Version 1.1
July 2022

Insulating Movement Joints with ROCKWOOL Stone Wool Insulation

This technical note applies to movement joints between the support structure and the superstructure, especially at floors. In modern enclosure design it has become a standard approach to apply an air, water, and vapor barrier on the exterior of an enclosure support structure with a continuous layer of insulation outboard of those control layers. Movement joints must be designed and built to allow movement, but maintain continuity of air, water control, and thermal control.

Introduction

Buildings move: materials expand and contract, structures sway and sag, soils compress and swell. These movements are considered in design in two common ways:

1. by selecting components in contact that can be harmlessly stretched and compressed or
2. by providing gaps that allow unrestrained movement of adjacent components.

The latter approach requires movement joints. Joints are used for a number of other reasons in buildings: to ease assembly, to meet aesthetic goals, and to accommodate the dimensional variations between components, but movement joints exist to allow unrestrained movement between two components.

For a structural engineer the primary concern is movement between and within superstructure components such as within floor slabs and between large building areas. For enclosure design and analysis, the two most important movements that need to be considered are the movement of the cladding and the movement between the superstructure and the support structure.

- Cladding movements due to temperature variations, moisture content variations, and drying mechanisms are accommodated in the cladding itself by a number of joints (often proprietary or specific to the cladding being considered).
- Movements between the superstructure and the enclosure support structure due to elastic deformation and sway must be accommodated. There are more standard solutions for this type of movement joints partly because these joints are hidden from view and hence can apply a broad range of solutions.

Some understanding of the cause of differential movement between components is necessary to properly size and locate movement joints. Elastic and creep deformation of slabs (Figure 1) are usually the largest source of movement (and both result in closing, or contraction, of joints). Temperature and moisture movements can be important for some assemblies and should be assessed.

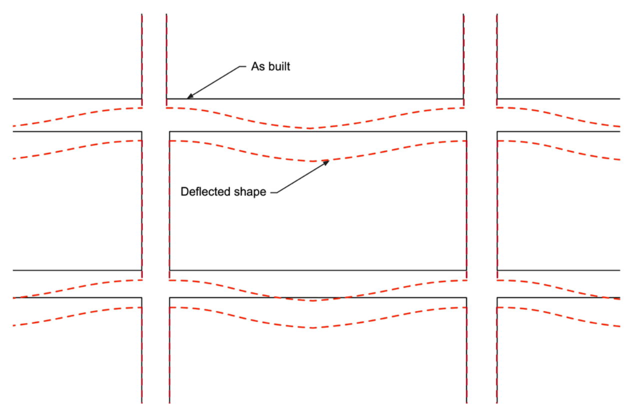

Figure 1: Both long-term creep deflection and short-term elastic deformation cause movements of floor slabs

The most common superstructure systems requiring movement joints are framed steel and reinforced concrete systems (Figure 2).

The enclosure support structure resists out-of-plane wind load but does not carry the gravity and in-plane loads collected by the building superstructure. This support structure is most commonly made of light-gauge steel framing or "nonloadbearing" concrete masonry. Applications of nonloadbearing wood frame support structures are rare but increasing in practise.

Figure 2: Steel Framed (left) and Concrete Framed (right) superstructure systems

Enclosure support structures made of light wood framing and reinforced concrete are almost always an integrated part of the superstructure and hence do not have movements between the superstructure and enclosure support elements (except perhaps around windows).

Most design details do not show how continuous insulation and air-water barriers are accommodated at floor joints as they tend to be provided by the suppliers of the support structure.

For example, Figure 3 shows the detail provided by suppliers of light-gauge steel framing and Figure 4 shows the recommendation by concrete masonry unit suppliers.

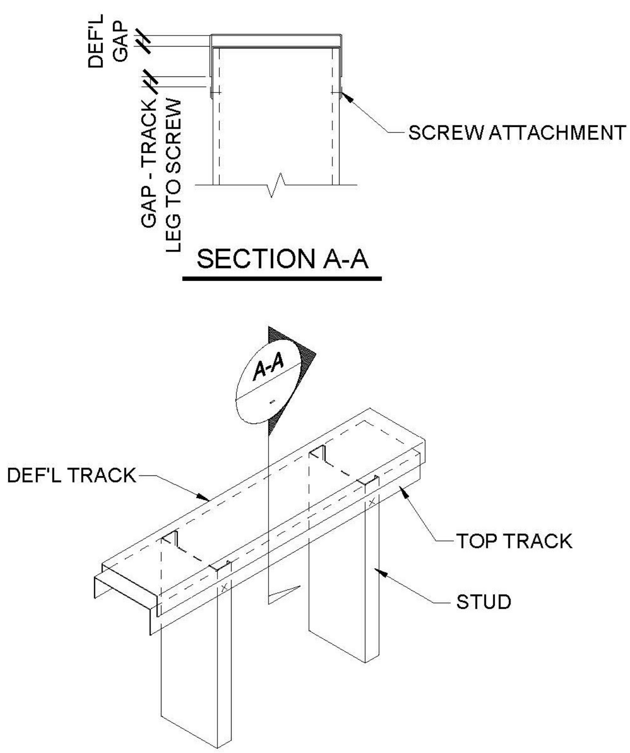

Figure 3: Light-gauge Steel Framing Movement Joint (from Steel Stud Manufacturer's Association, pg. 30)

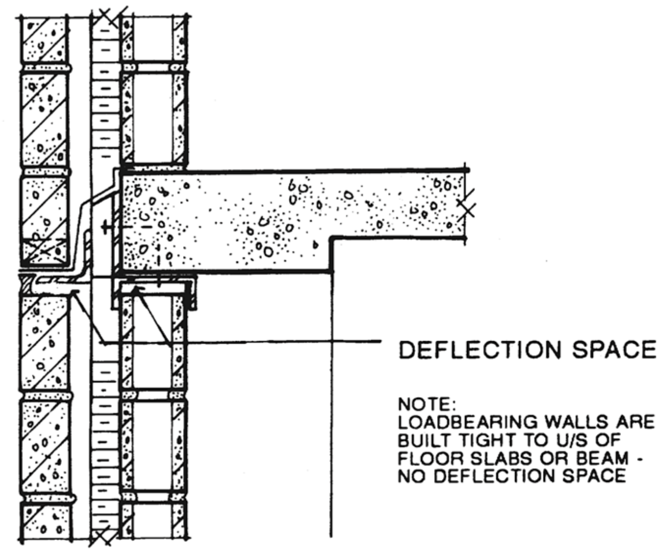

Figure 4: Masonry "Soft Joint" from Canadian Concrete Masonry Producers Association, 6th ed (2013)

Movement Joints

Joints that allow movement can be broken into a number of useful and simple to understand categories (Figure 5).

- Expansion joints allow expansion (opening of the joint)
- Contraction joints which allow contraction (closing of the joint)
- Movement joints which allow both
- Control joints which are normally only used to control the location of shrinkage cracks and are mostly concerned with aesthetics (Figure 6).

It is important to be aware that industry publications and design drawing routinely misuse these terms: expansion joint is a term widely used for joints that are movement joints for example. Clarity in labeling and specifications can avoid the risk of misunderstanding.

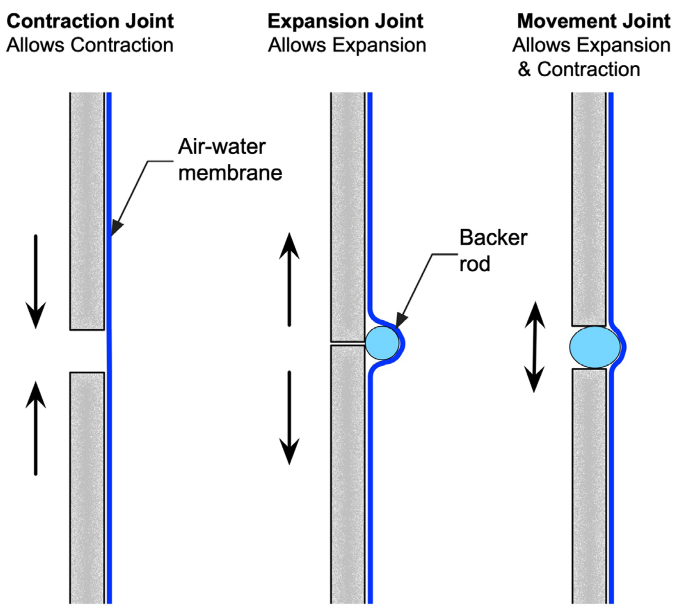

Figure 5: Three categories of joints

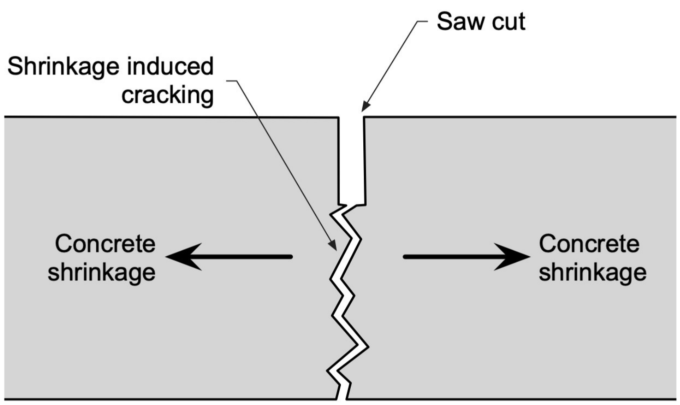

Figure 6: A crack-control joint example for a concrete slab-on-grade

To accommodate movement while maintaining the control functions of the enclosure, that is, the control of water, air, thermal, and vapor is a design challenge. There are in general two approaches.

- The first strategy is to continue the air-water-vapor membrane over a movement joint and choosing a membrane that is elastomeric (i.e., a membrane that can stretch or compress and return to its original shape). Many, if not most, membranes used in the industry are not elastomeric, but sealant joints are routinely used as means of ensuring continuity across flexible joints.
- The second strategy is to use a membrane that provides air, water, and vapor control and use the geometry of the membranes installation to allow the movement to occur unhindered while also not damaging the membrane itself (Figure 7).

Two important factors to consider when designing movement joints are both how much movement will (or is expected to) occur and how much reversible movement will occur. Reversible movement is movement that is expected to be recovered. For example, changes in temperature and moisture content will cause materials to expand and contract in a reversible or cyclical manner over a day, season or year. On the other hand there are many other types of movements that are irreversible as they occur only once in one direction. For example, concrete shrinks as it dries out from construction, and all beams sag under load. Soils consolidate and concrete creeps (deflects under constant load). None of these deflections recover.

The size of the movement joint should in most situations be labelled on the design documents (e.g., "25 mm". Ideally, the range of movement should be shown (e.g., "25 +10 / -15 mm"). These dimensions are typically provided by the structural engineer responsible for the design of the superstructure.

Practical Designs

The need for "soft joints" at floor lines is very common. In many cases, the required movement capacity is specified by the structural engineer as 15 to 25 mm (5/8" to 1") for common structural systems and spans. A widely used detail for this type of joint, which does not rely on the air-water membrane to stretch, is shown in Figure 8 for a light steel framed wall system and in Figure 9 for a concrete masonry unit wall, installed between concrete floors.

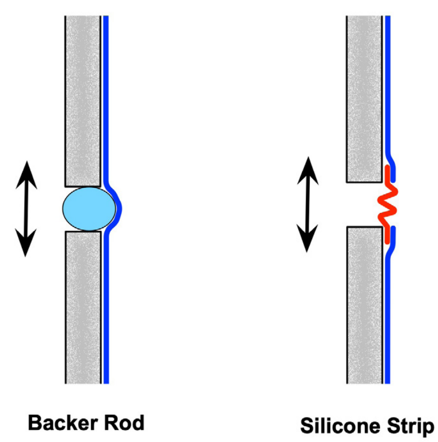

Figure 7: Two strategies for allowing movement of a membrane crossing a joint via geometry

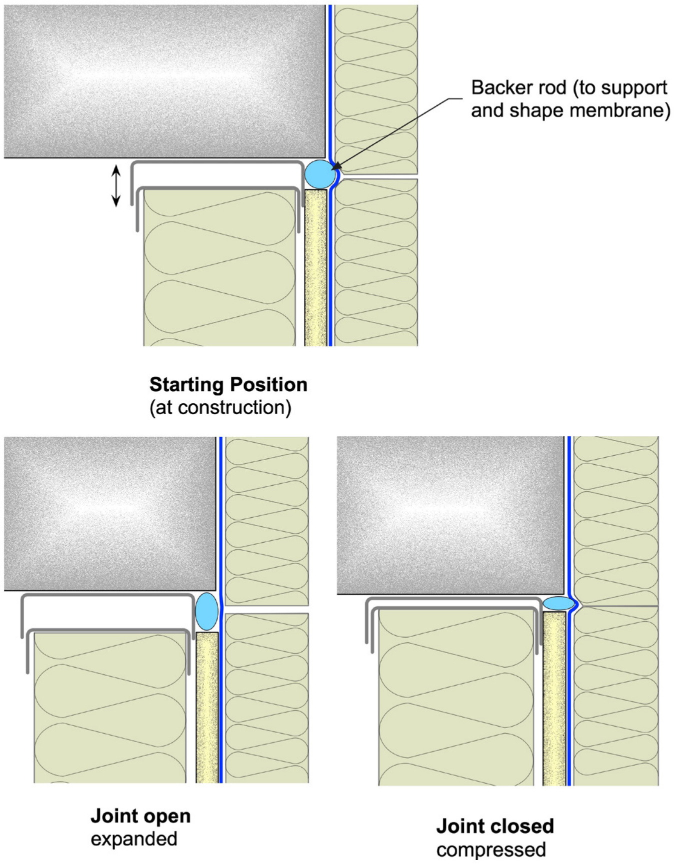

Figure 8: Movement joint at top of steel stud wall that allows both opening (lower left) and closing (lower right) of the joint

In these joints the movement expected is predominately closing, because beam or floor sagging tends to be the largest movement and is irreversible. However, some reversible movements, due to changing floor loads and temperatures, may cause short-term opening of these joints.

Insulation Continuity at Movement Joints up to About 1" or 25 mm

In the design of most movement joints no special considerations are provided to accommodate movement in the insulation because insulation products, especially ROCKWOOL stone wool products, are inherently flexible.

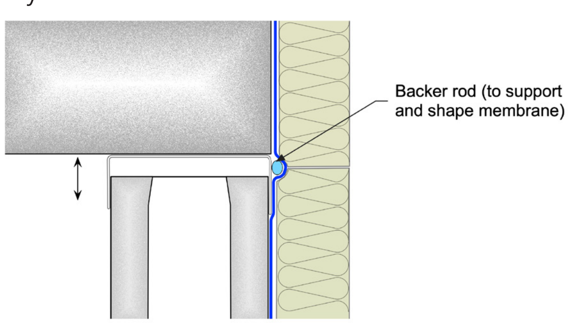

Figure 9: Movement joint at top of CMU enclosure wall that allows both closing and opening of the joint

For the majority of movement joints which expect a small range of movement (defined here as less than about 1" or 25 mm), ROCKWOOL stone wool insulation can be installed just as it would normally be, that is, with butted joints. The flexibility of the insulation and its fastening to the support structure can accommodate the movement that occurs. There are no known reports of insulation products, even stiff rigid foam insulation products, being damaged and rendered ineffective at normal floor line movement joints.

As most floor line joints have a net closing deformation over time, the closing of small gaps installed between insulation and the compressibility of the insulation itself results in continuous insulation. If expansion occurs at the floor line joint (that is, the floor slab moves upward relative to the wall) insulation can rebound somewhat and small gaps can open up.

Unlike air and water control, modest sized gaps (in the range of ¼" or 6 mm in width) between insulation boards, especially horizontal gaps, have little effect on thermal performance because the air in the gap is kept mostly still (Bankvall 1972). Hence, small gaps between insulation boards can be specified as part of a joint without concern that a major impact on thermal continuity will result. However, gaps of 1" (25 mm) or more will begin to impact the local thermal performance especially if exposed to moving air.

Insulation Continuity for Larger Movement Joints Over 1" or 25 mm

For joints with large openings (over about 25 mm) special products or designs may be needed to span the joint and allow movement while providing sufficient mechanical support to the air-water-vapor control membranes. Special premanufactured "expansion joint" products are often specified, or special movement joints designed for the project. These joints are beyond the scope of this short document but a pair of examples is shown in Figure 10.

The range of movement may exceed the ability of insulation products to compress and rebound. In this case, layered insulation solutions with gaps can be designed. Even if most of the wall system uses one layer of insulation (as would be common for an insulation layer of, for example 2"(50 mm), two layers can be used at the movement joint with an offset forming a ship-lap joint (Figure 11).

This technique minimizes the reduction in thermal continuity that could occur for large movements by limiting the discontinuity to only half of the layer at any one location. For thick layers of exterior continuous insulation, the same approach can use three layers of staggered joints, thereby allowing large gaps to form with little impact on thermal performance.

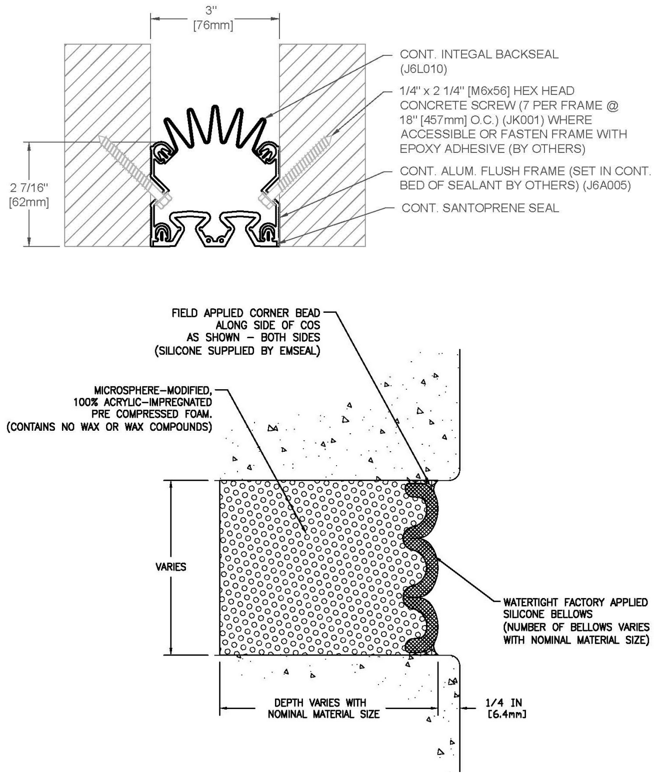

Figure 10: Examples of commercial pre-manufactured movement joints (top: Inpro Corporation, www.inprocorp.com , bottom: Emseal, www.emseal.com)

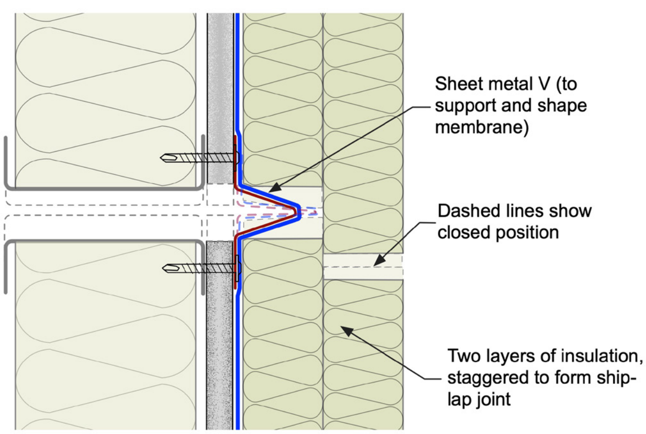

Figure 11 : Larger movement ranges in both directions can be accommodated with project-specific details, premanufactured expansion joints, and lapped insulation

Summary

Movement joints, especially joints at floor lines, are a common part of many modern building enclosures. Providing continuity of air, water, and thermal control across these joints even when movement is expected to occur, is necessary. Common and time-tested details and methods are available that provide designers and builders solutions when using continuous ROCKWOOL insulation.

References

Canadian Sheet Steel Building Institute, *Lightweight Steel Framing Architectural Design Guide*, CSSBI, 2002

Bankvall, C. *Natural convective heat transfer in insulated structures.* (Report 38). Div. of Building Technology, Lund Institute of Technology. 1972.

Canadian Concrete Masonry Producers Association, *Metric Technical Manual*, 6th Edition, April 2013.

Malhotra, A. *Brick veneer concrete masonry unit backing best practice guide*, CMHC, Ottawa, 2001.

Posey, J. *Brick veneer steel stud : best practice guide*, CMHC, Ottawa, 2001.

Steel Stud Manufacturers. *Cold-Formed Steel Details.* www.ssma.com accessed April 2022.

Version 1.1: July 2022

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