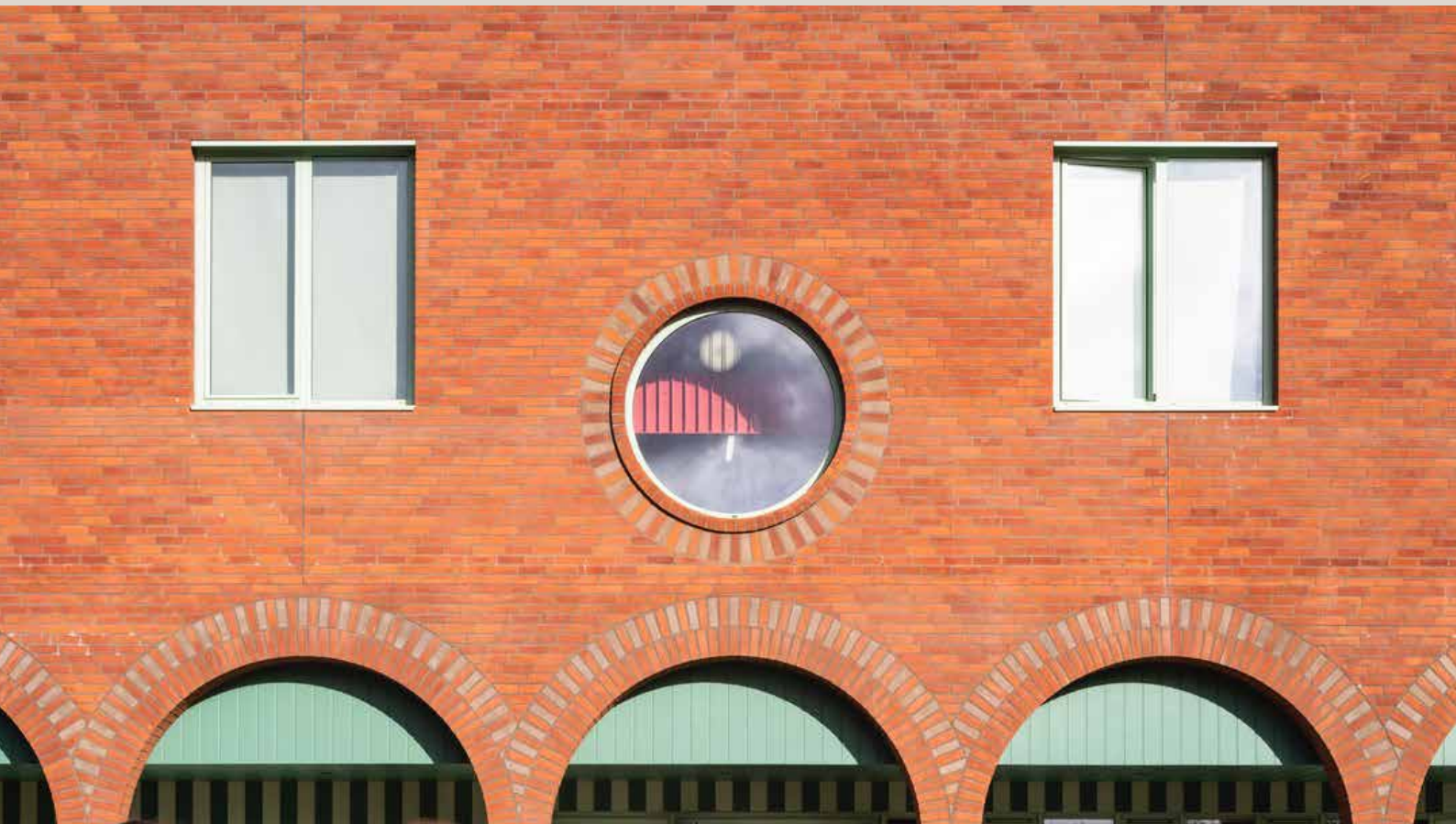


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# Designing for Movement in Brickwork

**General Guide**

Last Updated: April 2023



# The Brick Development Association

The Brick Development Association is the national authority on clay bricks and pavers.

The membership accounts for almost 99% of the bricks produced in the UK; the BDA members are committed to manufacturing products of outstanding quality and developing one of the nation's most productive and sustainable supply chains.

The BDA Guides and Technical Guides are continually updated to take account of the latest materials, systems and products developed in the clay brick and paver sector.

We are grateful to our various team of experts, contributors, staff as well as our membership whose support, we are eternally grateful for.

Keith Aldis

Chief Executive Officer  
Brick Development Association

## **Scope of Document**

This is an initial guidance document for the general public and members of the construction profession.

Designing for Movement in Brickwork can involve many sources, so this document is not intended to be a comprehensive guide, but rather a summary of the key issues and a signpost to further information if required.

Published by the Brick Development Association.(BDA).

The BDA are committed to providing impartial and authoritative information. We make every effort to ensure the accuracy and quality of information and guidance when it is published. However we can take no responsibility for the subsequent use of this information, nor for any errors or omissions it may contain.

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# Introduction

All building materials are subject to movement. This movement is due to a number of reasons including:-

- Thermal expansion / contraction due to temperature changes
- Moisture movement
- Creep and structural loading
- The effects of chemical changes such as sulphate attack

It is the first two of these which are particularly influential on masonry movement. Clay brickwork will generally be subjected to long term expansion while concrete masonry, aggregate blocks and aircrete blocks will be prone to shrinkage.

The expansion and contraction of masonry needs to be accommodated and controlled by the inclusion of both vertical and horizontal joints within the building. If such movement is not allowed there will be a build-up of internal stresses and a risk of cracking which is unsightly and costly to repair. The frequency, location and width of the joints should be sufficient to accommodate both reversible and irreversible movements.

This document provides empirical recommendations for the specification and location of movement joints in clay brickwork and it is applicable to the majority of construction situations.

References:-

- PD6697 Recommendations for the design of masonry structures
- EC6 Eurocode 6 Design of Masonry Structure
- BS 8000-3 Workmanship on Building Sites



HTA Design London, Savoy Circus Wembley Brent.

# Vertical Movement Joint Spacing

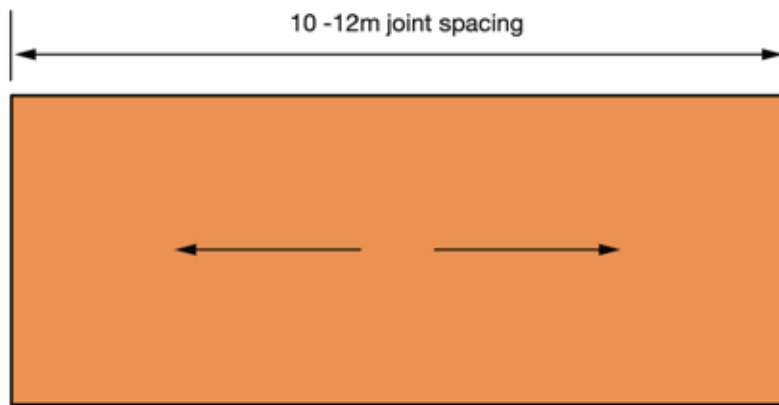
When designing for brickwork movement consideration must be given to the geometry of the building and its orientation. South, South West and South East facing elevations will be susceptible to more movement and an increase in joint frequency should be considered, particularly where darker coloured bricks are being used.

Unrestrained or lightly restrained unreinforced walls expand approximately 1 mm/m during the life of a building due to combined thermal and moisture movement changes. Not all clay types expand at the same rate and in some cases an allowance of greater than 1 mm/m may be necessary. It is advisable to check this information with the brick manufacturer when specifying movement joints.

As a general guide and to allow for the compressibility of the movement joint filler, the width of the joint in millimetres should be about 30% more than the distance between joints in metres. For example, movement joints at 12m centres should be 16mm wide.

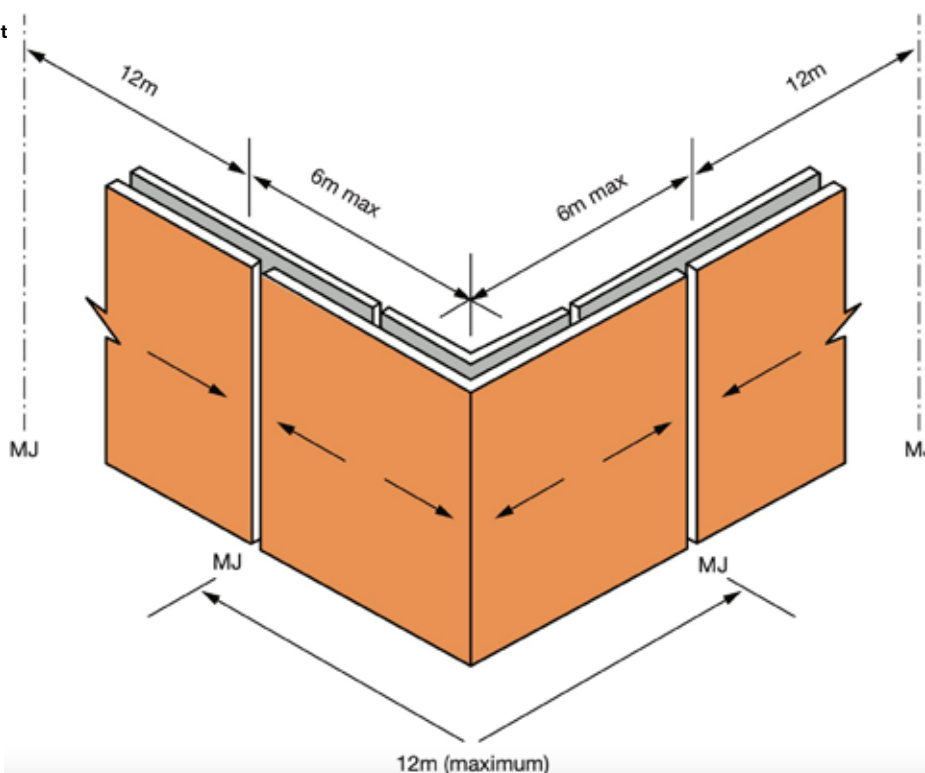
A vertical movement joint should be located at no greater than half the maximum spacing from a corner or return in a wall. Hence for joint spacing of 12m in a straight run of walling, a joint is required to be no more than 6m from the corner.

Fig 1. Typical vertical movement joint spacing



Joint spacing at external returns should be based on being continuous around the corner.

Fig 2. Typical vertical movement joint spacing at an external return.



# Vertical Movement Joint Spacing

In freestanding walls, parapet walls, unrestrained or lightly restrained brickwork and non-load-bearing cladding or spandrel brickwork panels brickwork movement joints should be provided at twice the frequency recommended for full walls as described previously. For these walls, the joint spacing should not exceed 6m.

Note:- Some manufacturers recommend reduced joint spacing for copings and cappings.

Fig 3. Freestanding Wall

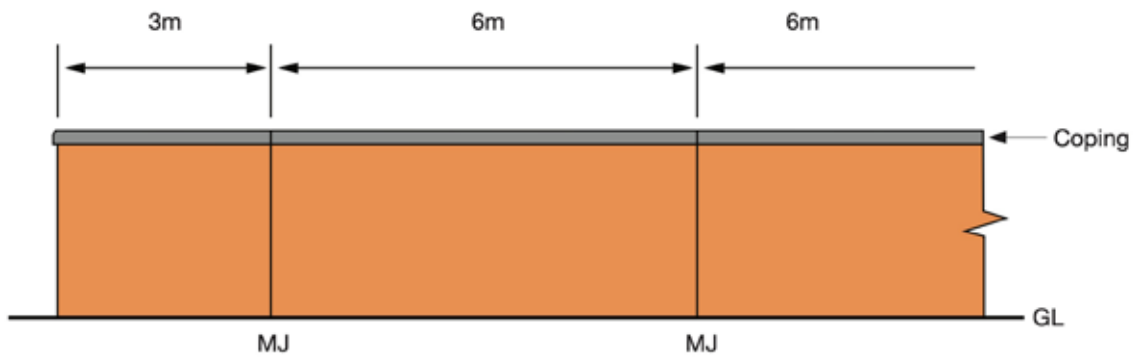
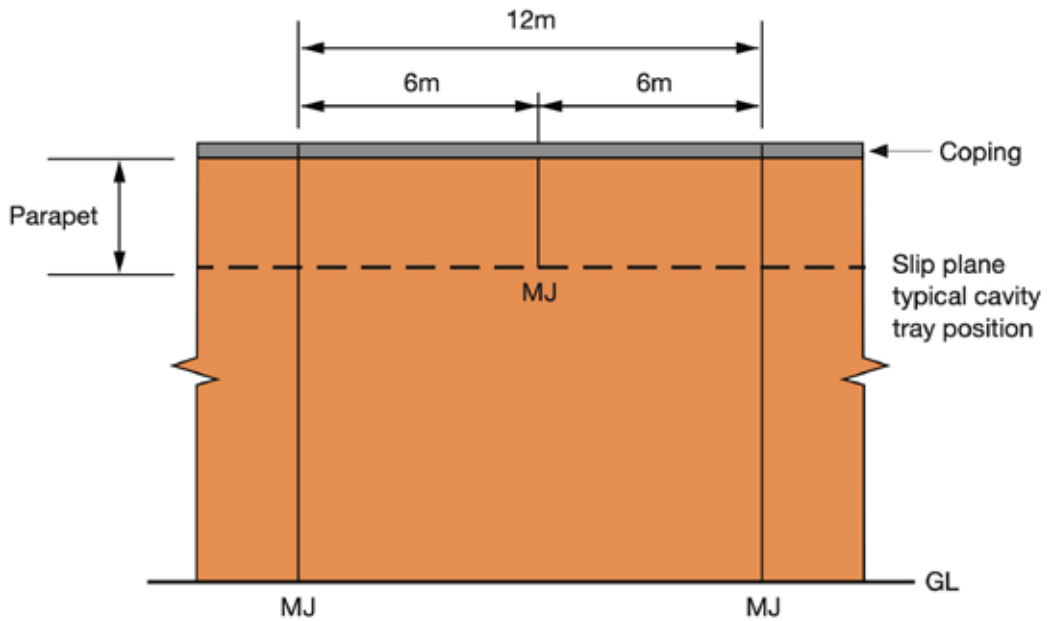


Fig 4. Parapet wall.



# Movement Joint Positions and Building Details

Features of the building which should be considered when determining joint positions in masonry are:-

1. Short returns in clay masonry
2. Changes in height or external materials
3. Window and door openings
4. Location of wall ties with respect to movement joints
5. Bed joint reinforcement

## 1. Short returns in clay masonry

If a return in the length of brickwork is less than 675mm, movement joints should be included to avoid the risk of cracking. This can be achieved by the introduction of a vertical, compressible joint or a "slide-by" detail (see below).

Fig. 5 Mechanical couple in short return of clay masonry

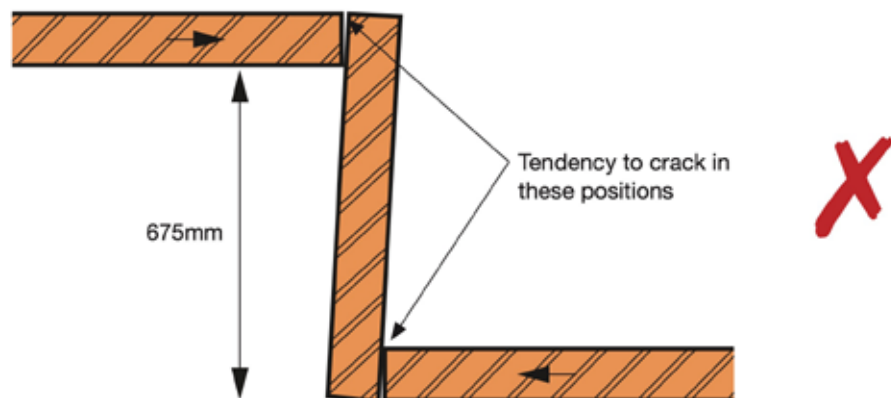
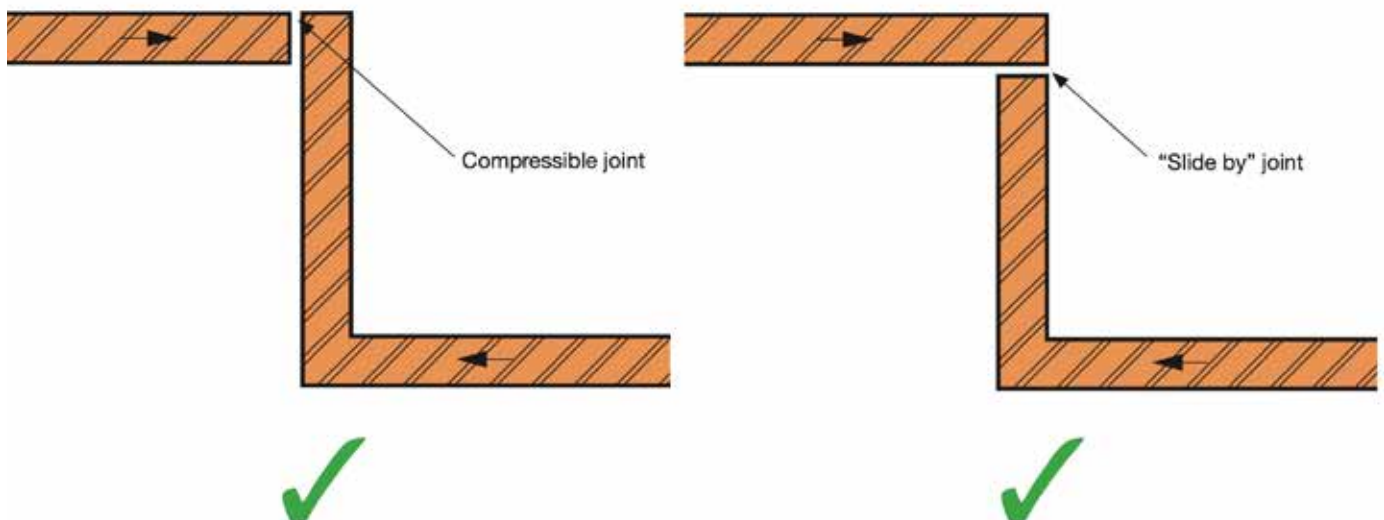


Fig. 6 and 7 Preferably positions for movement joints





# Movement Joint Positions and Building Details

Returns of 1m or more should be flexible enough to allow brickwork to move without cracking. (See below).

Fig. 8 Long return - more than 1m

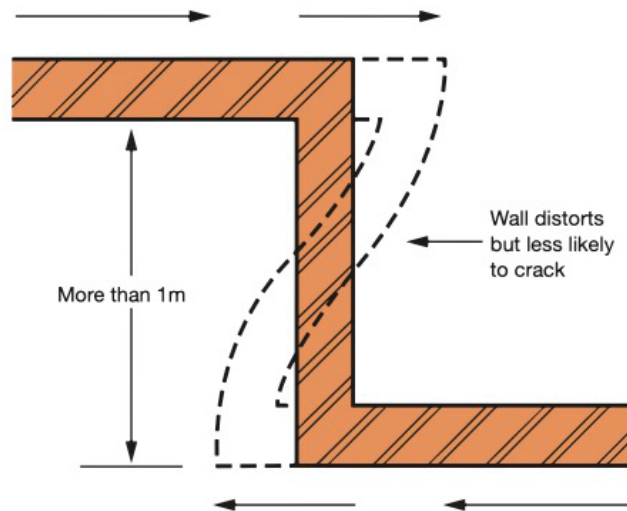
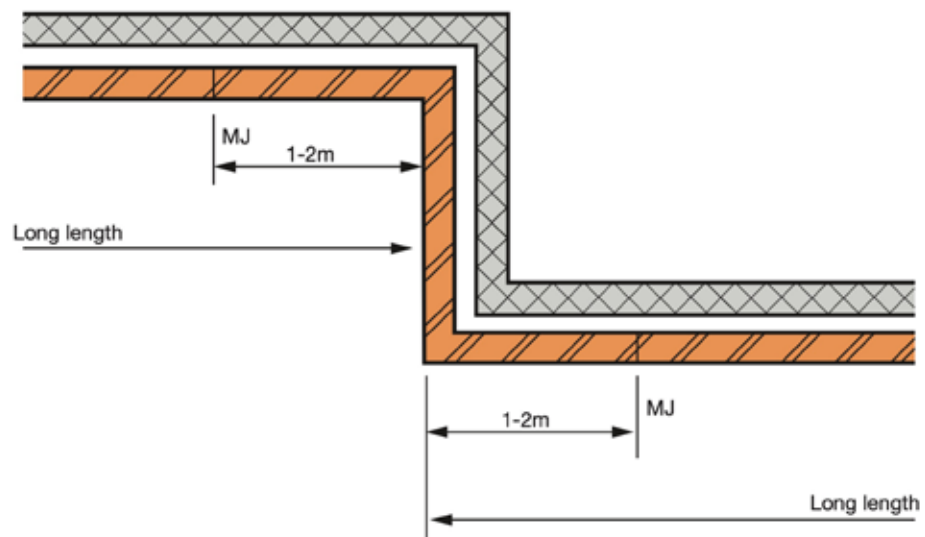


Fig. 9 Alternative arrangement using compression joints at some distance from the corner

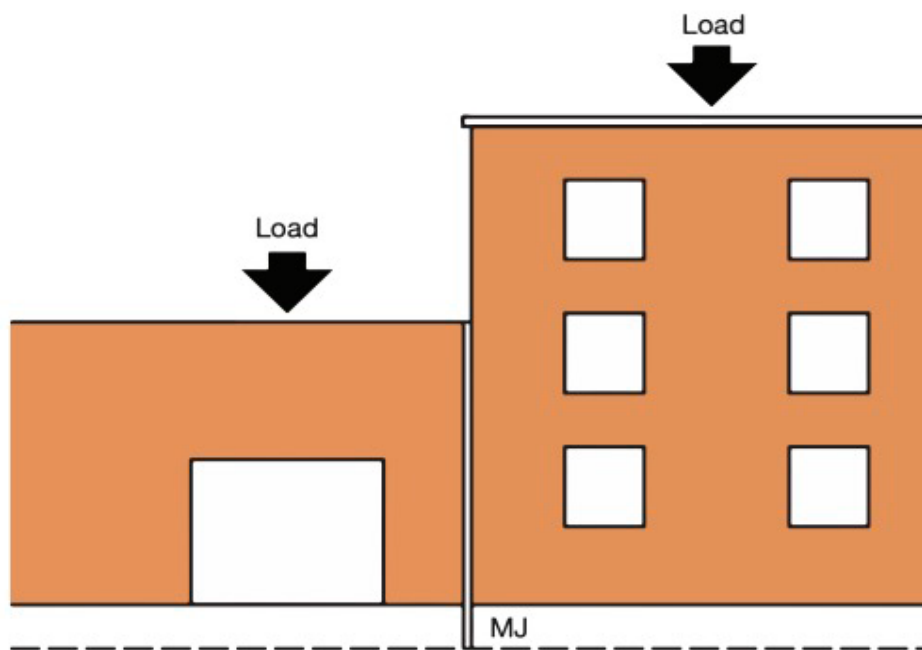


# Movement Joint Positions and Building Details

## 2. Changes in height or external materials

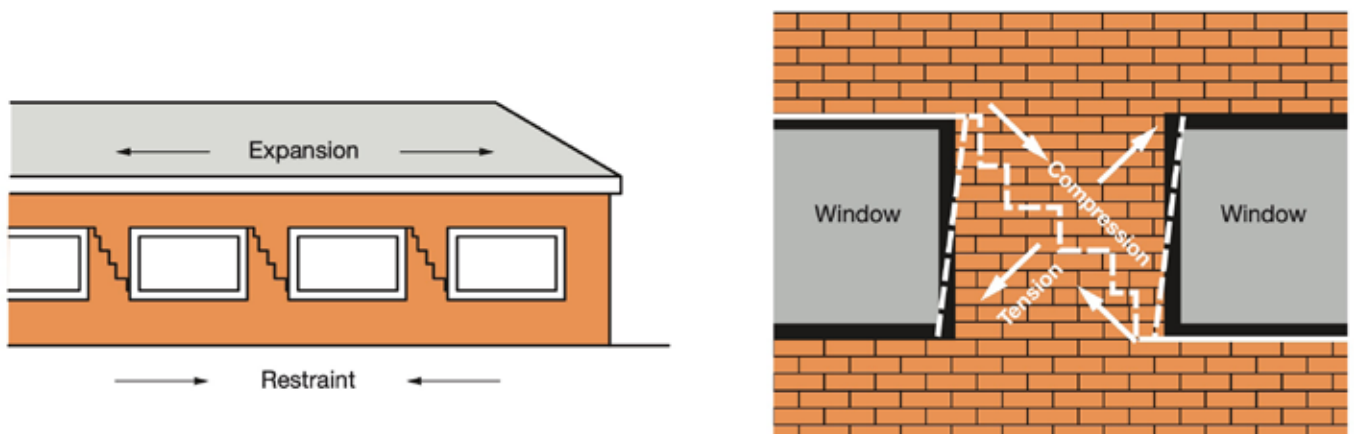
It is advisable to consider locating vertical expansion joints where there is a significant change in height within the building elevation or wherever there is a change in material such as rendered blockwork or stone. This can be achieved by the introduction of a vertical, compressible joint or a "slide-by" detail (see below).

Fig. 10 Movement joint position at a change in height



## 3. Window and Door Openings.

Fig. 11 Cracking due to differential horizontal movement



# Movement Joint Positions and Building Details

## 4. Changes in height or external materials

It is advisable to consider locating vertical expansion joints where there is a significant change in height within the building elevation or wherever there is a change in material such as rendered blockwork or stone. This can be achieved by the introduction of a vertical, compressible joint or a "slide-by" detail (see below).

Fig. 12 Typical movement joint

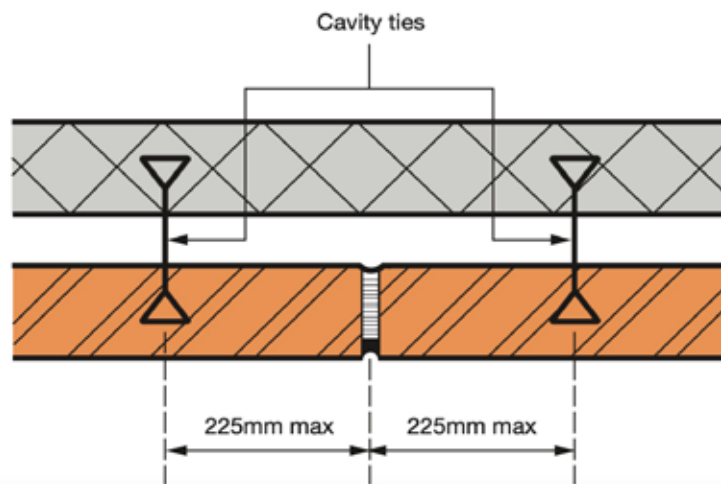
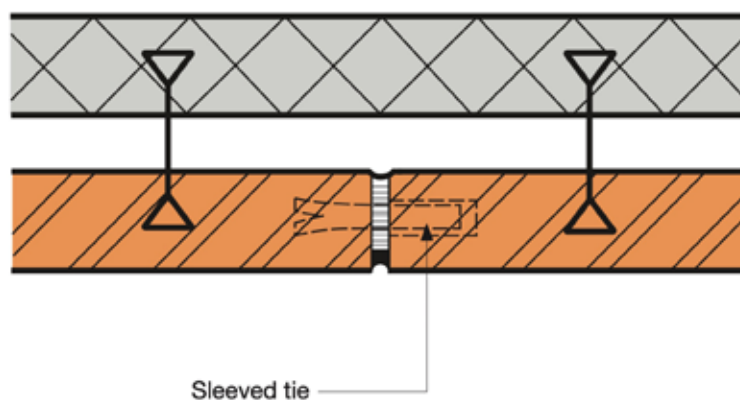


Fig. 13 Movement joint with sleeve debonding tie



# Movement Joint Positions and Building Details

## 5. Bed Joint Reinforcement

Bed joint reinforcement may be used to extend the centres of vertical movement joints and to minimise the risk of cracking. Areas above doors and above or below windows may benefit from the inclusion of bed joint reinforcement to distribute tensile stresses and avoid localised cracking. Proprietary bed joint reinforcements with parallel bars of at least 3mm diameter can be used to increase joint spacing. Light "chicken wire" meshes can be used for crack control only.

Brickwork, like concrete, is good in compression but poor in tension and the addition of reinforcement to the mortar bed joints will:

- Give more freedom in the spacing of movement joints
- Reduce cracking due to the following causes:
  - Movement due to fluctuating temperatures
  - Flexural or tensile stresses resulting from loading
  - Stress concentrations around openings (windows and doors)
  - Differential movement between bonded materials
  - Differential settlement
  - Irregular elevations
  - Changes in wall thickness

Reinforcement is supplied in various widths and shapes to suit the application, but for external walling suitable grades of austenitic stainless steel should always be specified.

Design guides and technical and structural advice are available from manufacturers and suppliers, together with guidance on the correct application and installation of the material.

Fig. 14

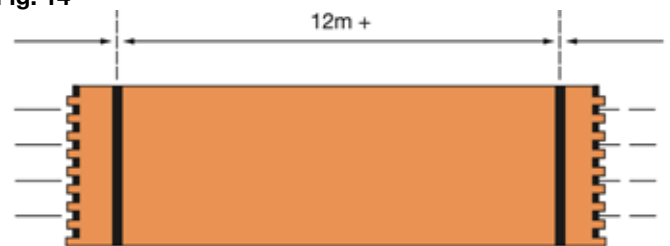


Fig. 15

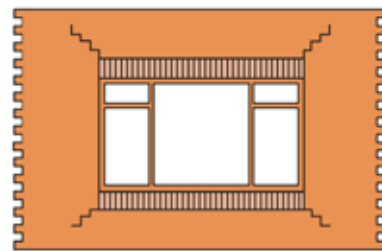


Fig. 16

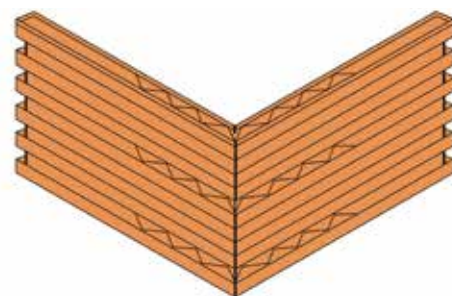


Fig. 17

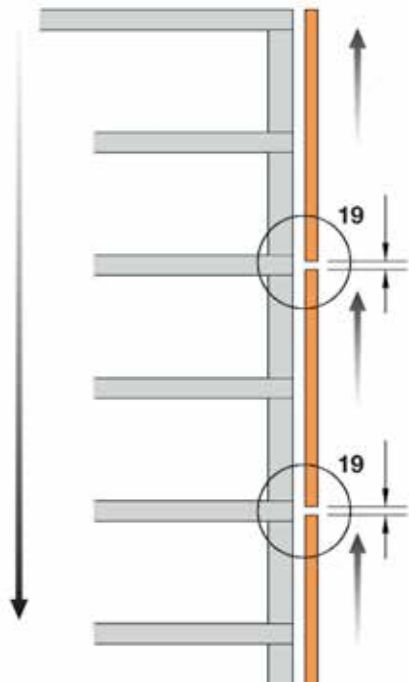


# Horizontal Joints to Accommodate Vertical Movement

Present evidence suggests that vertical movement of unrestrained walls is of the same order as horizontal movement.

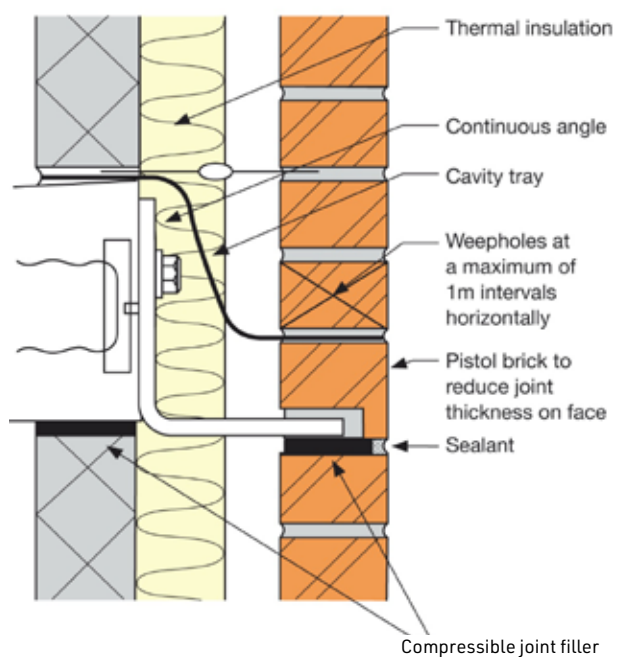
In order to avoid the detrimental effects of differential vertical movement between the inner and outer leaves of a wall a horizontal movement joint should be provided at no more than every third storey or 9m, whichever is the less. For buildings not exceeding 4 storeys or 12m height, whichever is the lesser, the outer leaf may be uninterrupted for its full height.

Fig. 18



It is common practice to incorporate support at every second storey so providing the opportunity to locate movement joints of reduced thickness.

Fig. 19



An example of a support system showing provision for movement.

## Materials for Movement Joints

The material for filling movement joints to accommodate expansion should be easily compressible to approximately 50% of its original thickness. Flexible cellular polyurethane, cellular polyethylene or foam rubbers are satisfactory materials.

Movement joints should be sealed with polysulfide or low modulus silicon which has sufficient flexibility to accommodate movement and be resistant to water penetration.

# Clay Brickwork - Simple Guidelines for Specification of Movement Joints

1. In general, experience suggests that movement joints in clay brickwork should be spaced at approximately 10-12 metres. PD 6697 states that in no case should movement joints exceed 15 metres. Moreover, the spacing of the first joint from an internal or external angle should not exceed half of the general spacing. In long narrow runs of walling or panels, which have certain unrestrained edges, a spacing of half the general recommendations should again be incorporated. Movement joints should be continuous for the full height of brickwork.
2. For unrestrained masonry such as parapets and freestanding walls vertical joint spacing should be reduced to 5 - 6m centres. For copings and cappings which may be prone to greater movement further provision of joints should be considered.
3. With respect to horizontal expansion joints for vertical movement, the outer leaf should be supported at intervals of not more than every third storey or every 9 metres whichever is less. However, for buildings not exceeding four storeys or 12 metres in height, whichever is less, the outer leaf may be uninterrupted for its full height.
4. Cracking due to movement can often be induced from the corner of openings, i.e. windows and doors, but the prediction of such cracking is extremely difficult with many parameters to consider, including the interaction of various materials such as concrete and brickwork, and the structural behaviour of the building. The use of bed joint reinforcement can provide some control over such cracking.
5. Where the superstructure comprises a reinforced concrete frame, allowance must be made for the full potential differential movement between the frame and the clay masonry. This may necessitate the provision of horizontal expansion joints typically at every two storeys. If formed using a pistol brick (see page 11 Fig. 19) the joint must be of sufficient width to allow for full differential movement.
6. Brick cladding to timber framed buildings should be designed to prevent cracking as a result of stresses generated by vertical differential movement between the brickwork and the timber frame. Ref. PD6697 cl. 6.2.6.8.
7. When movement joints are positioned behind rainwater pipes (rwp`s) the fixings for the rwp`s must allow for sufficient movement of the brickwork.
8. The location of vertical movement joints should take into consideration:-
  - Short returns and changes in direction on plan
  - Changes in height on elevation
  - Different materials within the external leaf
  - Southerly elevations which are more susceptible to temperature changes
9. Wherever movement joints are positioned it is important that the Structural Engineers are aware of their location to ensure that assumptions in brickwork design including the form of panel edge restraint, are fully considered.
10. Joints should be weather-sealed on the external face and be filled with an easily compressible material. Materials, which cannot be readily compressed by hand, will not normally allow the masonry to move freely. PD6697 cl. 6.2.6.3.2 states that "the width of a joint in millimetres should be about 30% more than the distance between joints in metres".

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# Brick Development Products & Services

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## Brick Awards

The Brick Awards celebrate the best examples of clay brick in our built environment. Each year the awards attract over 350 entries from leading architects, housebuilders, developers and contractors; across 17 hotly contested categories. It is FREE and simple to enter on our web site: [www.brick.org.uk](http://www.brick.org.uk)

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## Technical Publications

The BDA provides a range of technical publications and guides; which are freely available to Architects, Developers, Builders and General public on our web site: [www.brick.org.uk](http://www.brick.org.uk)

The Fourth Edition of 'Guide to Successful Brickwork' is available at all good book shops.

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## Brick Works Events

The BDA regularly runs courses and seminars for all those professionals involved with the design and construction of brick buildings. Please contact George Spreckley our Events & PR Manager on email: [georgespreckley@brick.org.uk](mailto:georgespreckley@brick.org.uk)

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## Brick Bulletin

This widely acclaimed e-magazine features the latest developments in brick design and is recognised world wide as the foremost journal of contemporary brickwork. It is available free through the 'Brick Bulletin' tab our website: [www.brick.org.uk](http://www.brick.org.uk).

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## Brickmakers Quality Charter

Clay brick makes a significant contribution to the UK's safe, healthy and sustainable built environment. The Brickmakers Quality Charter scheme promotes the responsible sourcing of clay brick, through credentialling and the flexibility businesses seek from an established and audited supply chain.

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## Training and Education

The BDA offers lectures and other educational services for Architects, Engineers, Developers as well as support for students and public interested in creating successful brickwork. We also provide technical input to events for practicing architects, engineers and organisations involved in continuing professional development.

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## Research and Testing

The BDA identifies specific areas where independent research and testing programmes are required to further the confident use of clay brick and to ensure quality.

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## Statistical and Marketing Information

The Brick Development Association is an independent body committed to providing authoritative information about the use of clay brick in construction.

We collate statistical information on brick production, UK deliveries, and related supply for imported products together with volume information including testing, research and development.

We provide free technical support on the use of clay brick, and encourage best practice in the use of brick in the built environment.



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**The Brick Development Association**  
**1st Floor,**  
**31 Worship Street,**  
**London,**  
**EC2A 2DY**

**020 7323 7034**  
**brick@brick.org.uk**  
**www.brick.org.uk**

