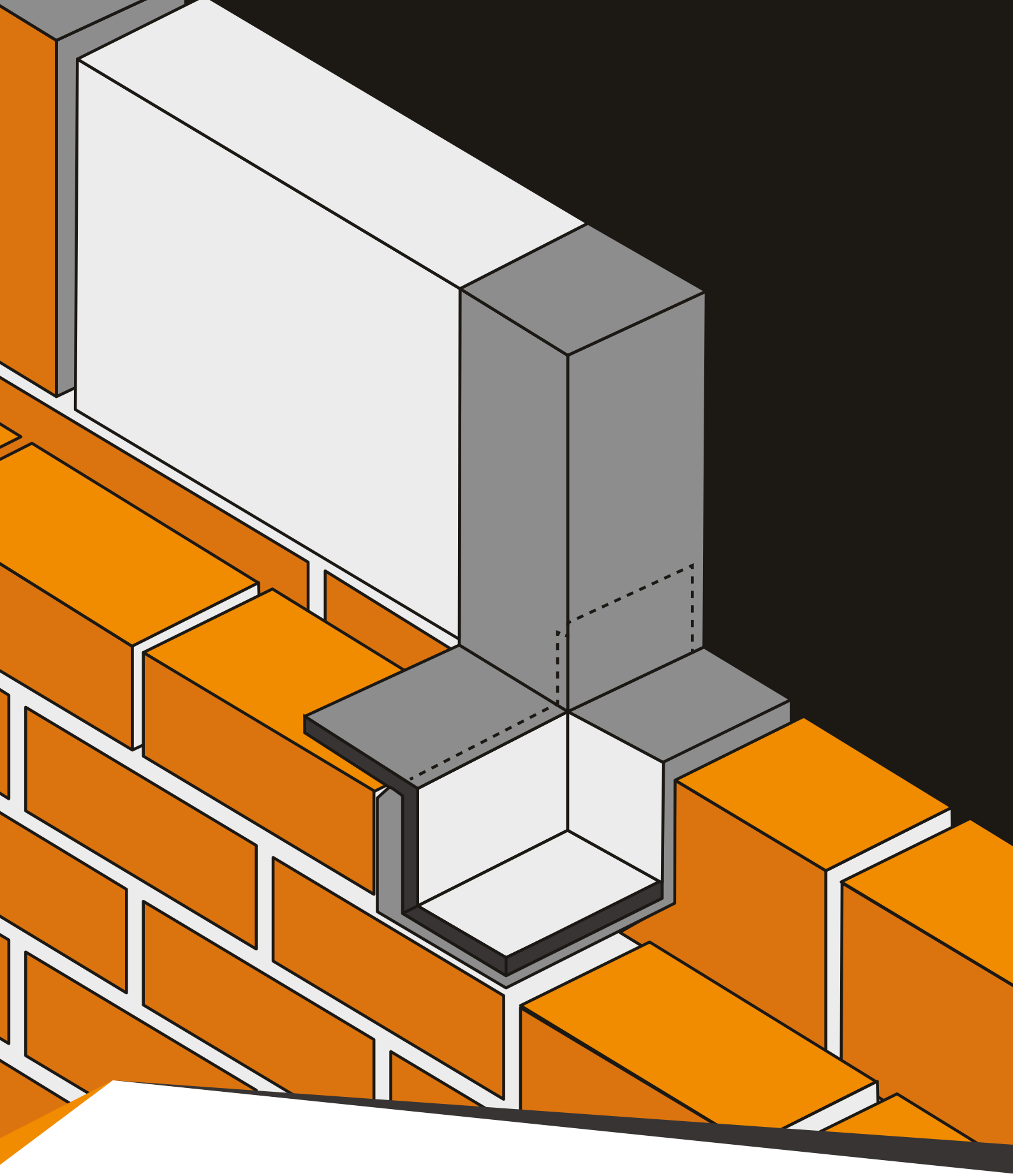


BEST PRACTICE

POWERED BY RIJSWAARD BAKSTEEN

CONTENTS

BLENDING

One of the inherent and appealing characteristics of fired clay products is it's natural variation in shade. This variation is a result of the naturally occurring variances in the mineral composition of the raw clay material and the ultimate firing position of the bricks in the kiln.

The variation contributes to the overall appearance of the product and a successful brick façade is a result the colour spectrum / shade and variation being evenly distributed.

To avoid colour banding or gathering, sufficient blending of brick packs should be conducted prior to the bricks being laid. Blending should be carried out for the duration of the build, mixing from a minimum of 3 packs and where possible ensuring the packs chosen mix between deliveries.

The correct method of blending is demonstrated below.

DELIVERY

Access arrangements must be suitable for the specified delivery vehicle, further information on vehicle sizes and costs can be discussed with AAB.

Where mechanical discharge (lorry mounted crane or Moffett) is allowed for, the offload will be managed by the driver to ensure safe offloading is adhered to. If the driver feels the site is unsafe, you may be contacted for aborted haulage or redirection which will incur extra charges.

Mechanical offload is a means of offloading the pallets to a flat hard standing surface only, either vehicle or kerb side. Alternative off load requirements, such as lifting over walling or fencing, maybe refused based on risk assessment, therefore we ask that flat hardstanding is provided at all times.

Each consignment should be checked to confirm the correct product type has been delivered and for any visible signs of damage and any concerns reported to AAB immediately.

Following discharge, a number of bricks should be selected from three packs to ensure they are reasonably consistent with the agreed reference panel.

STORAGE

The area chosen for storage should be flat, hardstanding, clean and well drained. It should provide isolation or protection from passing vehicles or other site operation which could damage or contaminate the product.

During storage the bricks should be kept covered and protected from inclement weather. This will prevent the subsequent issues associated with laying such as efflorescence, lime leaching or mortar staining.

HANDLING

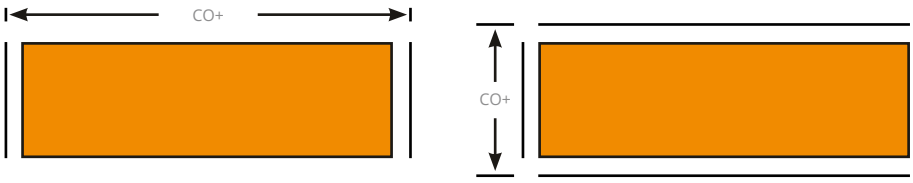
AAB's packaging is designed to allow for transportation from factory to site, whilst it is commonly used to enable transport of the product around site, material handling should be risk assessed on a site specific basis.

BONDS AND DIMENSIONS

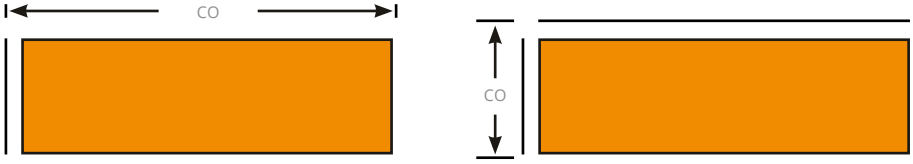
For ease, this document considers standard UK size bricks applied in stretcher bond (also referred to as half bond). The principals discussed will apply what ever brick size or bond is chosen.

Successful laying out of brickwork relies on the correct understanding of three possible co-ordination factors detailed below.

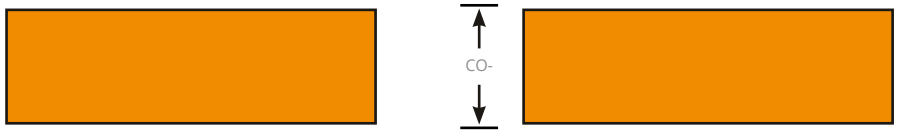
CO+
Co-ordinated size plus joint on each side. brick height or length, plus 2 joints.



CO
Co-ordinated size plus one joint. So, the brick height or length, plus 1 joint.



CO-
Co-ordinated size with no joints. So, the brick height or length.



Based on the module used normally in the UK, the standard brick is 215mm long by 102.5mm wide and 65mm high. It is typical for vertical and horizontal joints to be specified as 10mm, giving the following module sizes;

CO+ L235mm x W122.5mm x H85mm

CO L225mm x W112.5mm x H75mm

CO- L215mm x W102.5mm X H65mm

Brickwork should be set out based on CO

Horizontal Module = 215mm Brick + 10mm Joint = 225mm Module
Vertical Module = 65mm + 10mm = 75mm Module

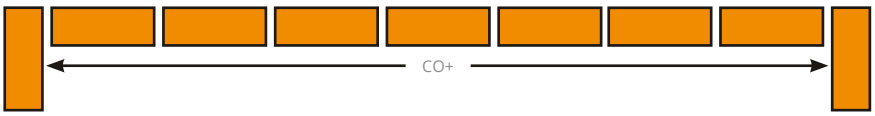
The mortar joint will act as a buffer and should be adjusted to maintain an average module of 225mm / 75mm, based on the brick size during construction.

Examples of the three co-ordinating factors below

CO+ CO-ORDINATED SIZE PLUS A JOINT ON EACH SIDE.

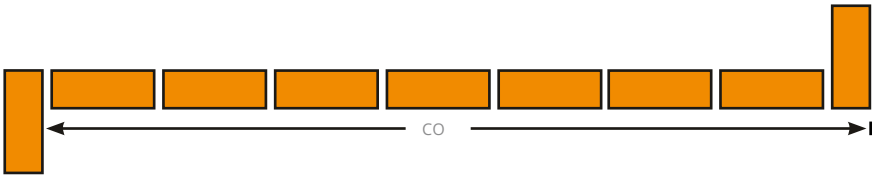
Door and window openings

Walls with double internal corners



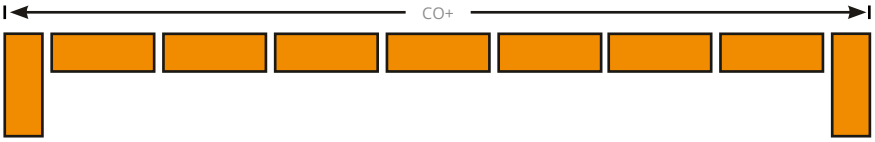
CO CO-ORDINATED SIZE WITH ONE JOINT.

Return end (external to internal corner)



CO- CO-ORDINATED SIZE – NO JOINT.

Brick piers or panel between openings.

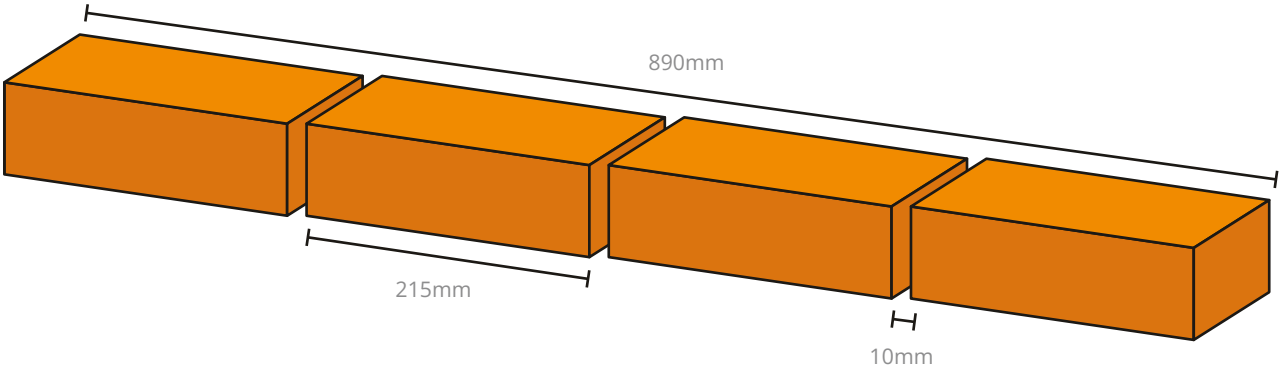


Maintaining module size based on a BSEN771-1 T2 Brick

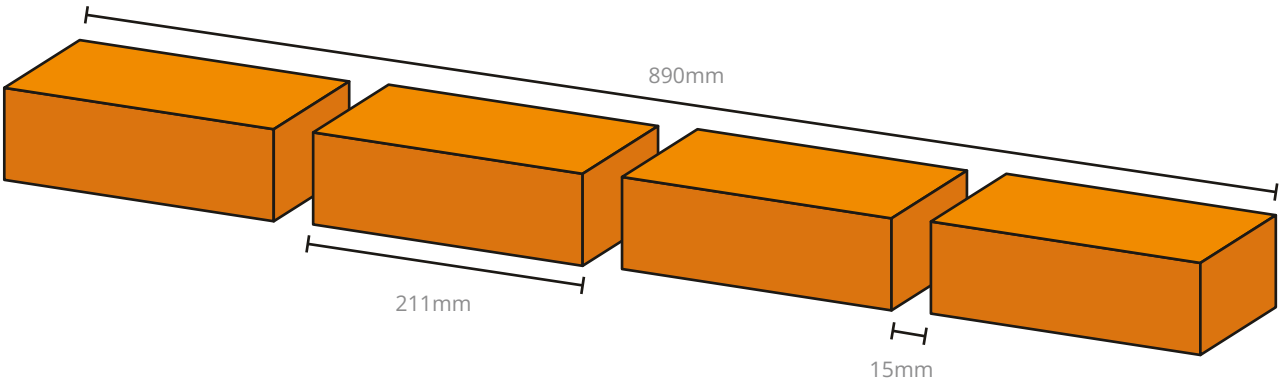
BSEN771-1 requires manufacturers declare product dimensions and the tolerance its mean performance meets. This document considers the impact for the permissible variance of a T2 brick on CO of 225mm, demonstrated in 890mm setting out (CO-), though the principals will apply to other brick and module sizes.

A UK format brick produced to BSEN771-1 T2 has a permissible tolerance of +/- 4mm, allowing an average performance of 211mm to 219mm – We can consider this CO (+/-)

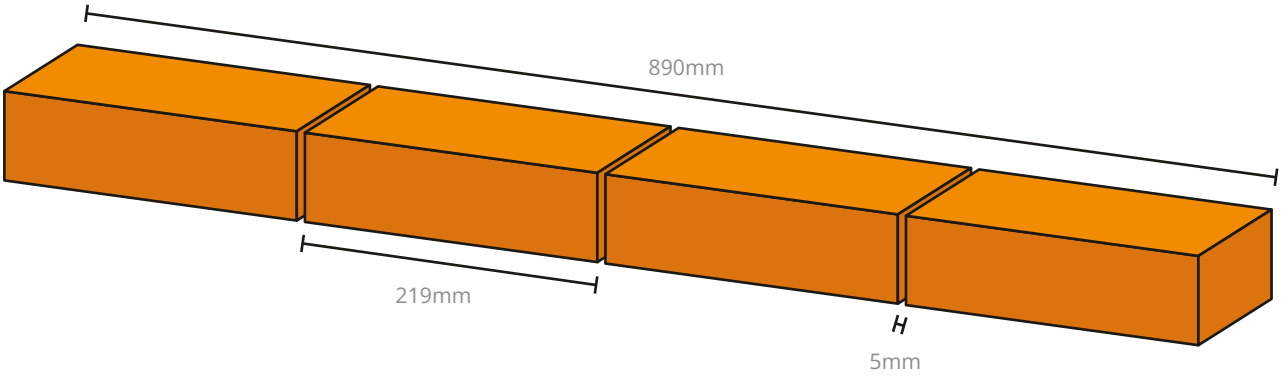
BRICKS PERFORMING TO THE MIDDLE OF THE 211MM TO 219MM TOLERANCE:



BRICKS PERFORMING TO 211MM, LOWER END TOLERANCE:

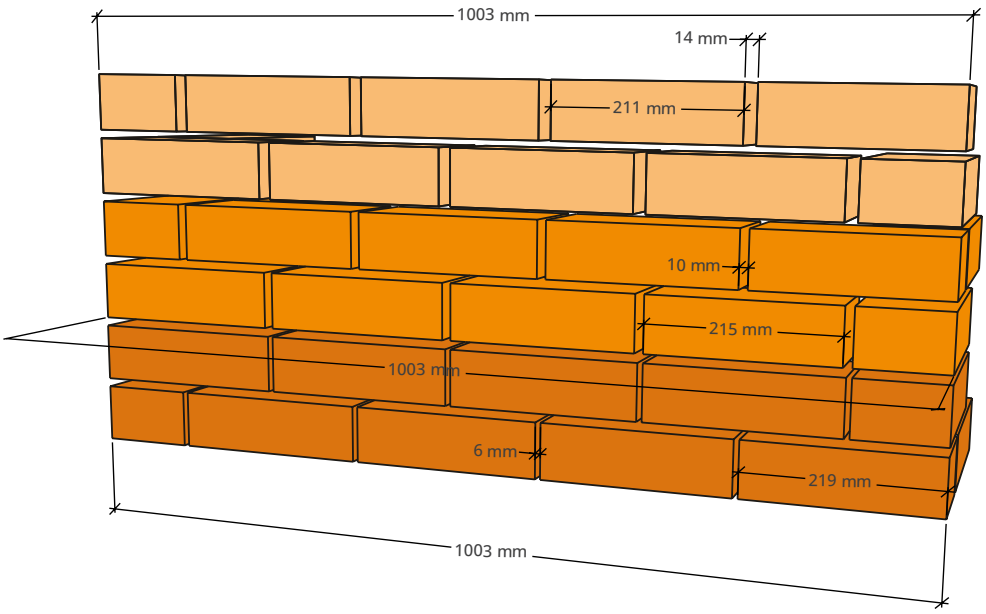


BRICKS PERFORMING TO 219MM, HIGHER END TOLERANCE:



As demonstrated, by maintaining the designated CO of 225mm (by varying the average mortar joint to suit the brick size in construction), ensures that all brickwork designs based on the CO of 225mm can be achieved without the need for cut bricks.

The same practice can be applied to accommodate two brick types of differing tolerance in the same façade, this is common when extruded bricks are used below DPC with Stock/ Handmade product is used in the courses above, or where to differing colours are used, thus accommodating bricks of differing tolerance.



Accommodating Dimensions not suited to CO (+/-)
Building Discrepancy, Bricks with greater variance than T2 or T2 maintain a specific joint size

For many reasons, brick bonds may be required to work outside the module size of CO, this could be a result of the building frame being built incorrectly, building element such as window and doors being placed outside of bond or supplied in incorrect dimensions. Conversely a brick could be used which due to its T1 or TM category, cannot maintain bond without the requirement for cut bricks. Lastly the specifier may wish to specify a joint size not supported by the bricks T2 performance.

NB – Many of the most popular bricks in the UK are T1, creating the need for cuts to maintain bonds. Creating correct bond through effective cutting is standard practice in brick laying, it should not be seen as an issue but rather part of the skill of good brick laying.

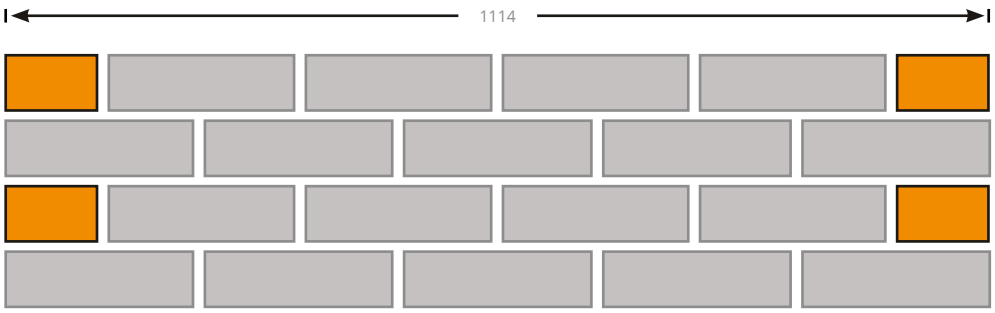
NB – Cutting bricks in the correct manner won't prevent perp joints from being plumb, nor should it adversely impact the appearance of the wall.

Summary of Actions to accommodate the above possibilities:

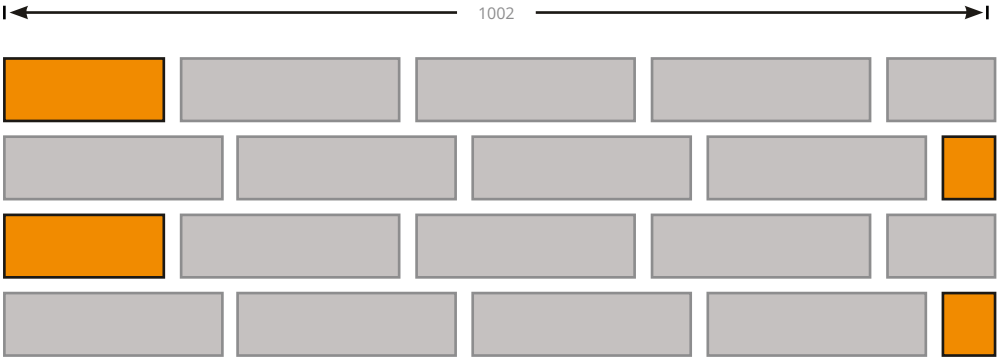
- Open or close the mortar joint by 50% to consider the dimensional difference
- If the dimension needs to be reduced, replace a stretcher brick with a header (1/2 brick)
- To increase or decrease a brickwork length, introduce a ¾ batt not on the corner but one brick in from the corner or end panel. This is always unnoticed.
- A Queen closer or ¼ brick can be used alternate courses again one brick in from corner or end of panel. This is used for example on 100% of Flemish or English bond walls prior to the cavity wall.

Examples of different laying patterns to achieve varying sizes. These examples are not exhaustive and many other additional techniques can be applied by a competent brick layer. Laying out should always be completed in dry bond before work commences.

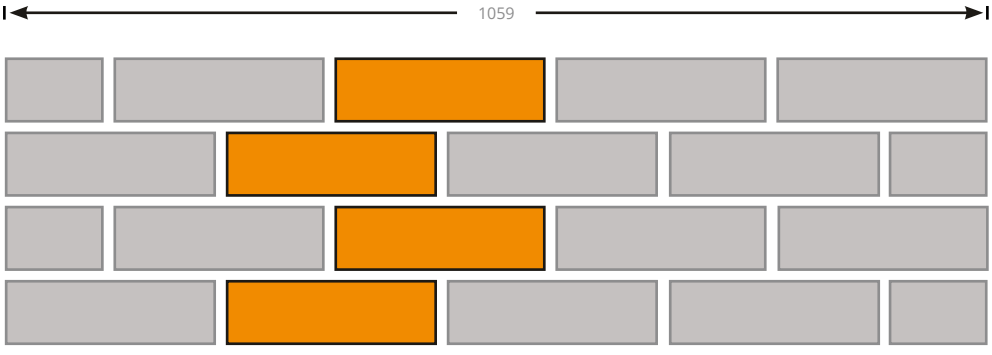
WALL DESIGNED TO BE 1114MM



REVERSE BOND ENABLES WALL TO BE BUILT WITHOUT EXTRA CUTTING TO 1002MM



USING A ¾ BONDING BRICK ENABLES 1059 TO BE ACHIEVED.



BRICK CO-ORDINATING TABLE

The table below gives the dimension requirements for a standard UK brick. The co-joint gives the linear length edge to edge.

Number of Bricks	CO+ Joint	CO (Co-ordinating Size)	CO- Joint
0.5	122.5	112.5	102.5
1	235.0	225.0	215.0
1.5	347.5	337.5	327.5
2	460.0	450.0	440.0
2.5	572.5	562.5	552.5
3	685.0	675.0	665.0
3.5	797.5	787.5	777.5
4	910.0	900.0	890.0
4.5	1,022.5	1,012.5	1,002.5
5	1,135.0	1,125.0	1,115.0
5.5	1,247.5	1,237.5	1,227.5
6	1,360.0	1,350.0	1,340.0
6.5	1,472.5	1,462.5	1,452.5
7	1,585.0	1,575.0	1,565.0
7.5	1,697.5	1,687.5	1,677.5
8	1,810.0	1,800.0	1,790.0
8.5	1,922.5	1,912.5	1,902.5
9	2,035.0	2,025.0	2,015.0
9.5	2,147.5	2,137.5	2,127.5
10	2,260.0	2,250.0	2,240.0
10.5	2,372.5	2,362.5	2,352.5
11	2,485.0	2,475.0	2,465.0
11.5	2,597.5	2,587.5	2,577.5

MOVEMENT JOINTS

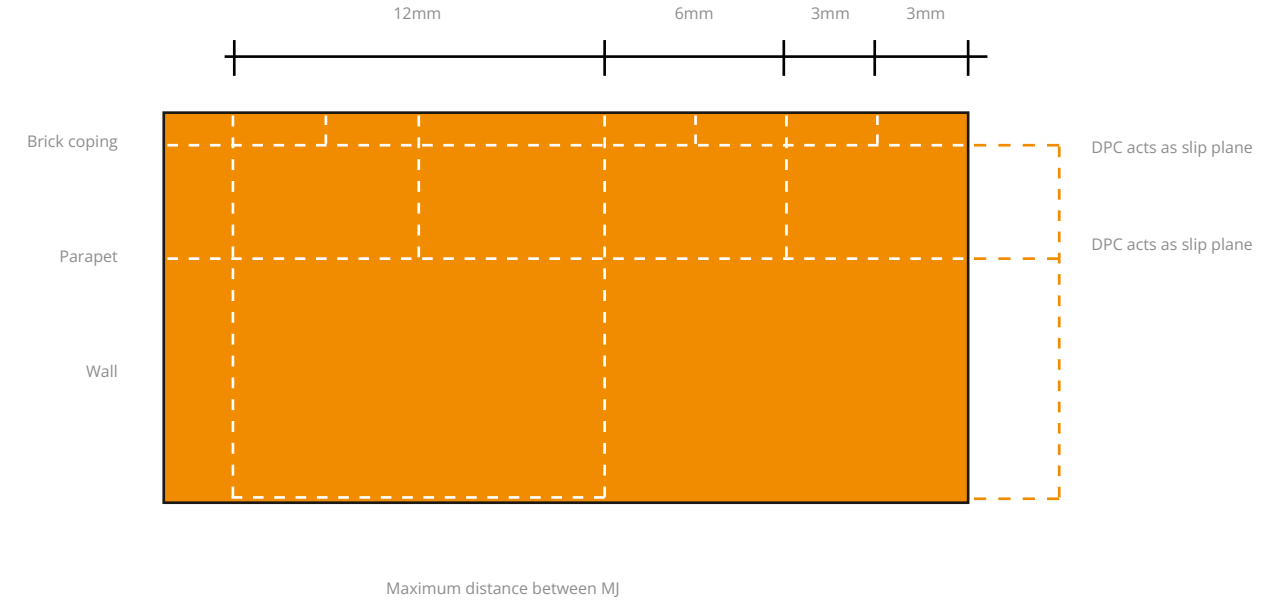
Clay bricks are unusual in that while most building materials contract in use, bricks conforming to EN BS 771-1 expand after firing and continue to do so at a decreasing rate for some years thereafter. Many other materials shrink over the same period. Timber cladding and timber structures shrink significantly. Reinforced concrete frames creep and contract. Concrete blocks contract throughout their initial life as do concrete bricks which are excluded from the advice contained within this document.

Clay bricks require movement joints to allow for irreversible expansion during the first few years of installation. After 5 years the most of the irreversible movement has occurred and stability has been achieved. Although expansion may continue for up to 20 years this is generally minor, and unimportant. Other structural movements are part of the building's design including deflections are in addition to MJ provision for expansion.

Where vertical and horizontal Movement Joints (MJ) are required. They are designed as compressible gaps which will close up as the brickwork expands. Other movement joint provision which work in a satisfactory way may be junctions with other materials. Movement joint are generally viewed as visually unpleasing, and placing of MJs can detract from the façade overall appearance. For this reason, placement of movement joint should be considered and specified at design stage and not establish during the laying process.

The following illustration summarises the information for vertical movement joint provision.

Vertical Movement Joints for horizontal expansion:

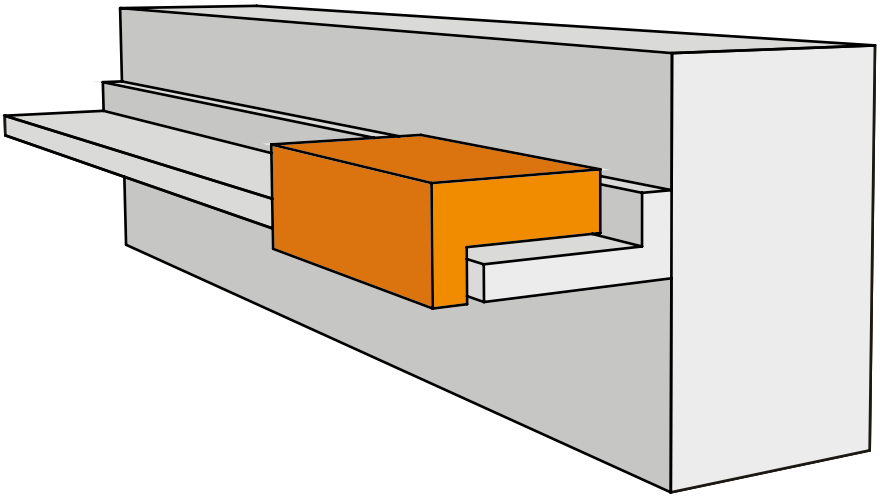


- MJs required at maximum 12M centres
- Above the Parapet MJs required at 6M centres
- Clay Cappings require MJs at 3M centres
- MJs maximum distance to corner normally 6M

Please note freestanding walls have particular requirements for movement joints, these are detailed in Movement Joints for freestanding walls.

HORIZONTAL MOVEMENT JOINTS

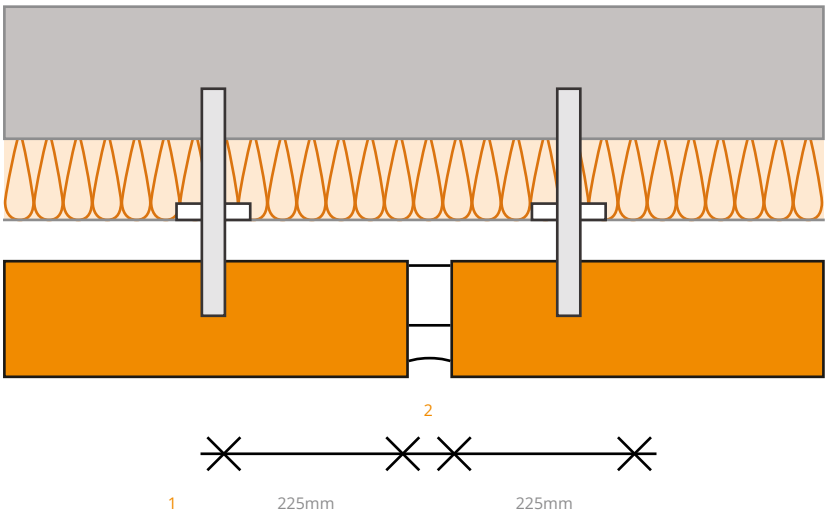
Generally vertical expansion joints should be placed at a maximum 9m, whilst façade are commonly built higher than this, consideration needs to be given to providing a suitable expansion joint. This will commonly involve place a structural support to the brickwork above and using a Bed Pistol Brick to conceal the details.



WALL TIES AT MOVEMENT JOINTS

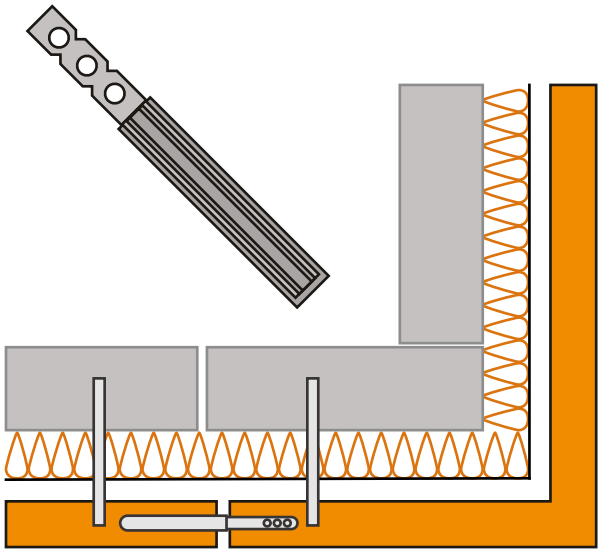
Ties are required either side of MJs within 225mm of the opening at a Max of 300mm vertically to maintain stability.

1. Ties to within 225mm of MJ and Min of 300mm Vertically
2. Movement Joint



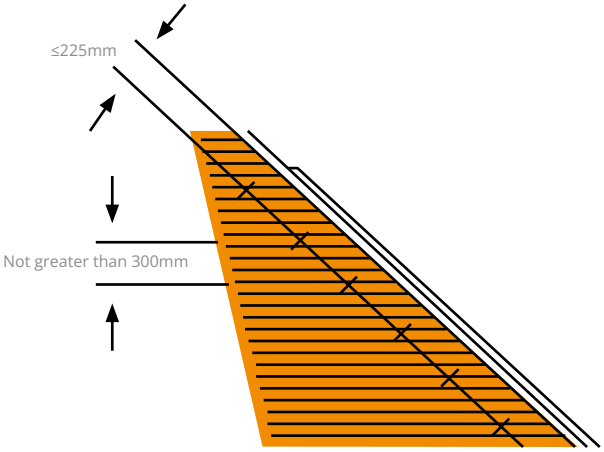
DEBONDED TIE

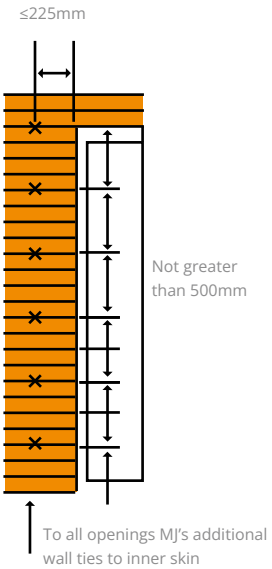
If additional security is required across for instance a Movement Joint to strengthen a corner return, a de-bonded tie can be used this allows movement to take place but still gives lateral support.



WALL TIES GENERALLY

A single leaf ½ wall of a 102.5mm wide is unstable and needs to be connected to an internal structure such as lightweight steel framing or blockwork with wall ties. Advice on positioning should be taken from PD 6697 but as a minimum requirement all walls require ties at 450mm vertically and 900mm horizontally arranged in a diamond formation. To every opening MJ or gable ties are required as a minimum at 300mm vertically within 225mm of the brick edge return. These requirements will need to be increased above sheltered exposure.





LAYING OF UNITS

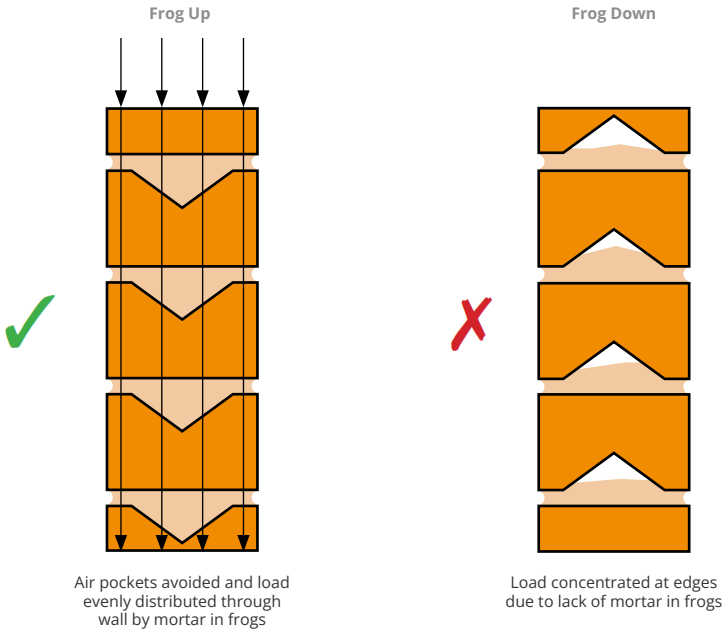
Masonry should be within the permissible deviations given in Table 24 below taken from PD 6697

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 5m length	±5
Verticality in any 3m height	±10
Verticality in any 5m height	±14
Overall thickness of walls	±10
Level of bed joints up to 5m for brick masonry	±11
Level of bed joints up to 5m for block masonry	±13

Unless specified by the designer a regular masonry joint should be laid with nominal 10mm Joints. Occasionally a designer may specify much larger joints to cater for a vernacular joint with a manufacturers larger tolerance to cater for a greater variation.

The perp/cross joints should be full filled and vertically aligned. The bed joints should be level and to a as uniform a thickness as the brick will permit.

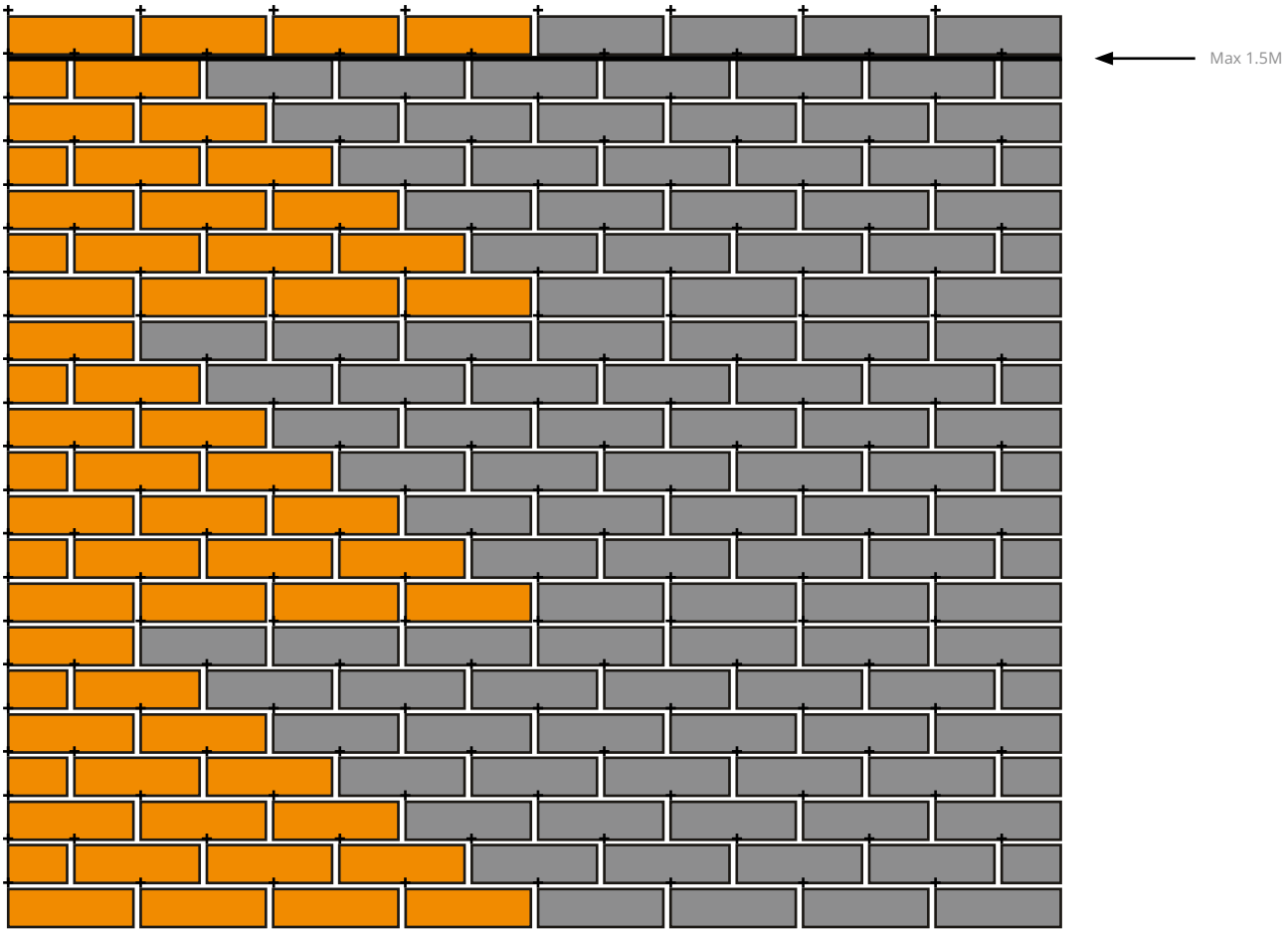
Soft mud bricks are always laid with the frog uppermost. There may be structural implications if this is not carried out. Facing work and fair faced joints should be finished to the chosen profile as the work proceeds.



If pointing is required joints are raked to a min. of 15mm to provide a key for the subsequent pointing. The joints should be clean and debris free before pointing starting at the top and working downwards. The mortar material should be of the same strength and a similar mix and materials as the mortar used for constructing the wall.

If cut and bond specials or moulded specials are used, they should be of a similar clay bond to the general units. If other materials such as stone are laid in the same façade the bed joint should be laid with bed joint reinforcement to cater for differential expansion.

When building corners, they should not be racked back higher than 1.2M above the general level. A general lift of masonry should not be greater than 1.5M in one working day.



PROTECTION OF BRICKWORK

Brickwork, blockwork and building cavities should be protected from water ingress, rainfall, snowfall and other contamination during the build. Many instances of brick discolouration are a result of these factors, rather than batch or pack variation as commonly reported by site.

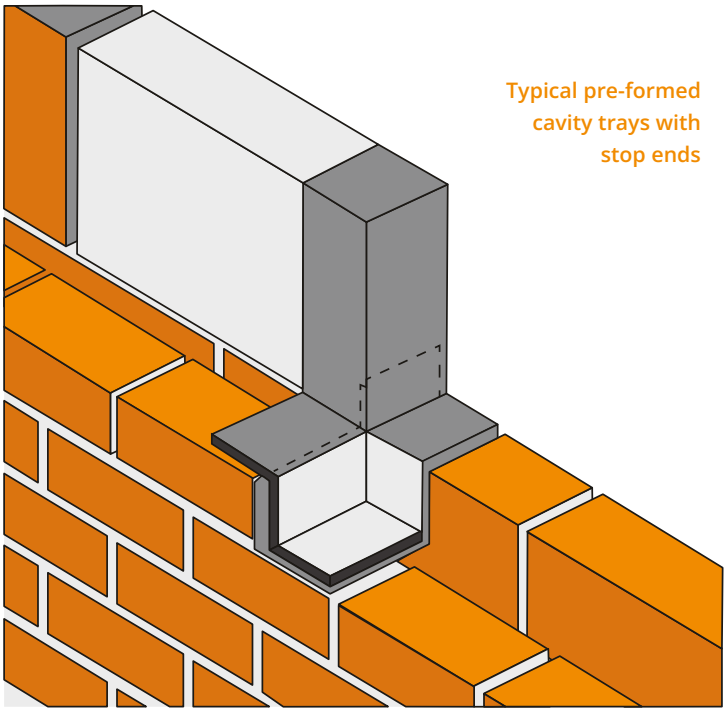
Brickwork discolouration caused by outside influence, can become permanent and it is not guaranteed to revert to original colour once the saturation or contamination dries or is removed.

Good brick laying skill, time & care should be allowed to ensure the following is achieved;

- Brick faces remain mortar free, with efforts made to prevent mortar smears and splashing.
- Cavities should be inspected to ensure that mortar build up on ties, cavity trays, lintels other junctures is avoided and that weep holes remain open.
- During breaks in construction;
    - Brickwork and cavities should be protected by waterproof sheeting, this should;
        - Protect the cavity from water ingress,
        - Protect insulation from saturation
        - Ensure bricks are protected from driving rain.
        - Where the plastic falls down the wall face, ventilation should be created.
    - Loaded out bricks should be protected by mean of covering. Proprietary covers such as BrickJackets are worth considering.
- Laying brickwork in temperatures of 3°C and falling. Brickwork should not resume until temperature return to 3°C and above.
- Freshly laid mortar should be protected from frost by placing hessian sheeting prior to the plastic sheeting. The hessian sheeting provides an insulating layer and for this reason, should be dry and not saturated prior to placing.
- During hot periods, newly built brickwork can dry too quicky, preventing the cement from fully hydrating and bonding. Placing hessian sacking over the newly laid brickwork will act as an insulating layer. The hessian sacking should be dry, as saturation of this layer can lead to staining

EXPOSURE TO WIND DRIVEN RAIN

Brick walls must be designed to suit the function but also the location. Suitable details to suit exposure are required. The provision of correctly detailed cavity trays is very important along with DPCs and correctly positioned weep holes every 900mm with a minimum of 2 per opening.

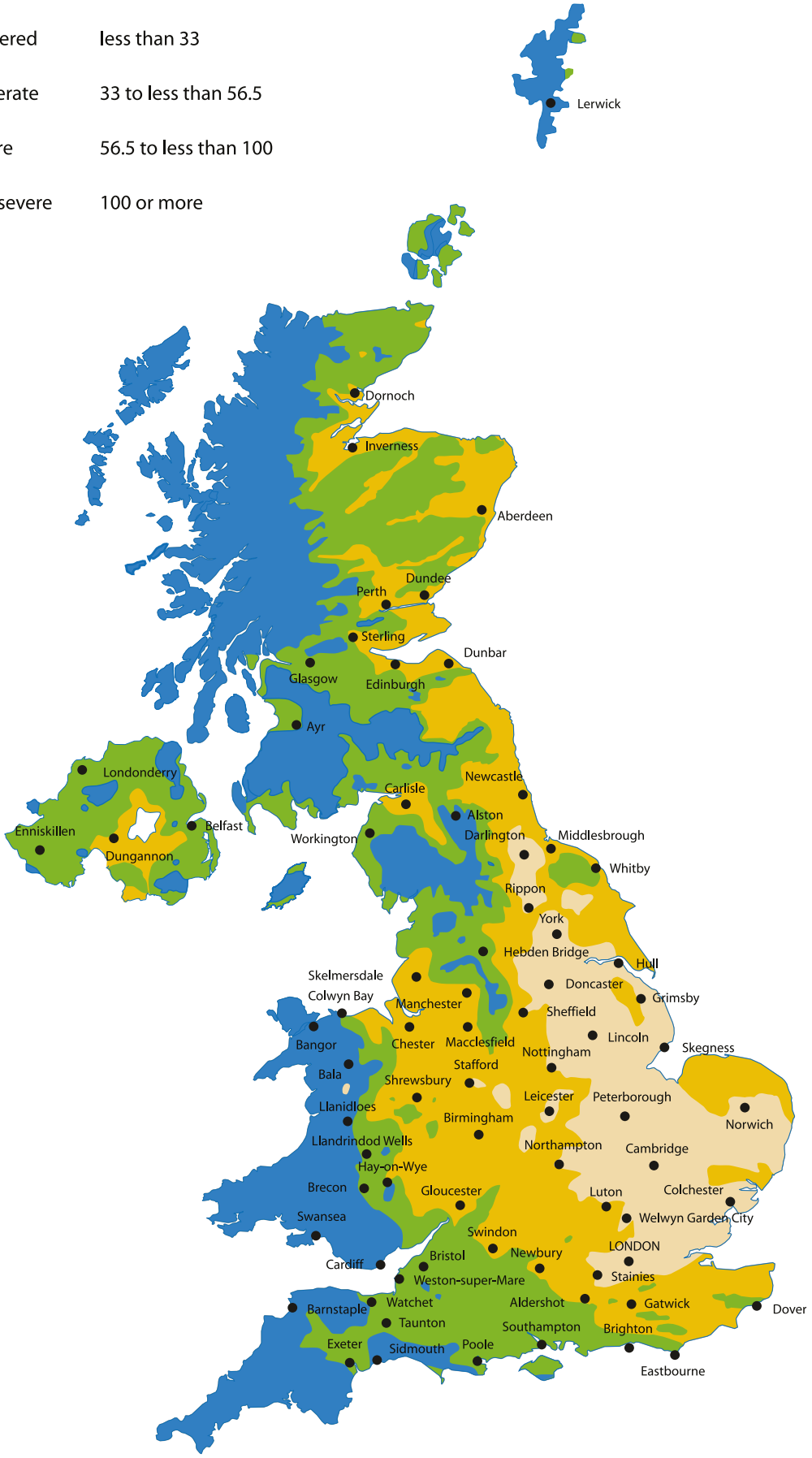


Typical pre-formed cavity trays with stop ends

Projects must be evaluated in accordance with exposure requirements this may require increased concentration on workmanship higher mortar strengths and emphasising cappings, coping, DPCs etc.

Exposure should be assessed following the recommendations in BS 8104. BRE Report BR 262 gives a simplified procedure for assessing exposure.

Exposure zones	Approximate wind-driven rain (litres/m2 per spell)
1 Sheltered	less than 33
2 Moderate	33 to less than 56.5
3 Severe	56.5 to less than 100
4 Very severe	100 or more

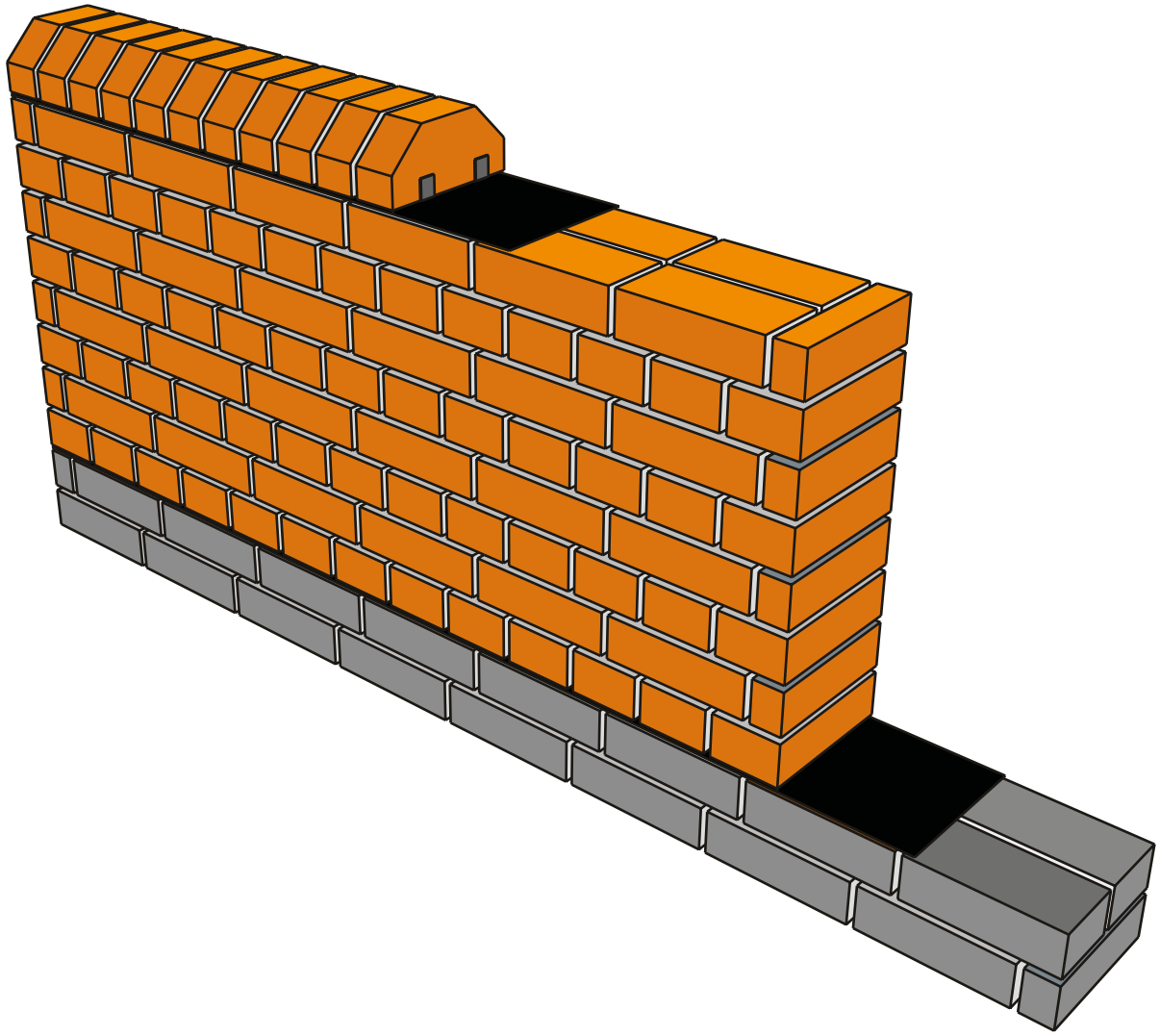


CAPPING AND COPINGS

Cappings and Copings protect the wall beneath. They require additional care and should be made of Durable materials to F2 and S2 designation, bond at each expansion joint by stainless steel cramp and always laid on a DPC to stop water penetrating through the wall. Movement Joints are always required at max 3m centres. A soldier course is not suitable for a top course; this is confirmed in the Severe Exposure Document published by the BDA in 2014.

To be effective the top course needs:

- To be laid to a fall to shed water with an overhang with a drip to either side.
- The unit must be extremely durable – F2 and S2
- Laid on a high bond DPC, mortared either side of the DPC, which is lapped and sealed at junctions.
- Movement Joints at 3m centres. With a compressed and worked mortar joint normally minimum M6 mortar.



MOVEMENT JOINTS IN FREESTANDING WALLS

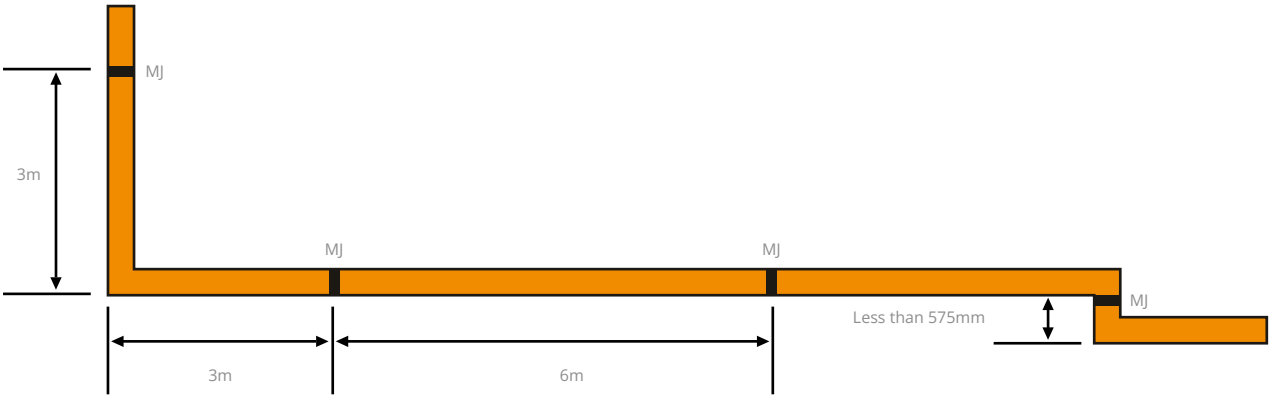
Freestanding walls have particular requirements with regards to movement joints.

Freestanding walls require Movement Joints at 6m centres in walls. All walls longer than about 9m require movement joints to cater for expansion. These vertical joints break the wall into discontinuous lengths to prevent cumulative stress that could cause cracking, movement or instability.

Movement joints for free standing walls should be at an absolute maximum be located no further than 4m from a corner. Short returns in brickwork can be vulnerable, if they interrupt long straight runs they can concentrate stress and cause cracking. Such returns should be treated as corners even if they are only a half brick offset.

Movement joints should be continuous for the full height of the wall, including any coping or capping. They should be 15mm wide and filled with a soft, compressible polyethylene or polyurethane cellular foam to keep stones or mortar out and allow the gap to close partially over time. Sealant can give the joint a neat finish – especially in copings or capping – but it must not be pointed with mortar this is sometimes done in error however, may lead to failure.

Maintaining alignment of the wall across a movement joint slip ties can be incorporated, spaced at third points between ground level with a topmost tie four or five courses below the top of the wall. These de-bonded ties should be of stainless steel, shaped at one end to bond with mortar in a bed joint on one side of the movement joint. The other end should be plain and enclosed in a plastic sleeve with a gap at the end at least equal to the width of the movement joint; it is set in the corresponding mortar joint in the adjoining length of wall. The ties allow the movement gap to close, but resist any other movement.



MORTAR

Mortars conform to the requirements of BS EN 998-2 if they are factory made, but if they are site batched they are defined by a design document, BS1996-1-1, Eurocode 6. These standards cover a number of properties, including strength. The published document is PD 6678. There are two ways to specify mortar.

Designed Mortars: composition and manufacturing method is selected by the producer to choose specified properties. They're classified by their compressive strength.

Prescribed Mortars: Are made in pre-determined proportions, the properties of which are assumed from the stated proportions of the constituents and are classified by designations. It is difficult to state categorically the proportions can be equated to the strength intimated in the table below but it is sufficient as a guide.

BS EN 998-2 2013 Mortar Mix table						
Designed Mortars **Compressive Strength Class**	**Mortar Designation**	**Prescribed mortars** (proportions of material by volume)				**Environmental usage condition**
		Portland Cement or Sulfate resisting Portland cement and lime with or without air entering additive	Masonry cement containing Portland cement and lime in approx 1:1 ratio, and air entraining additive	Masonry cement containing Portland cement (min 75%) and inorganic materials other than lime and air entraining additive	Portland cement or Sulfate resisting Portland cement and an air entraining additive	
M12	(i)	1:1 to 1/4:3	-	-	1:3	Severe (S)
M6	(ii)	1:1/2:4 to 4 1/2	1:3	1:2 1/2 to 3	1:4	Severe (S)
M4	(iii)	1:1:5 to 6	1:3 1/2 to 4	1:4 to 5	!;5 to 6	Moderate (M)
M2	(iv)	1:2:8 to 9	1:4 1/2	1:5 1/2 to 6 1/2	1:7 to 8	Passive (P)

Note: Lime mortars used prior to the late 19th Century are becoming popular again and if considered should be specified with the assistance of a specialist mortar supplier

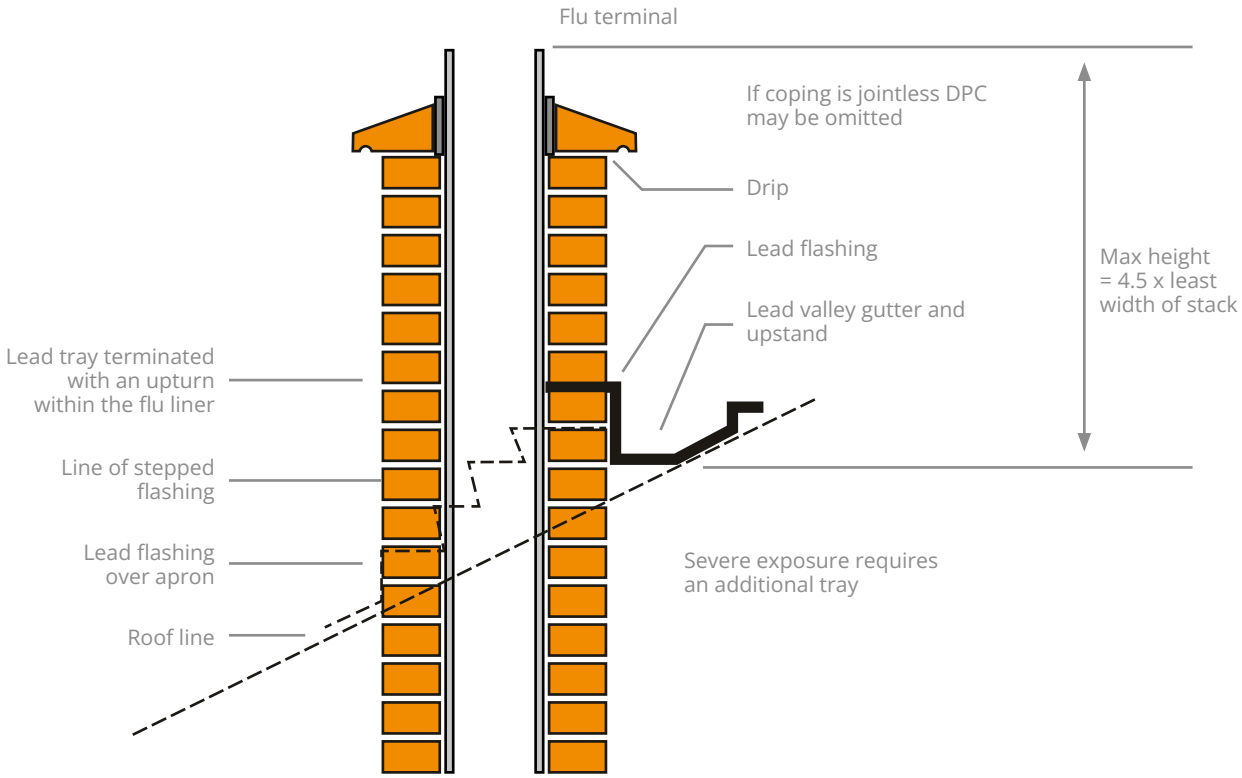
The wet mortar properties, for example the water: cement ratio, should be determined by the bricklayer/ labourer, who will need to adjust the mix to the correct wetness for laying the particular units in the particular weather conditions with the particular brick.

A cold winter day with engineering bricks will require a drier mix than a hot summer, perhaps in full sunlight, with absorptive stock bricks. Both extremes have the potential to produce good masonry, but the final wetness, and thus the workability, of the mortar must be left to the experience of the bricklayer.

Many designers prefer natural mortars with the colour in the mortar being altered by the selection in sand. Coloured mortars matching the brick can be specified as lower quality workmanship can be disguised by the wall being perceived as a whole without individual bricks standing out. Pigments are frequently used in mortars and often based on metallic oxides, generally of iron. They are chemically stable and will not fade and can be effectively used to cover up both inconsistencies in the mortar and to disguise water saturation and damage. Coloured mortar has the effect of making the wall more homogeneous and can be a panacea in complex bonding. Visual colour loss may occur if the surface of the joint becomes eroded due to the effects of weathering. Pigments based on carbon are unsuitable for external use as they will fade.

CHIMNEYS

The chimney should be protected from severe exposure with corbelled brickwork and M12 mortar over a high bond DPC sandwiched beneath. The minimum flaunching is 25mm. The stack must be constructed in M12 mortar preferably or at least M6 for stock bricks. An overhanging unit to the top of the chimney should overhang by at least 50mm and have a drip.



RELEVANT BRITISH STANDARDS

1. BS EN 771-1:2011 Specification for masonry units part 1: Clay Masonry Units
2. PD 6697:2010 Recommendations for the design of masonry structures to BS EN 1996-1-1 and BS EN 1996-2
3. BS 8221-1:2012 Code of practice for cleaning and surface repair of buildings
4. BS 7533-9:2010 Pavements constructed with Clay natural stone or concrete pavers
5. PAS 70:2003 HD clay bricks guide to appearance and site measured dimensions and tolerance
6. BS EN 15804:2012 Sustainability of construction works
7. BS 8103-2:2012 Structural design of low rise buildings
8. BS 8000-3:2008 Workmanship on building sites
9. BS EN 1344:2003 Clay pavers – requirements and test methods
10. National Federation of Demolition Contractors: (NFDC). Demolition of refurbishment information data sheet 13. Nfdc-drids.com/sheet 13
11. BS EN 772-3:1998 Methods of test for masonry units determination of net volume
12. BS EN 772-1:2011 Methods of test determination of compressive strength
13. BS EN 1998-1.1:2005 and A1 2012: Design of masonry structures
14. BS EN 998-2:2010 Specification for mortar and masonry
15. BS EN 772-5:2001 Methods of test for masonry units' determination of the active soluble salts
16. BS EN 772-7:1998 Methods of test of masonry units. Determination of water absorption of clay masonry damp proof courses

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