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Thermal Bridging and Part L Compliance

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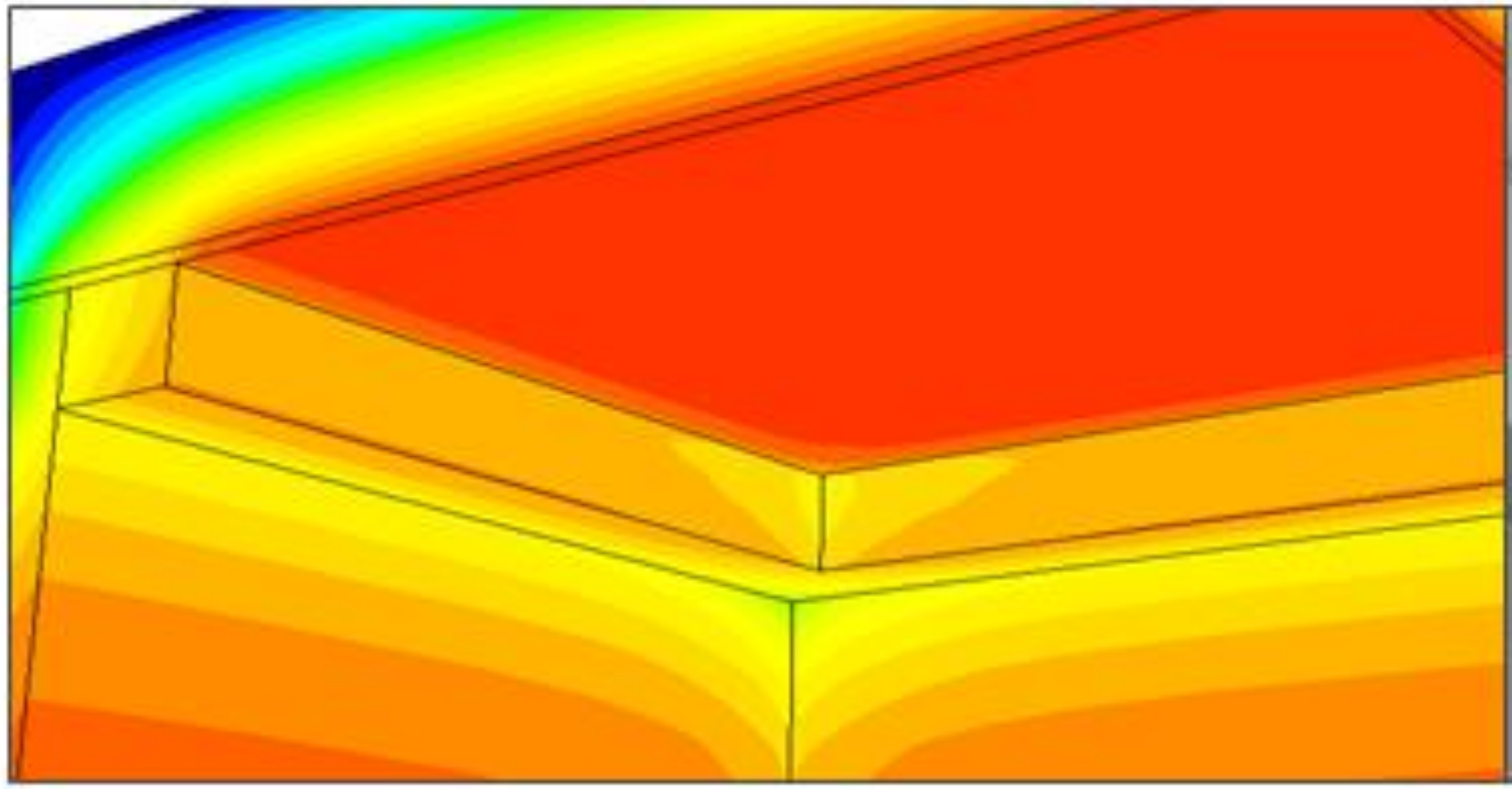
Department of Housing, Local Government and Heritage

1 Thermal Bridging for New Houses

Learning outcome:
How do you assess compliance?



1) Heat Loss

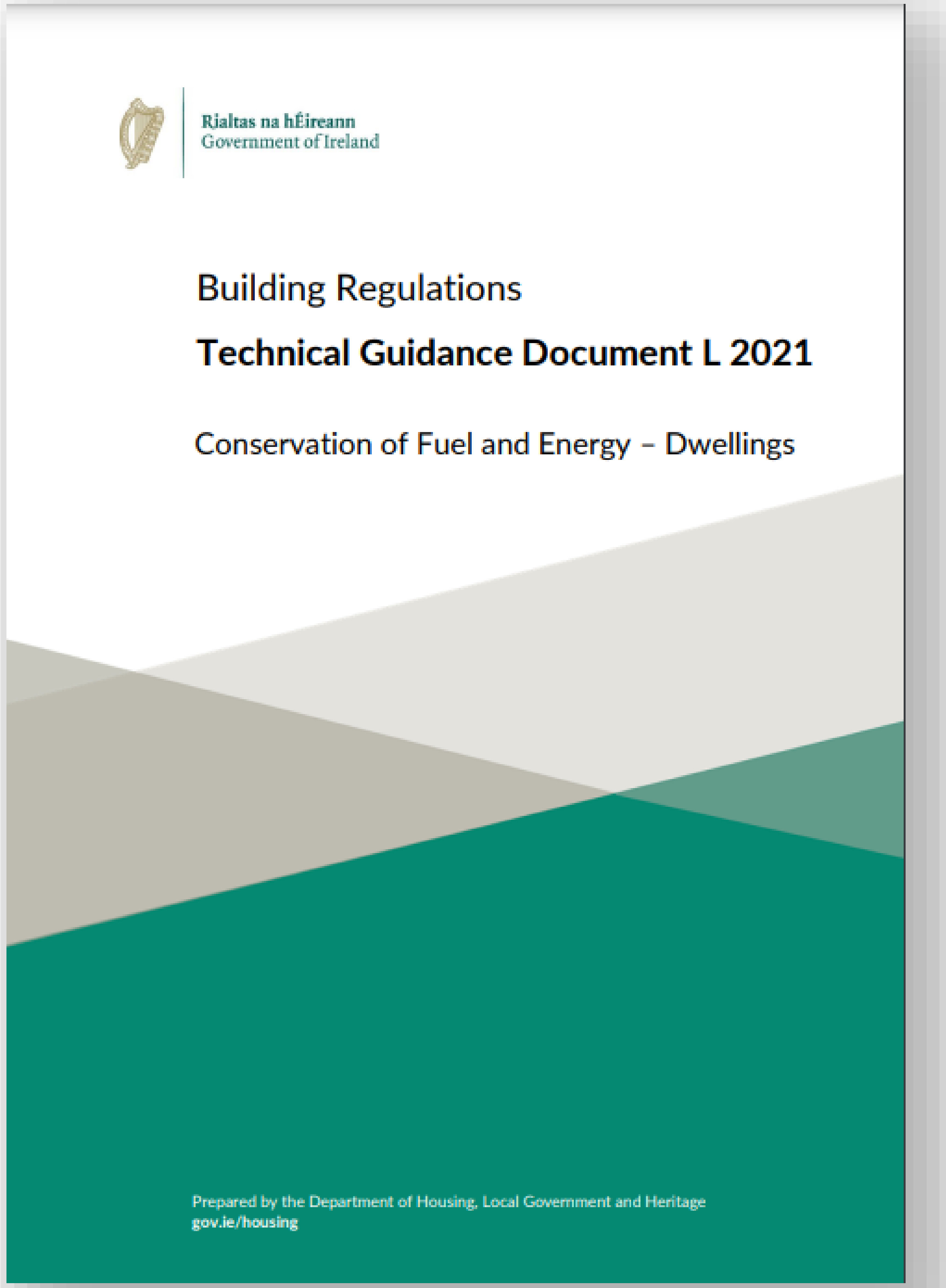
2) Surface Condensation

2 Regulatory Context

Building Regulations

Part L of the Second Schedule to the Building Regulations - **Regulation L1**

A building shall be designed and constructed so as to ensure that the energy performance of the building is such as to limit the amount of energy required for the operation of the building and the amount of carbon dioxide (CO_2) emissions associated with this energy use insofar as is reasonably practicable.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Building Regulations

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Conservation of Fuel and Energy – Dwellings

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European Union (Energy Performance of Buildings) Regulations 2019

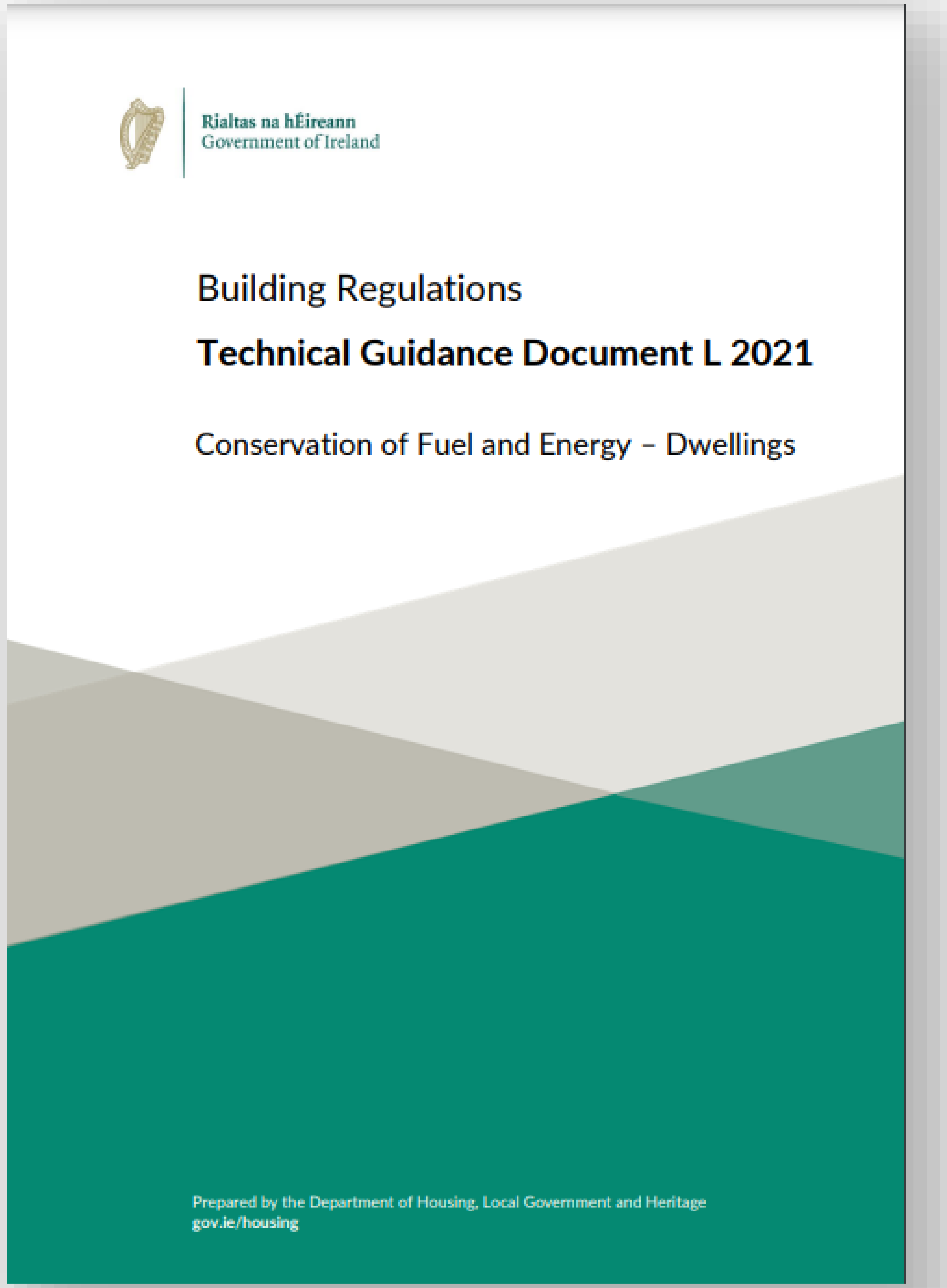
(S.I. No. 183 of 2019)

Regulation 8

For new dwellings, the nearly zero energy performance requirements of this regulation shall be met by:

[…]

(c) limiting the heat loss and, where appropriate, availing of heat gain through the fabric of the building;



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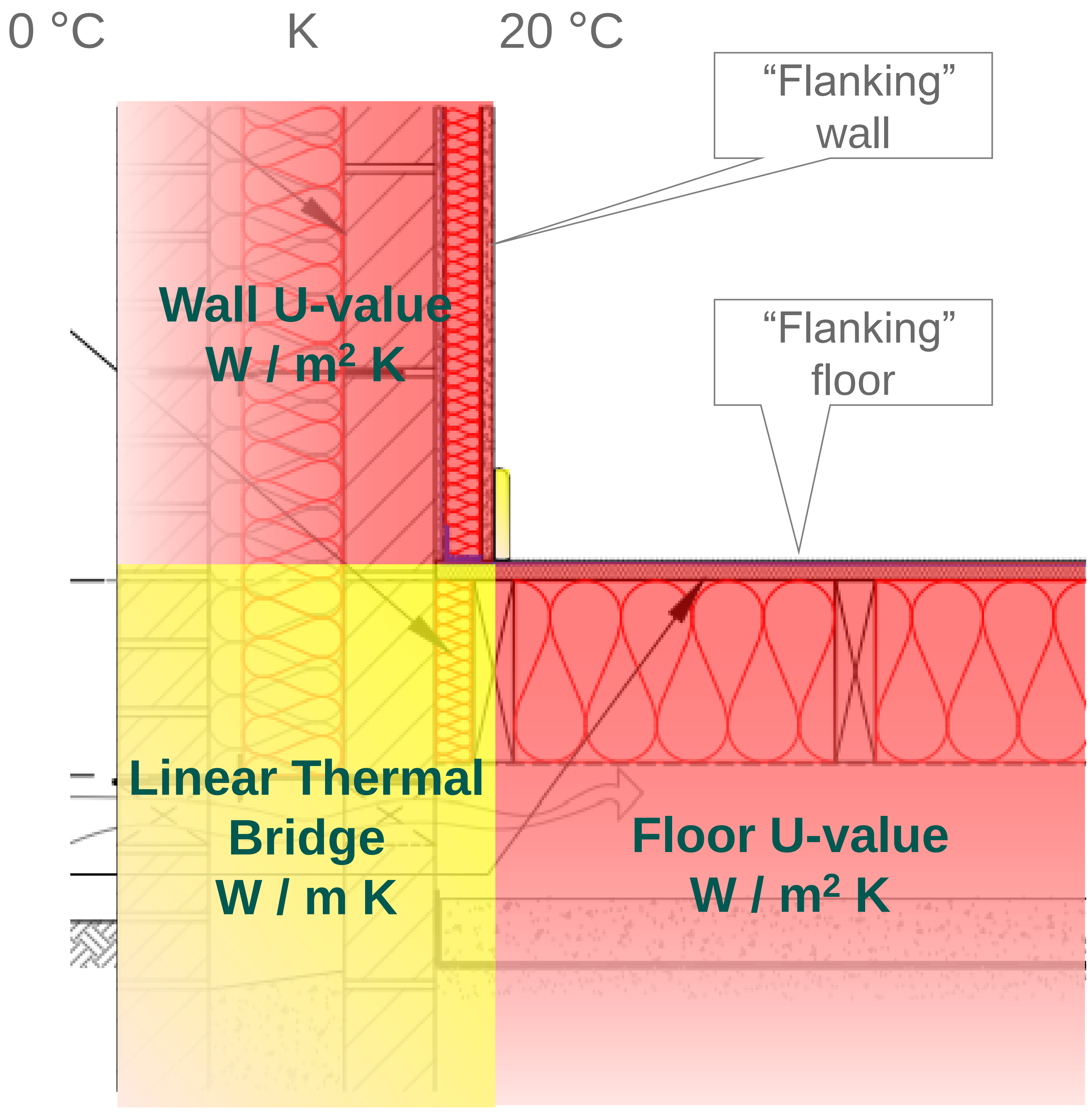
3

Technical Guidance Document L

What is Thermal Bridging?

- Heat loss through planar elements is accounted for in their respective U-values.
- There is a need to account for the extra heat loss that occurs at junctions between planar elements (wall, floor, roof, windows & doors).
- The extra heat loss associated with the junction is measured by its “Psi-value”.
- This is determined by thermal modelling.



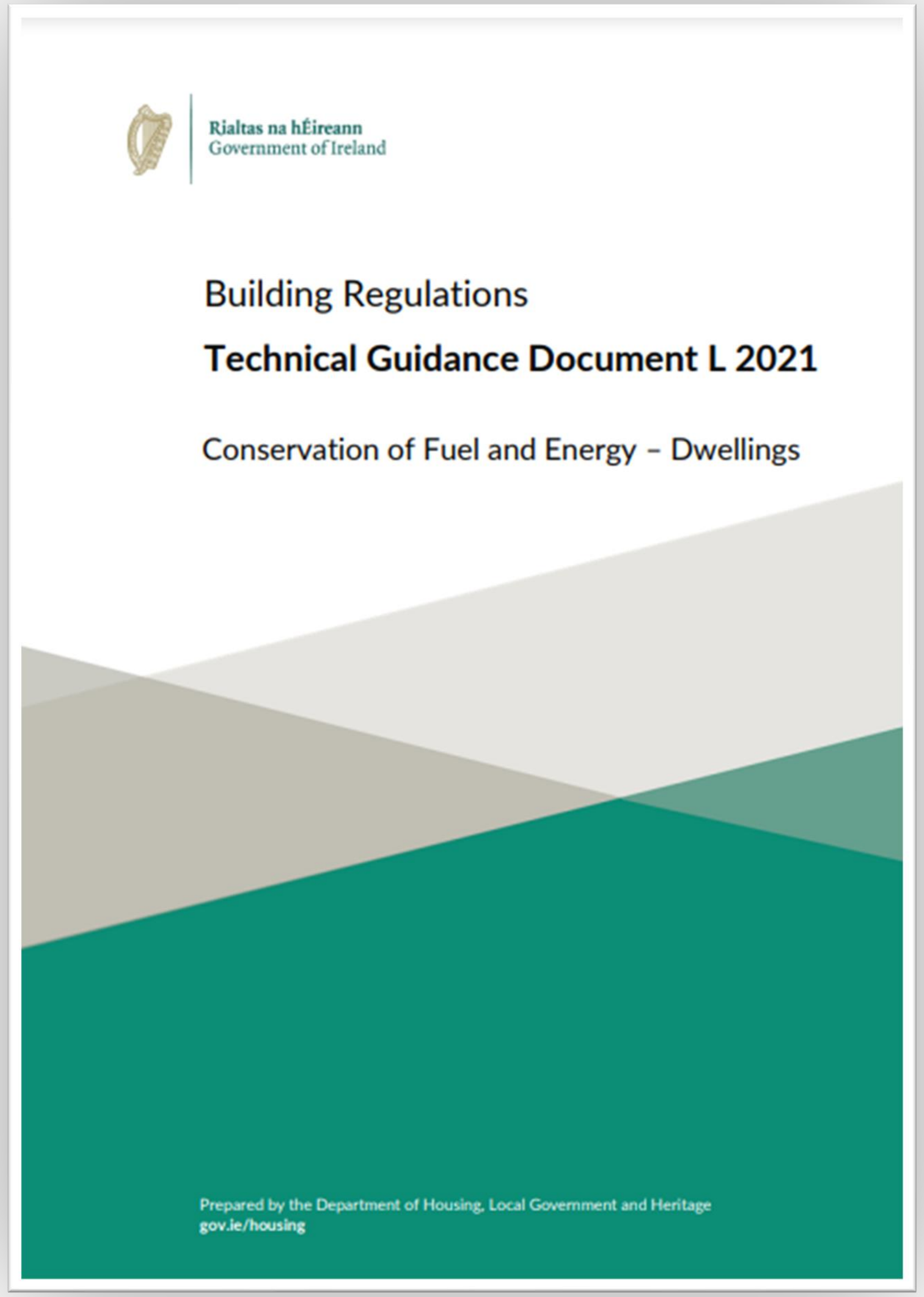
TGD L guidance on Thermal Bridging

TGD L – Paragraph 1.3.3.1

To avoid **excessive heat losses** and local **condensation** problems, reasonable care should be taken to ensure continuity of insulation and to limit local thermal bridging at key junctions, e.g. around windows, doors, other wall openings and at junctions between elements.

Any thermal bridge should not pose a risk of surface or interstitial condensation.

- **Appendix D.2** provides further information on assessing surface condensation risk and
- **Appendix B.3** provides information on assessing interstitial condensation risk.

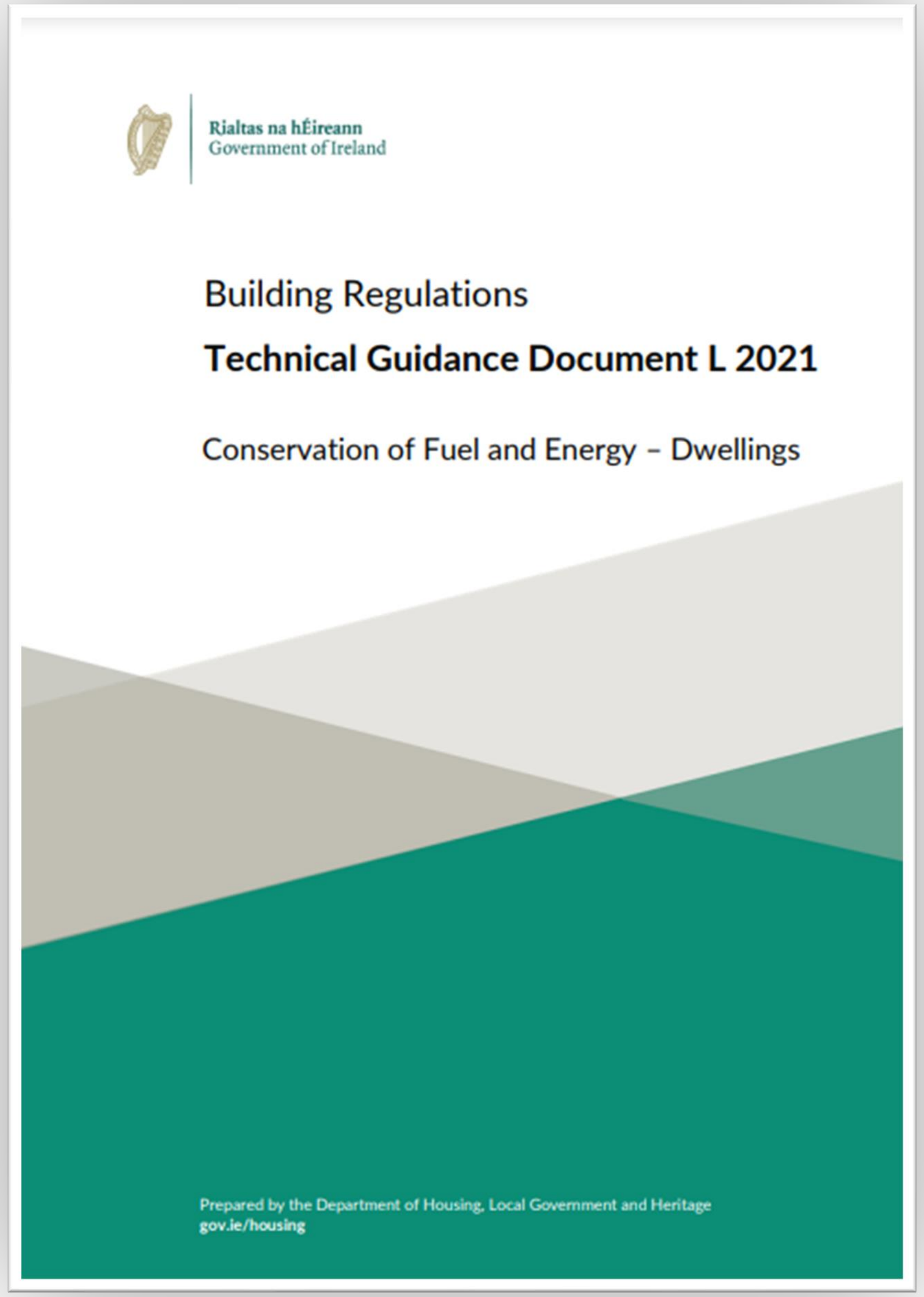


TGD L guidance on Thermal Bridging

TGD L – Paragraph 1.3.3.1 continued

Heat loss associated with thermal bridges is taken into account in calculating energy use and CO2 emissions using the DEAP methodology.

See **Appendix D** for further information in relation to thermal bridging and its effect on dwelling heat loss and how this is taken account of in DEAP calculations.



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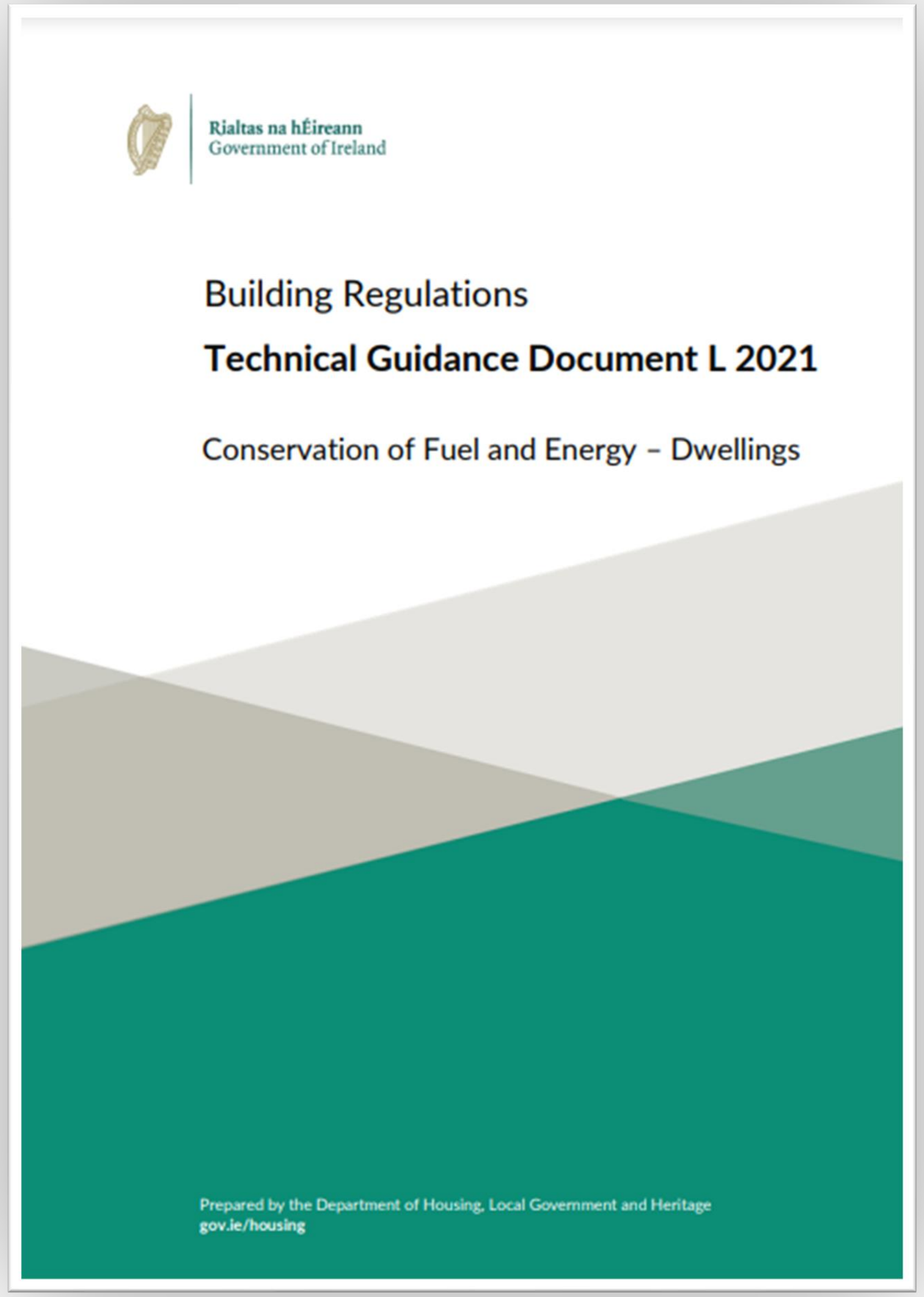
TGD L guidance on Thermal Bridging

TGD L – Paragraph 1.3.3.2 (summary)

The following represents alternative approaches to making **reasonable provision** with regard to limitation of thermal bridging:

i. adopt **Acceptable** Construction Details for all key junctions;
ii. adopt Acceptable Construction Details in combination with other **certified** details for all key junctions;
iii. use certified details for all key junctions;
iv. use **alternative** details which limit the risk of mould growth and surface condensation to an acceptable level

as set out in paragraph D.2 of Appendix D for all junctions.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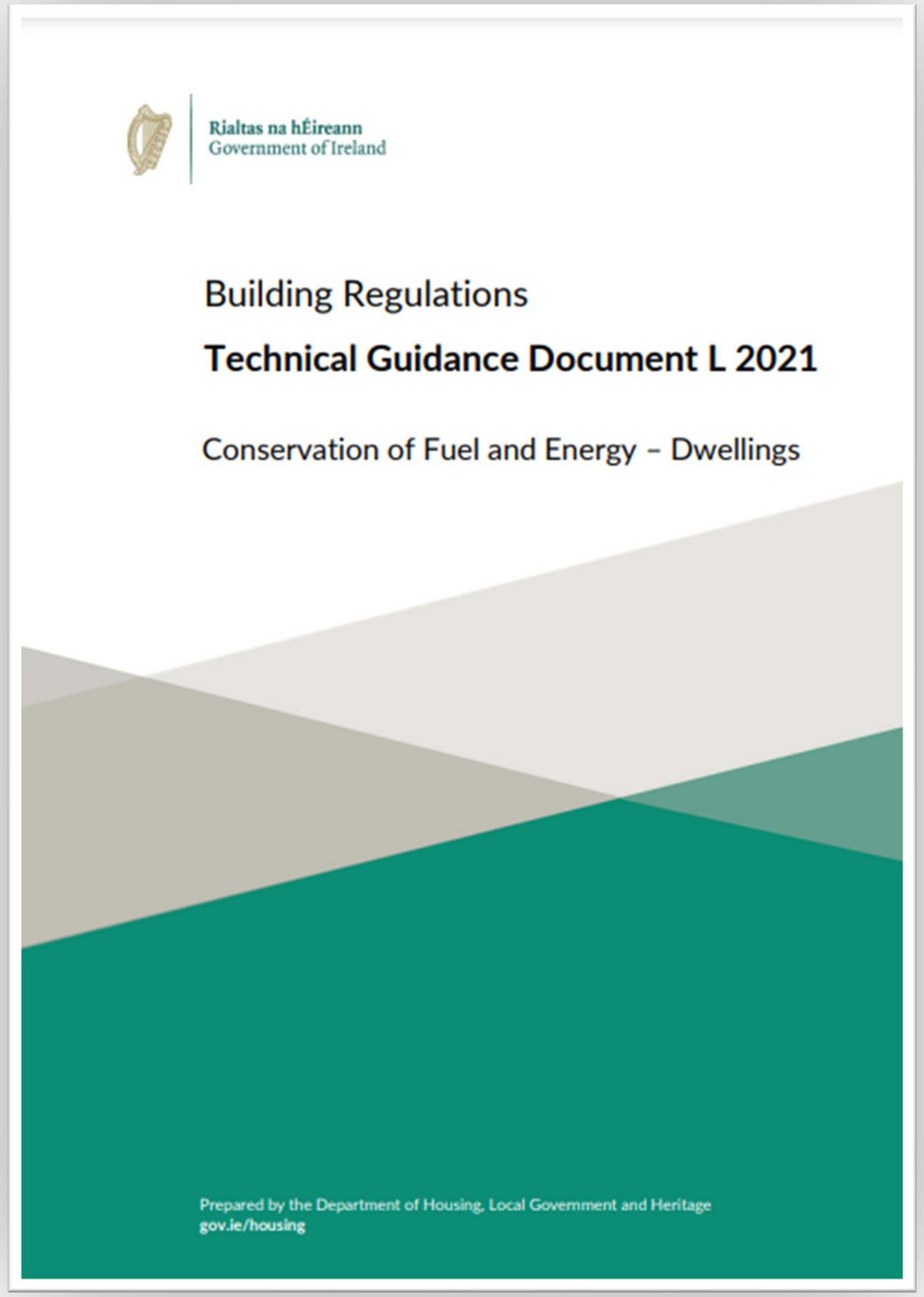
Thermal Bridging in DEAP calculations

TGD L – Paragraph 1.3.3.3

The DEAP calculation of primary energy use and CO_2 emissions takes account of thermal bridging effects.

In general, this is done by including **an allowance for additional heat loss due to thermal bridging**, expressed as a multiplier (“y”) applied to the total exposed surface area, or by the calculation of the transmission heat loss coefficient H_{TB}.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Conservation of Fuel and Energy – Dwellings

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Reasonable Provision for Thermal Bridging

TGD L – Paragraph 1.3.3.2 and 1.3.3.3 (summary)

Para. 1.3.3.2	Reasonable provision alternatives	Value of y ("y-value" or "Y-factor")
(i)	Adopt **Acceptable** Construction Details for all key junctions	**0.08** *or* Calculated using the psi values given in Tables D1 to D6 in Appendix D
(ii)	Adopt Acceptable Construction Details in combination with other **certified** details for all key junctions	Calculated using the psi values given in Tables D1 to D6 in Appendix D and other certified Psi values
(iii)	Use certified details for all key junctions	Calculated using certified Psi values for the specific details adopted
(iv)	Use **alternative** details which limit the risk of mould growth and surface condensation to an acceptable level as set out in paragraph D.2 of Appendix D for all junctions	**0.15**

Three kinds of details

- **Acceptable** Details
- **Certified** Details
- **Alternative** Details
  compliant with Appendix D.2
  - *for avoiding mould*
  - *and surface condensation*

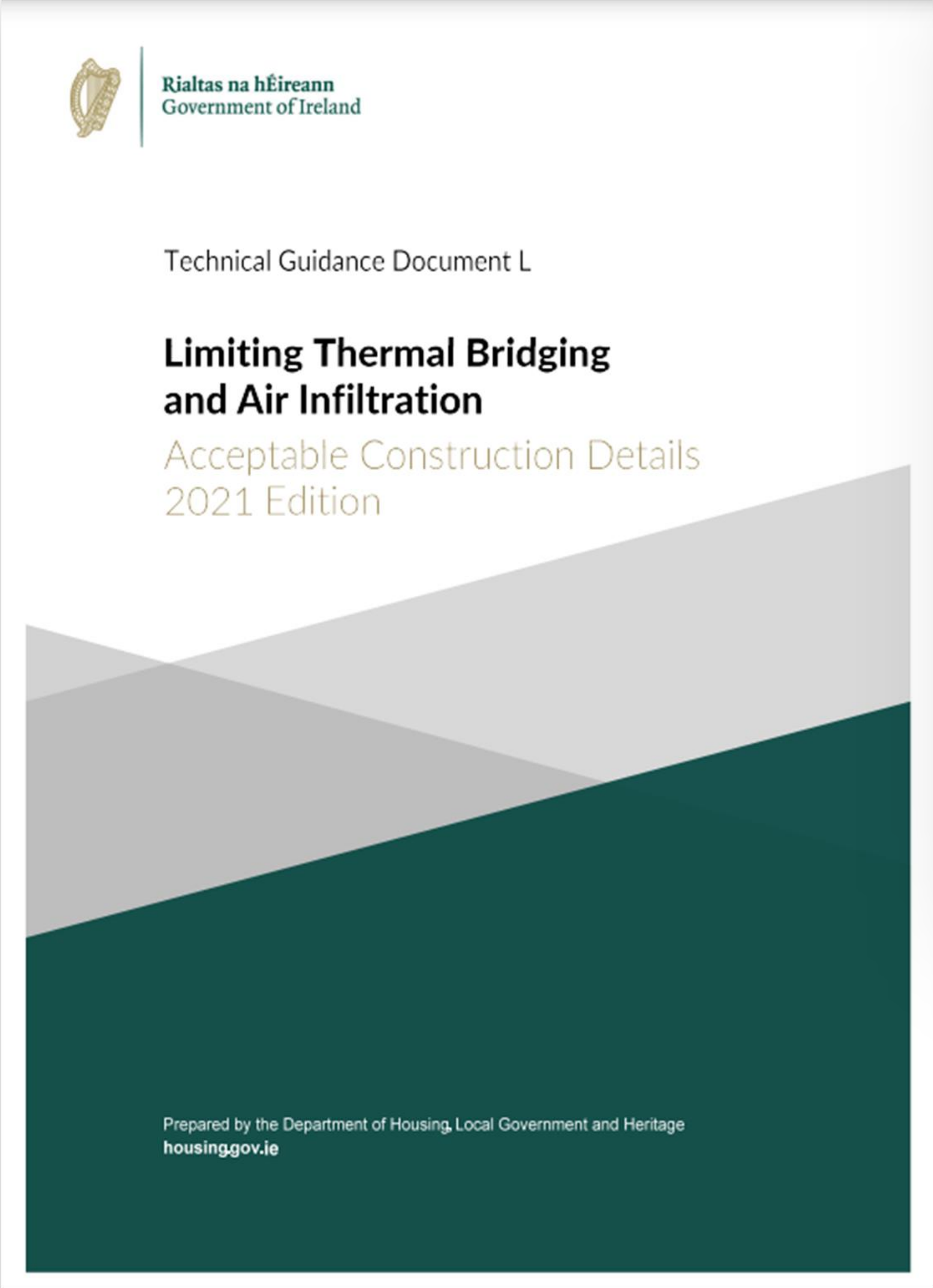
Para. 1.3.3.2	Reasonable provision alternatives
(i)	Adopt Acceptable Construction Details for all key junctions
(ii)	Adopt Acceptable Construction Details in combination with other certified details for all key junctions
(iii)	Use certified details for all key junctions
(iv)	Use alternative details which limit the risk of mould growth and surface condensation to an acceptable level as set out in paragraph D.2 of Appendix D for all junctions

What are “Acceptable Construction Details”?

TGD L supplementary guidance document **“Limiting Thermal Bridging and Air Infiltration”**

Part 1:
General theory of insulation continuity and air tightness

Part 2:
Acceptable Construction Details



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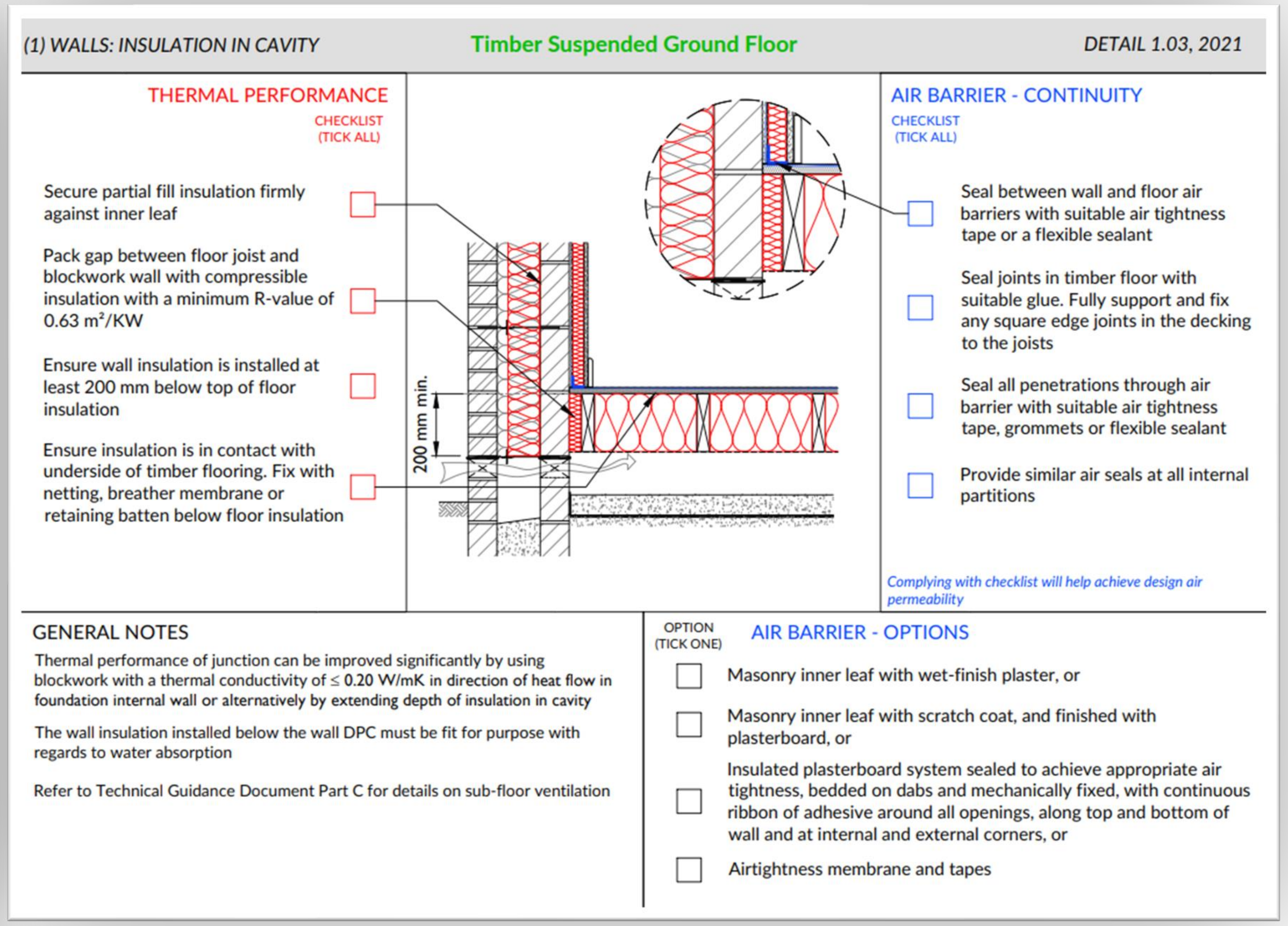
Technical Guidance Document L

Limiting Thermal Bridging and Air Infiltration

Acceptable Construction Details
2021 Edition

Prepared by the Department of Housing, Local Government and Heritage
housing.gov.ie



(1) WALLS: INSULATION IN CAVITY | Timber Suspended Ground Floor | DETAIL 1.03, 2021

THERMAL PERFORMANCE
CHECKLIST
(TICK ALL)

- Secure partial fill insulation firmly against inner leaf
- Pack gap between floor joist and blockwork wall with compressible insulation with a minimum R-value of 0.63 m²/KW
- Ensure wall insulation is installed at least 200 mm below top of floor insulation
- Ensure insulation is in contact with underside of timber flooring. Fix with netting, breather membrane or retaining batten below floor insulation

AIR BARRIER - CONTINUITY
CHECKLIST
(TICK ALL)

- Seal between wall and floor air barriers with suitable air tightness tape or a flexible sealant
- Seal joints in timber floor with suitable glue. Fully support and fix any square edge joints in the decking to the joists
- Seal all penetrations through air barrier with suitable air tightness tape, grommets or flexible sealant
- Provide similar air seals at all internal partitions

Complying with checklist will help achieve design air permeability

GENERAL NOTES

Thermal performance of junction can be improved significantly by using blockwork with a thermal conductivity of ≤ 0.20 W/mK in direction of heat flow in foundation internal wall or alternatively by extending depth of insulation in cavity

The wall insulation installed below the wall DPC must be fit for purpose with regards to water absorption

Refer to Technical Guidance Document Part C for details on sub-floor ventilation

OPTION
(TICK ONE)

AIR BARRIER - OPTIONS

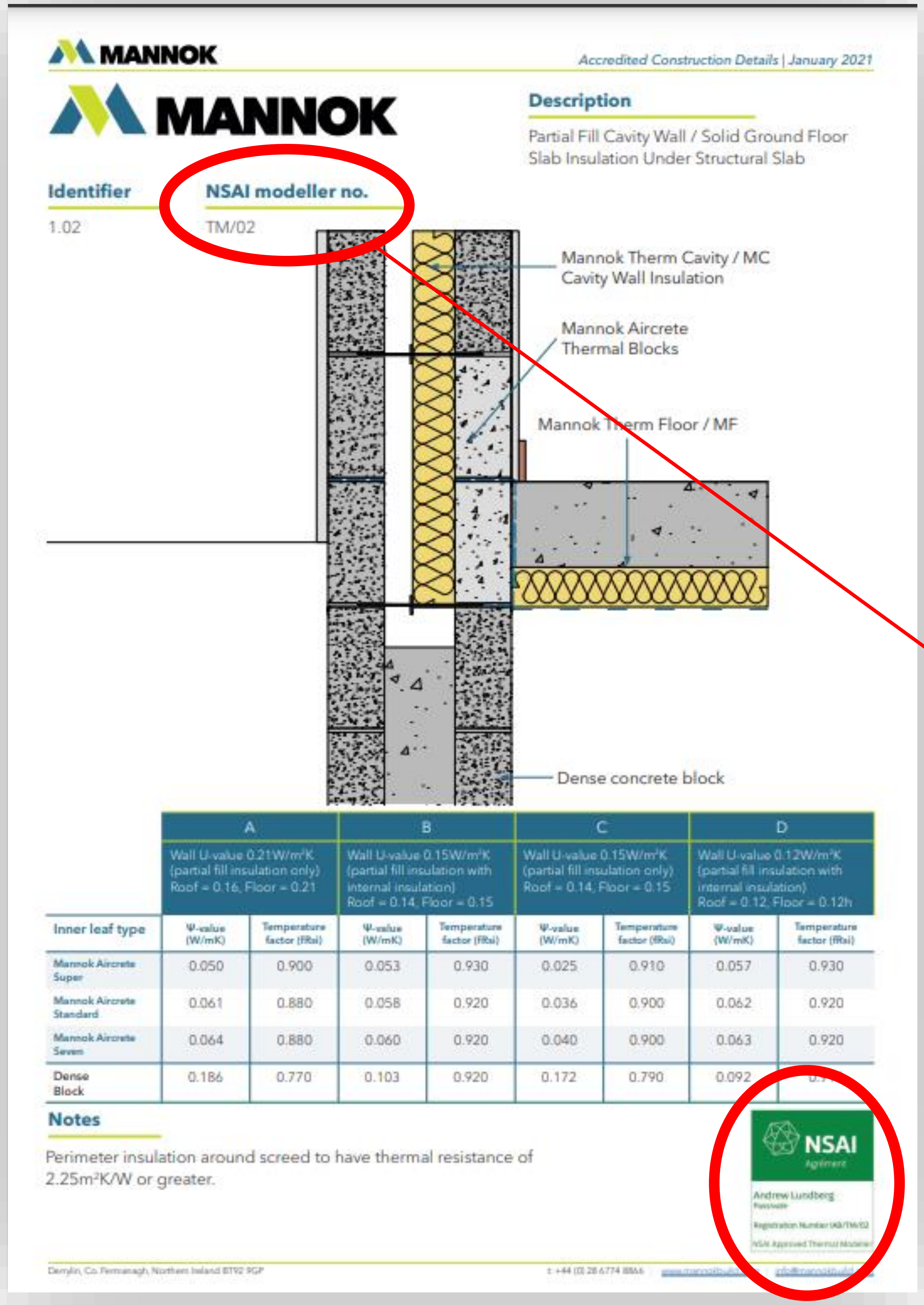
- Masonry inner leaf with wet-finish plaster, or
- Masonry inner leaf with scratch coat, and finished with plasterboard, or
- Insulated plasterboard system sealed to achieve appropriate air tightness, bedded on dabs and mechanically fixed, with continuous ribbon of adhesive around all openings, along top and bottom of wall and at internal and external corners, or
- Airtightness membrane and tapes

Download:
https://www.gov.ie/en/publication/d82ea-technical-guidance-document-l-conservation-of-fuel-and-energy-dwellings/#acceptable-construction-details

What are “Certified” Details?

These are details certified under the NSAI Thermal Modellers Scheme (or equivalent independent INAB accredited schemes)

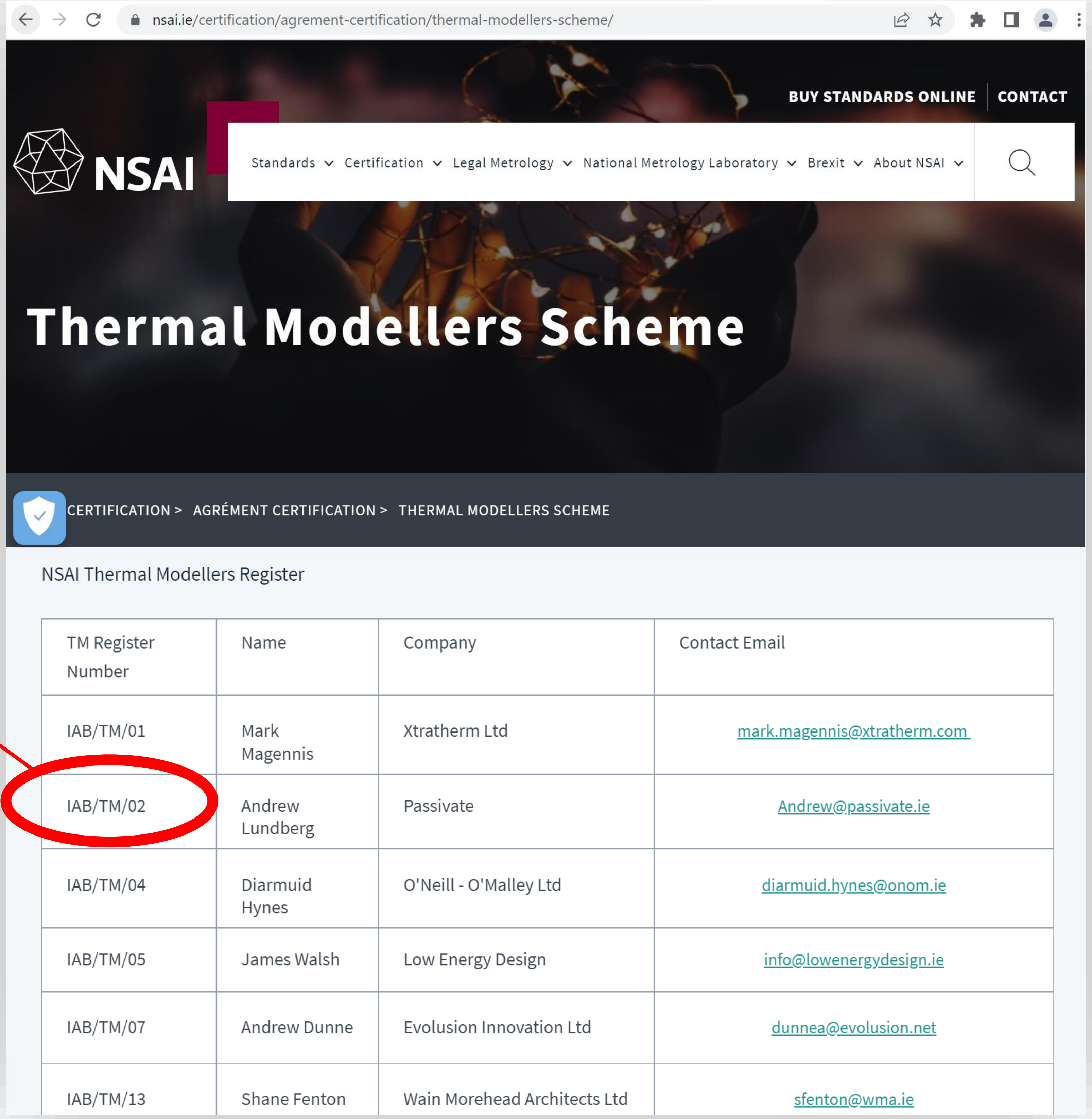
The purpose of the NSAI scheme is to allow applicants to register as an approved Thermal Modeller of thermal bridging details and junctions, for the purpose of compliance with Clause 1.3.3.2 (iii) of Technical Guidance Document Part L Conservation of Fuel and Energy - Dwellings.



	A		B		C		D	
	Wall U-value 0.21W/m²K (partial fill insulation only) Roof = 0.16, Floor = 0.21		Wall U-value 0.15W/m²K (partial fill insulation with internal insulation) Roof = 0.14, Floor = 0.15		Wall U-value 0.15W/m²K (partial fill insulation only) Roof = 0.14, Floor = 0.15		Wall U-value 0.12W/m²K (partial fill insulation with internal insulation) Roof = 0.12, Floor = 0.12h	
Inner leaf type	Ψ-value (W/mK)	Temperature factor (fRsi)	Ψ-value (W/mK)	Temperature factor (fRsi)	Ψ-value (W/mK)	Temperature factor (fRsi)	Ψ-value (W/mK)	Temperature factor (fRsi)
Mannok Aircrete Super	0.050	0.900	0.053	0.930	0.025	0.910	0.057	0.930
Mannok Aircrete Standard	0.061	0.880	0.058	0.920	0.036	0.900	0.062	0.920
Mannok Aircrete Seven	0.064	0.880	0.060	0.920	0.040	0.900	0.063	0.920
Dense Block	0.186	0.770	0.103	0.920	0.172	0.790	0.092	[illegible]

Notes

Perimeter insulation around screed to have thermal resistance of 2.25m²K/W or greater.



TM Register Number	Name	Company	Contact Email
IAB/TM/01	Mark Magennis	Xtratherm Ltd	mark.magennis@xtratherm.com
IAB/TM/02	Andrew Lundberg	Passivate	Andrew@passivate.ie
IAB/TM/04	Diarmuid Hynes	O'Neill - O'Malley Ltd	diarmuid.hynes@onom.ie
IAB/TM/05	James Walsh	Low Energy Design	info@lowenergydesign.ie
IAB/TM/07	Andrew Dunne	Evolusion Innovation Ltd	dunnea@evolusion.net
IAB/TM/13	Shane Fenton	Wain Morehead Architects Ltd	sfenton@wma.ie

https://www.nsai.ie/certification/agrement-certification/thermal-modellers-scheme/

What are “Alternative” Details?

Any other detail which is compliant with Appendix D.2 for **mould growth** and **surface condensation**

The key factor used in assessing the risk of mould growth or surface condensation in the vicinity of thermal bridges is the **temperature factor** (f_{Rsi}). The temperature factor (f_{Rsi}) is defined as follows:

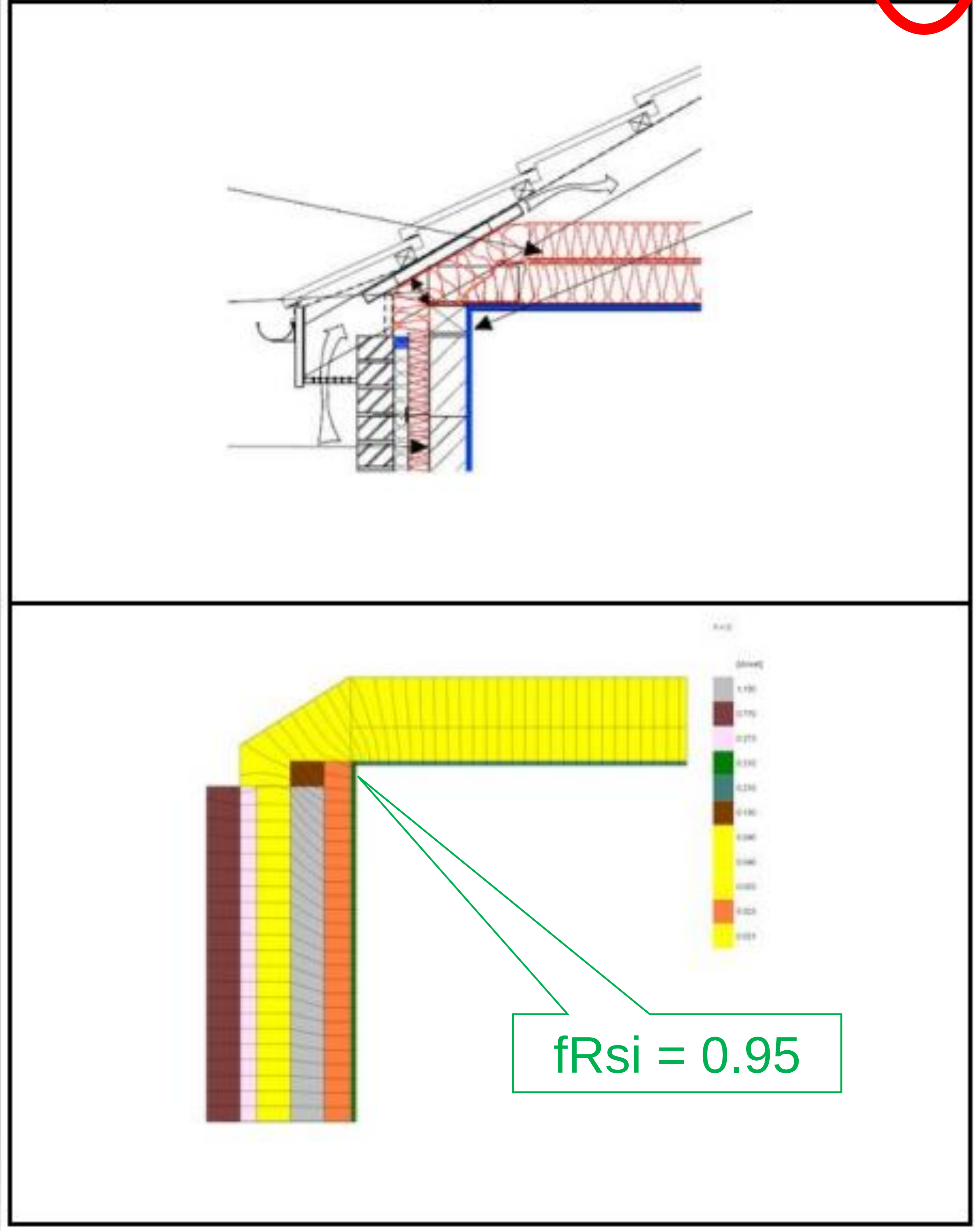
$$f_{Rsi} = (T_{si} - T_e) \; / \; (T_i - T_e)$$

Where: T_{si} = minimum internal surface temperature,
T_e = external temperature, and
T_i = internal temperature.

For dwellings, the value of f_{Rsi} should be greater than or equal to **0.75**, so as to avoid the risk of mould growth and surface condensation.

For three-dimensional corners of ground floors this value may be reduced to 0.70, for all points within 10 mm of the point of lowest f_{Rsi}.

1.09	0.12 Wall U-value - Cavity Walls	U_{Wall}	U_{Roof}	U_{Floor}	Ψ	ƒ
	Eaves - Ventilated roof space	0.12	0.14	0.00	0.031	0.95



What are “Alternative” Details?

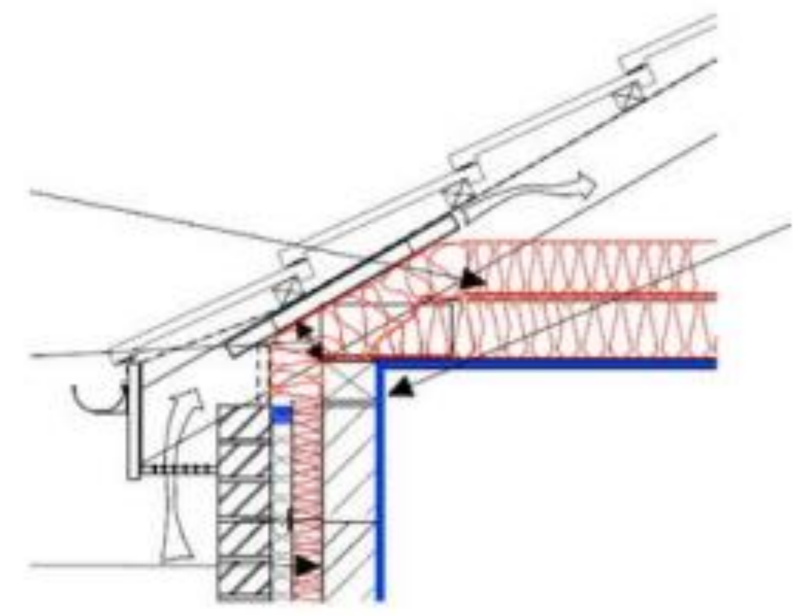
Appendix D.4 provides details on the **calculation procedures** for modelling these **alternative** details

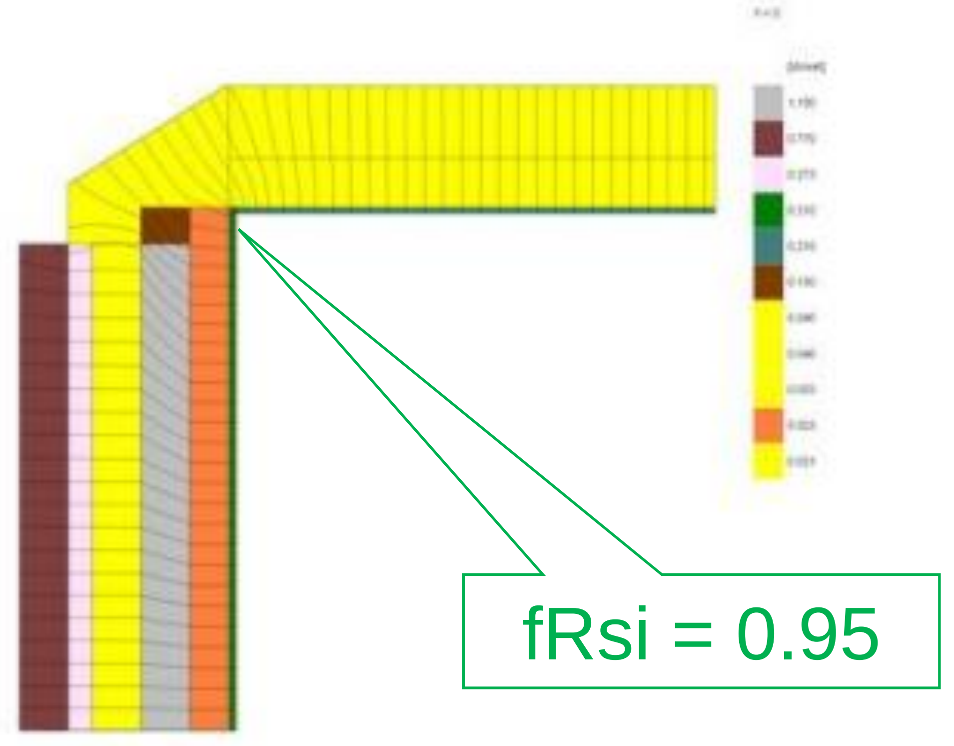
The calculation procedure to establish both temperature factor (fRsi) and the linear thermal transmittance (ψ) is outlined in **BRE IP 1/06**.
Details should be assessed in accordance with the methods described in **I.S. EN ISO 10211:2017**.
These calculations of two dimensional or three dimensional heat flow require the use of **numerical modeling software**.

To be acceptable, numerical modeling software should model the **validation examples** in I.S. EN ISO 10211:2017 with results that **agree with the stated values** of temperature and heat flow **within the tolerance** indicated in the standard for these examples.
Several packages are available that meet this requirement.

Detailed guidance on decisions regarding specific input to the modeling software and the determination of certain quantities from the output of the software is contained in …
BR 497 *Conventions for calculating linear thermal transmittance and temperature factors*.

1.09	0.12 Wall U-value - Cavity Walls	U_{Wall}	U_{Roof}	U_{Floor}	Ψ	f
	Eaves - Ventilated roof space	0.12	0.14	0.00	0.031	0.95





Reasonable Provision for Thermal Bridging

TGD L – Paragraph 1.3.3.2 and 1.3.3.3 (summary)

Para. 1.3.3.2	Reasonable provision alternatives	Value of y ("y-value" or "Y-factor")
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(iii)	Use certified details for all key junctions	Calculated using certified Psi values for the specific details adopted
(iv)	Use alternative details which limit the risk of mould growth and surface condensation to an acceptable level as set out in paragraph D.2 of Appendix D for all junctions	**0.15**

4

Calculating the transmission heat loss coefficient H_{TB} in DEAP

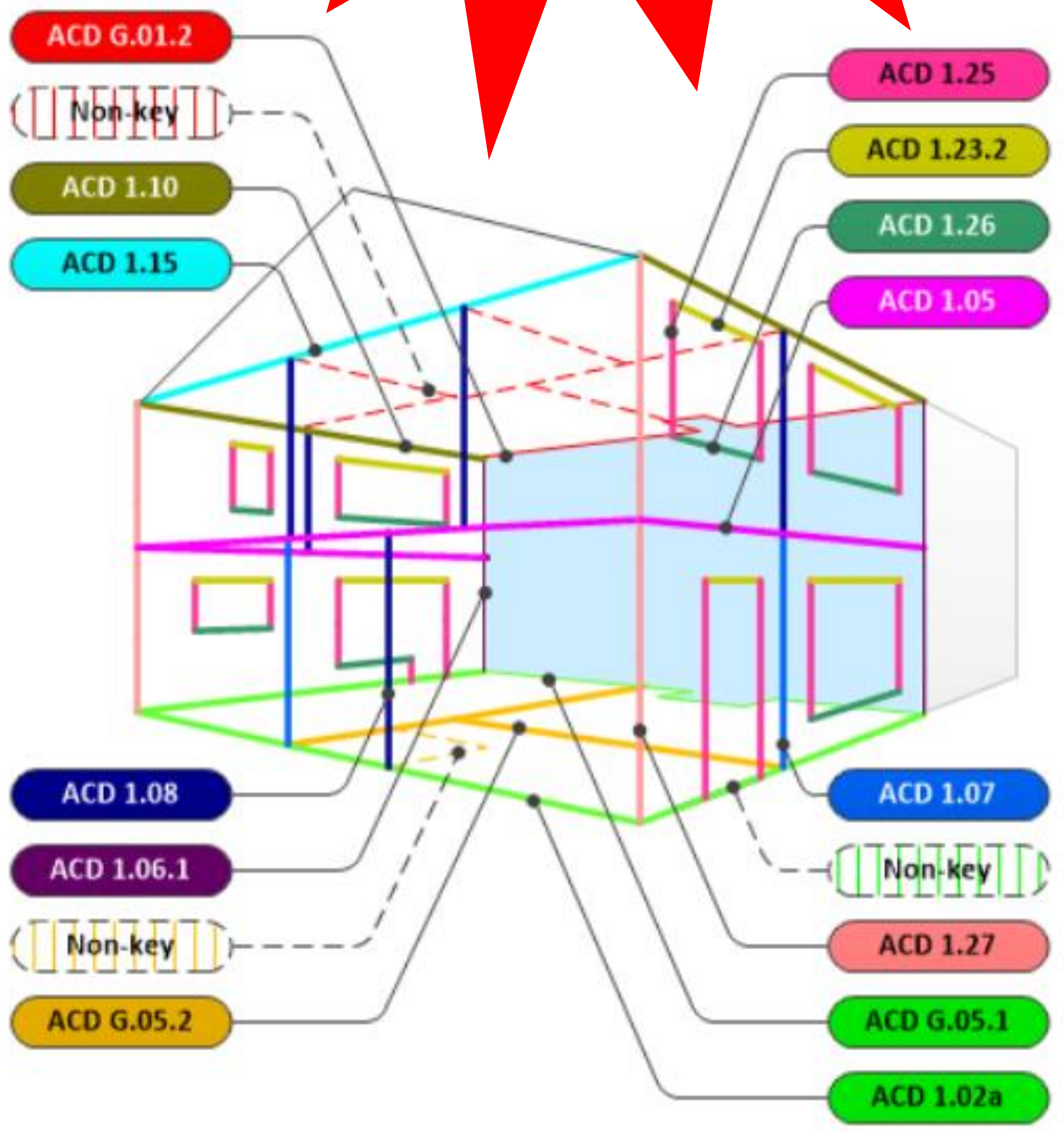
Bespoke Thermal Bridging calculations in DEAP

To account for thermal bridging heat loss, H_{TB}, in DEAP use a building specific y-factor calculation

EXAMPLE included in the supplementary guidance on Limiting Thermal Bridging and Air Infiltration – Acceptable Construction Details 2021 Edition.

https://assets.gov.ie/204483/db86c099-e3fa-4080-9a87-c2298fd831ee.pdf

Saving up to €3,000 in construction costs over the 0.08 y-factor



Y-factor 0.051

Y-FACTOR CALCULATION

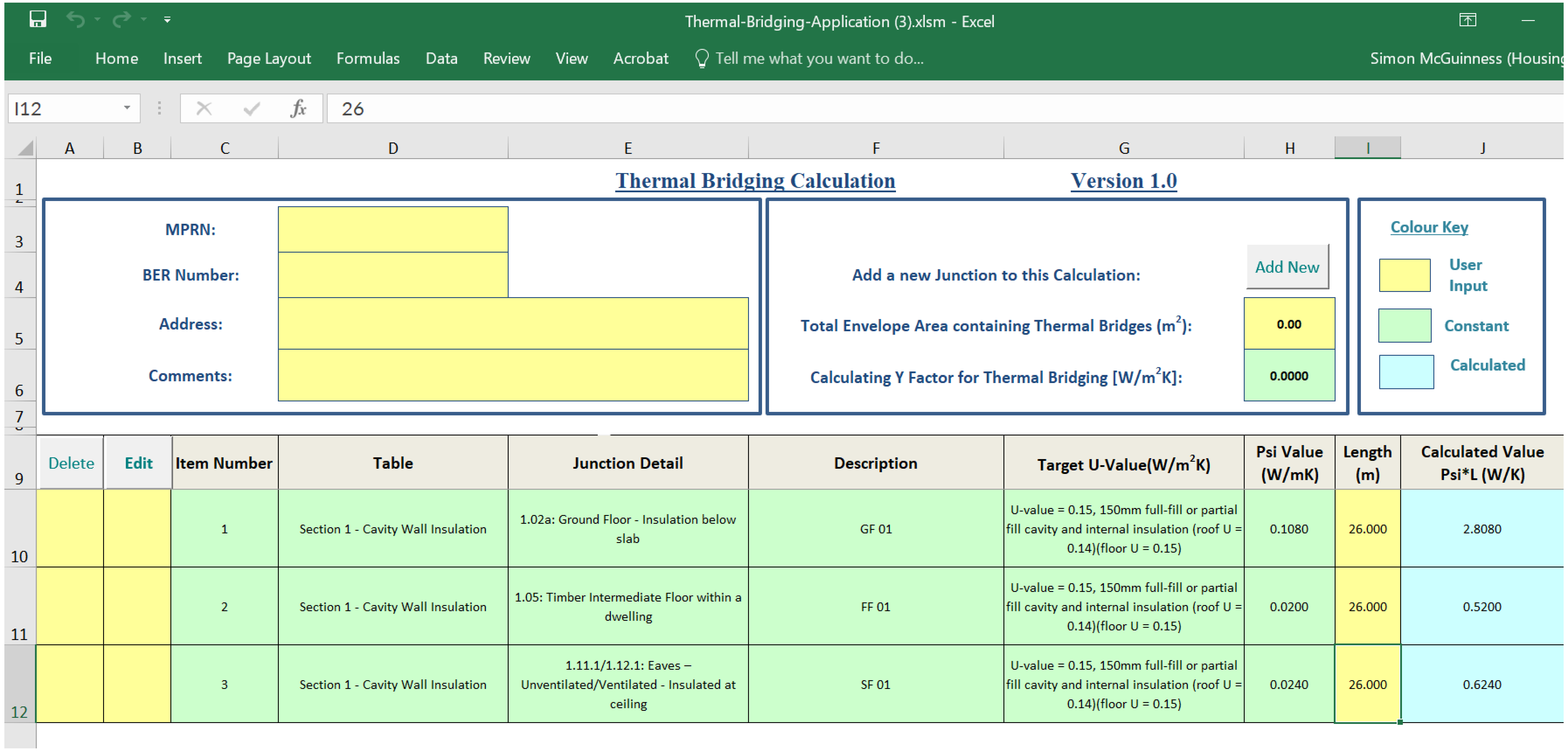
Key Junction Location/Description	ACD Reference	Target U-Value (W/m²K)	Psi-Value Table D1-6 (W/mK)	Junction Length (m)	Calculated Value Psi x L (W/K)
Ground floor/external wall	1.02a	0.15	0.108	23	2.484
Ground floor/separating wall	G.05.1	0.15	0.240/2	9.8	2.352
Ground floor/masonry partition wall through slab	G.05.2	0.15	0.150	12.8	1.920
Intermediate floor/ext. wall	1.05	0.15	0.020	23	0.460
Roof/external wall	1.10	0.15	0.030	14	0.420
Roof/gable wall	1.15	0.15	0.152	9	1.368
Roof/separating wall	G.01.2	0.15	0.458/2	9.8	2.244
External wall/external wall	1.27.1	0.15	0.032	10.2	0.326
External wall/separating wall	1.06.1	0.15	0.066/2	10.2	0.337
External wall/masonry partition	1.07	0.15	0.000	4.9	0.000
Ext wall/stud partition	1.08	0.15	0.000	12.3	0.000
External wall/jamb	1.25	0.15	0.011	23.4	0.257
External wall/lintel	1.23.2	0.15	0.012	11.7	0.140
External wall/cill	1.26	0.15	0.015	9.9	0.146

Non-key junctions Location/Description	Reason for exclusion	
Ground floor/stud partition	Fully within thermal envelope	0.0
Roof/stud partition	Fully within thermal envelope	0.0
Thresholds	fRsi ≥ 0.75, heat loss included in ACD 1.02a	0.0
Total heat transmission through thermal bridging, Σ(L x Ψ), expressed in W/m²K		12.4365
Total heat loss surface area of building, ΣA_{exp}, in m²		243.3
Y-factor = Σ(L x Ψ) / ΣA_{exp} =		0.051

Thermal Bridging calculation in DEAP using the SEAI y-factor calculation tool

The DEAP Methodology provides a software tool to calculate the (y) value with ACDs and/or certified junctions.

https://www.seai.ie/data-and-insights/Thermal-Bridging-Application.xlsm



Delete	Edit	Item Number	Table	Junction Detail	Description	Target U-Value(W/m^2K)	Psi Value (W/mK)	Length (m)	Calculated Value Psi*L (W/K)
		1	Section 1 - Cavity Wall Insulation	1.02a: Ground Floor - Insulation below slab	GF 01	U-value = 0.15, 150mm full-fill or partial fill cavity and internal insulation (roof U = 0.14)(floor U = 0.15)	0.1080	26.000	2.8080
		2	Section 1 - Cavity Wall Insulation	1.05: Timber Intermediate Floor within a dwelling	FF 01	U-value = 0.15, 150mm full-fill or partial fill cavity and internal insulation (roof U = 0.14)(floor U = 0.15)	0.0200	26.000	0.5200
		3	Section 1 - Cavity Wall Insulation	1.11.1/1.12.1: Eaves – Unventilated/Ventilated - Insulated at ceiling	SF 01	U-value = 0.15, 150mm full-fill or partial fill cavity and internal insulation (roof U = 0.14)(floor U = 0.15)	0.0240	26.000	0.6240

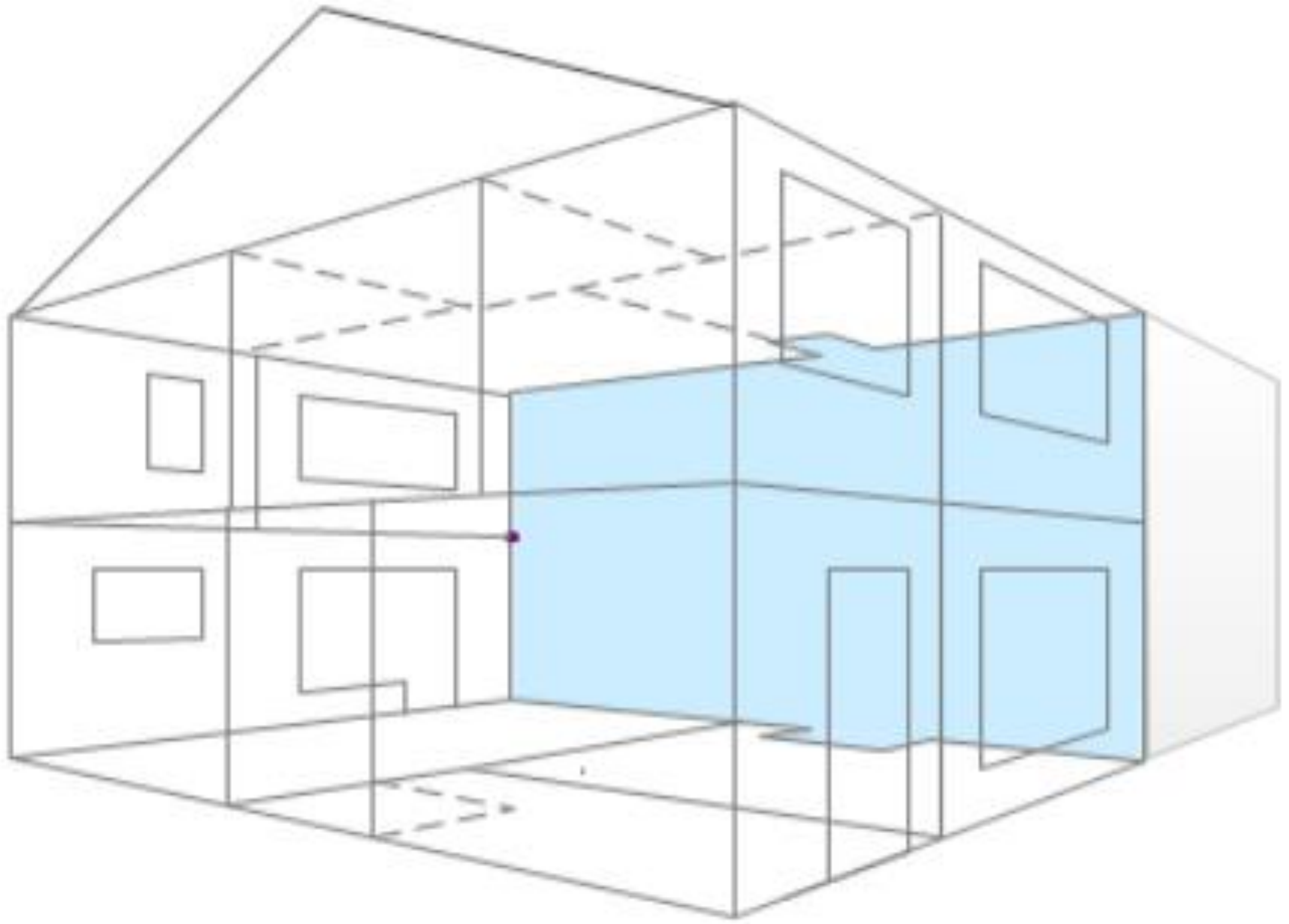
5 Bespoke Y-factor Calculation

Bespoke Y-factor Calculation

Key Junction Location/Description	ACD Reference	Target U-Value (W/m²K)	Psi-Value Table D1-6 (W/mK)	Junction Length (m)	Calculated Value Psi x L (W/K)

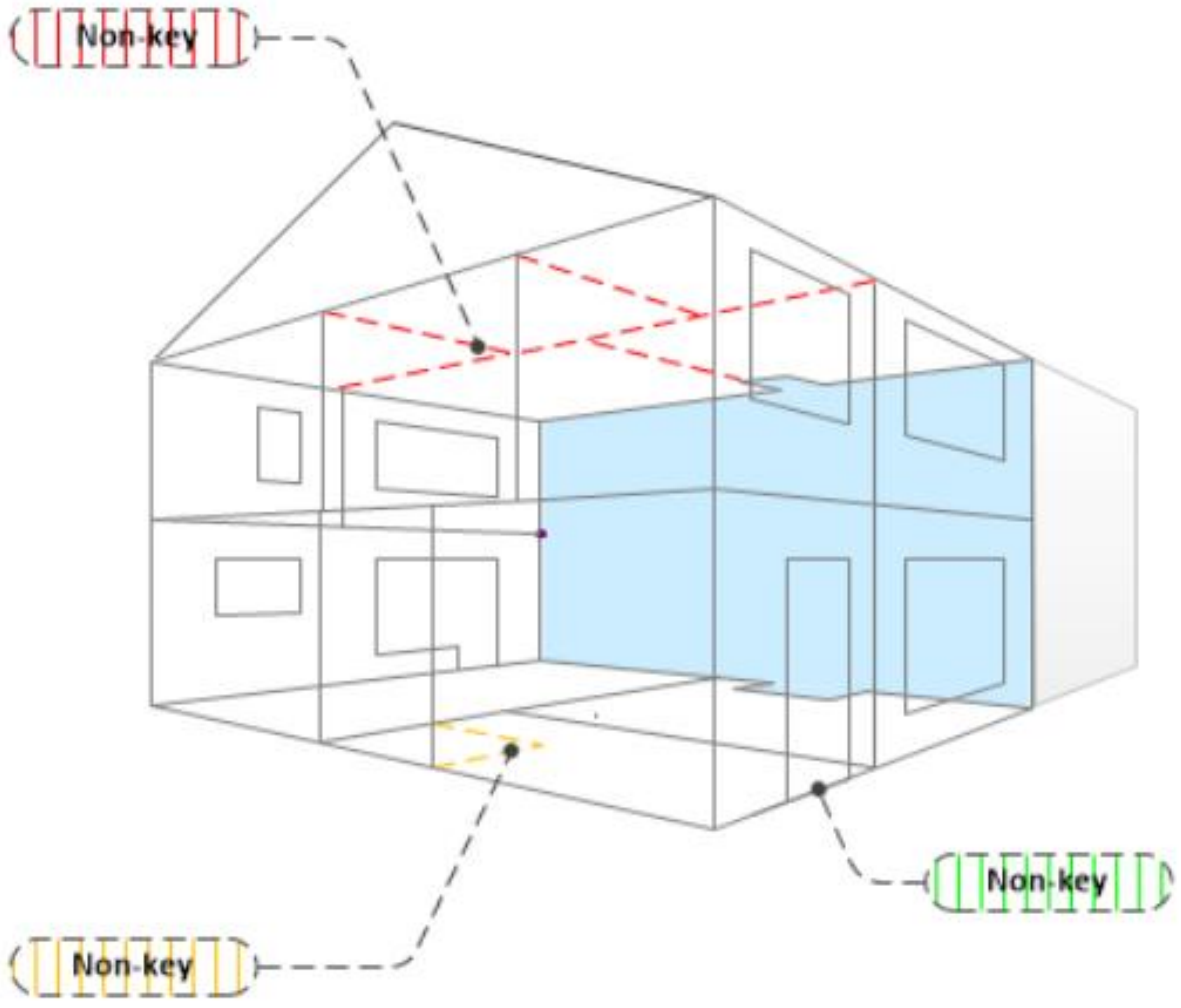
Non-key junctions Location/Description	Reason for exclusion

Total heat transmission through thermal bridging, $\Sigma(L \times \Psi)$, expressed in W/m²K	
Total heat loss surface area of building, ΣA_{exp}, in m²	
$\text{Y-factor} = \Sigma(L \times \Psi) / \Sigma A_{exp} =$	



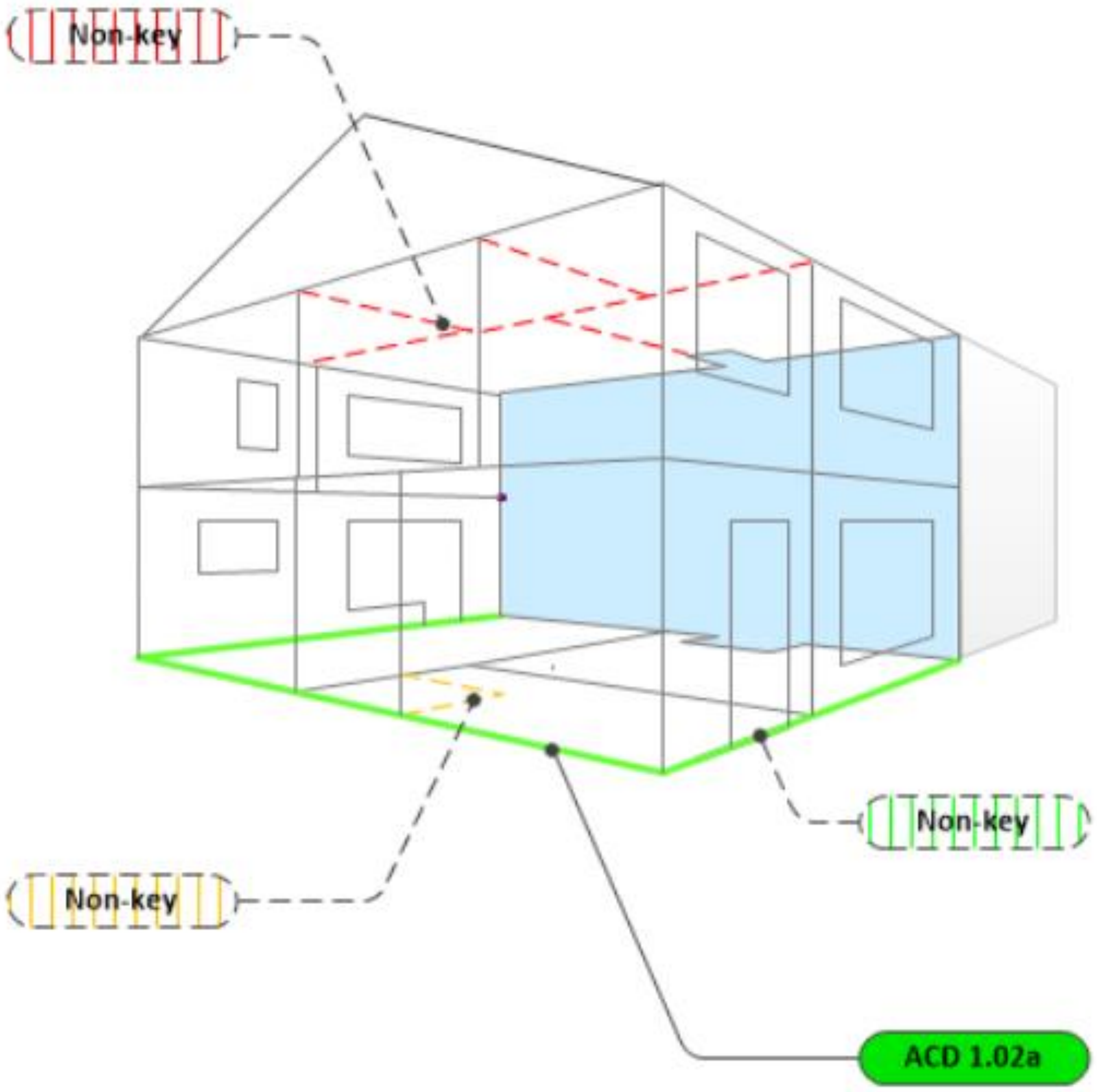
Bespoke Y-factor Calculation

Key Junction Location/Description	ACD Reference	Target U-Value (W/m^2K)	Psi-Value Table D1-6 (W/mK)	Junction Length (m)	Calculated Value Psi x L (W/K)
Non-key junctions Location/Description	**Reason for exclusion**				
Ground floor/stud partition	Fully within thermal envelope				0.0
Roof/stud partition	Fully within thermal envelope				0.0
Thresholds	$f_{Rsi} \geq 0.75$, heat loss included in ACD 1.02a				0.0
Total heat transmission through thermal bridging, $\Sigma(L \times \Psi)$, expressed in W/m^2K					
Total heat loss surface area of building, ΣA_{exp}, in m^2					
	Y-factor = $\Sigma(L \times \Psi) / \Sigma A_{exp}$ =				



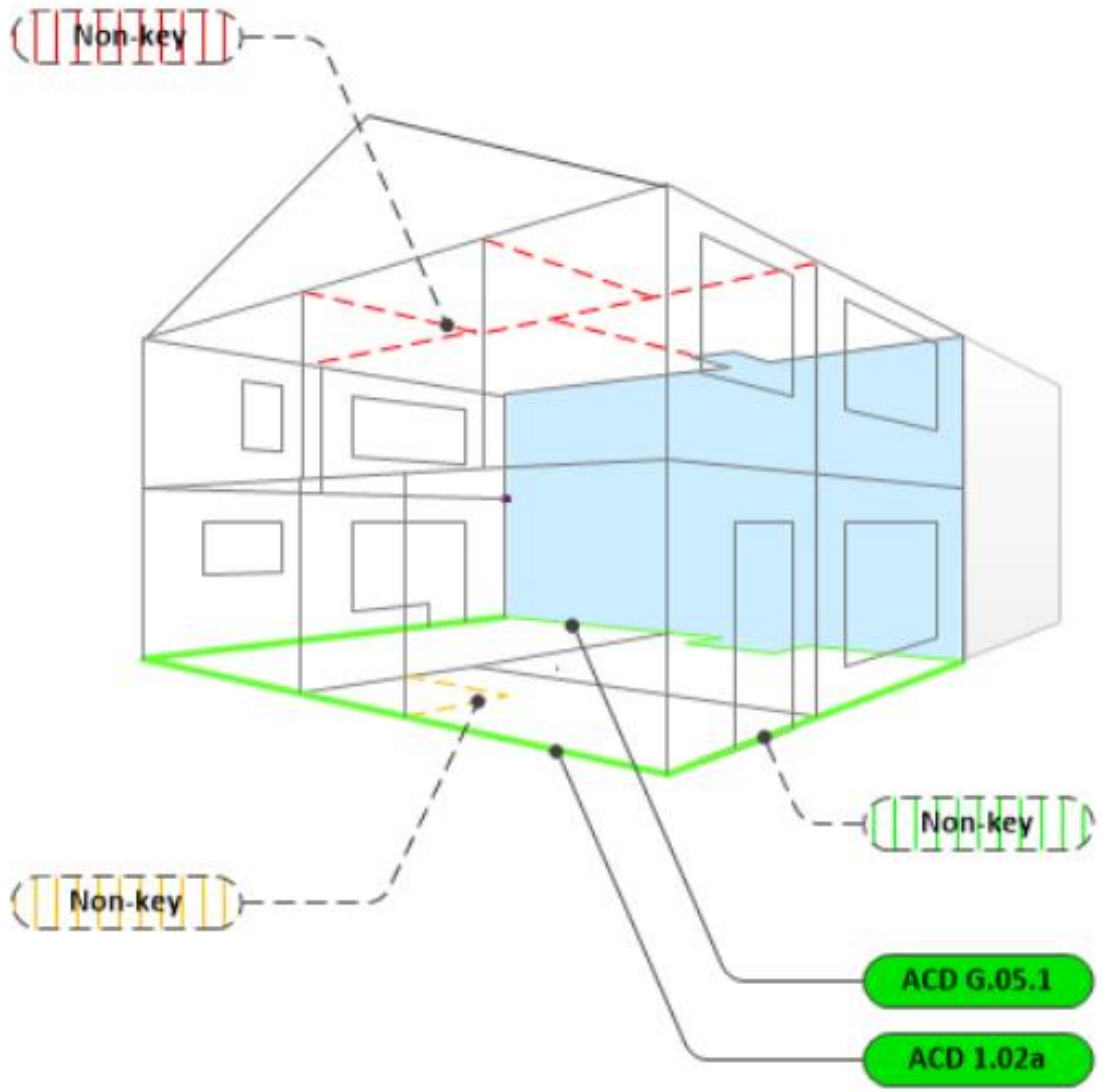
Bespoke Y-factor Calculation

Key Junction Location/Description	ACD Reference	Target U-Value (W/m^2K)	Psi-Value Table D1-6 (W/mK)	Junction Length (m)	Calculated Value Psi x L (W/K)
Ground floor/external wall	1.02a	0.15	0.108	23	2.484
Non-key junctions Location/Description	**Reason for exclusion**				
Ground floor/stud partition	Fully within thermal envelope				0.0
Roof/stud partition	Fully within thermal envelope				0.0
Thresholds	fRsi ≥ 0.75, heat loss included in ACD 1.02a				0.0
Total heat transmission through thermal bridging, Σ(L x Ψ), expressed in W/m^2K					
Total heat loss surface area of building, ΣA_{exp}, in m^2					
		Y-factor = $\Sigma(L \times \Psi) / \Sigma A_{exp}$ =			



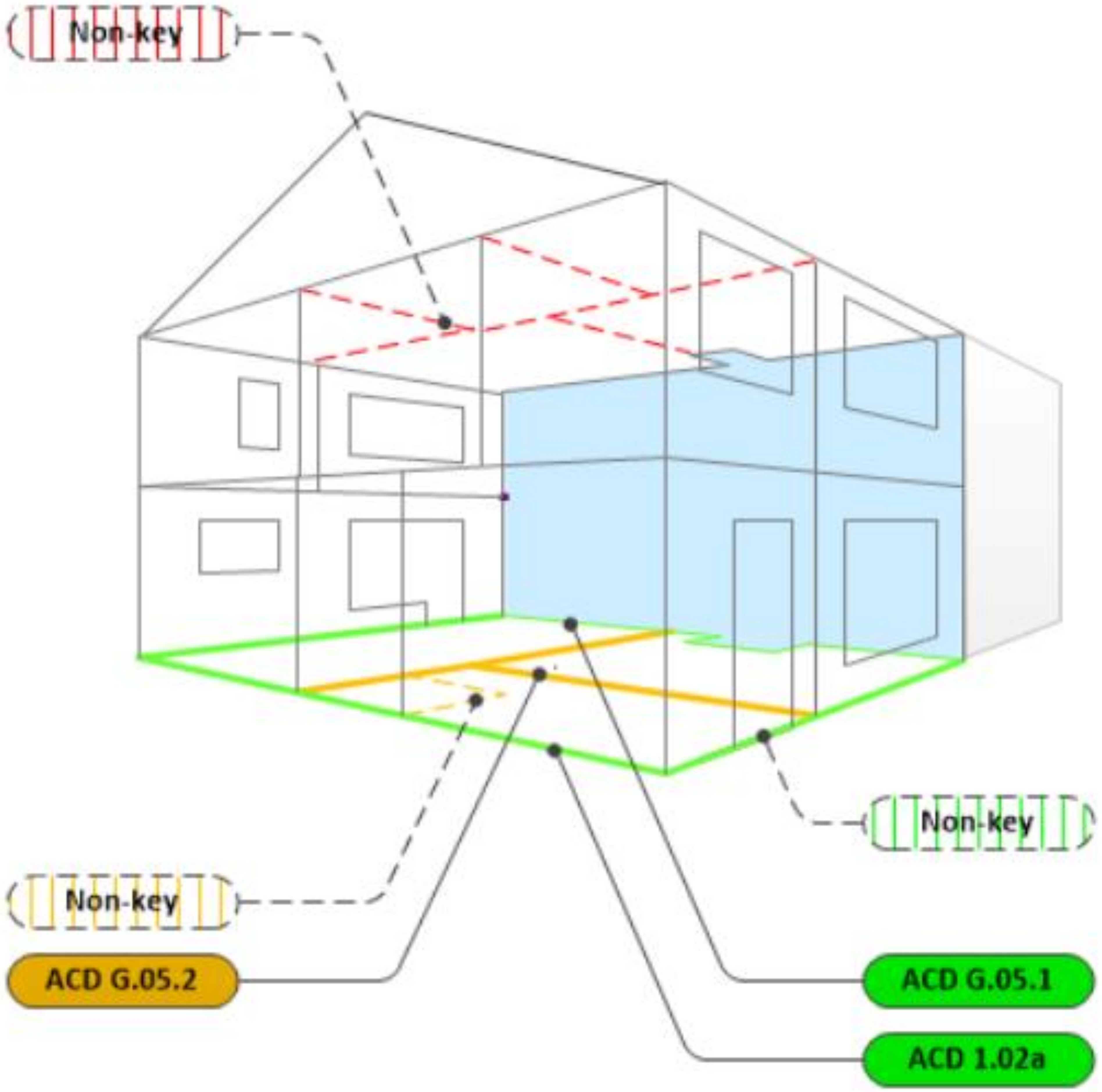
Bespoke Y-factor Calculation

Key Junction Location/Description	ACD Reference	Target U-Value (W/m^2K)	Psi-Value Table D1-6 (W/mK)	Junction Length (m)	Calculated Value Psi x L (W/K)
Ground floor/external wall	1.02a	0.15	0.108	23	2.484
Ground floor/separating wall	G.05.1	0.15	0.240/2	9.8	2.352
Non-key junctions Location/Description	**Reason for exclusion**				
Ground floor/stud partition	Fully within thermal envelope				0.0
Roof/stud partition	Fully within thermal envelope				0.0
Thresholds	fRsi ≥ 0.75, heat loss included in ACD 1.02a				0.0
Total heat transmission through thermal bridging, Σ(L x Ψ), expressed in W/m^2K					
Total heat loss surface area of building, ΣA_{exp}, in m^2					
		Y-factor = Σ(L x Ψ) / ΣA_{exp} =			



Bespoke Y-factor Calculation

Key Junction Location/Description	ACD Reference	Target U-Value (W/m^2K)	Psi-Value Table D1-6 (W/mK)	Junction Length (m)	Calculated Value Psi x L (W/K)
Ground floor/external wall	1.02a	0.15	0.108	23	2.484
Ground floor/separating wall	G.05.1	0.15	0.240/2	9.8	2.352
Ground floor/masonry partition wall through slab	G.05.2	0.15	0.150	12.8	1.920
Non-key junctions Location/Description	**Reason for exclusion**				
Ground floor/stud partition	Fully within thermal envelope				0.0
Roof/stud partition	Fully within thermal envelope				0.0
Thresholds	fRsi ≥ 0.75, heat loss included in ACD 1.02a				0.0
Total heat transmission through thermal bridging, $\Sigma(L \times \Psi)$, expressed in W/m^2K					
Total heat loss surface area of building, ΣA_{exp}, in m^2					
		Y-factor = $\Sigma(L \times \Psi) / \Sigma A_{exp}$ =			



Bespoke Y-factor Calculation

Key Junction Location/Description	ACD Reference	Target U-Value (W/m^2K)	Psi-Value Table D1-6 (W/mK)	Junction Length (m)	Calculated Value Psi x L (W/K)
Ground floor/external wall	1.02a	0.15	0.108	23	2.484
Ground floor/separating wall	G.05.1	0.15	0.240/2	9.8	2.352
Ground floor/masonry partition wall through slab	G.05.2	0.15	0.150	12.8	1.920
Intermediate floor/ext. wall	1.05	0.15	0.020	23	0.460
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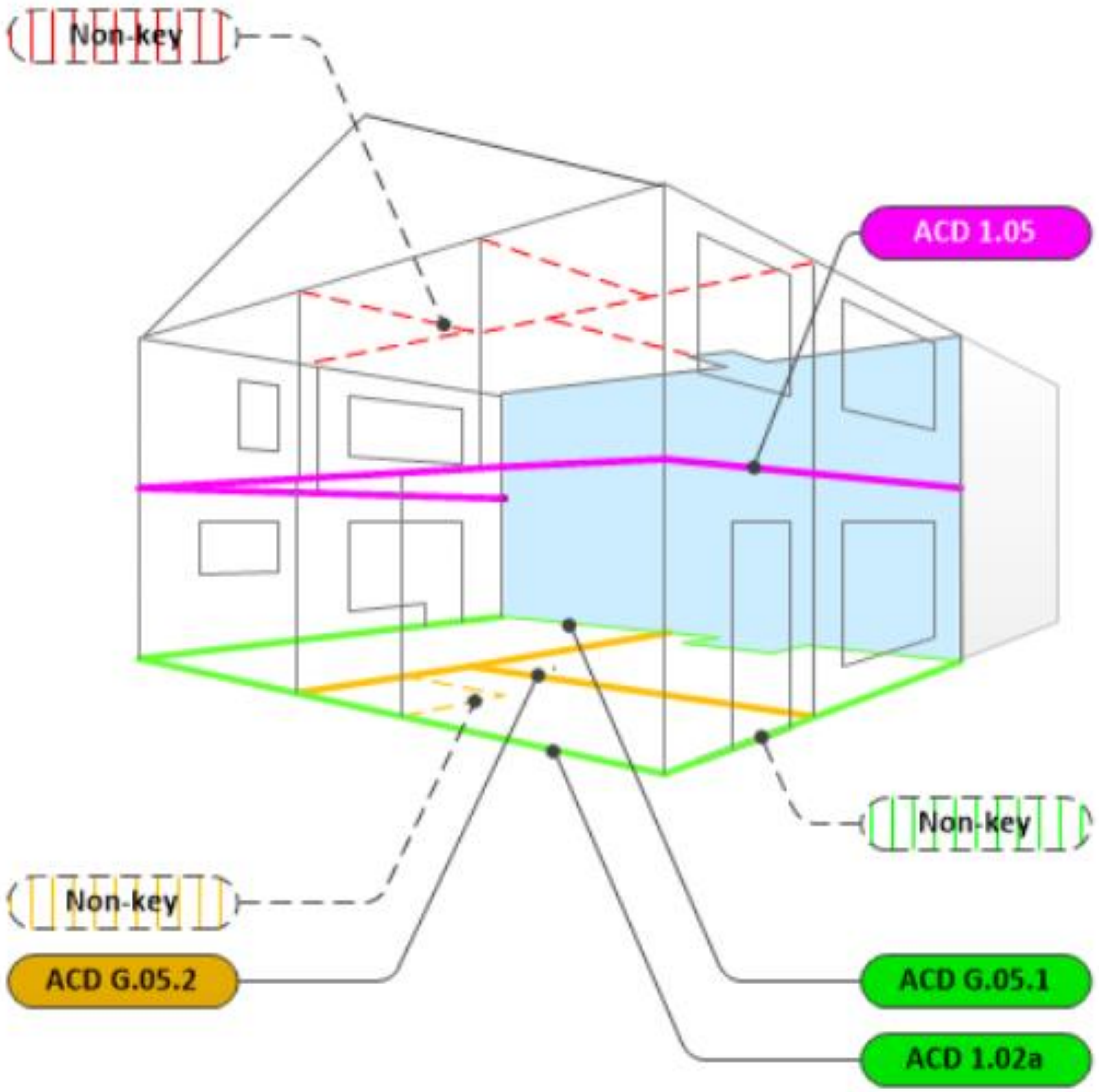

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Roof/external wall	1.10	0.15	0.030	14	0.420
Roof/gable wall	1.15	0.15	0.152	9	1.368
Roof/separating wall	G.01.2	0.15	0.458/2	9.8	2.244
External wall/external wall	1.27.1	0.15	0.032	10.2	0.326
External wall/separating wall	1.06.1	0.15	0.066/2	10.2	0.337
External wall/masonry partition	1.07	0.15	0.000	4.9	0.000
Ext wall/stud partition	1.08	0.15	0.000	12.3	0.000
External wall/jamb	1.25	0.15	0.011	23.4	0.257
Non-key junctions Location/Description	**Reason for exclusion**				
Ground floor/stud partition	Fully within thermal envelope				0.0
Roof/stud partition	Fully within thermal envelope				0.0
Thresholds	fRsi ≥ 0.75, heat loss included in ACD 1.02a				0.0
Total heat transmission through thermal bridging, Σ(L x Ψ), expressed in W/m^2K					
Total heat loss surface area of building, ΣA_{exp}, in m^2					
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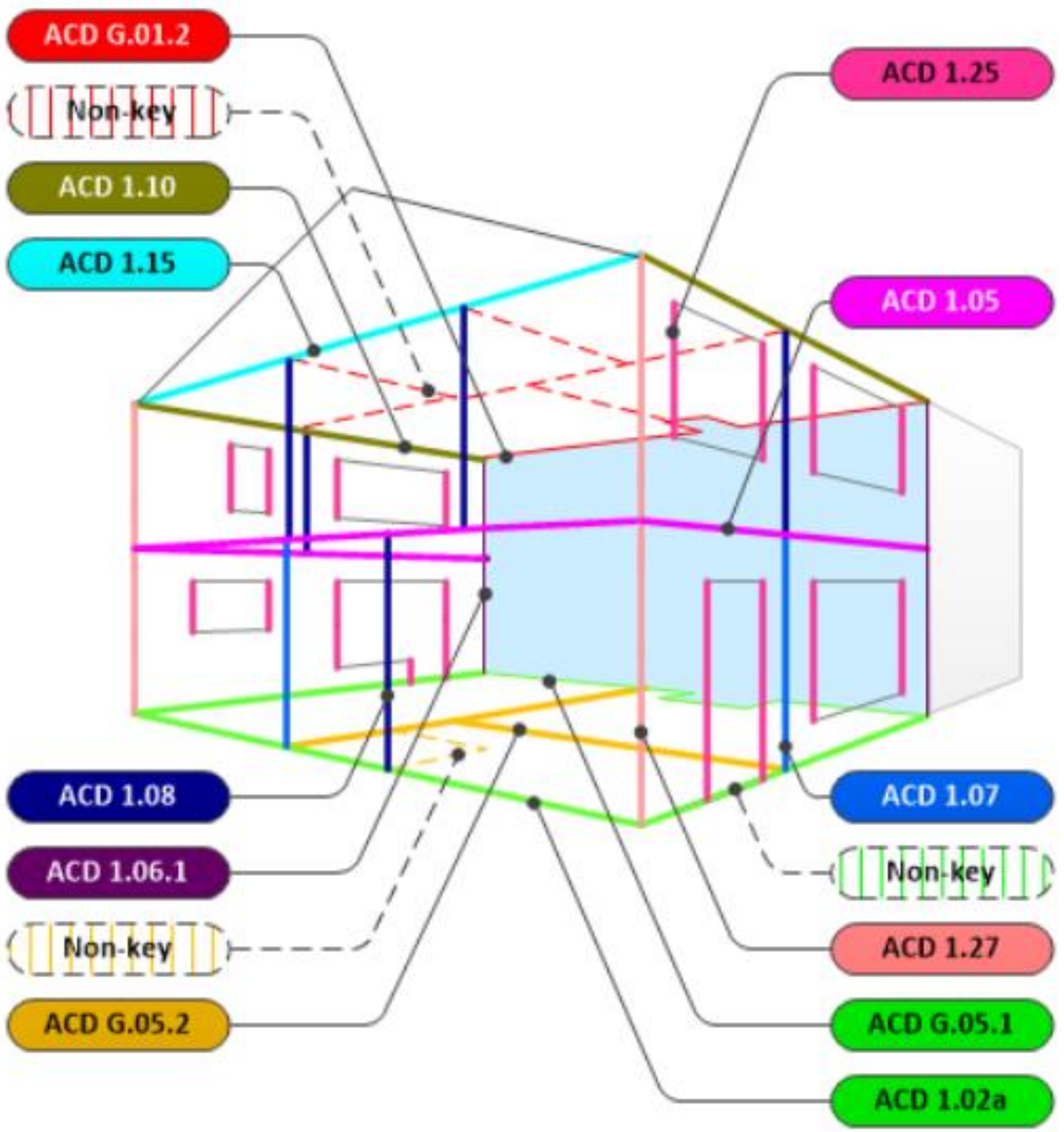

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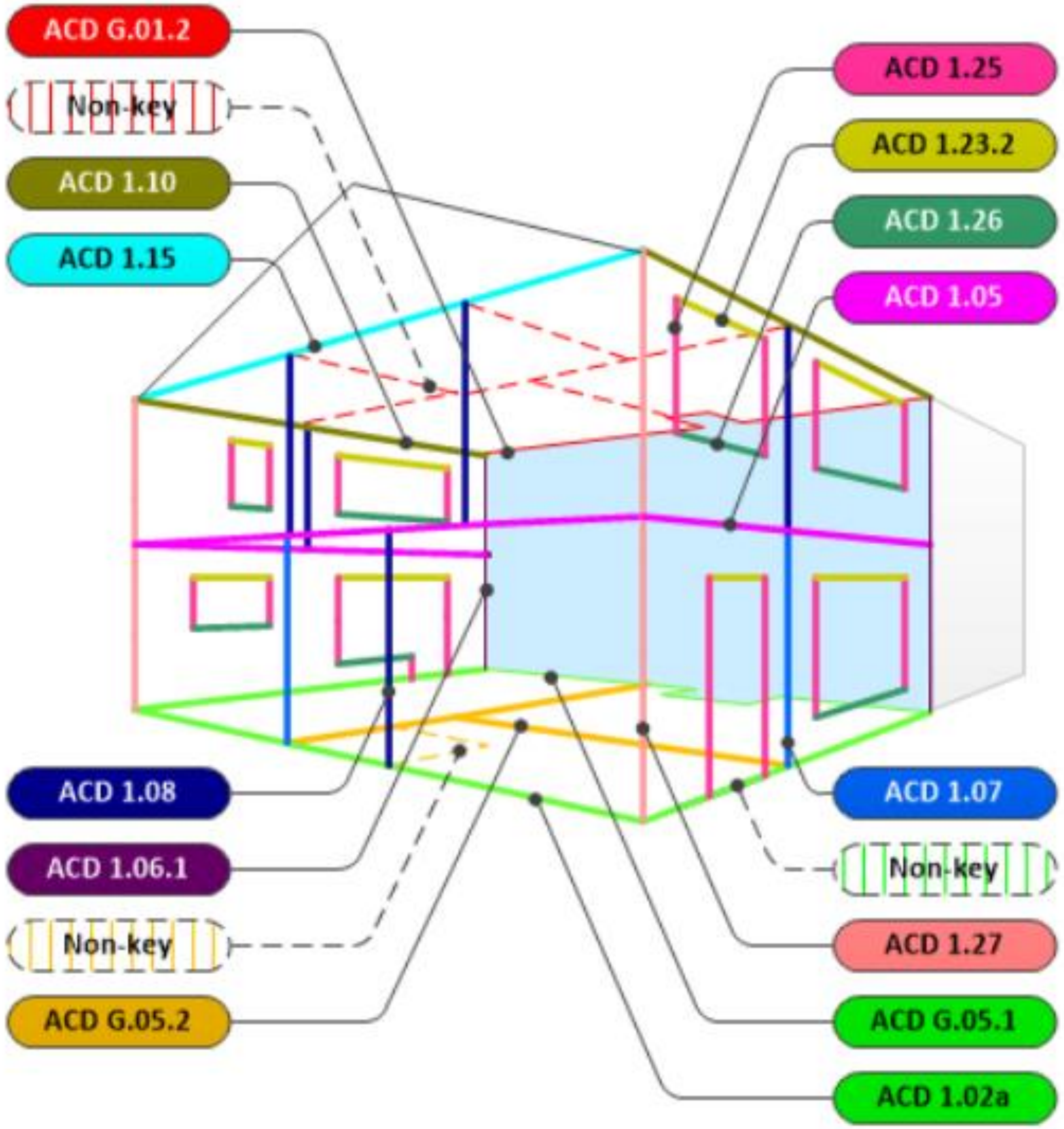
External wall/lintel	1.23.2	0.15	0.012	11.7	0.140
External wall/cill	1.26	0.15	0.015	9.9	0.146
Non-key junctions Location/Description	**Reason for exclusion**				
Ground floor/stud partition	Fully within thermal envelope				0.0
Roof/stud partition	Fully within thermal envelope				0.0
Thresholds	fRsi ≥ 0.75, heat loss included in ACD 1.02a				0.0
Total heat transmission through thermal bridging, Σ(L x Ψ), expressed in W/m^2K					12.4365
Total heat loss surface area of building, ΣA_{exp}, in m^2					
	Y-factor = Σ(L x Ψ) / ΣA_{exp} =				



Bespoke Y-factor Calculation

Key Junction Location/Description	ACD Reference	Target U-Value (W/m²K)	Psi-Value Table D1-6 (W/mK)	Junction Length (m)	Calculated Value Psi x L (W/K)
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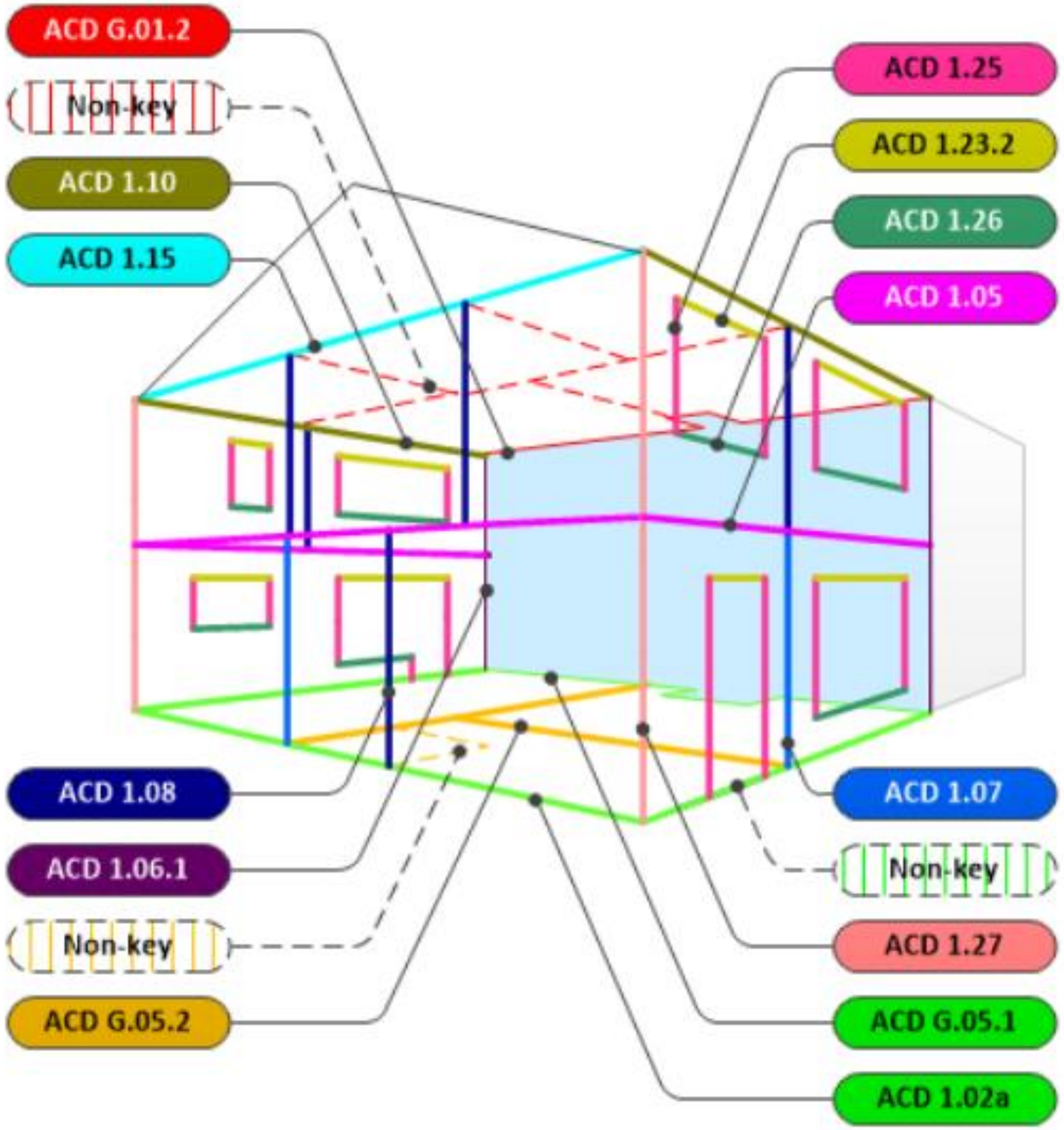
Ground floor/stud partition	Fully within thermal envelope				0.0
Roof/stud partition	Fully within thermal envelope				0.0
Thresholds	fRsi ≥ 0.75, heat loss included in ACD 1.02a				0.0
Total heat transmission through thermal bridging, Σ(L x Ψ), expressed in W/m²K					12.4365
Total heat loss surface area of building, ΣA_{exp}, in m²					243.3
	Y-factor = Σ(L x Ψ) / ΣA_{exp} =				



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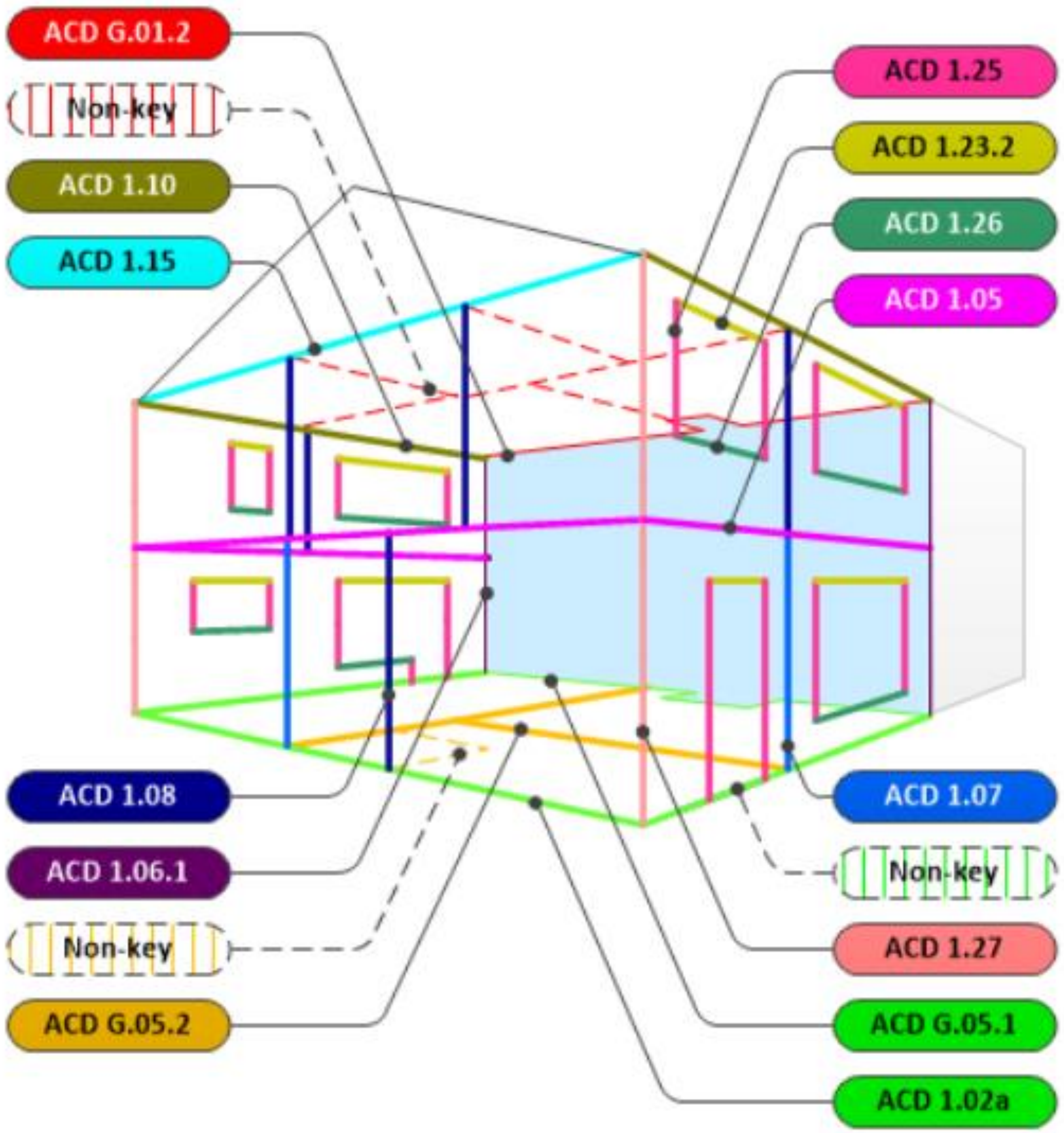
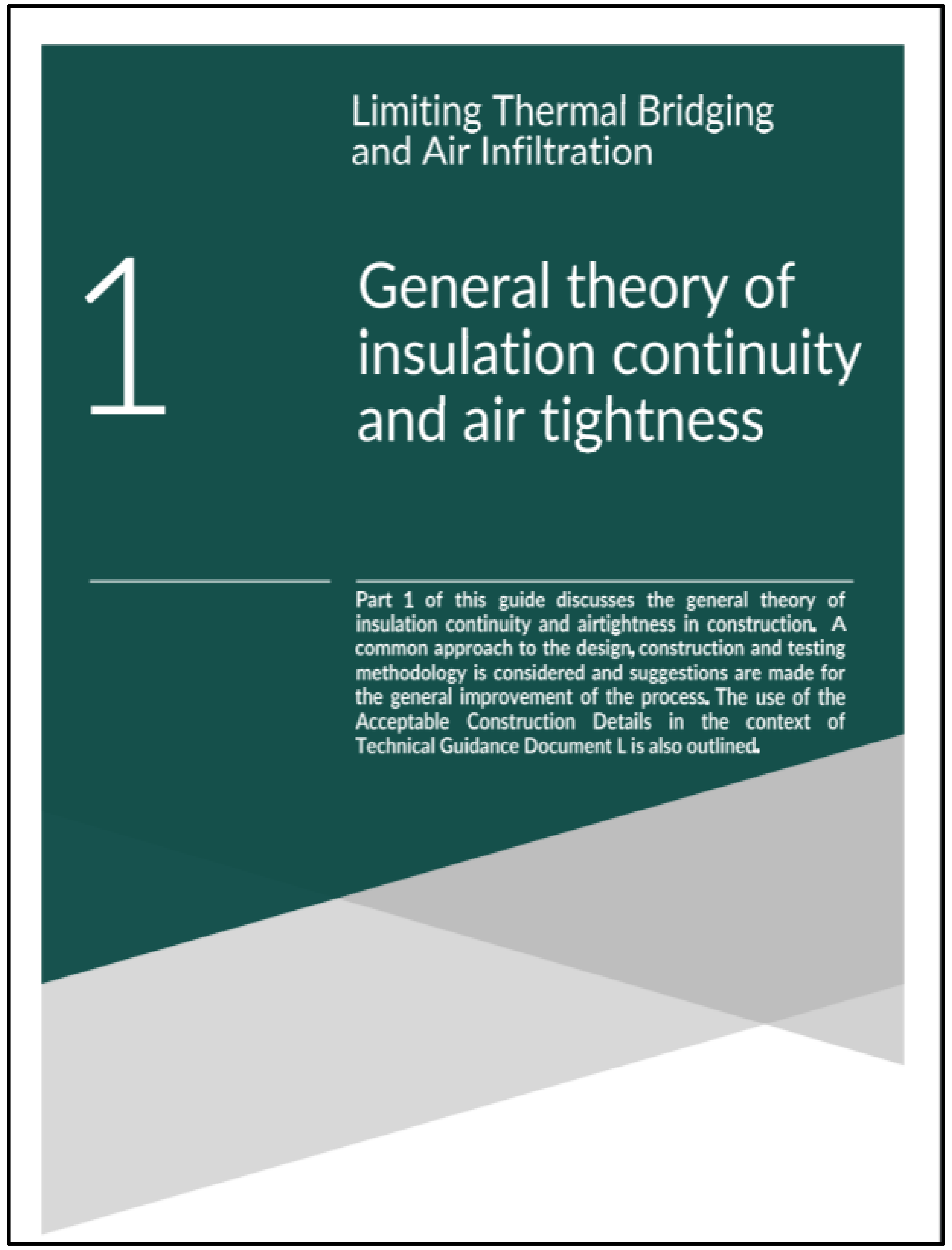
Total heat transmission through thermal bridging, Σ(L x Ψ), expressed in W/m^2K					12.4365
Total heat loss surface area of building, ΣA_{exp}, in m^2					243.3
				$\text{Y-factor} = \Sigma(L \times \Psi) / \Sigma A_{exp} =$	0.051



6 The Acceptable Construction Details

Part 1: Limiting Thermal Bridging and Air Infiltration



Limiting Thermal Bridging and Air Infiltration

1

General theory of insulation continuity and air tightness

Part 1 of this guide discusses the general theory of insulation continuity and airtightness in construction. A common approach to the design, construction and testing methodology is considered and suggestions are made for the general improvement of the process. The use of the Acceptable Construction Details in the context of Technical Guidance Document L is also outlined.

Limiting Thermal Bridging and Air Infiltration

Figure 6: Foil-faced insulation board sealed to joists providing an effective VCL, airtightness barrier and insulation continuity through the intermediate floor void

Figure 7: Wet plaster scratch coat forms a continuous air barrier through the intermediate floor zone, joists penetrations sealed with appropriate tape

If the insulation is on the inner face of the external wall, thermal continuity requires greater attention to detail. There is a potential cold bridge all along the zone of the suspended floor. Continue the wall insulation through the intermediate floor zone and seal any vapour control layer, where present, to the joist penetrations.

THERMAL CONTINUITY WITH CONCRETE INTERMEDIATE FLOORS

As with timber floors, if the thermal insulation is in the cavity or is the external type, thermal continuity at the junction of the intermediate floor and the outside wall is achieved readily.

If the insulation is on the inner face of the external wall, thermal continuity is not possible.

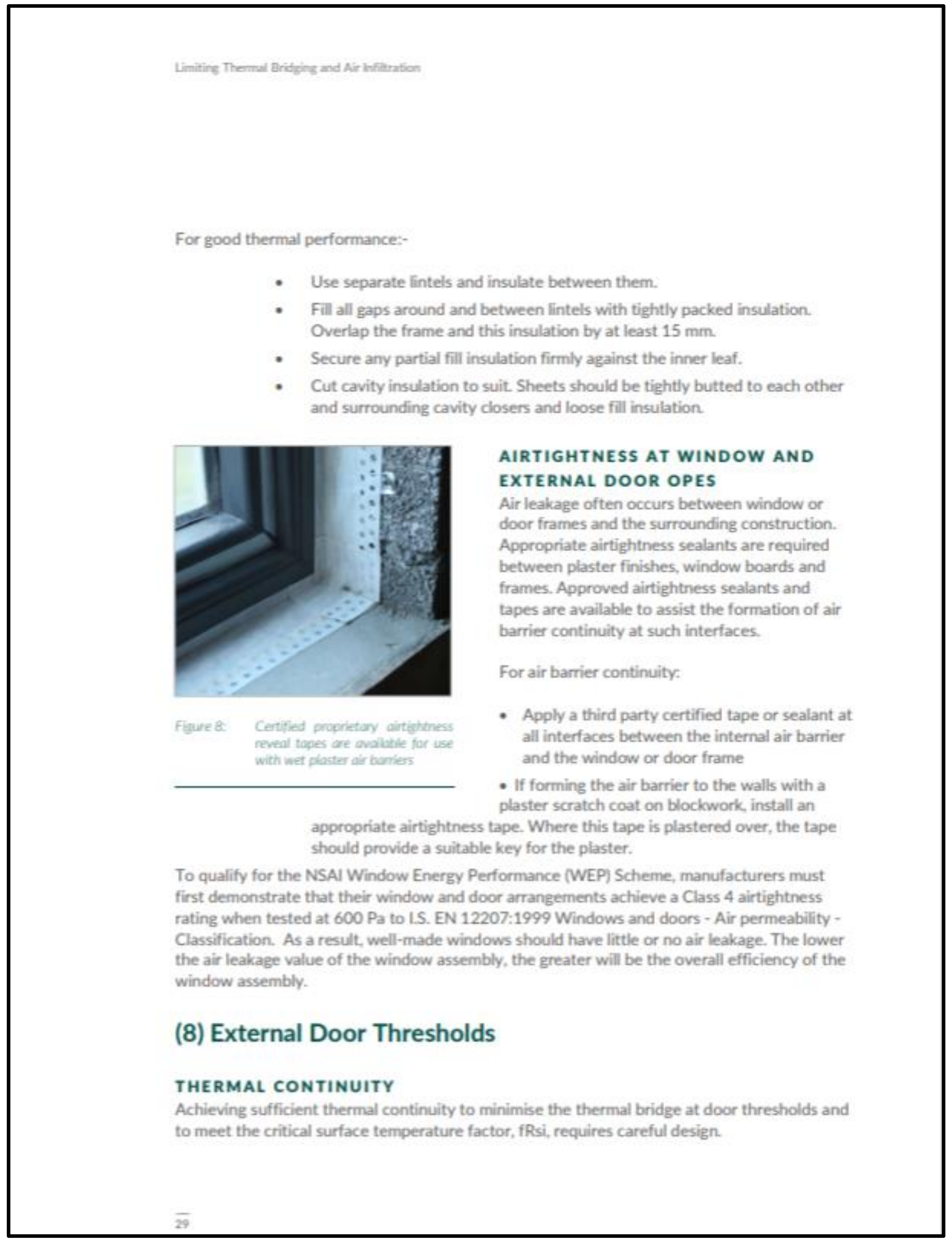
AIRTIGHTNESS WITH INTERMEDIATE FLOORS

Airtightness at intermediate floors is a matter of extending the wall air barriers above and below the floor through the intermediate floor zone and taping up any penetrations of the air barrier by joist, joist hangers, beams, services etc. Where the intermediate floor is mass concrete this may form part of the airtight layer.

In timber floors, where joists are built into the inner leaf, airtightness is achieved by plastering the wall around the joists and taping the face of the joist to the plaster finish, see Figure 8. Alternatively, proprietary airtight caps are available for building in. Where joist hangers are used, it is recommended that these be installed on a layer of airtight membrane which is plastered over.

With timber frame or with dry-lined masonry, carry the airtight membrane or plasterboards through the floor zone and tape around the joists.

27



Limiting Thermal Bridging and Air Infiltration

For good thermal performance:-

- Use separate lintels and insulate between them.
- Fill all gaps around and between lintels with tightly packed insulation. Overlap the frame and this insulation by at least 15 mm.
- Secure any partial fill insulation firmly against the inner leaf.
- Cut cavity insulation to suit. Sheets should be tightly butted to each other and surrounding cavity closers and loose fill insulation.

Figure 8: Certified proprietary airtightness reveal tapes are available for use with wet plaster air barriers

AIRTIGHTNESS AT WINDOW AND EXTERNAL DOOR OPES

Air leakage often occurs between window or door frames and the surrounding construction. Appropriate airtightness sealants are required between plaster finishes, window boards and frames. Approved airtightness sealants and tapes are available to assist the formation of air barrier continuity at such interfaces.

For air barrier continuity:

- Apply a third party certified tape or sealant at all interfaces between the internal air barrier and the window or door frame
- If forming the air barrier to the walls with a plaster scratch coat on blockwork, install an appropriate airtightness tape. Where this tape is plastered over, the tape should provide a suitable key for the plaster.

To qualify for the NSAI Window Energy Performance (WEP) Scheme, manufacturers must first demonstrate that their window and door arrangements achieve a Class 4 airtightness rating when tested at 600 Pa to I.S. EN 12207:1999 Windows and doors - Air permeability - Classification. As a result, well-made windows should have little or no air leakage. The lower the air leakage value of the window assembly, the greater will be the overall efficiency of the window assembly.

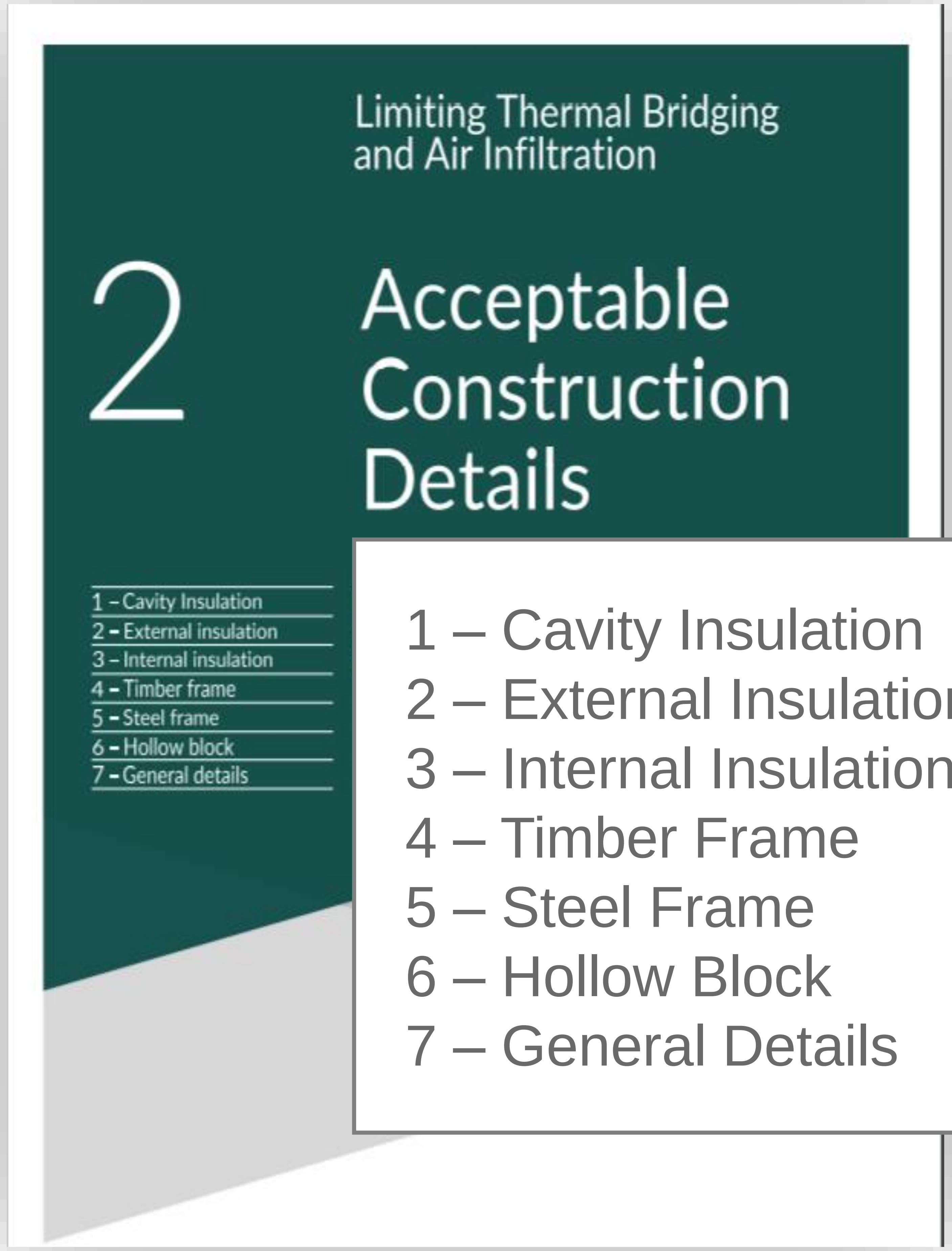
(8) External Door Thresholds

THERMAL CONTINUITY

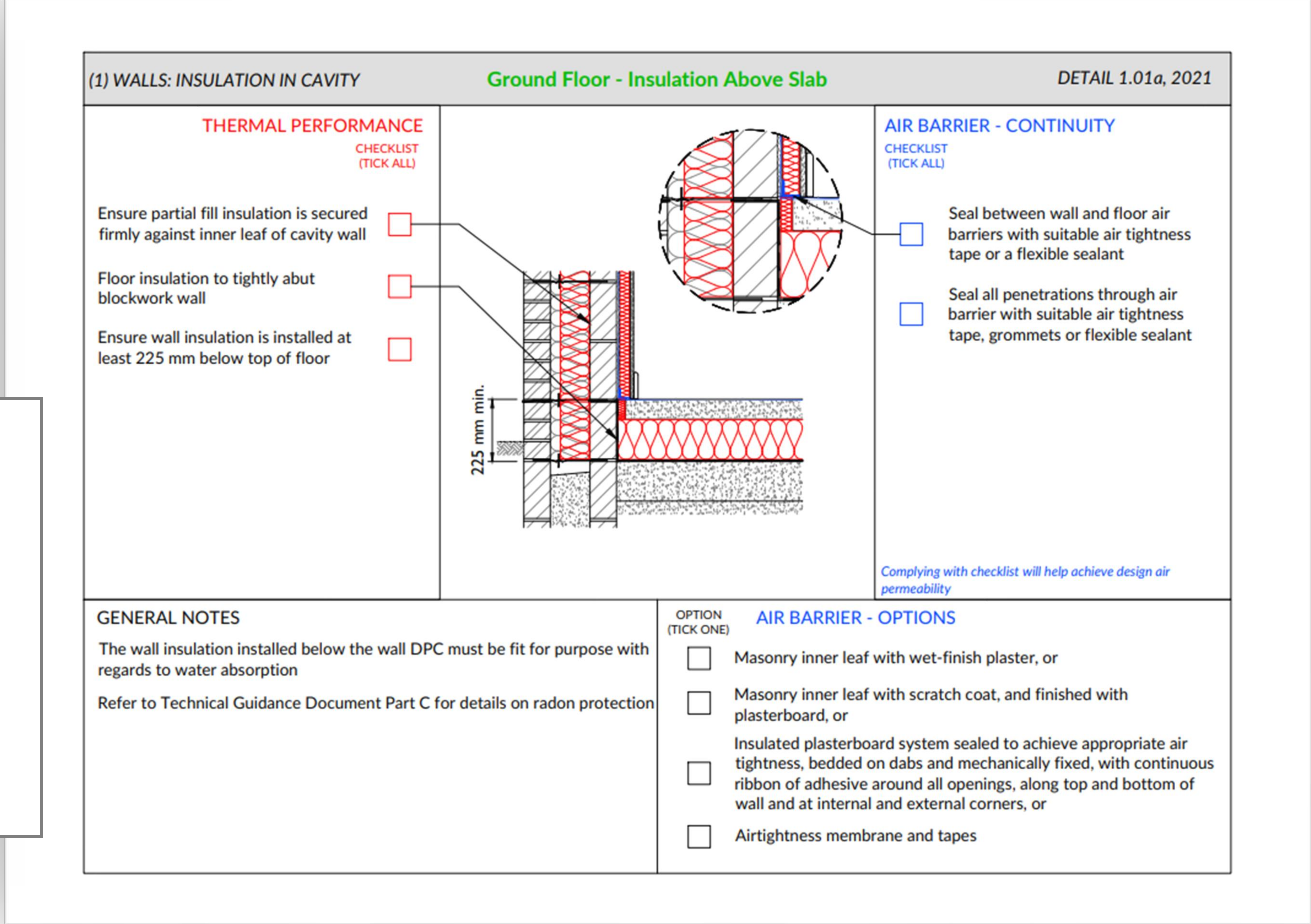
Achieving sufficient thermal continuity to minimise the thermal bridge at door thresholds and to meet the critical surface temperature factor, fRsi, requires careful design.

29

Part 2: ACDs for six different external wall constructions and general walls



1 – Cavity Insulation
2 – External Insulation
3 – Internal Insulation
4 – Timber Frame
5 – Steel Frame
6 – Hollow Block
7 – General Details



(1) WALLS: INSULATION IN CAVITY | Ground Floor - Insulation Above Slab | DETAIL 1.01a, 2021

THERMAL PERFORMANCE
CHECKLIST (TICK ALL)

- ☐ Ensure partial fill insulation is secured firmly against inner leaf of cavity wall
- ☐ Floor insulation to tightly abut blockwork wall
- ☐ Ensure wall insulation is installed at least 225 mm below top of floor

AIR BARRIER - CONTINUITY
CHECKLIST (TICK ALL)

- ☐ Seal between wall and floor air barriers with suitable air tightness tape or a flexible sealant
- ☐ Seal all penetrations through air barrier with suitable air tightness tape, grommets or flexible sealant

Complying with checklist will help achieve design air permeability

GENERAL NOTES

The wall insulation installed below the wall DPC must be fit for purpose with regards to water absorption

Refer to Technical Guidance Document Part C for details on radon protection

AIR BARRIER - OPTIONS
OPTION (TICK ONE)

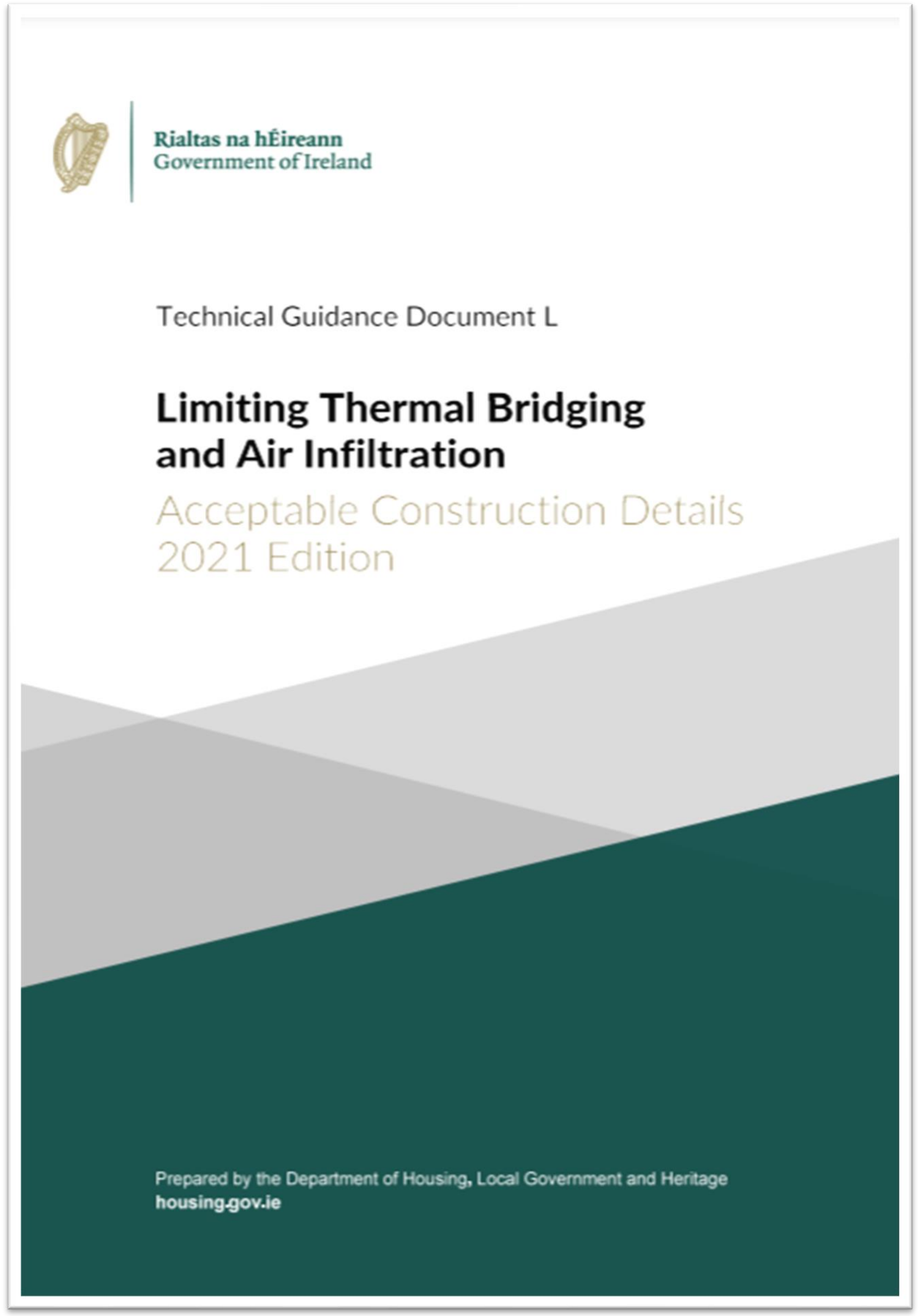
- ☐ Masonry inner leaf with wet-finish plaster, or
- ☐ Masonry inner leaf with scratch coat, and finished with plasterboard, or
- ☐ Insulated plasterboard system sealed to achieve appropriate air tightness, bedded on dabs and mechanically fixed, with continuous ribbon of adhesive around all openings, along top and bottom of wall and at internal and external corners, or
- ☐ Airtightness membrane and tapes

Key changes

1. No change in the performance requirements so no application date. The 2011 ACDs can continue to be used.

2. Takes account of internal insulation, which was previously provided for in text of 2011 ACDs to support advanced u-values.

3. Takes account of current best practice for airtightness and thermal bridging.


Rialtas na hÉireann
Government of Ireland

Technical Guidance Document L

Limiting Thermal Bridging and Air Infiltration

Acceptable Construction Details
2021 Edition

Prepared by the Department of Housing, Local Government and Heritage
housing.gov.ie

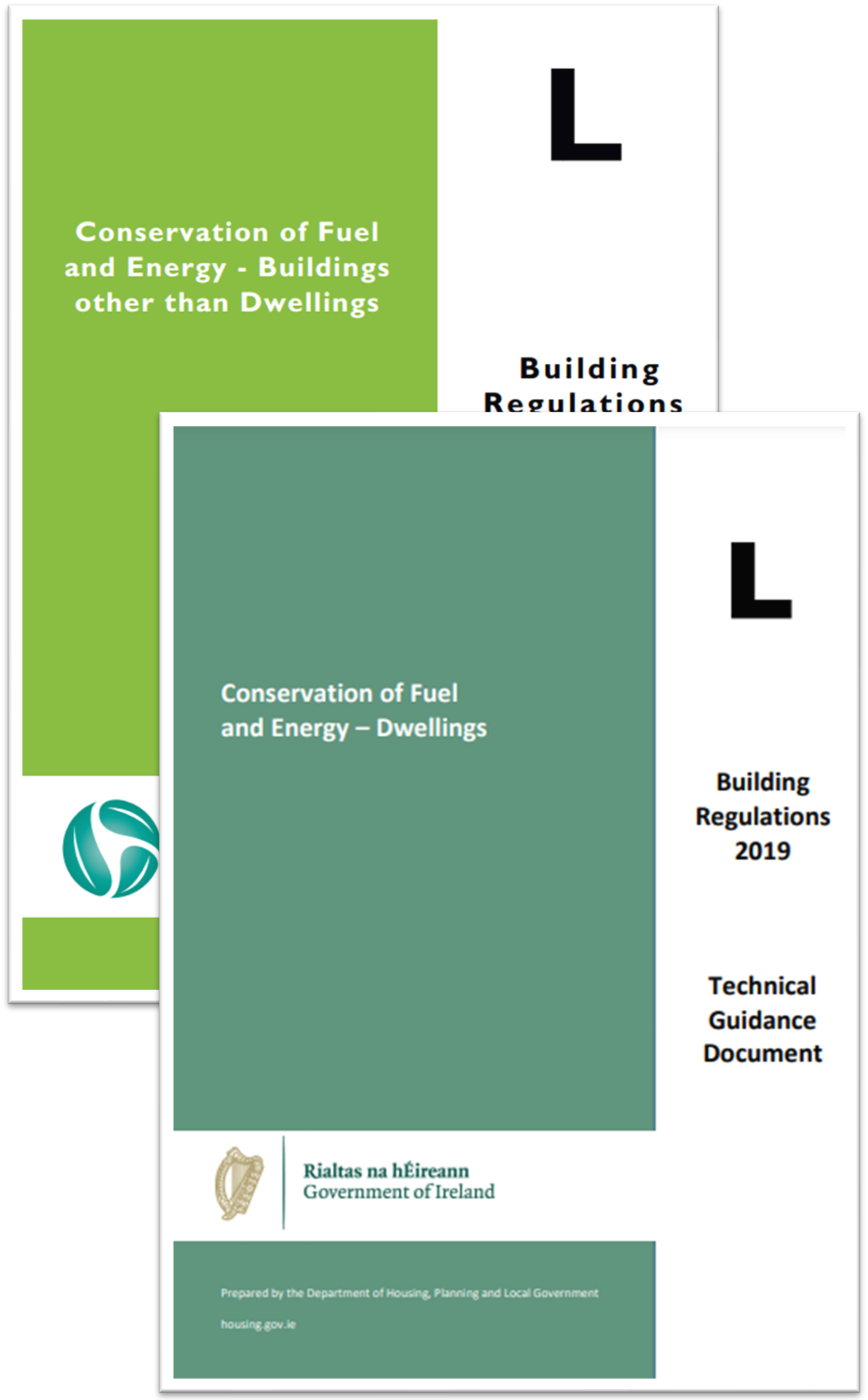
Drivers for the 2021 ACD update

TGD L (2017, 2019 & 2021)

- *Better U-values*
- *Better airtightness*
- *Reduced thermal bridging*

Developments in construction practice and products

Greater focus on compliance due to S.I. 9 of 2014



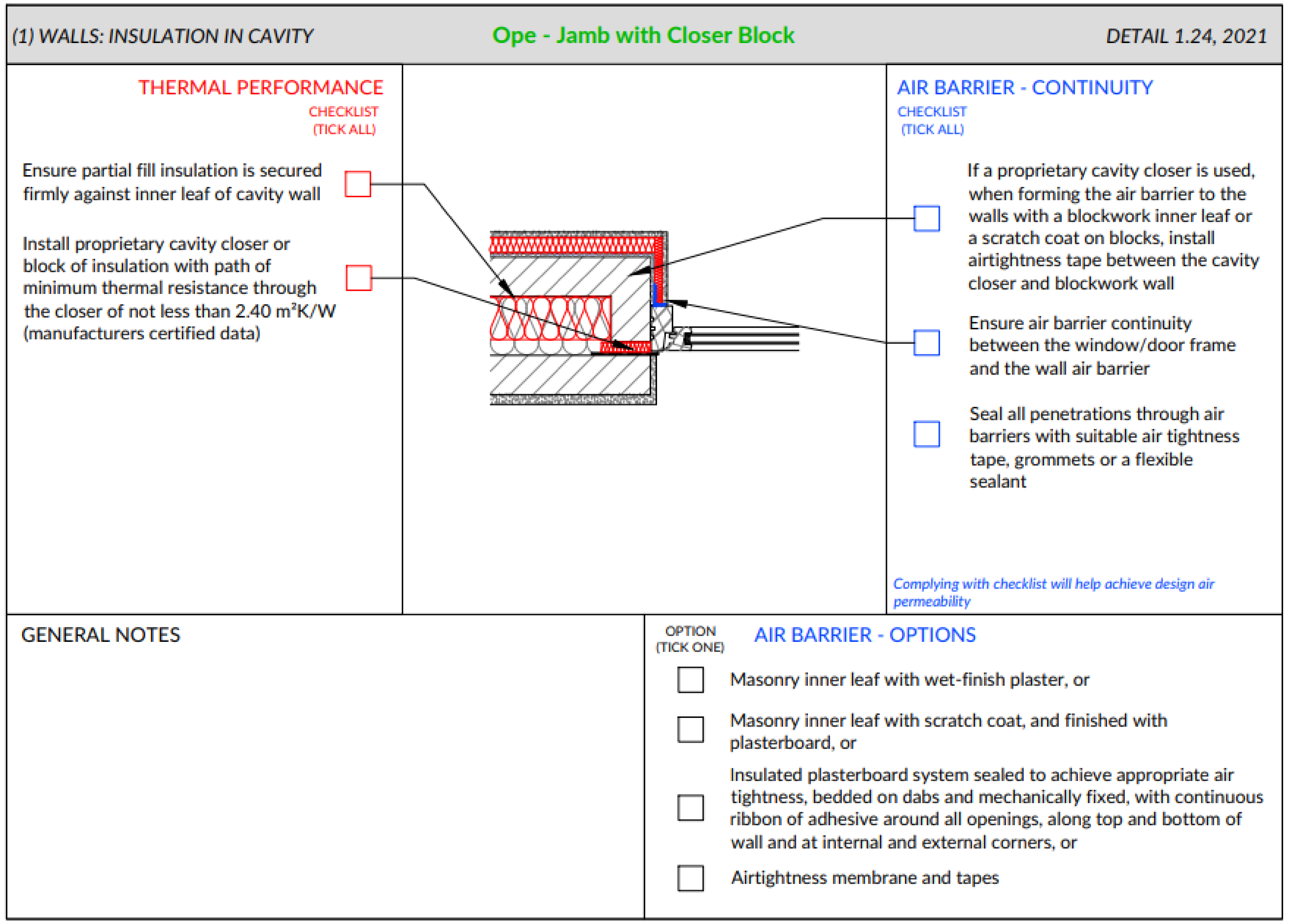
Purpose of the ACDs

These diagrams illustrate good practice for design and construction of interfaces only in respect to ensuring

- *thermal performance and*
- *air barrier continuity.*

The guidance must be implemented with due regard to all other requirements imposed by the Building Regulations.

Use of the ACDs during construction will enable the builder to demonstrate that provision has been made to eliminate all reasonably avoidable thermal bridges in the insulation layers.



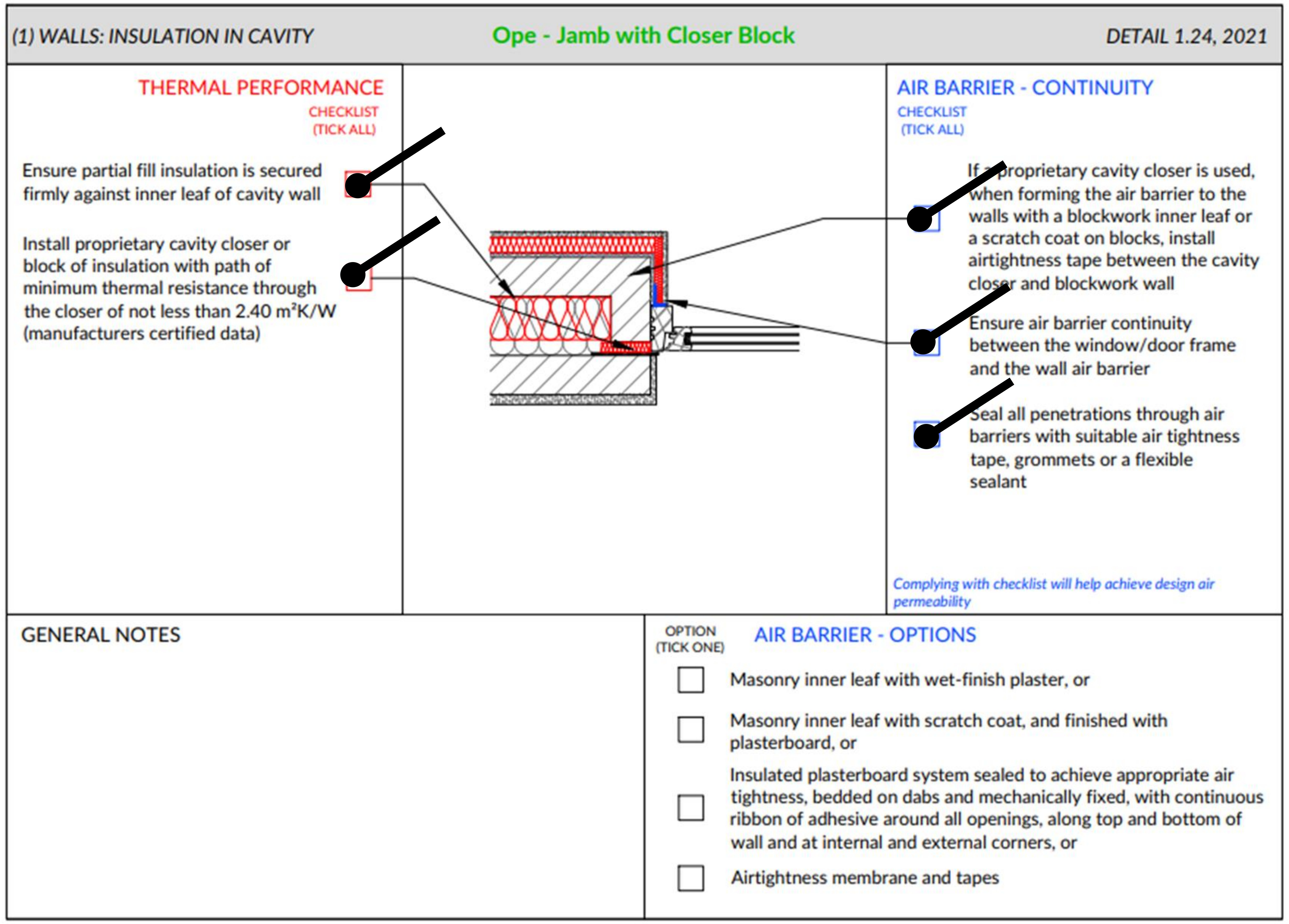
Thermal bridging factor in DEAP

Where ACDs are

— adopted for all key junction and

— are installed as per the ACD checklists,

the dwelling fabric design as a whole will meet the guidance provided in Par 1.3.3.2 in Building Regulations 2011 TGD-L (Dwellings) and qualify for the reduced thermal bridging factor (y-factor) of 0.08 in DEAP calculations.



Cavity Wall Construction

Introduction text

These are the terms and conditions for using ACDs.

(1) WALLS: INSULATION IN CAVITY *2021*

INTRODUCTION

The details in this section have been developed for a range of partial and full fill cavity wall construction to support TGD L 2021. The introduction document "Limiting Thermal Bridging and Air Infiltration Acceptable Construction Details" provides practical information with regards to implementation of these details onsite. This guide should be read in conjunction with these details. Details are given for the junctions with a range of roof, ground floor and internal floor types, as well as at external wall opes.

The details are indicative. They focus on the issues of thermal performance and air tightness. Other issues are not considered fully. Insulation thicknesses for the main building elements have not been provided, as these depend on the thermal properties of the material chosen, as well as on the desired U-value.

Masonry materials shown on the drawings are blocks and bricks. Other masonry materials, including precast and in-situ concrete, may be substituted without loss of thermal performance or increased technical risk. The use of thermally resistant materials, beyond that depicted, will naturally increase the thermal performance of the building fabric.

All materials and workmanship are to be installed to Technical Guidance Document D ‘Materials and Workmanship’.

The suitability of full fill construction depends on the site exposure and nature of the outer leaf. Further information is given in the BR 262 " Thermal Insulation: Avoiding Risks" and relevant Irish Agrément Board certificates.

These diagrams illustrate good practice for design and construction of interfaces only in respect to ensuring thermal performance and air barrier continuity. The guidance must be implemented with due regard to all other requirements imposed by the Building Regulations.

This set of details shows cavity wall insulation used in combination with internal insulation. The cavity wall details can also be used without the addition of internal insulation to achieve the construction described in Table D1. The air barrier detail apply in all cases.

In these details red insulation hatch pattern indicates partial and/or internal insulation and the gray insulation hatch pattern indicates full fill insulation as appropriate.

Insulation hatching is indicative and represents appropriate insulation materials depending on location and application as specified.

Where theses details are used for the Target U-values and construction described in Table D1 of TGD L 2021 the psi values published in Table D1 may be used to calculate the actual Thermal Bridging heat loss for a dwelling for the key thermal bridging junctions in that dwelling.

Technical Guidance Document B and Supplementary Guidance to TGD B provides guidance in relation to the provision of cavity barriers in air cavities, cavity barriers within combustible insulation layers and fire protection of structural elements.

The 2021 edition of the ACDs updates the drawings in the 2011 ACDs to include internal insulation which was previously provided for in the text. The performance requirements of the 2021 ACDs remain the same as for the 2011 edition.

Introduction text

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Technical Guidance Document B and the Supplementary Guidance to TGD B provides guidance in relation to the provision of:

- cavity barriers in air cavities,
- cavity barriers within combustible insulation layers and
- fire protection of structural elements.

(1) WALLS: INSULATION IN CAVITY *2021*

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Insulation hatching is indicative and represents appropriate insulation materials depending on location and application as specified.

Where theses details are used for the Target U-values and construction described in Table D1 of TGD L 2021 the psi values published in Table D1 may be used to calculate the actual Thermal Bridging heat loss for a dwelling for the key thermal bridging junctions in that dwelling.

Technical Guidance Document B and Supplementary Guidance to TGD B provides guidance in relation to the provision of cavity barriers in air cavities, cavity barriers within combustible insulation layers and fire protection of structural elements.

The 2021 edition of the ACDs updates the drawings in the 2011 ACDs to include internal insulation which was previously provided for in the text. The performance requirements of the 2021 ACDs remain the same as for the 2011 edition.

Introduction text

Where theses details are used for the Target U-values and construction described in Table D1 of TGD L 2021 the Psi-values published in Table D1 may be used to calculate the actual Thermal Bridging heat loss .. for the key thermal bridging junctions in that dwelling.

(1) WALLS: INSULATION IN CAVITY *2021*

INTRODUCTION

The details in this section have been developed for a range of partial and full fill cavity wall construction to support TGD L 2021. The introduction document "Limiting Thermal Bridging and Air Infiltration Acceptable Construction Details" provides practical information with regards to implementation of these details onsite. This guide should be read in conjunction with these details. Details are given for the junctions with a range of roof, ground floor and internal floor types, as well as at external wall opes.

The details are indicative. They focus on the issues of thermal performance and air tightness. Other issues are not considered fully. Insulation thicknesses for the main building elements have not been provided, as these depend on the thermal properties of the material chosen, as well as on the desired U-value.

Masonry materials shown on the drawings are blocks and bricks. Other masonry materials, including precast and in-situ concrete, may be substituted without loss of thermal performance or increased technical risk. The use of thermally resistant materials, beyond that depicted, will naturally increase the thermal performance of the building fabric.

All materials and workmanship are to be installed to Technical Guidance Document D 'Materials and Workmanship'.

The suitability of full fill construction depends on the site exposure and nature of the outer leaf. Further information is given in the BR 262 " Thermal Insulation: Avoiding Risks" and relevant Irish Agrément Board certificates.

These diagrams illustrate good practice for design and construction of interfaces only in respect to ensuring thermal performance and air barrier continuity. The guidance must be implemented with due regard to all other requirements imposed by the Building Regulations.

This set of details shows cavity wall insulation used in combination with internal insulation. The cavity wall details can also be used without the addition of internal insulation to achieve the construction described in Table D1. The air barrier detail apply in all cases.

In these details red insulation hatch pattern indicates partial and/or internal insulation and the gray insulation hatch pattern indicates full fill insulation as appropriate.

Insulation hatching is indicative and represents appropriate insulation materials depending on location and application as specified.

Where theses details are used for the Target U-values and construction described in Table D1 of TGD L 2021 the psi values published in Table D1 may be used to calculate the actual Thermal Bridging heat loss for a dwelling for the key thermal bridging junctions in that dwelling.

Technical Guidance Document B and Supplementary Guidance to TGD B provides guidance in relation to the provision of cavity barriers in air cavities, cavity barriers within combustible insulation layers and fire protection of structural elements.

The 2021 edition of the ACDs updates the drawings in the 2011 ACDs to include internal insulation which was previously provided for in the text. The performance requirements of the 2021 ACDs remain the same as for the 2011 edition.

TGD L 2021, Table D1

Table D1	Section 1 - Cavity Wall Insulation	Target U-values		
Junction detail Identifier 2011 Edition	Junction detail	U-value = 0.18 W/m²K, 150mm full-fill or partial fill cavity[1, 3] (roof U = 0.16) (floor U = 0.18)	U-value = 0.15 W/m²K, 150mm full-fill or partial fill cavity and internal insulation[2, 3] (roof U = 0.14) (floor U = 0.15)	U-value = 0.15 W/m²K, 200mm full-fill or partial fill cavity[2, 3] (roof U = 0.14) (floor U = 0.15)
		ψ-value (W/mK)	ψ-value (W/mK)	ψ-value (W/mK)
Section 1	**Details**			
1.01a	Ground Floor - Insulation above slab	0.170	0.072	0.196
1.01b	Ground Floor - Insulation above slab plus lightweight block	0.080	0.042	0.093
1.02a	Ground Floor - Insulation below slab	0.163	0.108	0.191
1.02b	Ground Floor - Insulation below slab plus lightweight block	0.070	0.061	0.083
1.03	Timber Suspended Ground Floor	0.219	0.102	0.227

TGD L 2021 Table D1

Footnote 1:

ψ values for a Target U-value for the wall of 0.18 W/m2K for the construction type specified. The U-values of the flanking elements to the wall can vary from the flanking element target U-value as follows:

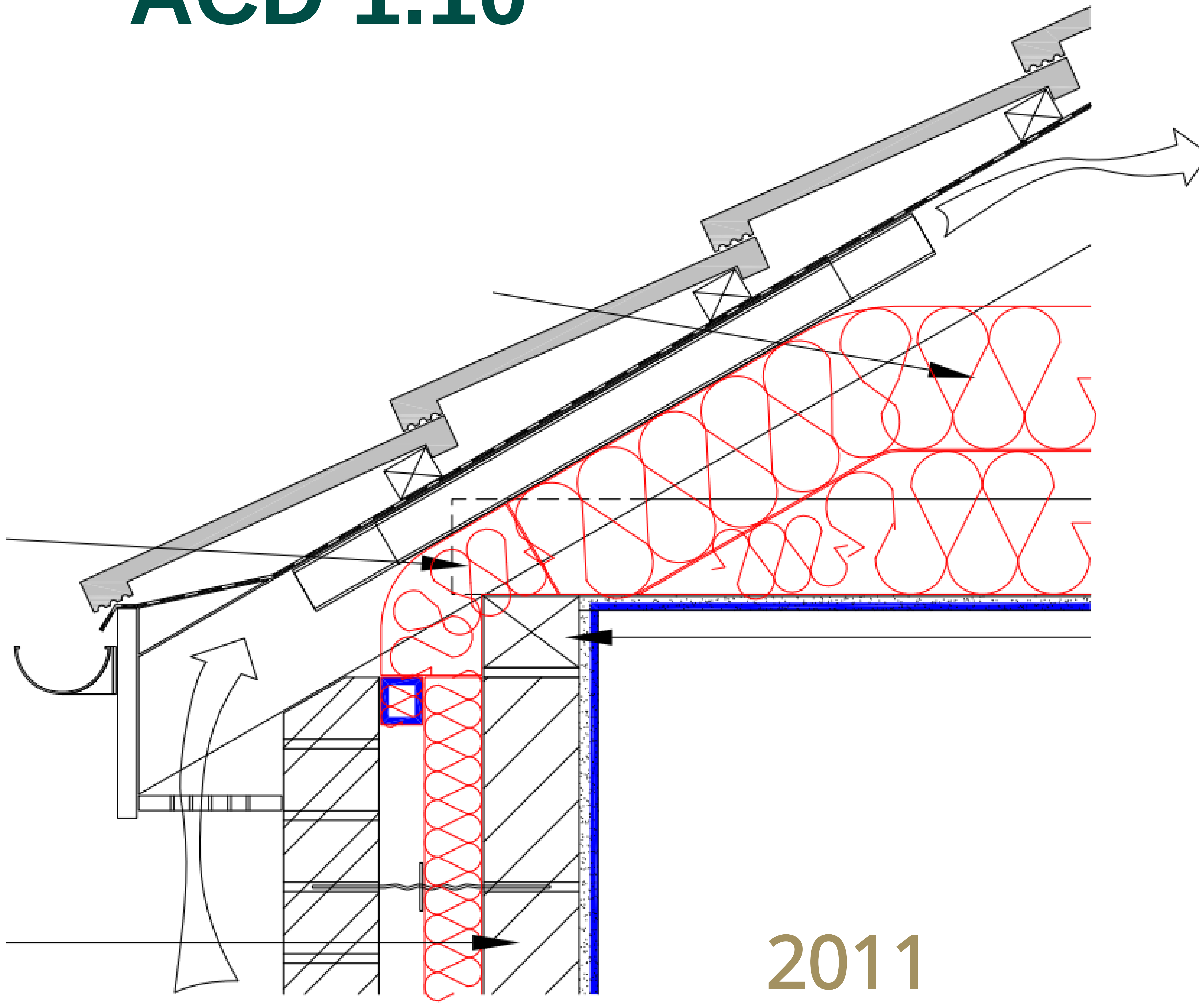
- Pitched roof = 0.13 to 0.16 W/m^{2}K;
- Flat Roof = 0.16 to 0.20 W/m^{2}K;
- Ground Floor = 0.16 to 0.21 W/m^{2}K.

		Target U-values		
		U-value = 0.18 W/m^{2}K, 150mm ll-fill or-partial cavity[1, 3] (roof U = 0.16) (floor U = 0.18)	U-value = 0.15 W/m^{2}K, 150mm full-fill or partial fill cavity and internal insulation[2, 3] (roo .14) = 0.15)	U-value = 0.15 W/m^{2}K, 200mm full-fill or partial fill cavity[2, 3] (roof U = 0.14) (floor U = 0.15)
			value	ψ-value V/mK)
Section 1	**Details**			
1.01a	Ground Floor			.196
1.01b	Ground Floor			.093
1.02a	Ground Floor			.191
1.02b	Ground Floor			.083

Footnote 3:

Where two building elements have one U-value above its target while the other is below its target U-value, the aggregate percentage change from the respective target U-values in the table should not exceed +20 % for the Psi (ψ) value to be valid.

ACD 1.10



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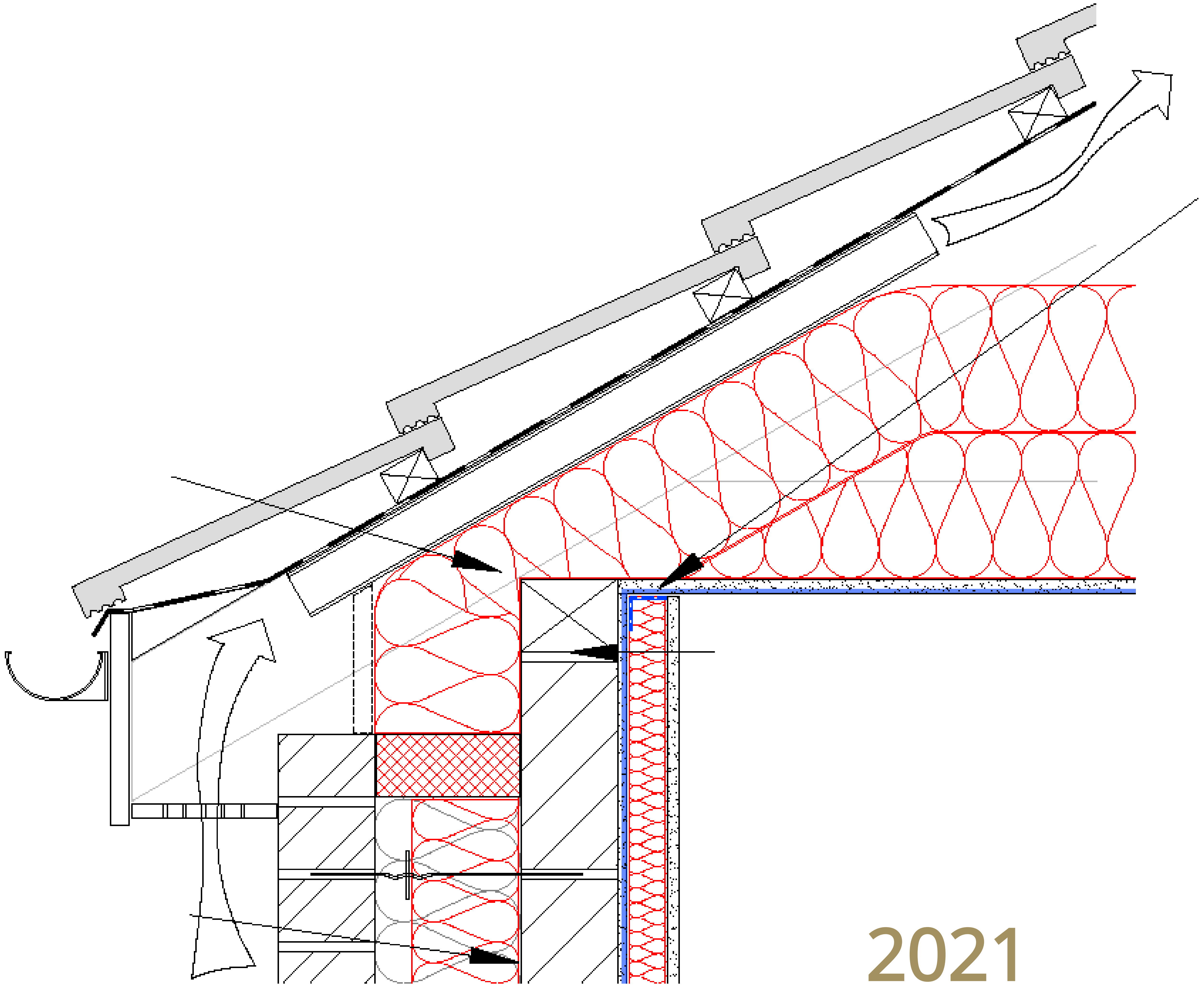

2021

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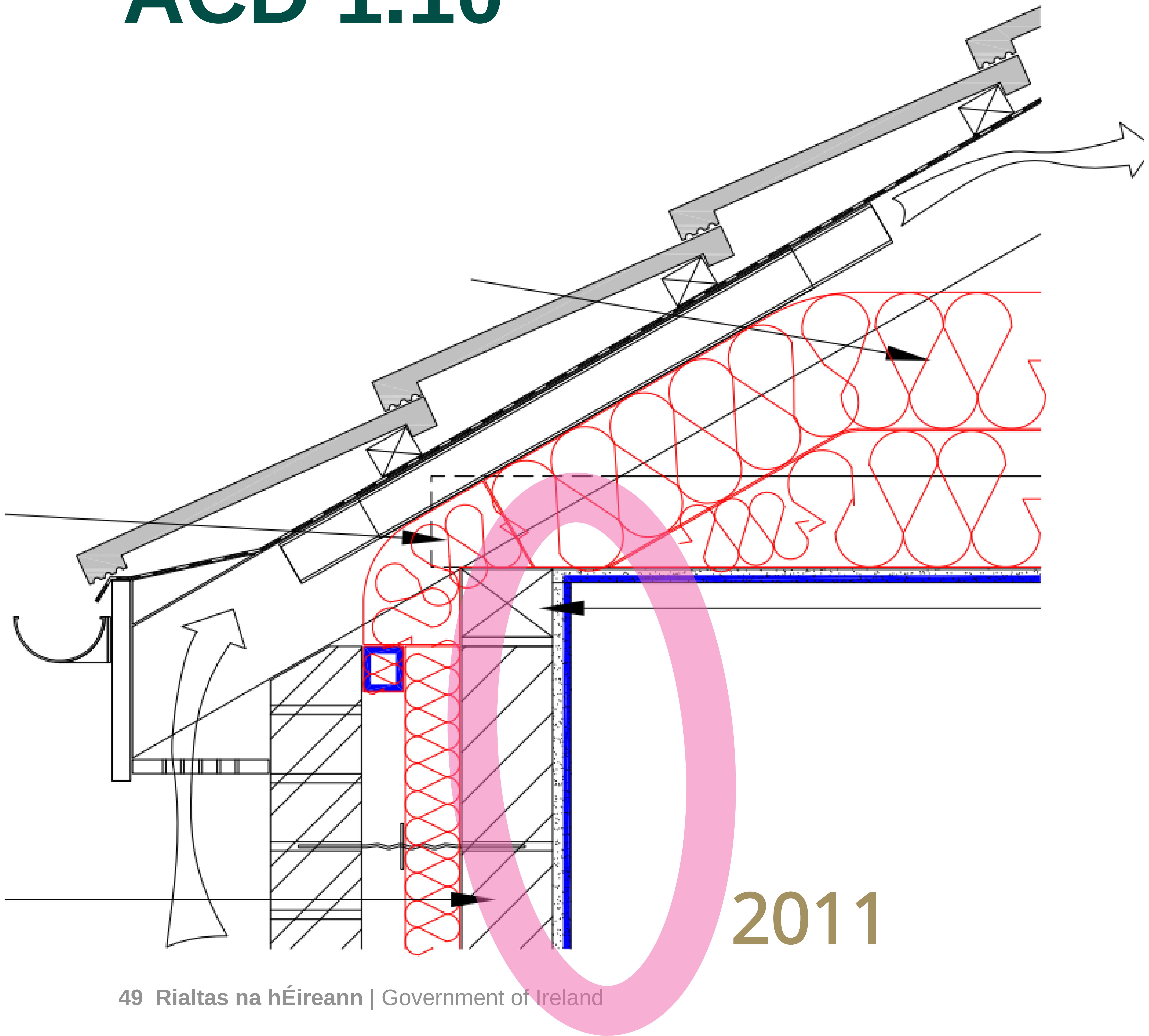

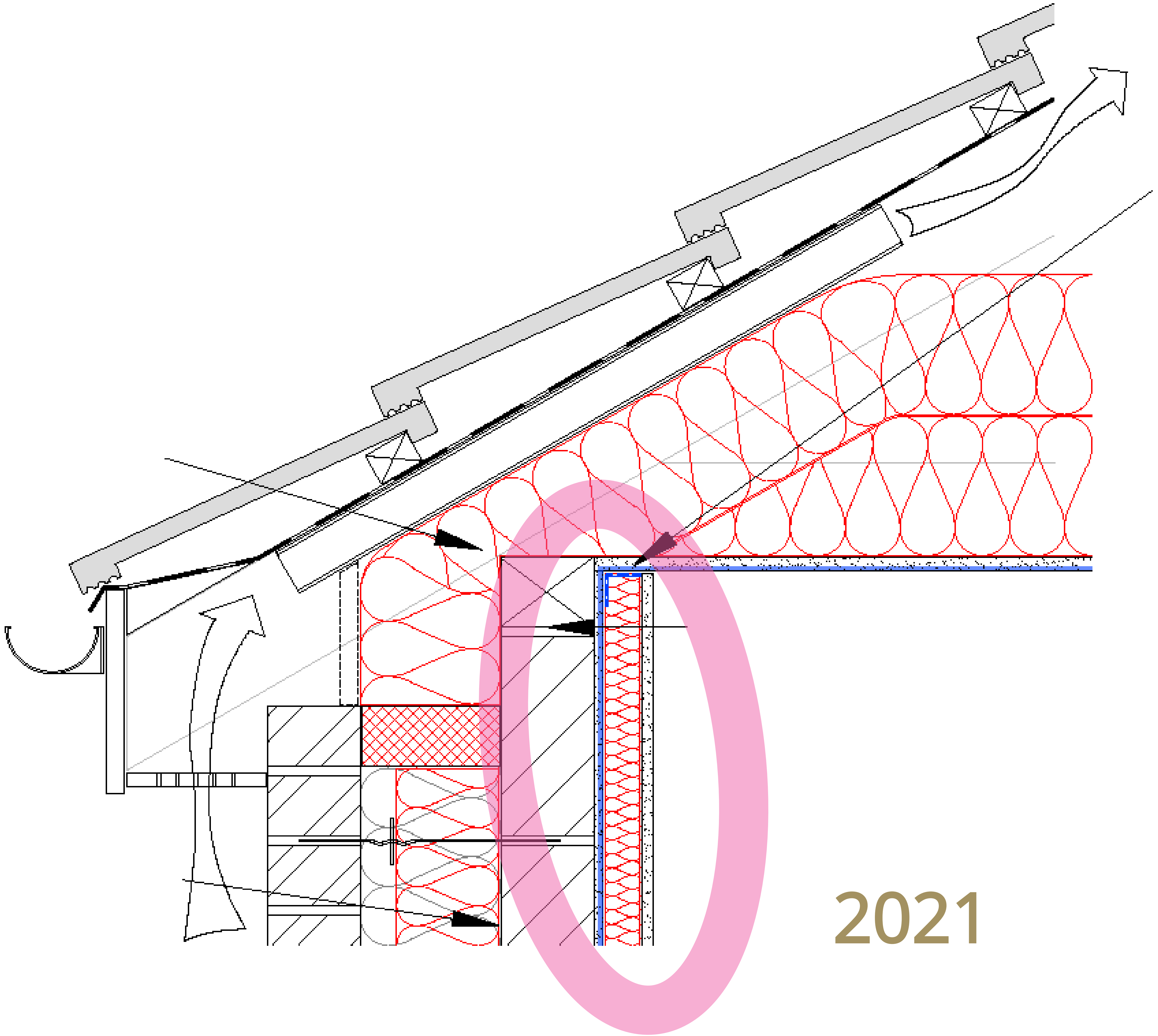

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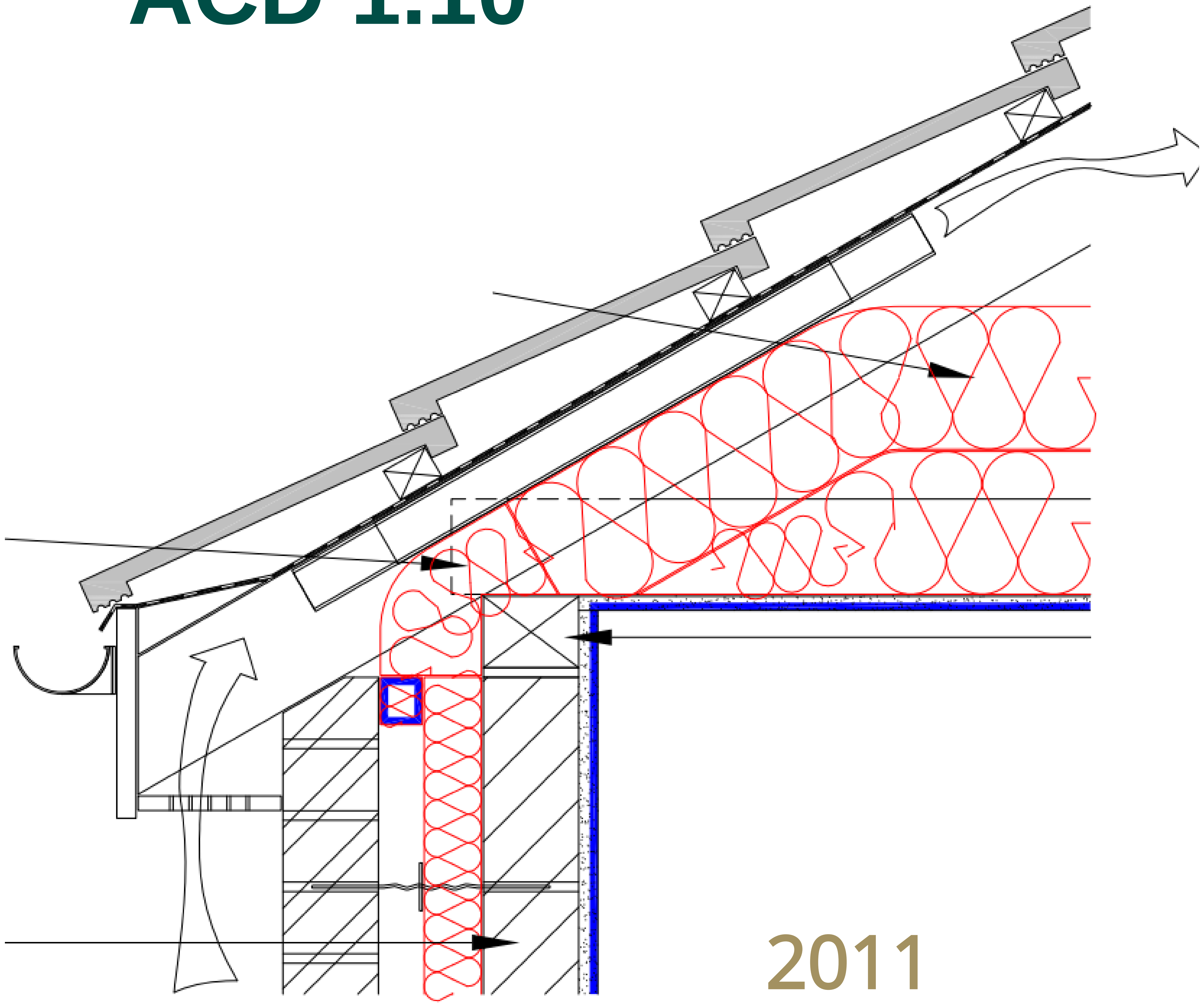

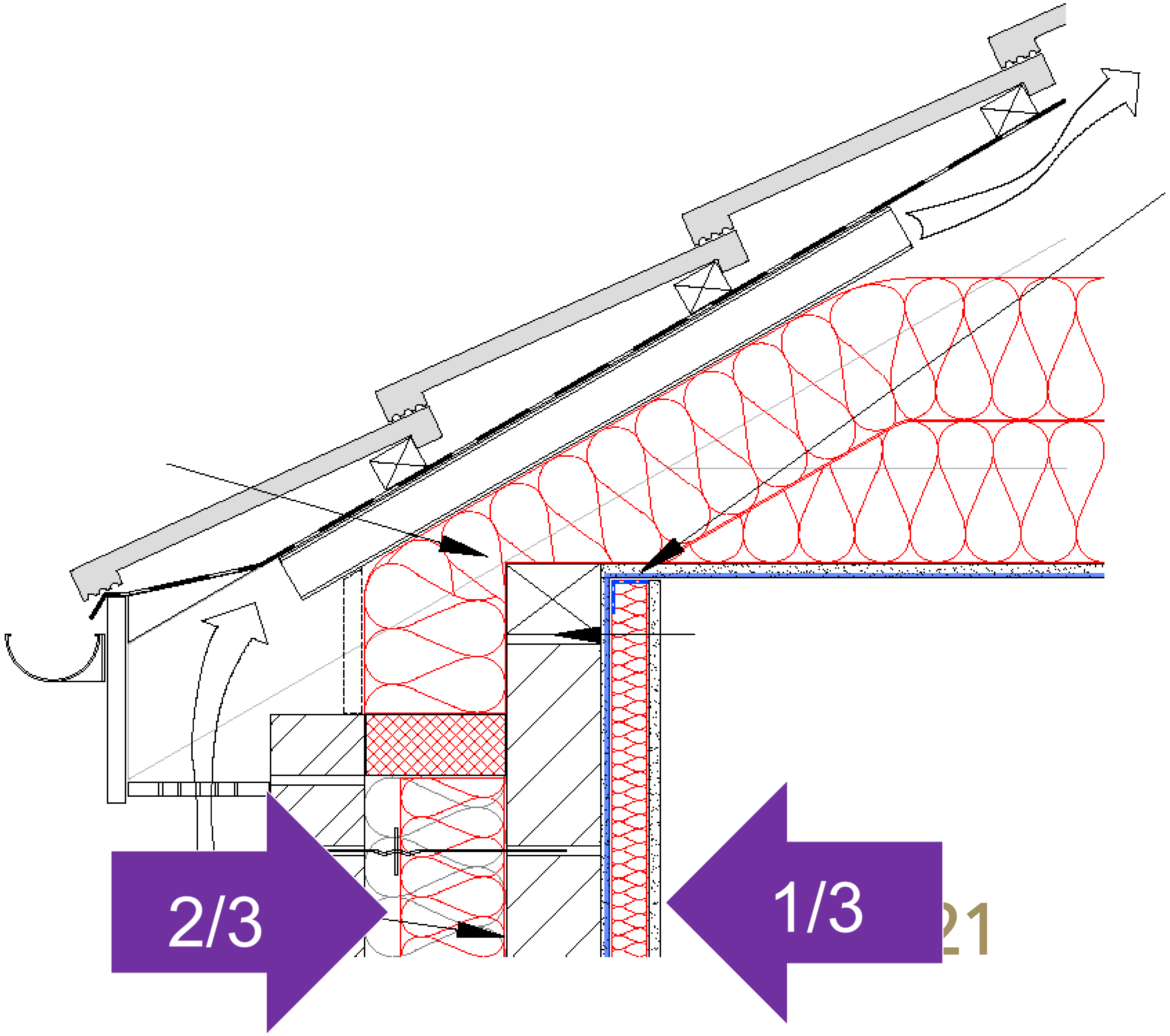

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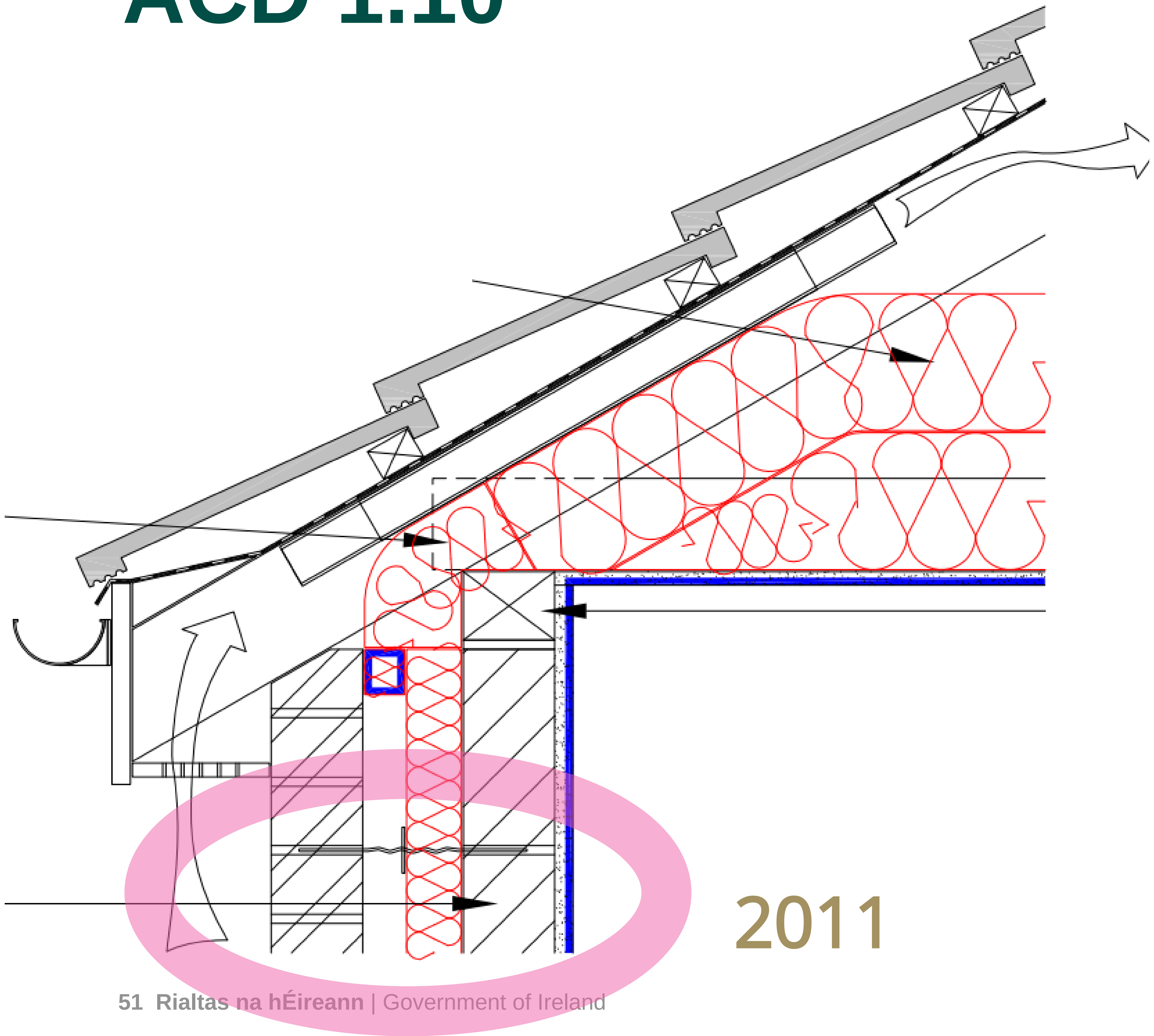

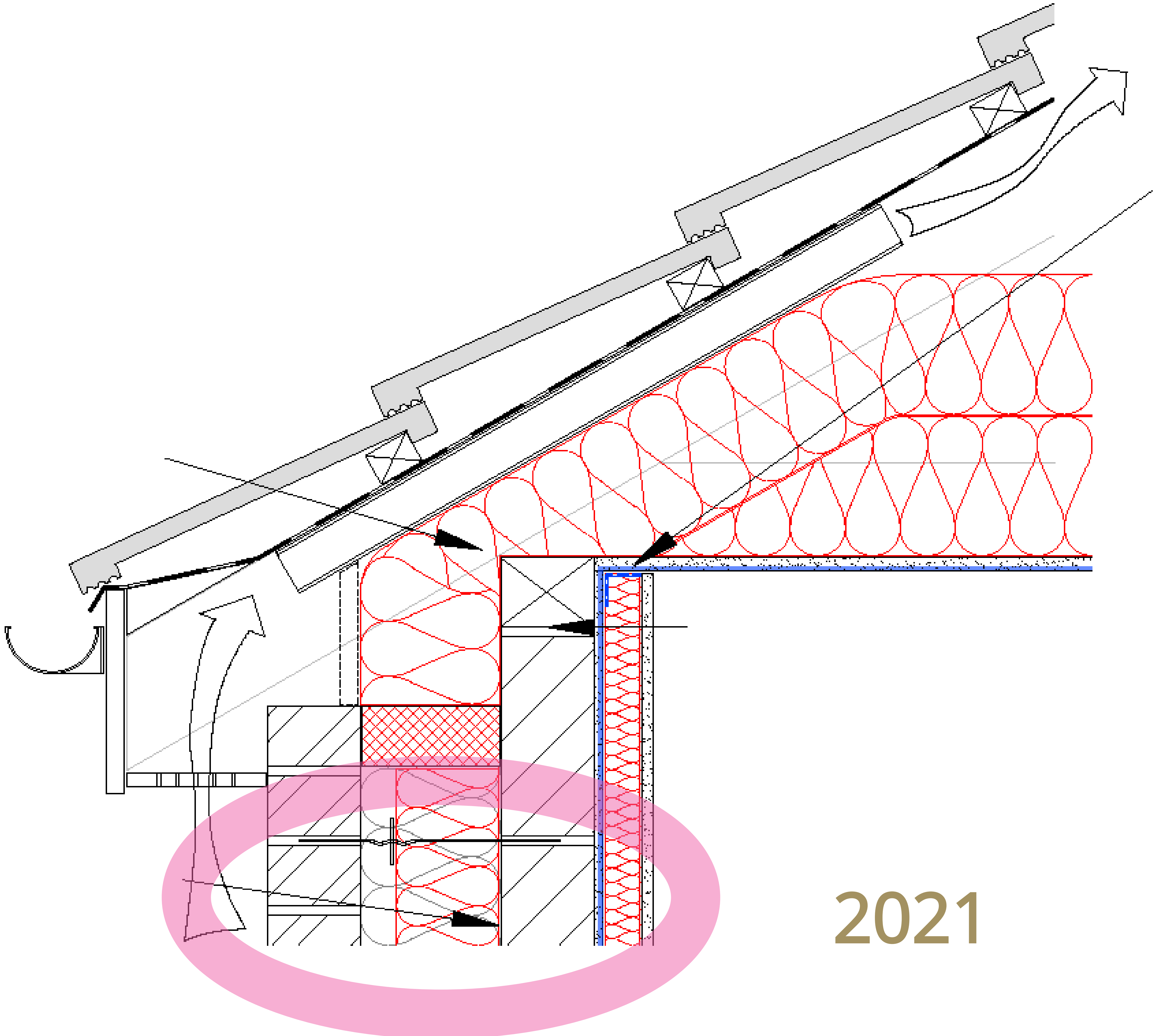

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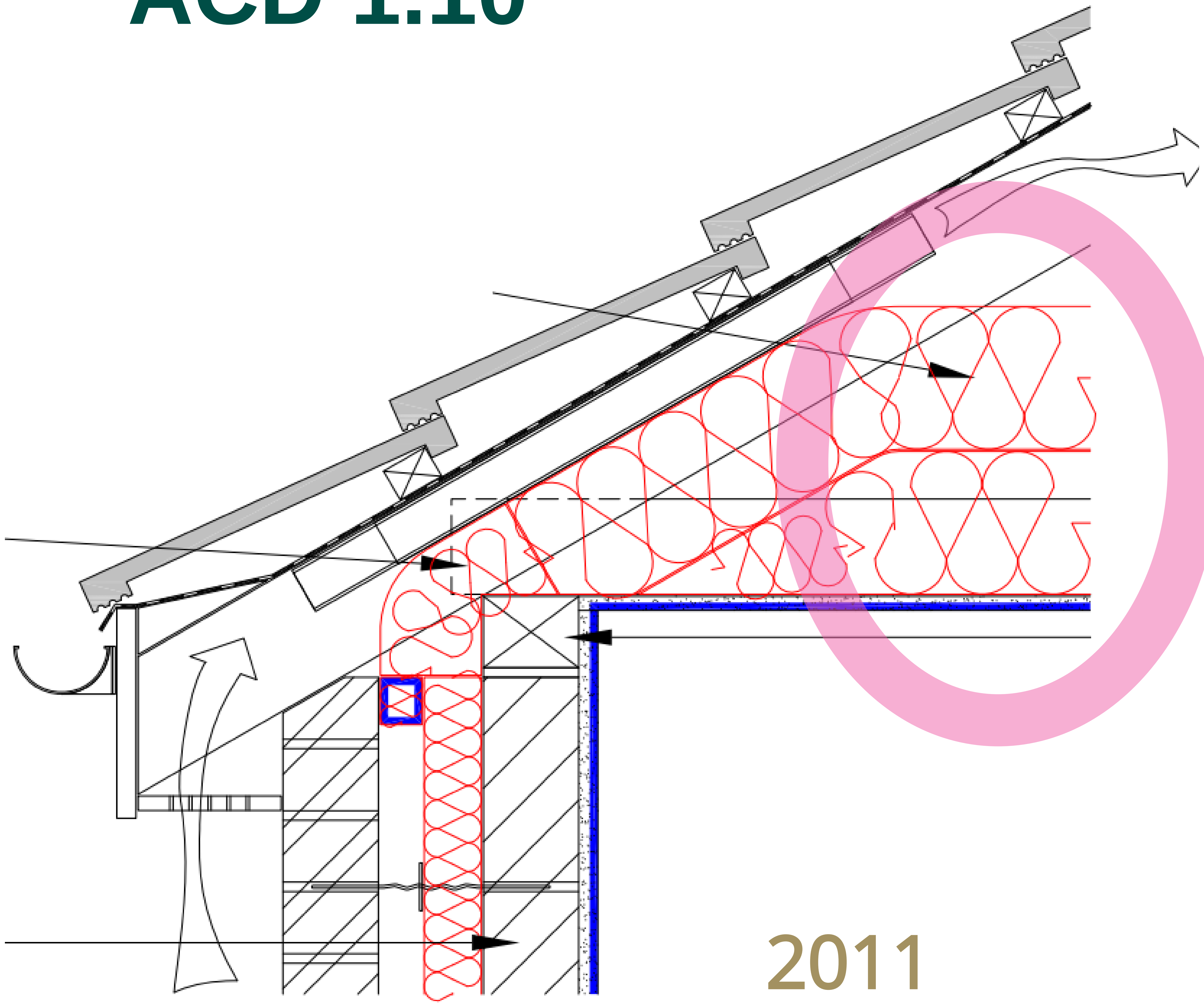

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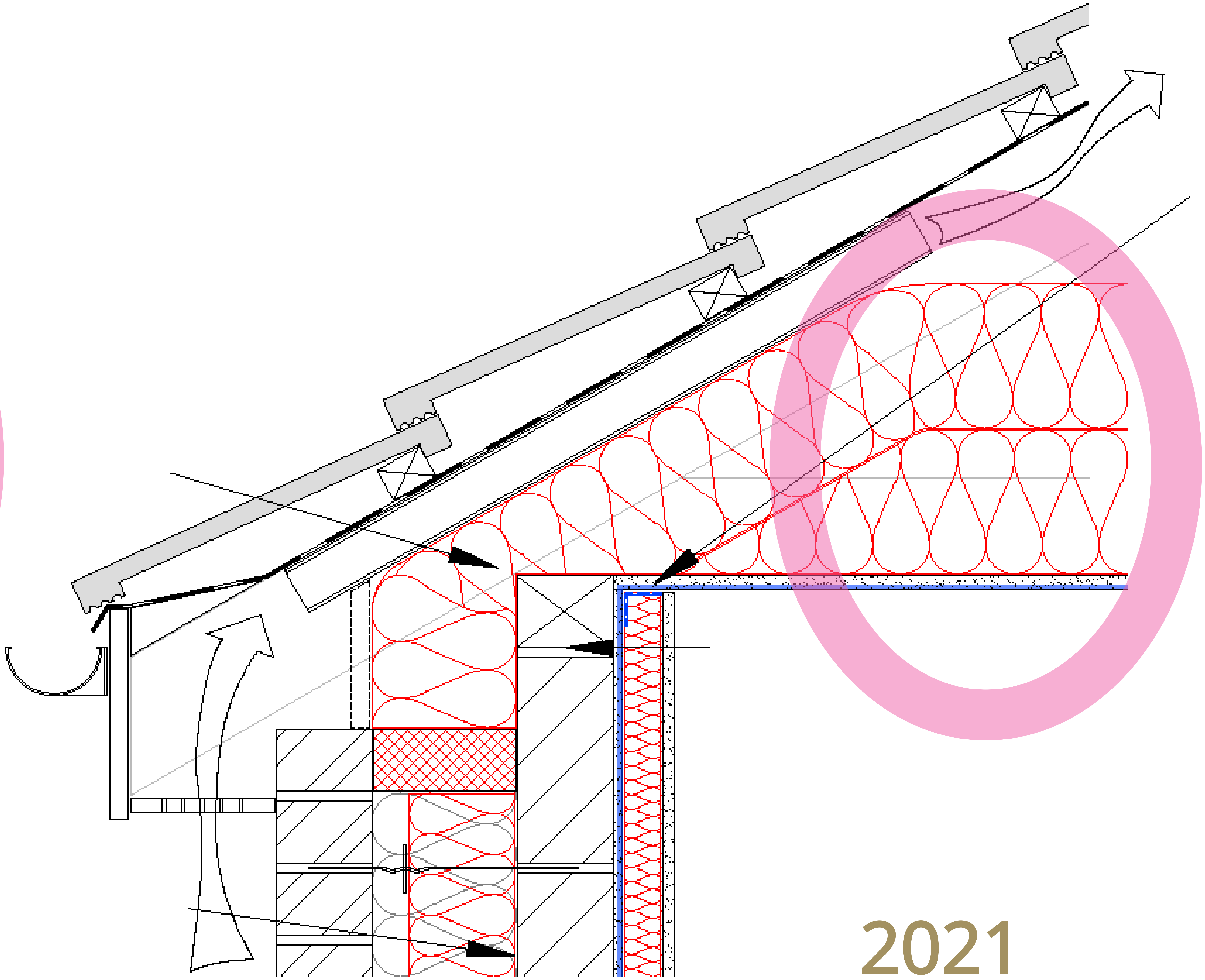

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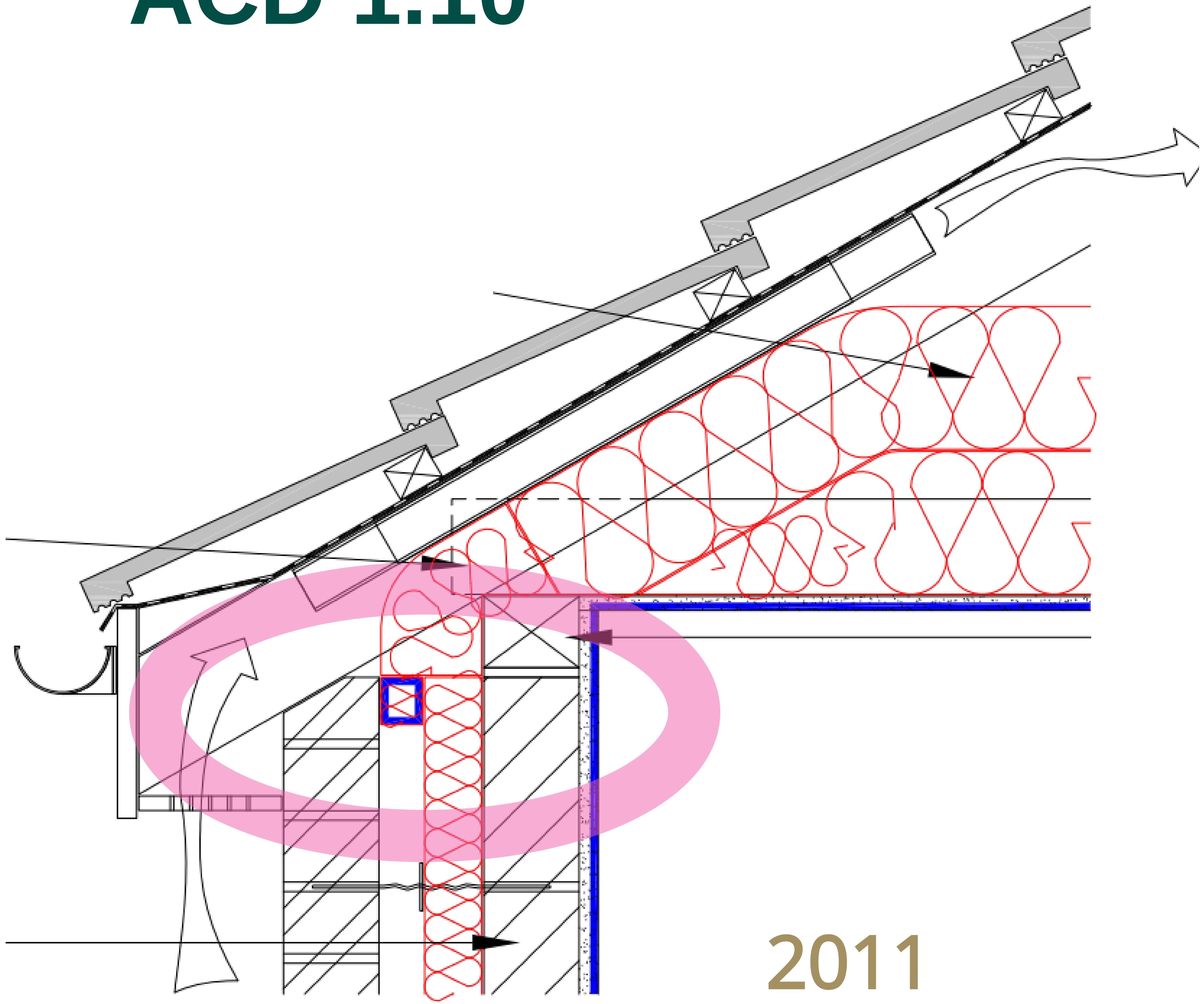

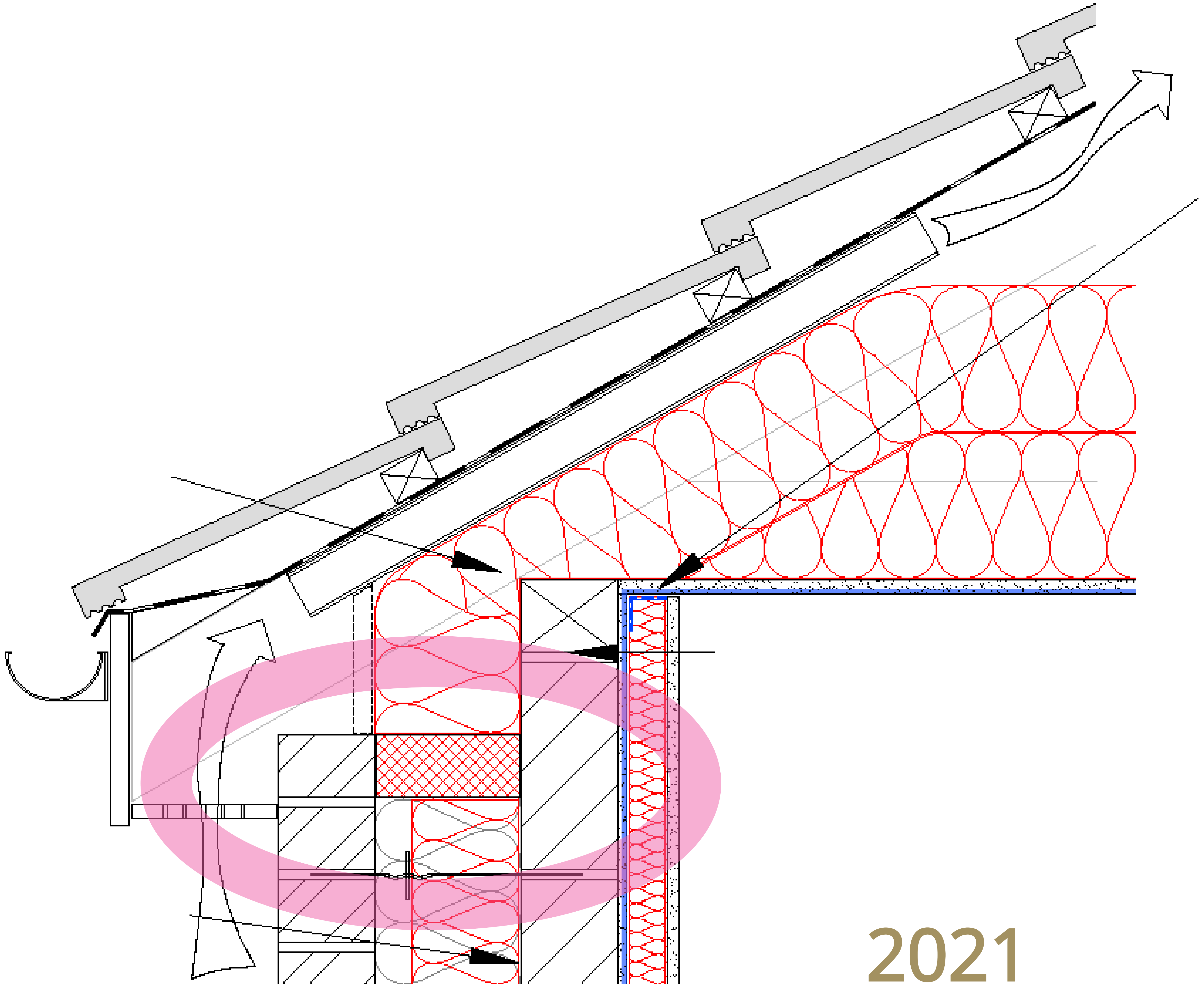

Acceptable Construction Details 2021 edition

Timber Frame Construction

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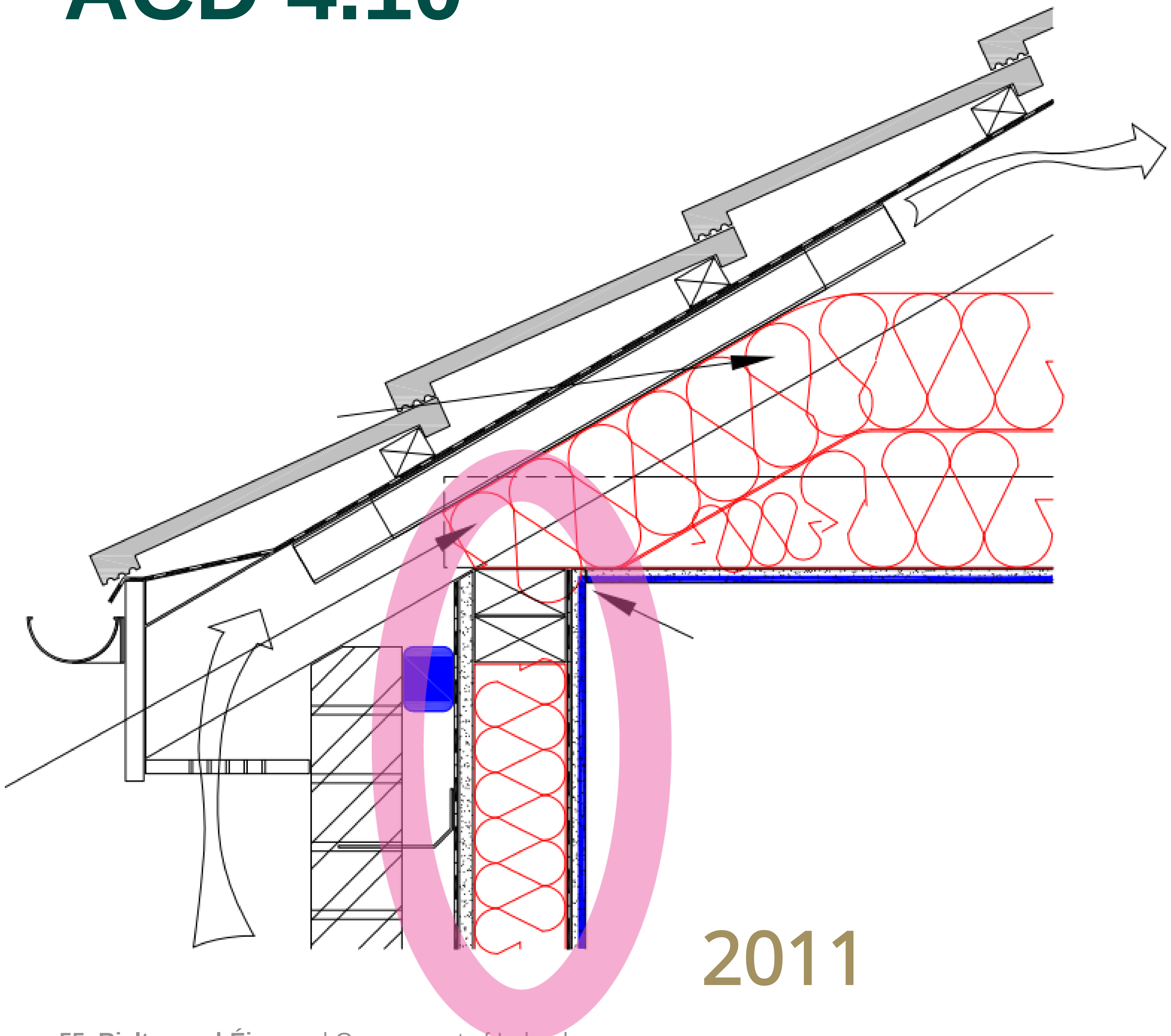

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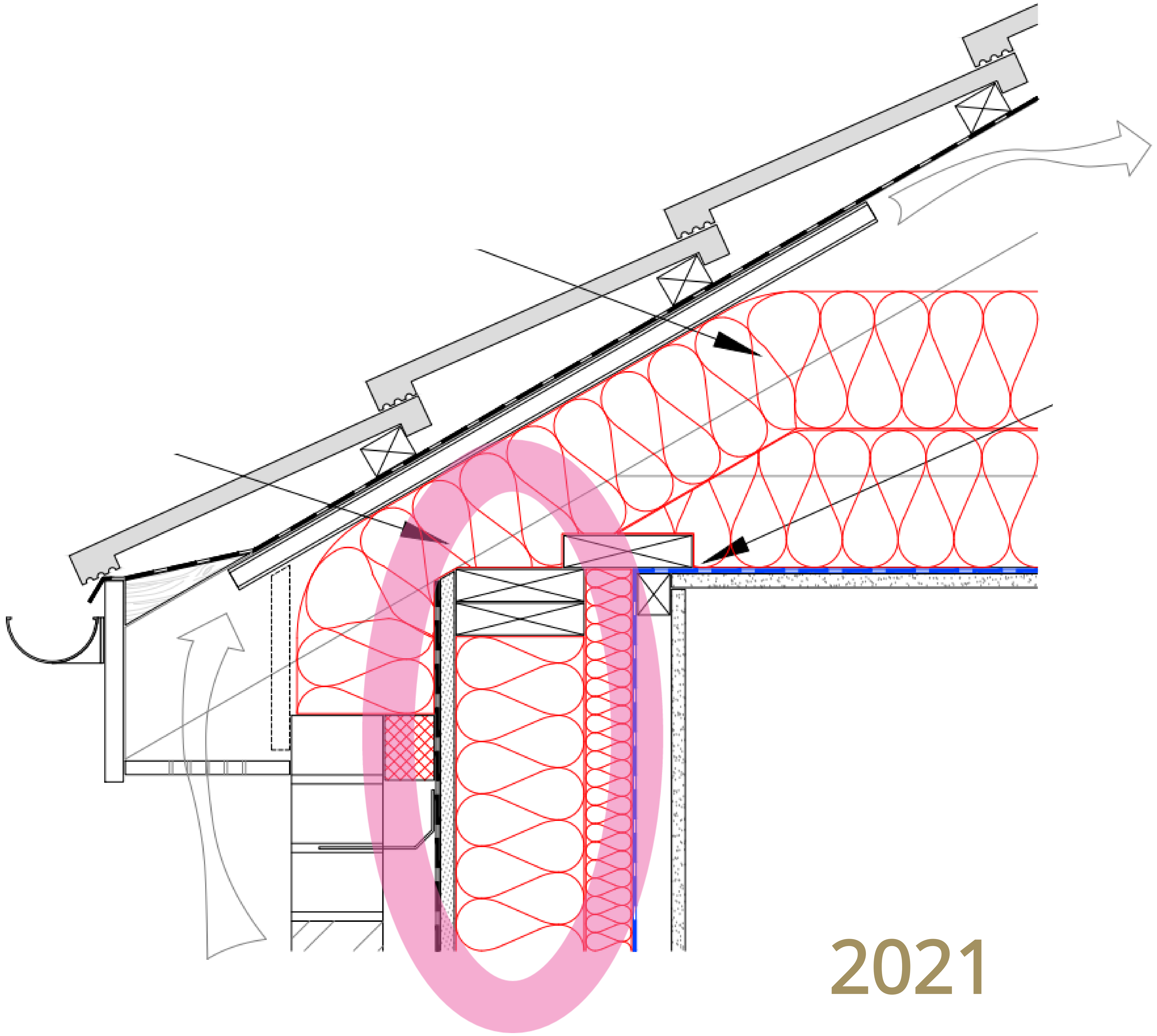

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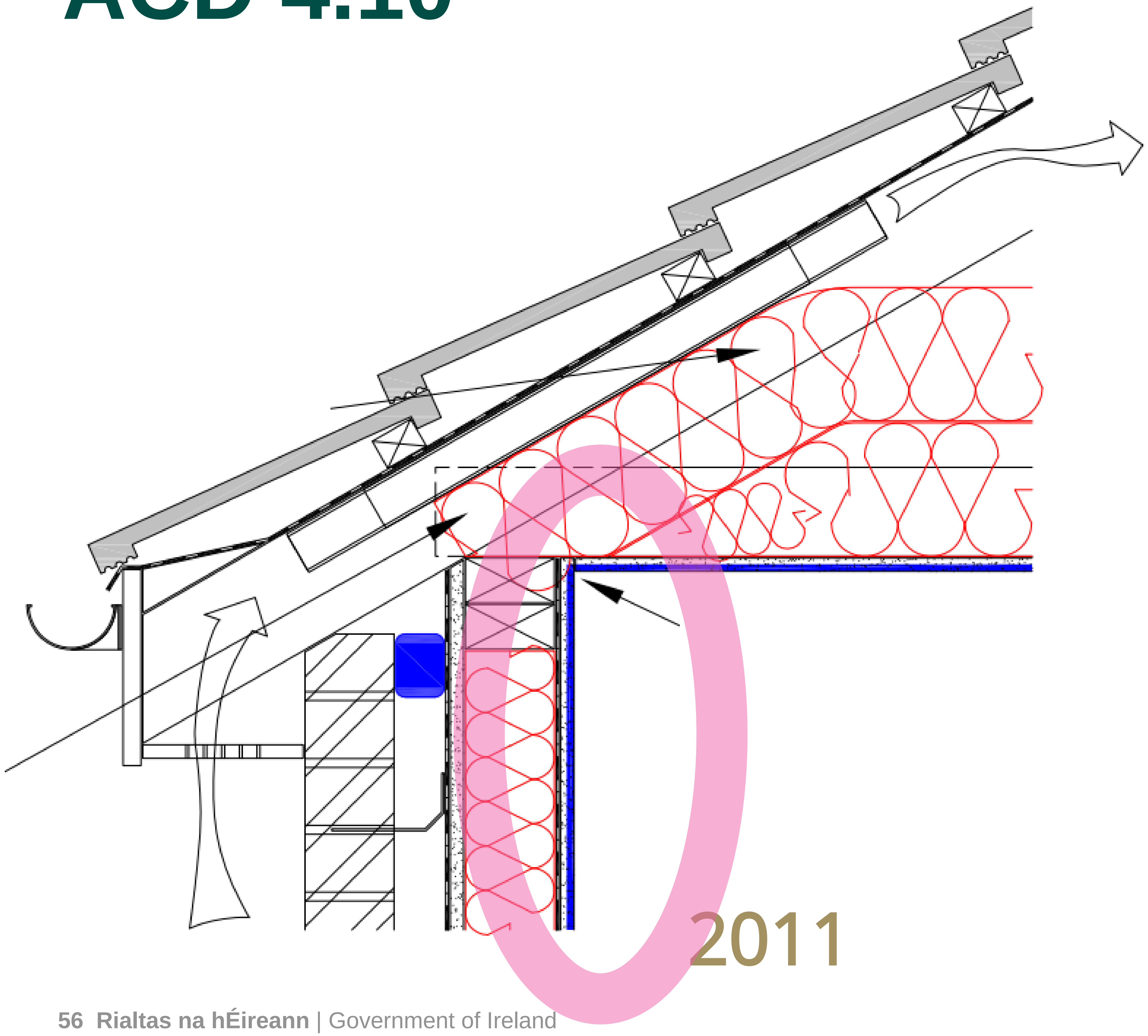

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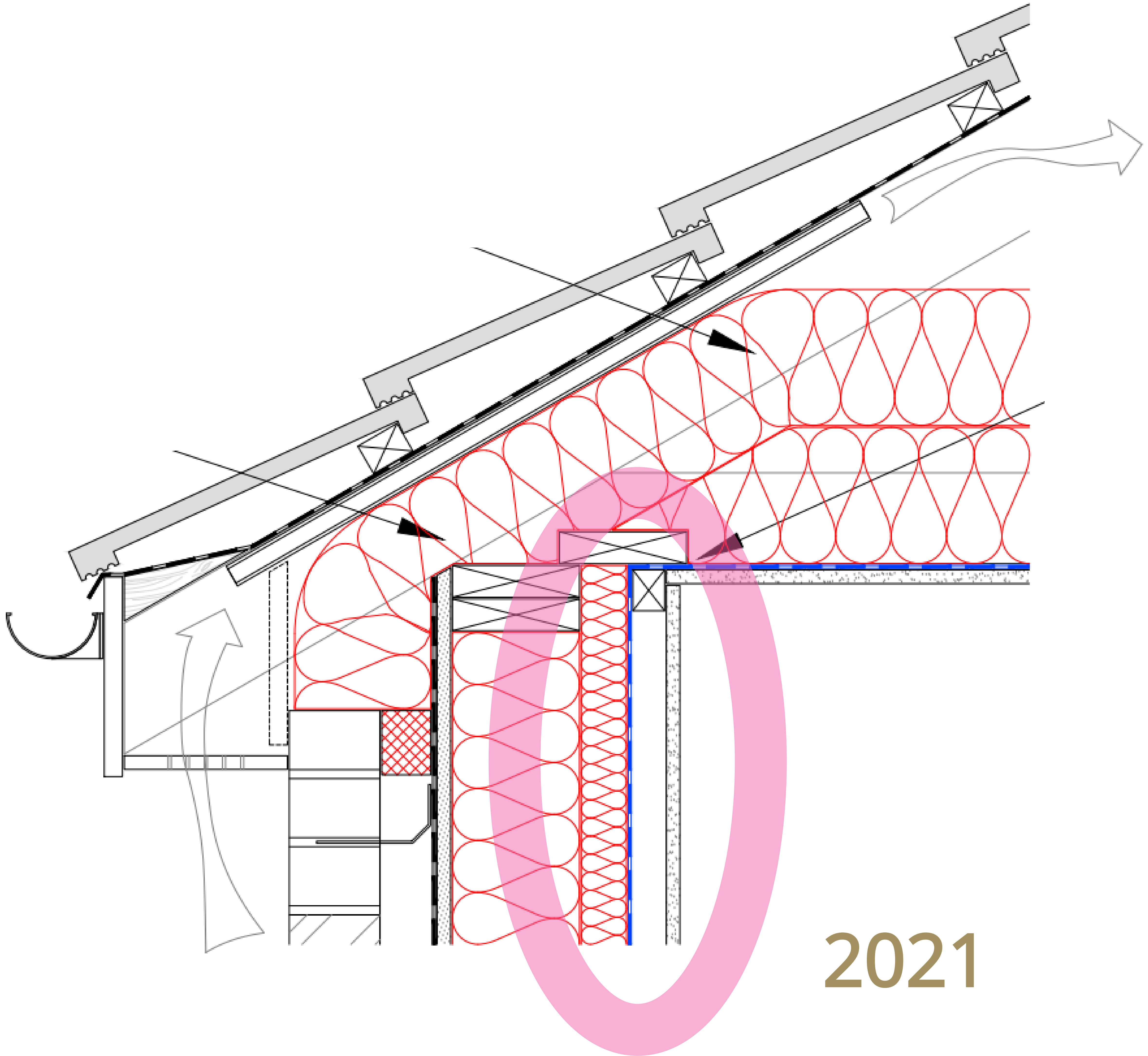

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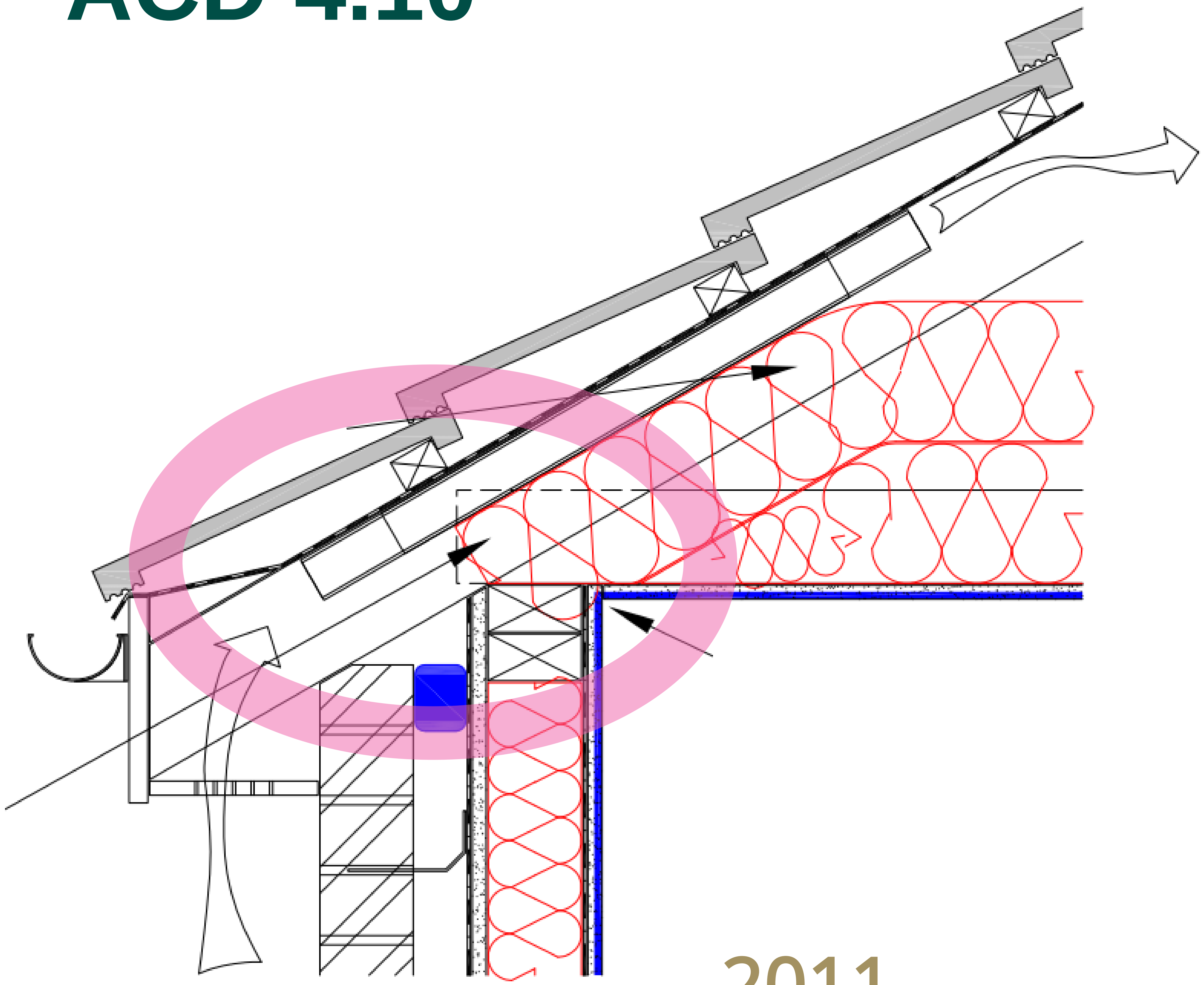

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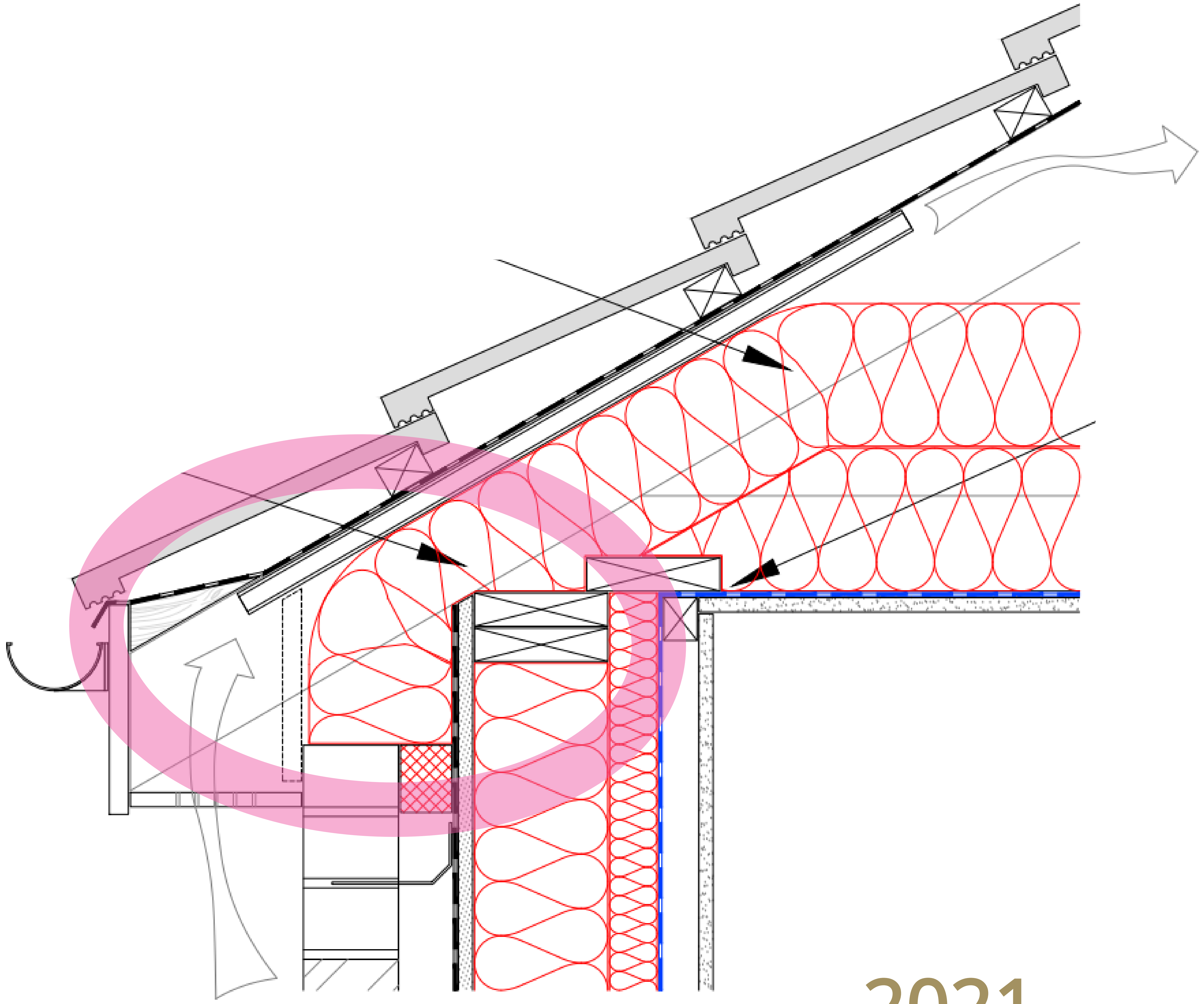

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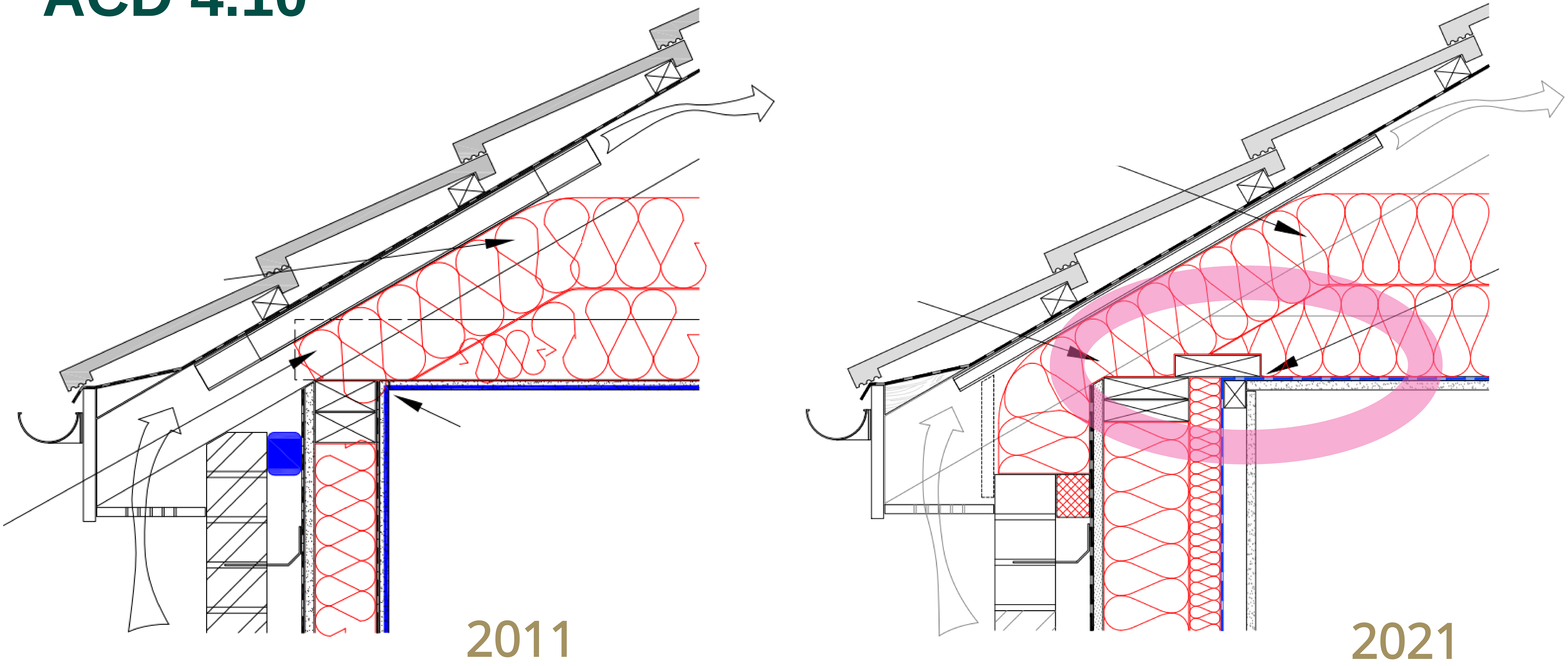

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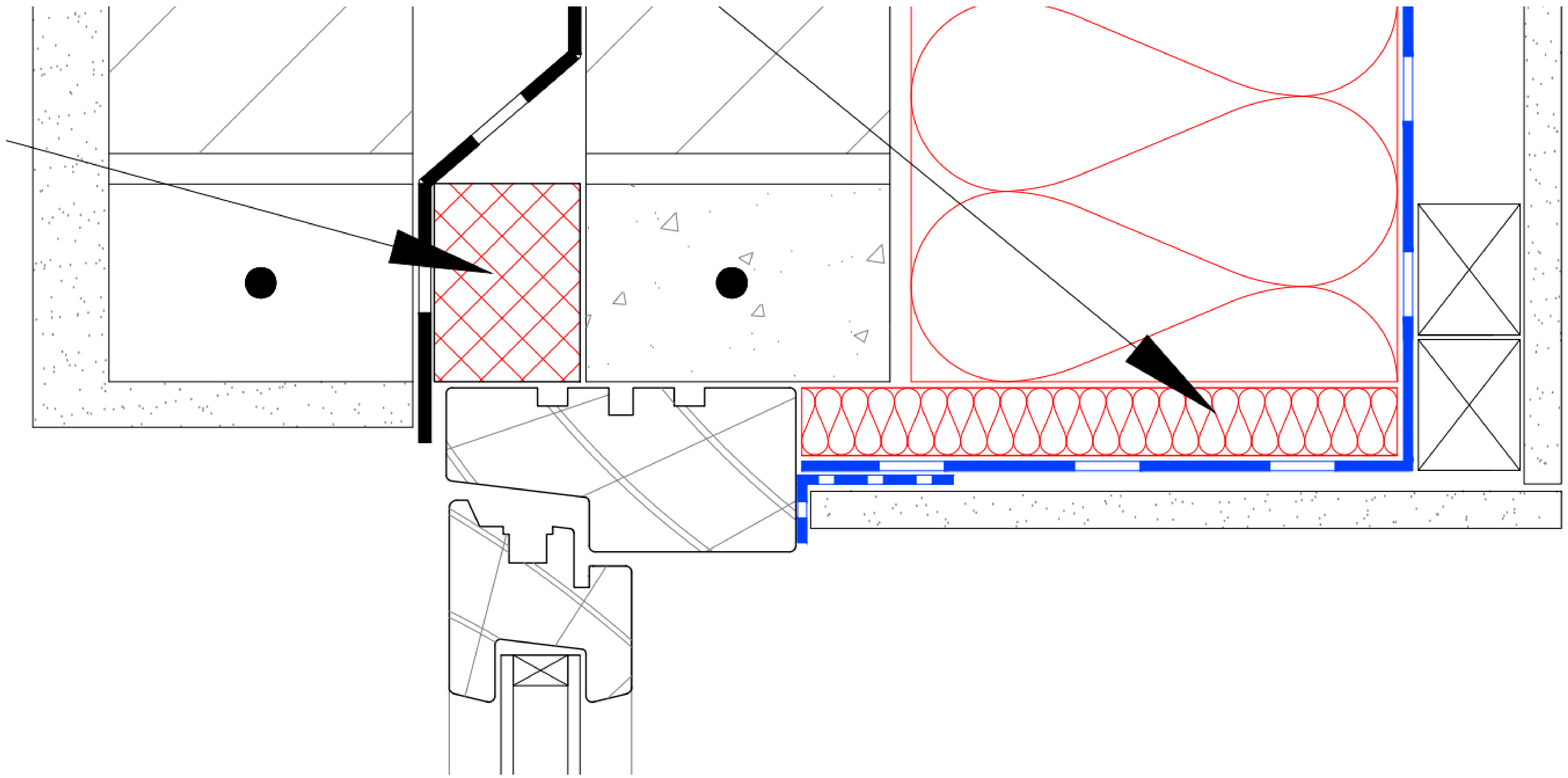
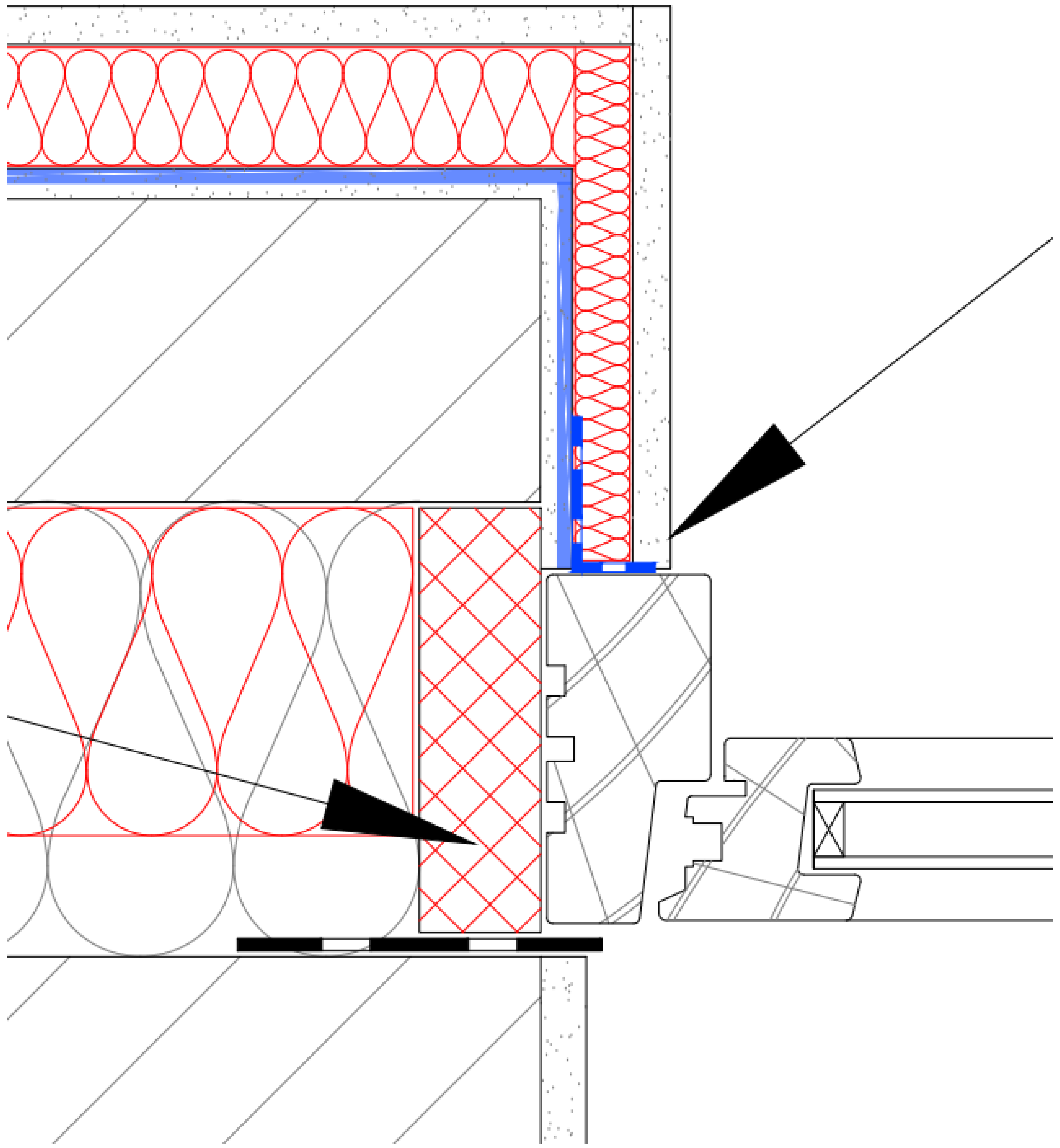
ACD 3.22



2021

(1) Cavity Wall: Jamb with proprietary cavity closer

ACD 1.25



2021

Queries: buildingstandards@housing.gov.ie

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Government of Ireland

Thank You

Simon McGuinness
Climate Action Policy and Construction Industry Regulation Unit
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