



APPROVED DOCUMENT Z-TB NET ZERO BUILDINGS

ACBA5028

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1.Executive Summary

- 1.1 The document will propose a new Welsh Building Regulation called Part Z-TB which will focus on achieving Net Zero by reducing operational carbon emissions. The focus will be on the control and reduction of thermal bridging; this has a large impact on heat loss and energy efficiency (BRE,2020) within the built environment.

2. Introduction

2.1 The Need for Operational Carbon Reduction

Climate change and the drive towards Net Zero carbon emissions have placed increasing pressure on Wales to update its current building requirements (Welsh Government, 2021) to meet a low carbon future. The built environment contributes 40% of carbon emissions (WorldGBC 2019), meaning changes need to be made in order for the Welsh Government to achieve its Net Zero target by 2050 (Environment (Wales) Act 2016). While the existing Welsh Building Regulations set minimum performance for energy conservation, additional technical guidance is required to support more detailed control of heat-loss mechanisms within domestic construction (Zero Carbon Hub, 2015).

This document represents Part 1 of a three-part Approved document for the proposed Part Z-TB Regulation, focusing specifically on thermal bridging at floor-external wall junctions in domestic buildings. Thermal bridging at these junctions is a significant contributor to fabric heat loss through improved detailing and approved modelling methods (Zero Carbon Hub, 2015).

2.2 Background and Context

The construction industry occupies a central role in Wales's transition towards a Net Zero future, with buildings heavily contributing to operational carbon emissions. The Environment (Wales) Act 2016 places a duty on the Welsh Government ensuring that the net Welsh emissions account in 2050 as at least 80%, implemented through Net Zero Wales Carbon Budget 2 (Welsh Government, 2021). It places responsibility on the built environment to decarbonise rapidly.

This means that improvements in the design, material choice and performance standards are a priority if national targets need to be met (Welsh Government, 2021).

The current Welsh Building regulations addresses energy efficiency mainly through Approved Document L (Welsh Government, 2022). While Part L provides minimum standards for U-values, heating systems and general fabric performance, it does not include detailed technical guidance on specific areas where heat loss is most likely to occur (Welsh Government, 2022). These measures reduce energy consumption to an extent, but additional guidance is required to support Wales's wider decarbonisation ambitions, particularly in relation to building junctions where significant unaccounted heat loss often occurs (Zero Carbon Hub, 2015).

One of the main areas for unintended heat loss is the junctions between the flooring and the walls. These junctions are recognised as significant sources of thermal bridging. As the insulation continuity is interrupted by the structural elements such as the concrete floor slab, internal blockwork, timber soleplates or at the DPC level.

Research and performance testing indicates the testing shown can contribute to the overall fabric heat loss, in some cases it can reach to 20-30% off total heat loss accountable to thermal bridging (Zero Carbon Hub, 2015) This is not only increases operational energy demand but it also increases the risks of surface condensation, mould growth and reduced occupant comfort (BRE,2020), particularly in colder Welsh climates.

Despite the scale of this issue, current regulations of the use of default Y-values and generic construction details, neither of which guarantee good junction performance (Welsh Government, 2022).

These limitations highlight the need for a more targeted regulatory approach that provides explicit technical, guidance on assessing and reducing thermal bridging at floor-wall junctions in domestic construction. A dedicated focus on this area supports improved operational carbon performance, reduces the energy demand and improves indoor environmental quality. The proposed Part Z-TB and its associated Approved Document (Part 1) respond to this need by outlining detailed requirements for the assessment, modelling and verification of thermal bridge performance at ground floor junctions in New Welsh builds.

3. Proposed Regulation: Part Z-TB

3.1 Scope and purpose

The proposed Part Z-TB Regulation introduces new requirements to support the reduction of operational regulation carbon emissions in domestic buildings by improving thermal performance at key junctions (Zero Carbon Hub, 2015). Part Z-TB is intended to complement the existing Welsh Building regulations by providing more detailed technical standards for controlling heat-loss where building materials meet, beginning with floor-wall junctions in the first part of the Approved document.

3.2 Performance Requirements

Under Part Z-TB, all new domestic buildings and major refurbishments would be required to demonstrate significant reductions in fabric heat loss through enhanced insulation and high levels of airtightness. The regulation would show maximum allowable Psi-values for thermal junctions, with the floor-wall junction subject to a strict performance limit to ensure that the insulation continuity is maintained.

Designers would no longer be permitted to rely on Psi values for the critical junctions. Instead, compliance must be shown either using accredited low thermal bridge details or bespoke numerical thermal modelling carried out in line with (BS EN ISO 10211).

This requirement ensures that thermal performance is based on real construction details rather than theoretical assumptions, thereby reducing the performance gap often observed in domestic new builds.

4. Technical Guidance.

4.1 Understanding Thermal Bridging

Effective control of thermal bridging is required for domestic buildings to meet the performance requirements of the proposed document Part Z-TB. Thermal bridges happen wherever the insulation is interrupted, reduced or bypassed, allowing the heat to escape faster through the buildings fabric (Zero Carbon Hub 2015).

4.2 Importance of Floor-Wall Junctions

In domestic construction, one of the most significant spots for thermal bridging is the junction between the ground floor and the external wall. These floor-wall junctions are vulnerable because of the structural components, damp-proofing and construction sequencing come together it can create gaps or breaks in the insulation (Approved Document L – Wales, 2022). Reducing thermal bridging at this junction is therefore important for lowering energy use and improving the overall thermal performance of Welsh homes.

Floor-wall junctions typically involve a concrete slab, internal blockwork skin, insulation in the cavity, below the slab and damp proof course level. Each of these elements meet at different heights and positions, which can create the potential for cold bridging if they are not carefully detailed. For example, in many traditional construction methods, the insulation is placed under neath the slab while in the internal skin of the cavity walling runs into the ground, leaving a possible path for heat loss. This creates a cold spot along the edge of the slab (Zero Carbon Hub 2015), where the heat flows outward towards the external wall and ground. If external insulation is used the insulation may not align with the internal insulation and will also cause a thermal bridge (Zero Carbon Hub 2015).

Timber-framed buildings face similar issues where the soleplate interrupts the insulation continuity (Zero Carbon Hub 2015), allowing heat loss if the junction is not detailed correctly.

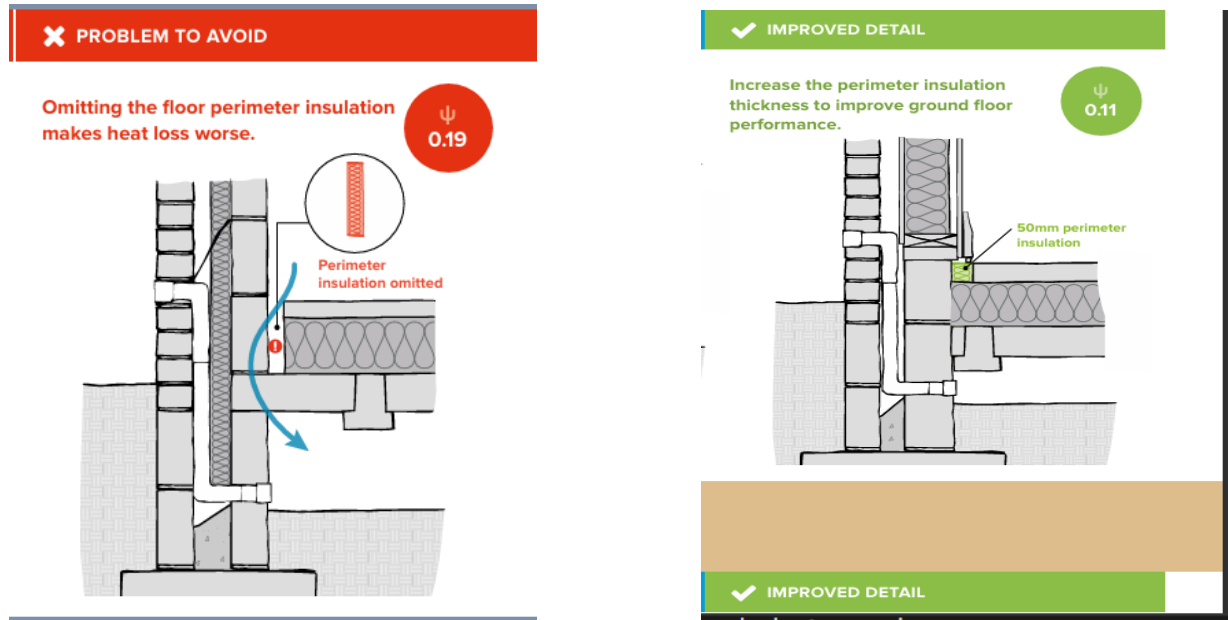
4.3 Modelling Requirements

The performance of a floor-wall junction is measured using a Psi value, which describes the heat loss per metre of junction, expressed in W/mk (Watts Per Metre-Kelvin). Under Part Z, Psi-values must be calculated by a numerical thermal-modelling software in accordance with (BS EN ISO 10211) using Approved methods such as (THERM) or (Flixo) ensuring that the reported value reflects the actual design rather than generic assumptions. This modelling uses two-dimensional or three-dimensional discretised heat flow analysis to identify pathways of increased thermal transmittance and to quantify the effect of junction design on overall heat loss. For domestic dwellings, achieving a low Psi-value in the region of 0.03 to 0.06W/mk is critical in reducing the buildings overall Y-value (Zero Carbon Hub 2015), which contributes to SAP calculations BRE (2020) SAP documentation and determines energy performance ratings.

4.4 Strategies To Reduce Heat Loss

A range of strategies can be used to reduce thermal bridging at floor-wall junctions. One of the most effective methods is to ensure that the insulation is continuous and well aligned between the concrete slab and external wall leaving no exposed structural elements. For example, using upstanding insulation around the perimeter of the concrete slab can significantly reduce heat loss from the edge of the slab.

In block and beam floors, laying insulation above the structural floor and ensuring it meets the cavity can prevent thermal bypass. In timber framed builds, raising the sole plate above the insulation line or using a thermal broken threshold support can help maintain continuity. These approaches must be supported by accurate design drawings and sequencing plans to ensure the continuity is achieved on site.



Both images are referenced from (Zero Carbon Hub 2015)

4.5 Material Specification

The use of thermal efficient materials is also central to good junction design. Thermally broken wall ties, thermalite blocks and low conductive fixings can reduce point break thermal bridges within the junction.

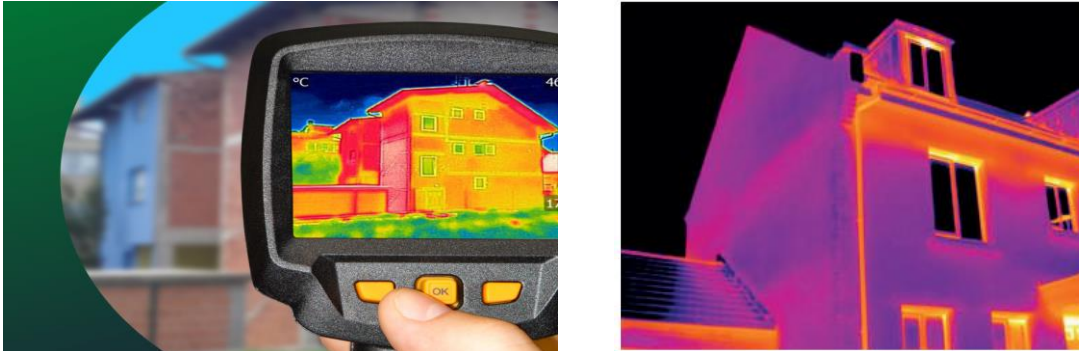
For high performance domestic buildings including those designed to Passivhaus or LETI standards, the use of external insulation systems are often preferred because it naturally provides across junctions. However, even when external insulation is used, detailing around windowsills thresholds and floor levels must still be carefully designed to prevent cold spots (Zero Carbon Hub 2015).

4.6 Construction Quality and Verification

Construction quality plays a crucial role in achieving the designed Psi-value. Even a well-designed junction can perform poorly if insulation is not installed correctly, if gaps remain at interfaces, or if workmanship fails to follow the specified details.

Under Part Z, construction teams would be required to photograph junctions before they are covered, demonstrating that insulation continuity has been maintained and the materials are correctly installed.

Thermal imaging conducted during post construction stage is recommended to verify performance, ideally under winter conditions where heat loss patterns are more visible. This provides a reliable method of finding cold spots and confirming that floor level insulation is continuous (Bedford, 2020).



5. Compliance and Verification

5.1 Demonstrating compliance

Under the proposed Part Z-TB Regulations Designer and contractors must ensure that the floor-wall junctions meet the required the required performance standards. Compliance starts at the design stage, where the Psi-value must reflect the actual materials, dimensions and construction methods using approved modelling software such as (THERM) or (Flixo), in line with BS EN ISO 10211. These calculations must be included within the design document that's submitted for building control approval.

The Psi Value must reflect the actual materials, dimensions and building methods used, ensuring that the predicted performance is realistic and achievable.

5.2 Construction Detailing

To support compliance there will need to be clear and accurate construction details. These drawings need to show exactly how the insulation will remain continuous at the junction, how it connects to the wall insulation and how the building's fabric such as concrete slabs, blocks, sole plates and DPC level will interact.

Details must be discussed between the architects, structural engineers and the teams on site to avoid any issues. Any changes made during the construction must be reviewed to ensure that they do not compromise the junction's performance.

5.3 Onsite Verification

The quality of work plays a crucial role in ensuring the junctions performs as modelled. Under Part Z-TB, Contractors will be required to provide photographs of the floors-wall junction before it is covered (Welsh Government, 2022).

These photos will show the insulation in place, its alignment with the cavity insulation and the absence of gaps. Site managers/supervisors must check that the detail matches the approved drawings and raise any issues before the work continues.

This method ensures quality control and minimises potential thermal bridges.

5.4 Post Construction Testing

Thermal imaging is recommended post construction, Thermography can identify areas where the heat loss is higher than expected, highlighting any issues with building continuity. Testing under cold external conditions increases accuracy as heat flow patterns become more visible.

If thermal inconsistencies appear, they must be investigated and rectified where practical. This will provide confidence that the junction is performing as it should.

6. Worked Example: Floor-Wall Junction Compliance.

6.1 Example Scenario

A New dwelling in South Wales is built and is using a traditional build cavity walling with a suspended block and beam floor. Default Psi-Values result in a higher than the desired Y-Value, so a detailed junction model is created.

6.2 Modelling the Junction

The junction is modelled using (Flixo), following the procedures in BS EN ISO 10211. The model shows a Psi-values of 0.085 W/Mk, which is above the recommended level for good thermal performance. The architect revises the detail by adding perimeter insulation and ensuring that the insulation sits above the suspended flooring rather than below it.

The updated model gives a Psi-value of 0.042 W/Mk, which meets the performance requirement set out Part Z-TB.

6.3 Construction Stage

During the construction, the builders install the upstand and will make sure that it will align with the cavity insulation. Photos are taken before the floor screed is laid, Showing full coverage and the correct positioning of the DPC. A supervisor will check the photos against the approved detail and confirms compliance.

6.4 Thermal imaging Verification

Once the house is occupied, a thermographic survey is carried out in winter to confirm the expected performance. The imaging shows consistent temperature around the floor perimeter with no visible cold spots, this shows that the junction is performing in line with the modelled Psi Value.

6.5 Outcome

The building achieves a lower Y-value in the SAP assessment, improving the overall energy performance. The successful modelling, detailed design and on-site verification demonstrate how Part Z-TB can effectively reduce thermal bridging at floor-wall junctions.

7. Conclusion

Thermal bridging at the floor-wall junction is a major source of unintended heatloss in domestic buildings (Zero Carbon Hub 2015), this contributes to higher carbon demand and increased risk of condensation issues. The proposed Part Z-TB regulation aims to address this by providing clear performance requirements, modelling standards and verification procedures to ensure that insulation continuity is maintained at this critical junction.

By requiring architects to use approved modelling methods such as (THERM) or (Flixo), and by placing the responsibility on the contractors to demonstrate correct installation through photographic evidence, Part Z-TB Helps reduce the performance gap between design and as built construction.

The use of thermal imaging provides confidence that the junctions are performing as they should be once the building is occupied.

This approved document (Part 1) provides the foundational guidance that is needed to assess and reduce thermal bridging at floor wall junctions. Future parts will expand upon this by looking at other junctions and additional fabric performance considerations.

Together these measures support Wales broader aim of reducing operational carbon emissions and achieve more energy efficient homes (Welsh Government, 2021).

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