ACCOMMODATION OF MOVEMENT

All Building materials are subject to movement due to temperature and moisture changes. Designers should therefore ensure that the effects of such movement are accommodated to prevent unsightly cracking which may further result in structural defects.

A number of factors should be considered by the designer.

- specifying a product with low drying shrinkage, e.g. Forticrete Masonry
- specifying the correct mortar
- providing control joints at suitable centres
- using bed-joint reinforcement (See page 9)
- protecting the blocks before and during construction

Detailed information is covered within BS5628: Part 3: 2005

CONTROL JOINTS

Control joints are vertical separations built into a wall and located where cracking may occur due to excessive stresses caused mainly by drying shrinkage.

As a general guide the joints should be at regular spacing up to 9.0m in external walls and up to 12.2m maximum for internal walls.

TABLE 11. RECOMMENDED SPACING OF MOVEMENT CONTROL JOINTS (IN METRES)

Product Range	Internal Spacing	External Spacing
Specification Masonry (except Novastone), **Polished Masonry,** **Splitface Masonry**	12.2	9
Glazed Masonry, Novastone, Cast Stone, Walling Stone	6 6	6 6
Standard Masonry Dense **Standard Masonry Lightweight**	9 6	6 6

It should be noted that on south and east elevations, the effect of the early morning sun on these faces can raise the temperature very rapidly and cause greater movement to take place than elsewhere in the structure. It is recommended that the above rules are strictly adhered to unless further advice is taken.

Control joints may also be required at:

- changes in wall height and thickness.
- junctions with other forms of construction e.g. steel stanchions and reinforced concrete columns.
- intersections with other walls and partitions - particular attention should be given where return walls occur.
- return angles in L, T and U shaped buildings.
- chases or recesses for piping, pilasters, fixtures, etc.
- one or both sides of some large wall openings, e.g. windows, louvres or doors. However the addition of localised bed-joint reinforcement above and below openings can often eliminate the need for control joints. (See page 10)
- movement joints in roof and floor slabs. These joints in the main structure must be continued through the wall construction. The width of the wall joint and the compressible filler should be similar to that used in the roof and floor slabs.

HELPFUL HINT

The sum of two panel lengths on either side of a corner should generally not exceed the recommendations for single panel length.

FIG 4 UTILISING OPENINGS FOR MOVEMENT CONTROL

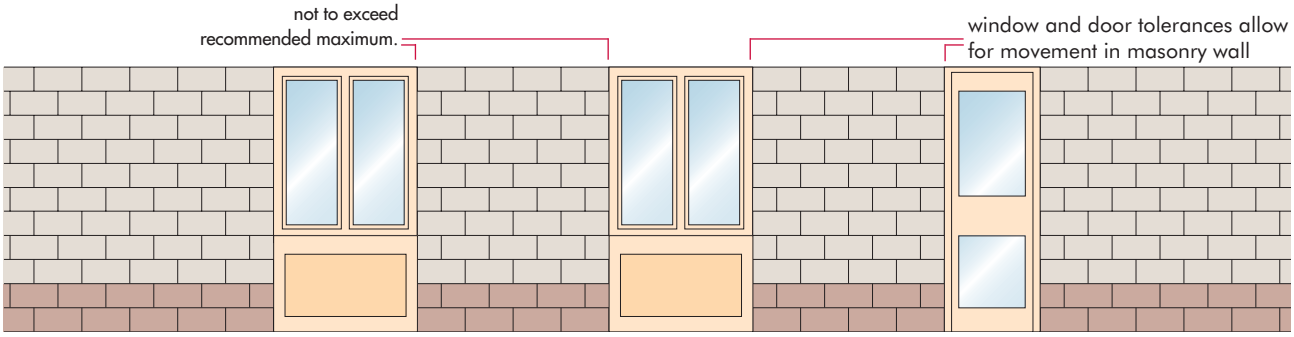
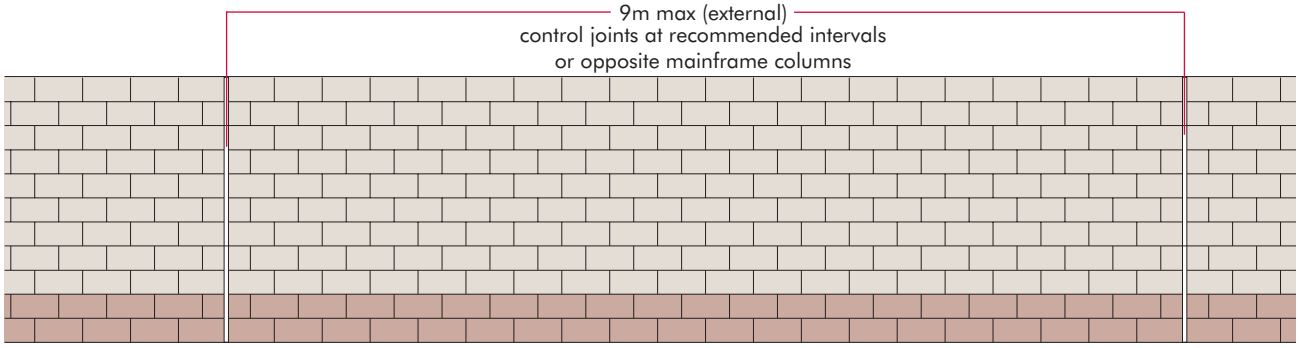


FIG 5 MOVEMENT CONTROL JOINTS IN UNBROKEN WALL



HELPFUL HINT

Slender panels of masonry are more susceptible to drying shrinkage movement because of the lack of restraint from the weight of masonry above. Therefore a totally square panel would have maximum effect in accommodating this potential movement.

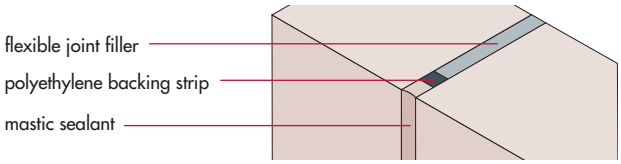
HELPFUL HINT

The inclusion of one or two courses of a darker coloured masonry will disguise splash marks and build-up of general dirt and grime.

FORMATION OF CONTROL JOINTS

The wall is built in the 'normal' half bond manner with the exception that on alternate courses, half length blocks are used to form a straight vertical joint.

FIG 6 CONTROL JOINT



The sealant should be one of the following or similar:

* an acrylic based sealant, such as these produced by Tremco Ltd tel: 01753 691696
* a two-part polysulphide, such as these produced by Fosroc Expandite Ltd tel: 01827 262222
* a silicone-based sealant, such as these produced by Adshead & Ratcliffe Ltd tel: 01773 826661

Internally the joint should be left open as long as possible to enable the wall to dry out thoroughly.

Control joints should be carried through all finishes. With partition walls not exceeding 8m in length the unbonded detail shown in Fig. 14 on page 12 will be adequate to accommodate this movement.

In cavity walls the control joints in each leaf should be offset. The flexibility of the cavity ties is normally sufficient to compensate for the very small differential movement between two leaves. Generally, the joint spacing is greater on the inner leaf so the staggering of joints is relatively simple. Additional wall ties should be provided either side of the control joint to enhance stiffness. Fig. 8 indicates how the control joint should be constructed incorporating a standard wall tie and plastic sleeve which may be used to create a de-bonding effect, for example that supplied by Halfen, Tel: 08705 316300. (See also Figs. 9 and 10)

HORIZONTAL CONTROL JOINTS

Limitation on uninterrupted height

When the method of limiting the uninterrupted height is adopted in accordance with BS 5628 : Part 1, the outer leaf should be supported at intervals of not more than every third storey or every 9m, whichever is less. This method employs shelf angles and vertical joints, which subsequently provides a means of vertical movement control. However, for buildings not exceeding four storeys or 12m in height, whichever is less, the outer leaf may be uninterrupted for its full height.

FIG 7 TYPICAL VERTICAL CONTROL JOINT

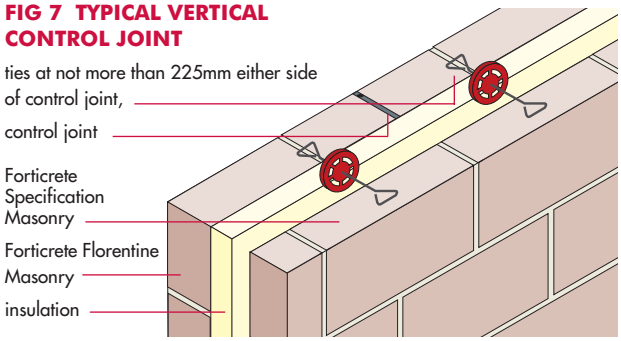


FIG 8 CONTROL JOINT WITH LATERAL RESTRAINT

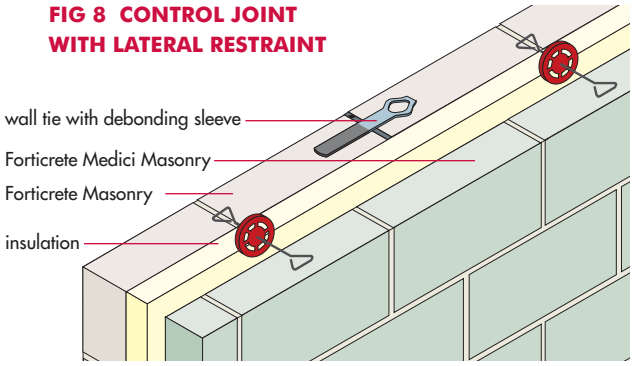


FIG 9 CONTROL JOINT AT COLUMN DETAIL 1 - BLOCKS ABUTTING COLUMN

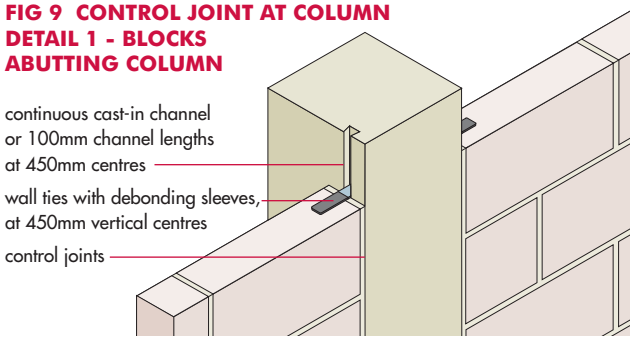


FIG 10 CONTROL JOINT AT COLUMN DETAIL 2 - BLOCKS RUNNING PAST COLUMN

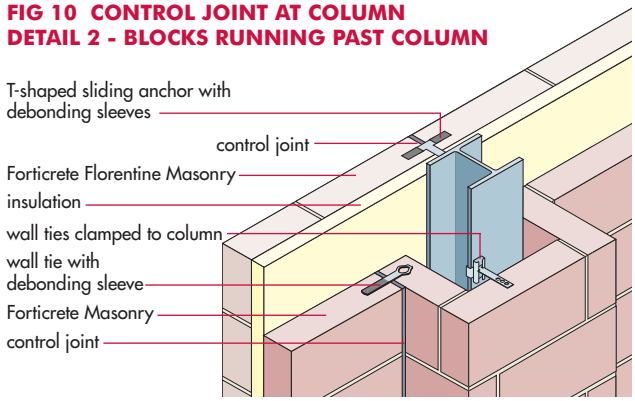
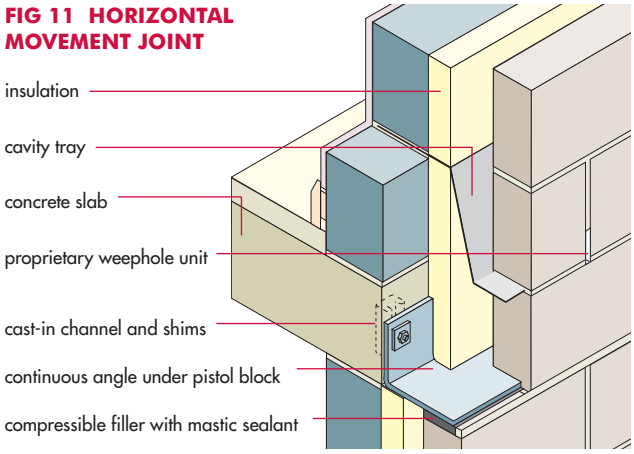


FIG 11 HORIZONTAL MOVEMENT JOINT



HELPFUL HINT

In Figure 10 Forticrete quoins may be used to form column encasement giving a stronger bond.

BED-JOINT REINFORCEMENT

Bed joint reinforcement is used to control the stresses induced in masonry walls, including the control of shrinkage.

Bond beams can have the same effect, but bed joint reinforcement may be more effective in controlling movement and is generally more economical.

INTERNAL WALLS

Table 12 gives an indication of the relationship between the spacing of control joints and that of bed-joint reinforcement for internal walls not subject to wind loads based on experience

TABLE 12 SPACING OF CONTROL JOINTS AND BED JOINT REINFORCEMENT FOR FORTICRETE MASONRY

Ratio L/H Panel length L (determined by control joint spacing) to panel height H	2	2.5	3	4
Limit of panel length L irrespective of panel height H	12.2m	13.6m	15.2m	18.4m
Vertical spacing of bed-joint reinforcement	no re-inforcement	every 3rd course	every other course	every course

EXTERNAL WALLS

For external walls subject to wind loading, a structural engineer must be consulted to assess the spacing of control joints and bed joint reinforcement. However, Forticrete offer a free checking service before the design is passed to the structural engineer for final approval.

In walls which have door and window openings, bed-joint reinforcement will eliminate the use of frequent control joints. Reinforcement should be provided in the first and second courses above and below all openings and should extend no less than 600mm either side of the opening (See Fig. 12). Other uses of bed joint reinforcement are near the top of the structural walls abutting concrete roofs, and in providing additional strength to parapet (upstand) walls.

Alternatively, in Fig 12 the control joint adjacent to window W on panel X could be omitted if bed-joint reinforcement is incorporated in every course throughout the length between the door and the joint behind the rainwater pipe.

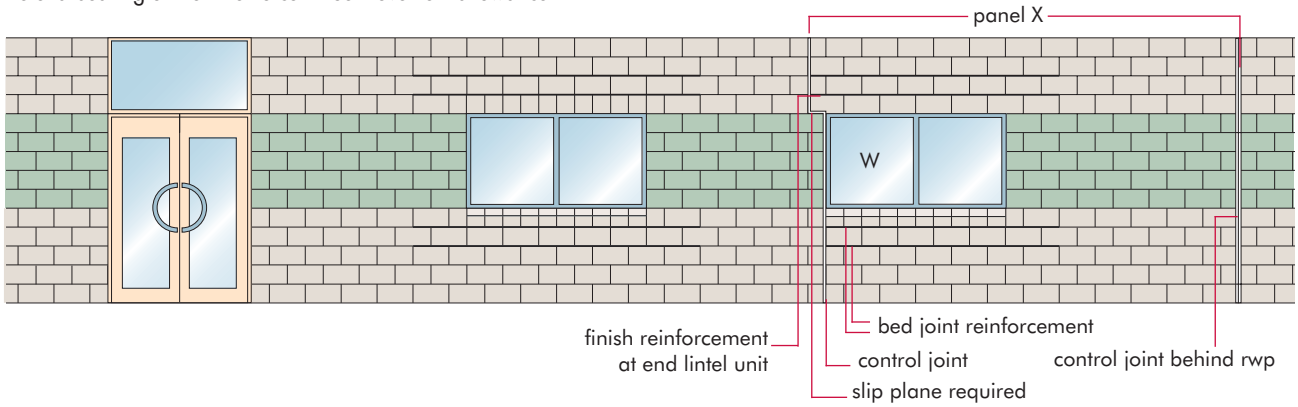
Where bed-joint reinforcement is required to enhance structural performance e.g. improving the flexural strength of stack bonded construction, it should be of the wire weld (ladder) type. Care must be exercised in selecting the correct width of reinforcement which should be approximately 40mm less than the width of the masonry unit. It is also important to ensure that the reinforcement is fully bedded in mortar and adequate adhesion between blocks is maintained.

HELPFUL HINT

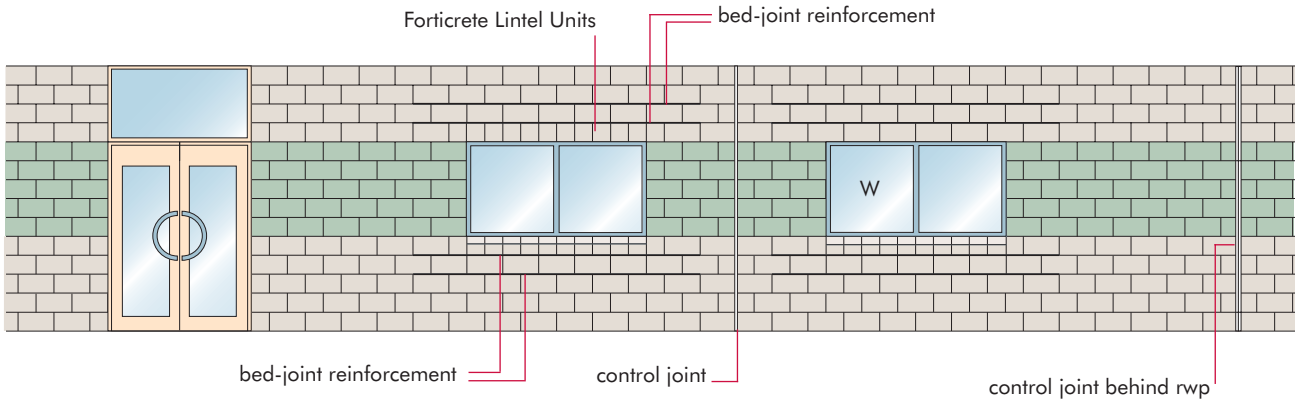
A dpc inserted under bearing of lintel over window W is required as a slip plane to accommodate the movement which will occur at the discontinuation of the control joint

FIG 12 CONTROL JOINTS AND BED JOINT REINFORCEMENT

Option 1: This method of aligning control joints with openings is often used but should always be checked by the project engineer to confirm stability. A slip plane should always be incorporated under the end bearing of the lintel to continue movement allowance



Option 2: Preferred detail



STACK BONDING

Stack bonding has a distinctive uniform bond pattern that is particularly suitable for panels in framed structures. It is often provided for aesthetic appearance without consideration for its design limitations. Stack bonding is economical to lay as it eliminates the need for cutting blockwork. However, the following criteria should be considered carefully when using a stack bond pattern.

The lack of cross bonding from the block directly above or below each unit will affect the flexural strength of the panel considerably. The compressive strength will also be reduced slightly.

In stack bond masonry, heavy concentrated loads will be carried down to the support by the particular vertical tier or "column" of masonry under load, with little distribution to adjacent masonry.

It is for this reason that BS 5628 does not recognise stack bonding as a "normal masonry bond pattern" when indicating calculation values for use by the designer/engineer.

Experience has shown that for blockwork masonry, Bed Joint Reinforcement should be included at every other course (450mm centres) for the full height of the stack bonded panel, and also for the width of the panel between columns or movement joints.
The reinforcement must not bridge the movement joints.

Alternatively bond beams can be used to restrain the panel against flexural failure. In effect, Bed Joint Reinforcement in alternate courses, will give the stack bond pattern a similar stability to that of a stretcher bond pattern.

It is important that when using this form of construction technique, a structural engineer must be consulted.

BRICK AND BLOCK BANDING

Over recent years, walls combining both clay and concrete masonry have become increasingly popular. If chosen, due account should be taken to accommodate differential movement.

Two design approaches can be used. BS 5628 suggests that slip planes be incorporated at the junction of the two dissimilar materials. However, this would seem to considerably reduce the flexural strength of the wall. The second approach is to tie the dissimilar materials together using Bed Joint Reinforcement, which reinforces the interface sufficiently to withstand the stresses induced by differential movement.

In either case it is advisable to ensure that movement joints are spaced at approximately 6m centres. Unfortunately little research has been carried out which would justify either design approach. Although both approaches have been used, slip planes are mostly incorporated on full height panels where shelf angles are used. To our knowledge no failures in this type of construction have been reported. This may be due to the low drying shrinkage of Forticrete masonry.

For further information please contact the Technical Department on 0800 262136.

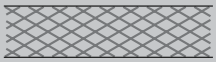
THE USE OF BED JOINT REINFORCEMENT

Bed joint reinforcement may be used for a variety of purposes and locations, as set out in Table 13 below either for structural applications or crack control only.

TYPICAL MANUFACTURERS

Expamet Building Products Tel: 01429 866 655
BRC Building Products Ltd. Tel: 01785 240029

TABLE 13 THE USE OF BED JOINT REINFORCEMENT

Purpose/Location	 Ladder type for structural applications	 Expanded metal type for crack control only (below & above openings and tying)
Increased panel sizes (refer to table 12)	•	
Alternative to using windposts	•	
Increased movement joint spacing	•	
Feature courses, corbles, plinths	•	•
Collar joint walls	•	•
Corner and 'T' junction pieces	•	•
Stack bonded panels	•	
Differential movement control	•	•
Brick/block banding	•	•
Above and below openings	•	•

HELPFUL HINT

Ensure that due consideration is given to the thickness of bed joint reinforcement when used in conjunction with 5mm mortar joints (as with Regency Ashlar Traditional and City Bonds), especially at corner detailing and lapping of reinforcement.