Bulk insulation products feel the pinch

Bulk insulation blankets provide a cost-effective and flexible solution when insulating roof assemblies where a minimum thermal performance is prescribed in accordance with the SANS10400-XA building code. However, compression of bulk insulation significantly reduces the performance of this form of insulation — and this is presenting the South African roofing sector with some very real installation challenges.

Article and images provided by: Dion Marsh, General Manager of Ash & Lacy South Africa (Pty) Ltd.

Studies have shown that compression of insulation reduces its performance by up to 50% depending on the installation methodology. It is precisely *because* of the detrimental effects of compression that SANS204 specifically stipulates that insulation must maintain its position and thickness throughout the roof assembly, except where it crosses roof battens or purlins.

THE CHALLENGE

Per the prescriptive route of compliance, SANS10400-XA stipulates that a prescribed *minimum total* R-value be achieved based on the building classification and geographical location. These minimum requirements are unfortunately not being achieved in a large majority of new buildings being constructed in South Africa, due to compression caused by incorrect installation methods. And this has hugely negative ramifications on the overall energy efficiency and associated operational costs incurred over the life cycle of the building.

Physical mock-up with measured tapered compression.

Misaligned concealed fix clip caused by compressed insulation.

Compressed insulation can also result in reduced performance of the outer weather sheet, especially when the highly preferred concealed fix profiles are utilized.

Installing concealed fix clips directly over bulk insulation results in compression ranging anywhere from 4mm to 20mm below the clip. This varied compression can result in misalignment of the clip, which affects the overall clipping action of the roof sheet.

There is also considerable negative pressure imposed on the underside of the roof sheet when the uncompressed insulation on either side of the clip expands and attempts to bulk back to its design depth. This is particularly prevalent when thicker insulation is specified to meet the prescribed thermal performance.

Unaddressed thermal bridging also plays a considerable role in reducing the overall thermal performance of a roof assembly. SANS204 stipulates that, when steel roof sheeting is affixed to steel purlins, a thermal break with a minimum R-value of $0{,}2m^2.K/W$ must be installed between the roof sheet and purlin. Bulk insulation compressed down to 4mm below roof sheeting or concealed fix clips does *not* achieve this requirement.

THE SOLUTION

Despite the challenges faced with over purlin installation, it is still the preferred method – and has been proven to be the most effective.

Countries such as Australia and the UK had to face the very same challenges when energy efficiency standards were introduced to their markets many years ago. With the energy efficiency standards in South Africa being in relative infancy stage in comparison to our overseas counterparts, we are in an extremely favourable position to draw on the collective experiences of trusted international industry partners, such as CSR Bradford from Australia and Ash & Lacy Building Systems in the UK, to overcome these challenges.

There are a number of tried-and-tested systems designed to reduce or prevent compression of bulk insulation when installed over purlin, by raising the height of the outer weather sheet. However, it is imperative that the overall structural performance of the roof assembly and the attachment of the outer weather sheet be carefully considered when selecting a system. It is important to note that certain systems have very specific restrictions of use and are not designed as structural components of a roof assembly.

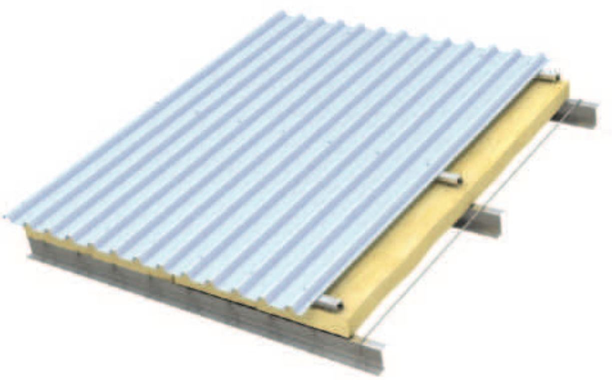
MECHANICAL SPACERS[1]

Ashgrid™ bracket and bar.

Mechanical spacer systems, such as the Ash & Lacy Ashgrid™ system, are engineered to perform as structural components of the roof assembly and are used to eliminate compression of the insulation blanket whilst taking the guesswork out of roof assembly connections.

They comprise of lightweight structural steel purlins with engineered support brackets that are mechanically locked into position at specified centres. Mechanical spacer systems provide a structural interface between the primary purlin and the raised outer weather sheet. The support brackets are available in a variety of heights to accommodate corresponding blanket thicknesses.

The support brackets are secured directly to the purlins, creating a defined cavity for the insulation material and keeping fasteners within safe working lengths. The outer weather sheet is secured directly to the raised structural purlin, thereby ensuring clip alignment and fastener performance.



Ashgrid™ with bulk insulation and straining wire.

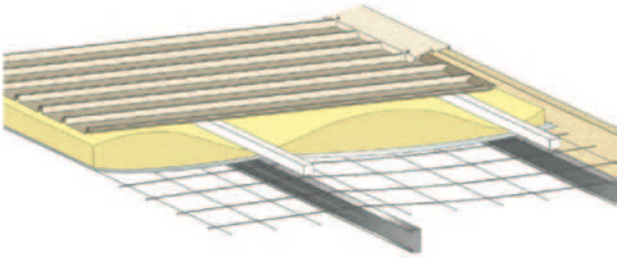
Specific loading requirements are achieved by varying the support bracket centres.

Mechanical spacer systems form the backbone of single and dual skin built-up systems where specific structural, thermal and fire performance is required.

[1] *Only accredited, independently tested mechanical spacer systems should be used.*

FOAM SPACERS[2]

Foam spacers, such as the CSR Bradford Thermodeck™ spacer, are manufactured from high-density, extruded closed cell rigid foam.



Thermodeck™ spacer.

These spacers are secured directly to the purlins in continuous lengths after the insulation blanket has been draped over purlin. They still cause compression at the purlin, but allow the blanket to regain some loft between purlins by simultaneously elevating the weather sheet and providing the required thermal break.

Draping the insulation over purlin results in a tapered compression, which *does* still affect the overall R-value of the installed insulation. It is extremely important to compensate for this loss in overall R-value by increasing the depth of the specified insulation blanket and packer accordingly. Accurate thermal modelling should be carried out to determine the additional depth of insulation required.

[2] IMPORTANT NOTE

Foam spacers have a number of design constraints that limit their application:

- NOT suitable for any form of concealed fix roofing profiles
- NOT suitable for roof pitches exceeding 5°
- NOT suitable for high wind zones
- NOT suitable for roof surfaces that support static or dynamic loads, including but not limited to loads such as: foot traffic, air-conditioning units, hot flues, vents, aerials, walkways, solar panels, etc.
- NOT suitable as a wall spacer system

CONCLUSION

The additional costs associated with the incorporation of a suitable spacer system into the roof assembly design remain negligible when considering the cost savings achieved by insulation that ultimately achieves its full design capability over the life cycle of the building.

Achieving energy-efficient, structurally sound and compliant roof assemblies no longer needs to be an onerous task for professionals and contractors. With proven installation methods and tighter on-site quality control, bulk insulation, whether used in single skin or dual skin applications, can still achieve its well earned reputation as an affordable solution in achieving excellent thermal, acoustic and fire performance.

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