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Industry Voices

PRODUCT CERTIFICATION

Preventing Thermal Bridging and Mould Growth

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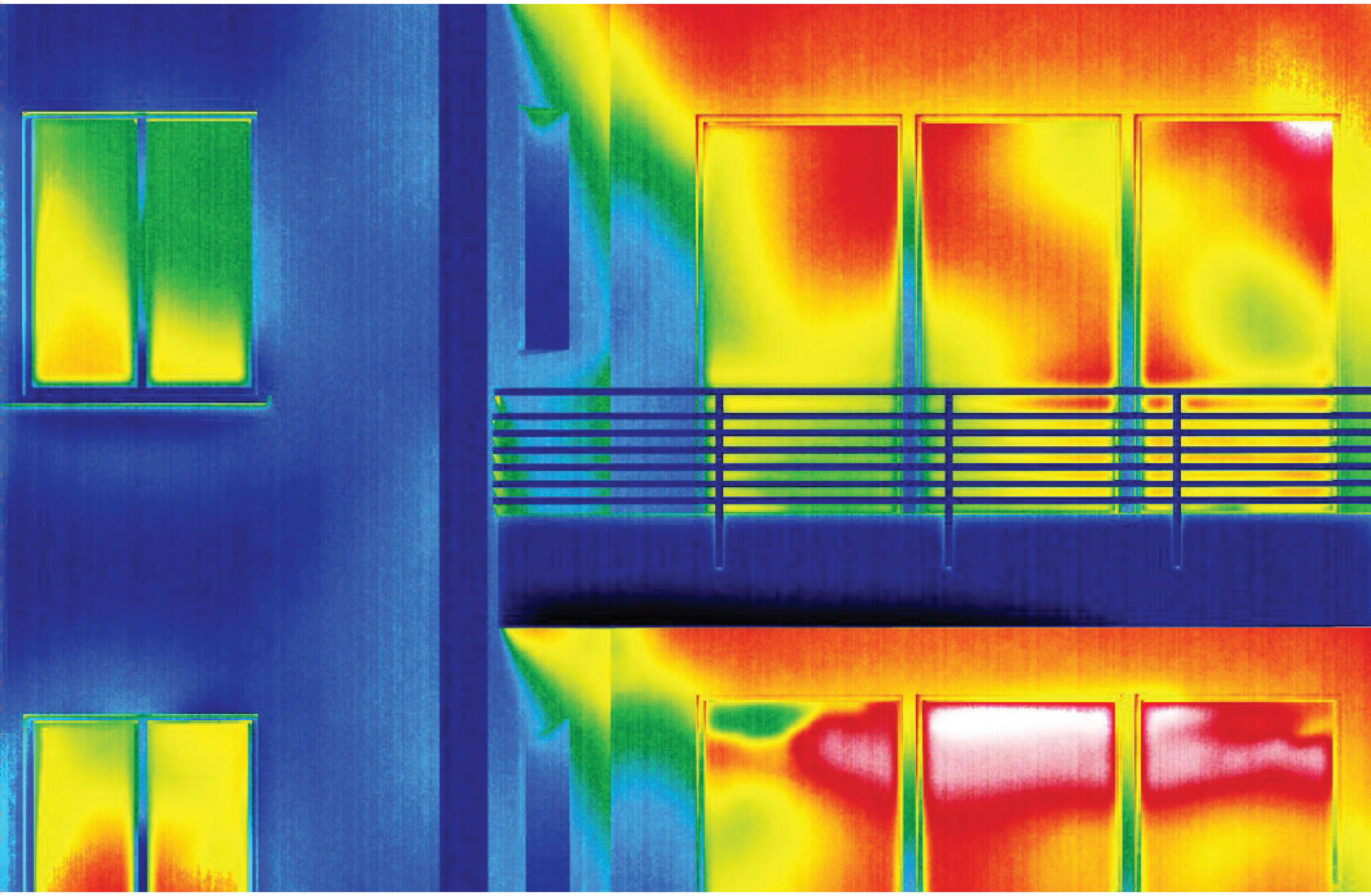

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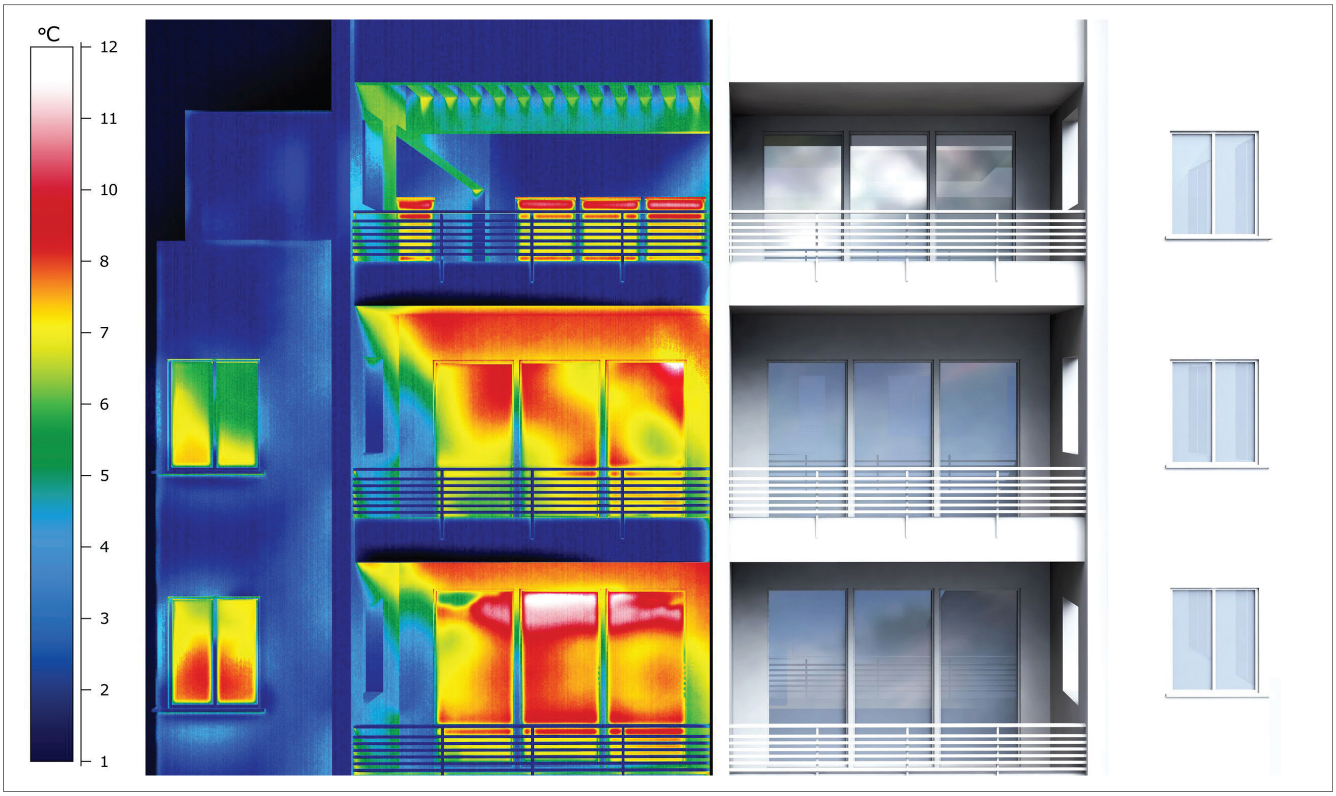
Preventing thermal bridging and mould growth is critical

Preventing heat loss from dwellings as a result of thermal bridges at balconies and other cantilever connections is a critical design consideration. However, preventing condensation and mould growth is an equally important factor.

Minimising energy use in buildings and thereby improving the thermal performance of building envelopes has become increasingly important in the drive for sustainability and energy efficiency. With voluntary certification schemes such as BREEAM and Passivhaus, there has been a move towards more stringent envelope thermal performance. The requirements of Part L1A of the Building Regulations are unequivocal too: "The building fabric should be constructed so that there are no reasonably avoidable thermal bridges in the insulation layer caused by gaps within the various elements, at the joints between elements and the edges of the elements, such as those around window and door openings." So basically, compensation for heat loss at any thermal bridging points by adding more insulation elsewhere is not the most effective solution. The biggest impact on avoiding thermal bridging is to incorporate a thermal break with the necessary verifiable performance standards, at the various critical connectivity points. This clearly also includes balcony and parapet connections.

The 'HOOLA' building in East London, next to the Excel is a new twin tower glass-clad landmark building. They are super-insulated and the concrete frame acts as a heat sink – absorbing heat on warm days and releasing it back into apartments when it cools. The building involves 1410 precast concrete balcony sections



Thermal image of a residential building with higher temperatures at the windows, doors and concrete balcony slabs.

> "Cantilevered balconies and exposed slab edges are therefore considered to be the most critical thermal bridges in a building envelope."

Cantilevered balconies and exposed slab edges are critical elements

The possible consequences of thermal bridges include greater energy use for both heating and cooling, non-compliance with Building Regulations and structural integrity problems with absorbent materials such as insulation products or plasterboard.

A structural thermal bridge may occur wherever you have a structural connection. With non-insulated cantilevered elements, such as balconies, the interaction between the geometric thermal bridge (cooling fin effect of the cantilever) and the material thermal bridge (penetrating the thermal insulation layer with reinforced concrete or steel) leads to severe heat loss and significantly reduces the internal surface temperature.

Cantlevered balconies and exposed slab edges are therefore considered to be the most critical thermal bridges in a building envelope. These are obviously crucial aspects of thermal bridging, but for the building occupants there are further potentially serious implications.

Mould growth presents potentially serious health risks

Low internal surface temperatures in the area of the thermal bridge, resulting in the formation of condensation, can lead to the occurrence of mould growth and this presents potentially serious health risks ranging from simple skin irritation, dizziness and flu-like symptoms, through to serious respiratory tract illnesses, such as allergic asthma. The elderly and the very young are particularly at risk.

Mould development is caused by micro-organisms; basically fungal spores and materials containing cellulose, such as wallpaper, wallpaper paste, distemper and other organic coatings are particularly good substrates for growth.

Moulds do not contain chlorophyll, so they do not require light to grow and fungal growth can set in even before the condensation occurs. In addition, the temperature zone for optimal growth also lies in the temperature range which human beings find comfortable. Mould is not a new phenomenon of course, but a combination of circumstances is elevating interest in the problem. Primarily, these are better insulated and more airtight buildings, along with improved energy efficiency requirements. Practically every building, irrespective of its construction, contains mould spores within its fabric which are dormant and completely harmless. However, given the right conditions these spores will germinate.

Mould growth on the ceiling formed from a concrete slab adjacent to an exposed thermal bridge can allow moisture vapour to condence when surface temperatures foil below dew point.

A typical structural thermal break installation for concrete-to-concrete applications.

The 'surface temperature factor' (fRsi) – identifies risk areas

The surface temperature factor - (fRsi) - is a ratio described in BRE IP1/06; a document cited in Building Regulations Approved Documents Part L1 and L2 and Section 6 in Scotland. This compares the temperature drop across the building fabric, with the total temperature drop between the inside and outside air. The use of this factor allows the risk of surface condensation and mould growth to be identified for different internal and external conditions.

The actual surface temperature will depend greatly on the temperatures exisiting both internally and externally at the time of the assessment. So crucially the surface temperature factor (fRsi) is formulated to work independently of the absolute conditions. The recommended value for (fRsi) in offices and retail premises is equal to or greater than 0.50. To ensure higher standards of occupancy comfort in residential properties and to prevent condensation and mould growth, it should be equal to, or greater than, 0.75. In more extreme conditions of high humidity, such as swimming pools or other wet areas, 0.90 would be expected.

Cantilevered balconies and exposed slab edges are critical elements

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The effects of thermal bridging occurring around a continuous steel beam.

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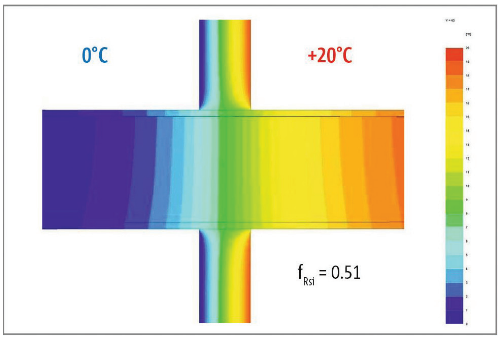
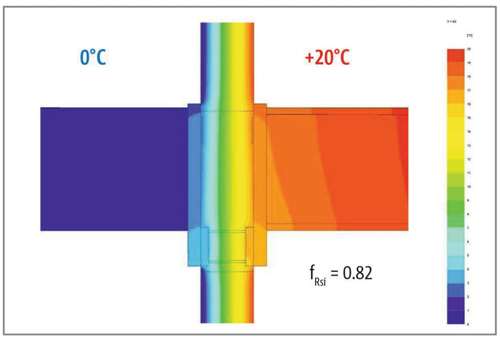


Exterior steel canopies penetrating the envelope are another example of critical thermal bridges which lead to significant heat loss.
The section images show the temperature distribution obtained by computer modeling.
The section image on the left shows a direct connection that does not conform to UK Building Regulations Part L. The section image on the bottom with a steel-to-steel thermal break, conforms with UK Building Regulations Part L requirements to meet the minimum temperature factor in dwellings (fRsi = 0.75).



Meet the authors

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Jon Denyar is a physicist with over 30 years' experience in the assessment and evaluation of construction products and systems and their compliance with national building regulations, in particular thermal insulation products and systems. He is active in a number of UK and European standardisation committees responsible for specification and design standards in the area of thermal and hygrothermal performance of construction products, systems and buildings. Currently part of the BBA's Technical Excellence Team the UK's leading Certification body for construction products and systems, he is engaged in developing technical excellence across the company and supporting technical decisions.

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Managing Director at Schöck Ltd. A graduate from Nottingham Trent University, Chris started his career at Allied Steel & Wire. Opportunities within the group led to him becoming European Sales Manager at Macalloy and, following a successful MBO, Sales Director at the age of 34. In the ensuing years, the business expanded across 40 countries and was awarded the Queen's Award for Export. In 2013 Chris was appointed as MD of Schöck Ltd and today, additionally holds several international managerial positions within the organisation.