Part L 2014 - where to start:

An introduction for house builders and designers - masonry construction

For Wales





Guide

NHBC Foundation
Housing research & guidance

Ariennir yn Rhannol gan
Lywodraeth Cymru
Part Funded by
Welsh Government

F64

Acknowledgements

This guide was written and illustrated for the NHBC Foundation by Studio Partington.

The psi-value guidance published in this guide was developed in conjunction with C4Ci Ltd.

Special thanks to AECOM for their assistance in reviewing the new ADL1A for Wales and developing the models and options for each type of home.

Front cover image: Derwenthorpe Housing, York architect: Richards Partington Architects; photography © Tim Crocker.

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First published July 2015 by NHBC Foundation.
NF64
ISBN 978-0-9930691-4-7

About the NHBC Foundation

The **NHBC Foundation**, established in 2006, provides high quality research and practical guidance to support the house-building industry as it addresses the challenges of delivering 21st century new homes. To date we have published over 60 reports on a wide variety of topics, including the sustainability agenda, homeowner issues and risk management.

The NHBC Foundation is also involved in a programme of positive engagement with the Government, academics and other key stakeholders, focusing on current and pressing issues relevant to house building.

To find out more about the NHBC Foundation, please visit **www.nhbcfoundation.org**. If you have feedback or suggestions for new areas of research, please contact **info@nhbcfoundation.org**.

NHBC is the standard-setting body and leading warranty and insurance provider for new homes in the UK, providing risk management services to the house-building and wider construction industry. All profits are reinvested in research and work to improve the construction standard of new homes for the benefit of homeowners. NHBC is independent of the Government and builders. To find out more about NHBC, please visit **www.nhbc.co.uk**.

NHBC Foundation Expert Panel

The NHBC Foundation's research programme is guided by the following panel of senior representatives from Government and industry:

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Foreword

The Welsh Government is committed to tackling climate change and promoting sustainable development. Reducing emissions from new homes is an area that the Welsh Government can help achieve this commitment. As we move forward it is important to ensure that new homes are meeting the required levels of energy efficiency. Improving the energy performance of these homes will also help reduce fuel bills, which are an ever increasing concern to family budgets.

The energy efficiency requirements for new homes, set out in the Building Regulations, are crucial to the achievement of these aims. In 2010, through national planning policy, energy efficiency standards in Wales were raised above the then Building Regulations for England and Wales. In 2014 these higher energy efficiency requirements were removed from planning policy and consolidated into the newly devolved Building Regulations for Wales regulatory requirements.

Thanks to the work of the Zero Carbon Hub and partners we know that in construction, the detailing of junctions is a key factor in heat loss from homes. It is crucial that builders get the junctions right, but we recognise the technical challenges that may be faced in this area. This is why the Welsh Government is pleased to support the development of this guidance from the NHBC Foundation. Using their own resources, financial support from the Welsh Government and goodwill from partners, the Foundation has produced guidance for builders on how to construct some of the key masonry and timber junctions in homes. The guidance provides a useful reference point for builders who are working to achieve the required levels of energy efficiency. I would hope that these construction techniques will be particularly useful to smaller builders, who often have less access to technical expertise and resources than larger firms.

I am pleased to be able to support these publications which will be a useful companion to the Building Regulations and the Approved Documents in Wales. I am grateful to NHBC and other organisations who have contributed to the production of this guidance.

Carl Sargeant AM
Minister for Natural Resources,
Welsh Government

Contents

Introduction to the guide

This guide is intended to help house builders and designers understand the 2014 changes to Approved Document L1A - Conservation of fuel and power in new dwellings (ADL1A) in Wales. ADL1A 2014 builds on the process for demonstrating compliance established in previous editions for England and Wales. However, there are some important differences in the detail when compared to previous editions. The ADL1A 2014 specifications aim to deliver 8% carbon dioxide (CO_2) savings across the new homes build-mix relative to 2010. A new elemental specification has been introduced. If a new home is constructed entirely to the elemental specification it will typically also meet the CO_2 emissions rate. While there is no mandatory fabric efficiency standard in ADL1A 2014, mandatory (area weighted average) fabric values ensure that good fabric efficiency is achieved.

This guide gives examples of some typical homes outlining a combination of measures needed to comply with ADL1A 2014. The intention is to give a broad understanding of the specifications that may be adopted as a starting point for detailed design.

To supplement the 'options for compliance' tables and construction 'build-ups' we have also included diagrams of important construction junctions to give house builders and their advisors a better feel for the critical elements and their likely performance.

This is only a general guide and there is no obligation to adopt any of the options given. You should always check with the Building Control Body that your proposals comply with all the requirements of the Building Regulations. You will also need to comply with NHBC Standards and any planning or regulatory requirements.

As part of your Building Regulations application you will have to provide a CO_2 emissions rate calculation using the Government's Standard Assessment Procedure (SAP) before construction commences and again on completion.

The five criteria that must be met in order to demonstrate compliance with Part L are:

Criterion 1

Achieving the Target Emission Rate (TER): the target value is set using the approach set out in ADL1A and SAP 2012 based on the elemental specification set out in Table B1 of ADL1A 2014 and Appendix R of the SAP document.

Criterion 2

Limits on design flexibility: the thermal performance of building elements and efficiencies of services must not fall below minimum values.

Criterion 3

Limiting the effects of heat gains in summer: the building must not suffer from excessive solar and other heat gains. This takes into account the ventilation strategy adopted in the home and now gives greater prominence to the insulation of hot water circulation pipes within communal spaces.

Criterion 4

Building performance consistent with the Dwelling Emission Rate (DER): the performance of the building fabric and services is verified through appropriate site inspection procedures, testing and commissioning.

Criterion 5

Provisions for energy efficient operation of the dwelling: information is provided to the home occupiers to enable them to operate their new home efficiently.

Section 1: Options for compliance

1.1 How to use this section

This section sets out an approach for discussions with advisors and suppliers. For each home type there is a summary page showing the possible options for compliance. This is only a general guide and the options illustrated are not exhaustive or prescriptive.

Decide on approach to overall compliance

There is considerable flexibility in devising a design strategy to demonstrate compliance with Criterion 1.

Options 1 and 2, given in the blue tables, show the fabric specification and renewables required if no particular attention is given to thermal bridging. In this instance, the SAP assessor can input a 'default' y-value into the SAP calculations. In terms of calculations, using the default y-values in these approaches may be deemed simpler than using the psi-values.

Options 3 and 4, given in the yellow tables, show the fabric specification required if the heat loss through thermal bridges is accounted for by calculations specific to the junction detail adopted. With these approaches attention should be paid to the construction of the junctions on site. Note, there are instances where some of the fabric specifications needed for Option 4 may be more demanding but this option requires smaller amounts of renewables and solar thermal is a viable technology.

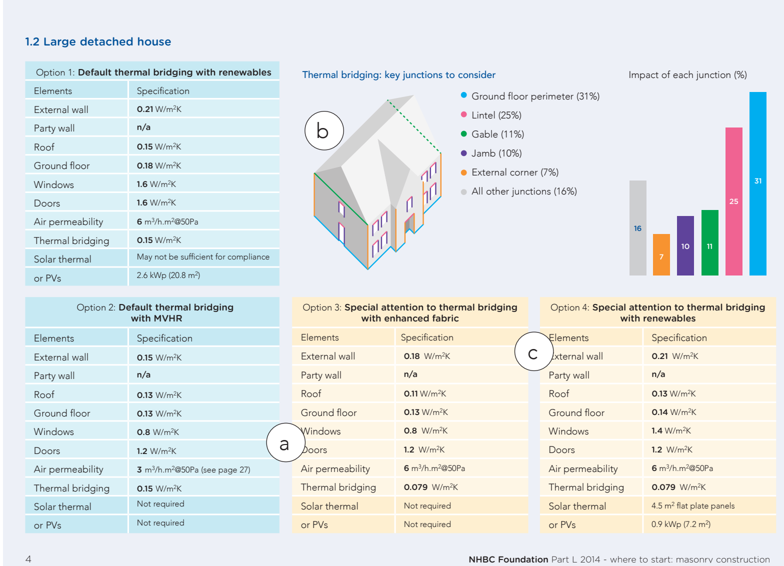
Options 2 and 3 aim to deal with situations where renewables are either not desired or impractical.

Further advice on thermal bridging

If the heat losses through thermal bridging are to be calculated, reference should be made to Section 2 of this guide, which shows construction details. A bar chart is included on each specification page indicating the relative impact of each junction on the overall thermal bridging for that home type.

For reference, the elemental specification is based on values given in Appendix K of SAP 2012.

A typical specification page


1.2 Large detached house

Option 1: Default thermal bridging with renewables	
Elements	Specification
External wall	**0.21** W/m²K
Party wall	**n/a**
Roof	**0.15** W/m²K
Ground floor	**0.18** W/m²K
Windows	**1.6** W/m²K
Doors	**1.6** W/m²K
Air permeability	**6** m³/h.m²@50Pa
Thermal bridging	**0.15** W/m²K
Solar thermal	May not be sufficient for compliance
or PVs	2.6 kWp (20.8 m²)

Option 2: Default thermal bridging with MVHR	
Elements	Specification
External wall	**0.15** W/m²K
Party wall	**n/a**
Roof	**0.13** W/m²K
Ground floor	**0.13** W/m²K
Windows	**0.8** W/m²K
Doors	**1.2** W/m²K
Air permeability	**3** m³/h.m²@50Pa (see page 27)
Thermal bridging	**0.15** W/m²K
Solar thermal	Not required
or PVs	Not required

Option 3: Special attention to thermal bridging with enhanced fabric	
Elements	Specification
External wall	**0.18** W/m²K
Party wall	**n/a**
Roof	**0.11** W/m²K
Ground floor	**0.13** W/m²K
Windows	**0.8** W/m²K
Doors	**1.2** W/m²K
Air permeability	**6** m³/h.m²@50Pa
Thermal bridging	**0.079** W/m²K
Solar thermal	Not required
or PVs	Not required

Option 4: Special attention to thermal bridging with renewables	
Elements	Specification
External wall	**0.21** W/m²K
Party wall	**n/a**
Roof	**0.13** W/m²K
Ground floor	**0.14** W/m²K
Windows	**1.4** W/m²K
Doors	**1.2** W/m²K
Air permeability	**6** m³/h.m²@50Pa
Thermal bridging	**0.079** W/m²K
Solar thermal	4.5 m² flat plate panels
or PVs	0.9 kWp (7.2 m²)

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(a) At the outset first decide whether to assume the 'default' thermal bridging value (y=0.15 W/m²K) or account for heat loss along each junction. The specifications listed give an indication of what is needed to meet the target emissions rate (TER) and indicate where additional measures may be required for compliance, e.g. solar renewables, MVHR systems.

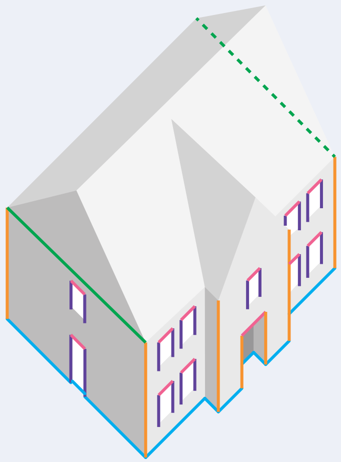
(b) The icon highlights the type of home and the five junctions that have the greatest impact on the total heat loss through thermal bridging. Refer to Section 2 for the corresponding details. The residual heat loss occurring at the remaining junctions (assessed under Appendix K) is accounted for under 'all other junctions'.

(c) If the heat loss through each junction is being considered, then two alternative routes are available to achieve overall compliance: enhanced fabric specification and the incorporation of solar renewables, e.g. solar thermal or PVs.

1.2 Large detached house

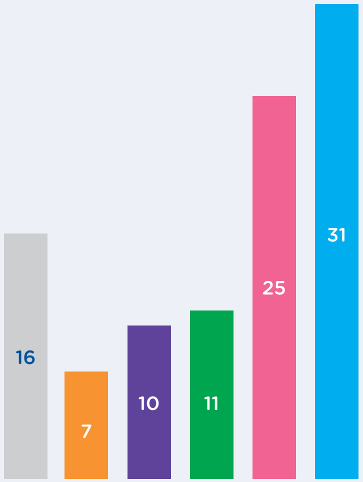
Option 1: **Default thermal bridging with renewables**	
Elements	Specification
External wall	**0.21** W/m²K
Party wall	**n/a**
Roof	**0.15** W/m²K
Ground floor	**0.18** W/m²K
Windows	**1.6** W/m²K
Doors	**1.6** W/m²K
Air permeability	**6** m³/h.m²@50Pa
Thermal bridging	**0.15** W/m²K
Solar thermal	May not be sufficient for compliance
or PVs	2.6 kWp (20.8 m²)

Thermal bridging: key junctions to consider



- Ground floor perimeter (31%)
- Lintel (25%)
- Gable (11%)
- Jamb (10%)
- External corner (7%)
- All other junctions (16%)

Impact of each junction (%)



Option 2: **Default thermal bridging with MVHR**	
Elements	Specification
External wall	**0.15** W/m²K
Party wall	**n/a**
Roof	**0.13** W/m²K
Ground floor	**0.13** W/m²K
Windows	**0.8** W/m²K
Doors	**1.2** W/m²K
Air permeability	**3** m³/h.m²@50Pa (see page 27)
Thermal bridging	**0.15** W/m²K
Solar thermal	Not required
or PVs	Not required

Option 3: **Special attention to thermal bridging with enhanced fabric**	
Elements	Specification
External wall	**0.18** W/m²K
Party wall	**n/a**
Roof	**0.11** W/m²K
Ground floor	**0.13** W/m²K
Windows	**0.8** W/m²K
Doors	**1.2** W/m²K
Air permeability	**6** m³/h.m²@50Pa
Thermal bridging	**0.079** W/m²K
Solar thermal	Not required
or PVs	Not required

Option 4: **Special attention to thermal bridging with renewables**	
Elements	Specification
External wall	**0.21** W/m²K
Party wall	**n/a**
Roof	**0.13** W/m²K
Ground floor	**0.14** W/m²K
Windows	**1.4** W/m²K
Doors	**1.2** W/m²K
Air permeability	**6** m³/h.m²@50Pa
Thermal bridging	**0.079** W/m²K
Solar thermal	4.5 m² flat plate panels
or PVs	0.9 kWp (7.2 m²)

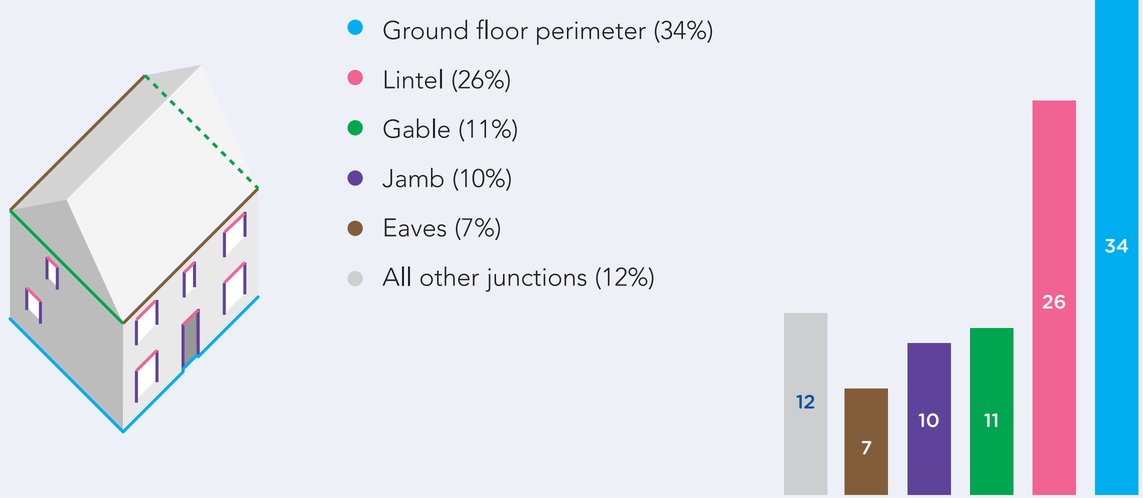
1.3 Detached house

Option 1: **Default thermal bridging with renewables**

Elements	Specification
External wall	**0.21** W/m²K
Party wall	**n/a**
Roof	**0.15** W/m²K
Ground floor	**0.18** W/m²K
Windows	**1.6** W/m²K
Doors	**1.6** W/m²K
Air permeability	**6** m³/h.m²@50Pa
Thermal bridging	**0.15** W/m²K
Solar thermal	May not be sufficient for compliance
or PVs	1.6 kWp (12.8 m²)

Thermal bridging: key junctions to consider

Impact of each junction (%)



Option 2: **Default thermal bridging with MVHR**

Elements	Specification
External wall	**0.15** W/m²K
Party wall	**n/a**
Roof	**0.13** W/m²K
Ground floor	**0.13** W/m²K
Windows	**0.8** W/m²K
Doors	**1.2** W/m²K
Air permeability	**3** m³/h.m²@50Pa (see page 27)
Thermal bridging	**0.15** W/m²K
Solar thermal	Not required
or PVs	Not required

Option 3: **Special attention to thermal bridging with enhanced fabric**

Elements	Specification
External wall	**0.18** W/m²K
Party wall	**n/a**
Roof	**0.11** W/m²K
Ground floor	**0.13** W/m²K
Windows	**0.8** W/m²K
Doors	**1.2** W/m²K
Air permeability	**6** m³/h.m²@50Pa
Thermal bridging	**0.078** W/m²K
Solar thermal	Not required
or PVs	Not required

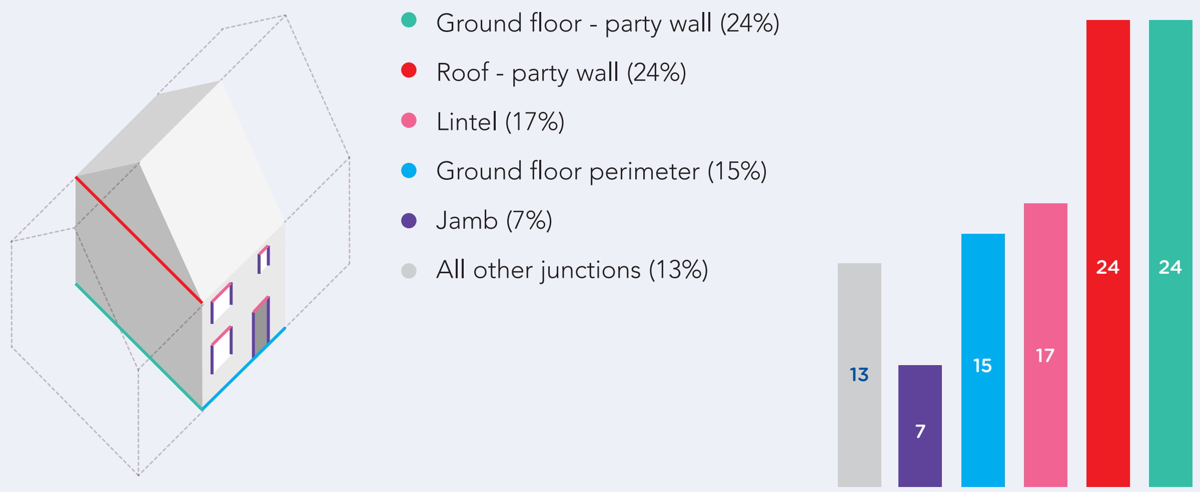
Option 4: **Special attention to thermal bridging with renewables**

Elements	Specification
External wall	**0.21** W/m²K
Party wall	**n/a**
Roof	**0.13** W/m²K
Ground floor	**0.14** W/m²K
Windows	**1.4** W/m²K
Doors	**1.2** W/m²K
Air permeability	**6** m³/h.m²@50Pa
Thermal bridging	**0.078** W/m²K
Solar thermal	4.5 m² flat plate panels
or PVs	0.6 kWp (4.8 m²)

1.4 Mid-terrace house

Option 1: **Default thermal bridging with renewables**	
Elements	Specification
External wall	**0.21** W/m²K
Party wall	**0.20** W/m²K
Roof	**0.15** W/m²K
Ground floor	**0.18** W/m²K
Windows	**1.6** W/m²K
Doors	**1.6** W/m²K
Air permeability	**6** m³/h.m²@50Pa
Thermal bridging	**0.15** W/m²K
Solar thermal	May not be sufficient for compliance
or PVs	1.6 kWp (12.8 m²)

Thermal bridging: key junctions to consider



Option 2: **Default thermal bridging with MVHR**	
Elements	Specification
External wall	**0.18** W/m²K
Party wall	**0** W/m²K
Roof	**0.13** W/m²K
Ground floor	**0.13** W/m²K
Windows	**0.8** W/m²K
Doors	**1.2** W/m²K
Air permeability	**3** m³/h.m²@50Pa (see page 27)
Thermal bridging	**0.15** W/m²K
Solar thermal	Not required
or PVs	Not required

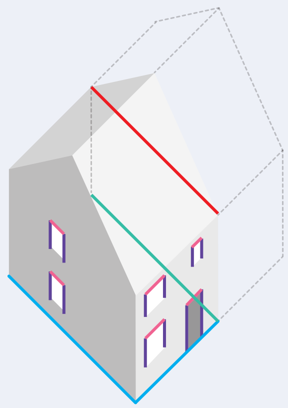
Option 3: **Special attention to thermal bridging with enhanced fabric**	
Elements	Specification
External wall	**0.15** W/m²K
Party wall	**0** W/m²K
Roof	**0.07** W/m²K
Ground floor	**0.10** W/m²K
Windows	**0.8** W/m²K
Doors	**1.2** W/m²K
Air permeability	**3** m³/h.m²@50Pa (see page 27)
Thermal bridging	**0.126** W/m²K
Solar thermal	Not required
or PVs	Not required

Option 4: **Special attention to thermal bridging with renewables**	
Elements	Specification
External wall	**0.21** W/m²K
Party wall	**0** W/m²K
Roof	**0.13** W/m²K
Ground floor	**0.14** W/m²K
Windows	**1.4** W/m²K
Doors	**1.2** W/m²K
Air permeability	**6** m³/h.m²@50Pa
Thermal bridging	**0.126** W/m²K
Solar thermal	3.5 m² flat plate panels
or PVs	0.5 kWp (4.0 m²)

1.5 End-terrace house

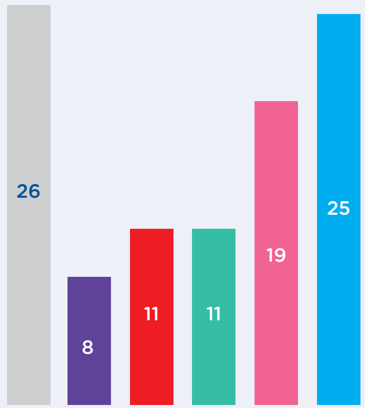
Option 1: **Default thermal bridging with renewables**	
Elements	Specification
External wall	**0.21** W/m^{2}K
Party wall	**0.20** W/m^{2}K
Roof	**0.15** W/m^{2}K
Ground floor	**0.18** W/m^{2}K
Windows	**1.6** W/m^{2}K
Doors	**1.6** W/m^{2}K
Air permeability	**6** m^3/h.m^2@50Pa
Thermal bridging	**0.15** W/m^{2}K
Solar thermal	May not be sufficient for compliance
or PVs	1.5 kWp (12.0 m^2)

Thermal bridging: key junctions to consider



- Ground floor perimeter (25%)
- Lintel (19%)
- Ground floor - party wall (11%)
- Roof - party wall (11%)
- Jamb (8%)
- All other junctions (26%)

Impact of each junction (%)



Option 2: **Default thermal bridging with MVHR**	
Elements	Specification
External wall	**0.15** W/m^{2}K
Party wall	**0** W/m^{2}K
Roof	**0.10** W/m^{2}K
Ground floor	**0.12** W/m^{2}K
Windows	**0.8** W/m^{2}K
Doors	**1.2** W/m^{2}K
Air permeability	**3** m^3/h.m^2@50Pa (see page 27)
Thermal bridging	**0.15** W/m^{2}K
Solar thermal	Not required
or PVs	Not required

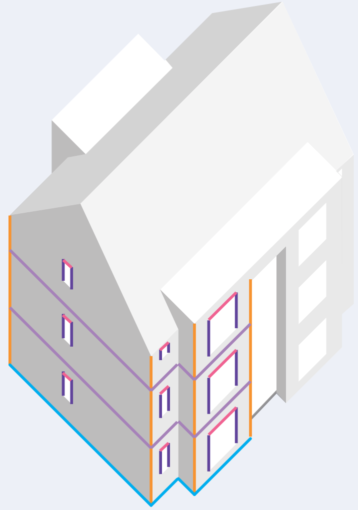
Option 3: **Special attention to thermal bridging with enhanced fabric**	
Elements	Specification
External wall	**0.15** W/m^{2}K
Party wall	**0** W/m^{2}K
Roof	**0.11** W/m^{2}K
Ground floor	**0.13** W/m^{2}K
Windows	**0.8** W/m^{2}K
Doors	**1.2** W/m^{2}K
Air permeability	**3** m^3/h.m^2@50Pa (see page 27)
Thermal bridging	**0.100** W/m^{2}K
Solar thermal	Not required
or PVs	Not required

Option 4: **Special attention to thermal bridging with renewables**	
Elements	Specification
External wall	**0.21** W/m^{2}K
Party wall	**0** W/m^{2}K
Roof	**0.13** W/m^{2}K
Ground floor	**0.14** W/m^{2}K
Windows	**1.4** W/m^{2}K
Doors	**1.2** W/m^{2}K
Air permeability	**6** m^3/h.m^2@50Pa
Thermal bridging	**0.100** W/m^{2}K
Solar thermal	3.5 m^2 flat plate panels
or PVs	0.5 kWp (4.0 m^2)

1.6 Apartments

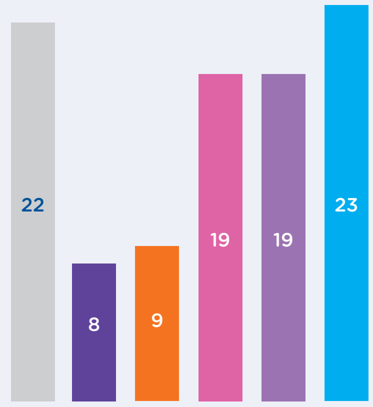
Option 1: **Default thermal bridging with renewables**	
Elements	Specification
External wall	**0.21** W/m²K
Party wall	**0.20** W/m²K
Roof	**0.15** W/m²K
Ground floor	**0.18** W/m²K
Windows	**1.6** W/m²K
Doors	**1.6** W/m²K
Air permeability	**6** m³/h.m²@50Pa
Thermal bridging	**0.15** W/m²K
Solar thermal	May not be sufficient for compliance
or PVs	6.12 kWp for block (48.8 m²)

Thermal bridging: key junctions to consider



- Ground floor perimeter (23%)
- Floor between dwellings (19%)
- Lintel (19%)
- External corner (9%)
- Jamb (8%)
- All other junctions (22%)

Impact of each junction (%)



Option 2: **Default thermal bridging with MVHR**	
Elements	Specification
External wall	**0.15** W/m²K
Party wall	**0** W/m²K
Roof	**0.13** W/m²K
Ground floor	**0.13** W/m²K
Windows	**0.8** W/m²K
Doors	**1.2** W/m²K
Air permeability	**3** m³/h.m²@50Pa (see page 27)
Thermal bridging	**0.15** W/m²K
Solar thermal	Not required
or PVs	Not required

Option 3: **Special attention to thermal bridging with enhanced fabric**	
Elements	Specification
External wall	**0.15** W/m²K
Party wall	**0** W/m²K
Roof	**0.13** W/m²K
Ground floor	**0.15** W/m²K
Windows	**0.8** W/m²K
Doors	**1.2** W/m²K
Air permeability	**6** m³/h.m²@50Pa
Thermal bridging	**0.093** W/m²K
Solar thermal	Not required
or PVs	Not required

Option 4: **Special attention to thermal bridging with renewables**	
Elements	Specification
External wall	**0.21** W/m²K
Party wall	**0** W/m²K
Roof	**0.13** W/m²K
Ground floor	**0.14** W/m²K
Windows	**1.4** W/m²K
Doors	**1.2** W/m²K
Air permeability	**6** m³/h.m²@50Pa
Thermal bridging	**0.093** W/m²K
Solar thermal	18.0 m² flat plate panels for block
or PVs	2.1 kWp for block (16.8 m²)

1.7 Compliance for apartments and terraces

For homes in a block of apartments or that form part of a terrace, compliance with the CO_2 emissions target may either be demonstrated individually for each home or as an average across the block. The form of some home types is inherently energy efficient, such as mid-terraces and mid-floor apartments, where there is relatively smaller surface area through which heat is lost. 'Block averaging' allows for the fabric specification to be optimised across attached homes, with better performing unit types compensating for less efficient ones.

If solar renewable technologies are adopted to comply with the CO_2 emissions target, the size of the panel may be optimised across the dwellings as long as the average target is met. In the case of apartments, the output from PVs may be connected to the landlord's supply for common services.

1.8 Other low and zero carbon technologies

A combination of other technologies such as flue gas heat recovery and waste water heat recovery systems may be used to achieve overall compliance. These systems may be particularly beneficial in small or attached homes.

In certain situations, such as developments with no access to mains gas connections, heat pumps or biomass boilers may be suitable choices. In these cases some elements of the fabric and renewables specifications may be relaxed when compared to a gas fuel source.

Builders should also be aware that using oil-fuelled boilers are likely to make individual 'enhanced fabric', solar thermal, or MVHR options insufficient for compliance. In this case a significantly greater area of PVs, or a combination of improved fabric measures and one of the alternative technologies mentioned above, would be required.

1.9 Homes with rooms in roofs

Further explanations of the considerations that are needed for homes with complex building geometries may be found in NHBC Foundation publication 'Designing homes for the 21st century - Lessons for low energy design' (NF50).

For each of the home types illustrated in this guide a flat ceiling has been assumed. For thermal bridging around complex geometries, such as dormers and rooms-in-the-roof, see Appendix R of SAP 2012. In such cases, heat loss values will need to be calculated or data from system manufacturers may be used where appropriate.

Section 2: Thermal bridging details

2.1 How to use this section

This section introduces thermal bridging and illustrates typical approaches to the key construction junctions identified for the home types discussed in Section 1. These junctions have been designed to correspond with the U-values that are applicable for ADL1A 2014.

The calculated psi-values stated for each junction can be used by the SAP assessor provided that on-site construction is in strict accordance with the detail.

Some details can be significantly improved by changing the density of the blockwork, and in these cases two calculated psi-values have been given.

Other ways in which the performance of the junction may be improved are also described. However, these improvements in psi-values can only be claimed if these are modelled in accordance with the guidance in ADL1A 2014.

Only details for junctions that are relevant to the home types in this guide have been included. For other masonry details refer to Constructive Details' 'Handbook of thermal bridging details' (www.constructivedetails.co.uk), the Concrete Block Association (www.cba-blocks.org/uk/tech/thermal-bridge), LABC Registered Details, and individual manufacturer's literature.

Note:

The details illustrated here are not intended to be working drawings and consideration must also be given to structure, waterproofing, risk of condensation, airtightness, general good-practice and sequencing on site. The calculated psi-values have been tested for robustness against the ranges of variations stated. The details have been verified to meet the provisions under ADL1A 2014 (paragraph 6.3.3b).

A typical thermal bridging detail page

E5: Ground floor - suspended beam & block (1)

Base conditions (2)
This detail requires:

- Suspended ground floor U-values from 0.11 to 0.15 W/m²K
- External walls U-values from 0.15 to 0.21 W/m²K
- Psi-values for dense and aircrete blockwork have been calculated for above-ground blockwork to inner leaf
- Substructure blockwork composed of dense blockwork (<2000 kg/m³)
- A minimum of 25 mm of perimeter insulation to screed ($\lambda \leq 0.023$ W/m.K).

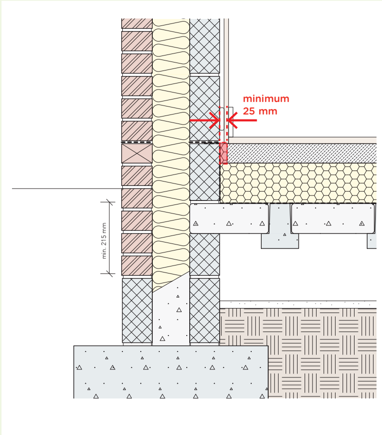
Critical features (3)
The thermal performance compromised:

- Unless a minimum of 25 mm of perimeter insulation is installed
- If the thermal conductivity of the inner leaf of blockwork is worsened.

Improving performance

- Change the substructure blockwork from dense to aircrete blockwork
- Increase the thickness of the perimeter insulation.

Calculated psi-value (dense inner leaf blockwork): 0.24 W/mK
Calculated psi-value (aircrete inner leaf blockwork): 0.15 W/mK



Notes

- Ensure that the perimeter insulation is installed and cannot be displaced when the screed is laid
- Proprietary suspended floor systems may have an improved thermal performance and should be calculated
- Cavity wall insulation should extend at least 215 mm below the top of the concrete beam.

If this detail is constructed as drawn with the components and materials as specified in the base conditions, then the calculated psi-values can be used in the SAP calculation in accordance with ADL1A 2014 6.3.3b.

(1) Refers to the junction reference as given in SAP 2012.

(2) The base conditions may be varied within the ranges stated.

(3) Conditions that are critical to achieving the stated psi-values are listed as 'critical features' and must be adhered to on site.

The following U-value assumptions form the basis of modelling:

- External walls: U-values from 0.15 to 0.21 W/m²K. The calculated psi-values are applicable to both fully and partially filled walls;
- Party walls: U-value of 0.00 W/m²K as per SAP 2012 guidance (with a fully filled cavity) and compliant with Robust Details;
- Ground floors: U-values from 0.11 to 0.15 W/m²K;
- Cold roofs: U-values from 0.09 to 0.13 W/m²K.

For robustness, the U-values quoted in this section are based on build-ups and materials illustrated in Section 3. Any variations in construction and materials will need to be modelled.

2.2 Introduction to thermal bridging

A thermal bridge occurs at any point of weakness or discontinuity in the insulation of a thermal element (wall, floor and roof, etc.) such as where a lintel bridges the wall insulation or where a wall and floor meet. In ADL1A these junctions are called 'linear' thermal bridges because heat loss occurs along the length of the bridging element.

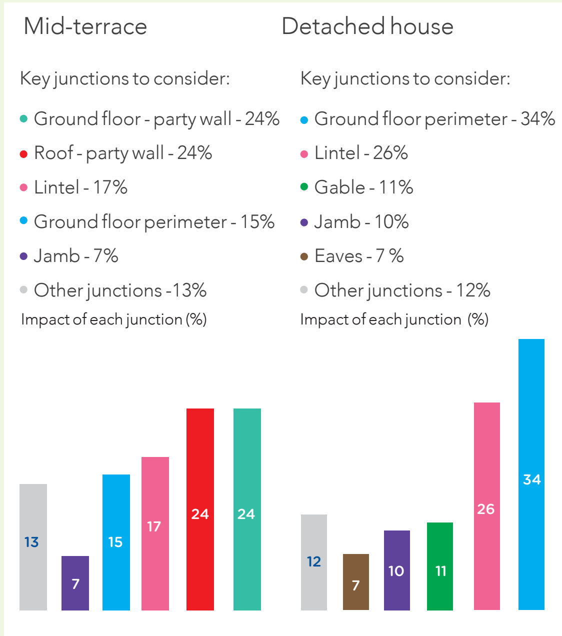
Thermal bridges also occur where components that are integral to the construction, for instance wall ties or timber studs, span across the insulation layer. These repeating thermal bridges are accounted for in the U-value calculation for each element and are not considered in this section.

The proportion of heat loss from thermal bridges generally increases as the performance of the insulation and airtightness improves.

2.3 Calculating thermal bridging

The heat loss along a linear thermal bridge is expressed as its psi-value, which is calculated by using complex thermal modelling (following the guidance in BR 497 and IP 1/06). Once the psi-value is established, the SAP assessor can then calculate the heat loss for the whole junction by multiplying the psi-value by the length of the corresponding construction junction (i.e. the length of the lintel or length of the junction where the wall meets the floor). The total calculated heat loss from all junctions is then divided by the area of all exposed (heat loss) surfaces, i.e. floors, roofs and walls (including windows and doors and rooflights), to arrive at what is known as the overall y-value for that particular home.

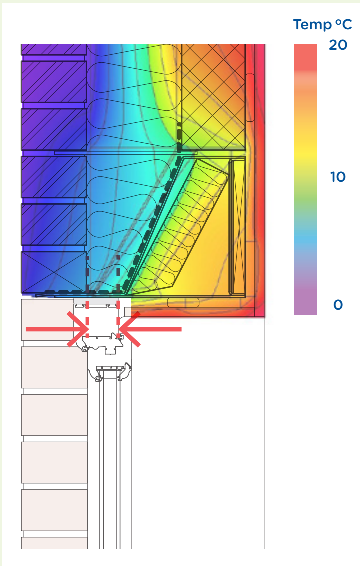
The calculated y-value will vary for different home types across a development.



The impact of different construction junctions and the proportion of heat loss associated with each junction will both vary depending on the home type.

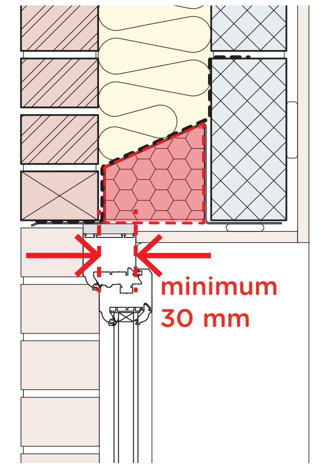
This is illustrated in the bar graphs to the left which show that for detached homes the heat loss through the junction between the external walls and the ground floor is quite significant; while in mid-terraces, the junction between the party walls and the ground floor is more important.

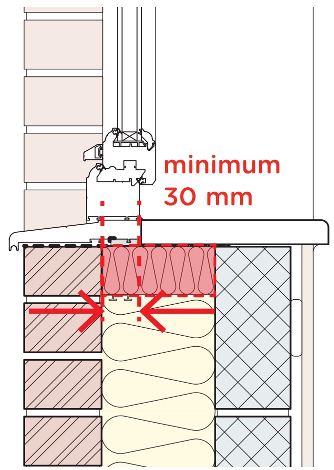
The details to consider will vary by home type and consequently the calculated y-values will differ depending on the design of the home.



Where combination steel box lintels are commonly used considerable heat loss may occur because of the proportion of steel, the minimal and discontinuous insulation and the length of the bridge.

E2: Lintel
Calculated psi-value: 0.30 W/mK





E3: Sills
Calculated psi-value: 0.05 W/mK

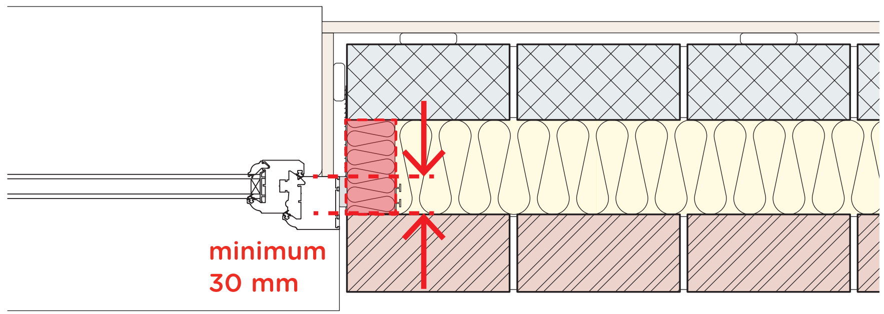
Base conditions
This detail requires:

- External walls U-values from 0.15 to 0.21 W/m^{2}K
- External walls with either partially or fully filled cavities
- An overlap between the window frame and cavity closer of 30 mm
- Any insulated cavity closer.

Critical features
The thermal performance will be compromised:

- Unless there is a minimum 30 mm overlap between the window frame and the cavity closer
- Unless there is an insulated cavity closer installed to the sill and jamb junctions.

Improving performance
- Increase the overlap between the window frame and cavity closer.



E4: Jamb
Calculated psi-value: 0.05 W/mK

Notes
- Position the window in the design drawings to allow for some tolerance on site so that the minimum window frame overlap is always maintained.

If these details are constructed as drawn with the components and materials as specified in the base conditions, then the calculated psi-values can be used in the SAP calculation in accordance with ADL1A 2014 6.3.3b.

E5: Ground floor - suspended beam & block

Base conditions

This detail requires:

- Suspended ground floor U-values from 0.11 to 0.15 W/m^{2}K
- External walls U-values from 0.15 to 0.21 W/m^{2}K
- Psi-values for dense and aircrete blockwork have been calculated for above-ground blockwork to inner leaf
- Substructure blockwork composed of dense blockwork (<2000 kg/m^3)
- A minimum of 25 mm of perimeter insulation to screed ($\lambda \leq 0.023$ W/m.K).

Critical features

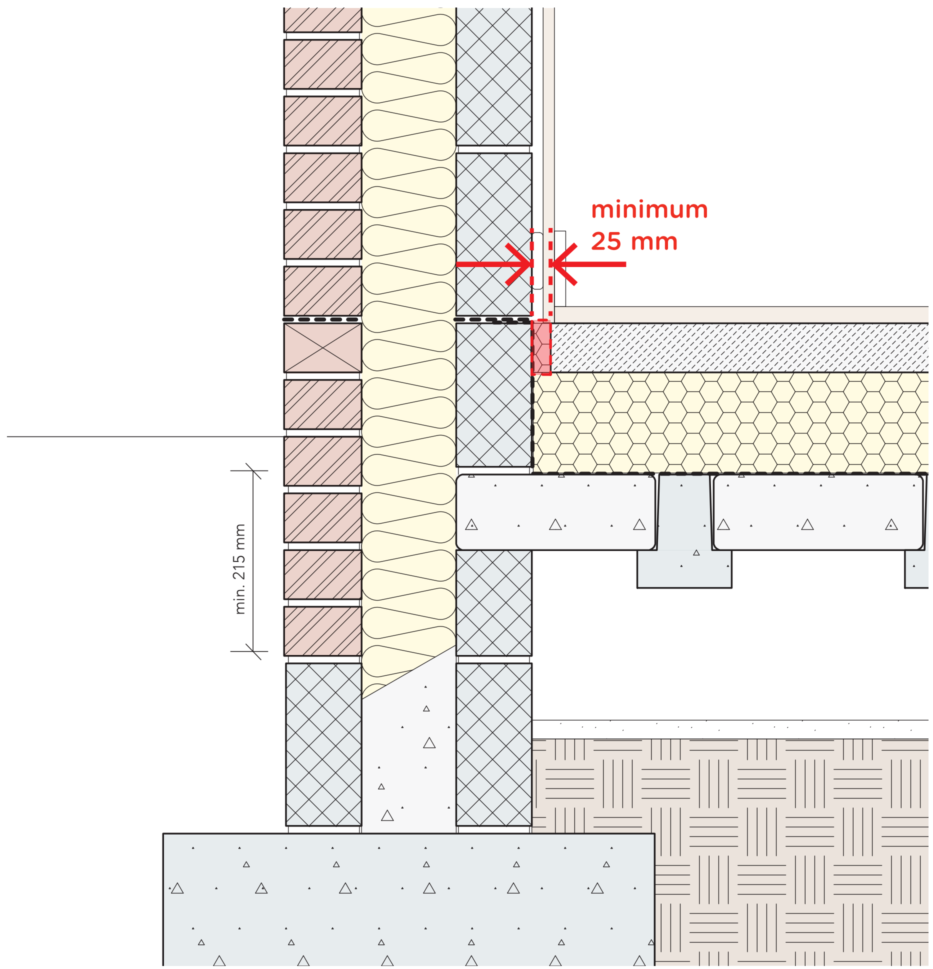
The thermal performance will be compromised:

- Unless a minimum of 25 mm of perimeter insulation is installed
- If the thermal conductivity of the inner leaf of blockwork is worsened.

Improving performance

- Change the substructure blockwork from dense to aircrete blockwork
- Increase the thickness of the perimeter insulation.

Calculated psi-value (dense inner leaf blockwork): 0.24 W/mK
Calculated psi-value (aircrete inner leaf blockwork): 0.15 W/mK

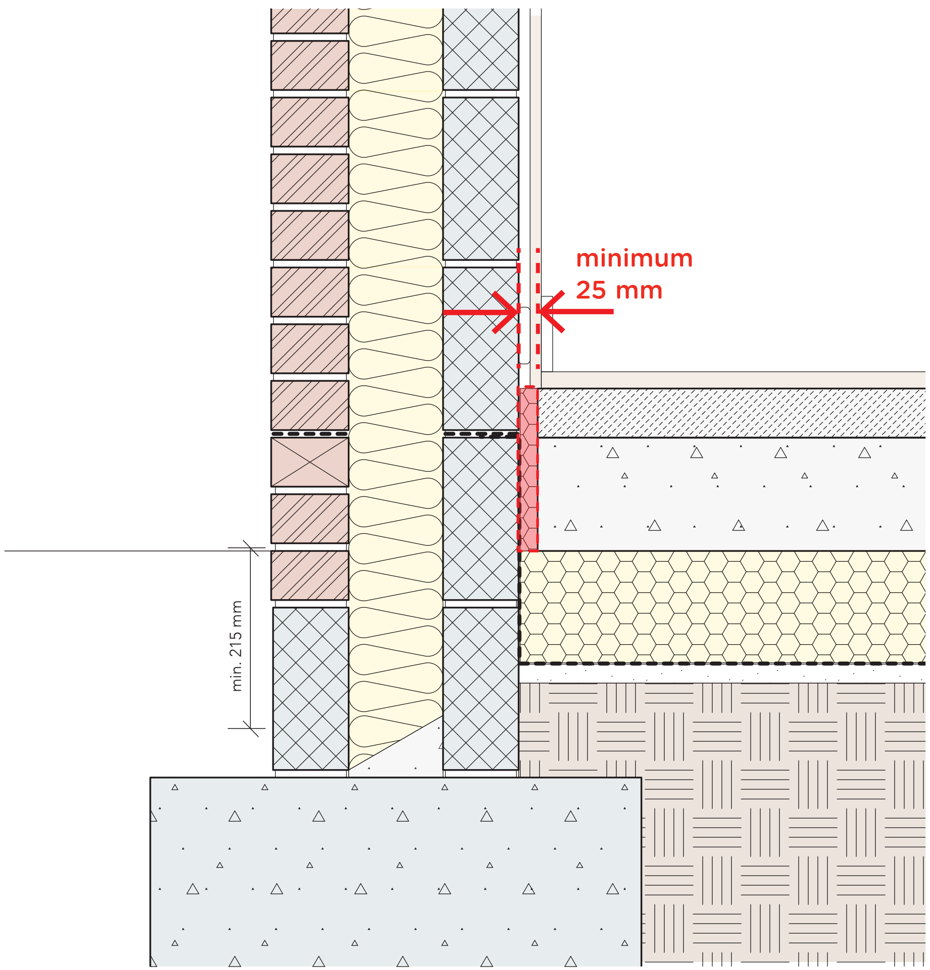


Notes

- Ensure that the perimeter insulation is installed and cannot be displaced when the screed is laid
- Proprietary suspended floor systems may have an improved thermal performance and should be calculated
- Cavity wall insulation should extend at least 215 mm below the top of the concrete beam.

If this detail is constructed as drawn with the components and materials as specified in the base conditions, then the calculated psi-values can be used in the SAP calculation in accordance with ADL1A 2014 6.3.3b.

Calculated psi-value (dense inner leaf blockwork): 0.24 W/mK
Calculated psi-value (aircrete inner leaf blockwork): 0.19 W/mK



Base conditions

This detail requires:

- Ground bearing floor U-values from 0.11 to 0.15 W/m^2K
- External walls U-values from 0.15 to 0.21 W/m^2K
- Psi-values for dense and aircrete blockwork have been calculated for above-ground blockwork to inner leaf
- Substructure blockwork composed of dense blockwork (<2000 kg/m^3)
- A minimum of 25 mm of perimeter insulation to screed ($\lambda \leq 0.023$ W/m.K).

Critical features

The thermal performance will be compromised:

- Unless a minimum of 25 mm of perimeter insulation is installed
- If the thermal conductivity of the inner leaf of blockwork is worsened.

Improving performance

- Change the substructure blockwork from dense to aircrete blockwork
- Increase the thickness of the perimeter insulation.

Notes

- Ensure that the perimeter insulation is installed and cannot be displaced when the screed is laid
- Cavity wall insulation should extend at least 215 mm below the underside of the slab.

If this detail is constructed as drawn with the components and materials as specified in the base conditions, then the calculated psi-values can be used in the SAP calculation in accordance with ADL1A 2014 6.3.3b.

E10: Eaves

Base conditions

This detail requires:

- Cold roof U-values from 0.09 to 0.13 W/m^{2}K
- External walls U-values from 0.15 to 0.21 W/m^{2}K
- External walls with either partially or fully filled cavities
- Inner leaf of blockwork with any density
- Minimum roof pitch of 30 degrees.

Critical features

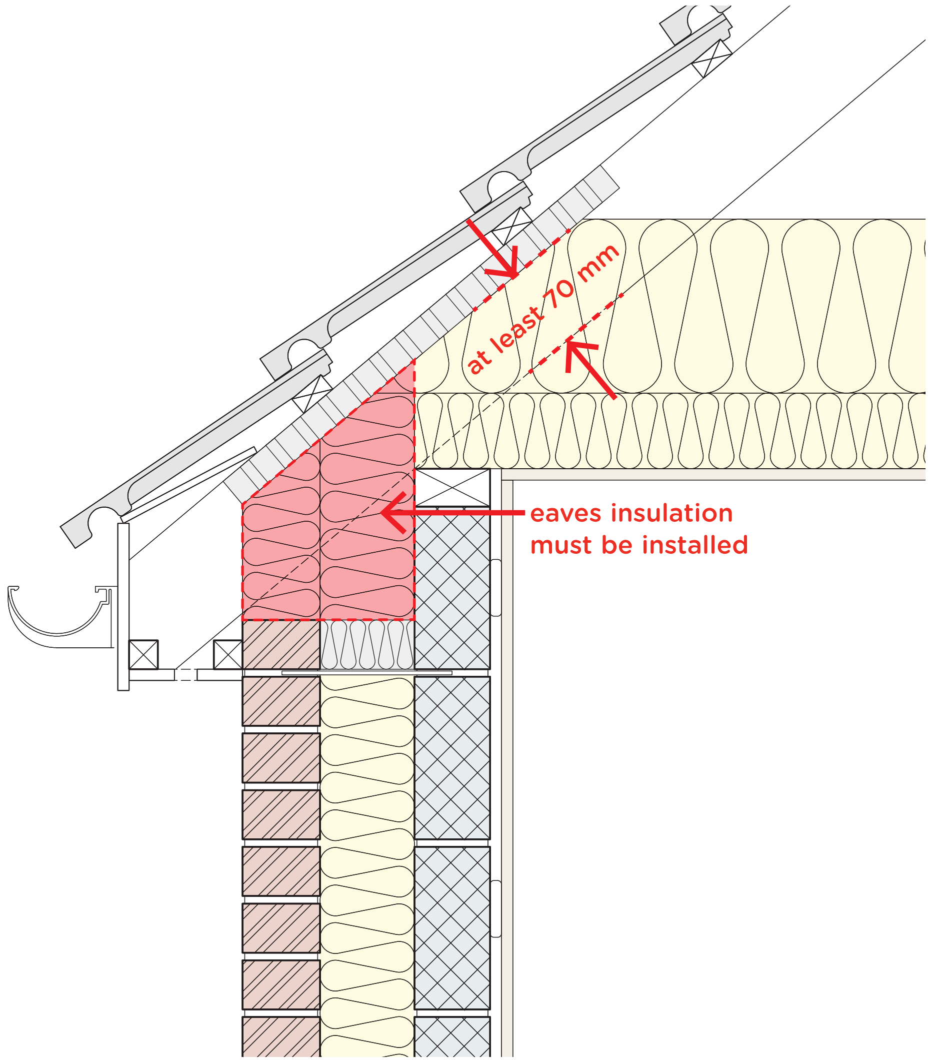
The thermal performance will be compromised:

- Unless there is a minimum distance of 70 mm between the underside of the ventilator tray and the wall plate that is fully insulated
- If the area under the eaves is not fully filled with insulation.

Improving performance

- Increase the depth of the insulation between the ventilator tray and the wall plate.

Calculated psi-value: 0.10 W/mK

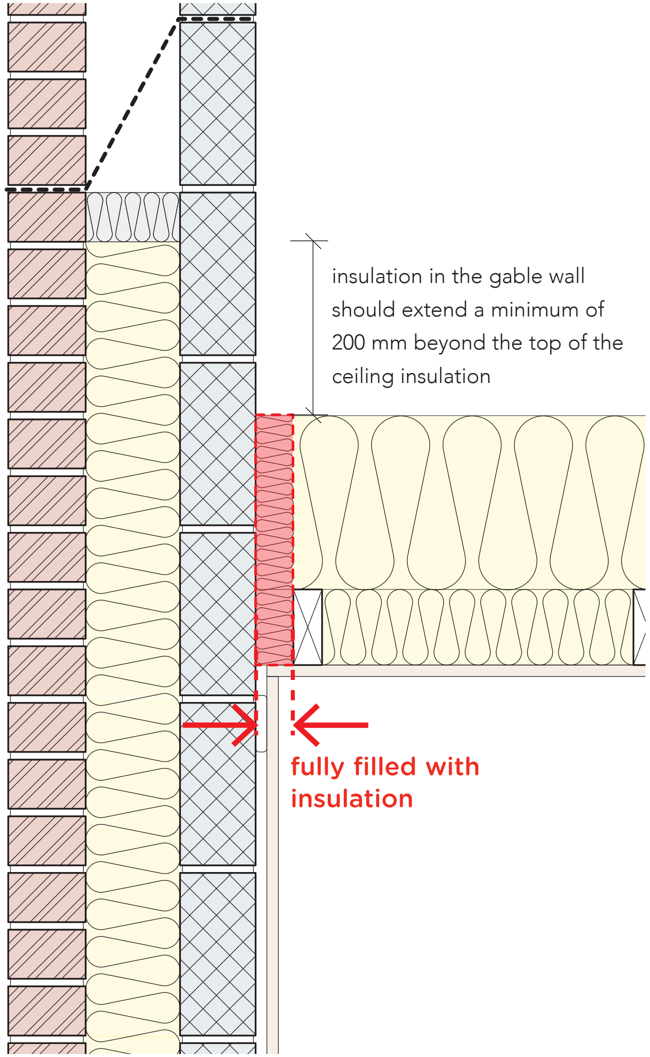


Notes

- Installing the perimeter eaves insulation can be difficult with shallow pitch roofs or where the distance between the ventilator tray and the wall plate is reduced. It is often helpful to fix insulation to the wall plate and fold it down towards the cavity before any roof tiling is installed.

If this detail is constructed as drawn with the components and materials as specified in the base conditions, then the calculated psi-values can be used in the SAP calculation in accordance with ADL1A 2014 6.3.3b.

Calculated psi-value (dense blockwork): 0.17 W/mK
Calculated psi-value (aircrete blockwork): 0.07 W/mK



Notes

- Install a minimum of 200 mm of insulation between the top of the cold roof insulation and the top of the insulation in the gable wall.

If this detail is constructed as drawn with the components and materials as specified in the base conditions, then the calculated psi-values can be used in the SAP calculation in accordance with ADL1A 2014 6.3.3b.

Base conditions

This detail requires:

- Cold roof U-values from 0.09 to 0.13 W/m^{2}K
- External walls U-values from 0.15 to 0.21 W/m^{2}K
- External walls with either partially or fully filled cavities
- Psi-values for dense and aircrete blockwork have been calculated for above-ground blockwork to inner leaf
- Insulation tightly packed between the last truss and the blockwork.

Critical features

The thermal performance will be compromised:

- Unless the void between the last truss and the blockwork wall of the gable is fully filled with insulation.

Improving performance

Not applicable to this detail.

E6 & E7: Intermediate and party floors

Base conditions

This detail requires:

- External walls U-values from 0.15 to 0.21 W/m^{2}K
- External walls with either partially or fully filled cavities
- Inner leaf of blockwork with any density
- For E7: any compliant Robust Detail party floor for masonry construction.

Critical features

Not applicable to these details.

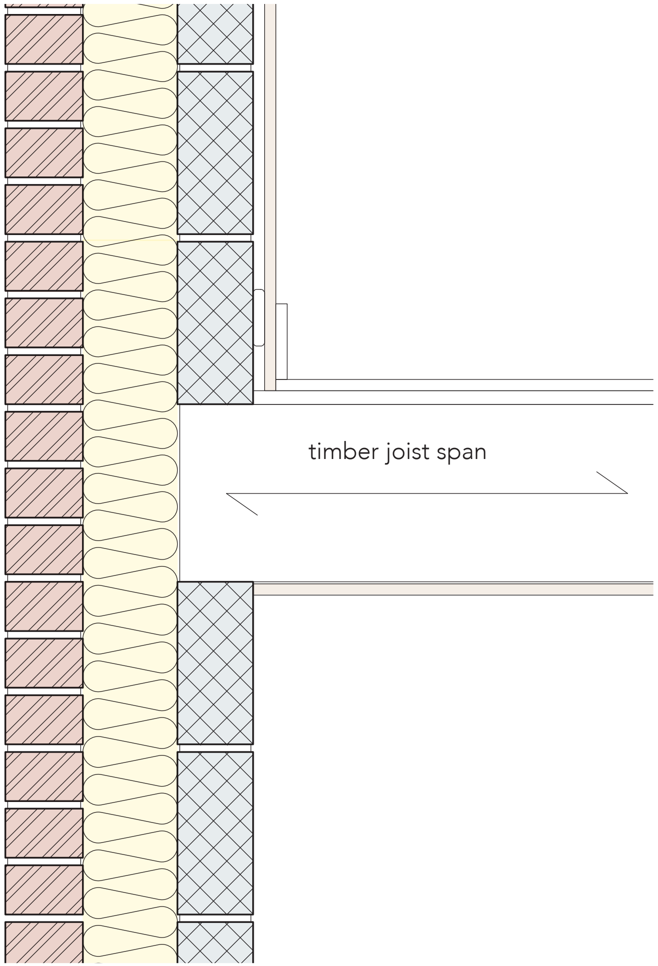
Notes

Not applicable to these details.

If these details are constructed as drawn with the components and materials as specified in the base conditions, then the calculated psi-values can be used in the SAP calculation in accordance with ADL1A 2014 6.3.3b.

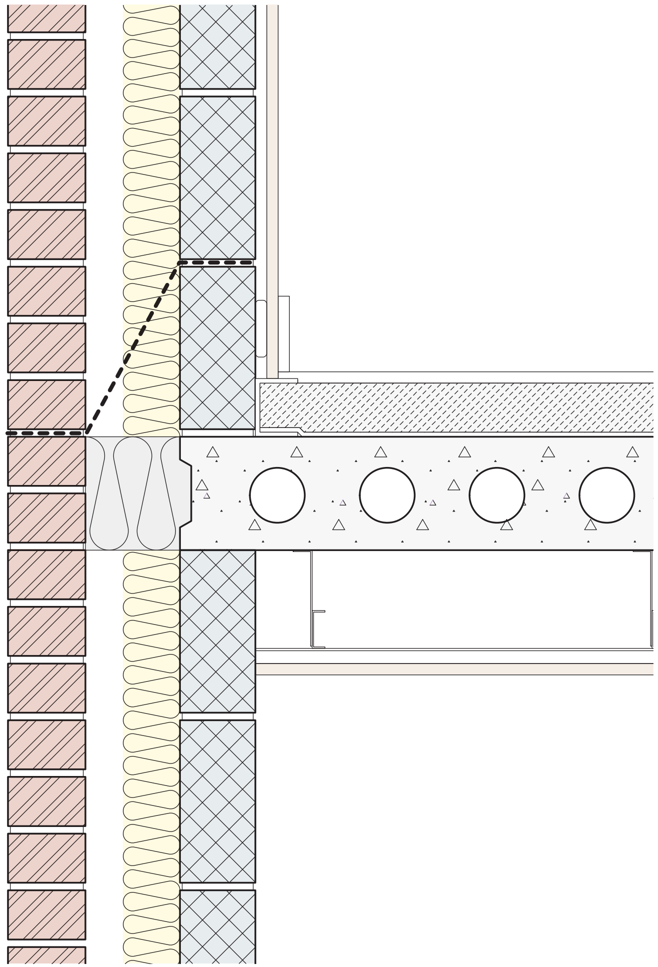
E6: Intermediate floor (within dwellings)

Calculated psi-value: 0.007 W/mK

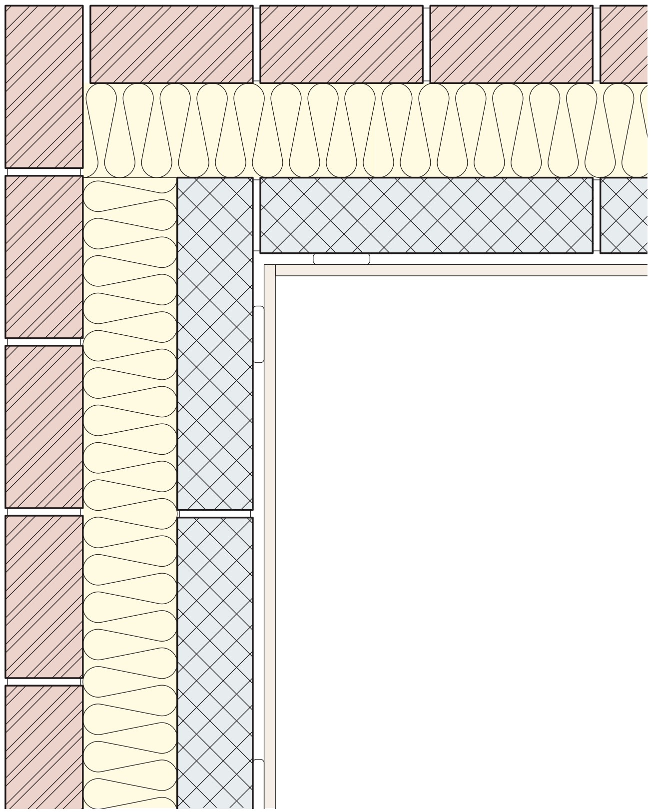


E7: Party floor (between dwellings)

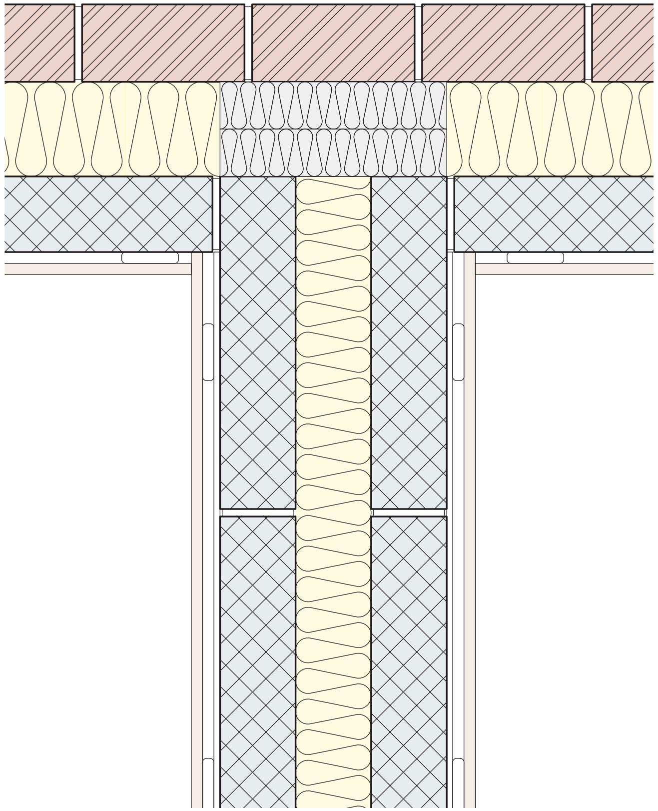
Calculated psi-value: 0.05 W/mK



E16: Corner
Calculated psi-value: 0.07 W/mK



E18: Party wall
Calculated psi-value: 0.05 W/mK



Base conditions
This detail requires:

- External walls U-values from 0.15 to 0.21 W/m²K
- External walls with either partially or fully filled cavities
- Inner leaf of blockwork with any density
- For E18: any masonry party wall construction with a fully filled cavity (maximum cavity width of 100 mm) that is both compliant with Robust Details and achieves a U-value of 0.00 W/m²K as per SAP 2012 guidance.

Critical features
Not applicable to these details.

Notes
Not applicable to these details.

If these details are constructed as drawn with the components and materials as specified in the base conditions, then the calculated psi-values can be used in the SAP calculation in accordance with ADL1A 2014 6.3.3b.

P1: Ground floor - suspended beam & block / party wall

Base conditions

This detail requires:

- Suspended ground floor U-values from 0.11 to 0.15 W/m²K
- Any masonry party wall construction with a fully filled cavity (maximum cavity width of 100 mm) that is both compliant with Robust Details and achieves a U-value of 0.00 W/m²K as per SAP 2012 guidance
- Psi-values for dense and aircrete blockwork have been calculated for above-ground blockwork to party wall
- Substructure blockwork composed of dense blockwork (<2000 kg/m³)
- A minimum of 25 mm of perimeter insulation to screed ($\lambda \leq 0.023$ W/m.K).

Critical features

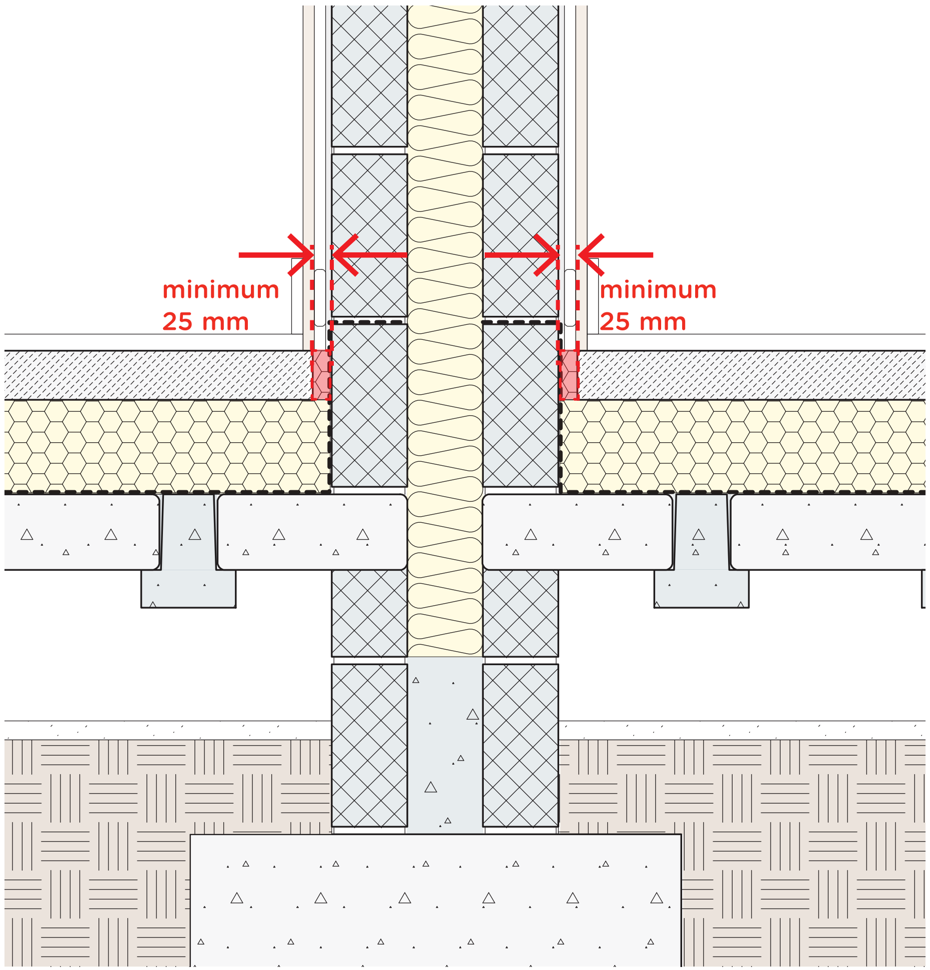
The thermal performance will be compromised:

- Unless there is a minimum of 25 mm of perimeter insulation
- If the thermal conductivity of the inner leaf of blockwork is worsened.

Improving performance

- Change the substructure blockwork from dense to aircrete blockwork
- Increase the thickness of the perimeter insulation.

Calculated psi-value (dense inner leaf blockwork): 0.24 W/mK
Calculated psi-value (aircrete inner leaf blockwork): 0.17 W/mK

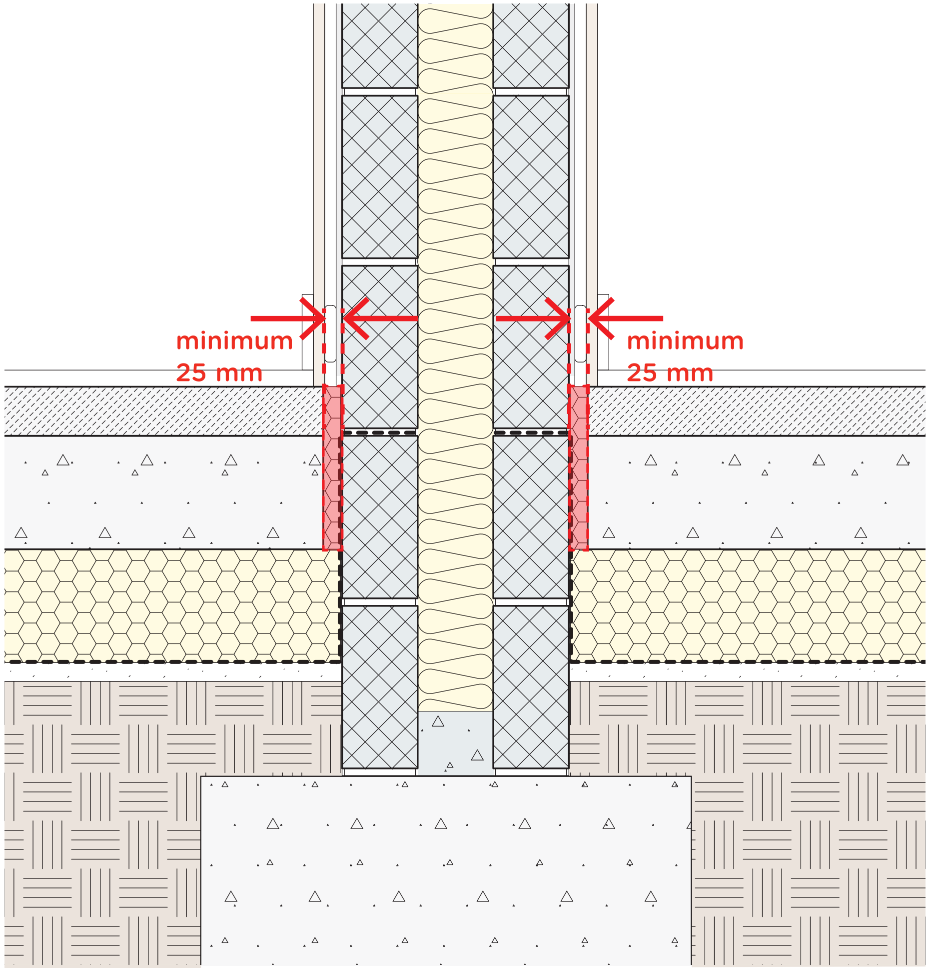


Notes

- Ensure that the perimeter insulation cannot be displaced when the screed is laid
- Party wall insulation should extend at least 215 mm below the top of the concrete beam
- Proprietary suspended floor systems may have an improved thermal performance and should be calculated.

If this detail is constructed as drawn with the components and materials as specified in the base conditions, then the calculated psi-values can be used in the SAP calculation in accordance with ADL1A 2014 6.3.3b.

Calculated psi-value: 0.17 W/mK



Base conditions

This detail requires:

- Ground bearing floor U-values from 0.11 to 0.15 W/m²K
- Any masonry party wall construction with a fully filled cavity (maximum cavity width of 100 mm) that is both compliant with Robust Details and achieves a U-value of 0.00 W/m²K as per SAP 2012 guidance
- Party walls with any density of blockwork
- Substructure blockwork composed of dense blockwork (<2000 kg/m³)
- A minimum of 25 mm of perimeter insulation to screed ($\lambda \leq 0.023$ W/m.K).

Critical features

The thermal performance will be compromised:

- Unless there is a minimum of 25 mm of perimeter insulation.

Improving performance

- Change the substructure blockwork from dense to aircrete blockwork
- Increase the thickness of the perimeter insulation.

Notes

- Ensure that the perimeter insulation cannot be displaced when the screed is laid
- Party wall insulation should extend at least 215 mm below the underside of the slab.

If this detail is constructed as drawn with the components and materials as specified in the base conditions, then the calculated psi-values can be used in the SAP calculation in accordance with ADL1A 2014 6.3.3b.

Base conditions

This detail requires:

- Cold roof U-values from 0.09 to 0.13 W/m^{2}K
- Any masonry party wall construction with a fully filled cavity (maximum cavity width of 100 mm) that is both compliant with Robust Details and achieves a U-value of 0.00 W/m^{2}K as per SAP 2012 guidance
- Psi-values for dense and aircrete blockwork have been calculated for above-ground blockwork to party wall
- Insulation tightly packed between the last truss and the blockwork.

Critical features

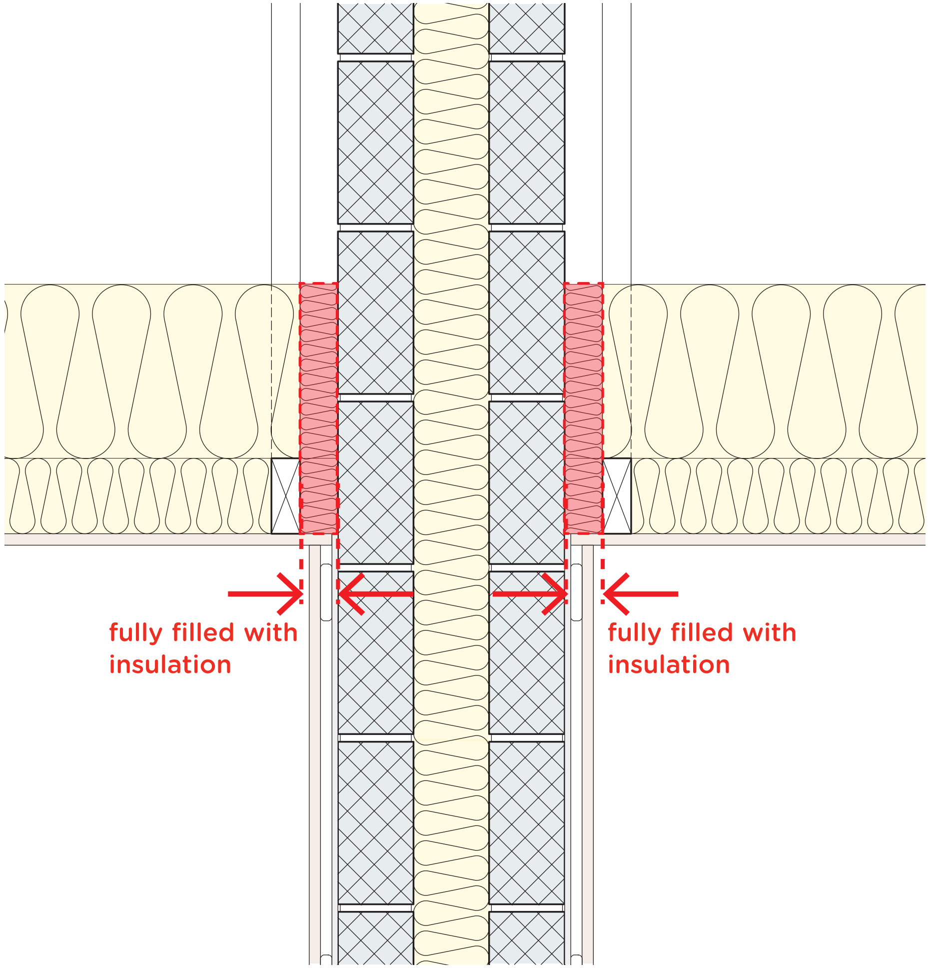
The thermal performance will be compromised:

- Unless the void between the last truss and the blockwork of the party wall is fully filled with insulation.

Improving performance

Not applicable to this detail.

Calculated psi-value (dense inner leaf blockwork): 0.24 W/mK
Calculated psi-value (aircrete inner leaf blockwork): 0.06 W/mK



Notes

- Insulation within the party wall should extend to the underside of the roof to comply with Robust Details.

If this detail is constructed as drawn with the components and materials as specified in the base conditions, then the calculated psi-values can be used in the SAP calculation in accordance with ADL1A 2014 6.3.3b.

Section 3: Construction build-ups

3.1 Notes on U-value assumptions

This section includes construction details for the U-values given in Section 1. U-value calculations should account for the material characteristics of the main wall elements and the secondary items such as fixings, ties, framing and air gaps as these can have a significant effect on the overall performance.

Blockwork:
The thermal performance varies according to the density and type of blockwork. The guide shows build-ups for dense, ultra-lightweight aggregate and aircrete blocks. The final selection may be influenced by other factors such as compressive strength, which will depend on the structural design.

Cavity width:
All mineral wool options are for fully filled cavities. Rigid insulation build-ups include a 50 mm clear cavity behind the outer leaf for effective cavity drainage.

Cavity wall ties:
Stainless steel wall ties have been assumed with a cross section and density as per guidelines in BR 443 (2006). Low thermal conductivity options such as basalt ties are commonly available and are beneficial when seeking high thermal standards.

Ground floor:
Ground conditions will affect the type of floor construction that may be used. In addition to this, the ratio of the exposed perimeter (along which a significant proportion of heat loss will occur) to the floor area will need to be taken into account. For this guide two floor systems are illustrated: a ground bearing slab and a suspended beam and block floor system.

Mineral wool insulation:
The term mineral wool generally describes insulation derived from inorganic sources and may refer to glasswool or rockwool. Two representative values for thermal performance have been assumed in this guide: one for external walls (a better performing glasswool in the form of batts with a thermal conductivity of 0.032 W/mK) and one for roofs (a more common mineral wool quilt used over ceiling joists with a thermal conductivity of 0.044 W/mK); however a wide range is available.

Rigid insulation:
Rigid insulation boards are made from expanded or extruded polystyrene (EPS and XPS respectively), phenolic foam, polyurethane (PU) or polyisocyanurate (PIR). These can be used in wall, roof and floor constructions. The rigid insulation in partial fill walls illustrated in this guide is of the PIR type. For partially filled cavity wall construction, foil-backed insulation has been assumed with a resulting airspace resistivity of 0.54 m^2k/W as agreed with the representing trade organisations.

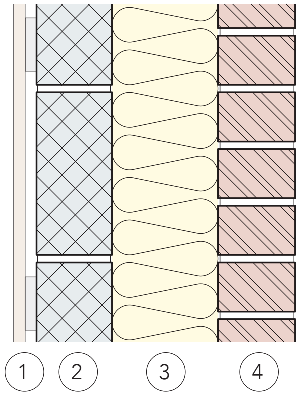
Roofs:
Flat ceilings have been assumed in each type of home with mineral wool insulation installed between and above the ceiling joists. The insulation to the roof is generally less dense than that in the walls, allowing for easier installation between the joists. The timber fraction for these U-value calculations is as per guidelines in BR 443 (2006).

3.2 U-values: external walls

	Aircrete blockwork (λ = 0.15 W/mK)		Ultra lightweight blockwork (λ = 0.28 W/mK)		Dense blockwork (λ = 1.33 W/mK)	
U-value	Insulation thickness	Wall thickness	Insulation thickness	Wall thickness	Insulation thickness	Wall thickness
0.20 W/m²K	140 mm	370 mm	150 mm	380 mm	160 mm	390 mm
0.18 W/m²K	160 mm	390 mm	175 mm	405 mm	180 mm	410 mm
0.15 W/m²K	195 mm	425 mm				

Wall type 1: fully filled external wall

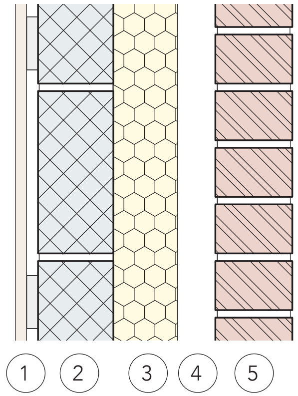
1. Plasterboard on dabs
2. 100 mm blockwork
3. Mineral wool insulation (λ = 0.032 W/mK)
4. 100 mm brickwork



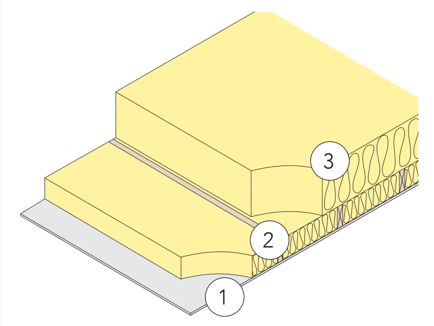
	Aircrete blockwork (λ = 0.15 W/mK)		Ultra lightweight blockwork (λ = 0.28 W/mK)		Dense blockwork (λ = 1.33 W/mK)	
U-value	Insulation thickness	Wall thickness	Insulation thickness	Wall thickness	Insulation thickness	Wall thickness
0.20 W/m²K	80 mm	360 mm	90 mm	370 mm	95 mm	375 mm
0.18 W/m²K	95 mm	375 mm	105 mm	385 mm	110 mm	390 mm
0.15 W/m²K	120 mm	400 mm	125 mm	405 mm	135 mm	415 mm

Wall type 2: partially filled external wall

1. Plasterboard on dabs
2. 100 mm blockwork
3. Rigid PIR insulation (λ = 0.022 W/mK)
4. 50 mm clear cavity
5. 100 mm brickwork



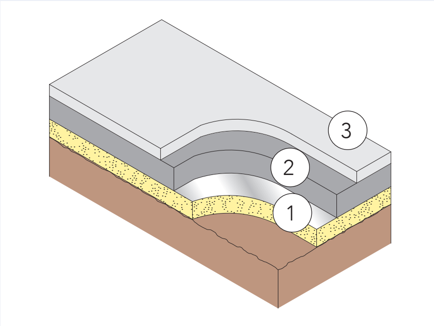
3.3 U-values: cold roof and ground floors



Roof: cold roof

1. Plasterboard
2. Mineral wool insulation between joists (λ = 0.044 W/mK)
3. Mineral wool insulation above joists (λ = 0.044 W/mK)

	Insulation thickness	
U-value	Between joists	Above joists
0.15 W/m²K	100 mm	200 mm
0.13 W/m²K	100 mm	250 mm
0.11 W/m²K	100 mm	290 mm

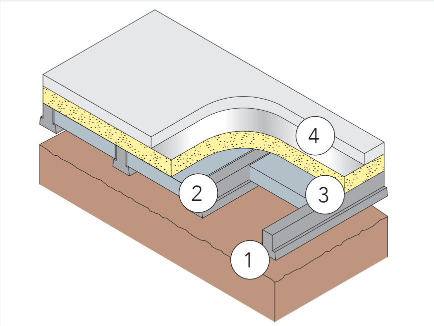


Ground floor type 1: ground bearing slab

1. Rigid PIR insulation (λ = 0.022 W/mK)
2. Reinforced concrete slab
3. 75 mm screed topping

The floor U-values have been calculated based on perimeter:area ratio of 0.53, as calculated for the detached house.

	Insulation thickness
U-value	Below slab
0.18 W/m²K	90 mm
0.15 W/m²K	115 mm
0.13 W/m²K	140 mm
0.11 W/m²K	170 mm



Ground floor type 2: suspended beam and block floor

1. Ventilated void
2. Concrete beam and block
3. Rigid PIR insulation (λ = 0.022 W/mK)
4. 75 mm screed topping

The floor U-values have been calculated based on perimeter:area ratio of 0.53, as calculated for the detached house.

	Insulation thickness
U-value	Below screed
0.18 W/m²K	85 mm
0.15 W/m²K	110 mm
0.13 W/m²K	125 mm
0.11 W/m²K	160 mm

Section 4: Home types & modelling assumptions

4.1 General modelling assumptions

All of the approaches in this guide consider standard practice - what can be achieved with readily available materials and common construction practices.

Along with the fabric specifications, which were discussed in Section 1 of the guide, the following assumptions have been made:

Ventilation:
Where natural ventilation has been proposed this will be achieved by a combination of trickle vents, opening windows and intermittent extractor fans. Where increased levels of air permeability are proposed, particular care should be taken to ensure that the ventilation requirements in Approved Document F can be achieved.

MVHR systems:
A high efficiency system has been selected with a specific fan power of 0.85 W/l/s and a heat recovery efficiency of 90%. For this type of ventilation system the target air permeability has been reduced to 3 $m^3/h.m^2$@50Pa.

Window specifications:
The windows modelled are thermally efficient, typically double-glazed with low-e coating and thermally broken frames. Double-glazed units have a U-value of 1.4 W/m^2K while triple-glazed units have a U-value of 0.8 W/m^2K. The overall light transmittance properties of the glazing, which affect the extent to which light passes through, are expressed as the 'g-value', which is set at a typical value of 0.63 for double-glazed units and 0.57 for triple-glazed ones.

Door specifications:
Insulated timber frame entrance doors have been assumed with a U-value of 1.2 W/m^2K.

Heating systems:
All houses and terraced homes have been modelled with a gas condensing boiler (SEDBUK efficiency of 89.5%) with a weather compensator (which allows for a conservative improvement in boiler efficiency by 3%), programmer and radiators with time and temperature zone controls. The apartments were assumed to have room thermostats, programmer and TRVs. It is assumed that all hot water systems will be separately timed and thermostatically controlled.

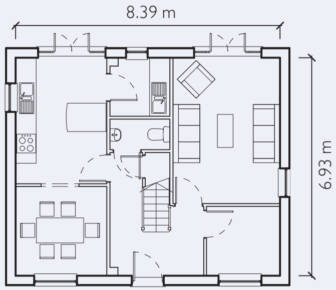
Solar renewables:
PVs with an easterly orientation have been assumed with a collector tilt of 30 degrees. SAP 2012 default efficiencies have been assumed for the flat plate solar panels.

Since the locations of the homes are unknown, 'moderate' overshading (20 - 60%) values has been assumed for both the PV and solar thermal panels.

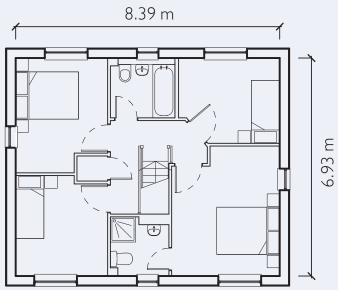
Y-values:
In Section 2, for particular details, two psi-values have been given - depending on whether dense or aircrete inner leaf blockwork has been used in the above-ground construction. In these cases the worse case psi-value (i.e. for dense blockwork) has been adopted to calculate the y-values given in Section 1. Improved y-values would be achieved if the better psi-value (i.e. for aircrete blockwork above ground) is used.

For any of the additional suggested improvements, including changes to the substructure blockwork, further modelling must be undertaken.

4.2 Detached homes



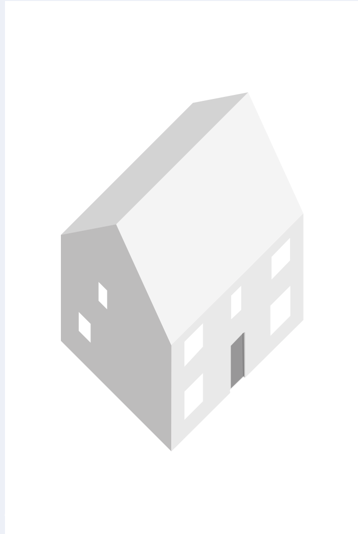
Ground floor

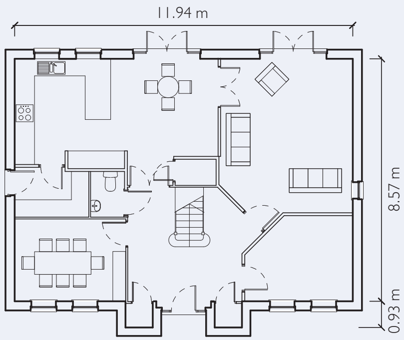


First floor

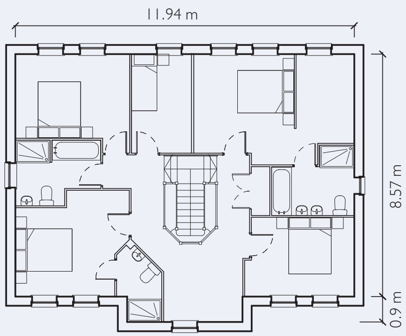
Detached house

Gross internal area:	116.3 m^2
Ground floor area:	58.1 m^2
Roof area:	58.1 m^2
Zone 1 area:	15.8 m^2
External wall area:	157.3 m^2
Opening area:	27.6 m^2
Average internal heights:	
Ground floor:	2.40 m
First floor:	2.70 m





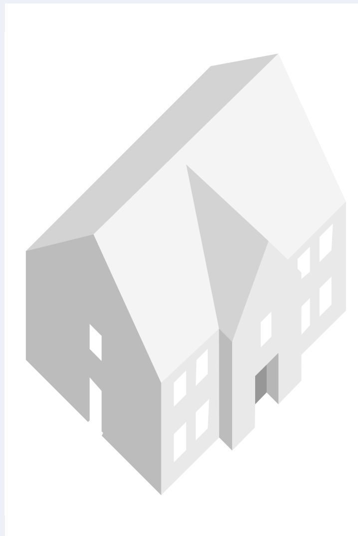
Ground floor



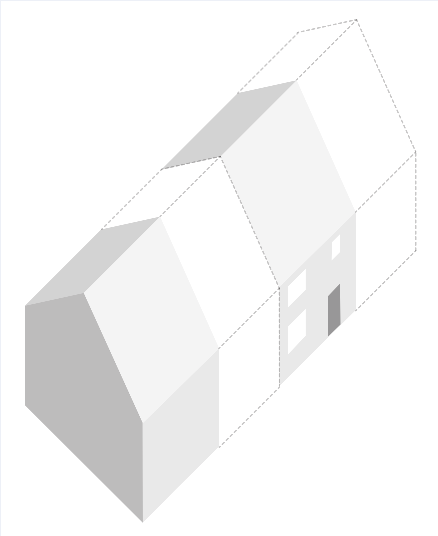
First floor

Large detached house

Gross internal area:	201.5 m^2
Ground floor area:	104.5 m^2
Roof area:	105.9 m^2
Zone 1 area:	25.6 m^2
External wall area:	222.2 m^2
Opening area:	42.1 m^2
Average internal heights:	
Ground floor:	2.40 m
First floor:	2.70 m

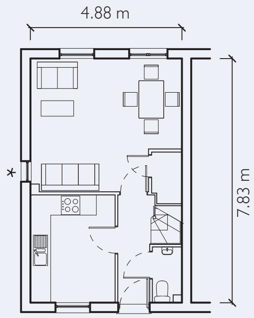


4.3 Attached homes and apartments

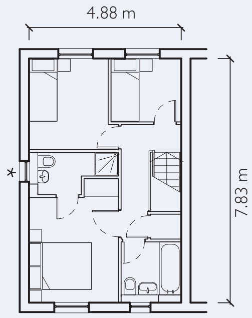


Terraced homes

	Mid-terrace	End-terrace
Gross internal area:	76.3 m^2	76.3 m^2
Ground floor area:	38.1 m^2	38.1 m^2
Roof area:	38.1 m^2	38.1 m^2
Zone 1 area:	19.3 m^2	19.3 m^2
External wall area:	49.7 m^2	89.6 m^2
Opening area:	13.7 m^2	15.5 m^2
Party wall area:	79.9 m^2	39.9 m^2
Average internal heights:		
Ground floor:	2.40 m	2.40 m
First floor:	2.70 m	2.70 m

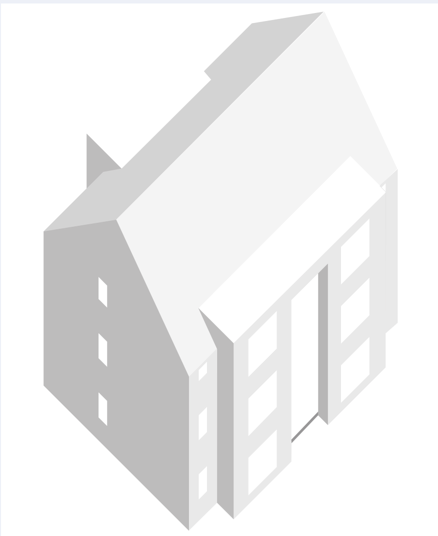


Ground floor



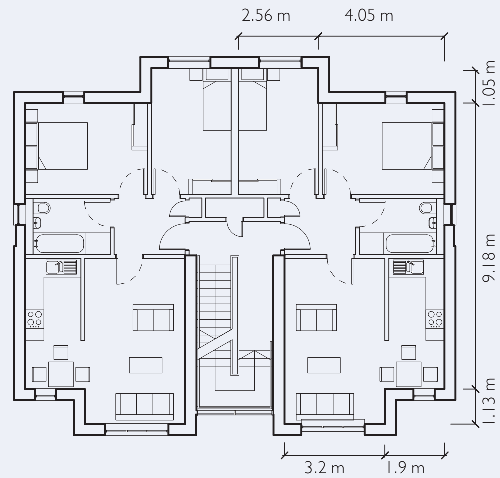
First floor

*Windows only applicable to end-terrace houses



Two bedroom apartment

Typical floor:	
Gross internal area:	59.0 m^2
Zone 1 area:	25.0 m^2
Sheltered wall area:	19.7 m^2
External wall area:	61.4 m^2
Opening area:	11.9 m^2
Party wall area:	10.3 m^2
Average internal heights:	
Ground floor:	2.55 m
First floor:	2.55 m
Second floor:	2.55 m



Glossary

Accredited Construction Details (ACDs): Typical construction details which were published in 2007 by the Department for Communities and Local Government to address issues with continuity of thermal and airtightness layers in construction. While ACDs are largely out of date, they have not been withdrawn and are still available for use.

Air permeability: The unintended leakage of air through gaps and cracks in the external envelope of a building. It is measured as the volume of air leakage per hour per square metre of external building envelope ($m^3/h.m^2$) at a tested pressure of 50 pascals (Pa).

Appendix R: Included in SAP 2012, this appendix contains the reference values for the parameters of the SAP calculation which are used to establish the target CO_2 emission rate (TER) for demonstrating compliance in new homes.

Carbon dioxide (CO_2) emissions: The release of carbon dioxide into the atmosphere, largely as a result of burning fossil fuels such as coal, gas and oil to produce heat and electricity.

Cold roof: A form of roof construction where the insulation is placed between the ceiling joists and outside air is allowed to ventilate through the loft space.

Design air permeability: The target value set at design stage and evaluated through a mandatory testing regime outlined in ADL1A 2014. A default value is set in ADL1A 2014 which may be used for specific cases and in the absence of testing.

Dwelling emission rate (DER): A measure of carbon dioxide emissions arising from use of energy in homes as calculated by the approved National Calculation Methodology, SAP. It is expressed as $kgCO_2/(m^2.yr)$ and takes into account energy used for space heating, hot water, fixed internal lighting, fans and pumps. To demonstrate compliance with ADL1A 2014, the DER of a dwelling must be no greater than its corresponding target emission rate (TER).

Elemental specification: This is the fabric and services specification that is used to calculate the target emissions rate (TER) for a new home under SAP 2012 for Wales. The full specification is outlined in Appendix B of ADL1A 2014 and Appendix R of SAP 2012.

MVHR: mechanical ventilation with heat recovery - a system of fans and ducts that recovers waste heat from outgoing air and pre-heats incoming air.

Natural ventilation: The supply of adequate fresh air to the home through windows, trickle ventilators, etc. Removal of air may take place by natural or mechanical means (via intermittent extracts).

Psi-value: Psi-value or linear thermal transmittance is the measure of heat loss along a non-repeating thermal bridge calculated as per guidance in BR 497 (2006) and IP 1/06; expressed in terms of W/mK.

Renewable energy: Energy produced without using finite fossil fuels (such as coal, oil and gas) and with minimal emissions of greenhouse gases. The main renewable energy sources are wind power, solar power, hydro-power and geothermal energy.

SAP: Standard Assessment Procedure; the Government's approved method for calculating energy efficiency and carbon emissions from homes to demonstrate compliance with Building Regulations.

Target emission rate (TER): The benchmark emission rate as calculated by SAP for a particular home expressed as annual kg of CO_2 per square metre of floor area. The calculation is based on a common recipe of elemental specifications in a dwelling of the same size, orientation and shape as the proposed dwelling.

Thermal conductivity: The theoretical rate at which a material conducts heat across a unit thickness; expressed in terms of W/mK.

U-value: The calculated rate at which heat is lost per unit area of a building element; expressed in terms of W/m^2K.

y-value: This is the calculated rate at which heat is lost through all of the non-repeating thermal bridges added together and then divided by the total area of exposed (heat loss) surfaces. It is expressed in terms of W/m^2K.

References

Approved Document ADL1A (Wales): Conservation of fuel and power in new dwellings (Crown Copyright, 2014)

Conventions for calculating linear thermal transmittance and temperature factors (BR 497) (BRE Press, September 2006)

Conventions for U-value calculations (BR 443) (BRE Press, July 2006)

Assessing the effects of thermal bridging at junctions and around openings (IP 1/06) (BRE Press, March 2006)

Part L 2014 - where to start:

An introduction for house builders and designers - masonry construction

This NHBC guide has been written in response to the 2014 changes made to Part L: Conservation of fuel and power (ADL1A 2014) in Wales. It is intended to give house builders, designers and assessors a broad understanding of the changes to the specification that will need to considered as a starting point for detailed design.

The guide provides examples of typical types of homes outlining possible options for overall compliance with ADL1A 2014.

The NHBC Foundation, established in 2006, provides high quality research and practical guidance to support the house-building industry as it addresses the challenges of delivering 21st century new homes. To date the NHBC Foundation has published over 60 reports on a wide variety of topics, including the sustainability agenda, homeowner issues and risk management.

Visit **www.nhbcfoundation.org** to find out more about the NHBC Foundation research programme.

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Written and illustrated by Studio Partington on behalf of the NHBC Foundation
ISBN 978-0-9930691-4-7

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