Architectural & Commercial

Copings and Cappings Design Guide

Introduction

1.1 Historical Background | 1.2 Design Considerations | 1.3 Caplock

The top of the wall will, in most instances, be the most exposed element of a structure and therefore the area most affected by exposure to the changing climate. A clay or cast stone masonry covering or finish in these areas will therefore require:

- The use of highly durable materials.
- Effective bonding together of these materials or mechanical attachment to the wall beneath.
- A level of detailing and workmanship commensurate with the requirement to maintain long term durability of such an exposed element.


Fig.1

Recent evidence indicates that in many cases these requirements are not being met, with the resultant failure of many coping and capping courses after only a few years.

To get it right the first time is not difficult and expensive but it does require an understanding of what is to be achieved. This guide draws on many years of experience, from the success of simple and effective details to the inspection and reporting of many failures.

1.1 Historical Background

All dictionary and textbook references describe copings and cappings as a covering course to throw off water and protect from weather the wall beneath.


Fig. 2

Early man's simple dry stone shelters with surrounding enclosures would feature a selected large flat stone, wider than the wall beneath, to cover the top, throw off the water and protect the walling below.

Traditionally, coping and capping courses were very elaborate and heavy, this being dictated by the requirement to cover and protect very thick walls. The design and shape, which very often reflected the experience gained with stone, provided the basic requirement to shed water away from the wall and with an overhang at the base, to protect the bedding mortar and vulnerable top courses of the wall.

The combination of heavyweight units and lime-sand mortars provided for a durable construction as well as an ability to accommodate movement.

By contrast modern copings and cappings are small and lightweight which with the use of cement sand mortars require a more considered approach to both design and specification to achieve acceptable durability. The choice of masonry, provision for movement and the correct installation of a suitable d.p.c. must therefore be an early consideration. (See fig.3)

1.2. Design Considerations

An effective and durable coping or capping arrangement will incorporate the following.


Fig 3.

- A means of shedding water
- An overhang incorporating a throating (drip-groove) at either side (copings)
- A frost resistant unit
- A high bond flexible d.p.c.
- Continuous rigid cavity closer
- Provision for movement
- A high standard of workmanship and supervision during construction.

1.3. Caplock


Fig 4.

To assist in the achievement of a secure wallcovering, the positive retainment by some mechanical means of a coping or capping arrangement is a sound economic consideration, particularly where vandalism is prevalent. The Ibstock 'Caplock' system is a simple and effective means of achieving this and at the same time, provides a choice and appearance no different to a normal coping or capping arrangement. All the common special brick shaped profiles are available in 'Caplock', complete with returns, angles, stop ends etc. The 'Caplock' system is also available in cast stone. (See Fig.5)


Fig 5.

The top unit, incorporating a simple key-way, positively locates with a 2 metre length of profiled extrusion which is itself retained by the lower courses. The result is the locking together of 2 metre lengths of double course coping or capping, which produces a secure and vandal resistant solution. (See Fig.4)

For further details and information reference should be made to the Ibstock 'Caplock' brochure, the Ibstock 'Special Shapes' catalogue and the Ibstock Architectural Masonry brochure.

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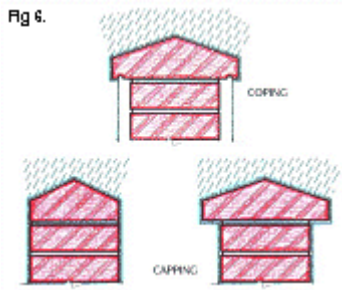
Technical Aspects

2.1 Definitions | 2.2 British Standards | 2.3 Durability and Mortars | 2.4 Damp-proof Courses
2.5 Movement Provisions | 2.6 Weathering | 2.7 Repairs and Renewals

2.1 Definitions

Copings and Cappings are defined as follows in BS 5628 Pt.3 Code of Practice for Use of Masonry:

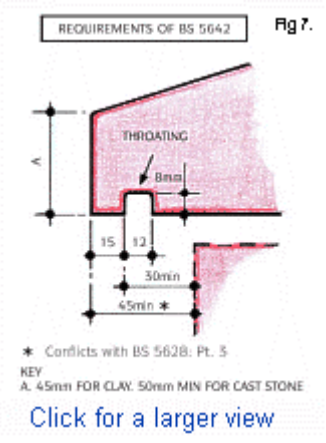
- **Coping** - Unit or assemblage placed at the head of a wall and designed to shed rainwater from the top of the wall clear of all exposed surfaces of the walling beneath.
  NOTE: Examples of copings are those complying with BS 5642:Pt. 2
- **Capping** - unit or assemblage placed at the head of a wall that does not shed rainwater from the top of the wall clear of all exposed surfaces of the walling beneath.
  NOTE: Examples of cappings are brick-on-edge and other cappings that may be flush or overhanging but that do not incorporate a throating or other device designed to shed rainwater clear of the walling beneath.



The difference between a Coping and a Capping according to the Code of Practice is, therefore, the provision of a throating (drip-groove) or other suitable device in the Coping. (See Fig.6) Units which merely provide an overhang do not constitute a coping. The throating must be continuous over mortar joints to be effective. This is a point which is often ignored and which can lead to pattern staining at joint positions.

2.2. British Standard Requirements

BS 5642 - Sills & Copings Pt. 2 - Specification for copings of pre-cast concrete, cast stone, clayware, slate and natural stone.



Click for a larger view

- Mass to be not less than 25kg per metre run when cramps or dowels are **not** used.
- Overhangs, throatings and minimum face dimensions are stated. (See Fig.7)

Overhang Detail.

- Requirements are specified in the areas of Materials & Quality, Tolerances & Finish.
- Appendix C gives recommendations for the design and installation of copings.
- States that the coping system should be designed to resist displacement by impact or pressure of ladders or by normal wind conditions.
- Recommendations for materials for cramps and dowels are listed.

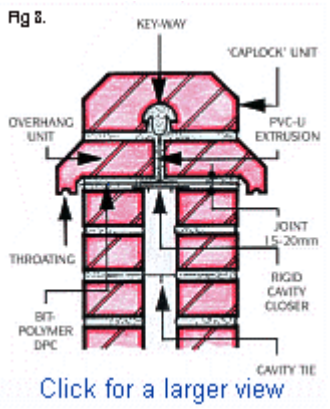
BS 5628:Pt.3 - British Standard Code of Practice for Use of Masonry, Materials and components, design and workmanship.

- States that chimney terminals, free-standing walls, including parapet walls and retaining walls exposed to the weather, should preferably be provided with a coping which may be a preformed unit or be built up using creasing tiles. In either case, the drip edge(s) should be positioned a minimum of 40*mm away from the face(s) of the wall (See fig.7). Overhang requirement conflicts with BS.5642: Pt. 2, which requires 45mm overhang. This is preferable as it provides more space for a 12mm wide throating. Where for aesthetic or other reasons a capping is used, special care is needed in the choice of materials, both for the capping and for the walling beneath, i.e. moderately frost resistant 'M' category bricks are not recommended for use beneath cappings.

** Conflicts with BS 5642: Pt. 2.*

- Recommends that consideration should be given to copings being displaced e.g. by lateral loads, and to the possibility of vandalism.

L-shaped copings and clip-over copings may be more satisfactory in these situations and where necessary, copings should be dowelled or joggle-jointed together, or suitably fixed down. Some of these suggested provisions may not be practical with small clay units; however, patented systems are available which assist in resisting displacement, e.g. the Ibstock "Caplock" system (see 1.3. and Fig.8).



- Strongly recommends that parapets and chimneys be protected by copings and d.p.c.'s.
- Gives guidance on selection of masonry units and mortar for durability but is currently out-of-date in its terminology (see Durability and Mortars.)

2.3 Durability and Mortars

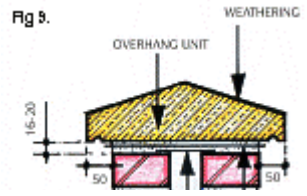
All clay units used in coping and capping situations must be rated as frost resistant as defined in BS 3921 and be suitable for this purpose.

Mortar Mixes for Clay Units

The Code of Practice, BS 5628:Pt.3, recommends the use of designation (i) Mortars only (1:1/4:3 cement;lime;sand or equivalent), in coping and capping courses. However, bricks with low strength and high absorption are not compatible with such strong mortar. For these brick types a designation (ii) mix may be more appropriate. (1:1/2:41/2 cement:lime:sand or equivalent) - See BRE Good Building Guide 17.

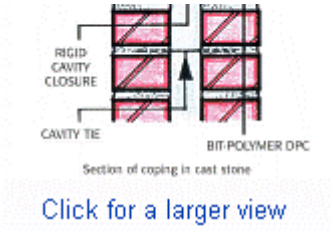
Mortar Mixes for Cast Stone

It is usual to use a designation (iii) (1:1:6 cement:lime:sand) See Section 6 - Other Sources of Reference.



D.p.c.'s should be bedded and sandwiched in the same mix as used for the coping/capping courses.

Flush or bucket handle tooled joint profiles should be used, as recessed joints will encourage moss and algal growths and be detrimental to long-



term durability and appearance.

With cast stone units, consideration should be given to the use of an easily compressible filler and low modulus silicone sealant for jointing / pointing to avoid pattern staining on the brickwork below from cracked joints due to shrinkage of the coping/capping course.

2.4 Damp-proof courses

All coping and capping courses or systems should incorporate a d.p.c. to prevent the downward migration of water. This applies even to bonded tile creasing courses, primarily because they are still mortar jointed, although staggered, and do not incorporate a throating.

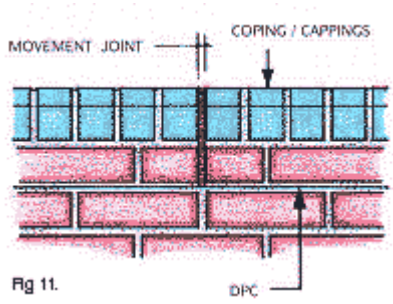
The d.p.c. should be continuous (i.e. lapped and sealed) and sandwiched in the mortar. It may be positioned two courses down rather than immediately below the capping course, in order to obtain greater weight on the d.p.c.with clay units. (See Fig.11).

Materials should be capable of developing a good bond strength with mortar. Bitumen polymer materials or equivalent are preferred.

D.p.c.'s should extend through the full thickness of the wall or leaf, and project beyond the external face by a minimum of 5mm. This is essential to prevent penetration of water beneath the d.p.c., which can occur if it is placed on an irregular mortar bed. D.p.c.'s should be laid on a smooth bed of fresh mortar and it is important not to use coarse aggregates which might damage the material.

2.5 Movement Provisions

Coping and capping courses are usually more exposed to changing climatic conditions than the general walling or other elevational features, and the effects of higher temperature and moisture changes will induce additional movement to these areas. This together with the use of higher strength mortars with clay units and with little or no restraint to coping and capping courses, will require a greater provision for movement.



Clay masonry coping and cappings therefore require movement joints at a maximum 3 metre centres to both horizontal and sloping applications. These should extend down to the coping/capping d.p.c. position and incorporate an easily compressible filler material with a sealant finish. (See Fig.11)

Any movement joints provided in the wall below the coping and capping courses must carry directly through these courses (see Fig. 10). This can be part of the coping or capping movement provisions. For a comprehensive Guide to Clay Brickwork Movement see the Ibstock Design Guide 'Clay Brickwork Designing for Movement'.

2.6 Weathering

The weathering of masonry materials in work is inevitable and will in most cases, enhance appearance, tone down some of the masonry contrasts and begin to give the construction some real character. But it may also produce unsightly staining, algal growth and erosion of mortar joints. (See

Fig.12).

Careful selection of materials compatible with the likely exposure and atmosphere into which the materials are to be placed, assist with even weathering of the masonry below. In addition, a good slope to all top surfaces and an overhang, incorporating a continuous throating, at least equal to the requirements of BS 5642: Pt. 2, will do much to distribute run-off water effectively. (See also 2.3 and 2.4).

2.7 Repairs and Renewals

Where failed coping and capping courses require replacement, the requirements will follow closely the advice given in this Design Guide. The cause of failure is usually obvious but where it is not, expert opinion should be sought. All walls must be structurally sound and built to a safe height in compliance with current requirements with respect to wall thickness to height ratio. This may necessitate some walls having their height reduced.

Defective brickwork should be removed to at least one course below the future high level d.p.c. Any existing movement joints must be continued through the replaced or repaired courses, inclusive of the coping or capping courses. See also BRE Good Building Guide No.17.

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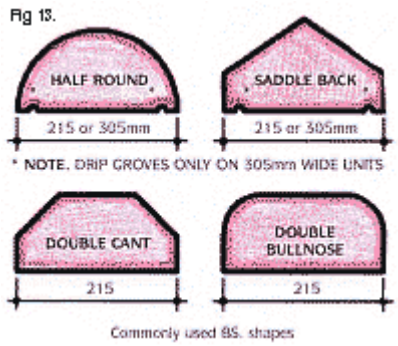
Applications

3.1 Shapes and Widths | 3.2 Angles and Returns | 3.3 Junctions and Stop Ends | 3.4 Horizontal
3.5 Sloping | 3.6 Radial | 3.7 Multiple Unit Designs | 3.8 Pillars, Piers and Chimneys

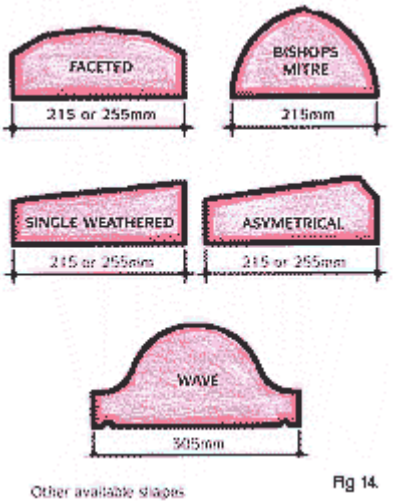
3.1. Shapes and Widths

The permutations and different profiles for copings and cappings are numerous but a series of standard shapes is available.

The starting point for selection of standard clay brick products available for copings and cappings, is the British Standard 4729, Bricks of Special Shape



Widths under this B.S. are restricted to 102, 215 and 305mm. It is possible however, through the use of Ibstock standard special shapes and by units designed specifically for a project, (including composite units), to produce copings and cappings to suit other width applications. (See also 3.7 and 3.8).

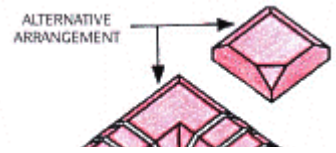


No equivalent British Standard to 4729 exists for stone copings and cappings but manufacturers have their own standard profiles which conform to the wall widths generally associated with both brick and stone.

Widths of manufacturers' standard special clay units, as opposed to B.S. and purpose made units, will depend upon the brick type, as different clays and process of manufacture will dictate the maximum size. Most brick factories can produce widths up to 305mm, depending on the overall volume of the unit. Some shapes may be available in wider units. Greater widths may be more satisfactorily achieved in cast stone. (See the Ibstock Special Shaped Bricks catalogue and the Ibstock Architectural Masonry brochure.)

Bespoke profiles and arrangements can be supplied to designers and specifiers own requirements. Note: Most profiles can incorporate the 'Caplock' keyway. (See 1.3)

3.2 Angles and Returns



One piece units are preferred for copings and cappings at angles and returns, which will give greater stability, improved bond strength and better

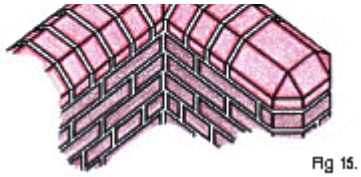


Fig 15.

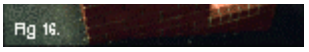


Fig 16.

weathering than smaller units. For brick applications this will relate to the thickness of the wall and the type of brick specified, as some clays and processes permit larger units to be manufactured.

With all angles and returns, the profiled edges need to be continued around the angle. This can be achieved in different ways. (See Fig.16).


Fig 17.

The British Standard 4729 ‘Bricks of Special Shape’ gives references for angles of 30, 45 and 60 degrees and returns of 90 degrees. (See Figs. 16 and 17.)

Units can also be manufactured to angles other than those included in the British Standard. The Ibstock Design Advisory Service will be able to assist in their specification and detailing. (See back page for Design Advice Hotline.)

3.3. Junctions and Stop-ends

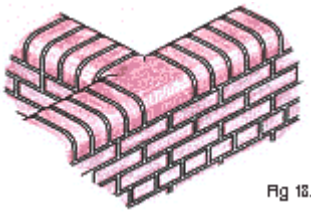


Fig 18.

As with angles, one piece units are preferred at junctions, in both plan and elevation, with similar restrictions to size. (See 3.2)


Fig 19.

Typical examples are at the end of walls (stop-ends) and at ‘T’ junctions (See Figs. 18 and 19). Where one piece units are not possible, a composite arrangement is an alternative.

One piece transition units are preferable at junctions between horizontal and sloping copings and cappings. (See Figs. 20 and 21)

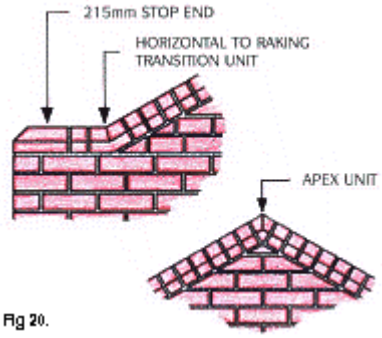


Fig 20.

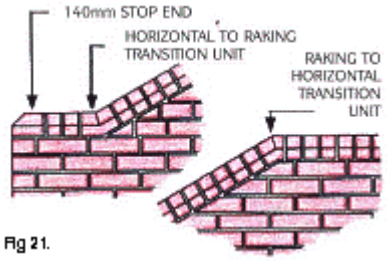


Fig 21.

Note: D.p.c.’s omitted for clarity.

3.4. Horizontal Applications

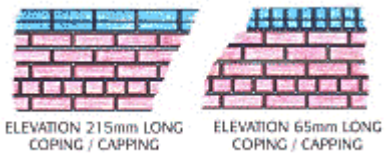


Fig 22.

Following selection of a profile for the coping or capping, the next stage is to consider the visual form it will take. For brickwork the main considerations are the length of unit (65, 102 or 215mm) and elevation bond pattern to the main wall, staggered cross joints being preferred. (See Fig.22)

3.5. Sloping Applications

Similar considerations are required for sloping or raking copings/cappings. Means of restraint, and transition units from horizontal to sloping, and from sloping to horizontal, plus the apex, need special attention. Fair raking cutting to the main brickwork is

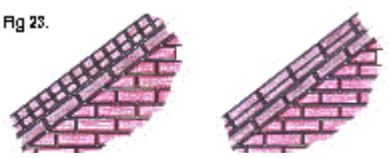


Fig 23.

necessary to obtain an even line with the units on the slope (See Figs. 20 and 23). For means of restraint refer to section 4 ‘Fixings and Restraints.’

3.6 Radial Applications


Fig 24.

These can be radial on plan or in elevation. Radial brickwork on plan necessitates further consideration on the type of units required. This will depend on the radius and the width of the wall. Standard rectangular units, with tapered joints, may be acceptable depending on the width ofthe tapered joints. However, it is desirable to specify tapered units with parallel mortar joints (See Fig.24). Stonework applications will normally comprise larger units which will incorporate radial faces and parallel joints.


Fig 25.

Requirements for radial brickwork in elevation are similar to those for radial on plan. (See Fig. 25) It is worth noting that the ‘Caplock’ concept can be applied to all radial brick applications.

3.7. Multiple Unit Designs

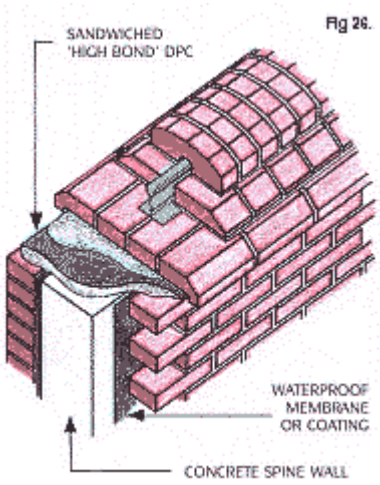


Fig 26.

Where widths of walls exceed the maximum dimensions for covering with a single piece coping or capping, multiple unit designs can be achieved using combinations of different special shaped bricks. (See Fig. 26) For wider walls and refurbishment (replacement copings and cappings), other combinations of standard special units or components designed to meet particular requirements, can be provided. (See Fig. 27)

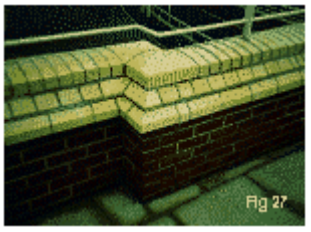
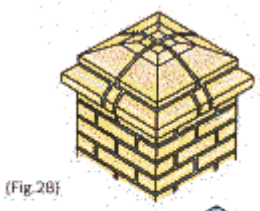


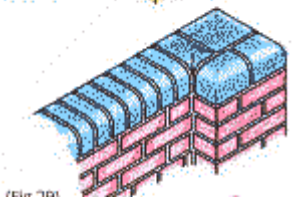
Fig 27

3.8 Pillars, Piers and Chimneys

Free-standing brickwork structures (See Fig. 28) or piers at the end of free-standing walls (See Figs. 29 and 30), which give stability to the wall and often support gate posts, require careful consideration of the copings or cappings due to the increased areas of brickwork requiring protection.

Differing configurations of the wall where it adjoins the pier will also need to be considered.

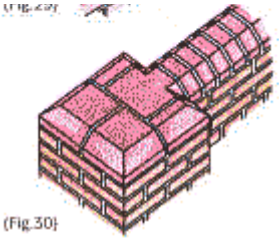

(Fig.28)



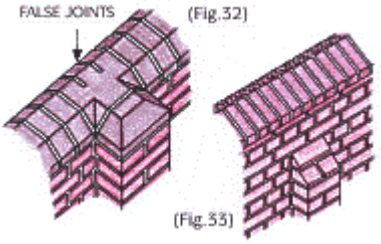
Cast stone units are available in one piece, to protect the tops of pillars and piers (See Fig. 31). However, Health & Safety regulations limit the weight of units which can be handled without mechanical assistance.


Fig 31.

Piers which project from a wall face within its length may be terminated either level with the top of the wall or part way down. Numerous methods can be adopted for protecting the tops of these piers. (Figs. 32 and 33 are examples).


(Fig.30)

On many buildings the chimney stack is the most exposed area of masonry. The use of sulphate resisting cement in the mortar, to prevent sulphate attack from flue gases, is therefore strongly recommended when continuous flue linings are not specified.



Tops of chimneys are often simply constructed using corbelled brickwork to protect the main stack, with strong mortar haunching up to the chimney pot to protect the top of the brickwork. (See Fig.34.)

It is preferable however, for a coping to be provided and cast stone units have traditionally been used for this purpose. (See Fig. 35)

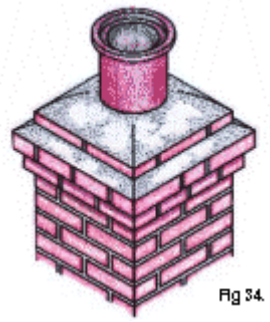


Fig 34.

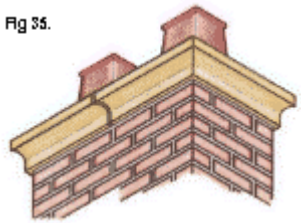


Fig 35.

Where the coping (or capping) is joined, a continuous d.p.c., bedded in designation (i) mortar for fired clay units or designation (ii) for cast stone units, should be provided.

To provide greater weight onto the d.p.c., the membrane can be positioned two courses down from the top, especially where lighter weight copings/cappings are used.

Copings or cappings for pillars, piers or chimneys, which are larger than those indicated in this Design Guide, can be provided but may require special designs. The Ibstock Design Advisory service is available to assist in both design and detailing of these applications.

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Fixing and Restraints

Most coping and capping courses will remain firmly in place, particularly those on level walling where a sandwiched high-bond d.p.c. has been used. In the case of clay masonry units only the stop ends become vulnerable and the use of a 215 x 215 x 102mm unit will prove satisfactory in most cases.

Mechanically retained units such as the Ibstock 'Caplock' system rely additionally on the proper use of a high bond d.p.c. for their ultimate retainment and in these cases, the manufacturer's fixing instructions should be strictly followed. Adequate movement provisions will contribute significantly towards the retainment and proper functioning of the coping or capping courses. (See 2.5)

Where coping and capping courses are used on sloping walls of 15 deg. and upwards, particularly gable ends, it is not sufficient to rely upon a high bond d.p.c. for retainment of the short lengths of level coping/capping usually provided at the bottom of each slope. There are many historical examples that support this.


Fig 36

Traditionally, sloping stone copings and cappings were provided with kneeler blocks at intervals within the length, which as restraints, were extremely effective. (See Fig. 36)

With brickwork, tumbling in courses at intervals would have provided the means of restraint. (See Fig. 37)

The present day inclusion of stone kneeler blocks as a means of restraint, will also have a continuous high bond 'sandwiched' d.p.c., and if the wall is of cavity construction, a cavity closer to all sloping and horizontal planes. (See Fig. 38.)

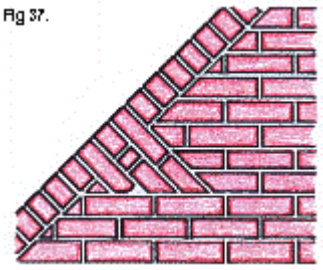
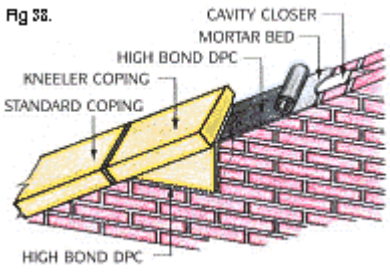


Fig 37.



The restraint of clay masonry copings and cappings is best attained by the provision of stainless steel mesh or flat strip, bent up at the lower end as illustrated in Fig. 39. The screw fixing for the restraint punctures the d.p.c. but this is covered by the min. 100mm lap of the following d.p.c. length. This arrangement can also be used to restrain stone copings and cappings.

Restraint will be required to sloping units at approximately 1.5m centres (stone kneeler blocks at approximately 3.0m centres) with, in many cases, restraint to the level short lengths also. Movement joints at 3.0m centres will, by necessity, incorporate some of the restraint provisions. (See Fig.40).

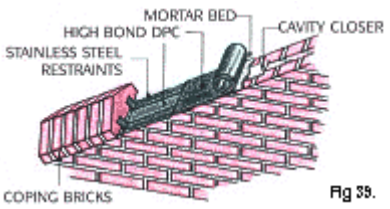
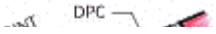


Fig 39.

Movement joint and restraint provisions for a typical gable are as



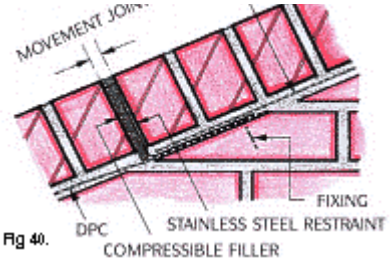
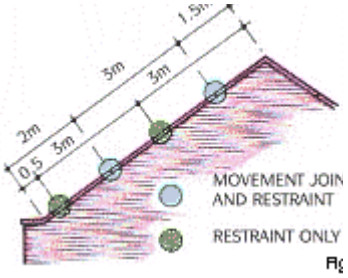


Fig 40.



Fig

will accord with the requirements for copings and cappings (See also 2.5). The lateral displacement of coping and capping courses (by the placement of ladders etc) is usually attributed to the lack of a high bond dpc and/or it being laid dry on one face of the brickwork. A sandwiched high bond dpc will do much to provide resistance to lateral displacement.

Architectural & Commercial

Copings and Cappings Design Guide

Site Practice

Setting out | Good Site Practice

Successful coping and capping applications are reliant upon good site practices and careful workmanship. Defects can result from rain penetration, cracking, frost or sulphate attack and poor workmanship. They are avoidable if correct preparation, setting-out and supervision are maintained. To maintain product quality and reduce damage the following procedures should be implemented.

Site Storage

- Products should be stored on level, dry areas at a safe distance from other trades and site traffic.
- Pallets of products should never be stacked.
- Individual units should not be stacked face to face without appropriate interface material (i.e. polystyrene, timber spacers etc.)
- Large individual units should be suitably supported by bearers.
- Products should remain packaged until immediately prior to use.
- When unpacking products, strapping/packaging should be cut not ‘burst.’
- Opened pallets of cast stone and clay units must be covered to prevent the ingress of water, dirt or dust.

Site Handling

The safe handling of brick specials & cast stone components is essential in order to ensure that they remain undamaged. Ibstock Health & Safety/COSHH guidance notes are available upon request (See Section 6).

- Where cast stone units are supplied with lifting sockets or eyes these must be used.
- Always use suitable plant for moving products around the site and aim to reduce movement and re-handling.
- Re-use the original packing to protect faces, arrises etc. during site handling.

SETTING OUT

Units set between piers

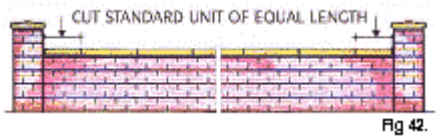


Fig 42.

Position equal cut units at each end and ensure joints are solidly buttered as units are bedded. (See Fig. 42)

Wall with free end

Fig 43.

Position whole unit at free end of the wall and cut unit against pier. Ensure units are set-out dry before bedding in mortar. (See Fig.43)

GOOD SITE PRACTICE

Important factors determining good site practice will include the following:

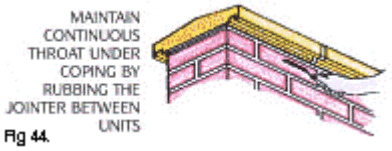


Fig 44.

- A continuous throating under the coping units and through the jointing material to avoid staining or deterioration of the masonry below. (See Fig.44)
- A gauged mortar produced to the specified mix.
- Neat and precise cutting of units by means of a masonry saw.
- Careful sorting and setting-out of units before bedding to establish a suitable and consistent spacing.
- Vertical joints ‘buttered’ and filled as the work progresses.
- The alignment of ‘high’ level copings along the lower edge and ‘low’ level copings along the upper edge.
- A high-bond d.p.c. material to the correct width for the application, supported across the cavity and sandwiched and bedded in the mortar.
- Good workmanship and effective supervision.

Protection During Construction

- Protect all units removed from the storage area.
- Protect completed work to prevent contamination, saturation and impact damage.
- Bedded units should not be used to support scaffolding poles, planks etc.

Copings and Cappings Design Guide

Other Sources of Reference

BS 1217 Specification for Cast Stone

BS 3921 Specification of Clay Bricks

BS 4729 Specification for dimensions of bricks of special shapes & sizes

BS 5628 Pt.3 Code of Practice for use of Masonry, Materials & components, design & workmanship

BS 8000 Pt.3 Workmanship on building sites, Code of Practice for masonry

BS 8215 Code of Practice for design and installation of damp-proof courses in masonry construction
Gives Guidance on materials, positioning and installation.

BRE Good Building Guide 14
Building brick or blockwork free-standing walls. Good general advice on units, mortars & d.p.c.'s for coping & cappings.

BRE Good Building Guide 17
Free-standing brick walls - repairs to copings and cappings - aimed at repair and re-installment but contains good general advice. Conflicts with BS 5628 mortar designations.

BRE Good Building Guide 19
Copings & cappings to reinforced diaphragm and wide plan walls.

BRE Good Building Guide 27
Building brickwork or blockwork retaining walls.

BRE Good Repair Guide 15
Repairing Chimneys & Parapets

BDA Guide to Successful Brickwork
Good advice on both design and construction with emphasis on the latter - very detailedBDA Building Note 1 - Good Site Practice

BDA Design Note 13 - Use of Bricks of Special Shapes
Good guidance on usage, d.p.c.'s etc.

BDA Design Note 16
Resisting rain penetration with facing brickwork.

UKCSA Specifier and user guide

Ibstock Design Guide - Clay Brickwork, Designing for Movement
Gives guidance on all aspects of movement joint positioning.

Ibstock Technical Note - Brickwork Mortars
Gives advice on choice of mortar mixes and types for different situations and includes table from BS 5628 Pt.3

Ibstock Design Guide - Clay Brickwork, Free-standing Walls

Ibstock Special Shaped Bricks

Ibstock Caplock - The Capping and Coping System

Ibstock Using Ibstock Caplock

Ibstock Architectural Cast Stone

Ibstock Packaged Bricks - Health & Safety Information

Ibstock Stone - Health & Safety Information