Don’t Let Thermal Bridging Undermine Your Building’s Performance

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Outline

• What is a thermal bridge
• Identifying thermal bridges
• Measuring thermal bridges
• Managing thermal bridges
• Demonstrating thermal bridge simulations
What is a thermal bridge?
Part of the building envelope where the otherwise uniform thermal resistance is significantly reduced by:

- full or partial penetration of the insulating layers by materials with a different thermal conductivity

- and/or
  - a change in thickness of the insulating layers

- and/or
  - a difference between internal and external areas, such as occurs at wall/floor/ceiling junctions.
3 Types of linear thermal bridges

- Geometric
  (> 60° change in orientation)
- Construction
- Repeating
Cold surfaces, mold, condensation, heat loss
Identifying thermal bridges
Q: What makes a good junction detail?

- Clear drawing showing all necessary detail
  - All materials and conductivities
  - Dimensions
  - Air barrier materials and connections
- Description of how connections are made
Good Detail
Good Detail

1. Well compacted hardcore to SE details and specification.
2. Ground bearing concrete slab details reinforcement and design mix to SE details and specification.
3. Dense concrete blockwork to SE details and specification. 1850-2300kg/m^3.
4. Preformed Visqueen DPC & Radon barrier sections taped and linked to DPM.
5. EPS flooring grade insulation to achieve a minimum U-value of 0.10 W/m²K.
6. 65mm fibre reinforced sand cement screed.
7. 20mm vertical flooring grade insulation.
8. Mastic pointing between floor tiling and U/S of skirting.
9. 18mm timber skirting.
10. Pro clima Contega FC Masonry junction airtight tape.
11. Visqueen DPM & Radon barrier linked and taped to DPC.
12. Insulating blockwork faced up to the external face. Blockwork to SE specification and details.
13. External wall insulation suppliers EPS insulation (suitable for below DPC construction) on primer (2 coats) on recommended EWI suppliers adhesive and reinforcing mesh.
15. Dense concrete blockwork laid on flat and faced up to the external face to SE approval and details.
16. 2 Part Aluminum starter track (to avoid thermal bridge) by External Wall Insulation supplier.
17. External Wall Insulation supplier adhesive.
18. External Wall Insulation supplier 250mm thick (or as dimensioned) insulation fixed to substrate with adhesive and mechanical fixings incorporating insulation dowels to achieve a U Value of 0.10W/m2C.
19. External Wall Insulation (EWI) supplier decorative finish on EWI primer on EWI ground coat and reinforcing mesh on insulation board.
20. 10mm thick ceramic floor tiles on 5mm adhesive bed.

What’s missing?
- Material types
- Material conductivities
Poor detail

What’s missing?
- Dimensions
- Wall materials
- EPS Type
- Air barrier to wall
- Air barrier connection details

4" 20 MPa Concrete Floor
10" EPS Insulation
8-MIL Poly Vapour Barrier
6"x16" 20 MPa Concrete Strip Footing:
Blueskin (or Equiv.) Wrapped
0.5" Anchors @ 48" O.C.
2.25" Drain Pipe @ 48" O.C.
Good Detail

1. PRE-FIN. 22ga. METAL FLASHING
2. BUILDING WRAP
3. SELF-ADHERING W/P MEMBRANE (SAM)
4. CONT. FLEXIBLE EXT. GRADE SEALANT & FOAM BACKER ROD - FRONT AND BACK OF WINDOW FRAME
5. RIGID INSULATION
6. WINDOW Rebate FASTENER CLIP
7. WINDOW FRAME & GLAZING TO MEET PPH+ PERFORMANCE REQU'TS.
8. CONT. FLEXIBLE EXT. GRADE SEALANT & FOAM BACKER ROD
9. GYPSUM WALLBOARD
10. SELF-ADHERING A/B TAPE & SEALANT - PROVIDE CONT. CONNECTION OF OSB A/B LVR WITH WINDOW FRAME
11. OSB A/B LAYER
12. CONT. 1.5 X 1.5 ALUM. SILL INSTALL ANGLE
13. 1 ENG. or SOLID STONE SILL
Inadequate Detail
“A break in the thermal continuity of the building envelope

Source: PHI, Author: J S
How do we identify them?

1. Visually

2. Thermal Imaging

3. Temperature Probe

4. Calculation
Quantifying Thermal Bridging

How can you quantify the amount thermal bridging?

1. Inspection: Is it TB free?
   - Continuous insulation
   - Amount of bridging material
   - Conductivity of bridging material
Qualitative Assessment

Is this detail thermal-bridge free?
Qualitative Assessment

Is this detail thermal-bridge free?

\[ U_{\text{Dach}} = 0.12 \text{ W/(m}^2\text{K)}, \]
\[ U_{\text{Wand}} = 0.12 \text{ W/(m}^2\text{K)}, \]
\[ \Psi_a = -0.026 \text{ W/(mK)} \]
Qualitative Assessment

Is this detail thermal-bridge free?
Measuring thermal bridges
The ‘PSI’ Value

\[ \Psi = \text{Heat loss with bridge} - \text{Heat loss without bridge} \]

It’s an accounting principle!