Movement joints in masonry walls

(March 2021) (Second issue supersedes January 2016)

Question

In cavity masonry walls where should vertical movement joints be located with respect to end walls, corners and window/door openings?

Considerations

- Movement in masonry cavity walls can be caused by a combination of actions including expansion, contraction and the volume changes resulting from the effects of moisture within the masonry units.
- Movement can be reversible such as that caused by temperature variations, or one way as caused by the expansion that occurs as clay bricks age or by shrinkage that occurs as concrete blocks/bricks age.
- Colour, texture and the orientation of a wall to the sun can also affect the heat absorbed by the masonry and the resulting degree of movement.
- The size and shape of the masonry panels, whether they are square or long rectangles, as well as the distribution of openings and restraints will also influence the build up of stresses and subsequent movement.
- Movement joints should be provided to control expansion and contraction and avoid unsightly cracking. The joints should be properly constructed to cater for the calculated degree of movement without reducing the stability and weathertightness of the wall.

Answer

Calculating the theoretical movement of a wall is complex which is why general guidance for spacing of movement joints is usually adopted. NHBC Standards clause 6.1.3 Table 1 quotes joint widths and spacing for movement joints in the outer leaf to minimise the risk of major cracking in different types of masonry. The distances quoted, between vertical movement joints, are based on straight sections of wall.

Horizontal expansion of the continuous panels of a masonry box will try to push the corners outwards (see Diagram 1). Where the length of wall exceeds the stated joint spacings, this effect can be reduced by sub-dividing the wall into shorter lengths of less than the normal spacing (see diagram 2), or by locating the first movement joint approximately half the stated joint spacing from the corner (see Diagram 3).

In theory, an expansion joint could be located at the corner, but this would affect the buttressing offered by the return wall unless the masonry was suitably tied in accordance with an engineer's design. In order for a return wall to provide sufficient buttressing to the flank wall, without providing additional ties, the expansion joint should be located at least 550mm from the internal corner (see Diagram 3).

Some guidance suggests that the distance between movement joints, measured around a corner, should be the same as the distance between movement joints in a straight wall. This approach could lead to a requirement for movement joints in end walls particularly with concrete block/brick masonry. In practice, providing that the length of an end wall between returns is not greater than the normal spacing of movement joints for the masonry material, it should perform satisfactorily even when the first movement joint on the return wall is up to half the maximum distance for the masonry material.

Straight clay brickwork walls containing short staggers with offsets less than 675mm, (see Diagram 4), should be treated as if they were a straight wall when determining movement joint spacings. Therefore if the sum of the lengths of wall on either side of the stagger exceeds the maximum length without a movement joint then a movement joint should be introduced into one of the two lengths or at the stagger as shown in Diagram 4. Staggers and movement joints in masonry walls, other than clay brickwork, should be engineer designed.

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Movement joints should not coincide with door or window openings due to the difficulty in continuing the movement joint between the frames and masonry and around the ends of the lintels (see Diagram 6). Vertical movement joints should therefore be located in sections of full height masonry between the openings (see Diagram 5). Where a full height masonry panel does not exist (see Diagram 7) the location and detailing of the movement joint should be designed by an engineer to avoid it passing around window and door frames.

Window and door openings in effect divide the wall into a series of masonry panels. This can lead to uncontrolled cracking in narrow horizontal panels between openings on different floor levels. Where the length to height ratio of each panel is high e.g. more than 3:1, the distance between movement joints may need to be reduced. Alternatively, bed joint reinforcement may be used to control the stresses. Any reinforcement should be used in accordance with the manufacturer's recommendations. See also Technical Guidance 6.1/14 'Movement joints in clay brick masonry' and Technical Guidance 6.1/16 'Masonry bed joint reinforcement'.

As a general rule movement joints in the outer leaf of external walls should be provided at not more than the following centres:

Clay brickwork	**10m - 12m**
Lightweight concrete block/brick (aircrete or using lightweight aggregates gross density not exceeding 1,500kg/m^3)	**6m**
Dense concrete block and brick (using dense aggregate gross density exceeding 1,500kg/m^3)	**7.5-9m**
Calcium silicate brick	**7.5-9m**
Any masonry in a parapet wall (length to height ratio > 3:1)	**half the above spacings and 1.5m from corners.**
Movement joint widths for clay bricks should be not less than 1.3mm/m i.e. 12m = 16mm and for other masonry not less than 10mm	

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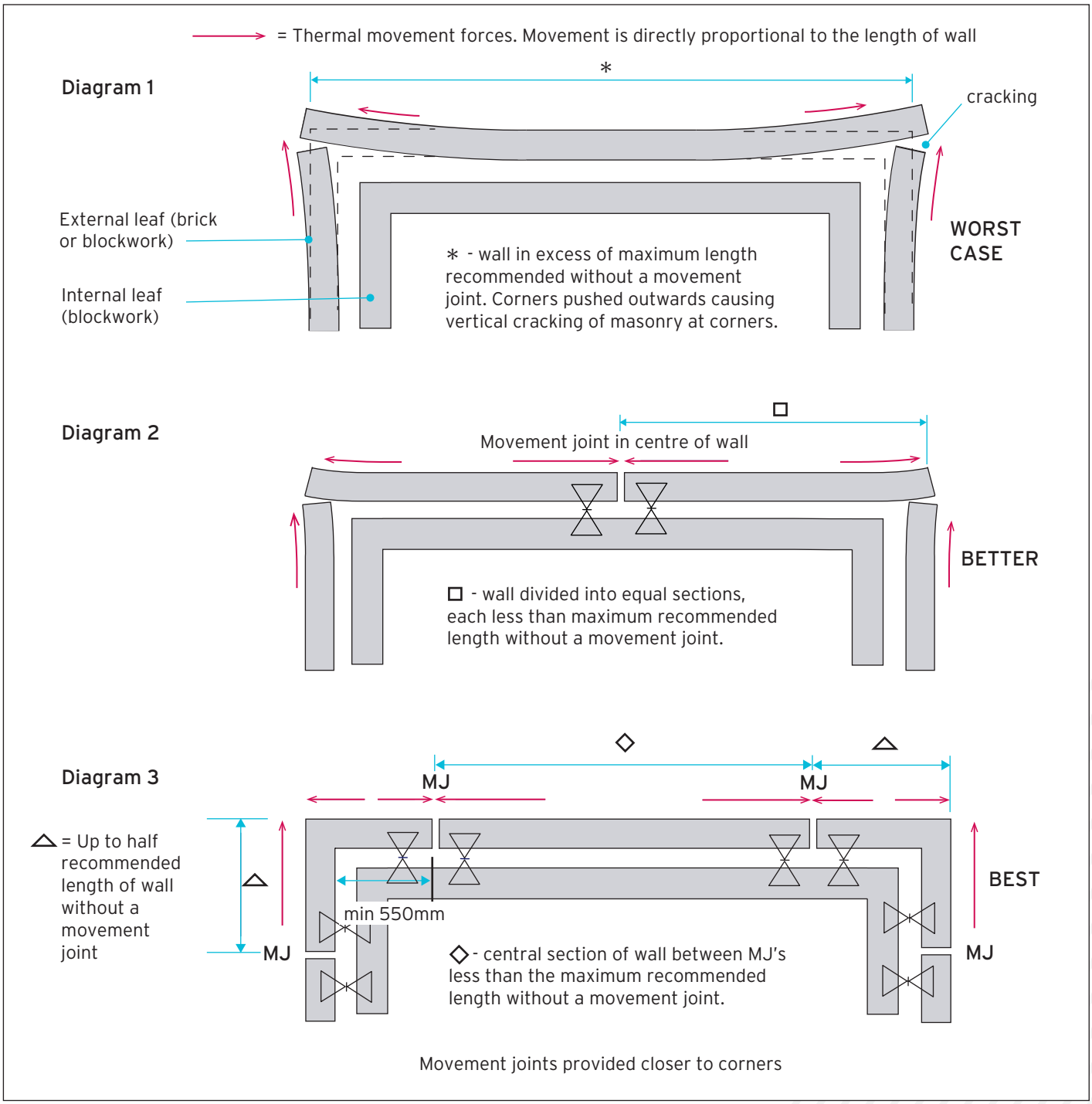

⋈ - Wall ties within 225mm of movement joint @ maximum 300mm centres vertically.

General Note:

Movement joints in internal walls are not normally necessary for single dwellings unless the walls are straight and unbroken and over 6m long, in which case the block manufacturer's recommendations should be adopted. This may include the use of bed joint reinforcement in the courses above and below window openings.

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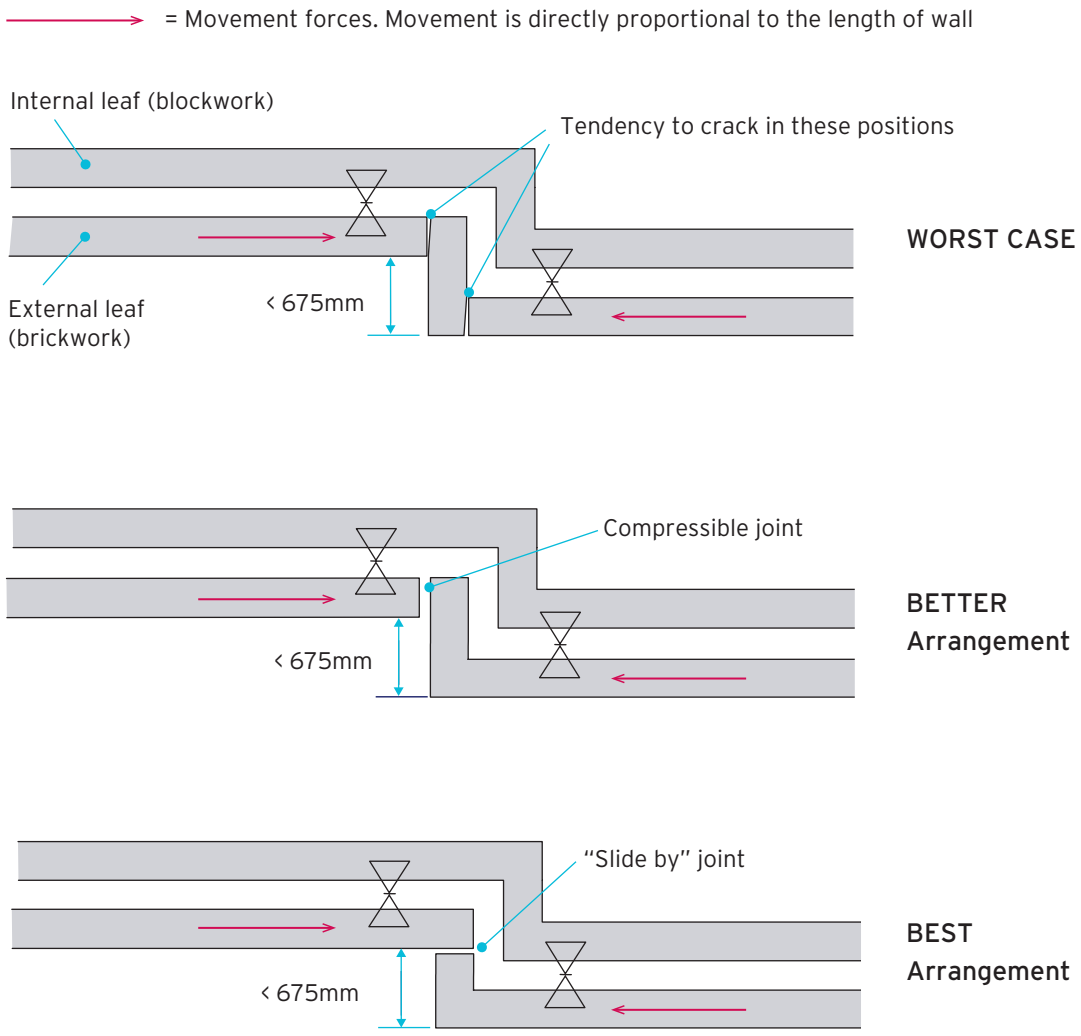

Diagram 4 - Short staggers in external cavity walls made from clay brickwork.

- Wall ties within 225mm of movement joint @ maximum 300mm centres vertically.

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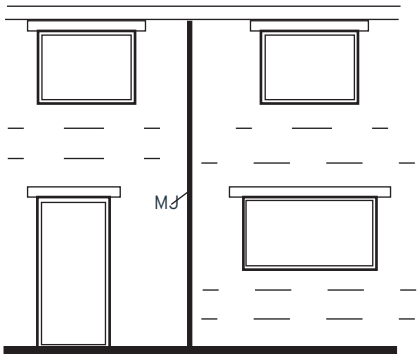
Diagram 5
Movement joint should be in full height masonry between window and door openings.



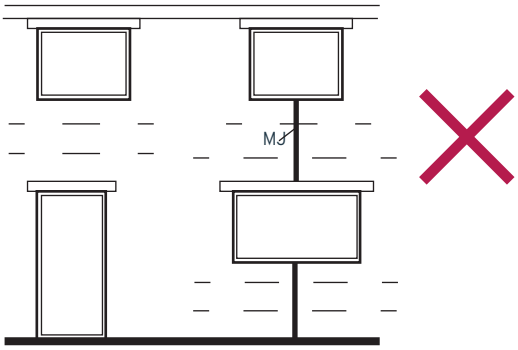
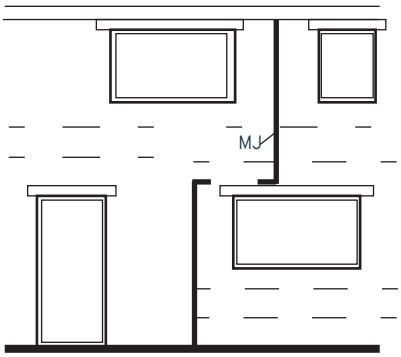


Diagram 6
Movement joint should not pass through openings due to the difficulty in continuing the joint between the frames and masonry and around the ends of the lintels.

Diagram 7
Where there is no full height path within the masonry the movement joint should be engineer designed to avoid any door or window openings. The design may involve the introduction of a slip plane to link the staggered joint.



– — – = Consideration should be given to the provision of bed joint reinforcement to control movement in the outer leaf where length to height ratio is high i.e. greater than 3:1. Similar bed joint reinforcement is often recommended by the block manufacturer within the inner leaf both above and below openings.