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

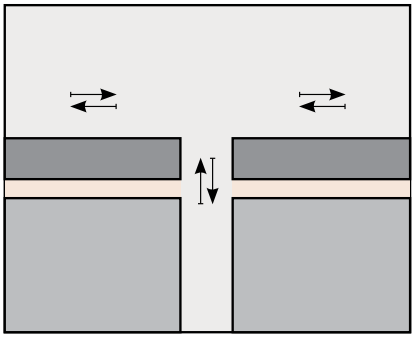
Movement joints are needed because all tiles expand and contract with temperature and moisture changes. In almost every case the substrate will move differently to the covering material. The larger the tile field, the more it will expand and contract, and be vulnerable to failure.

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.



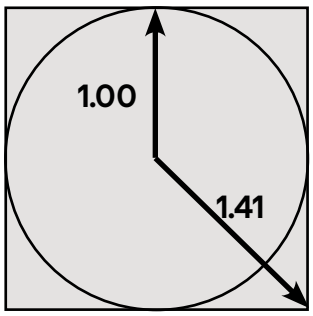
Tile and natural stone

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 3:2024 covers the requirements and methods for movement joint applications. Section 9 – 9.9.1.1 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 / screed.

Excerpt from: BS5385-Pt3:2024 Section 9:

9.9 Movement joints
9.9.1 Types of movement joints

9.9.1.1 General

The provision of movement joints should be determined at the design stage.

In addition to accommodating movement within internal and external flooring, movement joints might additionally be required for water tightness or fire resistance; the building designer, structural engineer and product manufacturer should be consulted regarding their use.

The correct type of movement joint should be selected for the application, based on factors such as:

a) movement accommodation factor (MAF)

b) exposure to chemicals/contaminants

c) resistance to wear and puncture; and

d) ageing.

Cold applied, non-structural elastic sealants used for movement joints in floors in building construction for interior and exterior should be in accordance with BS EN 15651-4.

The minimum joint width based on a typical Class 25 elastic sealant should be 6 mm, however, this should be confirmed with the structural engineer. The width of the joint should be adjusted based on the MAF of other materials selected.

NOTE 1 Three classes of movement are specified for elastic sealants used for movement joints in floors in BS EN 15651-4: Class 25 (±25%), Class 20 (±20%) and Class 12,5 (±12.5%). All movement joints should be installed in accordance with the relevant standard and the

manufacturer's instructions, where applicable, and be suitable for the application and exposure conditions.

NOTE 2 The type and location of movement joints involve taking into account construction materials, bedding systems, anticipated temperature and humidity conditions, areas concerned and the setting out of the floor finish.

Movement joints extending through the floor finish and its bed/screed should be incorporated in the installation to accommodate the stresses that can result from factors such as the natural expansion and contraction of the building materials in service, drying shrinkage, deflection, moisture movements in the substrate and thermal and moisture changes affecting the flooring.

Movement joints should be linear and continuous to alleviate stresses; they should maintain an unbroken circuit throughout the building.

NOTE 3 Stresses can sometimes cause loss of adhesion and bulging or cracking of the flooring.

Movement joints extending through the floor finish, its bed and screed should be incorporated in the installation. Where tiled finishes are to be installed to dissimilar substrates in adjacent areas, a movement joint should be incorporated at the interface and should extend through the floor finish and the junction between the substrate types, e.g. where raised access flooring abuts screed/concrete, the movement joint should extend through the floor finish and the junction between the substrate types.

The building designer/structural engineer should assess the magnitude of stresses and decide where movement joints should be located, having regard to all the relevant factors, including the type of flooring and bed/screed.

9.9.1.2 Structural movement joints

Movement joints should be inserted in the bed and tiles over movement joints in the substrate. The movement joints should extend through the tiling, tile bed and levelling screed, be continuous with the substrate joints and be of sufficient width to permit the joint filling to accommodate the expected movement.
The structural movement joint profile should be installed in accordance with the manufacturer's instructions and be designed to accommodate the anticipated movement, including both lateral movement and vertical displacement, where applicable. Movement joints should be seated on an appropriate levelling bed and be correctly anchored.

NOTE Profiles might require a slip resistant finish.

In the event of the substrate 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 an alternative procedure should be obtained from the building designer or structural engineer or their agent.

9.9.1.3 Perimeter joints

Movement joints should extend through the tiling, tile bed and levelling screed, be inserted where the tiling abuts restraining surfaces and other interruptions in the substrate, such as perimeter walls, partition walls, columns, manhole covers, kerbs, steps and plant fixed to the substrate.

Where timber or other skirtings are used, they should not be installed so that they restrict or impede any expansion/contraction movement within the tiled flooring.

9.9.1.4 Intermediate movement joints

In large, open floor areas uninterrupted by walls, corridors or projections, intermediate joints, should be employed between perimeter joints to divide the floor area into bays of size not greater than 10 m × 10 m – maximum bay edge length 10 m – for internal floors without underfloor heating. For external floors, the spacing of intermediate movement joints should be less than 10 m × 10 m (see 9.9.1.6).

In large areas interrupted by sharp projections, an intermediate movement joint should be located commencing from this point.

NOTE 1 The need for spacing of intermediate joints between perimeter joints depends on the size of the tiles and slabs and the dimensions of the floor, e.g. large format floor tiles and panels require closer spacings of intermediate joint positions than smaller tiles.

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

On suspended floors, stress-relieving intermediate movement

joints should be inserted where deflection is likely to occur, e.g. over supporting walls or beams.

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

Movement joints should be located where stresses might concentrate, such as at door thresholds between solid walls affixed to the sub-floor, where there is a change of plane, such as at the beginning and end of a ramp or where there is a change of direction.

For internal floors, which might be subjected to significant thermal changes, i.e. direct sunlight in atria, or underfloor/ undertile 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 8 m.

Where underfloor heating is separated into zones that might operate independently, a movement joint extending through the tiling and substrate should be incorporated at the interface between the zones.

NOTE 4 This is applicable where a heated zone abuts an unheated zone.

9.9.1.5 Movement joint positions

In floors that have to withstand hard-rimmed wheel traffic or the transportation 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, joints using pre-formed strips should be incorporated, with their edges reinforced with metal or rigid plastics sections.

Joints other than those protected by metal or rigid plastics edging, or those purpose-designed for such applications, 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/profile selected.

9.9.1.6 External tiling

Exposure to greater fluctuations of thermal and moisture movement means that for external tile installations, intermediate movement joints should be incorporated within the tile assembly at intervals between 3 m to 5 m.

Depending upon the positioning of the installation (amount of exposure to sunlight and heat),

anticipated movement in the substrate, the size, darkness of colour and format of the tiles and slabs selected and the width of the tile joints, further reductions in the distances between intermediate movement joints should be taken into account.

Where there are supporting beams and where the tile assembly abuts restraining surfaces,

e.g. parapet walls, drainage systems, movement joints should be incorporated. In all cases,

movement joints should be continuous throughout the entire assembly.

Sealants should be installed in accordance with the manufacturer's instructions.

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