Movement joints

An introduction to the what, why and where of movement joints in commercial applications.

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AN INTRODUCTION TO MOVEMENT JOINTS

Ceramic and stone tiles can be subjected to a variety of strains and stresses caused by movement in the tiled surface, leading to tiles bulging, cracking or becoming detached from the substrate.

Movement joints compensate for the movement of tiles, which extends down through the tiles, the bed and substrate layer below. Without them, stress builds up between the tile and the substrate; therefore these stress-relieving joints, are an essential part of any tiling installation, and should be incorporated at the design stage.

Movement joints create a tile field, which moves independently from those around it, and should be included at set distances in floor and wall tiles in accordance with recommendations from the British Standards Institution (BSI). BS 5385 states that the maximum tile field should be no more than ten metres in each direction for floors - but in practice, depending on the individual application, it tends to be between five and eight metres for floors, and every three to four and a half metres on walls.

Types

There are many sorts of pre-formed movement joints that accommodate different types of movement.

To entertain the various types of movement, the correct material type and width needs to be specified; these could be constructed from brass, aluminium, stainless-steel or PVC.

Some examples of movement joints are shown below:

The amount of movement that can be absorbed - and therefore the degree of protection given by the joint - depends on the size of the profile and the compressible material used. Pre-formed surface joints will usually accommodate movement of up to 20% of the movement zone width. A 10mm joint will extend and compress by approximately 2mm for example one of Schlüter's stress relieving movement joints, the Schlüter-DILEX-KS, has a movement zone of 11mm, and will accommodate up to 2.5mm of tile movement. The fact is that there are specific movement joints for specific types of application, most tiling failures are caused by using joints that aren't suitable for what is being demanded of them. There are many situations, each with their own technically engineered solution in the form of the correct joint. Very often using the wrong joint - one that is not able to meet the requirements that are demanded of it - can cause severe problems.

Generally aluminium is ideal for commercial use; with brass and stainless steel used for heavy duty commercial and industrial projects such as warehouses, production facilities and airports, and where the tiled surface is cleaned by a scrubbing machine, or where there are rolling loads such as pallet trucks and metal-rimmed trolleys. Stainless steel is also ideal in places like laboratories and food processing plants where chemicals are used. PVC can be used for residential and light to medium commercial applications.

Solus is always happy to advise on the requirements of individual projects.

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WHY MOVEMENT JOINTS ARE NEEDED

Ceramic or stone covering can be compared to a sheet of glass, in that each is rigid by nature. Movement joints must be installed in certain areas and positions to prevent tiles or grout from cracking, and in some cases prevent the tiles from tenting and becoming de-bonded from the substrate.

A movement joint is the interruption of the surface to allow for movement. Common terms are:

- Structural movement joint
- Expansion joint
- Stress relieving joint

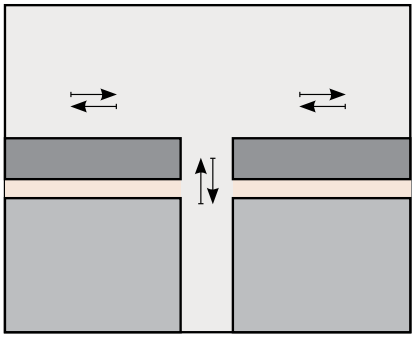
Movement joints are needed because all tiles expand and contract with temperature and moisture changes. In almost every case the substrate will move differently to the covering material. The larger the tile field, the more it will expand and contract, and be vulnerable to failure.

In 95 per cent of today's tile installations tiles will be fixed using the thin-bed method. This means that the tile is adhered directly to the substrate with an appropriate adhesive. Movement joints accommodate the differential stresses within each "field" of tiling, so they don't build up to a level, which would cause shearing stresses at the bonded interface, in turn protecting the tiles from cracking, tenting and de-bonding.

Damage to the tiling installation can be caused from drying shrinkage, deflection and moisture movement in the substrate, plus thermal and seasonal moisture changes.

Deflections in suspended floors can induce high compressive stresses in rigid floor tiling and may cause hollowness. Shear stresses, where the substrate and the tiling installation moving differently from each other, can become too great for the adhesive. Therefore stress relieving joints are an essential part of any tiling installation, and should be incorporated at the design stage.

However, as the majority of tiled installations involve the thin-bed fixing method, cracks in the substrate will readily be transferred to the surface, causing the tiles to crack. Where irregular hairline cracks in the screed or timber board joints are present, it becomes impractical or impossible to position movement joints. In this situation the best way of preventing damage is to incorporate movement joints with an uncoupling system, such as a polyethylene membrane, to separate the covering from the substrate, in order to guarantee the long-lasting integrity of the installation.



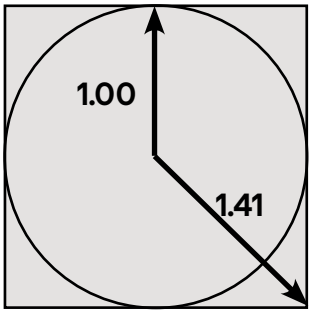
Tile and natural stone

All tiles expand and contract with changes in temperature

The larger the field tile, the higher the coefficient of expansion and contraction

Substrate and tiles move differently

WHERE MOVEMENT JOINTS ARE FITTED



The ideal field size

Ratio of the shortest to the longest distance from the centre of the force should be approximately 1:1.5

The theory is to create “tile fields” large enough to absorb differential movement between the substrate and the ceramic or stone covering -- movement joints must be installed in certain areas and positions to prevent tiles or grout from cracking -- and in some cases prevent the tiles from tenting and becoming de-bonded from the substrate. But the exact positioning of movement joints is vital to them successfully protecting the installation. If they’re installed in the wrong place they won’t work.

Industry guidelines suggest that the maximum tile field should be no more than ten metres in each direction - but in practice, depending on the individual applications, it tends to be between five and eight metres. British Standards (BSI) 5385 Part 3: 2014 covers the requirements and methods for movement joint applications. Section 3 – 6.8 1.1 states that the building designer should assess the magnitude of any stresses and decide where movement joints should be located, having regard to all relevant factors, including the type of flooring, bed and substrate.

Excerpt from: BS5385-Pt3:2014 Sect 6. And Sect 7

6.8 Movement joints
NOTE: For the positioning and location of movement joints see 7.1.6.

6.8.1 Types of movement joints

6.8.1.1 General

Stresses can result from factors such as drying shrinkage, deflection and moisture movements in the base and thermal and moisture changes affecting the flooring. These stresses can sometimes cause loss of adhesion and bulging or cracking of the flooring. To counteract this, movement joints extending through the tiling and its bed should be incorporated in the installation.
The building designer should assess the magnitude of any stresses and decide where movement joints should be located, having regard to all the relevant factors including the type of flooring and bed. Movement joints for the floor tiling are as follows:
a) Flexible joints aligned to structural movement joints;
b) Flexible joints to accommodate smaller movements than structural joints;

NOTE: For movement joints in special conditions refer to BS 5385-4.

6.8.1.5 Structural movement joints
Structural movement joints in the bed and tiling should be sited immediately over and be continuous with structural movement joints in the base. This procedure might not be acceptable if the base joints are not straight and parallel, or if their layout does not coincide with that of the floor tiles; in these circumstances, guidance should be sought from the building designer or engineer.

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6.8.1.6 Other movement joints
Flexible joints should be inserted over supporting walls and beams at intermediate positions to accommodate deflection of the base and movements in the flooring.
Flexible joints should be used at floor perimeters and to divide the floor into bays at the intervals recommended in 7.1.6.4. Wherever possible they should coincide with structural features, e.g. columns and door openings, or they can be planned to provide a decorative panelled effect.
Where high temperatures are expected, for instance around boilers, over heating installations or from strong sunlight, an assessment of the likely temperature range and corresponding linear changes in the flooring should be made to determine whether and where any additional allowance for movement is necessary.
In floors that have to withstand hard-rimmed wheel traffic or the dragging of heavy loads, the position of movement joints should, where possible, be planned so that they do not occur in the traffic area. Where this is not practicable, pre-formed strip joints should be used with their edges reinforced with metal or rigid plastics sections.
Joints other than those protected by metal or rigid plastics edging, subject to traffic heavier than light pedestrian, should not be wider than 10 mm.
Information on the permissible maximum and minimum joint widths should be obtained from the manufacturer of the particular joint filling selected.

7.1.6 Movement joints

7.1.6.1 General
NOTE: Types of movement joints and stress-relieving joints are given in 6.8. The siting of these joints is given in 7.1.6.2, 7.1.6.3 and 7.1.6.4.

Care should be taken to ensure that levelling screeds or tile beds adjacent to movement joints are fully compacted. Movement joint cavities should extend through the tiling, tile bed and levelling screed and should be completely filled and sealed after the grouting of the normal joints. Where separating layers are incorporated, however, the movement joint should extend to this layer but should not penetrate it. Prior to the filling and sealing operation, the joints should be thoroughly cleaned of all extraneous matter, excess grout, dust, etc.

7.1.6.2 Structural movement joints
Movement joints as should be inserted in the bed and tiles over movement joints and/or contraction joints in the base. They should be continuous with the base joints and should be of sufficient width to permit the joint filling to accommodate the expected movement. In the event of the base joints not being true: e.g. not straight and parallel, or their layout not coinciding with that of the tiles, the siting of the movement joints in the finish as stated might not be acceptable and a decision as to any alternative procedure should be obtained from the building designer or engineer or their agent.

7.1.6.3 Perimeter joints
Movement joints type F should be inserted where the tiling abuts restraining surfaces such as perimeter walls, columns, curbs, steps and plant fixed to the base. In floors with dimensions of 2m or less between restraining surfaces, perimeter joints are not necessary unless the conditions that can generate stresses are likely to be extreme, for example, violent temperature changes or prolonged immersion in liquid.

7.1.6.4 Intermediate joints
In larger floor joints, joints between perimeter joints should be employed to divide the area into bays of size not greater than 10m × 10m for internal floors without underfloor heating. For external floors, the spacing of intermediate movement joints should be less than 10m × 10m.

NOTE 1: The need for intermediate joints between perimeter joints depends on the dimensions of the floor; for example, with the exception of those on suspended construction, in floors with less than 10m between perimeter joints no intermediate joints are necessary.

NOTE 2: For information on underfloor heating see Annex C.

On suspended floors, stress-relieving joints should be inserted where flexing is likely to occur, e.g. over supporting walls or beams.

NOTE 3: Suspended floors are not resting on a solid base but are supported by other forms of construction.

For internal floors, which might be subjected to significant thermal changes, i.e. direct sunlight in atria, or underfloor heating, etc., the floor area should be divided up by intermediate movement joints into bays of size not greater than 40 m2 with an edge length not greater than 8m.

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