BRITISH STANDARD

BS 8000-3:2001

Workmanship on building sites —

Part 3: Code of practice for masonry

ICS 91.200

Confirmed March 2008

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee, B/525, Building and civil engineering structures, to Subcommittee B/525/6, Use of masonry, upon which the following bodies were represented:

Autoclaved Aerated Concrete Products Association

Brick Development Association

British Ceramic Research Ltd.

British Masonry Society

British Precast Concrete Federation

Construction Confederation

Concrete Block Association

Department of the Environment, Transport and the Regions represented by the Building Research Establishment

Department of the Environment, Transport and the Regions Construction Services Directorate

Institution of Civil Engineers

Institution of Structural Engineers

National House Building Council

Royal Institution of British Architects

This British Standard, having been prepared under the direction of the Building and Civil Engineering Sector Policy and Strategy Committee, was published under the authority of the Standards Policy and Strategy Committee and comes into effect on 15 October 2001

First published October 1989
Second edition August 2001

The following BSI references relate to the work on this British Standard:
Committee reference B/525/6
Draft for comment 99/101454 DC

ISBN 0 580 33301 9

Amendments issued since publication

Amd. No.	Date	Comments

Contents

Foreword

This part of BS 8000 has been prepared by Subcommittee B/525/6, Use of masonry. It makes recommendations and gives guidance on basic workmanship for conventional types of building work. It supersedes BS 8000-3:1989 which is withdrawn.

The recommendations given are not fully comprehensive as particular project documents, e.g. project specifications, may need to cover particular recommendations not dealt with by this standard. This standard may not be applicable to the use of some proprietary systems[1)].

BS 8000-3 is unique in that it draws together recommendations given in other British Standards.

The purpose of BS 8000-3 is to encourage good workmanship by providing the following.

a) The most frequently required recommendations on workmanship for building work in a readily available and convenient form to those working on site.

b) Assistance in the efficient preparation and administration of contracts.

c) Recommendations on how designers' requirements for workmanship may be satisfactorily realized.

d) Guidance on good practice on building sites for supervision and for training purposes; this guidance is not intended to supplant the normal training in craft skills.

e) A reference for quality of workmanship on building sites.

f) The recognition that design, procurement and project information should be conducive to good workmanship on site.

During the preparation of BS 8000-3 the Building Industry's Co-ordinating Committee for Project Information (CCPI[2)]), produced a Common Arrangement of Work Sections (CAWS) for building work. BS 8000-3 has been drafted in accordance with this CAWS so that it can be used easily with project specifications and bills of quantities using the CAWS. Other major documents are being restructured in accordance with the CAWS.

[1)] The user's attention is drawn to the need to follow any relevant Technical Approval.
[2)] The CCPI was sponsored by the Association of Consulting Engineers, the Building Employers' Confederation, the Royal Institution of Chartered Surveyors and the Royal Institute of British Architects.

BS 8000 is published in the following parts:

— *Part 1: Code of practice for excavation and filling*;
— *Part 2: Code of practice for concrete work*;
— *Part 3: Code of practice for masonry*;
— *Part 4: Code of practice for waterproofing*;
— *Part 5: Code of practice for carpentry, joinery and general fixings*;
— *Part 6: Code of practice for slating and tiling of roofs and claddings*;
— *Part 7: Code of practice for glazing*;
— *Part 8: Code of practice for plasterboard partitions and dry linings*;
— *Part 9: Cementitious levelling screeds and wearing screeds — Code of practice*;
— *Part 10: Code of practice for plastering and rendering*;
— *Part 11: Code of practice for wall and floor tiling*;
— *Part 12: Code of practice for decorative wallcoverings and painting*;
— *Part 13: Code of practice for above ground drainage and sanitary appliances*;
— *Part 14: Code of practice for below ground drainage*;
— *Part 15: Code of practice for hot and cold water services (domestic scale)*;
— *Part 16: Code of practice for sealing joints in buildings using sealants.*

The content of BS 8000-3 is based on and is consistent with that of BS 5628 and BS 8215. However, BS 5628 and BS 8215 cover the subject matter more comprehensively and include design, materials and other related aspects in addition to workmanship on site. The user's attention is also drawn to [1].

In this standard a commentary on the relevant principles accompanies the recommendations that are made. The commentary is intended to provide further guidance.

NOTE Commentary text is printed in italics.

As a code of practice BS 8000-3 takes the form of guidance and recommendations. It should not be quoted as though it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

This standard was drafted on the assumption that the execution of its recommendations is entrusted to appropriately qualified and competent people.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

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1 Scope

BS 8000-3 gives recommendations for basic workmanship in relation to masonry but does not specifically address health and safety issues.

For design aspects of masonry, the user is referred to BS 5628.

BS 8000-3 does not necessarily cover the use of proprietary systems. The user is referred to the particular recommendations of any technical approval in this case.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 5628-3:2001, *Code of practice for use of masonry — Part 3: Materials and components, design and workmanship*.

BS 8000-2, *Workmanship on building sites — Part 2: Code of practice for concrete work*.

3 Definitions

For the purpose of this part of BS 8000, the definitions given in BS 5628-3 apply.

NOTE Other associated definitions which may be of use to the user of this standard can be found in BS 6100-1 and -5.

4 Materials, handling and preparation

4.1 Checking, handling and site storage of materials and components

4.1.1 *General*

Keep the site clean and tidy to ensure that checking, handling and storage of materials and components can be carried out speedily and effectively.

4.1.2 *Checking*

Check delivery tickets and certificates against the specification. Examine marks, labels and the condition of materials and components and report any discrepancies to the supplier immediately. Check masonry units that are delivered wrapped or banded, at the time of delivery.

In particular check that:

a) materials and components are clean and are not damaged or unduly wet;

b) the colour and texture of facing masonry units match the agreed reference panels;

c) that there is continuity in the supply of materials and components, and particularly of sand and cement from the same source and of materials for the approved mortar mixes and facing work;

d) sand is visually clean.

COMMENTARY. *The condition of masonry units at the time of delivery can impose requirements on site before use (see **4.2.2**). Testing and/or certification may be called for by the specifier.*

It is desirable that colour differences between consignments of masonry units do not result in banding or patchiness of colour in finished walling. Distributing units from different packs throughout the site helps to blend units of different colour within the consignment. Ascertaining in advance whether the manufacturer can blend the units in their factory is useful. Where several consignments will be delivered to site over a long period of time, blending on site may not solve the problem of colour variation between consignments. It is worthwhile identifying the problem before deliveries begin and consulting the manufacturer.

Sands and cement supplied from different sources can give rise to colour variations in the mortar. This can significantly affect the appearance of walling.

4.1.3 *Handling and site storage*

4.1.3.1 *General*

The manufacturers' recommendations for handling and site storage of materials should be followed.

4.1.3.2 *Masonry units*

Unload masonry units with care, either by machine or by hand, to minimize soiling, chipping and breakage. Handle prepacked masonry units with wrapping and banding in place unless it is not practical to do so. Use mechanical handling equipment where practicable.

Protect the stacks from rain and frost, and from soiling from the ground and passing traffic. Protect the bottom of the stack from becoming wet from ground moisture.

Stack unwrapped masonry units in such a manner as to allow free circulation of air.

COMMENTARY. *If masonry units are too wet they can be difficult to lay and the finished work can develop efflorescence or leaching from the joints causing white stains. The risk of unacceptable shrinkage cracking, particularly with concrete block masonry and calcium silicate brick masonry, is greater when units have been wetted unnecessarily because of lack of protection.*

4.1.3.3 *Stone*

Deliver the stone from the yard to a suitable off-loading facility on site, and in the fixing sequence. Stack clear of the ground on battens to prevent contamination from moisture and soluble salts in the earth. In wintry weather take precautions to prevent damage to the stones from the freezing of rainwater or residual quarry-sap by covering with tarpaulins or polyethylene sheet over straw, hessian or other suitable insulating materials, which contain nothing that might damage or stain the stone. Protect against staining from other building materials, particularly hardwoods, oils and fuels.

4.1.3.4 *Ancillary components*

Handle all ancillary components, e.g. lintels, flue linings, tiles, cavity closers and edge trims with care to avoid cracking, damage to edges, damage to surfaces and coatings, distortion and soiling.

Stack lintels and copings of precast concrete and pressed metal on level bearers so that they are clear of the ground. Cover the stacks, to protect them from staining and splashing of mud, and follow any additional advice in the manufacturer's recommendations.

Store metal and plastics components, e.g. wall ties, straps, etc. under cover and protect from damage and distortion.

4.1.3.5 *Bags of cement and hydrated lime and dry prepacked cementitious mortar mixes*

Where materials are to be stored for later use, store:

a) in a dry, frost-free, enclosed shed or building with a dry floor. If the floor is concrete, upon a timber platform;

b) with different materials in separate stacks;

c) with bags stacked away from walls, not more than eight high, and covered with a tarpaulin or polyethylene sheet;

d) in an arrangement so that consignments can be used in the order of delivery.

Keep cement stored on site to a practical minimum. Check materials for deterioration when taken out of storage and discard if lumpy.

Stack small quantities of cement and hydrated lime intended for immediate use, if not stored in a shed or building, on a timber platform, well clear of the ground. Cover with a tarpaulin or a polyethylene sheet so that all the bags are protected from wind and rain.

Arrange deliveries so that the materials do not arrive at site too early and that excessively large quantities are not delivered at one time.

COMMENTARY. *Even if materials are protected from rain, moisture in the air will gradually cause deterioration. Even in fair weather-conditions cement eventually goes lumpy and gives a lower strength.*

4.1.3.6 *Cement in bulk*

Store cement delivered in bulk in a proper cement silo, in accordance with BS 8000-2.

4.1.3.7 *Sand, aggregates and mortars*

Store different sands, aggregates and lime–sand mixes in different stockpiles on hard clean bases which permit free drainage. Avoid intermix and contamination from other building materials, debris or other deleterious material.

Store factory produced premixed lime–sand for mortars on a clean hard impervious surface and cover to prevent excessive drying out, wetting and loss of fine particles of lime and pigments.

Store factory produced ready-to-use retarded mortars in covered containers to prevent excessive drying out or wetting.

Cover all sands and mortars and protect from freezing during frosty weather.

Do not store retarded ready-to-use mortars for longer than the manufacturer's quoted periods of retardation.

4.1.3.8 *Damp-proof course (DPC) materials*

Store DPC materials in the dry, under cover, and protected against damage. In addition, follow these recommendations for flexible materials.

a) Stand rolls on their ends to form a stable stack not more than three packs or more than 1 m high.

b) Keep bitumen and other thermoplastic materials away from any direct heat source.

c) Store sufficient rolls for the next day's use in a warm place prior to use, since some DPC materials can become stiff in cold weather conditions.

d) Check all labels on adhesives for any particular storage recommendations, e.g. avoidance of high or low temperature, and for any hazards relating to solvent vapours.

4.1.3.9 *Thermal insulation materials*

Store thermal insulation materials in the dry, under cover, and protected against damage. Follow the manufacturer's recommendations for storage and handling.

4.2 Preparation of work, materials and components

4.2.1 *General*

4.2.1.1 *Distributed components and materials*

Where materials and components are distributed to the work position ensure that:

a) neither the structure nor the access scaffolding are overloaded;

b) the components and materials are protected to prevent damage or deterioration before use.

4.2.1.2 *Setting out building*

Set out masonry relative to securely marked or pegged reference lines and datum levels using appropriate serviceable equipment. Squareness should be checked with diagonal measurements or a builder's square. Securely fix any datum and profile marks. Leave datum level points in position so that a gauge rod can be used for coursing other heights such as openings, storeys and string courses (see **5.1.2**).

4.2.1.3 *Horizontal setting out*

Anticipate the position of openings, etc. in the starting course prior to carrying out work to avoid unnecessary cutting and adjustment of masonry units at a later stage which can lead to incorrect or uneven bonding (see **5.1.3**).

4.2.2 *Masonry units*

4.2.2.1 *General*

Protect units from rain. Where appropriate allow newly manufactured units to cool before being used.

4.2.2.2 *Clay masonry units*

In dry warm weather wet the surfaces of very absorbent clay masonry units sufficiently to reduce suction, but without over-wetting.

COMMENTARY. *Low water absorption units such as engineering bricks should not be wetted as they can slide on the mortar. Over-wetting of any bricks can cause efflorescence or lime staining.*

4.2.2.3 *Calcium silicate masonry units*

To achieve better adhesion and laying of calcium silicate masonry units in dry warm weather adjust the consistency of the mortar. Alternatively, the surfaces to be bedded can be wetted just sufficiently to reduce the suction by briefly dipping in water.

COMMENTARY. *Over-wetting of calcium silicate units prior to laying should be avoided in order to minimize the shrinkage of the built masonry when it dries.*

4.2.2.4 *Concrete masonry units*

Do not wet concrete masonry units before laying. Where necessary adjust the consistency of the mortar to suit the suction rate of the units.

4.2.2.5 *Stone masonry units*

Check that stone masonry units as delivered are of proper dimensions and will work-in satisfactorily. Check the positions of the main features, such as quoins, door jambs, etc., and prepare a marked off gauge-lath, making allowance for the joints. In intricate work lay a trial assembly of stones dry for the first two courses to check bonding and jointing.

4.2.3 *Preparation of mortar mixes*

4.2.3.1 *Gauging*

When mortar is gauged by volume use a gauge box, bucket, or similar standard container for each material. Use containers of a size to be completely filled to proportion each batch. When cement is supplied in bags it is preferable to use whole bags of cement for any one mix.

COMMENTARY. *Gauging volumes by the shovelful cannot be relied upon to give sufficiently accurate mix proportions, e.g. the volume of material in a shovelful of free flowing cement is approximately half the volume of material in a shovelful of damp cohesive sand. If mortar materials are not properly proportioned, this will lead to variations in the colour, strength and durability characteristics of the mortar.*

4.2.3.2 *Admixtures*

Do not use admixtures except where specified by the designer. Where this is the case, follow the manufacturer's recommendations.

COMMENTARY. *Calcium chloride added to mortar can lead to corrosion of embedded metal.*

4.2.3.3 *Pigments*

Unless otherwise specified do not use more than 10 % pigment or not more than 3 % in the case of carbon black, of the cement mass, in coloured mortar mixes. Proportions should be consistent from batch to batch of mortar.

COMMENTARY. *It is not practicable to proportion accurately on site unless all materials are batched by weight. Inaccuracies can lead to colour variation. It is preferable to use ready-mixed pigmented material. Proportioning small quantities of mortars on site is particularly difficult.*

4.2.3.4 *Mixing method*

Mix mortar by machine except in the case of small quantities of mortars not containing plasticizers (see **4.2.3.2**). Do not load a mixer to more than its rated capacity. Hand-mix mortar on a clean watertight platform.

4.2.3.5 *Mixing sequence*

Where mixing by machine, load about three-quarters of the sand or premixed lime–sand mixtures and water. While mixing, gradually add lime and/or cement and continue mixing. Load the remainder of sand or pre-mixed lime–sand mixtures and further water to achieve required workability. Alternatively, add half the water to the mixer followed by all the cement and all the sand in that order. Add the final quantity of water to achieve the correct workability.

Where mixing by hand, mix the cement (and lime, if used) with sand before adding water until the colour is consistent. Add and thoroughly mix about three-quarters of the required amount of water. Then add further water and mix to achieve the required workability.

4.2.3.6 *Mixing time*

Continue mixing long enough to obtain a uniform consistency and colour from the ingredients.

COMMENTARY. *In general, a machine mixing time of 3 min to 5 min after all the constituents have been added should be sufficient. Wide variation in the mixing time of different batches should be avoided. Prolonged mixing where air-entraining plasticizers are used can lead to excessive air entrainment and thus to a reduction in strength, adhesion and durability.*

4.2.3.7 *Setting time of mortars containing cement*

Use cement based mortars, other than retarded mortars, within 2 h of mixing. Discard any unused mortar (see also **5.1.1.1**).

COMMENTARY. *If workability is reduced due to water loss by evaporation the mortar can be re-tempered within a maximum of 2 h by the addition of a small amount of water. Retarded mortars can be re-tempered but only within the manufacturer's stated retardation time. In hot weather the prescribed retardation time may be shortened.*

4.2.3.8 *Mixing in cold weather*

Do not mix mortar when the air temperature is at or below 3 °C and falling or below 1 °C and rising. Do not use sand or lime–sand mixtures containing ice particles (see also **5.1.1.1**).

4.2.3.9 *Care of mixing plant*

Clean the mixer at least once a day and whenever mixes are changed. If the mixer has a weighing mechanism check it regularly in accordance with the manufacturer's site work instructions to ensure constant accuracy.

COMMENTARY. *Cleaning the mixer is particularly important when changing from or to coloured mortars.*

4.2.3.10 *Mix proportions*

Use the specified mix proportions.

COMMENTARY. *Mortar mixes may be specified by the Designations given in Table 1. Mixes of the same Designation have approximately equivalent strength and durability.*

Table 1 — Mortar mixes

Types of mortar		Cement:lime:sand[a]	Masonry cement:sand[a]		Cement:sand[a] (plasticized)
Binder constituents		A Portland cement and lime, with or without an air entraining additive	Masonry cement containing a Portland cement and lime in the approximate ratio 1:1, and an air entraining additive	Masonry cement containing a Portland cement and inorganic materials other than lime[b] and an air entraining additive	A Portland cement and an air entraining additive
Designation	(i)	1:0 to 0.25:3	—	—	1:3
	(ii)	1:0.5:4 to 4.5	1:3	1:2.5 to 3.5	1:3 to 4
	(iii)	1:1:5 to 6	1:3.5 to 4	1:4 to 5	1:5 to 6
	(iv)	1:2:8 to 9	1:4.5	1:5.5 to 6.5	1:7 to 8

NOTE 1 The range of sand volumes is to allow for the effects of differences in grading on the properties of the mortar. In general the lower values apply to Type G of BS 1199 and 1200:1976 and the higher values to Type S. Mortars incorporating both lime and air-entrainment can be used with any sands within the BS 1199 and 1200 gradings.

NOTE 2 Air entrainment to improve the durability and the working properties of the mortar is recommended. It may be achieved by the use of air-entrained cements, either masonry cements or improved cements, by the addition of plasticizer to the site mixer, or by the use of a factory made mortar. (Improved cements are Portland cements modified for use in masonry containing a relatively small amount of air entrainment. They are produced for use in masonry and similar applications.)

NOTE 3 BS 8221 contains recommendations for other mortar mixes that are more suitable for the repair of the masonry of historic buildings.

[a] Cements for mortar and the standards to which they should conform are listed in BS 5628-3:2001, **5.3.1**.
[b] Where masonry cement contains less than 75 % PC, no data exists with regards to equivalence (with other mixes of that Designation) of strength and durability.

5 Brick and/or block walling

5.1 General

5.1.1 *Weather conditions*

5.1.1.1 *Cold weather*

In cold weather do not:

— build masonry when air temperature is at or below 3 °C and falling or unless it is at least 1 °C and rising (see also **4.2.3.8**);

— lay mortar on frozen surfaces;

— use wet bricks or blocks when there is a danger of freezing.

5.1.1.2 *Frost damage*

If the mortar is susceptible to frost damage, obtain guidance and instructions before proceeding work.

5.1.1.3 *Protection*

Cover the tops of newly built brick and block masonry to protect it from rain and also from frost, if imminent, and at all times when work is not proceeding. If there is any danger of the work being frozen then consideration should be given to the use of insulation under the covers.

COMMENTARY. *Unless the work is protected when not proceeding there is always the risk of sudden frosts or showers causing damage. It is important to cover work at the end of each day. These covers should be kept handy for use. Wet covers can freeze in contact with the work, therefore, it may be preferable to top the wall with a clean and dry wooden plank, wider than the wall and place polyethylene or similar sheeting over the plank, clear of the wall face in order to provide an insulating air gap. It is important to weight the covers to prevent the wind lifting them.*

5.1.1.4 *Hot weather*

Protect newly-built masonry during hot weather.

COMMENTARY. *In hot, sunny weather, especially with drying winds, mortar joints can dry before the cement has set and the mortar has bonded adequately with the brick and/or block masonry units. This is more likely to happen with masonry units of high water absorbency.*

5.1.2 ***Accuracy***

Build masonry (other than stone masonry) within the permissible deviations given in Table 2, unless otherwise specified.

COMMENTARY. *The permissible deviations given in Table 2 and Table 3 are intended to provide satisfactory structural performance of the masonry. They should not be regarded as defining acceptability of appearance. Furthermore, they do not necessarily accord with standards of accuracy required for the fit of associated building components (e.g. door and window frames) or with the provision of flat backgrounds for wall finishes or linings. Higher levels of accuracy may need to be specified where such components or finishes are to be installed.*

Table 2 — Permissible deviations in masonry (other than stone masonry)

Dimensions	Permissible deviation mm
Position in plan of any point or face in relation to the specified building reference line and/or point at the same level	±10
Straightness in any 5 m length	±5
Verticality up to 3 m height	±10
Verticality up to 7 m height	±14
Overall thickness of walls	±10
Level of bed joints up to 5 m for brick masonry	±11
Level of bed joints up to 5 m for block masonry	±13
NOTE 1 These deviations are generally derived from BS 5606:1990 and represent the level which can be reasonably expected for general brick and block masonry. NOTE 2 These deviations should be measured in accordance with the methods described in BS 5606:1990, Annex D.	

Build stone masonry within the permissible deviations given in Table 3 unless otherwise specified.

Table 3 — Permissible deviations in stone masonry

Dimensions	Permissible deviation mm
(A) Walls	
Overall height (up to 3 m)	±15
Verticality up to 3 m height	±6
Verticality up to 7 m height	±10
Straightness (in 5 m length)	±6
Bed joint level (in 5 m)	±6
Length along wall (in 6 m)	±15
(B) Window and door openings	
Width along wall (up to 3 m)	±6
Height (up to 3 m)	±6

5.1.3 *General laying*

5.1.3.1 *Masonry bond*

Lay using the masonry bond in accordance with that specified by the designer.

5.1.3.2 *Laying bricks*

Unless otherwise specified, lay bricks on a full bed of mortar, substantially fill cross joints and keep courses level and perpend joints vertically aligned. Plumb quoins and wall faces course by course as the work proceeds.

COMMENTARY. *For walling subject to exposure to wind-driven rain, and where sound insulation or fire resistance is necessary, the bricklayer should substantially fill bed and cross joints. However, in practice, some partially filled joints are unlikely to lead to a significant reduction in performance. It is not practical to vertically align every perpend joint, particularly with bricks having the maximum permissible deviation from the work sizes. It is good practice in such cases to align vertically about every fifth cross joint in each course and "even out" the size of intermediate joints. This will give a regular appearance of verticality when viewed from positions other than very close to the wall.*

BS 3921 permits variation in the dimensions of clay bricks. The tolerance is based on a measure of 24 bricks.

BS 187 for calcium silicate units and BS 6073-1 for precast concrete masonry units, give tolerances for each individual dimension.

5.1.3.3 *Laying single frog bricks*

Unless otherwise advised lay single frog bricks with frog uppermost and bricks with a double frog with deeper frog uppermost. Fill all frogs with mortar where advised.

COMMENTARY. *Brick walls built with frogs down and unfilled are weaker and less resistant to sound transmission. Advice should be sought as to whether bricks laid frog down are acceptable. It is not intended that the voids in perforated bricks are filled with mortar.*

5.1.3.4 *Laying solid and cellular blocks*

Unless otherwise specified, lay solid and cellular blocks on a full bed of mortar and substantially fill cross joints. Keep horizontal joints level and to a uniform thickness. Vertically align the perpend joints in fair faced work. Lay hollow blocks on shell bedding with the vertical joints filled.

COMMENTARY. *For walling subject to exposure to wind-driven rain, and where sound insulation or fire resistance is necessary, the blocklayer should substantially fill bed and cross joints. However, in practice, some partially filled joints are unlikely to lead to a significant reduction in performance. It is not practical to vertically align every perpend joint, particularly with bricks having the maximum permissible deviation from the work sizes. It is good practice in such cases to align vertically about every fifth cross joint in each course and "even out" the size of intermediate joints. This will give a regular appearance of verticality when viewed from positions other than very close to the wall.*

It is not practical to vertically align every perpend joint, particularly with blocks having the maximum permissible deviation from the work sizes. It is good practice in such cases to align vertically about every fifth cross joint in each course and "even out" the size of intermediate joints. This will give a regular appearance of verticality when viewed from positions other than very close to the wall.

BS 6073-1 for precast concrete masonry units, gives tolerances for each individual dimension.

5.1.3.5 *Make-up masonry*

Use cut or special shaped masonry units of the same type in situations such as making up courses, closing cavities, fitting around structural steel profiles, etc. Do not use materials with different physical properties, e.g. clay and concrete masonry, which have different rates of expansion.

5.1.3.6 *Height of lifts*

Do not rack back corners and other advanced work higher than 1.2 m above the general level.

For facing work complete the whole lift within one period of operation.

Except where permitted by a proprietary system or by the designer, do not carry up any one leaf more than 1.5 m in one day.

COMMENTARY. *If work rises more than 1.5 m in a day the mortar in the lower courses may be over-stressed as it may not have developed sufficient strength. It may be possible to safely carry lightweight masonry units higher than 1.5 m a day; conversely, dense units may need to be restricted to lifts lower than 1.5 m.*

5.1.3.7 *Honeycomb sleeper walls*

Build half-brick sleeper walls with all vertical joints left open 65 mm to 75 mm wide (see Figure 1).

COMMENTARY. *Leaving vertical joints open ensures a free flow of air in all directions under a ventilated floor.*

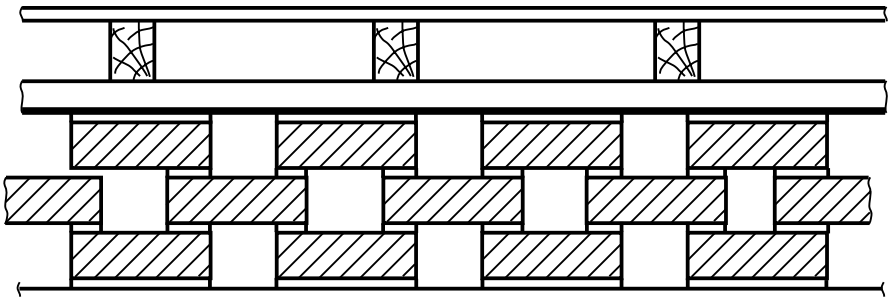


Figure 1 — Honeycomb sleeper wall

5.1.3.8 *Joint reinforcement*

When installing prefabricated bed reinforcement in the joints, embed in mortar to provide a full even bed. Lay reinforcement in the mortar as follows and complete joints to the normal thickness.

Keep reinforcement at least 20 mm from external mortar face and at least 12 mm from internal building faces.

Lap reinforcement a minimum of 225 mm at joints in the length and fully lapped at angles.

5.1.3.9 *Bedding ashlar*

To obtain a solid, even bed, use two strips of corrosion resistant metal or heavy duty plastic of the thickness of the specified joint as distance pieces, flushing all joints solidly at the time of fixing. Spread only sufficient mortar to bed one ashlar at a time.

COMMENTARY. *Uneven bedding can cause the stone to crack.*

If necessary, re-moisten the bedding mortar slightly by sprinkling with a brush immediately before laying the stone. Moisten the faces of the stones adjacent to beds and joints prior to final pointing.

The projecting members of an overhanging cornice should be hollow bedded. Take precautions to prevent overturning of projecting cornice stones, which can be unstable, pending the setting of the mortar, the fixing of dowels or cramps and the bedding of stabilizing courses.

Fit dowels and cramps as the work proceeds. Completely fill grouted joggle joints and tamp to ensure that any trapped air is expelled.

5.1.3.10 *Rubble walls*

Build up quoins in advance of the main body of the rubble wall to a height of approximately 1 m with the adjacent walling built or stepped down on either side.

Build the front part of the wall to a height of not more than 400 mm, raise the back part to approximately the same level using as far as possible stones that are broad on bed and which tail-in well with the front portion. At the same time, fill any spaces left between the stones of the two wall faces with core stones carefully chosen to bond in with the remainder. Fill all voids.

Build in bonders, one to each superficial metre in each face in random work, and at approximately 1 m vertical and horizontal intervals in coursed work, staggering the stones between the two faces.

COMMENTARY. *Bonders should have a height of not less than one-third their length and should extend through two-thirds of the wall thickness.*

5.1.3.11 *Plumbing of stone walls*

To ensure that rough-faced stone masonry is plumb, erect temporary but rigid vertical forms or battens at the building angles, approximately 300 mm away from the wall face, from which a constant distance should be maintained when forming the bed joints of the quoins. Lines should then be stretched either from the laid quoin stones or from the battens which will indicate the face of the bed joints in the intermediate walling.

COMMENTARY. *When a wall is to be built to a batter or slope, the battens should be erected at the desired angle from the vertical, and measurements taken as before.*

5.1.3.12 *Quoins and jambs*

Unless otherwise specified, use selected large stones for quoins and jambs. These should be more regular in shape and more carefully dressed than stones for the main walling, and should be selected and set out on the ground beforehand. The use of these stones at the angles will give greater strength and stability to the wall, and enable the mason to course and plumb the wall as the work advances.

5.2 Jointing and pointing

5.2.1 *Jointing*

5.2.1.1 *General*

Finish facing work and fair faced work joints to the specified profile as the work proceeds.

5.2.1.2 *Unexposed joints*

As the work proceeds, use a trowel to strike off any joints which are not to be exposed to view in the finished work, e.g. in roof spaces.

5.2.1.3 *Masonry to be plastered or rendered*

Unless units have a suitable texture or purpose-made key unit or metal-lathing is used, rake out joints approximately 15 mm deep, as work proceeds, on all those faces to be plastered or rendered.

COMMENTARY. *Raking out joints gives a good key for the coating.*

5.2.2 *Pointing*

If pointing is specified do not use mortar stronger than that used when constructing the wall.

If pointing is specified, rake out the joints to a depth of between 10 mm and 15 mm as the work proceeds, to give an adequate key. Brush out the joints to remove dust and loose material and then lightly wet using a brush. Carry out pointing from the top of the wall downwards.

COMMENTARY. *It is important that the specified depth of raking out is achieved throughout the wall, checked with a suitable depth gauge.*

5.3 Laying DPCs

5.3.1 *General*

5.3.1.1 *Warming DPC rolls*

Warm DPC rolls in cold weather to avoid cracking.

5.3.1.2 *Junction with damp-proof membrane*

Ensure that care is taken to follow the detail and specification in order to achieve continuity of the DPC at ground level with the damp-proof membrane.

5.3.1.3 *Sealing junctions*

Where flexible DPCs are to resist the downward movement of moisture within walls, seal the lap joints and all junctions, e.g. at columns. Also follow these recommendations.

a) For bitumen DPC materials, lap at least 100 mm and seal together with cold applied roofing felt adhesive.

b) For pitch polymer and bitumen polymer materials, lap at least 100 mm and seal joints with adhesive in accordance with the manufacturer's instructions.

c) For polyethylene, seal joints with double-sided adhesive tape.

d) For joints in lead, form the seals with 100 mm passing lap and interlocking upstands.

e) For joints in copper, form seals by welding or welting.

COMMENTARY. *If joints and junctions are not sealed, the flow of water from above can penetrate through the joints and give rise to costly and inconvenient remedial work. Examples requiring particular attention are parapet walls and wall panel and floor junctions with concrete frames (see also* ***5.4.1.4****).*

5.3.1.4 *Stepping DPCs*

Where a DPC is used in an external wall on a sloping site, ensure the DPC is never less than 150 mm above the finished ground level (see Figure 2).

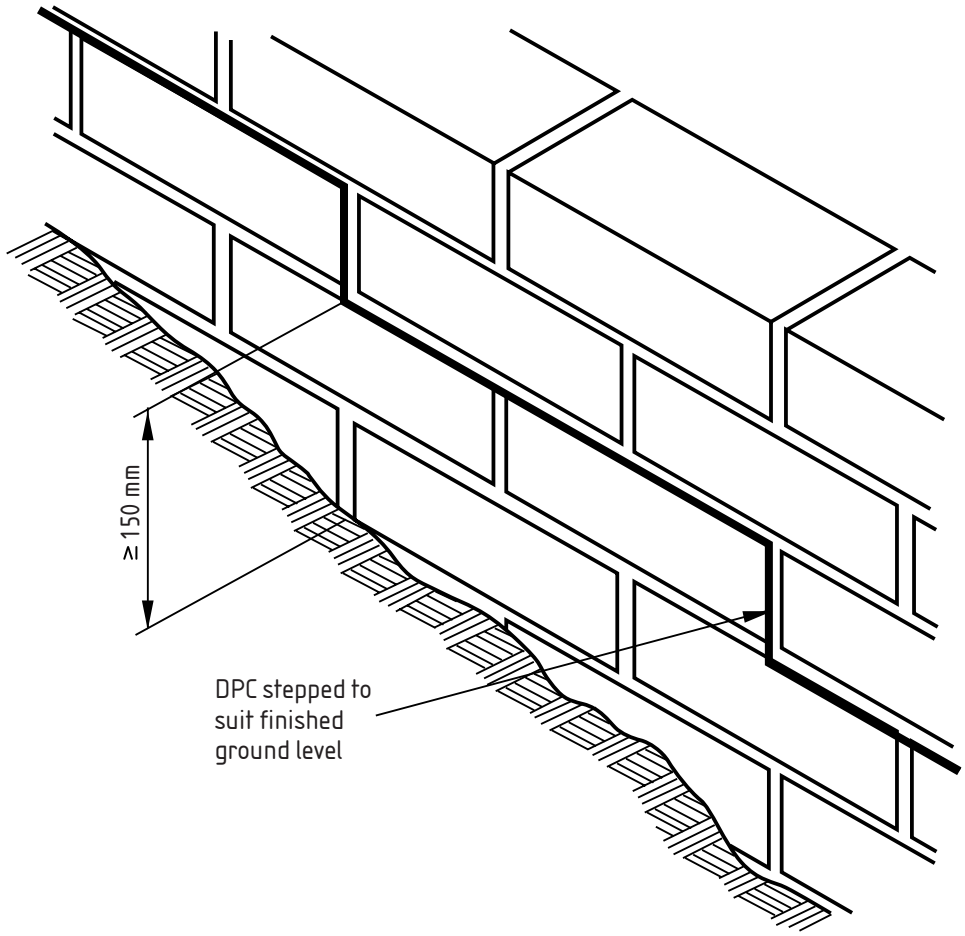


Figure 2 — Stepping DPC above ground

5.3.2 ***Horizontal DPCs***

5.3.2.1 *Flexible horizontal DPCs*

Bed DPCs on mortar. Lay DPCs in continuous lengths for the full width of the leaf, with 100 mm minimum laps in runs and with full laps at angles. Bed at least one further course of units on mortar on the DPC.

COMMENTARY. *The weight of the course above the DPC, if laid immediately after the DPC, helps to develop good adhesion between the masonry units, the mortar and the DPC.*

5.3.2.2 *Slate horizontal DPCs*

Lay two courses of slate with joints staggered, and fully bed each course in the Designation (i) mortar (see Table 1). The total thickness of joint should be not more than 40 mm.

5.3.2.3 *Brick horizontal DPCs*

Form a DPC of brick masonry with not less than two courses of DPC category bricks laid in Designation (i) mortar (see Table 1) with all the bed joints and perpend joints filled solid with mortar.

5.3.2.4 *DPCs at base of wall*

Where there are separate DPCs in each leaf, ensure edges do not project into the cavity. Do not cover edges of the DPC with mortar.

COMMENTARY. *DPCs projecting into cavities provide a place for debris to lodge. DPCs should cover the full width of the wall if they are to prevent the passage of moisture effectively (see Figure 3).*

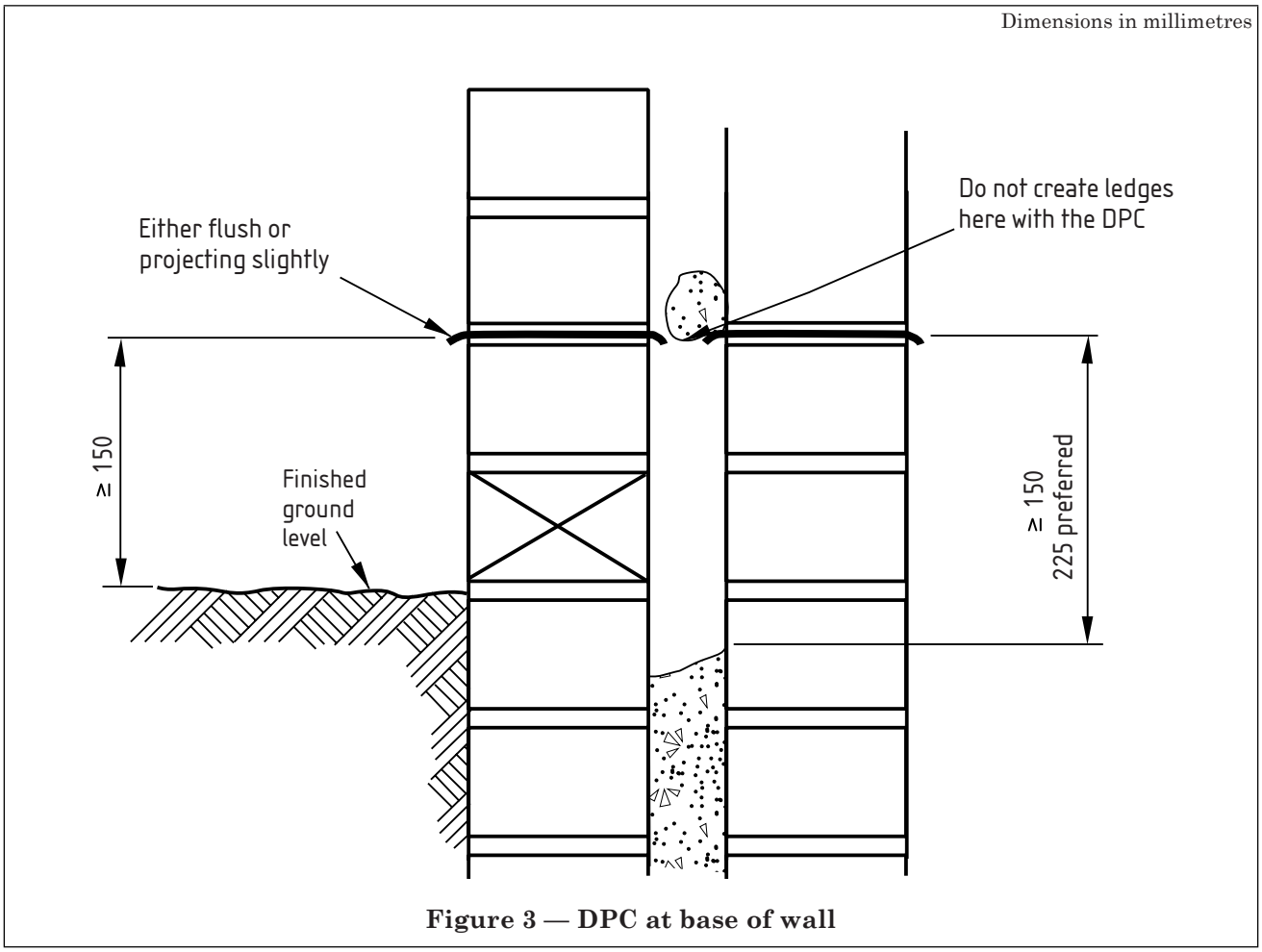


Figure 3 — DPC at base of wall

5.3.2.5 *Horizontal DPCs under sills*

With jointed, pervious, or timber sills, turn up the DPC underneath at the rear face to prevent moisture coming into contact with inner leaf or finishings. Allow the leading edge of the DPC to project 5 mm from the wall face below sill.

COMMENTARY. *The joints in a sill are a source of weakness. Water running off the window on to the sill can cause moisture to penetrate through the sill or joints and back, to any part of the inner leaf or finishes in contact with the sill without an adequate DPC (see* ***5.3.3.6****).*

5.3.3 ***DPCs in cavity work***

5.3.3.1 *Cavity trays over cavity bridges*

Where flexible DPCs span cavity bridges, e.g. over door and window openings, ducts and horizontal cavity barriers:

a) use cavity trays, wherever possible, in continuous lengths. If a joint cannot be avoided, use a rigid support of suitable material at the position of the joint to ensure solid bonding is provided. Overlap joints in DPCs to a minimum of 100 mm and seal with an appropriate jointing compound;

b) securely fix trays across the cavity, stepping up towards the inner leaf. Prevent sagging by providing support where necessary;

c) ensure that trays cover the full extent of any lintels or other cavity bridgings;

d) ensure that trays with stop ends to direct water flow to weepholes are provided.

See also **5.4.1.4** and **5.3.2.4**.

COMMENTARY. *Cavity trays provide a watertight barrier which discharges water to the outside.*

5.3.3.2 *Cavity trays at roof abutments*

Where pitched roofs abut cavity walls, build-in cavity trays to ensure effective drainage of water through weepholes in the external leaf of the wall. Where a roof abutts a horizontal cavity, install a cavity tray above roof level. Where the junction between a pitched roof and a cavity wall forms a sloping abutment, install a system of stepped cavity trays.

5.3.3.3 *Trays and flashings in chimneys*

Where a tray is necessary, at one or two levels where a chimney penetrates a roof surface, extend the trays across the total area of the chimney and into the flue liner. The trays should have an upstand at the rear and to the sides of the chimney and be dressed down at the front edge. At least two weepholes above the tray at the front edge should be provided.

5.3.3.4 *Cavity trays above insulation*

If cavity insulation is terminated below the highest level of the wall, protect the top edge of the insulation by a cavity tray. Provide weepholes at centres not exceeding 1 m to provide adequate drainage from the cavity tray.

5.3.3.5 *Cavity trays to exclude soil gas*

Support any tray designed to prevent soil gases, e.g. radon and methane, from entering the building, across the cavity and seal all laps.

5.3.3.6 *Jambs in cavity walls*

Build-in flexible DPCs at jambs of all openings unless a proprietary closer is used. Lap a vertical DPC under the DPC at the head, and lap in front of the DPC at sill level. Ensure DPCs are in close contact with frames and properly held in position to prevent sagging. Project the jamb DPC at least 25 mm into the cavity area.

COMMENTARY. *It is essential that continuity of all the DPC at the corners of all openings is maintained to prevent rain penetration.*

5.4 Cavity walling

5.4.1 *Cavities*

5.4.1.1 *Forming a cavity wall*

Form the cavity wall to the specified overall thickness and with the specified cavity width. Clean off any surplus mortar from joints on the cavity faces as the work proceeds. Keep the cavity and ties free from mortar and debris.

COMMENTARY. *Draw battens should be used as a means of keeping the cavity clear of mortar and debris since anything that bridges the cavity can lead to damp patches appearing on the inner face of the wall. The battens should be drawn up and cleaned regularly, particularly at the end of the day's work.*

Cavities at the base of the wall should be kept clear. If cleaning becomes necessary take care not to damage the DPCs.

5.4.1.2 *Filling the bottoms of cavities*

Unless otherwise specified, fill cavities below ground level with concrete to a level 75 mm below finished ground level (see Figure 3).

COMMENTARY. *Filling cavities below ground level stabilizes the two leaves and prevents the bottom of the wall filling with water. Any water reaching the bottom of the cavity is drained away through weepholes left in the base of the wall (see **5.4.1.4**).*

5.4.1.3 *Cavity bridges*

Where the tops of cavities are to be spanned with in situ concrete, use a rigid durable material to serve as formwork.

5.4.1.4 *Weepholes*

Where specified provide weepholes in the external leaf at centres not exceeding 1 m at the locations and in the form specified. If weepholes are not specified obtain instructions.

COMMENTARY. *It should be assumed that moisture runs down the inner face of the external leaf of all cavities. Where the cavity is bridged by an extensive barrier, e.g. lintels, floor slabs, concrete frame members or at the location of a horizontal cavity fire barrier, a cavity tray and weepholes are necessary (see also **5.4.1.2**).*

Normally in brick masonry, open cross joints (perpend joints) or, in block masonry, part open cross joints (perpend joints) serve as weepholes.

5.4.2 ***Cavity wall ties***

5.4.2.1 *Bedding*

Except for proprietary systems, bed ties at least 50 mm into masonry leaves, and level or slope slightly downwards towards the outer leaf. Ensure that the drips point downwards. It is also important that proprietary wall ties are laid the right way up.

Build ties in as the work proceeds and do not push ties into joints after the joints have been completed. Do not bend ties or move after installation.

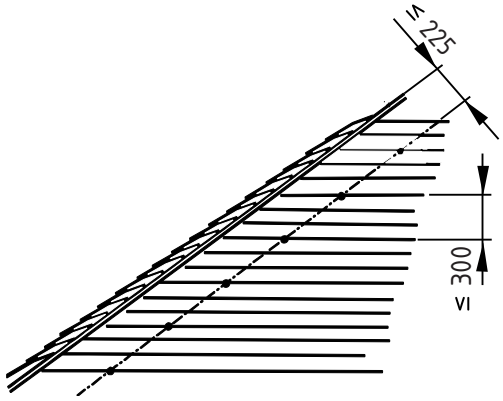
5.4.2.2 *Spacing for masonry cavity walls*

Stagger ties in alternate courses at the spacings given in Table 4, unless otherwise specified.

Provide additional ties at sides of openings at every block course or every fourth brick course (see Figure 4).

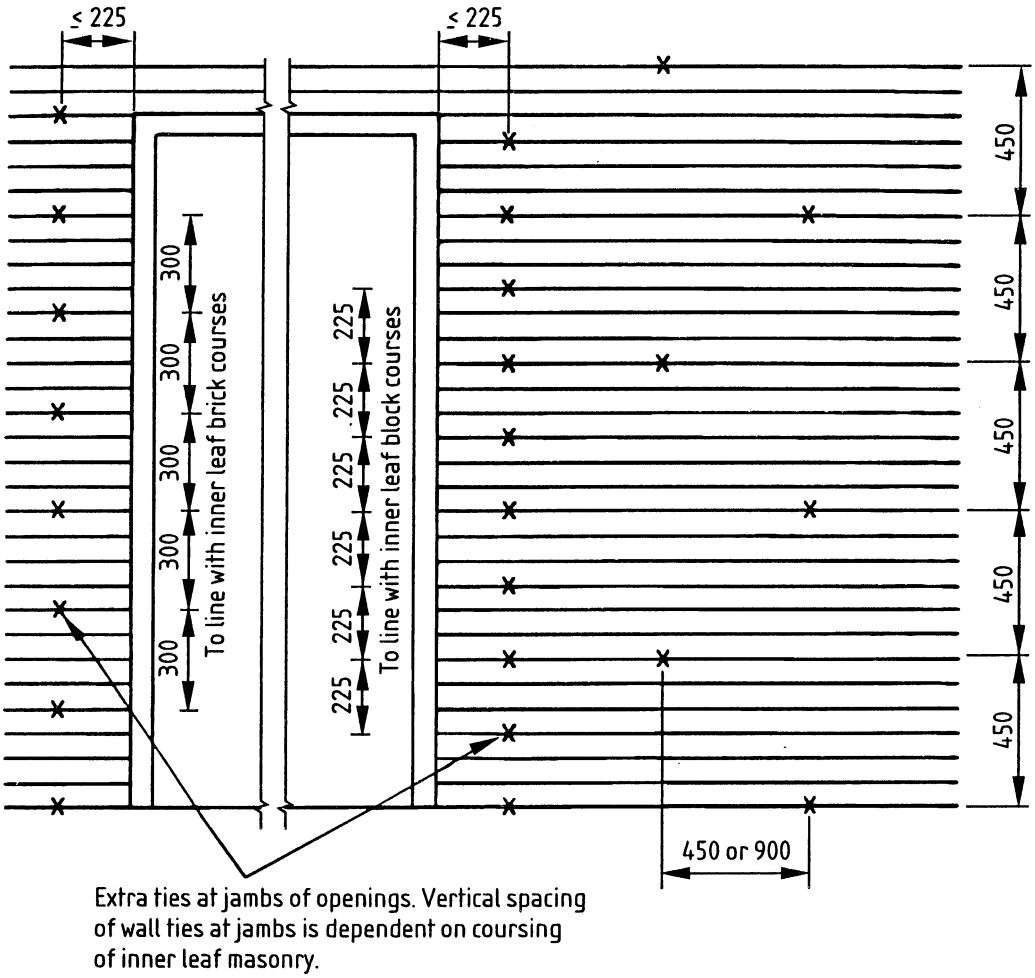
COMMENTARY. *Ties should be of sufficient length to ensure that the 50 mm minimum bedding is achieved in both leaves.*

Dimensions in millimetres



a) At gable verges

Figure 4 — Spacing of ties



b) At openings

NOTE This figure is based on the recommendations of BS 5628-3. The Approved Documents to the Building Regulations recommend the extra ties at jambs of openings to be within 150 mm of the opening.

Figure 4 — Spacing of ties *(concluded)*

5.4.2.3 *Spacing for timber frame/masonry walls*

Fix wall ties to stud members at the following maximum spacing (or equivalent in area cover):

a) at vertical spacings of 375 mm for studs at 600 mm centres;

b) at vertical spacings of 525 mm for studs at 400 mm centres;

c) at jambs vertically, not more than 225 mm from the brick reveal and at 300 mm maximum centres.

5.4.2.4 *Spacing for light steel frame/masonry walls*

Fix wall ties for stud members at full maximum spacing (or equivalent in area cover):

a) at vertical spacings of 375 mm for studs at 600 mm centres;

b) at vertical spacings of 450 mm for studs at 400 mm centres;

c) at jambs vertically, not more than 225 mm from the brick reveal and at 300 mm maximum centres.

5.4.3 ***Alignment***

Where vertical twist ties are used do not build one leaf above the other leaf by more than the vertical spacing between consecutive rows of ties.

COMMENTARY. *It is difficult to ensure that the bed joints stay in alignment if the two leaves are not raised together.*

Table 4 — Spacing of wall ties

Least leaf thickness (one or both)	Cavity width	Equivalent number of ties	Approximate spacing of ties	
			Horizontal	Vertical
mm	mm	/m^2	mm	mm
65 to 90	50 to 75	4.9	450	450
Not less than 90	50 to 300	2.5	900	450

5.4.4 ***Installing insulation*** *(see Figure 5)*

5.4.4.1 *Partial cavity fill*

Fix insulation boards or insulation slabs carefully in accordance with the manufacturer's instructions. Construct walls in accordance with the following recommendations.

a) Close butt boards and slabs at both horizontal and vertical joints and at closures.

b) Keep joints between boards and slabs clean and free from mortar droppings.

c) Securely fix boards and slabs to be backed to one leaf by a method approved in the design, only as specified, so as not to form ledges which can collect mortar or moisture.

d) Do not block or bridge air spaces, either by mortar or off-cuts of insulation.

e) Strike mortar joints flush within the cavity and keep inner faces of the masonry clean.

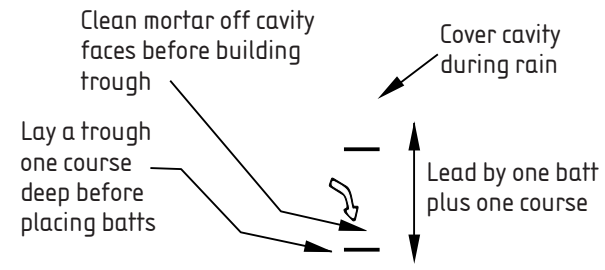
f) Do not leave gaps in the insulation.

g) Leave mortar joints open as weepholes in the outer leaf as recommended (see **5.4.1.4**).

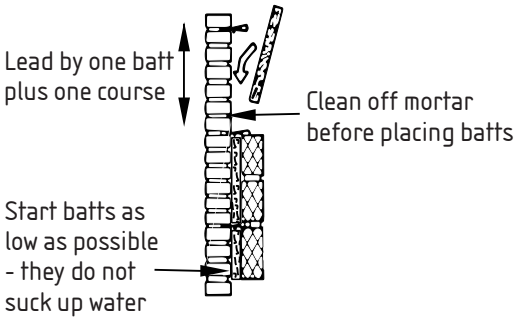
h) Ensure that horizontal joints of insulation correspond with horizontal rows of ties.

i) Do not use recessed mortar joints unless specified by the designer.

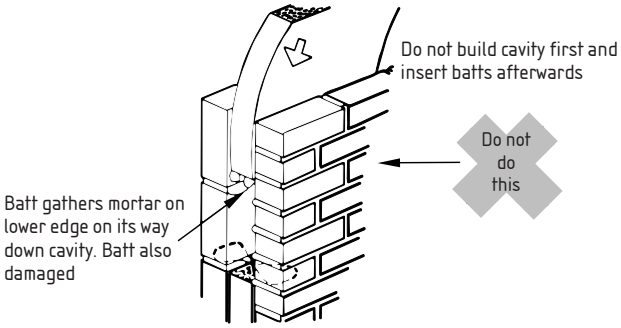
COMMENTARY. *The risk of moisture penetration is increased unless the recommendations for workmanship are adhered to carefully. If moisture penetration does occur, the fault cannot be traced easily.*



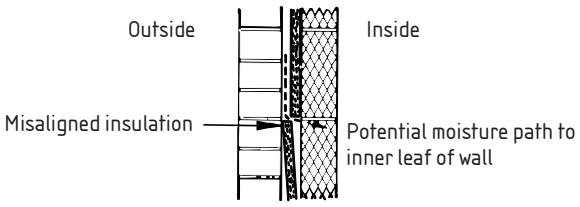
a) inner leaf construction leading outer leaf



b) outer leaf construction leading inner leaf



c) faulty technique: build-in batts as wall is built — do not slide batts into cavity



d) faulty technique: align and securely fix partial-fill slabs or boards

Figure 5 — Insulation in cavity walls

5.4.4.2 *Built-in cavity fill*

Fit insulation slabs carefully in accordance with the manufacturer's recommendations. Construct walls in accordance with the following recommendations.

a) Ensure that the insulation slabs are of a thickness appropriate to the cavity width so as to fill the cavity.

b) Close butt insulation slabs at both horizontal and vertical joints and at closures, and install them with staggered vertical joints.

c) Keep joints between insulation slabs clean and free from mortar droppings.

d) Strike mortar joints flush within the cavity and keep inner faces of the masonry clean.

e) Do not leave gaps in the insulation.

f) Do not place any small off-cuts with the cut edge against the wall surface.

g) Leave mortar joints open as weepholes in the outer leaf as specified (see **5.4.1.4**).

h) Ensure that insulation slabs are built into, and are not pushed into the cavity.

i) Ensure that horizontal joints of insulation correspond with horizontal rows of ties.

j) Where additional wall ties are required, cut insulation slabs neatly to accommodate them.

k) Do not use recessed mortar joints unless specified by the designer.

COMMENTARY. *The risk of moisture penetration is increased unless the recommendations for workmanship are carried out carefully and if moisture penetration does occur, the fault cannot be traced easily. Recessed joints also increase this risk as they increase the amount of water reaching the cavity. Further guidance is given in BS 6676-2.*

5.4.4.3 *Blown or injected cavity fill*

Blowing or injecting insulation should be carried out by appropriately qualified personnel.

Inspect cavity walls prior to the blowing or injecting of insulation and build in accordance with the following recommendations.

a) Strike mortar joints flush within the cavity and keep inner faces of the masonry clean.

b) Minimize mortar droppings into the footings.

c) Keep cavities free from obstructions such as lumps of mortar and parts of bricks.

d) Fully fill all putlog holes with mortar on removal of scaffolding.

e) Do not use recessed mortar joints unless specified by the designer.

COMMENTARY. *Independent attestation of conformity schemes for this process are in existence. The risk of moisture penetration is increased unless the walls are built correctly and cavities kept clean. Recessed joints also increase this risk as they increase the amount of water reaching the cavity*.

5.5 Fair faced masonry

5.5.1 *General*

5.5.1.1 *Blending*

Before laying, blend units so that the overall appearance of the finished work is uniform and without patches or bands of colour (see also **4.1.2**).

COMMENTARY. *To achieve a good blend, units should be loaded out from at least three packs. It is advisable to draw from the packs in vertical rather than horizontal slices. BS 3921:1985, Annex F and BS 5628-3, Annex D describe a detailed method of assessing the visual acceptability of clay facing bricks using reference and sample panels. In general, bricks should be reasonably free from deep and extensive cracks and from damage to edges and corners and from the inclusion of pebbles and expansive particles of lime.*

5.5.1.2 *Selection*

Select units needed for special situations (e.g. soldier course or narrow piers) for consistency of size.

5.5.2 *Fair faced work*

Lay masonry units with care so that the finished work has a clean and even surface with the joints consistent in width and profile and with the perpend joints in vertical alignment (see **5.1.3.2** and **5.1.3.3**). Construct in accordance with the following recommendations.

a) Only cut masonry units where necessary for the correct bond.

b) Make good any holes, such as those for putlog scaffold members and cavity cleaning, with matching mortar and matching masonry units.

c) Keep face work clean and free from staining at all times. Protect masonry adjacent to scaffold boards from rain splashes.

d) Provide temporary protection for projecting bands and plinths while the remainder of the wall above is completed.

e) Protect built-in windows and doors from mortar staining by mortar droppings.

f) Provide protection where in situ concrete work is being executed in close proximity to finished facing work.

COMMENTARY. *The type of scaffold (putlog or independent) is to be agreed. Putlog scaffolding, which is supported by the wall as it rises, will leave holes which should be made good with matching mortar at completion. There is a risk of damage as putlogs are removed.*

5.6 Construction details

5.6.1 *Sills, copings and cappings*

5.6.1.1 *Masonry sills, copings and cappings*

Set bricks, coping or capping units or blocks as specified on a bedding of the specified mortar mix. Fill all joints and keep the units true to line (see also **5.3** and **5.6.1.6**).

5.6.1.2 *Brick and tile sills, copings and cappings*

Form brick masonry as specified on a creasing course of two tiles thickness laid with joints staggered and bedded in mortar of the specified mix. Set tiles to over-sailing if specified and keep all arises true to line. Fill all joints and finish exposed joints flush with adjoining surfaces (see also **5.3**, **5.3.1.3** and **5.6.1.5**).

5.6.1.3 *Stone or precast concrete copings and cappings*

Bed stone or concrete copings and cappings in mortar. Set the coping to over-sailing correctly and to a true line. Excluding movement joints, fill joints with mortar and finish flush with the surface. Point or joint stone copings and cappings with suitable materials and to the specified profile.

5.6.1.4 *Stone or precast concrete sills and thresholds*

Bed only the ends of one-piece stone or concrete sills or thresholds in mortar. Leave the joint below open and at completion of the brick or block masonry seal the joint with a flexible material.

COMMENTARY. *If one-piece sills are bedded solidly in mortar there is an increased risk of fracture in the event of thermal movement or differential settlement.*

5.6.1.5 *DPCs under copings and cappings*

Provide DPCs below jointed or pervious copings and cappings. Lay the DPC and coping or capping units on fresh beds of mortar. Ensure the leading edge of the DPC projects 5 mm from the wall face below the coping. Beneath brick-on-edge cappings the DPC may be cut flush with the brick masonry. Provide a rigid support for the DPC in cavity walls.

COMMENTARY. *The joints in a coping or capping are a potential route for moisture penetration. A continuous DPC underneath will prevent moisture penetrating into the main portion of the wall. The DPC should be bedded in fresh mortar and the coping or capping immediately laid above in fresh mortar in order to maximize the bond between the coping or capping and the wall beneath.*

5.6.1.6 *Coping and capping cramps*

Ensure that non-ferrous or rustproof steel cramps are used, and build-in upstand legs tight to the face of the unit.

5.6.2 *Padstones*

Build in padstones to receive the ends of structural members and bed solidly in the specified mortar mix and ensure the top surface is accurately positioned in level, to provide an effective bearing area.

5.6.3 *Lintels*

5.6.3.1 *Lintel bearings*

Ensure that:

a) there is a full masonry unit immediately below lintel ends. Do not use off-cuts of bricks or blocks as they can permit local movement;

b) the lintel is of sufficient length to provide the specified bearing at each end;

c) the length of the brick or block is greater than the bearing length;

d) the lintel is level and is bedded in mortar.

It may be necessary to fill hollow and/or cellular blocks under lintel bearings with mortar.

COMMENTARY. *Lintels need to have a firm seating under each end that will not move under load.*

It may be necessary to prop long, heavy, precast lintels until the mortar has set under the bearings.

Lintel bearings length should be not less than 100 mm. The bearings length for pressed steel and boot lintels should be not less than 150 mm. The bearings length of proprietary lintels should be in accordance with the manufacturer's instructions (see also **5.3.3.1**).

5.6.3.2 *Prestressed and reinforced concrete lintels*

Build in lintels with the correct side uppermost in relation to the position of reinforcement.

Prop prestressed composite lintels at centres not exceeding 1.2 m during the construction of masonry above and retain props in position for at least 14 days. Follow the requirements in the manufacturer's sitework instructions for installation.

COMMENTARY. *Ends of lintels should be bedded to allow for long term shrinkage of the concrete at one or both ends. When using composite lintels of prestressed concrete with masonry, the masonry should be carefully built with solidly filled joints. No holes for services should be made nor should anything be built into the masonry part except the edge of a DPC, which should not intrude more than one-quarter width of the bed joint or 30 mm, whichever is the less. In cold weather when mortar gains strength more slowly, the period of propping may need to be extended. Professional advice should be sought in these situations*.

5.6.3.3 *Concrete block lintels*

Form reinforced concrete filled block lintels as follows.

a) Provide adequate temporary support to retain the blocks in position until the lintel develops full strength.

b) Bed the end blocks in mortar and build the outer casing with the lintel blocks jointed in mortar.

c) Lay reinforcement on suitable spacers to provide the required cover, fill the whole lintel, tamp well and trowel the top smooth.

d) Follow any additional requirements in the block manufacturer's sitework instructions.

5.6.3.4 *Steel lintels*

Where steel lintels have a drip nosing, ensure this is positioned clear of the frame head.

5.6.3.5 *Timber lintels*

Ensure timber lintels are not twisted or warped. If they have been cut from longer lengths on site, liberally treat the cut ends with two coats of preservative compounds (see BS 5268-5).

5.6.3.6 *Arches in fair faced work*

Unless preformed arch units are specified, form arches on temporary centres using masonry units. Fully fill joints with mortar. Leave the centre in position until the mortar has set. When the centre is removed, finish soffit joints to match the face joints.

5.6.4 ***Junctions***

5.6.4.1 *Angles and intersections in brick of block walls*

When movement joints are not specified, bond or tie all wall junctions in accordance with the following recommendations.

a) Fully bond the two walls at angles.

b) Bond or tie intersecting walls as specified. Obtain instruction if no requirement is specified.

COMMENTARY. *Strip metal ties, cramps, expanded metal or proprietary systems can be used for jointing. The construction should follow the recommendations of the designer.*

5.6.4.2 *Junctions between walls and joists or rafters*

Lay wall plates true to level on a solid bed of mortar.

If a filling is advised between the joists or rafters, build-in and keep the filling 12 mm below the tops of timber joists. Lay the filling as soon as is practicable after placing members to avoid displacement and distortion (see Figure 6).

On concrete floors tightly fit the horizontal straps and attach to both the blocks and the floor beams. Provide a full bed of mortar around the strap in the wall.

COMMENTARY. *The masonry filling can provide lateral firm support to the members, whether of steel, concrete or timber. The 12 mm gap shown in Figure 8 allows for the shrinkage of timber joists. The gap may need closing with a compressible filler depending on circumstances. The ends of members embedded in the wall should be protected against moisture.*

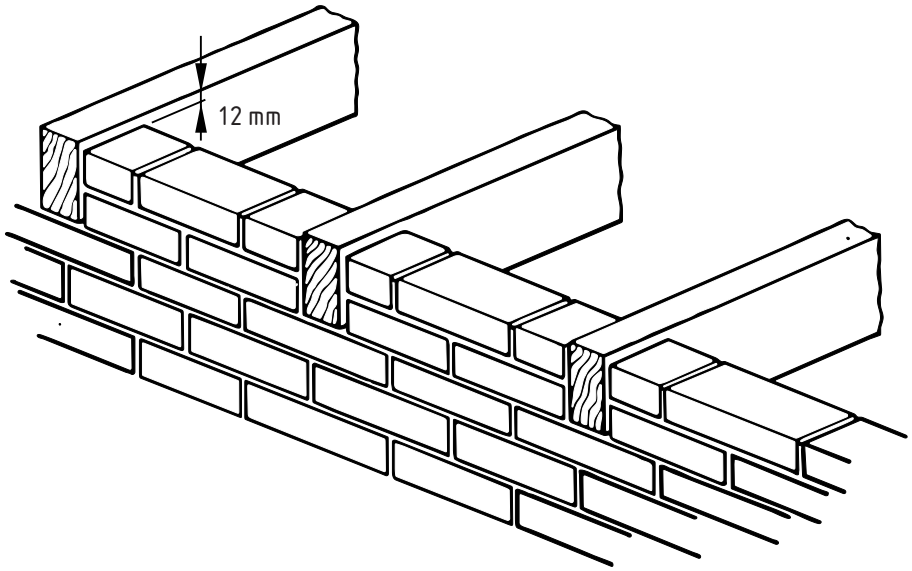


Figure 6 — Junctions between walls and joists/rafters

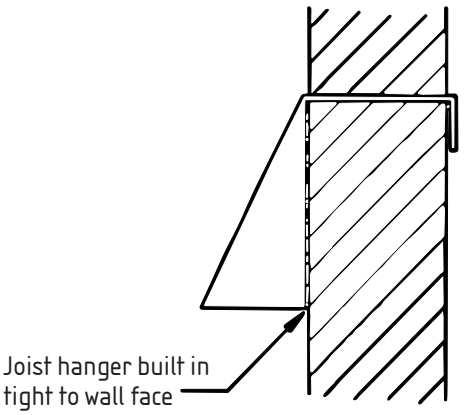


Figure 7 — DPC tray extended through the liner into the flue

5.6.5 ***Joist hangers***

Ensure joist hangers are of the type specified. Fit them securely and tightly to the wall without gaps at the contact faces (see Figure 7).

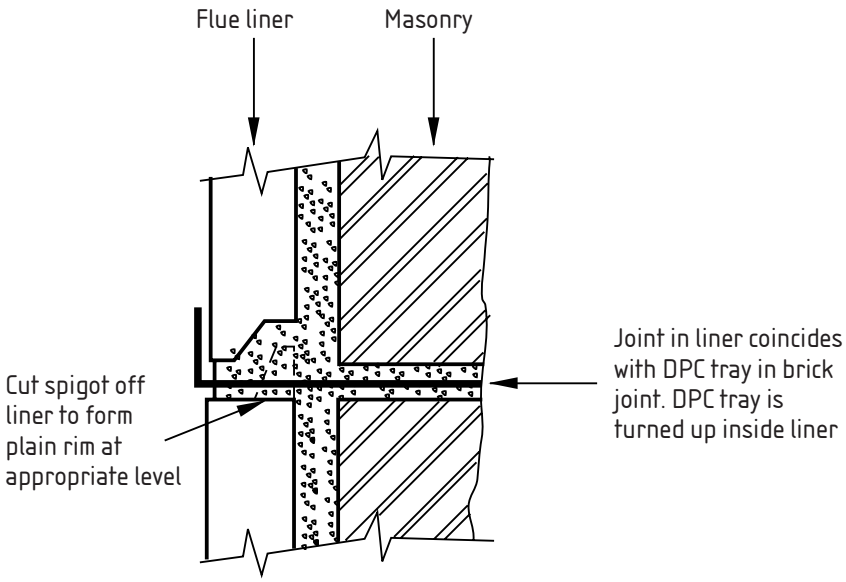


Figure 8 — Typical joist hanger built into masonry

5.6.6 ***Straps and metal ties***

Ensure all straps and metal ties are of the size and type specified. Fully bed in the mortar joint and fit tightly against the masonry face where specified.

It is essential that blocking be used between the joist or rafters and the parallel wall below all horizontal strapping positions

5.6.7 ***Movement joints***

Form movement joints and build-in the specified joint filler or provide a clear gap in the masonry of a size suitable for the installation of the filler.

When a filler is installed as the work proceeds locate the filler material vertically and firmly fix at the specified position. Where necessary leave a gap at the front and/or rear of the wall to allow for the installation of the sealant.

To form an open joint, locate a temporary spacer vertically and firmly fix in position. Keep the open joint clear of mortar and debris.

In all cases form a full bed to the face of the joint. Ensure the joint is vertical and of constant width. Bed joints each side of the movement joint should be at the same level.

COMMENTARY. *Any temporary spacer should be of a material which can easily be removed without damaging the face of the masonry.*

5.6.8 ***Fixing frames***

5.6.8.1 *Forming openings for doors and windows*

Where doors or windows are not built-in as the work proceeds form the openings accurately in the walls by using templates. Correctly position frame fixings and securely fix to the walls.

5.6.8.2 *Building-in doors and windows as the work proceeds*

Fix door and window frames as the work proceeds and ensure the frames are square and positioned correctly in relation to the DPCs to prevent moisture bypassing the junction between the DPCs and the frames.

5.6.9 *Service entries*

At service entries allow a minimum gap of 20 mm around the service entry to allow sealing later, by following trades, in accordance with the specification.

Obtain instructions where service entries need to be sealed later, by following trades, against ingress of ground water.

5.6.10 *Chases and holes*

The number and position of chases and holes should be in accordance with the specification. Chases and holes for services should be cut neatly. Follow the recommendations below, but if they conflict with either the specification or with the size limits set by the masonry unit manufacturer then obtain the necessary instructions.

a) Do not cut chases in any block masonry that is less than 75 mm thick.

b) Maintain a minimum of 15 mm thickness between the bottom of the chase and the void for hollow units, unless otherwise recommended by the manufacturer.

c) Do not cut horizontal or raking chases in solid walls to a depth greater than one-sixth of the thickness of the leaf.

d) Do not cut vertical chases to a depth exceeding one-third the thickness of the single-leaf in solid walls.

e) Offset chases on either side of a wall by a distance at least equal to the wall thickness. Ensure that chases back-to-back in line do not exceed the dimensional restrictions in b) and c).

f) Do not cut holes exceeding 300 mm wide in walls unless a suitable lintel has been specified.

COMMENTARY. *Mechanical rotary cutters should be used, particularly when it is necessary to avoid heavy impacts and vibration. Inappropriate chasing carried out not in accordance with the specification might adversely affect one or more of the functional requirements of the wall, e.g. its loadbearing capacity*.

5.7 Flues and linings

5.7.1 *General*

Ensure that throat units, linings and terminals are built in accordance with the following recommendations.

a) Fill all joints with jointing and caulking materials in accordance with the manufacturer's sitework instructions.

b) Build socketed flue liners with the inner surface of the lining smooth at the joints and socket ends uppermost. If necessary, core the lining as work proceeds.

c) Fill the void between brick chimneys and clay or concrete flue liners with lightweight concrete or weak mortar.

d) Do not use cracked or broken liner sections. Form bends with purpose made fittings.

e) Extend DPC trays through the liner into the flue and turn upwards (see Figure 8).

COMMENTARY. *The socket ends uppermost retain any condensation moisture within the flue*.

5.7.2 *Proprietary flue blocks*

Ensure proprietary flue blocks are coursed with the block masonry walls and build in accordance with the manufacturer's recommendations.

5.7.3 *Refractory brick flue linings*

Construct brick flue linings very carefully and ensure that:

a) only the special mortar mixed in accordance with the brick manufacturer's sitework instructions is used;

b) all joints, vertically and horizontally, are completely filled, finished flush with the face of the bricks, and kept to the thickness required by the manufacturer's sitework instructions;

c) the lining is bonded to the main brick masonry with refractory bricks in accordance with the manufacturer's sitework instructions.

COMMENTARY. *The quality of the workmanship is important as any flues contain large quantities of very hot gases.*

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