts – keep batts clean
Do not place the cut edges of small off-cuts against the wall surface. The laminations of the insulation must all be in the same direction.

Course batts with wall ties. If necessary, cut or insert cut pieces to restore full batts to correct coursing ensuring laminations are in the same direction.

Diagram 6.88: Installation of full fill insulation batts - cut edges
6.4 External Doors, Windows and Roof Lights

GENERAL

Timber used for external joinery should be of a species classified as suitable in BS EN 942:2007 and preservative treated if not a moderately durable species or better (with sapwood excluded). Guidance on selection is provided in TRADA Wood Information Sheets 3.10 and 4.16. Workmanship should follow the recommendations of BS 1186-2:2002.

Preservative treated joinery which is cut or adjusted on site should be liberally brushed with an appropriate and coloured preservative. Where the colour of the preservative will adversely affect the final appearance of the joinery then an appropriate clear preservative can be used.

Bay, oriel and dormer windows require particular care in detailing and fitting so that they are stable, weather-tight and reasonably airtight.

Roof lights should be proprietary components, fixed within prepared openings in accordance with manufacturer’s instructions, and have effective weather-sealing, trickle venting or if not possible the room should be provided with sufficient natural or forced air changes to prevent interstitial condensation.

Non-timber components should comply with the following British Standards (as appropriate) and be installed and fixed in accordance with manufacturer’s recommendations:

- BS 4873:2009 Aluminium windows
- BS 6510:2005 Steel windows and doors
- BS 7412:2007 PVC-u windows and doors
- BS EN 514:2000 PVC-u windows and doors
- PVC-u windows and doors should also be subject to independent Third Party certificates acceptable to Build-Zone.

Windows should comply with the current Building Regulations taking into consideration:

- Means of escape in the event of a fire
- Thermal insulation
- Ventilation
- Safety

Thresholds and sills should be at least 150mm above ground level. Where the top of a threshold is more than 225mm above ground level, a step or ramp arrangement may be necessary.

Where level (threshold) access is required, builders can follow the general guidance given in diagrams 6.89, 6.90, and 6.91 ensuring a high level of supervision and workmanship, together with the correct specification of materials, with consideration given to design, location, exposure and the requirements as set out in Approved Document M.

Wherever possible locate the entrance door away from the prevailing weather and provide a storm porch.

It is recommended that a mat well be constructed within the entrance hall to accommodate the full swing of the door without fouling the carpet and/or the proprietary door seal, thus maintaining the integrity of the seal.

External doors and opening lights to windows should be reasonably airtight by ensuring that effective draught seals are fitted.

External joinery should be designed and constructed in accordance with the requirements of the following British Standards:

- BS 4787:1:1980 Internal and external wood door sets, door leaves and frames
- BS 6262-7:2005 Code of practice for glazing for building
- BS 6375-1:2015 Performance of windows
- BS 644:2012 Wood windows
- BS 8213-1:2004 Windows, doors and roof lights
Notes to diagrams 6.89, 6.90 and 6.91 below:

- In severe/very severe exposure zones set frame well back to provide further protection (it is recommended to provide a storm porch or canopy, whenever using level thresholds).
- It is recommended to provide a proprietary mat well projecting beyond the swing of the door.

Diagram 6.89: Level threshold with approach rising towards property.

Diagram 6.90: Level approach with approach falling towards property
PROTECTION FROM FALLING

For houses and flats, the guidance in Approved Document K2 specifies a minimum guard height of 800mm to window openings in the external wall. This would normally be achieved by forming window openings at least 800mm above finished floor level. The wall beneath the opening is therefore considered to be the barrier to falling.

Where window openings are formed less than 900mm from the finished floor level permanent guarding should be provided to the opening in accordance with the design requirements specified in Approved Document K2, section 3, para 3.2 and 3.3.

The use of a restrictor stay in this situation is unlikely to be acceptable as guarding, because:

- It is unlikely to resist the loads of someone falling against the window
- It is releasable and therefore not considered to be permanent guarding
- The glazing, frame and fixings would need to be designed to provide containment.

CONTROL OF CONDENSATION

Minimise the effects of condensation on glazing and frames by:

- using insulated metal frames
- using details which prevent condensation running on to walls or floors
- housing window boards into frames to prevent condensation entering the joint and
- provide thermal insulation to walls at lintels, sills and jambs (See diagram 6.76).

Further guidance on this subject can be found in the BRE report, “Thermal Insulation: Avoiding Risks”.

SECURITY

External door leaves should be of a robust construction.

Timber doors should be not less than 44mm thick (or equivalent strength for other materials). Flush doors should be of solid core construction. Door stiles to which locks are fitted should be of sufficient width so as not to create a weak point in the general robustness of the door (119mm minimum width recommended for timber). Non-glazed panels should be sufficiently small to prevent access to within the dwelling. See diagram 6.92 for hardware to main entrance door.

The “throw” of the lock into the frame should be 20mm.
External doors should be hung on 3 no.100mm hinges.

A restraint arm or security chain should be provided to main entrance doors.

Main entrance doors should be provided with at least one security lock and keep (see diagram 6.92 for lock specification). If a second lock is fitted it is suggested that this is positioned 600mm away.
6.4 External Doors, Windows and Roof Lights

A 5 lever deadlock should be provided to other external doors, including patio doors. The lock should comply with BS 8621:2007+A1:2009 (and Euro Norm - 12209) or be of a similar performance standard. Locks to entrance doors of flats should not operate automatically and the deadlock mechanism on the dwelling side of the door should be non key operated (this is a fire precaution requirement).

On the ground floor, with the exception of kitchens, all habitable rooms should either open directly onto a hall leading to the entrance or other suitable exit or be provided with a suitable window (or door). Door frames should be securely fixed and the rebate formed preferably from a solid section. Where planted stops are used, they should be glued, screwed and pelleted.

Door and window frames should be fixed to vertical reveals with corrosion-resistant fixings at a minimum 600mm centres, the end fixings being located within 150mm of the top and bottom of the frame.

External doors (except main entrance doors) and sliding patio doors should be provided with suitable locking devices such as robust 100mm barrel bolts fixed with 30mm No. 8 screws. (See diagram 6.93). Where espagnolette multi locking points are provided the
bolts may be omitted.

Sliding doors should be designed so that they cannot be lifted out of the frame from the outside. Where necessary, barrel bolts should be fitted to the frame.

Letter plates should comply with BS EN 13724:2002 and either be located no closer than 400mm from the door lock or be fitted with a limited opening flap. Where fitted to a fire resistant door (e.g. flats), the letter plate should not adversely affect the fire resistance of the door. A separate letter box is preferred so as not to impede the fire resistance of the door.

Windows should be provided with a securing device which cannot be sprung by levering the casement or sash from the outside of the building when in a closed position. A key operated lock should also be provided to all ground floor windows and others which are readily accessible from the outside, either as part of the securing device or as a separate unit (See diagram 6.94).

Diagram 6.94: Securing the windows

Roof lights should not be used on single storey or other accessible roofs unless they are specifically designed to provide a deterrent against forced entry and can be locked with a removable key.

Externally located hinge pins should be non-demountable (e.g. welded or disturbed ends). If possible, these should be designed out.

EMERGENCY EGRESS WINDOWS IN TWO STOREY DWELLINGS

With the exception of kitchens, all habitable rooms in the upper storey served by one stairway shall be provided with a window:
- which has an unobstructed openable area of at least 0.33m$^2$
- at least 450 mm high x 450 mm wide in either width or height
- where the bottom of the openable area should not be more than 1100 mm above the floor.

INSTALLATION OF DOORS AND WINDOWS

Window and door frames should be installed so that:
- they do not carry loads unless designed to do so
- the face of the frame is set back at least 38mm from the masonry face. Masonry on the external side of a vertical DPC should not be in contact with internal finishes
- the window head is set back behind the edge of the cavity tray
- the frame to wall junction is weather-tight and reasonably airtight
- In areas of severe/very severe exposure checked rebates should be provided. The frame should be set back behind the outer leaf and should overlap it as shown in diagram 6.95. Alternatively an insulated finned cavity closer may be used that has Third Party accreditation for use in this location. (See diagram 6.96 moderate exposure).
- Distortion is minimised by not locating radiators or other heaters close to doors
- the water drip to window and door sills projects beyond the wall or subsill by at least 10mm and the sill edge by at least 25mm.
6.4 External Doors, Windows and Roof Lights

FIRE SAFETY

Fire resisting doors should be fitted with a positive self-closing device.

Any door between a dwelling and an attached or integral garage should be a half hour fire resisting door and frame and should be fitted with a positive self-closing device.

BAY WINDOWS

The vertical DPC and cavity closer should be installed as shown in diagram 6.97.

Window and door frames should be installed either by building in tightly as work proceeds, or by fitting into preformed openings, suitably dimensioned to provide an accurate fit for the frame plus the perimeter weather-tight joint.

Timber frame windows and doors can be installed so they abut the masonry. Any gap provided should not exceed 10mm. For gaps less than 5mm the sealant must cover both the frame and the masonry by 6mm. For gaps greater than 5mm a backing strip should be provided behind the sealant.

The sealant should have a minimum depth of 6mm.

PVC-U frame windows and doors should be installed with a gap of between 5 and 10mm to allow for thermal expansion. For large framed units such as patio doors then the gap can be up to 15mm.
Frames should be fixed in accordance with the manufacturer’s recommendations or, if no instructions are given, with the following guidance:

- fixings should be at 600mm maximum centres and within 150mm of corners of the frame
- frames should be fixed either by galvanized steel cramps or by non-corrodible screw fixings to the surrounding wall.

Diagram 6.97: Typical reveal detail showing vertical DPC and cavity closure at bay windows

GLAZING

Proprietary materials, possessing Third Party accreditation acceptable to Build-Zone, should be used to close cavities at window and door openings. They should also be installed in accordance with the manufacturer’s recommendations.

Critical Locations

Glazing in doors and windows in areas known as "critical locations" needs to be given special consideration in order to prevent potential injury to people within or around the building. Limits for annealed glass can be seen in diagram 6.98.

These "critical locations" are as follows (See diagram 6.99):

- in a door or a side panel within 300mm of it between floor level and a height of 1500mm
- in an internal or external wall or partition between floor level and a height of 800mm

It is important that any glazing within these "critical locations" should be either:

- provided with permanent protection or
- be of small panes or
- be robust or
- break safely.

If permanent protection is provided (See diagram 6.100) then there is no requirement for the glazing itself to be of a special type.

The permanent protection may take the form of railing or barriers and should:

- be designed to be robust
- have a maximum opening or gap in any railing of 75mm or less
- be 800mm high minimum
- be non-climbable (especially where floor acts as a balcony).
Small panes, either an isolated pane within glazing bars or copper or lead lights, should be restricted in size so that any breakage would be strictly limited.

Small panes should:

- be not more than 0.5m² in area, and
- be not wider than 250mm, and
- where concealed glass is used be min 6mm thick (4mm for lead or copper lights).

Some materials are inherently strong such as glass blocks or polycarbonates whereas concealed glass will require to be of an increased thickness as the area of the panel increases to be considered 'safe' (See diagram 6.98).
6.4 External Doors, Windows and Roof Lights

As an alternative to any of the above solutions it is possible for the material to break 'safely' when tested to BS EN 12600:2002. This would mean that:

- only a small opening was created with a limited size of detached particles, or
- the balance would create only small pieces that are not sharp or pointed, or
- the pane disintegrates with only small detached particles.

Detailed guidance on this aspect of glazing can be found in Approved Document N to the Building Regulations.

General Guidelines

Glazing should be in accordance with BS 6262:2005.

Insulated glass units should meet requirements of BS EN 1279-5:2005+A2:2010 Glass in building – insulating glass units. IGUs should carry Third Party accreditation. This includes windows in possession of a BBA certificate and timber windows.

- They should have dual seals; single seal units are not acceptable.
- Desiccant should be provided to every spacer bar.
- Any glazing on site must have a drained and ventilated bottom bead.
- Any glazing with an area greater than 1m² must have a drained and ventilated bottom bead.
- Glazing with an area less than 1m² may be solid bedded.
- All spacer bars should be stamped with BS EN 1279.

Linseed oil putty glazing should not be used when the joinery is finished with vapour permeable paint or stain, putty glazing should also not be used with organic solvent based stains. Putty should be neatly finished to receive a protective paint coat.

Putty is not suitable for double glazed units.

Workmanship should be in accordance with BS 8000-7:1990.

To ensure compatibility of the whole glazing system together with a high level of workmanship and control, it is recommended that factory pre-glazed systems be installed in all external openings.

External glazing beads should be pinned at maximum 150mm centres (maximum 50mm from corners) or screwed at 200mm centres (maximum 50mm from corners).

The preferred method of installation for double glazed units is either:

- drained and ventilated frames as recommended by the Glass and Glazing Federation (GGF). Where possible this method should be adopted for external glazing. (See diagram 6.101), or
- solid bedding of units in 16-18mm deep frame rebates. 18mm rebates are recommended by the GGF to allow for tolerances. Use bedding methods suggested in diagrams 6.102, 6.103 and 6.104 or another method recommended by the GGF or BS 8000-7:1990.

In all cases, sealants should not be sensitive to ultra-violet light.

External glazing beads should be fixed at maximum 150mm centres and the glazing bedded in a non-setting putty. Louvred windows should not be used. Double glazing should be fixed and bedded as recommended by the Glass and Glazing Federation.

Diagram 6.101: Typical drained and ventilated method for timber frames
6.4 External Doors, Windows and Roof Lights

Diagram 6.102: Installation of double glazed window units with solid bedding (timber joinery)

Diagram 6.103: Installation of double glazed window units with solid bedding (timber joinery)

Diagram 6.104: Installation of double glazed window units with solid bedding (timber joinery)

Notes to diagrams 6.101, 6.102, 6.103 and 6.104:

1. Ensure the frame, unit and glazing systems are compatible.
2. Ensure that the frame and rebates are clean, dry and sound prior to installation.
3. When using Butyl based hand applied compounds, the timber frame will require a proprietary sealer to be applied or recoated with a second primer coat.
4. Hand applied Butyls are sensitive to ultra-violet hence their use should be restricted to an internal bedding material only (if required).
5. When using silicones and/or non setting compounds, distance pieces as well as setting blocks are required.
6. Silicone sealants will not take paint or stain finishes.

CONTROL OF CONDENSATION

Minimise the effects of condensation on glazing and frames by:

- Using insulated metal frames
- Using details which prevent condensation running on walls or floors
- Housing window boards into frames to prevent condensation entering the joint
- Providing thermal insulation to walls at lintels, sills and jambs.
- Trickle ventilators, or similar, should be used to provide background ventilation where required by the Building Regulations. (Avoid the use of louvred windows).

Further guidance on this subject is provided in BRE report, BR262 Thermal Insulation: Avoiding Risks 2002 edition.
6.4 External Doors, Windows and Roof Lights

SCRATCHES TO DOORS, WINDOWS AND FRAMES

When viewed in daylight from within the room and at least 2m from the panes (3m for toughened, laminated or coated glass) and looking at right angles through the glass, the following are acceptable if they are neither obtrusive nor bunched:

- bubbles or blisters
- hairlines or blobs
- fine scratches not more than 25mm long
- minute particles

Note: The above does not apply within 6mm of the edge of the pane, where minor scratching is acceptable.

Scratches on doors, windows and frames: factory finished door and window components should not have conspicuous abrasions or scratches when viewed from a distance of 0.5m:

- Surface abrasions caused during the building-in process should be removed in accordance with manufacturer’s instructions which may include polishing out, re-spraying or painting.
- In rooms where there is no daylight, scratches should be viewed in artificial light (fixed wall or ceiling outlets) and not from portable equipment.

CAST STONE

Cast Stone Jambs And Mullions

Stainless steel dowels in the sides of the jambs should be bedded into adjacent mortar joints as the masonry is constructed and where applicable fixed in accordance with the manufacturer’s instructions. (See diagrams 6.105 – 6.107).

Cast Stone Heads

A cavity tray must be provided above all heads as this discharges water to the outside face of the masonry but also acts as a slip plane.

Diagram 6.105: Typical cast stone jamb/mullion & sill detail
Diagram 6.106: Typical cast stone jamb/mullion & lintel detail
A slip plane will be required at the end of the cast stone head as well as a soft joint between the top of the head and the steel support lintel. (See diagram 6.108 – 6.109).
6.4 External Doors, Windows and Roof Lights

**Cast Stone Window/Door Surrounds**

Where cast stone butts up to other materials allowance must be made to accommodate differential movement.

E.g. where cast stone abuts clay brickwork a slip surface between the two materials must be incorporated or the cast stone should be flexibly jointed.

**Sills**

The DPC should be overlapped by the vertical DPC at the jambs and should be turned up at the back and ends for the full depth of the sill. (See diagram 6.110).

The mortar bed below sills should be trowelled smooth, allowed to set, cleaned off and then a DPC laid over. The open section below the sill should be sealed with a flexible material only at completion of the structure. (See diagram 6.111).

To control water penetration through joints in window surrounds (e.g. at junctions between jambs and mullions and sills) rectangular and T shaped water bars should be provided.

![Diagram 6.110](image1.png)  
**Diagram 6.110: Typical cast stone sill detail**

![Diagram 6.111](image2.png)  
**Diagram 6.111: Typical cast stone sill detail**
6.5 Timber Frame

GENERAL

The moisture content of structural timber should not exceed 20% at the time of stress grading and at the time of erection. All structural timber for use within the building fabric should be stress graded marked 'KD' (Kiln Dry) or 'DRY'. Where elements are designed as stressed skin panels, notching, drilling and other perforations through the stressed skin should be designed by an Expert.

All timber elements should be fixed with durable fixings or otherwise restrained in a manner capable of resisting excessive movement caused by drying out.

Workmanship should comply with BS 8000:5.

Once timber frames have been erected, it is essential that the cladding and roof covering are installed as soon as possible. In no circumstances should the timber frame be left exposed for a period greater than specified by the manufacturers of either the frame or the breather membrane.

Frame certification may be requested by BZSS’s appointed Technical Auditor.

SETTING OUT

It is essential that the accuracy of setting out of the foundations is checked well in advance of delivery of materials to site. Design changes should be approved by the designer.

SOLE PLATES

Ensure sole plates are properly located and fixed to the substructure. The sole plates or the lowermost timber plate should be set level, accurately set out, and fixed as specified in the design.

Deviation in level should not be greater than 10 mm per 5m run. Particular care is required where the camber on a block and beam floor results in difficulties supporting the sole plate adequately.

Sole plates should not overhang the substructure by more than 12 mm, nor be set back from the edge of the substructure forming a ledge for mortar and debris to collect. Should a ledge be unavoidable then install a damp-proof tray.

Packings where necessary should:

- Be non-compressible
- Be durable and corrosion resistant
- Not exceed 20 mm
- Be as wide as the timber frame
- Be located below all vertical studs positions

Sole plates with DPC under should be mechanically fixed to the substructure masonry. Holding down anchors, straps or shoes to be of either stainless steel, phosphor bronze, silicon bronze or galvanized mild steel (940 g/m²) at suitable centres. Mechanical fixing points are to be as specified in the design. It is preferable to use straps or shoes, but where specified care should be taken with shot fixings so as not to damage the supporting masonry or split timber members.
GREEN TIMBER/UNGRADED TIMBERS

- The use of green or ungraded timbers is not permitted as structural members e.g. lintels, beams, joists, rafters, purlins etc., nor where they are aesthetic elements but are "fixed" to the structure, as the extent of their shrinkage is unknown and can lead to structural damage to the property. This does not include green oak structural frames.
- They can be used as lintels providing the detail on diagram 4.29 (Part 11 Conversions) is followed and allowance is made for any possible shrinkage and/ or swelling of the timber.

Sole plates should not be fixed to infill blocks of proprietary masonry flooring systems e.g. block and beam floors. Suitable anchoring straps must be fixed to the substructure masonry to provide adequate fixings.

With masonry, special density nailable blockwork is required and generally with concrete the fixings should not be closer than 75mm from the edge of the slab.

PROTECTING SOLE PLATES FROM DAMP

Sole plates should have a Hazard class 2 treatment in accordance with BS8417:2003 or equivalent and be laid on a DPC which is lapped onto the slab DPM. Wall panels should be skew-nailed to sole plates without perforating the DPM.

The breather membrane should extend over the sole plate (See diagram 6.112).

It is recommended that the inner leaf DPC is turned up approximately 30mm above screed to protect sole plate and bottom rails from construction moisture and spillage.

Cavity fill should be ST1 concrete and terminate no closer than 225mm below the DPC (See diagram 6.112).

Drain cavities below DPC level at 1.35m centres. e.g. open perpend mortar joints.
TIMBER STUD FRAMEWORK

<table>
<thead>
<tr>
<th>Timber element</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timber studs, rails, header joists, lintels, and binders, cavity barriers and sole plates above screed level, including any timber or plywood packing pieces</td>
<td>Hazard class 2 treatment in accordance with BS8417:2003, or equivalent, for a 60 year anticipated service life.</td>
</tr>
<tr>
<td>Sole plates below screed level</td>
<td>As above, but the vacuum pressure impregnation process required</td>
</tr>
</tbody>
</table>

**Note 1:**
The Preservative treatment should conform to the treatment recommendations specified in BS8417:2003 for CCA, organic solvent (O/S), micro-emulsions or copper-organic treatments according to the requirements for hazard class 2 for a 60 year anticipated service life. Treatments with micro-emulsion, those organic solvent preservatives not complying with BS5707:1997 and copper organic preservatives should meet the recommendations in Table 9 of BS8417:2003 for treatments for which an appropriate critical value as described in BS EN 599-1:2009 is available. The supplement to the PCA Manual lists preservatives for which an appropriate CV as described in BS EN 599-1:2009 has been audited. For other preservatives, interim critical values may have been declared by BSI, CCB, & CC may also be used.

**Note 2:**
From 30 June 2004, the use of CCA treated timber in the UK will be prohibited in residential or domestic constructions, whatever the purpose (this does not apply to CCA treated timber already in place). Its continued professional use will only be permitted in structural timber in public buildings, offices and industrial premises where human contact during service life is prevented provided skin contact by the general public during its service life is unlikely (Directive 1976/69/EEC, point 20).

Table 6.113: Treatment of external timber frame

**Avoid the following defects:**

- Gaps between panels and nails missing at panel to panel connection
- Bottom rails not securely fixed to sole plates
- Plates, rails and studs cut away for services and holes drilled for electrical services near edge of stud
- Use of damaged wall panels
- Upper-deck wall panels nailed to floor decking only and not to joists
- Inadequate packing under upper storey panels
- Studs out of plumb
- Studs missing or overloaded
- Split timbers caused by nailing too close to edge of timber

**MATERIALS AND FIXINGS**

Timber elements should be regularised, bear a stress grade stamp and the moisture content should not exceed 20% at time of erection. All structural timber to be used within dwellings must be clearly marked 'DRY' or 'KD'.

The moisture content of timber can be checked by the use of an electrical resistance moisture meter. The type with insulated probes is recommended which can be driven into the timber. Timbers forming part of the external timber frame should be treated, see table 6.113.

Where elements are designed as stressed skin panels, notching, drilling and other perforations through the stressed skin should be designed by an Expert.

All timber elements should be fixed with durable fixings or otherwise restrained in a manner capable of resisting excessive movement caused by drying out.

Workmanship should comply with BS 8000:5:1990.

Framed walls should be accurately aligned, plumb, level, without twist and securely fixed to adjacent elements using durable fixings suited to the location of the element.
Bedding under frames to accommodate variations in level should be made with a durable non-compressible material of full frame width. The maximum depth of the bedding should not exceed 20mm.

**LATERAL RESTRAINT**

The gable panels of timber frame buildings need to be laterally restrained to the roof construction in the same way a masonry construction is restrained.

It is acceptable to provide this lateral restraint by fixing the wind bracing of a trussed roof construction to the studs of the gable frame. (See diagram 6.114).

Unless designed by an Expert, holes for electrical services may only be drilled on the centre line of timber studs between 0.25 and 0.40 high. Maximum hole size is 0.25 of stud depth (See diagram 6.115). Timber studs should not be notched.

**TIMBER FRAME ASSOCIATIONS**

We would recommend that all timber framed buildings are designed, manufactured and erected by members of recognised associations such as the TFA (Timber Frame Association) who have attained Q mark quality standard (or similar). All erectors are to be appropriately qualified and insured as timber frame erectors.

All sites using timber frame construction should follow the 16 step guide as detailed in the ‘16 steps to fire safety – Promoting good practice on structural timber construction sites’ published by Structural Timber Association and also the ‘Fire Prevention on Construction sites – the joint code of practice on the protection from fire of construction sites and buildings undergoing renovation’, published by the Construction Confederation and the Fire Protection Association (Ninth Edition).
6.5 Timber Frame

Diagram 6.116: Timber frame, 1st floor details

SHEATHING

Sheathing is usually provided to timber framed walls to provide increased strength to the structure or simply to protect the building from the elements prior to fixing the external cladding. Where sheathing provides racking resistance to wind and other lateral loads, the edge distance and spacing of the fixings are critical.

When fixed on site, sheathing should be nailed to stud members with galvanised, sherardized, stainless steel, phosphor or silicon bronze nails at centres as the approved design. Nails must not be overdriven.

Sheathing should achieve standard durability level and be of the type shown in table 6.117.

Sheathings for dwellings that are subject to extreme exposure conditions on sites located in areas defined as 'very severely exposed' should use either improved protection of standard durability (see 1 in table 6.118), or alternatively, an enhanced level of sheathing durability, (see 2 in table 6.118). Such dwellings would not be sheltered by local features, including surrounding buildings and trees, and therefore would not qualify for the reductions of exposure category permitted.

<table>
<thead>
<tr>
<th>Standard Durability Sheathings</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Impregnated softwood type SBS which meets the requirements specified for sheathing in BS EN 622-4:2009.</td>
</tr>
<tr>
<td>* High-density medium board type HME which meets the requirements specified for sheathing in BS EN 622-2:2004.</td>
</tr>
<tr>
<td>* Wood chipboard of moisture resistant types P5, P6, P7 which meets the requirements specified for sheathing in BS EN 622-2:2004.</td>
</tr>
<tr>
<td>* High-density medium board type HME which meets the requirements specified for sheathing in BS EN 312.</td>
</tr>
<tr>
<td>* Orientated Strand Board (OSB) type OSB/3 and OSB/4 which meet the requirements specified in BS EN 300 and at least 8mm thick.</td>
</tr>
<tr>
<td>• Any board (treated or untreated) that has been certified by independent Third Party certificates acceptable to Build-Zone as suitable sheathing.</td>
</tr>
<tr>
<td>• Any board included in Table 6.118</td>
</tr>
</tbody>
</table>

Note: * These sheathings have a high moisture vapour resistance and designers should check that there is no risk of interstitial condensation in accordance with BS 5250:2002

Table 6.117: Standard durability sheathings
1. Improved protection of the sheathing using either:
   • High performance breather membranes as specified in the TRADA Wood Information Section 1, Sheet 35
   • A 50mm cavity wall with a rendered finish or with cladding of metal, plastics, slate, tile hanging, timber boarding or similar materials.

2. An enhanced level of sheathing durability using the following:
   • Tempered hardboard* type THE which meets the requirements specified for sheathing in BS EN 622 (also defined in BS EN 1995-1-1:2004)
   • Cement-bonded particle board* which meets the requirement specified for sheathing in BS EN 634:2:2007
   • Plywood that has been treated with
     i) an organic solvent preservative complying with type F/N of BS5707:1997
     ii) any preservative conforming to the requirements of BS EN 599-1:2009 for hazard class 3.
     iii) disodium octaborate in aqueous solutions according to the PCA Manual
     iv) CCA, CCB or CC (see note below)
     so that the outer veneers are completely penetrated
   • Any board (treated or untreated that has been certified by BBA as suitable for sheathing and which in the associated BS 1982:1 test has a durability at least equivalent to a plywood manufactured entirely from moderately durable timber

Note:
* These sheathings have a high moisture vapour resistance and designers should check that there is no risk of interstitial condensation in accordance with BS 5250:2002
From 30 June 2004, the use of CCA treated timber in the UK will be prohibited in residential or domestic constructions, whatever the purpose (this does not apply to CCA treated timber already in place). Its continued professional use will only be permitted in structural timber in public buildings, offices and industrial premises where human contact during service life is prevented provided skin contact by the general public during its service life is unlikely (Directive 1976/69/EEC, point 20). See also exposure to wind driven rain as detailed on Diagram 6.77

### Table 6.118: Sheathing for very severely exposed site

#### BREATHER MEMBRANE

<table>
<thead>
<tr>
<th>Fixing of breather membranes</th>
<th>Fixing centres (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical</td>
<td></td>
</tr>
<tr>
<td>at stud position</td>
<td>300</td>
</tr>
<tr>
<td>at sides of opening</td>
<td>150</td>
</tr>
<tr>
<td>at vertical membrane joints</td>
<td>150</td>
</tr>
<tr>
<td>at end of panel*</td>
<td>150</td>
</tr>
<tr>
<td>Horizontal</td>
<td></td>
</tr>
<tr>
<td>at eaves</td>
<td>300</td>
</tr>
<tr>
<td>at sole plate or bottom rail</td>
<td>150</td>
</tr>
<tr>
<td>at horizontal membrane joint</td>
<td>150</td>
</tr>
<tr>
<td>at head and base of openings</td>
<td>150</td>
</tr>
<tr>
<td>at head and base of panels*</td>
<td>150</td>
</tr>
</tbody>
</table>

* Required when membrane is fixed to panels in the factory

Avoid the following defects:

- Breather membrane torn at service entrance points
- Laps too small
- Breather membrane damaged by site work or wind
- Laps in breather membrane in wrong direction allowing ingress of water
- Breather membrane not extended to protect sole plate
- Marker tapes, or identification marks, for stud locations inaccurate or absent
- Breather membrane not lapped over lintels
- Increased timescales before final waterproof envelope is installed
### Suitable Breather Membranes

Breather membranes are normally provided to the face of sheathing as an additional waterproof barrier in cases where rainwater entering the cavity can come into contact with the timber frame construction (See diagram 6.116).

Suitable breather membranes can be identified by reference to BS 4016:1997 noted on each roll and TRADA publication TBL 64: Test methods for breather membranes for timber frame walls. It should be noted that in areas designated as 'very severe', only 'high performance' breather membranes can be used. Impervious roofing felts are not suitable as breather membranes.

Where no breather membrane is required (e.g. where bitumen impregnated fibreboard is used) the joints between sheets should be taped to prevent draughts.

### Fixing of Breather Membranes

Breather membranes are normally fixed with stainless steel staples and should be continuous, lap onto cavity trays and extend below sole plates and DPC's (See diagram 6.112).

Laps should be minimum 100mm horizontal and 150mm vertical (See diagram 6.120).

Breather membrane should be fixed in horizontal bands starting at the bottom of the building and working up so that upper layer overlaps the lower layer (See diagram 6.120).

Repair any damage to breather membrane before fixing of cladding (See diagram 6.121).

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![Diagram 6.120: Lapping breather membranes](image1)

![Diagram 6.121: Repairs to breather membranes](image2)
THERMAL INSULATION

Avoid the following defects:

- Thermal insulation quilt missing
- Thermal insulation not continuous above lintels and at junctions with other walls
- Paper backing on thermal insulation not stapled to studs
- Sagging thermal insulation (cold bridges)
- Thermal insulation squashed (reduced efficiency)

Fixing of Thermal Insulation

Generally flexible quilts should be mechanically fixed between studs to avoid sagging (e.g. by stapling).

Particular attention is required to avoid cold bridges at internal/external wall junctions where it is difficult to fix insulation between closely spaced studs.

Insulation should extend down to floor insulation (or provide perimeter insulation to slab edge).

Insulation should be stored on site in a dry environment and should not be fixed wet or subject to water penetration. Insulation should also be protected from the elements as soon as possible after installation.

VAPOUR CONTROL

Avoid the following defects:

- Vapour control layer with gaps at joints/junctions
- Holes in vapour check plasterboard and tears in polythene vapour control layer

Suitable Vapour Control Layers

Suitable vapour control layers include 500 gauge (125μm) sheet polythene (manufactured from virgin polymer) or metalised polyester backed plasterboard (not foil backed plasterboard). Sheet polythene is preferred to plasterboard due to the problem of sealing board joints.

Where metalised polyester backed plasterboard is used as a vapour control layer, it should be fixed in strict accordance with the manufacturer's instructions, in particular ensuring that joints occur at studs and noggins, and are filled and taped.

Fixing of Vapour Control Layers

Condensation can cause timber decay and reduced efficiency of thermal insulation.

The vapour control layer should have at least 5 times the vapour resistance of the breather membrane.

Vapour control layers should be provided to timber framed external walls on the warm side of the insulation (see diagram 6.122).

"Warm wall" constructions (thermal insulation located outside sheathing) normally do not require a vapour control layer. Such systems need to be approved by an independent assessment authority (see diagram 6.123).

The moisture content of the timber frame should be below 20% before the vapour control layer is fitted. In practice it is very difficult to achieve a perfect vapour barrier and consequently a combination of vapour check and ventilation of the fabric is often used.
6.5 Timber Frame

LINTELS

External masonry must be supported by purpose made lintels suitable for span and loading condition (See diagram 6.124). Lintels must be restrained by restraint clips that allow for future settlement and shrinkage of the timber frame. Clips must be fixed to the frame studs (See diagram 6.125).

The breather membrane must lap over the front of the lintel. Simple cranked metal lintels must have a pinch batten behind the bottom flange. In moderate, severe and very severe exposure situations weep holes should be provided to external masonry above all lintels and cavity trays.

Avoid the following defects:

- Door and window frames fixed to masonry instead of timber framed walls
- Vertical DPCs fixed with corrosive staples
- Frames which do not cover the vertical DPC
- End of steel lintel not provided with adequate bearing
- Uneven bearing under lintel supports
- Cavity tray DPC and cavity barrier DPC not lapped under breather membrane
- No weep holes in brickwork over windows and doors

VENTING OF CAVITIES

It is considered unnecessary to provide weep holes to the base and head of a timber-framed building, provided an equilibrium of moisture and air within the cavity behind the external masonry cladding can be achieved.

Weep holes are therefore only required at the foot of the wall, usually at DPC level, therefore eliminating the need to vent the cavity (See diagram 6.126).
The exception to the provision of one set of weep holes is where the cavity is bridged by lintels etc. in the normal way or where a fire barrier is provided at a floor level in accordance with Approved Document B, in which case weep holes are required directly above the fire break to allow any moisture entering the cavity to be readily drained away.

The use of a vent/weep hole ventilator incorporating an insect resistant grille is recommended.

Cavity widths should be:
- Masonry: 50mm
- Render: 25mm minimum when the mesh or metal lathing is backed by a breather membrane
- Render: 50mm when the mesh or metal lathing is unbacked
- Other claddings: 19mm minimum

**WALL TIES**

Avoid the following defects:
- Wall ties nailed to sheathing only, instead of the studs
- Wall ties not sufficiently embedded in brickwork
- Prefixed wall ties not coinciding with masonry mortar joints
- Mortar droppings on cavity wall ties
- Wall ties level or sloping backwards to the internal wall
- Rigid wall ties used instead of flexible ties

**Fixing of Wall Ties**

Wall ties should be fixed to studs with stainless steel, phosphor bronze or silicon bronze nails. Wall ties should be flexible stainless steel or equally durable.

Ties should be fixed to studs, not the sheathing, at the following spacing:
- For studs at 600mm centres the vertical spacing is maximum 375mm
- For studs at 450mm centres the vertical spacing is maximum 525mm

In all cases the vertical spacing should be 300mm at reveals (See diagram 6.127). Wall ties should be embedded in mortar joints to a minimum depth of 50mm with a slight fall towards the external brickwork.
MOVEMENT CONTROL

Avoid the following defects:

- Insufficient allowance for shrinkage and/or compression of timber frame relative to masonry at eaves, verges, windows and door sills
- Cracking of cladding due to absence of a movement joint between different types of cladding
- Absence of movement joint where timber or render cladding bridges intermediate floor zones
- Failure of weather-tight joint at window jambs due to shear from movement

Masonry

Ensure that differential movement between timber frame and independently supported claddings such as masonry can take place, particularly at:

- Eaves and verges (see diagram 6.128)
- Window and door sills (see diagram 6.129)

Make allowance for vertical sliding of masonry against side of openings by providing a flexible mastic joint between reveals and frames.

Where cladding horizontally abuts masonry, provide a movement joint to allow for differential movement (see diagram 6.130).

Where cladding vertically abuts masonry, provide a movement joint with drainage channel discharging onto a cavity tray DPC (see diagram 6.130).

Timber Cladding

Where timber cladding spans across a floor zone, provide a movement joint to accommodate timber shrinkage (see diagram 6.131).

Cement Render

Where cement render on lath fixed to the frame spans across an intermediate floor zone in timber frame construction, allow for differential movement due to timber shrinkage by incorporating a weather-tight movement joint using a proprietary render stop.

Vertical movement joints should also be provided at maximum 5m horizontal centres to render panels.

A movement gap must be maintained below any horizontal render stop bead on masonry below.
6.5 Timber Frame

Diagram 6.128: Timber frame, movement control at eaves

Diagram 6.129: Timber frame, movement control at window sill

Diagram 6.130: Typical movement joint between different claddings at first floor level

Diagram 6.131: Timber frame, first floor movement joint
6.5 Timber Frame

**CLADDING**

**Claddings Fixed Directly to Frame**

Avoid the following defects:

- Insufficient overhang of roof at verges to protect render
- Battens fixed directly to sheathing
- Mesh for render inadequately fixed to timber frame
- Mesh for render damaged or deformed
- Movement or slipping of timber cladding

**Timber**

Boarding to be preservative treated, minimum 16mm thick and sufficient tongues or overlaps provided to permit shrinkage and expansion of the timber.

Timber boarding should be battened off the sheathing to provide a minimum 19mm cavity for draining and venting (See diagram 6.132).

Battens should be a minimum 38mm wide, preservative treated or equivalent hazard class 2 and at maximum 600mm centres. Battens should be fixed to each stud (and not to sheathing) with annular ring nails of length at least twice the batten thickness plus the sheathing thickness or plain nails of length at least 2.5 times the batten thickness plus the sheathing thickness. All nails to be fixed at 600mm centres.

Counter battens should be used for vertical cladding (see diagram 6.133).

Boards should be fixed to battens or other substrate by screw fixings only. Face or secret nailing with annular ring nails is not an acceptable method of fixing in any circumstances.

Butt joints at board ends should occur at battens. Nails should be either hot dipped galvanised, stainless steel or equally durable. Aluminium nails should not be used with copper containing preservative treated timber and galvanised nails should not be used with Western Red Cedar.

Corners and reveals should be formed to provide a weather-tight construction (see diagram 6.134).

**Plywood**

Plywood sheets used as cladding should be pressure preservative treated, a minimum 12mm thick and bonded with WBP or equal quality exterior adhesive and marked accordingly. Battens should be vertical and treated. Joints between sheets should be made resistant to excessive water penetration by fixing cover battens or flashings (see diagram 6.135).

![Diagram 6.132: Vertical timber cladding](image1)

![Diagram 6.133: Vertical timber cladding](image2)
Render

Battens should be either 25 x 38mm or 50 x 50mm, preservative treated.

Battens should be fixed to each stud with annular ring nails of length at least twice the batten thickness plus the sheathing thickness or plain nails of length at least 2.5 times the batten thickness plus the sheathing thickness.

Horizontal battens must be drilled or notched to maintain ventilation requirements.

Nails should be hot dipped galvanised, stainless steel or equally durable.

Mesh or metal lathing should be stainless steel or assessed by an independent authority and fixed to vertical battens at maximum 600mm centres with stainless steel staples.

Laps in the lathing should be wired together at 150mm centres.

A damp-proof course should be provided between unbacked rendered lath and timber battens.

Render should not bridge the DPC and should be finished onto a durable render stop.

Three coat work is essential, at least 16mm thick.

First and second coats should be 1:1/2 :4 (cement : lime : sand) or 1:3 (cement : sand with plasticiser) or 1:3 (masonry cement : sand).

Final coat should be 1:1:6 (cement : lime : sand) or 1:6 (cement : sand with plasticiser) or 1:41/2 (masonry cement : sand). More detailed guidance on render selection and mixes is given in table 6.139.

Epoxy or polymer renders are acceptable but are to be used with the approval of Build-Zone and are to be supplied with the relevant BRE (British Research Establishment) Agrément Certification. All works are to be undertaken in accordance with the relevant manufacturer’s instructions and by fully experienced and insured contractors.

Diagram 6.134: Timber cladding – corner details

Diagram 6.135: Plywood cladding
**Tile and Slate Cladding**

Tile or slate cladding should be fixed in accordance with the manufacturer’s recommendations.

Battens should be a minimum 38 x 25mm for stud centres up to 600mm, and should be preservative treated (BS 8417:2003, or equivalent, hazard class 2). 38 x 19mm counter battens should be provided on severely exposed sites. Severely exposed sites are those shown on the wind driven exposure map.

Battens should be level and fixed to each stud (not to sheathing) with annular ring nails of length at least twice the batten thickness plus sheathing thickness or plain nails of length at least 2.5 times the batten thickness plus the sheathing thickness.

Battens should not normally be less than 1200mm in length and span across at least 3 supports.

Nails should be either hot dipped galvanised, stainless steel or equally durable.

A breather membrane (not a roof underlay) should normally be fixed to the sheathing behind the battens.

Edge of hanging tiles should be cloaked at the jambs of all openings with purpose made corner tiles or by butting against a timber reveal with drainage channel behind.

If natural “new” slates are being utilised, a Slate Conformity certificate must be provided to BZSS’s appointed Technical Auditor and reach the minimum requirement of T1 S1 A1.

**Other Claddings**

Other claddings should only be used if they:

- Conform with a British Standard and, where appropriate, are detailed for use with timber frame construction by the manufacturer or
- Are approved as being suitable by an Independent Assessment Authority such as the BRE and are provided with the relevant Agrément certification for the compatibility of proposed complete system and NOT just the individual component materials.

In addition they should be approved by Build-Zone or BZSS’s appointed Technical Auditor.

**CAVITY BARRIERS & FIRE-STOPS**

Materials used for cavity barriers and fire-stops must be capable of providing adequate resistance to fire and smoke.

Cladding systems incorporating proprietary intumescent materials should follow the guidance provided by The Intumescent Fire Seals Association (IFSA) and the Association for Specialist Fire Protection (ASFP). Cavity barriers and fire-stops should be installed in positions detailed by the design and relevant Building regulations.

Service penetrations in floors between dwellings should be fire-stopped. There should no holes or gaps for smoke to penetrate once the fire-stopping has been installed.
INSTALLATION OF SERVICES

Avoid the following defects:

- Insecurely fixed socket outlets, switches, cooker point boxes, etc
- Electric power cables not de-rated where they run in or beside thermal insulation
- Loadbearing studs cut away to accommodate meter boxes, flues, etc
- Holes in vapour barriers around service pipes not sealed
- Timber damaged by plumber’s blow torch
- Metal sleeves not provided to flues
- External and internal load bearing studs drilled or notched excessively

Cables running in, or covered by, thermal insulation should be de-rated to reduce the risk of overheating. The current carrying capacity should be reduced by 50% when the cable is fully surrounded or by 25% when the insulation is on one side.

Provide noggins to support heavy fixtures and fittings.

Holes in vapour control layers for services should be cut close and neat and sealed around the pipe or cable.

Provide fire protection around flue pipes (e.g. metal sleeve extending through the wall thickness and a 25mm air gap between the pipe and sleeve).

Plumbing runs should not be located in external walls to avoid inaccessibility and the risk of condensation occurring on the pipes.

Holes in studs for services should be sized and positioned in accordance with diagram 6.115.

COMPATIBILITY OF FIXINGS

Structural timber in timber framed walls and cavity barriers should be preservative treated where applicable in accordance with the manufacturer’s instructions.

When timber preservative containing copper is used, aluminium fixings should not be used.

In order to avoid corrosion of ferrous fixings, timber treated with water borne preservative should not be fixed until the timber has dried out to its required moisture content.
6.6 Steel Frame

GENERAL

Galvanised strip steel should be designated either grade S280GD or 350GD to BSEN 10326: 2004.

Structural design should be in accordance with BS 5950 – 5:1998 and the building should be designed to resist loadings in accordance with BS 6399 including:

- dead loads
- imposed loads
- wind loads

Steel and fixings should be suitable for the design and adequately protected against corrosion.

Load bearing walls should be designed to support and transfer loads to foundations safely and without undue movement.

Wall panels may provide resistance to racking forces using one or more of the following techniques:

- internal bracing
- cross flat bracing
- external sheathing board
- internal sheathing board
- rigid frame action

The design should detail how joints between the wall panels and other elements are to be securely fixed:

- to the structure
- to adjacent panels
- to the floor and roof

The design should ensure that the structure is adequately protected from the effects of moisture.

Exterior claddings should be compatible with the steel frame.

Suspended floors should be designed to support and transmit loads safely to the supporting structure without undue deflection.

Services should be adequately protected from damage.

Walls and floors should resist the spread of fire.

Internal walls and floors should be designed to adequately resist the passage of sound.

A copy of the manufacturer’s specification and fixing method statement should be made available to BZSS’s appointed Technical Auditor prior to the erection of the steel frame system and the cladding.

SITE TOLERANCES

It is essential that the accuracy of setting out of foundations and ground beams are checked well in advance of delivery of materials to site.

For accurate erection of the frame, the following tolerances are required at the level of the base of the wall frame:

- Length of wall frame +/- 10 mm in 10m
- Line of wall frame +/- 5mm from outer face of plate
- Level of base of wall frame +/- 5mm over complete wall line

Some packing may be required to achieve the required tolerances and may be as follows:

- Less than 10mm – pack under each steel with pre-galvanised steel shims
- 10-20mm – pack under each steel with steel shims and grout over length of sole plate
- over 20mm – refer to frame designer
FIXING OF FRAMES TO SUBSTRUCTURES

The oversite DPM should be attached to the side of the slab and returned under the DPC on which the frame is placed.

The DPM/DPC detail requires careful attention to prevent the cavity being bridged and providing a ledge for mortar droppings.

Holding down anchors may be galvanised or preferably stainless steel straps fixed to the stud wall and attached to masonry supports or concrete foundation or holding down bolts fixed to the concrete slab (see diagram 6.136).

Diagram 6.136: Steel frame at ground floor level

Steel joists should be spaced at centres not greater than 600mm.

Cutting holes for services on site is not recommended but where essential, should be carried out by a specialist with specialist tools.

Max size of rectangular holes should not exceed 40% of overall section and the length should not exceed 60% of overall section or be the depth of the section apart.

No holes should be closer than 1.5x the depth of the section to the end of the member. Notches are not acceptable. Where the frame is altered on site including but not limited to cutting or welding, additional documentation such as welding certificates will be required by BZSS’s Technical Auditor.

THERMAL INSULATION

Rigid thermal insulation material should be fixed to the outside face of the steel studs to create a 'warm frame' construction.

Where the condensation risk has been assessed, and shown to be negligible, additional insulation may be placed between the studs. The additional insulation should be placed in contact with the studs to minimise air gaps and to prevent local condensation. The following are acceptable:

- mineral wool to BS EN 13162: 2008
- FR (flame retardant) grade expanded polystyrene to BS EN 13163: 2008
- FR (flame retardant) grade extruded polystyrene to BS EN 13164: 2008
- rigid polyurethane foam and polyisocyanurate to BS EN 13166: 2008
- cellular glass to BS EN 13167: 2008
BREATHER MEMBRANES

Breather membranes should be capable of allowing water vapour from within the frame to pass out into the cavity and protect the sheathing and frame from external moisture and should be:

- vapour resistant to less than 0.6MN/sq m when calculated from the results of tests carried out in accordance with BS 3177 at 25°C and relative humidity of 75%
- capable of resisting water penetration
- self-extinguishing
- durable
- adequately strong when wet to resist site damage
- Type 1 to BS 4016 in areas of Very Severe Exposure

If foil faced insulation is not used then an independent breather membrane should be provided to the ‘cold side’ of the insulation.

See notes regarding breather membranes in Timber Frame section.

VAPOUR CONTROL LAYERS

Vapour control layers should resist the passage of water vapour from within the dwelling and should be a minimum 500 gauge polyethylene sheet or vapour control plasterboard. Products manufactured from recycled materials should be approved by Build-Zone and be acceptable to BZSS’s appointed Technical Auditor.

PLASTERBOARD

Plasterboard should be to BS EN 520:2004+A1:2009 and not less than:

- 9.5mm for stud spacing up to 450mm
- 12.5mm for stud spacing up to 600mm

To provide fire resistance, fire rated boards should be used and installed in accordance with the manufacturer’s instructions.

CLADDING

Masonry Cladding

- Cavity trays must be provided above all cavity barriers, windows and door openings and other construction joints such as roof abutments, parapet walls, chimneys/flues and utility boxes etc.
- Level cavity trays should extend 150mm either side of the door or window openings. Trays should be turned up at the ends or provided with stop ends. Stepped trays should be turned up or provided with a stop end at the lowest point of the tray.
- Weep holes should be provided above cavity trays at no more than 900mm centres. Where full fill insulation is proposed, it is advisable to reduce this spacing.
- A continuous cavity tray should be provided where intermediate floors meet the external wall.
- External skin of brickwork should be attached to the metal frame with either epoxy coated galvanised ties or austenitic stainless steel ties (to DD140, BS EN 845-1:2003, BS EN 1995-1-1:2004).
- Ties are normally fixed in vertical channels. These channels are then fixed directly to sheathing boards or attached through insulation boards with stand-off screws. Screws should be isolated from the channels with neoprene or similar washers.
- Ties should be spaced at jambs of openings, a maximum of 300mm vertically within 225mm of the masonry reveal. Additional studs may be needed to achieve this.
- Ties should be inclined away from the frame.
- Ties should be fixed to the studs, not the sheathing.
- Ties should accommodate differential movement between the frame and the cladding.
- Soft joints should be provided to allow for differential movement
- A gap of 1mm per metre of masonry should be provided at openings and soffits.
- All brick support angles should be installed by the manufacturer or specialist contractor.
Other Claddings

More traditional claddings can include amongst others timber boarding, plywood and tile hanging. These types of cladding should be fixed to battens, suitably attached at stud positions (see diagram 6.137).

For further details refer to the timber frame section of this manual and the manufacturers’ recommendations. Render on metal lath combined with a breather membrane should also be fixed to battens attached to studs. Breather membranes should be provided in areas of severe exposure or worse.

Other claddings should only be used if they are provided with an acceptable Third Party accreditation certificate.

Diagram 6.137: Typical cladding detail

INTERNAL WALLS – METAL PARTITIONS

Head rail should be fixed to structure above either directly with a channel or with noggins.

Purpose made sections or special corner studs should be used to connect the partition walls to the external or separating walls.

Plasterboard linings should be attached to partitions using bugle-headed self-drilling, self tapping screws to minimise the risk of popping fixings. Maximum spacing of fixing should not exceed 300mm.

Vertical edges require secondary supports.

METAL FLOORS – UPPER FLOORS

The cutting of holes in steel webs on site is not recommended but, where necessary, should be formed with specialist tools and subject to the designer’s approval.

The maximum depth of unstiffened rectangular holes should not exceed 40% of the overall depth of the member and its length should not be more than 3 x the depth of the hole.

Circular holes should not be more than 60% of the depth of the member, at least the depth of the member apart and a min. 1.5 x the depth away from the end of the member.

Rubber or polythene grommets should be used to line the holes etc.

Plasterboard and other ceiling linings may be fixed directly to the bottom flanges of joists or perimeter Z sections provided the maximum centres are 600mm. Where joists exceed 600mm resilient bars should be fixed to the joists and the ceiling fixed directly to them.
Noggins are required to unsupported edges of plasterboard. Joists may be built into walls or supported by joist hangers or cleats (see diagram 6.138).

- Steel joists should be spaced at centres not greater than 600mm.
- The maximum deflection for a single joist due to imposed load should be limited to span/450.
- The maximum deflection for a single joist due to dead and imposed load should be limited to the lesser of span/350 or 15mm.
- Where the floor construction span is greater than 3.5m for ‘C’ joists or 4.2m for sigma joists the prevention of roll is required and can be by one of the following:
  - A continuous line (or lines) of proprietary steel herringbone struts provided between the joists
  - Solid blocking provided to every third pair of joists with ties between them
  - Joists alternately reversed and tied together in pairs
  - Joist alternately reversed and continuous ties (e.g. resilient bar) fixed to the joist flanges.

Diagram 6.138: First floor junctions

Bridging and blocking are necessary to provide lateral stability but as different profiles require different solutions advice from the manufacturer should be sought on the exact requirements.

Decking requirements are as detailed for timber floors (see tables 6.164 – 6.165) but fixed with self-drilling, self-tapping screws. The following materials are acceptable for decking:

- Moisture resistant particleboard Type P5 to BS EN 312:2003
- Oriented strand board Type OSB3 to BS EN 300:1997:.2003
- Plywood in accordance with BS EN 636:2003

Fixings and supports should be as recommended by the manufacturer.
6.7 Render

Rendering should be in accordance with BS EN 13914-1:2005 and workmanship in accordance with BS 8000-10:1995. In particular the following should be considered:

- Abutments between cement render and other cladding materials or components should be weather-tight and allow for differential movement.
- Any joints in the wall where movement may occur should be continued through the rendering.
- Render should not bridge the DPC and be finished onto a durable render stop end or bellcast.
- External rendering should comply with BS EN 1314-1:2010. Guidance on mixes and uses is given in tables 6.139 and 6.142.
- Sand for rendering should be stored separately from other building and concreting sands.
- For bellcasts a galvanised steel bead is preferable.
- For other beads and stops an epoxy or PVC coated galvanised steel is preferable.

TIMBER FRAME BACKGROUND

A drained and vented cavity should be provided behind render on timber framed construction. Mesh or metal lathing should be approved by an independent authority and fixed to vertical battens at stud centres. The minimum size of the cavity should be 19mm when the mesh or metal lathing is backed by a water-resistant membrane and 50mm when the mesh or metal lathing is unbacked. A DPC should be provided between unbacked render and timber battens.

Battens should be either 25 x 38mm or 50 x 50mm, preservative treated (BS 8417, or equivalent, hazard class 2) and fixed at spacings recommended in BS EN 13914-1:2010. Fixings and preservatives should be compatible.

Battens should be fixed to each stud with annular ring nails of length at least twice the batten thickness plus the sheathing thickness. Nails should be hot dipped galvanised, stainless steel or equally durable. Render boards should be screw fixed to the substrate in accordance with the manufacturer’s instructions. Nail fixings are not an acceptable method of fixing under any circumstances. The board should be compatible with both the substrate and render system proposed and be supplied with the relevant BRE Agrément certificates for the proposed system as a whole and not the component parts. All works are to be undertaken in accordance with the relevant manufacturer’s instructions and by fully experienced and insured contractors.

Where cavity barriers are required, they should be correctly fitted without gaps, fill the cavity and be fixed with stainless steel staples or equally durable fixings.

Maintain settlement joints below external frames and soffits. Where cement render spans across an intermediate floor zone in timber frame construction, allow for differential movement due to timber shrinkage by incorporating a movement joint. Vertical movement joints should also be provided at maximum 5m horizontal centres.

MASONRY BACKGROUND

Walls should be examined for excessive moisture content prior to rendering. This is particularly important where the masonry background has no upper limit on its soluble salts content (e.g. N designation clay bricks).

Parapets, chimneys, retaining walls and walls below DPC level with this background should employ sulphate resisting cement in the render and mortar.

Chimneys, Parapets, Retaining Walls and Walls below DPC Level

- Pay special attention to the render mix specification and use sulphate resisting cement.
- It is recommended that the backs and exposed horizontal surfaces of parapets are not rendered.
- Throats or drips to copings of parapets and chimneys should project beyond the finished faces to throw water clear using galvanised stop ends and other castings as necessary.
- Rendering to chimneys should only be carried out where brickwork contains little or no sulphates. “Splatterdash” treatment should be used.
- As before horizontal DPCs and DPMs must not be bridged.
- It is recommended that rendering is not used below DPC level. However where this is not practical, the render must still not be allowed to bridge the DPC. A “bellcast” must be formed in the render above the DPC.
OTHER CONSTRUCTION DETAILING

- Ensure that drips and throating to sills, coping etc. project beyond the face of the finished render above the DPC.
- Notwithstanding wind loadings, the larger the eaves overhang the better. This will provide protection to the top joint and prevent rainwater percolating behind the render.

<table>
<thead>
<tr>
<th>Uses</th>
<th>Proportions by volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>To provide a strong relatively impervious finish but with high drying shrinkage, hence susceptible to cracking. Restrict its use to first base for metal lathing</td>
<td>1:3:3</td>
</tr>
<tr>
<td>To provide a suitable render for finishing and base coats in the majority of cases. More permeable than designation 1 and hence has lower drying shrinkage problems</td>
<td>1:3:4-4½</td>
</tr>
<tr>
<td>Only suitable for work in sheltered locations with weak backgrounds. Ideal for use in remedial works to weak lime based renders</td>
<td>1:3:10-12</td>
</tr>
</tbody>
</table>

Follow the guidance given regarding bathing, admixtures, working life, and cold weather working for mortars. Ensure the render coat does not bridge the dpc

Table 6.139: Recommended mortar mixes for use in render finishes

Angles, stop beads and jointing sections should be secured with drilled or shot-fired fixings and not with gypsum plaster.

Check whether the rendering can be applied directly onto the wall or whether any preparatory treatment is required in accordance with the manufacturer’s instructions.

The surface should be checked for suction by dampening the wall with clean water.

Vertical and Horizontal Flatness

Rendering should have a maximum vertical and horizontal deviation from flatness of ±10mm in 5m and is measured in a similar way to straightness on plan and plumb of masonry. See diagram 6.141.
**Table 6.142: Mortar specification for background exposure and finish**

<table>
<thead>
<tr>
<th>Background</th>
<th>Exposure*</th>
<th>First base coat</th>
<th>Second basecoat</th>
<th>Final coat</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal lathing</td>
<td>Very severe/severe</td>
<td>I 3-6</td>
<td>II 10-14</td>
<td>Roughcast</td>
<td>1:6:3:1½</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Buttercoat/drycast</td>
<td>II</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tyrolean</td>
<td>II</td>
</tr>
<tr>
<td></td>
<td>Moderate/sheltered</td>
<td>II 8-12</td>
<td>--</td>
<td>Roughcast</td>
<td>1:6:3:1½</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Buttercoat/drycast</td>
<td>II</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tyrolean</td>
<td>II</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Thrown</td>
<td>1:6:3:1½</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>II</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Troweled</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Woodfloat</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Scraped</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Patterned</td>
<td>IV</td>
</tr>
<tr>
<td>Strong to moderate</td>
<td>Very severe/severe</td>
<td>II 8-12</td>
<td>II 6-10</td>
<td>Roughcast</td>
<td>1:6:3:1½</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Buttercoat/drycast</td>
<td>II</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tyrolean</td>
<td>II</td>
</tr>
<tr>
<td></td>
<td>Moderate/sheltered</td>
<td>II 8-12</td>
<td>--</td>
<td>Roughcast</td>
<td>1:6:3:1½</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Buttercoat/drycast</td>
<td>II</td>
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<td></td>
<td>Tyrolean</td>
<td>II</td>
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<td></td>
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<td></td>
<td></td>
<td>Thrown</td>
<td>1:6:3:1½</td>
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<td></td>
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<td></td>
<td></td>
<td>II</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Troweled</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Woodfloat</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Scraped</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Patterned</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tooled</td>
<td>IV</td>
</tr>
<tr>
<td>Moderate to weak</td>
<td>Very severe/severe</td>
<td>III 8-12</td>
<td>III 6-10</td>
<td>Roughcast</td>
<td>1:6:3:1½</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>Buttercoat/drycast</td>
<td>II</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Tyrolean</td>
<td>II</td>
</tr>
<tr>
<td></td>
<td>Moderate/sheltered</td>
<td>III 8-12</td>
<td>--</td>
<td>Roughcast</td>
<td>1:6:3:1½</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Buttercoat/drycast</td>
<td>II</td>
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<td></td>
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<td></td>
<td>Tyrolean</td>
<td>II</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Thrown</td>
<td>1:6:3:1½</td>
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<td></td>
<td>II</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Troweled</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Woodfloat</td>
<td>IV</td>
</tr>
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<td></td>
<td></td>
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<td>Scraped</td>
<td>IV</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Patterned</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tooled</td>
<td>IV</td>
</tr>
<tr>
<td>Weak</td>
<td>Sheltered only</td>
<td>IV 8-12</td>
<td>--</td>
<td>Troweled</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Woodfloat</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>patterned</td>
<td>IV</td>
</tr>
</tbody>
</table>

* Reference to the map as detailed in diagram 6.77 with regard to wind driven rain index and exposure ratings.
** Where (designation) a mix is specified it is by volume using cement:lime:sand:coarse aggregate. The mix of each successive coat should never be stronger than the previous coat or background. A stronger background is deemed to be a dense concrete block. Lightweight blocks are classified as moderate, with bricks being moderate to weak. Depending on type and condition (always check with the manufacturer prior to rendering). Nominal overall thickness expected for three coat applications is 20mm and 16mm for two coat applications. For very severe and severe exposures and when the background is metal lathing it is recommended to provide two base coats thus providing an enhanced resistance to rain penetration. Refer to Table 6.139 for mixes relative to designation.
6.8 Curtain Walling

GENERAL

Curtain walling systems should have Third Party certification confirming satisfactory assessment in accordance with the “CWCT Standard” (Centre for Window and Cladding Technology) for Curtain Walling. The CWCT Standards provide detailed guidance on performance and testing.

Dead and live loads should be transferred safely to the building structure without undue permanent deformation or deflection of any component.

Imposed loads should be calculated in accordance with BS EN 1991-1-7:2006.

All movement should be accommodated without any reduction in performance.

Fixings and supports should be designed to accommodate specified loads and take account of product manufacturer’s recommendations.

Pull-out or destructive testing of anchors should be carried out in accordance with BS 5080-1:1993 and the construction Fixings Association Guidance Note ‘Procedure for Site Testing’ and should be carried out at a rate agreed by Build-Zone.

Packing of brackets to achieve surface tolerance should be permitted only in accordance with the manufacturer’s recommendations.

It should resist the passage of water to the inside of the building, allowing free drainage and not trap water and should have:

- External and internal air and water seals, and
- Drained and ventilated glazing rebates

Sealants should be specified in accordance with BS 6213:2000+A1:2010 and the manufacturer’s recommendations.

It should be designed to minimise the risk of surface and interstitial condensation by the use of thermal breaks and a continuous vapour control layer.

The system should be designed to resist the passage of airborne and impact sound within the building, particular attention should be given to flanking transmission at:

- The edges of separating floors
- The outer edges of separating walls
- The outer edges of partition walls
- The junctions with roof constructions and parapets.

It should comply with BS 7671:2008 ‘Requirements for Electrical Installations’ for electrical continuity and earth bonding.

The risk of bimetallic corrosion should be avoided where possible in the choice of materials being used. If not possible, avoidance can be obtained through isolation of dissimilar metals.

The curtain wall system should not include materials liable to infestation attack by micro-organisms, fungi, insects or vermin.

Design should allow for the line, level, plumb and plane of the completed curtain wall to be within the acceptable tolerances of:

- +/- 2mm in any one storey height or structural bay width and
- +/- 5mm overall.
INSULATED RENDER SYSTEMS

These are systems which are applied to the exterior walls of existing or new buildings, comprising of an insulant and a weather protective finish, or which there are three main types:

- Traditional renders and finishes;
- Thin coat renders and synthetic finishes;
- Preformed cladding materials.

Whilst a 10 year insurance backed warranty/guarantee covering workmanship and materials is normally required by Build-Zone, Build-Zone will also require relevant Agrément certificates for the materials AND backing board. Normally a composite Agrément certificate is required confirming that all materials are compatible together and are appropriate for the substrate material.

Dead and live loads should be transferred safely to the building structure without undue permanent deformation or deflection of any component.

Imposed loads should be calculated in accordance with BS EN 1991-1-4:2005.

Movement within the insulated render system should be accommodated without any reduction in performance. Movement joints in the backing wall should be continued through the insulated render system and formed in accordance with the manufacturer’s recommendations.

Fixings rails, frames and supports should be designed to accommodate specified loads and take account of product manufacturer’s recommendations.

Pull-out or destructive testing of anchors should be carried out in accordance with BS 5080-1:1993 and the construction Fixings Association Guidance Note 'Procedure for Site Testing' and should be carried out at a rate agreed by Build-Zone and overseen by BZSS’s appointed Technical Auditor or test results provided to the Technical Auditor.

Insulated render systems together with the backing wall to which they are applied should satisfactorily resist the passage of moisture to the inside of the building and provide adequate resistance of fire to the system as a whole.

Particular attention should be given to the interfaces between the insulated render system and the walls, roof, doors, windows etc. Sealants and tapes should be in accordance with BS 6213:2000+A1:2010 and the manufacturer’s recommendations.

The insulated render system should be securely fixed to the support frame or backing wall with the appropriate fixings/adhesive in accordance with the manufacturer’s recommendations.

A minimum of one non-combustible fixing per square metre or per insulation batt, whichever provides the greater number should be used in addition to other fixings. Reference should be made to BRE document BR 135-2003 'Fire performance of external thermal insulation for walls of multi-storey buildings' when specifying type of insulation system to be installed.

Insulation should be returned into window and door openings and be continuous around penetrations through the wall (see diagram 6.144).

A condensation risk analysis in accordance with BS 5250:2002 should be carried out. Unless it shows otherwise, a vapour control layer should be provided. The vapour control layer should be fixed on the warm side of the building.

Reinforcement mesh is to be provided and additional mesh should be provided where there is likelihood of increased stress in the render system, e.g. at the corners of window or door openings (see diagram 6.143). Corners, returns and features should be formed with appropriate trims in accordance with the manufacturer’s recommendations.

Fixings and brackets should be stainless steel, suitable non-ferrous metal or suitable plastics and should appropriate for the function being used. Fixings and brackets should be affixed in accordance with the manufacturer’s instructions.

The risk of bimetallic corrosion should be avoided by isolation of dissimilar metals.

The insulated render system should not include materials liable to infestation attack by micro-organisms, fungi, insects or vermin.

Acceptable tolerance for an insulated render system would normally be a maximum horizontal or vertical deviation from flatness of +/- 10mm in 5m.
RENDER APPLICATION FOR THIN COAT RENDER SYSTEMS

The undercoat should be built up to the correct thickness in two or more stages without any appreciable delay and ruled off with a straight edge between the grounds.

The undercoat should be finished with a wood or plastic float and, unless otherwise required, combed to divide the surface into small areas to provide a key for the final coat.

The undercoat should be allowed to dry before application of the next coat.

The final coat should be applied in a single, continuous operation over each wall. The position of any joints in the final coat should be determined in advance.

Where adhesives are used, the recommendations of the manufacturer should be followed.

Metal lathing should be galvanised where possible and fixed in accordance with the manufacturer’s instructions.

Precautions should be taken to prevent rapid drying out of wet applied materials by:

- Dampening porous supporting surfaces
- Providing sun screens across window openings in hot weather

Renders should (unless specifically intended otherwise) be finished to a reasonable plane, visually uniform surface in order that trims, paints, and other surface finishes may be applied without the need to carry out any excessive preparatory work such as levelling, stopping up or rubbing down.

Textured finishes should be uniform and neatly finished at perimeter edges.

Renders must not bridge any DPM or DPC (see diagram 6.145). Where necessary, appropriate stop ends and other castings should be used at junctions, edges and corners.

Work on site should be in accordance with BS 2000:10:1995.
PROTECTION OF RENDER

Render is vulnerable to damage through exposure to extremes of temperature during the execution of the works and the first few days following its application.

Therefore the following appropriate precautions should be arranged in advance:

- In hot weather, the wall should be shaded from the direct heat of the sun or the work programmed to be carried out in the shade.
- In cold weather, rendering should not be attempted when there is a risk of frost occurring during the day or the following night.
- Air temperature should be at least 5°C at the time of application.
- When rendering has been applied, it should be prevented from drying out for two or three days until the mortar has hardened.
- In drying winds it may need to be kept damp by gentle spraying.

Rendering should not be carried out when rainfall exceeds the lightest of showers.
6.9 Cladding

**GENERAL**

Timber and boards for exterior use should be of a durable species, with sapwood excluded, or preservative treated by pressure impregnation using preservatives suitable for use in hazard class 3 in compliance with BS8417:2003, or equivalent (see table 6.146).

Ends cut on site should be dipped in or liberally brushed with preservatives.

<table>
<thead>
<tr>
<th>hardwoods</th>
<th>softwoods</th>
<th>Preservative treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afrormosia</td>
<td>Western red cedar</td>
<td>not required</td>
</tr>
<tr>
<td>Afzelia</td>
<td></td>
<td>not required</td>
</tr>
<tr>
<td>Iroko</td>
<td></td>
<td>not required</td>
</tr>
<tr>
<td>Keruing</td>
<td></td>
<td>not required</td>
</tr>
<tr>
<td>Mahogany, African</td>
<td></td>
<td>not required</td>
</tr>
<tr>
<td>Oak, European</td>
<td></td>
<td>not required</td>
</tr>
<tr>
<td>Opepe</td>
<td></td>
<td>not required</td>
</tr>
<tr>
<td>Sapele</td>
<td></td>
<td>not required</td>
</tr>
<tr>
<td>Teak</td>
<td></td>
<td>not required</td>
</tr>
<tr>
<td>Utile</td>
<td></td>
<td>not required</td>
</tr>
<tr>
<td>Abura</td>
<td>Douglas fir</td>
<td>required</td>
</tr>
<tr>
<td>Elm</td>
<td>Hemlock, Western</td>
<td>required</td>
</tr>
<tr>
<td>Meranti</td>
<td>Larch, European</td>
<td>required</td>
</tr>
<tr>
<td></td>
<td>Larch, Japanese</td>
<td>required</td>
</tr>
<tr>
<td></td>
<td>Redwood (European)</td>
<td>required</td>
</tr>
<tr>
<td></td>
<td>or scots pine</td>
<td>required</td>
</tr>
<tr>
<td></td>
<td>Sitka spruce</td>
<td>required</td>
</tr>
<tr>
<td></td>
<td>Whitewood or European spruce</td>
<td>required</td>
</tr>
<tr>
<td>plywood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>European birch or birch faces plywood (WBP)</td>
<td>required</td>
<td></td>
</tr>
<tr>
<td>European softwood plywood (WBP)</td>
<td>required</td>
<td></td>
</tr>
<tr>
<td>North American Douglas fir or Douglas fir faced plywood (exterior grade)</td>
<td>required</td>
<td></td>
</tr>
<tr>
<td>Gaboon or mahogany plywood (WBP)</td>
<td>required</td>
<td></td>
</tr>
<tr>
<td>South East Asia Meranti/Lauan plywood (WBP)</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>Marine grade plywood specified in accordance with BS 1088-1:2003 but excluding Gaboon</td>
<td>not required</td>
<td></td>
</tr>
</tbody>
</table>

Typical preservatives are those conforming to the requirements of BS EN 599-1:2009 for hazard class 3. For example micro-emulsions or copper-organic pressure impregnated.

Table 6.146: Common species of timber with or without preservative treatment for claddings and external trim

Where timber boarding or plywood spans across an intermediate floor zone in timber frame construction, allow for differential movement caused through timber shrinkage, by incorporating a movement joint (see diagram 6.147).

Where cavity barriers are required they should be correctly fitted without gaps, fill the cavity and be fixed with stainless steel staples or equally durable fixings.

Abutments between cladding and other weather-resisting elements should be neatly made, be weather-tight and allow for differential movement (see diagram 6.148).

Workmanship should comply with BS 8000:5:1990.
6.9 Cladding

Diagram 6.147: Cladding to timber framed construction, movement gap at intermediate floors

Diagram 6.148: Abutments between brickwork and other cladding

TIMBER BOARDING

Timber boarding should be at least 16mm thick and allowance for moisture movement in boarding should be made by making tongues, joints or overlaps at least 10% of the board width. Timber boarding should be battened off the supporting background to provide a minimum 19mm cavity for draining and venting (see diagrams 6.149 and 6.150).

Battens should be a minimum 38mm wide, preservative treated and at maximum 600mm centres. A breather membrane should always be installed when horizontal battens are located against the sheathing. Battens on timber frame should be fixed to each stud (and not to the sheathing) with annular ring nails of length at least twice the batten thickness plus the sheathing thickness (or plain shank nails of length 2.5 times the batten thickness plus the sheathing thickness). Boards should be fixed to battens by face or secret nailing with annular ring nails at least twice the board thickness or plain shank nails at least 2.5 times the board thickness. Butt joints at board ends should occur at battens. Nails should be either hot dipped galvanised, stainless steel or equally durable. Aluminium nails should not be used with copper containing preservative treated timber and galvanised nails should not be used with Western Red Cedar.

Diagram 6.149: Vertical timber cladding

Diagram 6.150: Vertical timber cladding
6.9 Cladding

**TILE AND SLATE CLADDING**

Tile and slate cladding should comply with BS 8000:6:1990 and be fixed in accordance with the manufacturer’s recommendations.

All battens should be minimum 38 x 25mm.

Battens should be level and, if timber frame, fixed to each stud (not to sheathing) with annular ring nails of length at least twice the batten thickness plus sheathing thickness.

Battens should not be less than 1200mm in length and span across at least 3 supports. Nails should be either hot dipped galvanised, stainless steel or equally durable.

A breather membrane (not a roof underlay) should always be fixed to sheathing behind the battens.

If natural “new” slates are being utilised, a Slate Conformity certificate must be provided to BZSS’s appointed Technical Auditor and reach the minimum requirement of T1 S1 A1.

**OTHER CLADDINGS**

Other claddings should only be used if they are provided with independent Third Party certificates acceptable to Build-Zone.

Flint, stone or cobble cladding must be a non-loadbearing element of the wall, backed up by a masonry skin and secured by stainless steel ties at 450mm centres horizontally and vertically. Expanded metal is recommended as it is easily adjusted to suit the stonework.

Cladding finishes such as copper or zinc are acceptable to Build Zone but must be fixed in accordance with the manufacturer’s instructions, meet the requirements of the Building Regulations and where necessary, on completion be supplied with the relevant composite Agrément certificate for the system as a whole.

A minimum 50mm cavity and inner skin should be constructed in the usual way.
6.10 Upper Floors

TIMBER FLOORS

The moisture content of structural timber should not exceed 20% at the time of stress grading and at the time of erection. All structural timber for use within the building fabric should be stress graded marked ‘KD’ (Kiln Dry) or ‘DRY’.

Joists should be regularised to enable floor and ceiling finishes to be laid to a level and smooth finish.

Notching and drilling of joists should only be as shown in diagram 6.154, unless specifically designed by an suitable professional. If this is the case then certification will be required by Build-Zone from the professional. The professional must hold the appropriate Insurances for the project in hand.

Reference can be made to tables 6.151 and 6.152 which converts diagram 6.154 drilling and notching zones into actual dimensions for a number of typical depths and spans.

- Adjacent holes must not be closer than 3 times the diameter of the largest hole permitted (see table 6.152).
- A notch and a hole within the same joist must be at least 100mm apart measured horizontally along the centre of the joist.
- Where the joist depth is greater than 250mm, then the dimensions of the shaded zones given in diagram 6.154 should be calculated using d = 250mm.

<table>
<thead>
<tr>
<th>Clear span of joist (m)</th>
<th>Holes to be drilled only within the zones of A-B (distance given is taken from either supporting wall in mm)</th>
<th>Notches to be taken out only within the zones C-D (distance given is taken from either supporting wall in mm)</th>
<th>Depth of joist ‘d’ (mm)</th>
<th>Max. depth of notch 0.125d (mm)</th>
<th>Max. diameter of holes 0.25d (mm)</th>
<th>Min. distance between holes* (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.50</td>
<td>A 375</td>
<td>B 600</td>
<td>105</td>
<td>375</td>
<td>125</td>
<td>25</td>
</tr>
<tr>
<td>2.00</td>
<td>500</td>
<td>800</td>
<td>140</td>
<td>500</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>2.50</td>
<td>625</td>
<td>1000</td>
<td>175</td>
<td>625</td>
<td>22</td>
<td>44</td>
</tr>
<tr>
<td>3.00</td>
<td>750</td>
<td>1200</td>
<td>210</td>
<td>750</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>3.50</td>
<td>875</td>
<td>1400</td>
<td>245</td>
<td>875</td>
<td>28</td>
<td>56</td>
</tr>
<tr>
<td>4.00</td>
<td>1000</td>
<td>1600</td>
<td>280</td>
<td>1000</td>
<td>31</td>
<td>62.5</td>
</tr>
<tr>
<td>4.50</td>
<td>1125</td>
<td>1800</td>
<td>315</td>
<td>1125</td>
<td>37.5</td>
<td>112.5</td>
</tr>
<tr>
<td>5.00</td>
<td>1250</td>
<td>2000</td>
<td>350</td>
<td>1250</td>
<td>44</td>
<td>132</td>
</tr>
<tr>
<td>5.50</td>
<td>1375</td>
<td>2200</td>
<td>385</td>
<td>1375</td>
<td>50</td>
<td>150</td>
</tr>
<tr>
<td>6.00</td>
<td>1500</td>
<td>2400</td>
<td>420</td>
<td>1500</td>
<td>56</td>
<td>168</td>
</tr>
</tbody>
</table>

Notes: * clear span is the distance between supports
A= 0.25 x clear span
B= 0.40 x clear span
C= 0.07 x clear span
D= 0.25 x clear span

JOISTS

Internal partitions should be supported so as not to cause excessive floor deflection. Non-loadbearing lightweight partitions (up to 0.7KN/m run) such as timber stud partitions or plasterboard lined honeycomb partitions may be supported by timber floors as shown in diagram 6.153.

To prevent cold bridging, reduce air leakage and avoid the risks of moisture penetration, ends of joists should not be built into external masonry walls. The use of suitable proprietary joist hangers is recommended and must be fixed in accordance with the manufacturer’s instructions. Further information can be found in 'Robust Details' and BR262 "Thermal Insulation: avoiding the risks", 2002 edition.

To avoid distortion of finishes, joists should be prevented from twisting over supports and provision made to accommodate up to 10mm drying shrinkage in floor joists supported by steel beams (see diagram 6.156).

Joists should not be overloaded during construction.

Joints in joists, rafters and purlins should only occur over a loadbearing support, or the joint should be designed by an Expert.
Joists should be restrained at supports and along the span as shown in table 6.155, using tightly fitted strutting.

Joists should have a minimum end bearing of 90mm.

Joists should have a minimum 35mm bearing onto joist hangers. Double joists should be pattern nailed at 450mm centres, nails maximum 20mm from top and bottom.

Projecting nails ends should be bent over. Bolting of double joists recommended at 1m centres along centre line of joist - bolting should always be used on double stair trimmers.

Trimmer and trimming joist sizes should not be less than as shown in tables 6.160 – 6.163 unless the size is specifically calculated by an Expert.
Floor joist sizes should not be less than as shown in table 6.159 unless the size and spacing are specifically designed by an Expert.

| Table 6.160 |
| --- | --- |
| **Trimmer Size (mm)** | **Load length on Table 6.157** |
| | **Clear span (m)** |
| **Trimmer Size (mm)** | **C16 timber** | **C24 timber** |
| 2x47x147 | 2.55 | 2.14 | 1.78 | 1.54 | 1.36 | 1.23 | 2.67 | 2.25 | 1.99 | 1.81 | 1.67 | 1.36 |
| 170 | 2.96 | 2.50 | 2.09 | 1.81 | 1.61 | 1.45 | 3.10 | 2.62 | 2.33 | 2.12 | 1.96 | 1.68 |
| 195 | 3.41 | 2.88 | 2.41 | 2.10 | 1.87 | 1.69 | 3.56 | 3.02 | 2.69 | 2.45 | 2.27 | 2.02 |
| 220 | 3.85 | 3.25 | 2.73 | 2.38 | 2.13 | 1.93 | 4.03 | 3.42 | 3.05 | 2.78 | 2.58 | 2.36 |
| 2x63x147 | 2.83 | 2.39 | 2.11 | 1.83 | 1.63 | 1.48 | 2.96 | 2.50 | 2.22 | 2.03 | 1.88 | 1.76 |
| 170 | 3.28 | 2.78 | 2.46 | 2.14 | 1.91 | 1.73 | 3.43 | 2.91 | 2.59 | 2.37 | 2.20 | 2.06 |
| 195 | 3.76 | 3.20 | 2.83 | 2.47 | 2.21 | 2.01 | 3.93 | 3.36 | 2.99 | 2.74 | 2.54 | 2.39 |
| 220 | 4.25 | 3.63 | 3.20 | 2.80 | 2.51 | 2.29 | 4.44 | 3.80 | 3.39 | 3.11 | 2.89 | 2.72 |
| 2x75x147 | 3.00 | 2.54 | 2.26 | 2.03 | 1.81 | 1.64 | 3.13 | 2.66 | 2.37 | 2.17 | 2.01 | 1.89 |
| 170 | 3.47 | 2.96 | 2.64 | 2.36 | 2.11 | 1.92 | 3.63 | 3.10 | 2.76 | 2.53 | 2.35 | 2.21 |
| 195 | 3.99 | 3.41 | 3.04 | 2.73 | 2.44 | 2.23 | 4.17 | 3.56 | 3.19 | 2.92 | 2.72 | 2.56 |
| 220 | 4.50 | 3.85 | 3.45 | 3.08 | 2.77 | 2.53 | 4.70 | 4.03 | 3.61 | 3.31 | 3.09 | 2.90 |

**Table 6.161**

<table>
<thead>
<tr>
<th><strong>Trimmer Size (mm)</strong></th>
<th><strong>Clear span (m)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>2x47x147</td>
<td>0.87</td>
</tr>
<tr>
<td>170</td>
<td>0.97</td>
</tr>
<tr>
<td>195</td>
<td>1.07</td>
</tr>
<tr>
<td>220</td>
<td>1.17</td>
</tr>
<tr>
<td>2x63x147</td>
<td>1.37</td>
</tr>
<tr>
<td>170</td>
<td>1.47</td>
</tr>
<tr>
<td>195</td>
<td>1.57</td>
</tr>
<tr>
<td>220</td>
<td>1.67</td>
</tr>
<tr>
<td>2x75x147</td>
<td>1.87</td>
</tr>
<tr>
<td>170</td>
<td>1.97</td>
</tr>
<tr>
<td>195</td>
<td>2.07</td>
</tr>
<tr>
<td>220</td>
<td>2.17</td>
</tr>
</tbody>
</table>

**Key:**
1. C16 timber is approximately equivalent to SC3 timber;
2. C24 timber is approximately equivalent to SC3 timber;
3. Non loadbearing lightweight partitions (loading not greater than 0.8 Kn/m² run).

Notes:
- Joists should be doubles up beneath baths and any other point of concentrated load.
- Maximum partition load 0.8KN/m² (eg timber framed stud partition).
- Non loadbearing partitions should be supported as shown in diagram 6.157.
- No notches in trimmer beam unless designed by an expert.
See diagram 6.124 for positions of d1, d2, d3 and S

<table>
<thead>
<tr>
<th>Trimmer size (mm)</th>
<th>For ratios of d1/d2 upto 0.25</th>
<th>For ratios of d1/d2 between 0.26 &amp; 0.49</th>
<th>Dimension d3 (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.0</td>
<td>2.0</td>
<td>3.0</td>
</tr>
<tr>
<td>2x4x147</td>
<td>3.25</td>
<td>2.98</td>
<td>2.77</td>
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<tr>
<td>170</td>
<td>3.76</td>
<td>3.48</td>
<td>3.25</td>
</tr>
<tr>
<td>195</td>
<td>4.32</td>
<td>4.01</td>
<td>3.76</td>
</tr>
<tr>
<td>220</td>
<td>4.87</td>
<td>5.54</td>
<td>4.27</td>
</tr>
<tr>
<td>2x6x147</td>
<td>3.58</td>
<td>3.30</td>
<td>3.08</td>
</tr>
<tr>
<td>170</td>
<td>4.14</td>
<td>3.84</td>
<td>3.60</td>
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<tr>
<td>195</td>
<td>4.74</td>
<td>4.42</td>
<td>4.16</td>
</tr>
<tr>
<td>220</td>
<td>5.34</td>
<td>5.00</td>
<td>4.72</td>
</tr>
<tr>
<td>2x7x147</td>
<td>3.78</td>
<td>3.50</td>
<td>3.28</td>
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<tr>
<td>170</td>
<td>4.37</td>
<td>4.07</td>
<td>3.82</td>
</tr>
<tr>
<td>195</td>
<td>5.00</td>
<td>4.68</td>
<td>4.41</td>
</tr>
</tbody>
</table>

Table 6.162

See diagram 6.158 for positions of d1, d2, d3 and S

<table>
<thead>
<tr>
<th>Trimmer size (mm)</th>
<th>For ratios of d1/d2 upto 0.25</th>
<th>For ratios of d1/d2 between 0.26 &amp; 0.49</th>
<th>Dimension d3 (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.0</td>
<td>2.0</td>
<td>3.0</td>
</tr>
<tr>
<td>2x4x147</td>
<td>3.99</td>
<td>3.69</td>
<td>3.40</td>
</tr>
<tr>
<td>170</td>
<td>4.51</td>
<td>4.19</td>
<td>3.94</td>
</tr>
<tr>
<td>195</td>
<td>5.08</td>
<td>4.75</td>
<td>4.47</td>
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<tr>
<td>220</td>
<td>5.65</td>
<td>5.32</td>
<td>4.99</td>
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<tr>
<td>2x6x147</td>
<td>3.73</td>
<td>3.45</td>
<td>3.23</td>
</tr>
<tr>
<td>170</td>
<td>4.31</td>
<td>4.01</td>
<td>3.77</td>
</tr>
<tr>
<td>195</td>
<td>4.94</td>
<td>4.62</td>
<td>4.35</td>
</tr>
<tr>
<td>220</td>
<td>5.56</td>
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<tr>
<td>2x7x147</td>
<td>3.94</td>
<td>3.66</td>
<td>3.43</td>
</tr>
<tr>
<td>170</td>
<td>4.55</td>
<td>4.25</td>
<td>4.00</td>
</tr>
<tr>
<td>195</td>
<td>5.21</td>
<td>4.88</td>
<td>4.61</td>
</tr>
<tr>
<td>220</td>
<td>5.85</td>
<td>5.50</td>
<td>5.21</td>
</tr>
</tbody>
</table>

Key: 1. C24 timber is approximately equivalent to SC3 grade timber
2. C24 timber is approximately equivalent to SC4 grade timber
Notes: Maximum partition load 0.8KN/m² (avg timber framed stud partition).
No notches in trimmer beam unless designed by an expert.

Table 6.163

DECKING

The type and thickness of floor decking should not be less than as set out in tables 6.164, 6.165 and 6.166.

Other board types and thicknesses than those shown in tables 6.164 – 6.166 should be assessed as suitable by an Independent Testing Authority and laid in accordance with the recommendations of the relevant supplier’s, importer’s or manufacturer’s instructions.

To achieve adequate sound resistance to internal floors the board may need to be increased to 22mm to achieve the required density.

All square cut edges and all boards at room perimeters should have solid timber edge support. This is to ensure that the short edge of tongued and grooved boards meet over a joist.

Deck fixings should be as set out in tables 6.164 – 6.166 or as specified by the board manufacturer.

Floor decking should not generally be laid until the building is weather-tight, unless fully protected. Other types of proprietary timber floor construction, such as web beams, may be used if independent Third Party certificates acceptable to Build-Zone are available, or subject to a satisfactory appraisal by Build-Zone. All such systems should be installed in accordance with the manufacturer’s instructions.

### Table 6.164

<table>
<thead>
<tr>
<th>T &amp; G Softwood Boarding for Flooring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finished board thickness (mm)</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>150</td>
</tr>
</tbody>
</table>

Note: Softwood floor boarding should comply with BS 1297:1987 and have a moisture content of 16-20% at the time of laying. Boards should be doubled or secret nailed to each joist. Use 2.5 times the thickness of the board and punch well below board surface.
### Flooring grade particle board and Oriented Strand Board

<table>
<thead>
<tr>
<th>Thickness (mm) particle board</th>
<th>Thickness (mm) OSB</th>
<th>Maximum span (mm) centre to centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 &amp; 19</td>
<td>15</td>
<td>450</td>
</tr>
<tr>
<td>22</td>
<td>18 &amp; 19</td>
<td>600</td>
</tr>
</tbody>
</table>

**Note:**
- Softwood floor boarding should comply with BS 1297:1987 and chipboard flooring should be moisture resistant flooring Grade type P5 or P7 to BS EN 312:2003.
- Particle board may be square edged or tongue and grooved. Square edged boards should have all edges supported and are normally laid parallel to the joists and short ends supported of noggins. Tongued and grooved chipboard in normally laid across the joists with short ends occurring on the joists.
- Orientated Strand Boards (OSB) should be type 3 or 4 to BSEN 300:2006. OSB should be laid with its major axis at right angles to the supporting joists (The major axis is normally indicated by a series of arrows on the face of the board).
- Screw or nail chipboard and OSB at 200mm to 300mm (or closer) centres along the edges and elsewhere along the edges and elsewhere along the joist. Nails should be annular ringed shank (improved) of length 2.5 times the thickness of the board. Use 10 gauge nails positioned at least 9mm from the edge of the panel.
- A minimum 10mm expansion gap should be provided where chipboard and OSB flooring abuts a wall. Glueing of tongue and grooved panels is recommended to reduce squeaking. Glueing is essential where panels are over insulation as a floating floor.

Table 6.165
ENGINEERED TIMBER JOISTS

General

Engineered timber joists comprise a timber flange (typically solid timber or LVL – laminated veneer lumber) and a panel product web (usually OSB – oriented strand board). They are manufactured in a variety of depths and flange widths under carefully controlled factory conditions to low and uniform moisture contents.

Joists should be protected from the elements such as by being covered and supported on suitable and adequate bearers over a free-draining surface. Levels of exposure that are more severe than those encountered during a normal continuous build programme should be avoided or addressed by the provision of suitable protection. Where possible joists should not be stored on site over an extended time but rather delivered and set in position as soon as possible to avoid issues associated with weathering.

Large areas of floor joists can be assembled using engineered joists due to their light weight and availability in long lengths. It is extremely important however, that adequate safety bracing is provided to ensure that the joists remain stable during the construction phase. Joist manufacturers provide simple guidelines to allow the installer to facilitate this process quickly and easily.

Do not allow workers to walk on un-braced joist layouts.

Ensure that floors do not become overloaded during construction.

Design

The design of these members should be undertaken in accordance with BS EN 1995-1-1:2004 using design values obtained from the relevant Third Party product certification for service classes I and II only. These products are proprietary and cannot be substituted without design verification.

Notching and Drilling

Notching and drilling of engineered joists is very restricted and where possible should be avoided. Where any alteration of the joist including cutting or notching is necessary, it should be undertaken in accordance with the reference charts and tables provided by the joist manufacturer.

Under no circumstances should the flanges of the I-joist be cut, notched or drilled.

Standard Details

Components are assembled using standard details, connectors and fixings. Two important details are shown below (See diagrams 6.167 and 6.168) that illustrate the different approach that is utilised when detailing Engineered I-Joists.

Permanent rows of intermediate strutting are not required.

Support

Where any doubt exists relating to the design, specification or installation of engineered joists, contact should be made with the technical department of the relevant manufacturer. Further guidance is also available from associations such as the Timber Research and Development Association (TRADA).
Metal Web “Space Joists”

Metal Web “Space joist” is a designed floor joist supplied as a single joist of panel floor cassette system. It consists of parallel stress graded timber flanges joined together with V shaped galvanised steel webs. The webs are fixed to the flanges via nail plates. The open web design gives great flexibility to run services through. All damage should always be referred back to the manufacturer.

Notching and drilling of these forms of joists is normally not required due the nature of the web design. Under no circumstances should the flanges of the joist be cut, notched, drilled or reduced.

Building in of Joists over Internal Walls

The mortar should be sufficiently dry to reduce the likelihood of shrinkage and should be solidly packed in but should not be packed up tight to the underside of the top flange. All continuous joists must be packed down to the intermediate bearing wall before the floor decking is fixed. See diagram 6.169.
CONCRETE

General

The quality and type of finish for in situ concrete should be to the standards as set out in BS EN 1992-1-1:2004.

- Class 1 finish should be used where surfaces are exposed to view.
- Class 2 finish should be used where surfaces are to be exposed to view but where appearance is not critical.
- Special finish relates to the highest standards of finish where appearance is critical.

Finishes for precast products are normally specified by reference to an agreed sample which should be kept on site for comparison with delivered items prior to acceptance.

In situ slabs and beams should be fully propped until the element has achieved its design strength.

Movement joints in large ground floor slabs should be provided in accordance with the recommendations of the British Cement Association publication, "Concrete Ground Floors".

Directly finished in situ concrete floor surfaces should be produced to a level and smooth finish, and to a porosity and texture appropriate for the specified covering.

The maximum permissible movement due to combined shrinkage, creep and deflection of concrete beams, floors and slabs should be as determined in accordance with BS EN 1992-1-1:2004.

Columns, beams and slabs should be constructed level, square and plumb, and without excessive twist.

Precast Concrete Floor Units

Precast or in situ concrete floors should be designed to BS EN 1992-1-1:2004.

Proprietary concrete units or elements will be acceptable if supported by Independent Third Party certificates acceptable to Build-Zone or subject to appraisal by Build-Zone.

Reinforced concrete upper floors should be constructed in accordance with the designer’s details without deviations unless specifically agreed with the Designer.

Precast concrete units and infill blocks should be carefully stored and handled on site so as to avoid damage occurring before, during and after incorporation into the structure. Units should be lifted as near as possible to their ends.

The bearing surface of walls, beams and other supports to receive precast units should be smooth and level.

Infill blocks and slabs should fully bear onto supporting beams and walls.

Materials should be stored and protected so as to prevent damage by frost.

Reinforcement should be stored so as to keep it free from grease, oil, mud, excessive rust, loose concrete and ice.

Mixing of Concrete

Concrete, including ready-mixed concrete, should be produced and specified in accordance with BS 8500-1:2002.

Concrete should be mixed so that every batch is produced with the required workability, batch quantities, strength (where specified), uniform consistency, uniformity of colour and at the correct rate for the placing method used.

A mechanical mixer should be used except for very small quantities. Mixing water should be of drinking water quality.

Typical mixes used in house building are shown in table 6.170.
## Application

<table>
<thead>
<tr>
<th>Application</th>
<th>Standard mix</th>
<th>Designated mix</th>
<th>Compressive strength @ 28 days N/mm² (MPa)</th>
<th>Suggested workability slump (mm)</th>
<th>Suggested method of compaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>House floors with no embedded metal permanent finish to be added eg screed</td>
<td>ST2</td>
<td>GEN 1</td>
<td>10.0</td>
<td>75</td>
<td>Poker or beam vibration and/or tamping</td>
</tr>
<tr>
<td>No permanent finish to be added eg carpeted</td>
<td>ST3</td>
<td>GEN 2</td>
<td>15.0</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Garage floors with no embedded metal</td>
<td>ST4</td>
<td>GEN 3</td>
<td>20.0</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Other reinforced and prestressed concrete applications</td>
<td>N/A</td>
<td>RC 30</td>
<td>75</td>
<td>Poker</td>
<td></td>
</tr>
<tr>
<td>Reinforced or prestressed concrete: moderate exposure</td>
<td>N/A</td>
<td>RC 35</td>
<td>75</td>
<td>setEnabled</td>
<td></td>
</tr>
</tbody>
</table>

### Definitions

- **Standard Mix (ST)**: A standard mix is a concrete designed using the materials and mix proportions given in BS 8500-1-2002 and is suitable for most house construction activities. Note: Standard mixes should not be used in aggressive soil conditions where the soil, the ground water or any adjacent material contains sulphates or other aggressive chemicals.

- **Designated Mix (GEN, FND, RC, PAV)**: Designated mixes are designed and specified in accordance with BS 8500:1-2002. It is a quality controlled mix, produced under BS ENISO 9001 conditions. The purchaser orders the mix by specifying its required strength and is intended use ie RC to be used for reinforced concrete and GEN for general use.

### Compaction and Placing

Concrete may be placed and compacted at any time after mixing provided that it is still workable, due account being taken of the compacting method used and time taken for that work phase.

Mechanical compaction methods should be used where appropriate to ensure thorough compaction of the concrete. Over compaction resulting in the separation of component materials should be avoided.

Transport and placing methods should be used which minimise segregation of the concrete and do not damage or displace formwork or reinforcement.

### Formwork

Formwork should be erected with suitable materials to tolerances appropriate for the required degree of accuracy of the completed structure. It must be strong enough to support the pressure and weight of fresh concrete and any other loads without distortion, deflection or liquid leakage. Formwork should be designed and fabricated so it can be easily struck without causing damage to the concrete.

### Reinforcement

Reinforcement should be designed and fixed in the detailed positions with the designed minimum cover. Reinforcement should be securely tied together with appropriated coiled or preformed tie wire. Suitable preformed spacers and chairs should be utilised to allow normal concreting methods without the displacement of the reinforcement. Reinforcement should be cleaned of all loose rust, grease, water and dirt prior to concreting.

### Day Work Joints in Concrete Members

Any day work joints in concrete members should be located at suitable positions to suit design requirements. Generally, day work joints, if required in continuous slabs and beams, should be located at approximately one-quarter points of their span.

### Cold Weather Working

Special precautions should be taken if concreting work is to be carried out when the air temperature is below 2°C or when the overnight temperature is likely to fall below 0°C. The concrete temperature should be prevented from falling below 5°C for several days after placing.

Freshly placed concrete and screed mortar should be protected from freezing wind by covering with insulating mats, tarpaulins or other sheeting.

Heated concrete may be supplied and used in cold weather conditions. Mixing water should not be heated to more than 80°C.

### Admixtures

Admixtures should be used only when approved by the Designer and then only in accordance with the manufacturer’s recommendations.
Curing

Concrete should be continuously cured for at least 7 days. Curing should be carried out by:

- either closely and completely covering the concrete with impermeable plastic sheeting, or
- applying a complete coating of a proprietary liquid curing membrane material, provided that this will not affect subsequent coatings or applied materials, or
- covering the concrete with hessian or other absorbent sheeting which should be kept continuously wet.

Concrete containing pulverised fuel ash or ground blast furnace slag cement replacement achieves its strength over a longer period than ordinary cements, particularly in cold weather. When these materials are used, an extended period of curing should be carried out in accordance with the cement manufacturer’s instructions.

Sampling, Testing and Production of Concrete

Sampling and testing of fresh or hardened concrete should be carried out in accordance with BS EN 12350-12:2010 or as otherwise allowed in BS 8500-1:2002.

Precast Beam and Block Floors

Ensure that PC beam and block floors possess current Independent Third Party certificates acceptable to Build-Zone and are:

- Fully supported by loadbearing walls
- Laid as specified by the designer

Note: similar beams of the same size may have varying strength characteristics because of different size of reinforcement, therefore it is important to check beam reference numbers and their layout. Also, it is sometimes necessary to provide two or more beams adjacent to each other where spans are excessive or in heavily loaded areas.

Ensure that:

- suitable infill bricks or blocks, properly bedded on mortar, are provided between PC beams where bearing onto supporting walls
- beams and blocks are grouted together with a 1:6 cement/sand mix in accordance with the manufacturer’s instructions
- loadbearing walls continue through the beam and block floor
- holes for service pipes are properly filled by laying non-timber formwork between PC joists and filling with good quality concrete (ST2 mix) prior to screeding

Beams should bear onto masonry minimum 90mm and steelwork minimum 70mm.

Restraint straps should be provided to walls where the beams run parallel (see diagram 6.171).

Ensure that the blockwork carrying the beam and block flooring has sufficient compressive strength.

![Diagram 6.171: Restraint straps (Note: mechanical fixing required or turn down block. If over 3 storeys refer to BS 5328)](image)
6.10 Upper Floors

NON-TRADITIONAL CONSTRUCTION

Non traditional or proprietary forms of floor construction may be used if Independent Third Party certificates acceptable to Build-Zone are available, or subject to satisfactory appraisal by Build-Zone.
6.11 Sound Insulation

To achieve a standard of construction that is considered to be acceptable two different routes are available:

- The use of the guidance given within Approved Document E of the Building Regulations. This route requires the use of Pre-completion testing.
- The use of Robust Details.

PRE COMPLETION TESTING

Pre Completion Testing (PCT) is required in the following circumstances:

- To applicable new build domestic properties (including rooms for residential purposes), unless the Developer has registered and built in accordance with Robust Standard Details
- Where the sound insulation construction is a requirement under Approved Document E of the Building Regulations
- The requirements of the Robust Details system have not been met
- Where sound testing is required for conversions
- The building is considered as an historic or listed building or is within a conservation area

Where pre completion testing is carried out the construction needs to achieve the sound levels as specified in Tables 6.172 and 6.173.

Only a test body with appropriate Third Party accreditation can carry out testing. Such bodies should have either UKAS accreditation or be members of the ANC registration scheme.

The extent of pre completion testing should be agreed with the Building Control Body to ensure an adequate number of tests are carried out. Guidance on the extent and number of tests is provided in Approved Document E of the Building Regulations. Please note you must contact the relevant Building Control Body to discuss this.

A copy of the sound tests confirming compliance with Table 1a & 1b of Approved Document E of the Building Regulations will be required by the Technical Auditor prior to Technical Audit Approval being issued by BZSS and any insurance certificate being issued by Build-Zone.

Note: in the event of a failed set of tests appropriate remedial treatment should be applied to the rooms that failed the test. A failed set of tests raises the questions over the sound insulation between rooms sharing the same separating element. The Developer should demonstrate that these rooms meet the performance standards.

Normally this would be done by additional testing, and/or applying the appropriate remedial treatment to the other rooms and/or demonstrating that the cause of failure does not occur in other rooms.

Build-Zone must be consulted in order to agree the test regime, in addition to the Building Control Body.

GENERAL

Approved Document E aims to ensure that the construction of a dwelling should be such that the noise from normal domestic activities in an adjoining dwelling, within a dwelling or other building is kept down to a level that will not threaten the health of the occupants of the dwelling and will allow them to sleep, rest and engage in normal domestic activities in satisfactory conditions.

- This applies to houses and flats, residential hostels, boarding houses, halls of residence and residential homes. Schools are also included.

The areas of construction which the standards cover are:

- All separating walls and floors including between non habitable areas, flats and common areas
- Within dwellings between walls to bedrooms or a room containing a WC and any other room and to all internal floors.

Early consideration of the design/layout of the dwelling/building is important, particularly

- Wherever possible avoid having rooms of dis-similar uses on either side of a separating wall
- Avoid placing mechanical equipment such as cooker hoods, boilers and pumps directly onto separating walls. Where this is unavoidable fix such equipment on acoustic mountings
- Movement joints should not be built into separating walls
- Services should not be chased into separating walls
- Quality control on levels of workmanship should be maintained throughout the build
Where a suspended ceiling is continuous over adjoining rooms, provision should be made to maintain an adequate degree of sound insulation between WC’s and other parts of a dwelling.

**Wall Ties**

Suitable wall ties for use in masonry cavity walls are either type A or B. Type B should only be used in external masonry cavity walls where type A does not satisfy the requirements of Building Regulation Part A - Structure.

**Corridor Walls and Doors**

Doors between corridors and rooms in flats should have good perimeter sealing and a minimum mass of 25kg/m$^2$ or a minimum sound reduction index of 29dB Rw.

**Refuse Chutes**

A wall separating a habitable room or kitchen and a refuse chute should have a mass of at least 1320kg/m$^2$. Walls separating a non-habitable room from a refuse chute should have a mass of at least 220kg/m$^2$.

- Steps and staggers between dwellings can improve sound insulation.

**USING THE APPROVED DOCUMENT ROUTE**

The following performance standards have been given

<table>
<thead>
<tr>
<th>Purpose built dwelling-houses and flats:</th>
<th>Airborne sound insulation sound insulation $D_n,T_w +C_{tr}$dB (minimum values)</th>
<th>Impact sound insulation $L_{T,w}d$dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walls</td>
<td>45</td>
<td>---</td>
</tr>
<tr>
<td>Floors and stairs</td>
<td>45</td>
<td>62</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Purpose built rooms for residential purpose:</th>
<th>Airborne sound insulation sound insulation $D_n,T_w +C_{tr}$dB (minimum values)</th>
<th>Impact sound insulation $L_{T,w}d$dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walls</td>
<td>43</td>
<td>---</td>
</tr>
<tr>
<td>Floors and stairs</td>
<td>45</td>
<td>62</td>
</tr>
</tbody>
</table>

**Table 6.172: Dwelling houses and flats – performance standards for separating walls, separating floors, and stairs that have a separating function**

<table>
<thead>
<tr>
<th>Purpose built rooms for residential purposes formed by material change of use:</th>
<th>Airborne sound insulation sound insulation $D_n,T_w +C_{tr}$dB (minimum values)</th>
<th>Impact sound insulation $L_{T,w}d$dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walls</td>
<td>43</td>
<td>---</td>
</tr>
<tr>
<td>Floors and stairs</td>
<td>43</td>
<td>64</td>
</tr>
</tbody>
</table>

**Table 6.173: Rooms – performance standards for separating walls, separating floors, and stairs that have a separating function**
6.11 Sound Insulation

SEPARATING WALLS

The following construction details are ways of achieving adequate standards. The list is not exhaustive and other designs, materials or products may be suitable. Advice should be sought from the manufacturer or other appropriate expert. The walls are grouped into four main types (see Diagram 6.174).

Wall Type 1: Solid Masonry

The resistance to airborne sound depends mainly on the mass per unit area of the wall.

Wall Type 2: Cavity Masonry

The resistance to airborne sound depends on the mass per unit area of the leaves and on the degree of isolation achieved. The isolation is affected by connections (such as wall ties and foundations) between the wall leaves and by the cavity width.

Wall Type 3: Masonry between Independent Panels

The resistance to airborne sound depends partly on the type and mass per unit area of the core, and partly on the isolation and mass per unit area of the independent panels.

Wall Type 4: Framed Walls with Absorbent Material

The resistance to airborne sound depends on the mass per unit area of the leaves, the isolation of the frames, and the absorption in the cavity between the frames.

Diagram 6.174: Types of separating wall

JUNCTIONS BETWEEN SEPARATING WALLS AND OTHER BUILDING ELEMENTS

In order for the construction to be fully effective, care should be taken to correctly detail the junctions between the separating wall and other elements, such as floors, roofs, external walls and internal walls. Recommendations are also given for the construction of these elements, where it is necessary to control flanking transmission.

Table 6.175 indicates the availability of guidance on the junctions that may occur between each of the four separating wall types and various attached building elements.
6.11 Sound Insulation

Part 6 Superstructure

<table>
<thead>
<tr>
<th>Building element attached to a separating wall</th>
<th>Separating type of wall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Type 1</td>
</tr>
<tr>
<td>External Cavity Wall with masonry inner leaf</td>
<td>G</td>
</tr>
<tr>
<td>External cavity wall with timber inner leaf</td>
<td>G</td>
</tr>
<tr>
<td>Internal wall - framed</td>
<td>N</td>
</tr>
<tr>
<td>Internal wall - masonry</td>
<td>G</td>
</tr>
<tr>
<td>Internal floor – timber</td>
<td>G</td>
</tr>
<tr>
<td>Internal floor – concrete</td>
<td>G</td>
</tr>
<tr>
<td>Ground floor – timber</td>
<td>G</td>
</tr>
<tr>
<td>Ground floor - Concrete</td>
<td>G</td>
</tr>
<tr>
<td>Ceilings and roof space</td>
<td>G</td>
</tr>
</tbody>
</table>

For flats the following may also apply:

- Separating floor type 1 – concrete base with ceiling and soft floor covering
- Separating floor type 2 – concrete base with ceiling and floating floor
- Separating floor type 3 – timber frame base with ceiling and platform floor

See guidance in AD section E, separating floors and associated flanking construction for new buildings

**Key:** G= guidance available; N= no guidance available (seek specialist advice); X= do not build

**Note:** Where any building element functions as a separating element (e.g. a ground floor that is also a separating floor for a basement flat) then the separating element requirements should take precedence.

<table>
<thead>
<tr>
<th>Table 6.175: Separating wall junctions reference table</th>
</tr>
</thead>
</table>

Table 6.176 gives guidance on plasterboard weights. The information on plasterboards is correct as at 21 March 2017 but it is the user’s responsibility to ensure it remains current prior to use. Approved Document E generally requires 10kg/m² per layer. Table 6.177 indicates the junction requirements for Wall type 1.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Plasterboard Type</th>
<th>6.0mm</th>
<th>9.5mm</th>
<th>12.5mm</th>
<th>15mm</th>
<th>19mm</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Gypsum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>WallBoard</td>
<td>6.3 kg/m²</td>
<td>8 kg/m²</td>
<td>9.8 kg/m²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gyproc</td>
<td>WallBoard Duplex</td>
<td>8 kg/m²</td>
<td>9.8 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td>with vapour barrier</td>
</tr>
<tr>
<td>Gyproc</td>
<td>Plank (TE/SE)</td>
<td>6.3 kg/m²</td>
<td>8 kg/m²</td>
<td>15 kg/m²</td>
<td></td>
<td></td>
<td>ivory face</td>
</tr>
<tr>
<td>Gyproc</td>
<td>HandiBoard</td>
<td>8.6 kg/m²</td>
<td>10.1 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td>Green face and reverse</td>
</tr>
<tr>
<td>Gyproc</td>
<td>Fireline</td>
<td>9.8 kg/m²</td>
<td>11.7 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td>pink faced</td>
</tr>
<tr>
<td>Gyproc</td>
<td>Fireline Duplex</td>
<td>9.8 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>pink faced/vapour barrier</td>
</tr>
<tr>
<td>Gyproc</td>
<td>Fireline MR</td>
<td>9.5 kg/m²</td>
<td>11.5 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td>Pink faced/moisture resistant</td>
</tr>
<tr>
<td>Gyproc</td>
<td>Core Board</td>
<td>16 kg/m²</td>
<td></td>
<td>6 kg/m²</td>
<td></td>
<td></td>
<td>Green faced</td>
</tr>
<tr>
<td>Glasroc</td>
<td>MultiBoard F</td>
<td>6 kg/m²</td>
<td>8.5 kg/m²</td>
<td>10.6 kg/m²</td>
<td></td>
<td></td>
<td>White faced/glass reinforced</td>
</tr>
<tr>
<td>Glasroc</td>
<td>Tilebacker H</td>
<td>6 kg/m²</td>
<td>10.6 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td>Yellow faced</td>
</tr>
<tr>
<td>Gyproc</td>
<td>Moisture Resistant</td>
<td>8.6 kg/m²</td>
<td>10.1 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td>Green face</td>
</tr>
<tr>
<td>Gyproc</td>
<td>SoundBloc</td>
<td>10.6 kg/m²</td>
<td>12.6 Kg/m²</td>
<td></td>
<td></td>
<td></td>
<td>Blue face</td>
</tr>
<tr>
<td>Gyproc</td>
<td>SoundBloc F</td>
<td>13.5 Kg/m²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Blue face/water repellent</td>
</tr>
<tr>
<td>Gyproc</td>
<td>SoundBloc MR</td>
<td>10.6 kg/m²</td>
<td>12.6 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td>Blue faced</td>
</tr>
<tr>
<td>Gyproc</td>
<td>SoundBloc RAPID</td>
<td>12.6 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Blue faced</td>
</tr>
<tr>
<td>Gyproc</td>
<td>SoundBloc RAPID MR</td>
<td>10.5 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Blue faced</td>
</tr>
<tr>
<td>Gyproc</td>
<td>DuraLine</td>
<td>13.9 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ivory face</td>
</tr>
<tr>
<td>Gyproc</td>
<td>DuraLine MR</td>
<td>13.9 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Green faced</td>
</tr>
</tbody>
</table>
### 6.11 Sound Insulation

#### Part 6 Superstructure

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Plasterboard Type</th>
<th>9.5mm</th>
<th>12.5mm</th>
<th>15mm</th>
<th>19mm</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knauf</td>
<td>Wall board</td>
<td>6.2 kg/m²</td>
<td>8.3 kg/m²</td>
<td>10.2 kg/m²</td>
<td></td>
<td>Ivory face</td>
</tr>
<tr>
<td></td>
<td>Vapour Panel</td>
<td>8.3 kg/m²</td>
<td>10.2 kg/m²</td>
<td></td>
<td></td>
<td>Grey face/polyester foil</td>
</tr>
<tr>
<td></td>
<td>Plank</td>
<td></td>
<td>14 kg/m²</td>
<td></td>
<td></td>
<td>Ivory face</td>
</tr>
<tr>
<td></td>
<td>Impact Panel</td>
<td></td>
<td>12.8 kg/m²</td>
<td></td>
<td></td>
<td>Yellow faced</td>
</tr>
<tr>
<td></td>
<td>Fire Panel</td>
<td>10 kg/m²</td>
<td>12 kg/m²</td>
<td></td>
<td></td>
<td>Pink face</td>
</tr>
<tr>
<td></td>
<td>Moisture Panel</td>
<td>9.5 kg/m²</td>
<td>10.2 kg/m²</td>
<td></td>
<td></td>
<td>Green face</td>
</tr>
<tr>
<td></td>
<td>Sound Panel</td>
<td>10 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td>Blue face</td>
</tr>
<tr>
<td></td>
<td>Performance Plus</td>
<td>11.5 kg/m²</td>
<td>12.8 kg/m²</td>
<td></td>
<td></td>
<td>Grey face</td>
</tr>
<tr>
<td></td>
<td>Soundshield plus</td>
<td>11.5 kg/m²</td>
<td>12.8 kg/m²</td>
<td></td>
<td></td>
<td>Blue face</td>
</tr>
<tr>
<td></td>
<td>Core board</td>
<td></td>
<td></td>
<td>16.3 kg/m²</td>
<td></td>
<td>Green face</td>
</tr>
</tbody>
</table>

Table 6.176: Separating wall junctions reference table

#### Junctions of Type 1 (Solid Masonry) Separating Walls

**JUNCTIONS OF AN EXTERNAL CAVITY WALL WITH MASONRY INNER LEAF**

Where the external wall is a cavity wall:

- the outer leaf of the wall may be of any construction, and
- the cavity should be stopped with a flexible closer (see Diagram 6.178) unless the cavity is fully filled with mineral wool or expanded polystyrene beads (seek manufacturer’s advice for other suitable materials).

The separating wall should be joined to the inner leaf of the external cavity wall by one of the following methods:

- **Bonded.** The separating wall should be bonded to the external wall in such a way that the separating wall contributes at least 50% of the bond at the junction. (see Diagram 6.179).
- **Tied.** The external wall should abut the separating wall and be tied to it. (see Diagram 6.180).

<table>
<thead>
<tr>
<th>Wall type</th>
<th>Coursing height (mm)</th>
<th>Width excluding finishes (mm)</th>
<th>Min Mass required kg/m³</th>
<th>finishes</th>
<th>Material (density) kg/m³</th>
<th>Cavity (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>110</td>
<td>215 block</td>
<td>415* laid flat</td>
<td>A</td>
<td>1840</td>
<td>No</td>
</tr>
<tr>
<td>1.2</td>
<td>n/a</td>
<td>190</td>
<td>415*</td>
<td>A</td>
<td>2200</td>
<td>No</td>
</tr>
<tr>
<td>1.3</td>
<td>75</td>
<td>215</td>
<td>375*</td>
<td>A</td>
<td>1610</td>
<td>No</td>
</tr>
</tbody>
</table>

* including finishes to both sides
A 13mm lightweight plaster (minimum mass per unit area 10kg/m²)

Table 6.177: Junction requirements for wall type 1
6.11 Sound Insulation

The masonry inner leaf should have a mass per unit area of at least 120 kg/m² excluding finish. However, there is no minimum mass requirement where there are openings in the external wall (see Diagram 6.181) that are:

- not less than 1 metre high, and
- on both sides of the separating wall at every storey, and
- not more than 700mm from the face of the separating wall on both sides.

Where there is also a separating floor then the requirement for a minimum mass per unit area of 120 kg/m² excluding finish should always apply, irrespective of the presence or absence of openings.

Diagram 6.179: Wall type 1 - bonded junction - masonry inner leaf of external cavity wall with solid separating wall
6.11 Sound Insulation

Diagram 6.180: Wall type 1 - tied junction - external cavity wall with internal masonry wall

Diagram 6.181: Wall type 1 - position of openings in masonry inner leaf of external cavity wall

**JUNCTIONS OF AN EXTERNAL CAVITY WALL WITH TIMBER FRAME INNER LEAF**

Where the external wall is a cavity wall:

- the outer leaf of the wall may be of any construction, and
- the cavity should be stopped with a flexible closer (see Diagram 6.182).

Where the inner leaf of an external cavity wall is of framed construction, the framed inner leaf should:

- abut the separating wall, and
- be tied to it with ties at no more than 300 mm centres vertically.

The wall finish of the framed inner leaf of the external wall should be:

- one layer of plasterboard, or
- two layers of plasterboard where there is a separating floor

Each sheet of plasterboard to be of minimum mass per unit area 10 kg/m² (See table 6.176).

All joints should be sealed with tape or caulked with sealant.
6.11 Sound Insulation

JUNCTIONS WITH AN EXTERNAL SOLID MASONRY WALL

Build-Zone are unable to offer any guidance and recommend the Developer seeks specialist advice. However, where applicable, flexible jointing methods should be employed. Further consideration should also be given to the thermal properties of the material used and movement joints should be created as per the manufacturer’s guidelines.

JUNCTIONS WITH INTERNAL FRAMED WALLS

There are no restrictions on internal framed walls meeting a type 1 separating wall.

JUNCTIONS WITH INTERNAL MASONRY WALLS

Internal masonry walls that abut a type 1 separating wall should have a mass per unit area of at least 120 kg/m² excluding finish.

JUNCTIONS WITH INTERNAL TIMBER FLOORS

If the floor joists are to be supported on a type 1 separating wall then they should be supported on hangers and should not be built in (see Diagram 6.183).

Diagram 6.183: Wall type 1 - internal timber floor

JUNCTIONS WITH INTERNAL CONCRETE FLOORS

An internal concrete floor slab may only be carried through a type 1 separating wall if the floor base has a mass per unit area of at least 365 kg/m² (see Diagram 6.184).

Diagram 6.184: Wall type 1 - internal concrete floor

Internal hollow-core concrete plank floors and concrete beams with infilling block floors should not be continuous through a type 1 separating wall.

For internal floors of concrete beams with infilling blocks, avoid beams built in to the separating wall unless the blocks in the floor fill the space between the beams where they penetrate the wall.
6.11 Sound Insulation

JUNCTIONS WITH TIMBER GROUND FLOORS

If the floor joists are to be supported on a type 1 separating wall then they should be supported on hangers and should not be built in.

JUNCTIONS WITH CONCRETE GROUND FLOORS

The ground floor may be a solid slab, laid on the ground, or a suspended concrete floor. A concrete slab floor on the ground may be continuous under a type 1 separating wall (see Diagram 6.185).

A suspended concrete floor may only pass under a type 1 separating wall if the floor has a mass of at least 365 kg/m².

Hollow core concrete plank and concrete beams with infilling block floors should not be continuous under a type 1 separating wall.

![Diagram 6.185: Wall type 1 - concrete ground floor](image)

JUNCTIONS WITH CEILING AND ROOF

Where a type 1 separating wall is used it should be continuous to the underside of the roof.

The junction between the separating wall and the roof should be filled with a flexible closer which is also suitable as a fire stop (see Diagram 6.186).

Where the roof or loft space is not a habitable room and there is a ceiling with a minimum mass per unit area of 10 kg/m² with sealed joints, then the mass per unit area of the separating wall above the ceiling may be reduced to 150 kg/m² (see Diagram 6.186).

![Diagram 6.186: Wall type 1 - ceiling and roof junction](image)
6.11 Sound Insulation

If lightweight aggregate blocks of density less than 1200 kg/m\(^3\) are used above ceiling level, then one side should be sealed with cement paint or plaster skim.

Where there is an external cavity wall, the cavity should be closed at eaves level with a suitable flexible material (e.g. mineral wool, see Diagram 6.187).

**Note:** A rigid connection between the inner and external wall leaves should be avoided. If a rigid material is used, then it should only be rigidly bonded to one leaf. See BRE BR 262, Thermal Insulation: Avoiding Risks, Section 2.3.

**JUNCTIONS WITH SEPARATING FLOORS**

There are important details in Section 3 of Approved Document E concerning junctions between wall type 1 and separating floors.

![Diagram 6.187: External cavity wall at eaves level](image)

**Junctions of Type 2 (Cavity Masonry) Separating Walls**

<table>
<thead>
<tr>
<th>Wall type</th>
<th>Coursing height (mm)</th>
<th>Width excluding finishes (mm)</th>
<th>Min Mass required kg/m(^3)</th>
<th>finishes</th>
<th>Material (density) kg/m(^3)</th>
<th>Cavity (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>225</td>
<td>250</td>
<td>415*</td>
<td>A</td>
<td>1990</td>
<td>50</td>
</tr>
<tr>
<td>2.2</td>
<td>225</td>
<td>275</td>
<td>300*</td>
<td>A</td>
<td>1375</td>
<td>75</td>
</tr>
<tr>
<td>2.3 **</td>
<td>225</td>
<td>275</td>
<td>290*</td>
<td>B</td>
<td>1350-1600</td>
<td>75</td>
</tr>
</tbody>
</table>

* including finishes to both sides

** Only acceptable where there is a step and/or stagger of at least 300mm
A 13mm lightweight plaster (minimum mass per unit area 10kg/m\(^2\))
B plasterboard, minimum mass per unit area 10kg/m\(^2\) to both sides

**Table 6.188: Junction requirements for wall type 2**
### 6.11 Sound Insulation

#### Junctions of Type 3 (masonry between independent panels) Separating Walls

<table>
<thead>
<tr>
<th>Wall type</th>
<th>Coursing height (mm)</th>
<th>Width excluding finishes (mm)</th>
<th>Min Mass required kg/m³ finishes</th>
<th>Material (density) kg/m³</th>
<th>Cavity (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>110</td>
<td>140</td>
<td>300*</td>
<td>C</td>
<td>2200</td>
</tr>
<tr>
<td>3.2</td>
<td>225</td>
<td>140</td>
<td>150*</td>
<td>C</td>
<td>1400</td>
</tr>
<tr>
<td>3.3 **</td>
<td>225</td>
<td>250</td>
<td>Any</td>
<td></td>
<td>1350-1600</td>
</tr>
</tbody>
</table>

* of core only

** Recommended cavity widths are minimum values

** Core width only. The minimum core width is determined by structural requirements

C independent panels, each panel of mass per unit area 20kg/m² to be two sheets of plasterboard with staggered joints.

Table 6.189: Junction requirements for wall type 3

#### DETAILING

### Gas Flue Blocks In Separating Walls

Gas flue blocks must be positioned within separating walls so as not to reduce the effectiveness of the sound reduction factor across the wall.

Attention must be paid to the minimum cavity width of the wall and the density of the blockwork (see diagrams 6.190 and 6.191). Note: where this minimum cavity width cannot be maintained, the cavity must include a proprietary cavity slab between the back to back flue liners.

The flue blocks must be installed on a suitable bedding compound, care must be taken to ensure all perpend joints are fully filled with mortar.

Diagram 6.190: Gas flue blocks in separating walls

Diagram 6.191: Gas flue blocks in separating walls

### Services in Separating Walls

Back to back services in separating walls should be avoided. In particular, switches, socket outlets and chasing installed in blockwork and holes cut in plasterboard separating walls need particular attention to detail in order to avoid problems associated with sound transmission. Diagram 6.192 indicates guidance for sockets and switches in timber frame separating walls.
6.11 Sound Insulation

Diagram 6.192: Electrical fittings in timber frame separating walls

**Holes in Ceilings**

Downlighters and other flush fitting attachments should not be installed through a ceiling if the ceiling is providing part of the required, necessary sound insulation or fire resistant properties to the dwelling. An additional suspended ceiling, light box or proprietary fittings must be installed to maintain the integrity of the ceiling construction.

**Partitions – Design Considerations**

To improve modern living standards there is a requirement to provide protection against sound within dwellings. It is good practice to consider the layout of rooms at an early design stage to avoid placing noise sensitive rooms next to rooms which tend to generate noise (see diagram 6.193).

This applies to:

- Internal walls between a bedroom and another room
- Internal walls between a room containing a WC and another room (NOT including the wall between an en-suite WC and its associated bedroom)
- Internal floors

The requirement does not apply to an internal wall which contains a door.
6.11 Sound Insulation

**Ducts**

Provide adequate sound insulation to ducts around soil and waste pipes penetrating separating floors within all rooms of the dwelling (see diagram 6.194):

- The material of the enclosure should have a mass of at least 15 kg/m².
- The enclosure should be lined or wrap the duct with a minimum of 25 mm unfaced mineral wool.
- Leave a nominal gap between the enclosure and floor and seal with acrylic caulking or neoprene.

Adequate sound insulation should be provided to soil and waste pipes not penetrating separating floors but still situated within rooms of the dwelling.

Penetrations through a separating floor by ducts and pipes should have fire protection in accordance with Approved Document B (Technical Standard for Scotland: Part 2 Fire).

The fire stopping should be flexible and prevent rigid contact between the pipe and the floor.

Gas Safety Regulations require ventilation for ducts at each floor containing gas pipes. Gas pipes may be contained in a separate ventilated duct or they can remain unducted.

![Diagram 6.193: Sound insulation of partitions](image1)

![Diagram 6.194: Sound insulation of service ducts](image2)