BUILDING PERFORMANCE


# H1 Energy Efficiency

## Acceptable Solution H1/AS2

Energy efficiency for buildings greater than 300 m²

**FIRST EDITION AMENDMENT 1** | EFFECTIVE 4 AUGUST 2022

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

Te Kāwanatanga o Aotearoa
New Zealand Government

# Preface

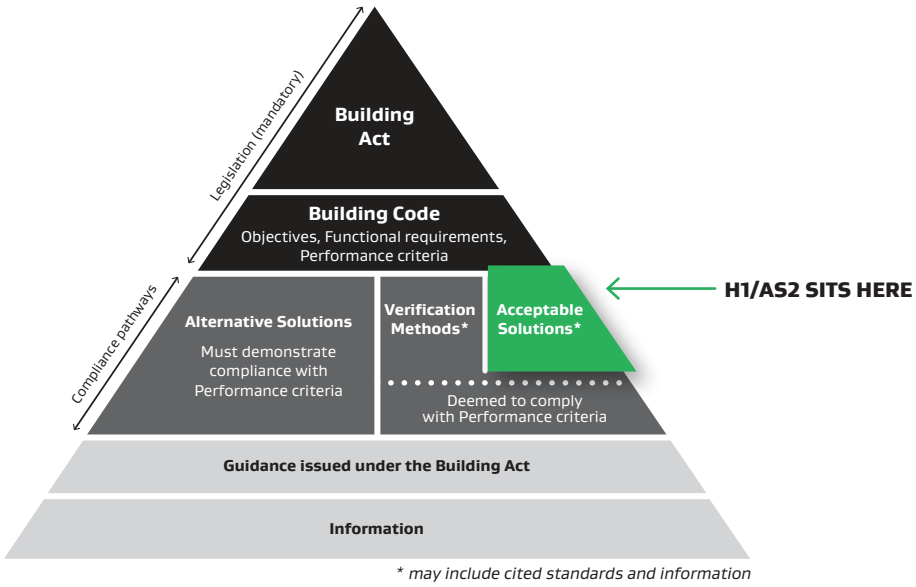
## Document status

This document (H1/AS2 First Edition Amendment 1) is an acceptable solution issued under section 22 (1) of the Building Act 2004 and is effective on 4 August 2022. It does not apply to building consent applications submitted before 4 August 2022. The previous Acceptable Solution H1/AS2 First Edition (unamended) can be used to show compliance until 4 August 2022. The previous Acceptable Solution H1/AS1 Fourth Edition Amendment 4, can be used to show compliance until 2 November 2022 and can be used for building consent applications submitted before 3 November 2022.

## Building Code regulatory system

Each acceptable solution outlines the provisions of the Building Code that it relates to. Complying with an acceptable solution or verification method is a way of complying with that part of the Building Code.  Other options for establishing compliance are listed in section 19 of the Building Act.

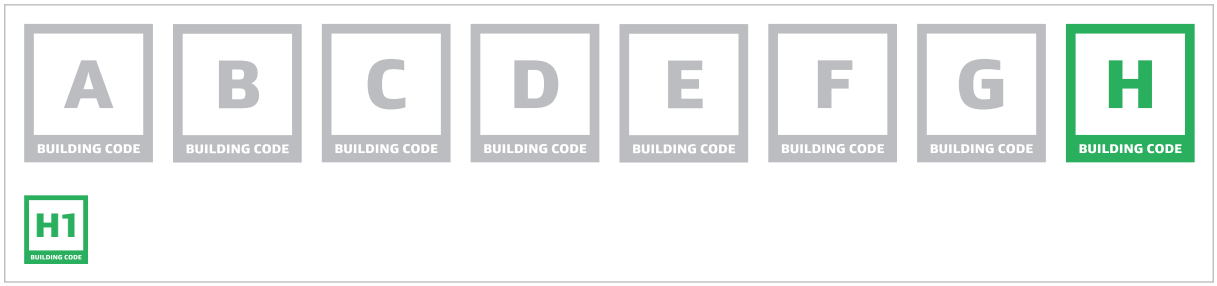
### Schematic of the Building Code System




** may include cited standards and information*

A building design must take into account all parts of the Building Code. The Building Code is located in Schedule 1 of the Building Regulations 1992 and available online at www.legislation.govt.nz

The part of the Building Code that this acceptable solution relates to is clause H Energy Efficiency. Further information on the scope of this document is provided in the introduction on page 5.




Further information about the Building Code, the objectives, functional requirements and performance criteria provisions that it contains, and other acceptable solutions and verification methods are available at www.building.govt.nz

## Main changes in this version and features of this document

# Main changes in this version

This is amendment 1 of the first edition of H1/AS2. However, prior to its release, similar requirements were previously found within H1/AS1. The main changes from H1/AS1 Fourth Edition Amendment 4 are:

- The scope of H1/AS1 has been reduced to cover only housing, and buildings other than housing less than 300 m². Requirements applicable to larger buildings have been combined into Acceptable Solution H1/AS2. To reflect the new scope of the documents and the new document layout, a new introduction and scope has been provided in Part 1. General.
- Buildings with curtain walling have been excluded from the scope of H1/AS2.
- Citations of NZS 4218: 2009 "Thermal insulation – Housing and small buildings" and NZS 4243.1: 2007 "Energy Efficiency – large buildings. Building thermal envelope" have been removed from the document. The relevant content from these standards has been adopted into H1/AS1 and H1/AS2 with permission from Standards New Zealand.
- The minimum R-values previously found in NZS 4218 and NZS 4243.1 have been replaced with new values and new text in Part 2. Building thermal envelope.
- The requirements for determining the thermal resistance and construction R-value of building elements have been revised to better reflect the thermal performance of windows, doors, skylights and slab-on-ground floors.
- Portions of text have been re-written to enhance clarity in the document and provide consistent language with other acceptable solutions and verification methods.
- References have been revised to include only documents within the scope of H1/AS2 and have been amended to include the most recent version of AS/NZS 4859.1 in Appendix A.
- Additional references have been added to include BS EN 673, ISO 10077-1 and ISO 10077-2, ISO 13370, and ISO 13789 in Appendix A.
- The definitions page has been revised to include all defined terms used in this document in Appendix B.
- The three-zone climate zone map previously found in NZS 4218 and NZS 4243.1 has been updated with a six-zone climate zone map in Appendix C.
- Requirements for establishing the orientation of a building have been added in Appendix D.
- A new procedure for calculating the construction R-value of windows, doors, and skylights has been added in Appendix E.
- Tables with construction R-values of selected slab-on-ground floor scenarios have been added to a new Appendix F.

The main changes from the unamended version of the first edition of H1/AS2 are:

- Throughout the document some obvious errors in the text, formatting and cross-references have been corrected, and minor text clarifications with minor to no impact have been made.

People using this document should check for amendments on a regular basis. The Ministry of Business, Innovation and Employment may amend any part of any acceptable solution or verification method at any time. Up-to-date versions of acceptable solutions and verification methods are available from www.building.govt.nz

# Features of this document

- For the purposes of Building Code compliance, the standards and documents referenced in this acceptable solution must be the editions, along with their specific amendments listed in Appendix A.
- Words in italic are defined at the end of this document in Appendix B.
- Hyperlinks are provided to cross-references within this document and to external websites and appear with a blue underline.
- Classified uses for *buildings*, as described in clause A1 of the Building Code, are printed in **bold** in this document. These are denoted with classified use icons for:

| | | |
|---|---|---|
| H **Housing** | Com **Commercial** | Out **Outbuildings** |
| CR **Communal residential** | Ind **Industrial** | Anc **Ancillary** |
| CN **Communal non-residential** | | |

- Appendices to this acceptable solution are part of, and have equal status to, the acceptable solution. Figures are informative only and the wording of the paragraphs takes precedence. Text boxes headed 'COMMENT' occur throughout this document and are for guidance purposes only.

# Contents

# Part 1. General

## 1.1 Introduction

### 1.1.1 Scope of this document

1.1.1.1 This document can be used for *buildings* other than **housing** with an area of *occupied space* greater than 300 m².

H 1.1.1.2 For all **housing**, and *buildings* other than **housing** with an *occupied space* less than 300 m², refer to the Acceptable Solution H1/AS1 or Verification Method H1/VM1 as a means to demonstrate compliance or use an alternative means to demonstrate compliance.

### 1.1.2 Items outside the scope of this document

1.1.2.1 This acceptable solution does not include the use of foil insulation.

Com 1.1.2.2 This acceptable solution does not apply to *buildings* with *curtain walling*. For these, use Verification Method H1/VM2 or use an alternative means to demonstrate compliance.

1.1.2.3 For **commercial** *buildings*, this acceptable solution does not include requirements to comply with clause H1.3.6 of the Building Code for the energy efficiency of *HVAC systems*. For this clause, use Verification Method H1/VM3 or use an alternative means to demonstrate compliance.

### 1.1.3 Compliance pathway

1.1.3.1 This acceptable solution is one option that provides a means of establishing compliance with the performance criteria in Building Code clauses H1.3.1, H1.3.3, H1.3.4 and H1.3.5.

1.1.3.2 Options for demonstrating compliance with H1 Energy Efficiency through the use of acceptable solutions and verification methods are summarised in Table 1.1.3.2. Compliance may also be demonstrated using an alternative solution.

## 1.2 Using this acceptable solution

### 1.2.1 Determining the classified use

1.2.1.1 Classified uses for *buildings* are described in clause A1 of the Building Code. Where a specific classified use is mentioned within a subheading and/or within the text of a paragraph, this requirement applies only to the specified classified use(s), and does not apply to other classified uses.

Ind 1.2.1.2 In *buildings* containing both **industrial** and other classified uses, the non-industrial portion shall be treated separately according to its classified use. For example, in a *building* containing both **industrial** and **commercial** classified uses, the **commercial** area shall meet the relevant energy efficiency requirements of the Building Code.

## General

**TABLE 1.1.3.2: Demonstrating compliance with H1 Energy Efficiency through acceptable solutions and verification methods**

Paragraph 1.1.3.2

| Performance clause | Applies to | Relevant acceptable solutions and verification methods |
|---|---|---|
| H1.3.1 (a) and (b) *Thermal Envelope* | H **Housing**<br>CR **Communal residential**<br>CN **Communal non-residential** (assembly care only)<br>Com **Commercial** | For **housing**, and *buildings* no greater than 300 $m^2$: H1/AS1 or H1/VM1<br>For large *buildings*: H1/AS2 or H1/VM2 |
| H1.3.2E *Building performance index* | H **Housing** | H1/AS1 or H1/VM1 |
| H1.3.3 (a) to (f) Physical conditions | All *buildings* | For **housing**, and *buildings* no greater than 300 $m^2$: H1/AS1 or H1/VM1<br>For large *buildings*: H1/AS2 or H1/VM2 |
| H1.3.4 (a) Heating of hot water | All *buildings* | For **housing**, and *buildings* no greater than 300 $m^2$: H1/AS1<br>For large *buildings*: H1/AS2 |
| H1.3.4 (b) Storage vessels and distribution systems | Individual storage vessels ≤ 700 L in capacity and distribution systems | For **housing**, and *buildings* no greater than 300 $m^2$: H1/AS1<br>For large *buildings*: H1/AS2 |
| H1.3.4 (c) Efficient use of hot water | H **Housing** | H1/AS1 |
| H1.3.5 Artificial lighting | Lighting not provided solely to meet the requirements of Building Code clause F6 in:<br>Com CN **Commercial** and<br>**Communal non-residential** having *occupied space* greater than 300 $m^2$ | H1/AS2 |
| H.1.3.6 *HVAC systems* | Com **Commercial** | H1/VM3 |

# Part 2. Building thermal envelope

## 2.1 Thermal resistance

### 2.1.1 Demonstrating compliance

CR CN Com

2.1.1.1 For **communal residential**, **communal non-residential** assembly care, and **commercial** *buildings,* the *building envelope* shall be provided with *construction* that provides *adequate thermal resistance.* The minimum required *construction R-values* shall be determined through the use of:

a) the Schedule method in Subsection 2.1.2, or

b) the Calculation method in Subsection 2.1.3, or

c) the Modelling method in H1/VM2.

2.1.1.2 For mixed-use *buildings* that include **housing**, the H1/AS1 Subsection 2.1.2 "Schedule Method", or H1/AS1 Subsection 2.1.3 "Calculation Method" shall be used for the parts of the *building* containing **housing**. For the other parts of the *building*, the methods in Paragraph 2.1.1.1 can be used.

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COMMENT: To satisfy the Building Code performance requirement E3.3.1 for internal moisture, it may be necessary, depending on the method adopted, to provide more insulation (a greater *R-value*) than that required to satisfy energy efficiency provisions alone.

2.1.1.3 The requirements for the Schedule method and Calculation method are separated based on the relevant climate zone for the *building*. A list of the New Zealand climate zones is provided in Appendix C.

2.1.1.4 For *building elements* with embedded heating systems, the minimum *construction R-values* shall be determined through the Schedule method. These apply whenever *building elements* that are part of the *thermal envelope* include heating systems and may not be reduced by applying the Calculation method in Subsection 2.1.3.

2.1.1.5 The *construction R-values* of individual *building elements* shall be determined in accordance with Subsection 2.1.4.

2.1.1.6 Insulation materials shall be installed in a way that achieves the intended thermal performance in *buildings* without compromising the durability and safety of insulation or *building elements* and the health and safety of installers and *building* occupants. Gaps, tucks, folds, and over compaction of insulation material shall be avoided.

### 2.1.2 Schedule method

2.1.2.1 The schedule method shall only be used for *buildings* where the sum of the *window area* and *door area* is less than or equal to 50% of the *total wall area*. Otherwise the Calculation method in Subsection 2.1.3 or the Modelling method in H1/VM2 shall be used.

2.1.2.2 *Building elements* that are part of the *thermal envelope* shall have minimum *construction R-values* no less than:

a) For *building elements* that contain embedded heating systems, those in Table 2.1.2.2A; or

b) For *building elements* that do not contain embedded heating systems, Table 2.1.2.2B.

**TABLE 2.1.2.2A: Minimum construction R-values for heated roofs, walls or floors**

Paragraph 2.1.2.2 a)

| Building element | Construction R-values (m²·K/W)[1],[2],[3] | | | | | |
|---|---|---|---|---|---|---|
| | Climate zone 1 | Climate zone 2 | Climate zone 3 | Climate zone 4 | Climate zone 5 | Climate zone 6 |
| *Heated roof*[4] | R6.6 | R6.6 | R6.6 | R6.6 | R6.6 | R7.0 |
| *Heated wall* | R2.9 | R2.9 | R3.0 | R3.2 | R3.4 | R3.6 |
| *Heated floor* | R2.9 | R2.9 | R2.9 | R3.0 | R3.2 | R3.4 |

**Notes:**

(1) $R_{IN}$/R-value < 0.1 and $R_{IN}$ is the *thermal resistance* between the heated plane and the inside air.

(2) Floor coverings, for example carpet or cork, will reduce the efficiency of the *heated floor*.

(3) Climate zone boundaries are shown in Appendix C.

(4) In *roofs* with a *roof space*, where the insulation is installed over a horizontal ceiling, the *roof R-value* may be reduced to R3.3 for a distance of up to 500 mm from the outer edge of the ceiling perimeter where space restrictions do not allow full-thickness insulation to be installed.

**TABLE 2.1.2.2B: Minimum construction R-values for building elements that do not contain embedded heating systems**

Paragraphs 2.1.2.2 b), 2.1.3.11

| Building element | Construction R-values (m²·K/W)[1] | | | | | |
|---|---|---|---|---|---|---|
| | Climate zone 1 | Climate zone 2 | Climate zone 3 | Climate zone 4 | Climate zone 5 | Climate zone 6 |
| *Roof* | R3.5 | R4.0 | R5.0 | R5.4 | R6.0 | R7.0 |
| Wall | R2.2 | R2.4 | R2.7 | R3.0 | R3.0 | R3.2 |
| Floor | R2.2 | R2.2 | R2.2 | R2.4 | R2.5 | R2.6 |
| Windows and doors | R0.33 | R0.33 | R0.37 | R0.37 | R0.40 | R0.42 |
| *Skylights* | R0.42 | R0.42 | R0.46 | R0.46 | R0.49 | R0.51 |

**Notes:**

(1) Climate zone boundaries are shown in Appendix C.

(2) In *roofs* with a *roof space*, where the insulation is installed over a horizontal ceiling, the *roof R-value* may be reduced to R3.3 for a distance of up to 500 mm from the outer edge of the ceiling perimeter where space restrictions do not allow full-thickness insulation to be installed.

## 2.1.3 Calculation method

2.1.3.1 This method allows for increased flexibility in proposed wall *construction* such as more than one type of wall *construction*, a mix of window types, a range of *thermal resistances*, any *window area* and *door area*, or a combination of these. This method does not allow reducing the *thermal resistances* of the *roof*, floor and *skylights* of the proposed *building*.

2.1.3.2 The calculation method shall only be used where the proposed *solar aperture (V)* is less than or equal to 0.5 as given by Equation 1:

Equation 1: $$V = \frac{\sum SC_{glazing} A_{glazing}}{A_{totalwall}}$$

where:

V is the *solar aperture*, and

$SC_{glazing}$ is the *shading coefficient, and*

$A_{glazing}$ is the *glazing area* ($m^2$), and

$A_{totalwall}$ is the *total wall area* ($m^2$).

2.1.3.3 The thermal performance of the proposed *building* wall, as defined by the total wall *thermal resistance* ($R_{total}$), shall be at least equal to the reference *building* wall.

2.1.3.4 *Building elements* that form part of the *thermal envelope* with *construction R-values* and conditions different from those given in the Schedule method in Subsection 2.1.2 may be used providing the heat loss of the proposed *building* is less than or equal to the heat loss of the reference *building* for the relevant climate zone as per Equation 2.

Equation 2: $HL_{Proposed} \leq HL_{Reference}$

where:

$HL_{Proposed}$ is the heat loss of the proposed total wall (W/K), and

$HL_{Reference}$ is the heat loss of the reference total wall (W/K).

2.1.3.5 $HL_{Reference}$ shall be calculated from Equation 4b in Paragraph 2.1.3.8 using the *thermal resistance* and conditions from Subsection 2.1.2 as appropriate.

2.1.3.6 $HL_{Proposed}$ shall be calculated from Equation 4a in Paragraph 2.1.3.8 using the actual proposed areas and *R-values* from Paragraph 2.1.3.8.

2.1.3.7 The reference *building wall area*, *window area*, and *door area* shall be determined using Equation 3.

Equation 3:

If $(A_{window,proposed} + A_{door,proposed}) \leq A_{wall,proposed}$ then:

$$A_{wall,reference} = A_{wall,proposed}$$

$$A_{window,reference} = A_{window,proposed}$$

$$A_{door,reference} = A_{door,proposed}$$

Otherwise,

$$A_{wall,reference} = ½\ A_{totalwall,proposed}$$

$$A_{window,reference} + A_{door,reference} = ½\ A_{totalwall,proposed}$$

where:

$A_{wall,reference}$ is the *wall area* ($m^2$) of the reference *building*, and

$A_{wall,proposed}$ is the *wall area* ($m^2$) of the proposed *building*, and

$A_{window,reference}$ is the *window area* ($m^2$) of the reference *building*, and

$A_{window,proposed}$ is the *window area* ($m^2$) of the proposed *building*, and

$A_{door,reference}$ is the *door area* ($m^2$) of the reference *building*, and

$A_{door,proposed}$ is the *door area* ($m^2$) of the proposed *building*, and

$A_{totalwall,proposed}$ is the total *wall area* ($m^2$) of the proposed *building*.

2.1.3.8 The heat flow (HL) through the *thermal envelope* shall be determined using:

a) For the proposed *building*, Equation 4a, and

b) For the reference *building*, Equation 4b.

Equation 4a: $$HL_{proposed} = \frac{A_{wall,proposed}}{R_{wall,proposed}} + \frac{A_{window,proposed}}{R_{window,proposed}} + \frac{A_{door,proposed}}{R_{door,proposed}}$$

Equation 4b: $$HL_{reference} = \frac{A_{wall,reference}}{R_{wall,reference}} + \frac{A_{window,reference} + A_{door,reference}}{R_{window,reference}}$$

where:

$HL_{proposed}$ is the heat loss of the total wall (W/K) of the proposed *building*, and

$A_{wall,proposed}$ is the *wall area* ($m^2$) of the proposed *building*, and

$A_{window,proposed}$ is the *window area* ($m^2$) of the proposed *building*, and

$A_{door,proposed}$ is the *door area* ($m^2$) of the proposed *building*, and

$R_{wall,proposed}$, $R_{window,proposed}$ and $R_{door,proposed}$ are the *R-values* ($m^2 \cdot K/W$) of the corresponding *thermal envelope* components for the proposed *building*, and

$HL_{reference}$ is the heat loss of the total wall (W/K) of the reference building, and

$A_{wall,reference}$ is the *wall area* ($m^2$) of the reference *building*, and

$A_{window,reference} + A_{door,reference}$ is the sum of the *window area* ($m^2$) and *door area* ($m^2$) of the reference *building*, and

$R_{wall,reference}$ and $R_{window,reference}$ are the *R-values* ($m^2 \cdot K/W$) of the corresponding *thermal envelope* components for the reference *building*.

2.1.3.9 The *total wall area* used shall be the same for both the proposed and reference *building*.

2.1.3.10 Where a *building thermal envelope* component is proposed to have two or more methods of *construction* with different *thermal resistances*, the corresponding term in the proposed *building* thermal characteristic shall be expanded to suit. For example:

$$\frac{A_{wall}}{R_{wall}} \text{ becomes } \frac{A_{wall(1)}}{R_{wall(1)}} + \frac{A_{wall(2)}}{R_{wall(2)}}$$

2.1.3.11 The *roof*, floor, and *skylights* that are part of the proposed *building thermal envelope* shall have minimum *construction R-values* no less than:

a) For *building elements* that contain embedded heating systems, those in Table 2.1.2.2A; or

b) For *building elements* that do not contain embedded heating systems, Table 2.1.2.2B.

### 2.1.4 Determining the thermal resistance of building elements

2.1.4.1 Acceptable methods for determining the *thermal resistance (R-values)* of *building elements* are:

a) For walls, *roofs*, and floors other than *slab-on-ground floors*, contained in NZS 4214; and

b) For windows, doors, and *skylights*, specified in Appendix E; and

c) For *slab-on-ground floors*, specified in Appendix F.

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COMMENT: The BRANZ House Insulation Guide provides *thermal resistances* of common *building* components and is based on calculations from NZS 4214. However, the BRANZ House Insulation Guide, 5th edition or earlier, should not be used for determining the *thermal resistances* of *slab-on-ground floors*, windows and doors due to differences in calculation methods and assumptions compared to Appendix E and Appendix F.

2.1.4.2 The *thermal resistance (R-values)* of insulation materials may be verified by using AS/NZS 4859.1.

2.1.4.3 The *construction R-values* of *building elements* shall be calculated as follows:

a) For walls and *roofs*, the *R-value* is of a typical area of the *building element*; and

b) For framed walls, the *R-value* shall include the effects of studs, dwangs, top plates and bottom plates, but may exclude the effects of lintels, sills, additional studs that support lintels and sills, and additional studs at corners and junctions; and

c) For walls without frames, the *R-value* excludes any attachment requirements for windows and doors; and

d) For windows, doors and *skylights*, as specified in Appendix E; and

e) For *slab-on-ground floors*, the *R-value* is as specified in Appendix F; and

f) For floors other than *slab-on-ground floors*, the *R-value* is of a typical area of the floor ignoring the effect of floor coverings (including carpets).

2.1.4.4 The *R-value* of an unconditioned air-space between the *thermal envelope* and the *building envelope* may be included in the *construction R-value*. This can include a subfloor, *roof* space, garage, and/or conservatory.

COMMENT: Garages should form part of the *unconditioned space* of a *building*, that is, they should be outside the *thermal envelope*. Any *building elements* between attached garages and the *conditioned spaces* of a *building* form part of the *thermal envelope* and should therefore be insulated.

## 2.2 Airflow

### 2.2.1 Control of airflow

CR CN Com

2.2.1.1 **Communal residential**, **communal non-residential** assembly care, and **commercial** *buildings* shall have windows, doors, vents or other *building elements* that allow significant movement of air, to be *constructed* in such a way that they are capable of being fixed in the closed position.

COMMENT:

1. G4/AS1 provides for the supply of outdoor air for ventilation by way of windows and doors that can be fixed in the open position.
2. Measures should be taken to limit the amount of moisture that can migrate from *occupied spaces* into the *roof* or *roof* space. This includes limiting the air permeability of ceilings, including through ceiling linings and penetrations such as recessed luminaires, electrical and plumbing services, and ceiling access hatches.

## 2.3 Solar heat gains

### 2.3.1 Control of solar heat gains

2.3.1.1 Requirements to account for heat gains from solar radiation are satisfied by complying with the requirements for *thermal resistance* in Section 2.1.

COMMENT: Passive measures to prevent overheating from excessive solar heat gains through the *building envelope* should be taken to reduce dependence on active cooling systems. Such measures should include a combination of:

- Providing *adequate thermal resistance* to the *thermal envelope* of the *building*; and
- Avoiding excessive *window areas* (particularly on the east, north and west-facing facades); and
- Avoiding excessive *skylight areas*; and
- Selecting glass types with appropriate *solar heat gain coefficients (SHGC)*; and
- Providing external shading for windows and *skylights*; and
- Providing the ability to ventilate the *building* at a sufficient rate to maintain comfortable indoor temperatures in summer.

# Part 3. Building services

## 3.1 Hot water systems

### 3.1.1 Hot water systems for sanitary fixtures and sanitary appliances

3.1.1.1 Hot water systems for *sanitary fixtures* and *sanitary appliances* having a storage water heater capacity of up to 700 litres shall comply with NZS 4305.

COMMENT:

1. NZS 4305 deals with domestic type electrical and gas systems having a storage water heater capacity of up to 700 litres. Larger systems and their associated piping are not controlled by the Building Code.
2. The manufacture and sale of hot water cylinders and gas water heaters are covered by the Energy Efficiency (Energy Using Products) Regulations 2002. The associated NZ Minimum Energy Performance Standards for electric storage water heaters (MEPS as defined in NZS 4606.1 and the relevant NZ section of AS/NZS 4692.2) are equivalent to the requirements in this acceptable solution (see NZS 4305 clause 2.1.1). Electric storage water heaters that do not comply with NZ MEPS do not comply with this acceptable solution.

## 3.2 Artificial lighting

### 3.2.1 Communal Non-residential and Commercial Buildings

CN Com 3.2.1.1 Artificial lighting energy consumption in **communal non-residential** and **commercial** *buildings* having *occupied space* greater than 300 $m^2$ shall comply with NZS 4243.2 section 3.3.

# Appendix A. References

For the purposes of Building Code compliance, the standards and documents referenced in this acceptable solution must be the editions, along with their specific amendments, listed below.

| **Standards New Zealand** | | **Where quoted** |
|---|---|---|
| NZS 4214: 2006 | Methods of determining the total thermal resistance of parts of buildings | 2.1.4.1, Definitions |
| NZS 4243:- | Energy efficiency – large buildings | |
| Part 2: 2007 | Lighting<br>Amend 1 | 3.2.1.1 |
| NZS 4305: 1996 | Energy efficiency – domestic type hot water systems | 3.1.1.1 |
| NZS 4606:- | Storage water heaters | |
| Part 1: 1989 | General requirements | 3.1.1.1 Comment |
| AS/NZS 4692:- | Electric water heaters | |
| Part 2: 2005 | Minimum Energy Performance Standards (MEPS) requirements and energy labelling | 3.1.1.1 Comment |
| AS/NZS 4859:- | Thermal insulation materials for buildings | |
| Part 1: 2018 | General criteria and technical provisions | 2.1.4.2 |
| **British Standards Institute** | | |
| BS EN 673: 2011 | Glass in building – Determination of thermal transmittance (U value) – Calculation method | E.1.2.2 a), E.1.2.4 a), E.2.1.2 a) |
| **International Organization for Standardization** | | |
| ISO 10077:- | Thermal performance of windows, doors and shutters - Calculation of thermal transmittance | |
| Part 1: 2017 | General | E.1.2.2, E.1.2.4, Equation 3, E.2.1.2 |
| Part 2: 2017 | Numerical method for frames | E.1.2.2, E.1.2.4, Equation 3, E.2.1.2 |
| ISO 13370: 2017 | Thermal performance of buildings – Heat transfer via the ground – Calculation methods | F.1.2.2 Comment |
| ISO 13789: 2017 | Thermal performance of buildings – Transmission and ventilation heat transfer coefficients – Calculation method | Equation F.1 |

These standards can be accessed from www.standards.govt.nz.

# References

**BRANZ Ltd.**

BRANZ House Insulation Guide (5th Edition), 1 July 2014 — 2.1.4.1 Comment, F.1.1.1 Comment

Cox-Smith, I. (2016). Perimeter insulation of concrete slab foundations. Study Report SR352, BRANZ Ltd, Judgeford, New Zealand. — F.1.2.2 Comment

These documents can be accessed from www.branz.co.nz.

**New Zealand Legislation**

Energy Efficiency (Energy Using Products) Regulations 2002 — 3.1.1.1 Comment

This document can be accessed from www.legislation.govt.nz

# Appendix B. Definitions

These definitions are specific to this acceptable solution. Other defined terms found in italics within the definitions are provided in clause A2 of the Building Code.

| | |
|---|---|
| **Adequate** | Means *adequate* to achieve the objectives of the Building Code. |
| **Building** | Has the meaning given to it by sections 8 and 9 of the Building Act 2004. |
| **Building element** | Any structural or non-structural component or assembly incorporated into or associated with a *building*. Included are *fixtures*, services, *drains*, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports. |
| **Building envelope** | The *building thermal envelope* plus the exterior surface of any spaces not requiring conditioning, e.g. garage, floor space (below insulating layer), *roof* space (above any outer surface defining an attic or when there is no attic above the insulating layer). |
| **Conditioned space** | That part of a *building* within the *building thermal envelope* that may be directly or indirectly heated or cooled for occupant comfort. It is separated from *unconditioned space* by *building elements* (walls, windows, *skylights*, doors, *roof*, and floor) to limit uncontrolled airflow and heat loss. |
| **Construct** | In relation to a *building*, includes to design, build, erect, prefabricate, and relocate the *building*; and *construction* has a corresponding meaning. |
| **Construction R-value** | The *total thermal resistance (R-value)* of a typical area of a *building element*. |
| **Curtain walling** | Part of the *building envelope* made of a framework usually consisting of horizontal and vertical profiles, connected together and anchored to the supporting structure of the *building*, and containing fixed and/or openable infills, which provides all the required functions of an internal or *external wall* or part thereof, but does not contribute to the load bearing or the stability of the structure of the *building*. |
| **Door area ($A_{door}$)** | The total area of doors in the *thermal envelope*, including frames and opening tolerances, and including any opaque panels, glazing, decorative glazing and louvres. |
| **External wall** | Any vertical exterior face of a *building* consisting of primary and/or secondary elements intended to provide protection against the outdoor environment |
| **Glazing Area ($A_{glazing}$)** | The total area of vertical windows and doors that include glazing in the *thermal envelope* including transparent or translucent glazing, frames and opening tolerances, decorative glazing, and louvres. This excludes opaque panels, opaque doors, and *skylights*. |
| **Habitable space** | A space used for activities normally associated with domestic living, but excludes any bathroom, laundry, water-closet, pantry, walk-in wardrobe, corridor, hallway, lobby, clothes-drying room, or other space of a specialised nature occupied neither frequently nor for extended periods. |
| **Heated roof, wall, or floor** | Any *roof*, *wall*, or floor incorporating embedded pipes, electrical cables, or similar means of raising the temperature of the *roof*, wall, or floor for room heating. |
| **HVAC system** | For the purposes of performance H1.3.6 and in relation to a *building*, means a mechanical, electrical, or other system for modifying air temperature, modifying air humidity, providing ventilation, or doing all or any of those things, in a space within the *building*. |
| **Insulating glazing unit (IGU)** | Two or more panes of glass spaced apart and factory sealed with dry air or special gases in the unit cavity. (Often abbreviated to IGU or referred to as the unit or double glazing). |

# Definitions

| | |
|---|---|
| **Intended use** | In relation to a *building*, —<br>a) includes any or all of the following:<br>i) any reasonably foreseeable occasional use that is not incompatible with the intended use;<br>ii) normal maintenance;<br>iii) activities undertaken in response to *fire* or any other reasonably foreseeable emergency; but<br>b) does not include any other maintenance and repairs or rebuilding. |
| **Occupied space** | Any space within a *building* in which a person will be present from time to time during the *intended use* of the *building* |
| **Persons** | Includes—<br>a) the Crown; and<br>b) a corporation sole; and<br>c) a body of *persons* (whether corporate or unincorporated). |
| **R-value** | The common abbreviation for describing the values of both *thermal resistance* and *total thermal resistance*. |
| **Roof** | Any *roof*-ceiling combination where the exterior surface of the *building* is at an angle of 60° or less to the horizontal and has its upper surface exposed to the outside. |
| **Roof area ($A_{roof}$)** | The area of the *roof* that is part of the *thermal envelope*, excluding the *skylight area*. |
| **Sanitary appliance** | An appliance which is intended to be used for *sanitation*, but which is not a *sanitary fixture*. Included are machines for washing dishes and clothes. |
| **Sanitary fixture** | Any *fixture* which is intended to be used for *sanitation.* |
| **Sanitation** | The term used to describe the activities of washing and/or excretion carried out in a manner or condition such that the effect on health is minimised, with regard to dirt and infection |
| **Shading coefficient (SC)** | The ratio of the total *solar heat gain coefficient* (SHGC) through a particular glass compared to the total *solar heat gain coefficient* through 3 mm clear float glass. |
| **Slab-on-ground floors** | Floor *construction* consisting of a concrete slab or concrete raft foundation in contact with the ground over its whole area. |
| **Skylight** | Translucent or transparent parts of the *roof*, including frames and glazing. |
| **Skylight area ($A_{skylight}$)** | The area of *skylights* that are part of the *roof thermal envelope*, including frames and opening tolerances. |
| **Solar aperture (V)** | The fraction of total solar radiation received on the vertical *wall* (opaque and glazed) that actually enters the perimeter space being considered. |
| **Solar heat gain coefficient (SHGC)** | The total solar energy entering a *building* through the glazing, that is, the direct transmission of energy from the sun plus the inwards re-radiation of heat from solar radiation that is absorbed in the glass. The SHGC is also known as the solar factor (SF) or g (glazing factor). |
| **Surface (of glass)** | The glass surfaces of single glazing and double glazing are numbered from the outside to the inside. The outside face of the outer pane is surface one, the inside face of the outer pane is surface two. In single glazing there are only two surfaces. With double glazing the outer surface of the inner pane is surface three, and the inner surface of the inner pane is surface four. |
| **Thermal envelope** | The *roof*, wall, window, *skylight*, door and floor *construction* between *unconditioned spaces* and *conditioned spaces*. |
| **Thermal envelope floor area ($A_{floor}$)** | The area of the floor that forms part of the *thermal envelope*. |

## Definitions

| | |
|---|---|
| **Thermal resistance** | The resistance to heat flow of a given component of a *building element*. It is equal to the air temperature difference (K) needed to produce unit heat flux ($W/m^2$) through unit area ($m^2$) under steady conditions. The units are $m^2 \cdot K/W$. |
| **Total roof area** | The *roof* area ($A_{roof}$) plus the *skylight area* ($A_{skylight}$) |
| **Total thermal resistance** | The overall air-to-air *thermal resistance* across all components of a *building element* such as a wall, *roof* or floor.<br><br>(This includes the surface resistances which may vary with environmental changes e.g. temperature and humidity, but for most purposes can be regarded as having standard values as given in NZS 4214.) |
| **Total wall area** | In relation to a *building,* means the sum (expressed in square metres) of the following:<br><br>a) the *wall area* of the *building*; and<br>b) the area (expressed in square metres) of all vertical windows and doors in *external walls* of the *building*. |
| **Unconditioned space** | Space within the *building envelope* that is not *conditioned space* (for example, this may include a garage, conservatory, atrium, attic, subfloor, and so on). However, where a garage, conservatory or atrium is expected to be heated or cooled these spaces shall be included in the *conditioned space*. |
| **Wall area** | The area of walls that are part of the *thermal envelope*, excluding the *door area* and the *window area*. |
| **Window area ($A_{window}$)** | The total area of windows in the *thermal envelope*, including transparent or translucent glazing, frames and opening tolerances and decorative glazing and louvres, but excluding glazing in doors and *skylights*. |

# Appendix C. New Zealand climate zones

## C.1 Climate zones

### C.1.1 Climate zone boundaries

C.1.1.1 There are six climate zones. These climate zone boundaries are based on climatic data taking into consideration territorial authority boundaries.

C.1.1.2 A list of the climate zones for each territorial authority is provided in Table C.1.1.2 and illustrated in Figure C.1.1.2. The list in the table takes precedence over the figure.

# New Zealand climate zones

**TABLE C.1.1.2: Climate zones by territorial authority**
Paragraph C.1.1.2

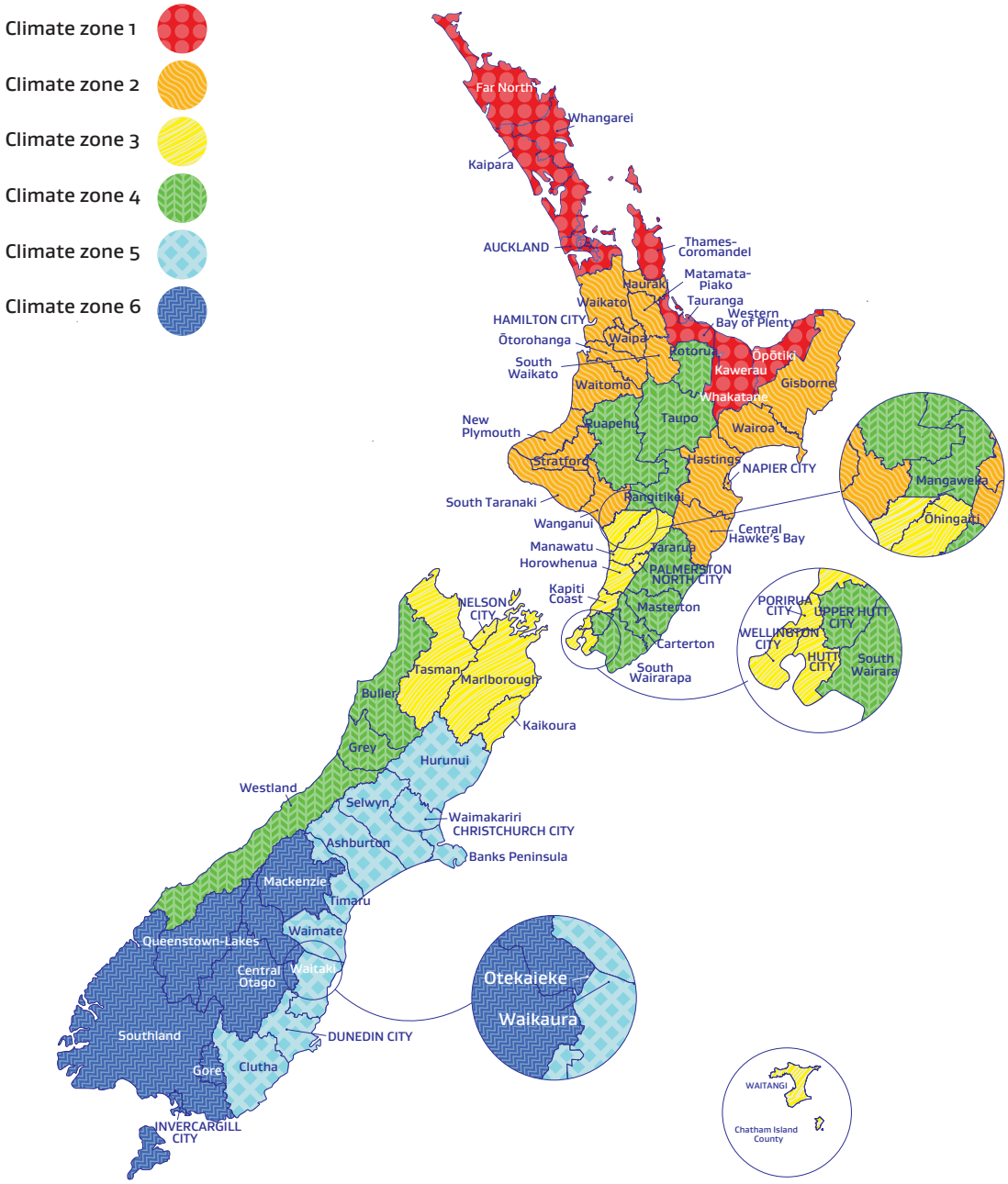
| North Island/Te Ika-a-Māui | |
|---|---|
| **Territorial authority** | **Climate zone** |
| Far North District | 1 |
| Whangarei District | 1 |
| Kaipara District | 1 |
| Auckland | 1 |
| Thames-Coromandel district | 1 |
| Hauraki District | 2 |
| Waikato District | 2 |
| Matamata-Piako District | 2 |
| Hamilton City | 2 |
| Waipa District | 2 |
| Ōtorohanga District | 2 |
| South Waikato District | 2 |
| Waitomo District | 2 |
| Taupo District | 4 |
| Western Bay of Plenty District | 1 |
| Tauranga City | 1 |
| Rotorua District | 4 |
| Whakatane District | 1 |
| Kawerau District | 1 |
| Ōpōtiki District | 1 |
| Gisborne District | 2 |
| Wairoa District | 2 |
| Hastings District | 2 |
| Napier City | 2 |
| Central Hawke's Bay District | 2 |
| New Plymouth District | 2 |
| Stratford District | 2 |
| South Taranaki District | 2 |
| Ruapehu District | 4 |
| Whanganui District | 2 |
| Rangitikei District (north of 39°50'S (-39.83)) | 4 |
| Rangitikei District (south of 39°50'S (-39.83)) | 3 |
| Manawatu District | 3 |
| Palmerston North City | 3 |
| Tararua District | 4 |
| Horowhenua District | 3 |
| Kapiti Coast District | 3 |
| Porirua City | 3 |
| Upper Hutt City | 4 |
| Lower Hutt City | 3 |
| Wellington City | 3 |
| Masterton District | 4 |
| Carterton District | 4 |
| South Wairarapa District | 4 |

| South Island/Te Waipounamu | |
|---|---|
| **Territorial authority** | **Climate zone** |
| Tasman District | 3 |
| Nelson City | 3 |
| Marlborough District | 3 |
| Kaikoura District | 3 |
| Buller District | 4 |
| Grey District | 4 |
| Westland District | 4 |
| Hurunui District | 5 |
| Waimakariri District | 5 |
| Christchurch City | 5 |
| Selwyn District | 5 |
| Ashburton District | 5 |
| Timaru District | 5 |
| Mackenzie District | 6 |
| Waimate District | 5 |
| Chatham Islands | 3 |
| Waitaki District (true left of the Otekaieke river) | 6 |
| Waitaki District (true right of the Otekaieke river) | 5 |
| Central Otago District | 6 |
| Queenstown-Lakes District | 6 |
| Dunedin City | 5 |
| Clutha District | 5 |
| Southland District | 6 |
| Gore District | 6 |
| Invercargill City | 6 |

# New Zealand climate zones

**TABLE C.1.1.2:** Climate zones by territorial authority

Paragraph C.1.1.2



# Appendix D. Orientation

## D.1 Orientation

### D.1.1 Establishing building orientation

D.1.1.1 A *building* wall, including the windows it contains, shall be considered to face north if it faces any direction in the north orientation sector of Figure D.1.2.1.

D.1.1.2 The orientations of *skylights* and other walls, including the windows they contain, shall be determined in a similar way.

### D.1.2 Description of sectors

D.1.2.1 Orientation sectors are based on true north and are as follows (see Figure D.1.2.1):

a) North sector lies between north west (more than 315°) and north east (less than 45°); and

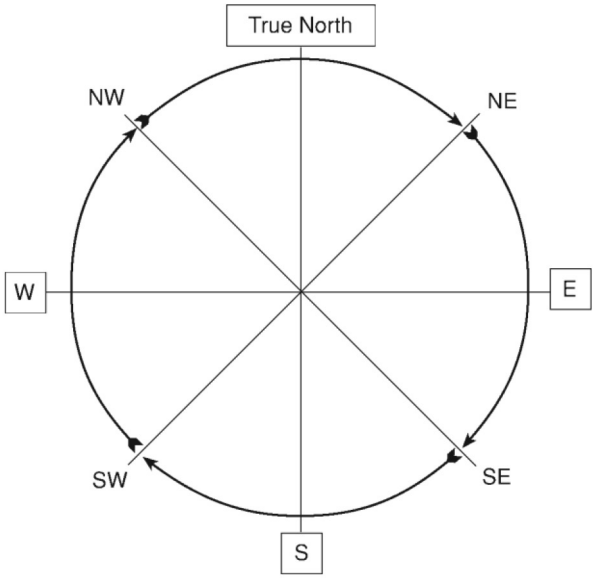
b) East sector lies between north east (45°) and south east (135°); and

c) South sector lies between south east (more than 135°) and south west (less than 225°); and

d) West sector lies between south west (225°) and north west (315°).

**FIGURE D.1.2.1: Orientation sector map**

Paragraphs D.1.1.1, D.1.2.1




COMMENT: A compass points toward magnetic north. Magnetic north varies from true north by 21° in Auckland, 24° in Wellington and 24° in Christchurch. In New Zealand magnetic north is always east of true north. It is important that true north is used for the orientation rather than magnetic north. The following website calculates the difference between magnetic north and true north (magnetic declination) www.gns.cri.nz/Home/Our-Science/Land-and-Marine-Geoscience/Earth-s-Magnetic-Field/Declination-around-New-Zealand.

# Appendix E. Windows, doors, and skylights

## E.1 Vertical windows and doors

### E.1.1 Methods for determining construction R-values

E.1.1.1 The *construction R-values* for vertical windows and doors shall be determined using one of the following methods:

a) Calculation of the *construction R-value* of each individual window and door that is part of the *thermal envelope*, in accordance with Section E.1.2; or

b) Calculation of the representative *construction R-value* of all windows and doors that are part of the *thermal envelope* of the proposed *building*, which is then deemed to apply to all windows and doors of the proposed *building*, in accordance with Section E.1.3.

i

COMMENT: The window size and frame material have a major impact on the *construction R-value* of a window as a *building element*. Often the *thermal resistances* of the glazing and the frames are dissimilar. For large windows, the *thermal resistance* of the glazing will have more impact on the overall window *construction R-value* than in a small window, which is dominated by the frame performance. This means that the *construction R-values* of two differently-sized windows consisting of identical frame and glazing materials will usually be dissimilar.

### E.1.2 Calculation of the construction R-value of each individual window and door that is part of the thermal envelope

E.1.2.1 For each window that is part of the *thermal envelope* of the proposed *building*, the window *construction R-value* ($R_W$) shall be calculated in accordance with Equation E.1. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.1: $$R_w = \frac{1}{U_w}$$

where:
$R_W$ is the *construction R-value* of the window ($m^2 \cdot K/W$); and
$U_W$ is the thermal transmittance of the window ($W/(m^2 \cdot K)$), determined in accordance with Paragraph E.1.2.2.

E.1.2.2 The thermal transmittance ($U_W$) of each vertical window that is part of the *thermal envelope* of the proposed *building* shall be determined in accordance with ISO 10077-1, with:

a) The thermal transmittance of the glazing ($U_g$) determined using BS EN 673; and

b) The thermal transmittance of the frame ($U_f$) determined using ISO 10077-2. For frames with special extensions overlapping the wall or other *building elements*, such as frames with flanges to the cladding, the following deviations from ISO 10077-2 Section 6.3.1, are permitted:

i) Special extensions may be disregarded or included in the calculation model, but shall be disregarded when determining the projected width of the frame section ($b_f$) as per ISO 10077-2: 2017 Appendix F; and

ii) Window reveal liners that are integral with the window unit may either be disregarded or included in the calculation model.

E.1.2.3 For each door that is part of the *thermal envelope* of the proposed *building*, the door *construction R-value* ($R_D$) shall be calculated in accordance with Equation E.2. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.2: $$R_D = \frac{1}{U_D}$$

where:
$R_D$ is the *construction R-value* of the door (m²·K/W); and
$U_D$ is the thermal transmittance of the door (W/(m²·K)), determined in accordance with Paragraph E.1.2.4.

i

COMMENT: The door *construction R-value* ($R_D$) includes the effects of the frame, any glazing and any opaque panels.

E.1.2.4 The thermal transmittance ($U_D$) of each door that is part of the *thermal envelope* of the proposed *building* shall be determined in accordance with ISO 10077-1, with:

a) the thermal transmittance of any glazing ($U_g$) determined using BS EN 673; and

b) the thermal transmittance of the frame ($U_f$) determined using ISO 10077-2. For frames with special extensions overlapping the wall or other *building elements*, such as frames with flanges to the cladding, deviating from ISO 10077-2 Section 6.3.1, the special extensions may either be disregarded or included in the calculation model, but shall be disregarded when determining the projected width of the frame section ($b_f$) as per ISO 10077-2: 2017 Appendix F. Door reveal liners that are integral with the door unit may either be disregarded or included in the calculation model.

### E.1.3 Calculation of the representative construction R-value of all windows and doors that are part of the thermal envelope

E.1.3.1 The representative window and door *construction R-value* ($R_{WD}$) shall be calculated in accordance with Equation E.3. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.3: $$R_{WD}=\frac{\Sigma A_w + \Sigma A_D}{\Sigma\frac{A_w}{R_w} + \Sigma\frac{A_D}{R_D}}$$

where:

$R_W$ is the *construction R-value* of each vertical window that is part of the *thermal envelope* of the proposed *building* (m²·K/W), calculated in accordance with Section E.1.2.1; and
$A_W$ is the *window area* of each vertical window that is part of the *thermal envelope* of the proposed *building* (m²), calculated in accordance with ISO 10077-1 Section 6.3.1; and
$R_D$ is the *construction R-value* of each door that is part of the *thermal envelope* of the proposed *building* (m²·K/W), calculated in accordance with Section E.1.2.3; and
$A_D$ is the *door area* of each door that is part of the *thermal envelope* of the proposed *building* (m²), calculated in accordance with ISO 10077-1 Section 6.3.1.

## E.2 Skylights

### E.2.1 Construction R-values

E.2.1.1 The *construction R-values* for *skylights* ($R_{skylight}$) shall include the effects of both the glazing materials and the frame materials and shall be calculated in accordance with Equation E.4. The *construction R-value* shall be rounded down to no less than two significant figures.

Equation E.4: $$R_{skylight} = \frac{1}{U_w}$$

where:
$R_{skylight}$ is the *construction R-value* of the *skylight* (m²·K/W); and
$U_w$ is the thermal transmittance of the *skylight* (W/(m²K)), determined in accordance with Paragraph E.2.1.2.

E.2.1.2 The thermal transmittance ($U_w$) of a *skylight* shall be determined in accordance with ISO 10077-1, with:

a) the thermal transmittance of the glazing ($U_g$) determined using BS EN 673, considering the effects of horizontal or angled glazing on the heat transfer; and

b) the thermal transmittance of the frame ($U_f$) determined using ISO 10077-2.

# Appendix F. Thermal resistance of slab-on-ground floors

## F.1 Construction R-values

### F.1.1 Methods for determining construction R-values for slab-on-ground floors

F.1.1.1 The *construction R-values* for concrete *slab-on-ground floors*, including floors of basements that contain *conditioned spaces*, shall be determined using:

a) The performance tables described in Section F.1.2; or

b) The calculation method in Verification Method H1/VM2 Appendix F.

COMMENT:

1. The *thermal resistances* for *slab-on-ground floors* provided in the BRANZ House Insulation Guide, 5th edition or earlier, should not be used for determining compliance with the requirements of this acceptable solution. This is because they are based on a different calculation method and different assumptions than those specified in this Appendix.
2. Where a concrete floor is only partially in contact with the ground, with other parts being suspended, the part that is in contact with the ground shall be treated as a *slab-on-ground floor*, and the other part be treated as a suspended floor.

### F.1.2 Performance tables for slab-on-ground floor R-values

F.1.2.1 The *construction R-value* for selected generic concrete *slab-on-ground floors* is provided for different floor types, floor insulation types, and *external walls* types. An overview of the *construction R-value* tables included in this subsection for different combinations of these components is provided in Table F.1.2.1.

F.1.2.2 The *construction R-value* of selected generic concrete *slab-on-ground floors* may be determined from:

a) For concrete raft foundation floors without insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2A; and

b) For concrete raft foundation floors without insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2B; and

c) For concrete raft foundation floors with R1.0 vertical edge insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2C; and

d) For concrete raft foundation floors with R1.0 vertical edge insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2D; and

e) For slab-floors without insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2E; and

f) For slab-floors without insulation, where the *external walls* do not have masonry veneer cladding, Table, F.1.2.2F; and

g) For slab-floors with R1.0 vertical edge insulation but without underslab insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2G; and

h) For slab-floors with R1.0 vertical edge insulation but without underslab insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2H; and

i) For slab-floors with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the *external walls* have masonry veneer cladding, Table F.1.2.2I; and

## Thermal resistance of slab-on-ground floors

j) For slab-floors with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2J; and

k) For slab-floors with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the *external walls* have masonry veneer cladding, Table F.1.2.2K; and

l) For slab-floors with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2L; and

m) For slab-floors with R1.2 full cover underslab insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2M; and

n) For slab-floors with R1.2 full cover underslab insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2N; and

o) For slab-floors with R2.4 full cover underslab insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2O; and

p) For slab-floors with R2.4 full cover underslab insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2P; and

q) For slab-floors with R1.0 vertical edge insulation and with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the *external walls* have masonry veneer cladding, Table F.1.2.2Q; and

r) For slab-floors with R1.0 vertical edge insulation and with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2R; and

s) For slab-floors with R1.0 vertical edge insulation and with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the *external walls* have masonry veneer cladding, Table F.1.2.2S; and

t) For slab-floors with R1.0 vertical edge insulation and with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2T; and

u) For slab-floors with R1.0 vertical edge insulation and with R1.2 full cover underslab insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2U; and

v) For slab-floors with R1.0 vertical edge insulation and with R1.2 full cover underslab insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2V; and

w) For slab-floors with R1.0 vertical edge insulation and with R2.4 full cover underslab insulation, where the *external walls* have masonry veneer cladding, Table F.1.2.2W; and

x) For slab-floors with R1.0 vertical edge insulation and with R2.4 full cover underslab insulation, where the *external walls* do not have masonry veneer cladding, Table F.1.2.2X.

# Thermal resistance of slab-on-ground floors

COMMENT:

1. Any parts of a *slab-on-ground floor* that are not part of the *thermal envelope* (such as the floor of porches, attached garages or storage areas) should be thermally separated by installing vertical edge insulation in between conditioned and unconditioned parts of the floor.
2. Since insulation cannot be easily retrofitted to *slab-on-ground floors*, it is recommended to also insulate the floor of any *unconditioned spaces* of the *building*, where these may become *conditioned spaces* at a later stage during the *building* life. An example is an attached garage that could potentially be converted into a *habitable space* in the future.
3. Tables F.1.2.2A – F.1.2.2X differentiate situations where the *external walls* have a masonry veneer cladding from walls with other types of cladding. With masonry veneer walls, the slab edge has a step-down, resulting in different heat transfer characteristics compared to *slab-on-ground floors* for other *external wall* types.
4. *Construction R-values* are only provided for vertical edge insulation with a *thermal resistance* of 1.0 $m^2 \cdot K/W$. The thermal benefits of increasing the *R-value* of vertical edge insulation beyond R1.0 are very limited. Refer to BRANZ study report SR352 (2016) for further details.
5. The *construction R-values* provided in Tables F.1.2.2A – F.1.2.2X are based on the calculation method provided in Verification Method H1/VM2 Appendix F, using the default values for the thermal properties of the ground from ISO 13370 Table 7 category 2 (thermal conductivity $\lambda = 2.0$ W/(m·K), heat capacity per volume $\rho c = 2.0 \times 10^6$ J/($m^3 \cdot K$)).

F.1.2.3 When determining the slab area-to-perimeter ratio, any parts of the *slab-on-ground floor* that are not part of the *thermal envelope* (such as the floor of patios, porches, attached garages or storage areas) shall be treated as if they were not present.

F.1.2.4 The slab area-to-perimeter ratio of the proposed *building* may be determined using:

a) The overall internal slab dimensions in accordance with Equation F.1; or

b) The external slab dimensions in accordance with Equation F.2.

Equation F.1: slab area-to-perimeter ratio $= \frac{A_{slab,\,internal}}{P_{slab,\,internal}}$

where:

$A_{slab,internal}$ is the area of the *slab-on-ground floor* that is part of the *thermal envelope*, measured using overall internal dimensions (ignoring internal partitions, as per ISO 13789) between the interior surfaces of the walls that form the *thermal envelope* ($m^2$); and

$P_{slab,internal}$ is the perimeter of the *slab-on-ground floor* that is part of the *thermal envelope*, measured using overall internal dimensions (ignoring internal partitions, as per ISO 13789) along the interior surfaces of the walls that form the *thermal envelope*, including the length of any wall(s) between *conditioned spaces* and *unconditioned spaces* (m).

Equation F.2: slab area-to-perimeter ratio $= \frac{A_{slab,\,external}}{P_{slab,\,external}} - \frac{w}{2}$

where:

$A_{slab,external}$ is the area of the *slab-on-ground floor* that is part of the *thermal envelope*, measured between the exterior vertical edges of the slab beneath *external walls* and the unconditioned edges of any wall(s) between *conditioned spaces* and *unconditioned spaces* ($m^2$); and

$P_{slab,external}$ is the perimeter of the *slab-on-ground floor* that is part of the *thermal envelope*, measured along the exterior vertical edges of the slab beneath *external walls* and including the length of any wall(s) between *conditioned spaces* and *unconditioned spaces* (m); and

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w is the horizontal distance between the outermost exterior concrete slab edge and the interior surface of the *external wall* (m).

COMMENT:
Where the *external walls* do not have masonry veneer cladding, w is the same as the 'Effective thickness of *external walls* on slab' in Tables F.1.2.2A – F.1.2.2X. However, where the *external walls* have masonry veneer cladding, w is to be determined from the exterior concrete slab edge at the bottom of the step-down, whereas the 'Effective thickness of *external walls* on slab' in Tables F.1.2.2A – F.1.2.2X is to be determined from the concrete slab edge at floor level.

**Table F.1.2.1: Overview of construction R-value tables for selected slab-on-ground floor scenarios**

Paragraph F.1.2.1

| Floor type | Floor insulation type | External wall type | Table number |
|---|---|---|---|
| Concrete raft foundation | None | Masonry veneer | Table F.1.2.2A |
| | | Other | Table F.1.2.2B |
| | Vertical edge R1.0 | Masonry veneer | Table F.1.2.2C |
| | | Other | Table F.1.2.2D |
| Slab floor | None | Masonry veneer | Table F.1.2.2E |
| | | Other | Table F.1.2.2F. |
| | Vertical edge R1.0 | Masonry veneer | Table F.1.2.2G |
| | | Other | Table F.1.2.2H |
| | Underslab 1.2 m strip R1.2 | Masonry veneer | Table F.1.2.2I |
| | | Other | Table F.1.2.2J |
| | Underslab 1.2 m strip R2.4 | Masonry veneer | Table F.1.2.2K |
| | | Other | Table F.1.2.2L |
| | Underslab full cover R1.2 | Masonry veneer | Table F.1.2.2M |
| | | Other | Table F.1.2.2N |
| | Underslab full cover R2.4 | Masonry veneer | Table F.1.2.2O |
| | | Other | Table F.1.2.2P |
| | Vertical edge R1.0 and Underslab 1.2 m strip R1.2 | Masonry veneer | Table F.1.2.2Q |
| | | Other | Table F.1.2.2R |
| | Vertical edge R1.0 and Underslab 1.2 m strip R2.4 | Masonry veneer | Table F.1.2.2S |
| | | Other | Table F.1.2.2T |
| | Vertical edge R1.0 and Underslab full cover R1.2 | Masonry veneer | Table F.1.2.2U |
| | | Other | Table F.1.2.2V |
| | Vertical edge R1.0 and Underslab full cover R2.4 | Masonry veneer | Table F.1.2.2W |
| | | Other | Table F.1.2.2X |

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2A:** Construction R-values for concrete raft foundation floors without insulation, where the external walls have masonry veneer cladding

Paragraph F.1.2.2 a)

| Insulation type | Slab area-to-perimeter ratio (1) | $R_{floor}$ ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab(2) | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| No vertical edge insulation | 1.6 | R1.2 | R1.2 | R1.2 | R1.3 | R1.3 |
| | 1.8 | R1.3 | R1.3 | R1.3 | R1.4 | R1.4 |
| | 2.0 | R1.3 | R1.4 | R1.4 | R1.4 | R1.5 |
| | 2.2 | R1.4 | R1.5 | R1.5 | R1.5 | R1.6 |
| | 2.4 | R1.5 | R1.6 | R1.6 | R1.6 | R1.7 |
| | 2.6 | R1.6 | R1.6 | R1.6 | R1.7 | R1.7 |
| | 2.8 | R1.7 | R1.7 | R1.7 | R1.8 | R1.8 |
| | 3.0 | R1.7 | R1.8 | R1.8 | R1.9 | R1.9 |
| | 3.2 | R1.8 | R1.9 | R1.9 | R2.0 | R2.0 |
| | 3.4 | R1.9 | R1.9 | R2.0 | R2.0 | R2.0 |
| | 3.6 | R2.0 | R2.0 | R2.0 | R2.1 | R2.1 |
| | 3.8 | R2.0 | R2.1 | R2.1 | R2.2 | R2.2 |
| | 4.0 | R2.1 | R2.1 | R2.2 | R2.2 | R2.3 |
| | 5.0 | R2.5 | R2.5 | R2.6 | R2.6 | R2.7 |
| | 6.0 | R2.8 | R2.9 | R2.9 | R3.0 | R3.0 |
| | 7.0 | R3.2 | R3.3 | R3.3 | R3.4 | R3.4 |
| | 8.0 | R3.6 | R3.6 | R3.7 | R3.8 | R3.8 |
| | 9.0 | R3.9 | R4.0 | R4.1 | R4.2 | R4.2 |
| | ≥ 10.0 | R4.3 | R4.4 | R4.4 | R4.5 | R4.6 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2B:** Construction R-values for concrete raft foundation floors without insulation, where the external walls do not have masonry veneer cladding

Paragraph F.1.2.2 b)

| Insulation type | Slab area-to-perimeter ratio (1) | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab(2) | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| No vertical edge insulation | 1.6 | R1.0 | R1.0 | R1.1 | R1.1 | R1.1 |
| | 1.8 | R1.1 | R1.1 | R1.2 | R1.2 | R1.2 |
| | 2.0 | R1.2 | R1.2 | R1.3 | R1.3 | R1.4 |
| | 2.2 | R1.2 | R1.3 | R1.3 | R1.4 | R1.4 |
| | 2.4 | R1.3 | R1.4 | R1.4 | R1.5 | R1.5 |
| | 2.6 | R1.4 | R1.4 | R1.5 | R1.5 | R1.6 |
| | 2.8 | R1.4 | R1.5 | R1.5 | R1.6 | R1.6 |
| | 3.0 | R1.5 | R1.6 | R1.6 | R1.7 | R1.7 |
| | 3.2 | R1.6 | R1.6 | R1.7 | R1.8 | R1.8 |
| | 3.4 | R1.6 | R1.7 | R1.7 | R1.8 | R1.9 |
| | 3.6 | R1.7 | R1.8 | R1.8 | R1.9 | R1.9 |
| | 3.8 | R1.8 | R1.8 | R1.9 | R2.0 | R2.0 |
| | 4.0 | R1.9 | R1.9 | R2.0 | R2.0 | R2.1 |
| | 5.0 | R2.2 | R2.3 | R2.3 | R2.4 | R2.5 |
| | 6.0 | R2.5 | R2.6 | R2.7 | R2.7 | R2.8 |
| | 7.0 | R2.8 | R2.9 | R3.0 | R3.1 | R3.2 |
| | 8.0 | R3.2 | R3.3 | R3.3 | R3.5 | R3.5 |
| | 9.0 | R3.5 | R3.6 | R3.7 | R3.8 | R3.9 |
| | ≥ 10.0 | R3.9 | R4.0 | R4.1 | R4.2 | R4.3 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2C: Construction R-values for concrete raft foundation floors with R1.0 vertical edge insulation, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 c)

| Insulation type | Slab area-to-perimeter ratio [1] | $R_{floor}$ ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2] | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R1.0 vertical edge insulation[3] | 1.6 | R1.3 | R1.3 | R1.3 | R1.3 | R1.4 |
| | 1.8 | R1.4 | R1.4 | R1.4 | R1.5 | R1.5 |
| | 2.0 | R1.4 | R1.5 | R1.5 | R1.5 | R1.5 |
| | 2.2 | R1.5 | R1.6 | R1.6 | R1.6 | R1.6 |
| | 2.4 | R1.6 | R1.7 | R1.7 | R1.7 | R1.7 |
| | 2.6 | R1.7 | R1.7 | R1.7 | R1.8 | R1.8 |
| | 2.8 | R1.8 | R1.8 | R1.8 | R1.9 | R1.9 |
| | 3.0 | R1.9 | R1.9 | R1.9 | R2.0 | R2.0 |
| | 3.2 | R2.0 | R2.0 | R2.0 | R2.1 | R2.1 |
| | 3.4 | R2.0 | R2.0 | R2.1 | R2.1 | R2.1 |
| | 3.6 | R2.1 | R2.1 | R2.2 | R2.2 | R2.2 |
| | 3.8 | R2.2 | R2.2 | R2.2 | R2.3 | R2.3 |
| | 4.0 | R2.2 | R2.3 | R2.3 | R2.3 | R2.4 |
| | 5.0 | R2.6 | R2.7 | R2.7 | R2.8 | R2.8 |
| | 6.0 | R3.0 | R3.0 | R3.1 | R3.1 | R3.2 |
| | 7.0 | R3.4 | R3.4 | R3.5 | R3.5 | R3.6 |
| | 8.0 | R3.8 | R3.8 | R3.9 | R3.9 | R4.0 |
| | 9.0 | R4.2 | R4.2 | R4.3 | R4.4 | R4.4 |
| | ≥ 10.0 | R4.5 | R4.6 | R4.7 | R4.8 | R4.8 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2D: Construction R-values for concrete raft foundation floors with R1.0 vertical edge insulation, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 d)

| Insulation type | Slab area-to-perimeter ratio [1] | $R_{floor}$ ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2] | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R1.0 vertical edge insulation[3] | 1.6 | R1.3 | R1.3 | R1.3 | R1.3 | R1.3 |
| | 1.8 | R1.4 | R1.4 | R1.4 | R1.4 | R1.4 |
| | 2.0 | R1.5 | R1.5 | R1.5 | R1.6 | R1.6 |
| | 2.2 | R1.5 | R1.5 | R1.6 | R1.6 | R1.6 |
| | 2.4 | R1.6 | R1.6 | R1.7 | R1.7 | R1.7 |
| | 2.6 | R1.7 | R1.8 | R1.8 | R1.8 | R1.8 |
| | 2.8 | R1.8 | R1.8 | R1.8 | R1.8 | R1.9 |
| | 3.0 | R1.9 | R1.9 | R1.9 | R1.9 | R2.0 |
| | 3.2 | R2.0 | R2.0 | R2.0 | R2.0 | R2.1 |
| | 3.4 | R2.0 | R2.0 | R2.1 | R2.1 | R2.1 |
| | 3.6 | R2.1 | R2.1 | R2.1 | R2.2 | R2.2 |
| | 3.8 | R2.2 | R2.2 | R2.2 | R2.3 | R2.3 |
| | 4.0 | R2.3 | R2.3 | R2.3 | R2.3 | R2.4 |
| | 5.0 | R2.6 | R2.7 | R2.7 | R2.7 | R2.8 |
| | 6.0 | R3.0 | R3.1 | R3.1 | R3.1 | R3.2 |
| | 7.0 | R3.4 | R3.4 | R3.5 | R3.5 | R3.6 |
| | 8.0 | R3.8 | R3.8 | R3.9 | R3.9 | R4.0 |
| | 9.0 | R4.2 | R4.2 | R4.3 | R4.3 | R4.4 |
| | ≥ 10.0 | R4.6 | R4.6 | R4.7 | R4.8 | R4.8 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2 \cdot K/W$, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2E: Construction R-values for slab-floors without insulation, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 e)

| Insulation type | Slab area-to-perimeter ratio (1) | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab(2) | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| No insulation | 1.6 | R0.8 | R0.9 | R0.9 | R0.9 | R0.9 |
| | 1.8 | R0.9 | R0.9 | R1.0 | R1.0 | R1.0 |
| | 2.0 | R1.0 | R1.0 | R1.0 | R1.1 | R1.1 |
| | 2.2 | R1.0 | R1.1 | R1.1 | R1.1 | R1.2 |
| | 2.4 | R1.1 | R1.1 | R1.2 | R1.2 | R1.2 |
| | 2.6 | R1.2 | R1.2 | R1.2 | R1.3 | R1.3 |
| | 2.8 | R1.2 | R1.3 | R1.3 | R1.3 | R1.4 |
| | 3.0 | R1.3 | R1.3 | R1.4 | R1.4 | R1.4 |
| | 3.2 | R1.4 | R1.4 | R1.4 | R1.5 | R1.5 |
| | 3.4 | R1.4 | R1.5 | R1.5 | R1.5 | R1.6 |
| | 3.6 | R1.5 | R1.5 | R1.6 | R1.6 | R1.6 |
| | 3.8 | R1.6 | R1.6 | R1.6 | R1.7 | R1.7 |
| | 4.0 | R1.6 | R1.7 | R1.7 | R1.7 | R1.8 |
| | 5.0 | R1.9 | R2.0 | R2.0 | R2.1 | R2.1 |
| | 6.0 | R2.3 | R2.3 | R2.4 | R2.4 | R2.5 |
| | 7.0 | R2.6 | R2.6 | R2.7 | R2.8 | R2.8 |
| | 8.0 | R2.9 | R3.0 | R3.0 | R3.1 | R3.2 |
| | 9.0 | R3.2 | R3.3 | R3.4 | R3.5 | R3.5 |
| | ≥ 10.0 | R3.5 | R3.6 | R3.7 | R3.8 | R3.9 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2F: Construction R-values for slab-floors without insulation, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 f)

| Insulation type | Slab area-to-perimeter ratio (1) | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab(2) | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| No insulation | 1.6 | R0.8 | R0.8 | R0.8 | R0.9 | R0.9 |
| | 1.8 | R0.8 | R0.9 | R0.9 | R0.9 | R0.9 |
| | 2.0 | R0.9 | R0.9 | R0.9 | R1.0 | R1.0 |
| | 2.2 | R0.9 | R1.0 | R1.0 | R1.1 | R1.1 |
| | 2.4 | R1.0 | R1.0 | R1.1 | R1.1 | R1.2 |
| | 2.6 | R1.1 | R1.1 | R1.1 | R1.2 | R1.2 |
| | 2.8 | R1.1 | R1.2 | R1.2 | R1.3 | R1.3 |
| | 3.0 | R1.2 | R1.2 | R1.3 | R1.3 | R1.4 |
| | 3.2 | R1.2 | R1.3 | R1.3 | R1.4 | R1.4 |
| | 3.4 | R1.3 | R1.3 | R1.4 | R1.4 | R1.5 |
| | 3.6 | R1.4 | R1.4 | R1.4 | R1.5 | R1.5 |
| | 3.8 | R1.4 | R1.5 | R1.5 | R1.6 | R1.6 |
| | 4.0 | R1.5 | R1.5 | R1.6 | R1.6 | R1.7 |
| | 5.0 | R1.8 | R1.8 | R1.9 | R2.0 | R2.0 |
| | 6.0 | R2.1 | R2.1 | R2.2 | R2.3 | R2.3 |
| | 7.0 | R2.4 | R2.4 | R2.5 | R2.6 | R2.7 |
| | 8.0 | R2.7 | R2.7 | R2.8 | R2.9 | R3.0 |
| | 9.0 | R2.9 | R3.0 | R3.1 | R3.2 | R3.3 |
| | ≥ 10.0 | R3.3 | R3.4 | R3.4 | R3.6 | R3.7 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2G: Construction R-values for slab-floors with R1.0 vertical edge insulation but without underslab insulation, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 g)

| Insulation type | Slab area-to-perimeter ratio (1) | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab(2) | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R1.0 vertical edge insulation(3) | 1.6 | R0.9 | R0.9 | R1.0 | R1.0 | R1.0 |
| | 1.8 | R1.0 | R1.0 | R1.0 | R1.1 | R1.1 |
| | 2.0 | R1.1 | R1.1 | R1.1 | R1.1 | R1.2 |
| | 2.2 | R1.1 | R1.2 | R1.2 | R1.2 | R1.2 |
| | 2.4 | R1.2 | R1.2 | R1.3 | R1.3 | R1.3 |
| | 2.6 | R1.3 | R1.3 | R1.3 | R1.4 | R1.4 |
| | 2.8 | R1.3 | R1.4 | R1.4 | R1.4 | R1.5 |
| | 3.0 | R1.4 | R1.4 | R1.5 | R1.5 | R1.5 |
| | 3.2 | R1.5 | R1.5 | R1.5 | R1.6 | R1.6 |
| | 3.4 | R1.6 | R1.6 | R1.6 | R1.6 | R1.7 |
| | 3.6 | R1.6 | R1.6 | R1.7 | R1.7 | R1.7 |
| | 3.8 | R1.7 | R1.7 | R1.7 | R1.8 | R1.8 |
| | 4.0 | R1.8 | R1.8 | R1.8 | R1.9 | R1.9 |
| | 5.0 | R2.1 | R2.1 | R2.2 | R2.2 | R2.2 |
| | 6.0 | R2.4 | R2.5 | R2.5 | R2.6 | R2.6 |
| | 7.0 | R2.8 | R2.8 | R2.9 | R2.9 | R3.0 |
| | 8.0 | R3.1 | R3.2 | R3.2 | R3.3 | R3.3 |
| | 9.0 | R3.5 | R3.5 | R3.6 | R3.7 | R3.7 |
| | ≥ 10.0 | R3.8 | R3.9 | R3.9 | R4.0 | R4.1 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2$·K/W, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2H: Construction R-values for slab-floors with R1.0 vertical edge insulation but without underslab insulation, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 h)

| Insulation type | Slab area-to-perimeter ratio (1) | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab(2) | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R1.0 vertical edge insulation(3) | 1.6 | R1.0 | R1.0 | R1.0 | R1.0 | R1.0 |
| | 1.8 | R1.0 | R1.1 | R1.1 | R1.1 | R1.1 |
| | 2.0 | R1.1 | R1.1 | R1.1 | R1.2 | R1.2 |
| | 2.2 | R1.2 | R1.2 | R1.2 | R1.2 | R1.3 |
| | 2.4 | R1.3 | R1.3 | R1.3 | R1.3 | R1.3 |
| | 2.6 | R1.3 | R1.4 | R1.4 | R1.4 | R1.4 |
| | 2.8 | R1.4 | R1.4 | R1.4 | R1.5 | R1.5 |
| | 3.0 | R1.5 | R1.5 | R1.5 | R1.5 | R1.6 |
| | 3.2 | R1.5 | R1.6 | R1.6 | R1.6 | R1.6 |
| | 3.4 | R1.6 | R1.6 | R1.7 | R1.7 | R1.7 |
| | 3.6 | R1.7 | R1.7 | R1.7 | R1.8 | R1.8 |
| | 3.8 | R1.8 | R1.8 | R1.8 | R1.8 | R1.9 |
| | 4.0 | R1.8 | R1.8 | R1.9 | R1.9 | R1.9 |
| | 5.0 | R2.2 | R2.2 | R2.2 | R2.3 | R2.3 |
| | 6.0 | R2.5 | R2.5 | R2.6 | R2.6 | R2.7 |
| | 7.0 | R2.9 | R2.9 | R2.9 | R3.0 | R3.0 |
| | 8.0 | R3.2 | R3.3 | R3.3 | R3.4 | R3.4 |
| | 9.0 | R3.6 | R3.6 | R3.7 | R3.7 | R3.8 |
| | ≥ 10.0 | R3.9 | R4.0 | R4.0 | R4.1 | R4.2 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2$·K/W, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2I: Construction R-values for slab-floors with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 i)

| Insulation type | Slab area-to-perimeter ratio [1] | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab[2] | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| 1.2 m wide strip of R1.2 underslab insulation[3] | 1.6 | R1.1 | R1.2 | R1.2 | R1.2 | R1.2 |
| | 1.8 | R1.2 | R1.2 | R1.2 | R1.3 | R1.3 |
| | 2.0 | R1.2 | R1.3 | R1.3 | R1.3 | R1.4 |
| | 2.2 | R1.3 | R1.3 | R1.4 | R1.4 | R1.4 |
| | 2.4 | R1.3 | R1.4 | R1.4 | R1.5 | R1.5 |
| | 2.6 | R1.4 | R1.4 | R1.5 | R1.5 | R1.6 |
| | 2.8 | R1.5 | R1.5 | R1.6 | R1.6 | R1.6 |
| | 3.0 | R1.5 | R1.6 | R1.6 | R1.7 | R1.7 |
| | 3.2 | R1.6 | R1.6 | R1.7 | R1.7 | R1.8 |
| | 3.4 | R1.7 | R1.7 | R1.8 | R1.8 | R1.8 |
| | 3.6 | R1.7 | R1.8 | R1.8 | R1.9 | R1.9 |
| | 3.8 | R1.8 | R1.9 | R1.9 | R2.0 | R2.0 |
| | 4.0 | R1.9 | R1.9 | R2.0 | R2.0 | R2.1 |
| | 5.0 | R2.2 | R2.3 | R2.3 | R2.4 | R2.4 |
| | 6.0 | R2.5 | R2.6 | R2.7 | R2.7 | R2.8 |
| | 7.0 | R2.9 | R3.0 | R3.0 | R3.1 | R3.2 |
| | 8.0 | R3.2 | R3.3 | R3.4 | R3.5 | R3.5 |
| | 9.0 | R3.6 | R3.7 | R3.8 | R3.9 | R3.9 |
| | ≥ 10.0 | R3.9 | R4.0 | R4.1 | R4.2 | R4.3 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 1.2 $m^2$·K/W, installed along the entire slab perimeter, placed on the interior side of the wall footing.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2J: Construction R-values for slab-floors with a 1.2 m wide strip of R1.2 underslab insulation along the slab perimeter, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 j)

| Insulation type | Slab area-to-perimeter ratio [1] | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab[2] | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| 1.2 m wide strip of R1.2 underslab insulation[3] | 1.6 | R1.0 | R1.0 | R1.1 | R1.1 | R1.2 |
| | 1.8 | R1.0 | R1.1 | R1.1 | R1.2 | R1.2 |
| | 2.0 | R1.1 | R1.1 | R1.2 | R1.2 | R1.3 |
| | 2.2 | R1.1 | R1.2 | R1.2 | R1.3 | R1.3 |
| | 2.4 | R1.2 | R1.3 | R1.3 | R1.4 | R1.4 |
| | 2.6 | R1.3 | R1.3 | R1.4 | R1.4 | R1.5 |
| | 2.8 | R1.3 | R1.4 | R1.4 | R1.5 | R1.5 |
| | 3.0 | R1.4 | R1.4 | R1.5 | R1.6 | R1.6 |
| | 3.2 | R1.4 | R1.5 | R1.6 | R1.6 | R1.7 |
| | 3.4 | R1.5 | R1.6 | R1.6 | R1.7 | R1.7 |
| | 3.6 | R1.6 | R1.6 | R1.7 | R1.8 | R1.8 |
| | 3.8 | R1.6 | R1.7 | R1.7 | R1.8 | R1.9 |
| | 4.0 | R1.7 | R1.8 | R1.8 | R1.9 | R1.9 |
| | 5.0 | R2.0 | R2.1 | R2.1 | R2.2 | R2.3 |
| | 6.0 | R2.3 | R2.4 | R2.5 | R2.6 | R2.6 |
| | 7.0 | R2.6 | R2.7 | R2.8 | R2.9 | R3.0 |
| | 8.0 | R2.9 | R3.1 | R3.1 | R3.3 | R3.4 |
| | 9.0 | R3.3 | R3.4 | R3.5 | R3.6 | R3.7 |
| | ≥ 10.0 | R3.6 | R3.7 | R3.8 | R4.0 | R4.1 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 1.2 $m^2$·K/W, installed along the entire slab perimeter, placed on the interior side of the wall footing.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2K: Construction R-values for slab-floors with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 k)

| Insulation type | Slab area-to-perimeter ratio [1] | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab[2] | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| 1.2 m wide strip of R2.4 underslab insulation[3] | 1.6 | R1.2 | R1.2 | R1.3 | R1.3 | R1.3 |
| | 1.8 | R1.2 | R1.3 | R1.3 | R1.4 | R1.4 |
| | 2.0 | R1.3 | R1.3 | R1.4 | R1.4 | R1.4 |
| | 2.2 | R1.3 | R1.4 | R1.4 | R1.5 | R1.5 |
| | 2.4 | R1.4 | R1.5 | R1.5 | R1.5 | R1.6 |
| | 2.6 | R1.5 | R1.5 | R1.6 | R1.6 | R1.6 |
| | 2.8 | R1.5 | R1.6 | R1.6 | R1.7 | R1.7 |
| | 3.0 | R1.6 | R1.6 | R1.7 | R1.7 | R1.8 |
| | 3.2 | R1.7 | R1.7 | R1.8 | R1.8 | R1.8 |
| | 3.4 | R1.7 | R1.8 | R1.8 | R1.9 | R1.9 |
| | 3.6 | R1.8 | R1.8 | R1.9 | R2.0 | R2.0 |
| | 3.8 | R1.9 | R1.9 | R2.0 | R2.0 | R2.1 |
| | 4.0 | R1.9 | R2.0 | R2.0 | R2.1 | R2.1 |
| | 5.0 | R2.3 | R2.3 | R2.4 | R2.5 | R2.5 |
| | 6.0 | R2.6 | R2.7 | R2.7 | R2.8 | R2.9 |
| | 7.0 | R3.0 | R3.0 | R3.1 | R3.2 | R3.3 |
| | 8.0 | R3.3 | R3.4 | R3.5 | R3.6 | R3.6 |
| | 9.0 | R3.7 | R3.8 | R3.9 | R4.0 | R4.0 |
| | ≥ 10.0 | R4.0 | R4.1 | R4.2 | R4.4 | R4.4 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 2.4 $m^2$·K/W, installed along the entire slab perimeter, placed on the interior side of the wall footing.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2L: Construction R-values for slab-floors with a 1.2 m wide strip of R2.4 underslab insulation along the slab perimeter, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 I)

| Insulation type | Slab area-to-perimeter ratio (1) | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab(2) | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| 1.2 m wide strip of R2.4 underslab insulation(3) | 1.6 | R1.1 | R1.1 | R1.2 | R1.2 | R1.3 |
| | 1.8 | R1.1 | R1.1 | R1.2 | R1.3 | R1.3 |
| | 2.0 | R1.1 | R1.2 | R1.3 | R1.3 | R1.4 |
| | 2.2 | R1.2 | R1.3 | R1.3 | R1.4 | R1.4 |
| | 2.4 | R1.2 | R1.3 | R1.4 | R1.4 | R1.5 |
| | 2.6 | R1.3 | R1.4 | R1.4 | R1.5 | R1.5 |
| | 2.8 | R1.4 | R1.4 | R1.5 | R1.6 | R1.6 |
| | 3.0 | R1.4 | R1.5 | R1.6 | R1.6 | R1.7 |
| | 3.2 | R1.5 | R1.6 | R1.6 | R1.7 | R1.7 |
| | 3.4 | R1.5 | R1.6 | R1.7 | R1.8 | R1.8 |
| | 3.6 | R1.6 | R1.7 | R1.7 | R1.8 | R1.9 |
| | 3.8 | R1.7 | R1.7 | R1.8 | R1.9 | R2.0 |
| | 4.0 | R1.7 | R1.8 | R1.9 | R2.0 | R2.0 |
| | 5.0 | R2.0 | R2.1 | R2.2 | R2.3 | R2.4 |
| | 6.0 | R2.4 | R2.5 | R2.5 | R2.7 | R2.7 |
| | 7.0 | R2.7 | R2.8 | R2.9 | R3.0 | R3.1 |
| | 8.0 | R3.0 | R3.1 | R3.2 | R3.4 | R3.5 |
| | 9.0 | R3.3 | R3.5 | R3.6 | R3.7 | R3.8 |
| | ≥ 10.0 | R3.7 | R3.8 | R3.9 | R4.1 | R4.2 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 2.4 $m^2$·K/W, installed along the entire slab perimeter, placed on the interior side of the wall footing.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2M: Construction R-values for slab-floors with R1.2 full cover underslab insulation, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 m)

| Insulation type | Slab area-to-perimeter ratio [1] | $R_{floor}$ ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2] | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R1.2 full cover underslab insulation[3] | 1.6 | R1.3 | R1.4 | R1.5 | R1.6 | R1.6 |
| | 1.8 | R1.4 | R1.5 | R1.6 | R1.7 | R1.7 |
| | 2.0 | R1.5 | R1.6 | R1.7 | R1.8 | R1.8 |
| | 2.2 | R1.6 | R1.7 | R1.8 | R1.9 | R1.9 |
| | 2.4 | R1.7 | R1.8 | R1.9 | R2.0 | R2.0 |
| | 2.6 | R1.8 | R1.9 | R1.9 | R2.0 | R2.1 |
| | 2.8 | R1.9 | R2.0 | R2.0 | R2.1 | R2.2 |
| | 3.0 | R2.0 | R2.0 | R2.1 | R2.2 | R2.3 |
| | 3.2 | R2.0 | R2.1 | R2.2 | R2.3 | R2.4 |
| | 3.4 | R2.1 | R2.2 | R2.3 | R2.4 | R2.4 |
| | 3.6 | R2.2 | R2.3 | R2.4 | R2.5 | R2.5 |
| | 3.8 | R2.3 | R2.4 | R2.4 | R2.5 | R2.6 |
| | 4.0 | R2.3 | R2.4 | R2.5 | R2.6 | R2.7 |
| | 5.0 | R2.7 | R2.8 | R2.9 | R3.0 | R3.1 |
| | 6.0 | R3.1 | R3.2 | R3.3 | R3.4 | R3.5 |
| | 7.0 | R3.5 | R3.6 | R3.7 | R3.8 | R3.9 |
| | 8.0 | R3.8 | R4.0 | R4.1 | R4.2 | R4.3 |
| | 9.0 | R4.2 | R4.3 | R4.5 | R4.6 | R4.7 |
| | ≥ 10.0 | R4.6 | R4.7 | R4.9 | R5.0 | R5.2 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Horizontal underslab insulation with an *R-value* of 1.2 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2N: Construction R-values for slab-floors with R1.2 full cover underslab insulation, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 n)

| Insulation type | Slab area-to-perimeter ratio (1) | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab(2) | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R1.2 full cover underslab insulation(3) | 1.6 | R1.1 | R1.2 | R1.3 | R1.4 | R1.5 |
| | 1.8 | R1.2 | R1.3 | R1.4 | R1.5 | R1.6 |
| | 2.0 | R1.3 | R1.4 | R1.5 | R1.6 | R1.7 |
| | 2.2 | R1.4 | R1.5 | R1.6 | R1.7 | R1.8 |
| | 2.4 | R1.5 | R1.6 | R1.7 | R1.8 | R1.9 |
| | 2.6 | R1.5 | R1.6 | R1.7 | R1.9 | R1.9 |
| | 2.8 | R1.6 | R1.7 | R1.8 | R2.0 | R2.0 |
| | 3.0 | R1.7 | R1.8 | R1.9 | R2.0 | R2.1 |
| | 3.2 | R1.8 | R1.9 | R2.0 | R2.1 | R2.2 |
| | 3.4 | R1.8 | R1.9 | R2.0 | R2.2 | R2.3 |
| | 3.6 | R1.9 | R2.0 | R2.1 | R2.3 | R2.4 |
| | 3.8 | R2.0 | R2.1 | R2.2 | R2.3 | R2.4 |
| | 4.0 | R2.1 | R2.2 | R2.3 | R2.4 | R2.5 |
| | 5.0 | R2.4 | R2.5 | R2.6 | R2.8 | R2.9 |
| | 6.0 | R2.7 | R2.9 | R3.0 | R3.2 | R3.3 |
| | 7.0 | R3.1 | R3.2 | R3.4 | R3.6 | R3.7 |
| | 8.0 | R3.4 | R3.6 | R3.7 | R3.9 | R4.1 |
| | 9.0 | R3.8 | R4.0 | R4.1 | R4.3 | R4.5 |
| | ≥ 10.0 | R4.1 | R4.3 | R4.5 | R4.7 | R4.9 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Horizontal underslab insulation with an *R-value* of 1.2 $m^2$·K/W, installed in between footings underneath the entire floor slab.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2O: Construction R-values for slab-floors with R2.4 full cover underslab insulation, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 o)

| Insulation type | Slab area-to-perimeter ratio [1] | $R_{floor}$ ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab[2] | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R2.4 full cover underslab insulation[3] | 1.6 | R1.6 | R1.7 | R1.8 | R2.0 | R2.1 |
| | 1.8 | R1.7 | R1.8 | R2.0 | R2.1 | R2.2 |
| | 2.0 | R1.8 | R2.0 | R2.1 | R2.2 | R2.3 |
| | 2.2 | R2.0 | R2.1 | R2.2 | R2.4 | R2.5 |
| | 2.4 | R2.1 | R2.2 | R2.3 | R2.5 | R2.6 |
| | 2.6 | R2.2 | R2.3 | R2.4 | R2.6 | R2.7 |
| | 2.8 | R2.3 | R2.4 | R2.5 | R2.7 | R2.8 |
| | 3.0 | R2.4 | R2.5 | R2.6 | R2.8 | R2.9 |
| | 3.2 | R2.5 | R2.6 | R2.7 | R2.9 | R3.0 |
| | 3.4 | R2.6 | R2.7 | R2.8 | R3.0 | R3.1 |
| | 3.6 | R2.6 | R2.8 | R2.9 | R3.1 | R3.2 |
| | 3.8 | R2.7 | R2.9 | R3.0 | R3.2 | R3.3 |
| | 4.0 | R2.8 | R3.0 | R3.1 | R3.3 | R3.4 |
| | 5.0 | R3.2 | R3.4 | R3.5 | R3.7 | R3.8 |
| | 6.0 | R3.7 | R3.8 | R4.0 | R4.2 | R4.3 |
| | 7.0 | R4.1 | R4.2 | R4.4 | R4.6 | R4.7 |
| | 8.0 | R4.5 | R4.6 | R4.8 | R5.0 | R5.2 |
| | 9.0 | R4.9 | R5.1 | R5.2 | R5.5 | R5.6 |
| | ≥ 10.0 | R5.3 | R5.5 | R5.7 | R5.9 | R6.1 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Horizontal underslab insulation with an *R-value* of 2.4 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2P: Construction R-values for slab-floors with R2.4 full cover underslab insulation, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 p)

| Insulation type | Slab area-to-perimeter ratio (1) | $R_{floor}$ ($m^2 \cdot K/W$) for different effective thicknesses of external walls on slab(2) | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R2.4 full cover underslab insulation(3) | 1.6 | R1.3 | R1.4 | R1.5 | R1.7 | R1.9 |
| | 1.8 | R1.4 | R1.5 | R1.7 | R1.9 | R2.0 |
| | 2.0 | R1.5 | R1.7 | R1.8 | R2.0 | R2.1 |
| | 2.2 | R1.6 | R1.8 | R1.9 | R2.1 | R2.2 |
| | 2.4 | R1.7 | R1.9 | R2.0 | R2.2 | R2.3 |
| | 2.6 | R1.8 | R2.0 | R2.1 | R2.3 | R2.4 |
| | 2.8 | R1.9 | R2.1 | R2.2 | R2.4 | R2.5 |
| | 3.0 | R2.0 | R2.1 | R2.3 | R2.5 | R2.6 |
| | 3.2 | R2.1 | R2.2 | R2.4 | R2.6 | R2.7 |
| | 3.4 | R2.2 | R2.3 | R2.5 | R2.7 | R2.8 |
| | 3.6 | R2.3 | R2.4 | R2.6 | R2.8 | R2.9 |
| | 3.8 | R2.3 | R2.5 | R2.7 | R2.9 | R3.0 |
| | 4.0 | R2.4 | R2.6 | R2.7 | R3.0 | R3.1 |
| | 5.0 | R2.8 | R3.0 | R3.2 | R3.4 | R3.6 |
| | 6.0 | R3.2 | R3.4 | R3.6 | R3.8 | R4.0 |
| | 7.0 | R3.6 | R3.8 | R4.0 | R4.2 | R4.4 |
| | 8.0 | R3.9 | R4.2 | R4.4 | R4.7 | R4.8 |
| | 9.0 | R4.3 | R4.5 | R4.8 | R5.1 | R5.3 |
| | ≥ 10.0 | R4.7 | R4.9 | R5.2 | R5.5 | R5.7 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Horizontal underslab insulation with an *R-value* of 2.4 $m^2 \cdot K/W$, installed in between footings underneath the entire floor slab.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2Q: Construction R-values for slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R1.2 underslab insulation along the slab perimeter, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 q)

| Insulation type | Slab area-to-perimeter ratio [1] | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab[2] | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R1.0 vertical edge insulation[3] plus 1.2 m wide strip of R1.2 underslab insulation[4] | 1.6 | R1.2 | R1.2 | R1.3 | R1.3 | R1.3 |
| | 1.8 | R1.3 | R1.3 | R1.3 | R1.3 | R1.4 |
| | 2.0 | R1.3 | R1.3 | R1.4 | R1.4 | R1.4 |
| | 2.2 | R1.4 | R1.4 | R1.4 | R1.5 | R1.5 |
| | 2.4 | R1.4 | R1.5 | R1.5 | R1.5 | R1.6 |
| | 2.6 | R1.5 | R1.5 | R1.6 | R1.6 | R1.6 |
| | 2.8 | R1.6 | R1.6 | R1.6 | R1.7 | R1.7 |
| | 3.0 | R1.6 | R1.7 | R1.7 | R1.8 | R1.8 |
| | 3.2 | R1.7 | R1.8 | R1.8 | R1.8 | R1.9 |
| | 3.4 | R1.8 | R1.8 | R1.9 | R1.9 | R1.9 |
| | 3.6 | R1.9 | R1.9 | R1.9 | R2.0 | R2.0 |
| | 3.8 | R1.9 | R2.0 | R2.0 | R2.0 | R2.1 |
| | 4.0 | R2.0 | R2.0 | R2.1 | R2.1 | R2.2 |
| | 5.0 | R2.3 | R2.4 | R2.4 | R2.5 | R2.5 |
| | 6.0 | R2.7 | R2.8 | R2.8 | R2.9 | R2.9 |
| | 7.0 | R3.1 | R3.1 | R3.2 | R3.3 | R3.3 |
| | 8.0 | R3.4 | R3.5 | R3.6 | R3.6 | R3.7 |
| | 9.0 | R3.8 | R3.9 | R3.9 | R4.0 | R4.1 |
| | ≥ 10.0 | R4.2 | R4.3 | R4.3 | R4.4 | R4.5 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2$·K/W, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 1.2 $m^2$·K/W, installed along the entire slab perimeter, placed on the interior side of the wall footing.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2R: Construction R-values for slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R1.2 underslab insulation along the slab perimeter, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 r)

| Insulation type | Slab area-to-perimeter ratio (1) | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab(2) | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R1.0 vertical edge insulation(3) plus 1.2 m wide strip of R1.2 underslab insulation(4) | 1.6 | R1.3 | R1.3 | R1.3 | R1.3 | R1.3 |
| | 1.8 | R1.3 | R1.3 | R1.3 | R1.4 | R1.4 |
| | 2.0 | R1.4 | R1.4 | R1.4 | R1.4 | R1.5 |
| | 2.2 | R1.4 | R1.4 | R1.5 | R1.5 | R1.5 |
| | 2.4 | R1.5 | R1.5 | R1.5 | R1.6 | R1.6 |
| | 2.6 | R1.5 | R1.6 | R1.6 | R1.6 | R1.7 |
| | 2.8 | R1.6 | R1.6 | R1.7 | R1.7 | R1.7 |
| | 3.0 | R1.7 | R1.7 | R1.8 | R1.8 | R1.8 |
| | 3.2 | R1.8 | R1.8 | R1.8 | R1.9 | R1.9 |
| | 3.4 | R1.8 | R1.9 | R1.9 | R1.9 | R2.0 |
| | 3.6 | R1.9 | R1.9 | R2.0 | R2.0 | R2.0 |
| | 3.8 | R2.0 | R2.0 | R2.0 | R2.1 | R2.1 |
| | 4.0 | R2.0 | R2.1 | R2.1 | R2.2 | R2.2 |
| | 5.0 | R2.4 | R2.4 | R2.5 | R2.5 | R2.6 |
| | 6.0 | R2.8 | R2.8 | R2.9 | R2.9 | R3.0 |
| | 7.0 | R3.1 | R3.2 | R3.2 | R3.3 | R3.4 |
| | 8.0 | R3.5 | R3.6 | R3.6 | R3.7 | R3.8 |
| | 9.0 | R3.9 | R4.0 | R4.0 | R4.1 | R4.2 |
| | ≥ 10.0 | R4.3 | R4.3 | R4.4 | R4.5 | R4.6 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2$·K/W, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 1.2 $m^2$·K/W, installed along the entire slab perimeter, placed on the interior side of the wall footing.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2S: Construction R-values for slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R2.4 underslab insulation along the slab perimeter, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 s)

| Insulation type | Slab area-to-perimeter ratio (1) | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab(2) | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R1.0 vertical edge insulation(3) plus 1.2 m wide strip of R2.4 underslab insulation(4) | 1.6 | R1.3 | R1.3 | R1.4 | R1.4 | R1.4 |
| | 1.8 | R1.3 | R1.4 | R1.4 | R1.4 | R1.4 |
| | 2.0 | R1.4 | R1.4 | R1.4 | R1.5 | R1.5 |
| | 2.2 | R1.4 | R1.5 | R1.5 | R1.5 | R1.6 |
| | 2.4 | R1.5 | R1.5 | R1.6 | R1.6 | R1.6 |
| | 2.6 | R1.6 | R1.6 | R1.6 | R1.7 | R1.7 |
| | 2.8 | R1.6 | R1.7 | R1.7 | R1.8 | R1.8 |
| | 3.0 | R1.7 | R1.7 | R1.8 | R1.8 | R1.8 |
| | 3.2 | R1.8 | R1.8 | R1.9 | R1.9 | R1.9 |
| | 3.4 | R1.8 | R1.9 | R1.9 | R2.0 | R2.0 |
| | 3.6 | R1.9 | R2.0 | R2.0 | R2.0 | R2.1 |
| | 3.8 | R2.0 | R2.0 | R2.1 | R2.1 | R2.1 |
| | 4.0 | R2.1 | R2.1 | R2.1 | R2.2 | R2.2 |
| | 5.0 | R2.4 | R2.5 | R2.5 | R2.6 | R2.6 |
| | 6.0 | R2.8 | R2.8 | R2.9 | R3.0 | R3.0 |
| | 7.0 | R3.1 | R3.2 | R3.3 | R3.3 | R3.4 |
| | 8.0 | R3.5 | R3.6 | R3.7 | R3.7 | R3.8 |
| | 9.0 | R3.9 | R4.0 | R4.0 | R4.1 | R4.2 |
| | ≥ 10.0 | R4.3 | R4.4 | R4.4 | R4.5 | R4.6 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2$·K/W, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 2.4 $m^2$·K/W, installed along the entire slab perimeter, placed on the interior side of the wall footing.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2T: Construction R-values for slab-floors with R1.0 vertical edge insulation and with a 1.2m wide strip of R2.4 underslab insulation along the slab perimeter, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 t)

| Insulation type | Slab area-to-perimeter ratio (1) | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab(2) | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R1.0 vertical edge insulation(3) plus 1.2 m wide strip of R2.4 underslab insulation(4) | 1.6 | R1.3 | R1.4 | R1.4 | R1.4 | R1.4 |
| | 1.8 | R1.4 | R1.4 | R1.4 | R1.5 | R1.5 |
| | 2.0 | R1.4 | R1.5 | R1.5 | R1.5 | R1.5 |
| | 2.2 | R1.5 | R1.5 | R1.5 | R1.6 | R1.6 |
| | 2.4 | R1.5 | R1.6 | R1.6 | R1.7 | R1.7 |
| | 2.6 | R1.6 | R1.6 | R1.7 | R1.7 | R1.7 |
| | 2.8 | R1.7 | R1.7 | R1.7 | R1.8 | R1.8 |
| | 3.0 | R1.7 | R1.8 | R1.8 | R1.9 | R1.9 |
| | 3.2 | R1.8 | R1.8 | R1.9 | R1.9 | R2.0 |
| | 3.4 | R1.9 | R1.9 | R2.0 | R2.0 | R2.0 |
| | 3.6 | R2.0 | R2.0 | R2.0 | R2.1 | R2.1 |
| | 3.8 | R2.0 | R2.1 | R2.1 | R2.2 | R2.2 |
| | 4.0 | R2.1 | R2.1 | R2.2 | R2.2 | R2.3 |
| | 5.0 | R2.5 | R2.5 | R2.5 | R2.6 | R2.6 |
| | 6.0 | R2.8 | R2.9 | R2.9 | R3.0 | R3.0 |
| | 7.0 | R3.2 | R3.3 | R3.3 | R3.4 | R3.4 |
| | 8.0 | R3.6 | R3.6 | R3.7 | R3.8 | R3.8 |
| | 9.0 | R4.0 | R4.0 | R4.1 | R4.2 | R4.3 |
| | ≥ 10.0 | R4.4 | R4.4 | R4.5 | R4.6 | R4.7 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2$·K/W, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) A 1.2 m wide strip of horizontal underslab insulation with an *R-value* of 2.4 $m^2$·K/W, installed along the entire slab perimeter, placed on the interior side of the wall footing.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2U: Construction R-values for slab-floors with R1.0 vertical edge insulation and with R1.2 full cover underslab insulation, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 u)

| Insulation type | Slab area-to-perimeter ratio [1] | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab[2] | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R1.0 vertical edge insulation[3] plus R1.2 full cover underslab insulation[4] | 1.6 | R1.4 | R1.5 | R1.6 | R1.7 | R1.7 |
| | 1.8 | R1.5 | R1.6 | R1.7 | R1.8 | R1.8 |
| | 2.0 | R1.6 | R1.7 | R1.8 | R1.9 | R1.9 |
| | 2.2 | R1.7 | R1.8 | R1.9 | R2.0 | R2.0 |
| | 2.4 | R1.8 | R1.9 | R2.0 | R2.1 | R2.1 |
| | 2.6 | R1.9 | R2.0 | R2.1 | R2.1 | R2.2 |
| | 2.8 | R2.0 | R2.1 | R2.1 | R2.2 | R2.3 |
| | 3.0 | R2.1 | R2.2 | R2.2 | R2.3 | R2.4 |
| | 3.2 | R2.2 | R2.2 | R2.3 | R2.4 | R2.5 |
| | 3.4 | R2.3 | R2.3 | R2.4 | R2.5 | R2.5 |
| | 3.6 | R2.3 | R2.4 | R2.5 | R2.6 | R2.6 |
| | 3.8 | R2.4 | R2.5 | R2.6 | R2.7 | R2.7 |
| | 4.0 | R2.5 | R2.6 | R2.6 | R2.7 | R2.8 |
| | 5.0 | R2.9 | R3.0 | R3.1 | R3.2 | R3.2 |
| | 6.0 | R3.3 | R3.4 | R3.5 | R3.6 | R3.6 |
| | 7.0 | R3.7 | R3.8 | R3.9 | R4.0 | R4.1 |
| | 8.0 | R4.1 | R4.2 | R4.3 | R4.4 | R4.5 |
| | 9.0 | R4.5 | R4.6 | R4.7 | R4.8 | R4.9 |
| | ≥ 10.0 | R4.9 | R5.0 | R5.1 | R5.3 | R5.4 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2$·K/W, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) Horizontal underslab insulation with an *R-value* of 1.2 $m^2$·K/W, installed in between footings underneath the entire floor slab.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2V: Construction R-values for slab-floors with R1.0 vertical edge insulation and with R1.2 full cover underslab insulation, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 v)

| Insulation type | Slab area-to-perimeter ratio [1] | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab[2] | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R1.0 vertical edge insulation[3] plus R1.2 full cover underslab insulation[4] | 1.6 | R1.4 | R1.5 | R1.6 | R1.7 | R1.7 |
| | 1.8 | R1.6 | R1.6 | R1.7 | R1.8 | R1.8 |
| | 2.0 | R1.7 | R1.7 | R1.8 | R1.9 | R1.9 |
| | 2.2 | R1.7 | R1.8 | R1.9 | R2.0 | R2.0 |
| | 2.4 | R1.8 | R1.9 | R2.0 | R2.1 | R2.1 |
| | 2.6 | R1.9 | R2.0 | R2.1 | R2.2 | R2.2 |
| | 2.8 | R2.0 | R2.1 | R2.1 | R2.2 | R2.3 |
| | 3.0 | R2.1 | R2.2 | R2.2 | R2.3 | R2.4 |
| | 3.2 | R2.2 | R2.3 | R2.3 | R2.4 | R2.5 |
| | 3.4 | R2.3 | R2.3 | R2.4 | R2.5 | R2.6 |
| | 3.6 | R2.4 | R2.4 | R2.5 | R2.6 | R2.7 |
| | 3.8 | R2.4 | R2.5 | R2.6 | R2.7 | R2.7 |
| | 4.0 | R2.5 | R2.6 | R2.7 | R2.8 | R2.8 |
| | 5.0 | R2.9 | R3.0 | R3.1 | R3.2 | R3.2 |
| | 6.0 | R3.3 | R3.4 | R3.5 | R3.6 | R3.7 |
| | 7.0 | R3.7 | R3.8 | R3.9 | R4.0 | R4.1 |
| | 8.0 | R4.1 | R4.2 | R4.3 | R4.4 | R4.5 |
| | 9.0 | R4.5 | R4.6 | R4.7 | R4.9 | R5.0 |
| | ≥ 10.0 | R4.9 | R5.0 | R5.2 | R5.3 | R5.4 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2$·K/W, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) Horizontal underslab insulation with an *R-value* of 1.2 $m^2$·K/W, installed in between footings underneath the entire floor slab.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2W: Construction R-values for slab-floors with R1.0 vertical edge insulation and with R2.4 full cover underslab insulation, where the external walls have masonry veneer cladding**

Paragraph F.1.2.2 w)

| Insulation type | Slab area-to-perimeter ratio [1] | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab[2] | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R1.0 vertical edge insulation[3] plus R2.4 full cover underslab insulation[4] | 1.6 | R1.7 | R1.8 | R1.9 | R2.1 | R2.2 |
| | 1.8 | R1.8 | R2.0 | R2.1 | R2.2 | R2.3 |
| | 2.0 | R2.0 | R2.1 | R2.2 | R2.3 | R2.4 |
| | 2.2 | R2.1 | R2.2 | R2.3 | R2.5 | R2.6 |
| | 2.4 | R2.2 | R2.3 | R2.4 | R2.6 | R2.7 |
| | 2.6 | R2.3 | R2.4 | R2.5 | R2.7 | R2.8 |
| | 2.8 | R2.4 | R2.5 | R2.7 | R2.8 | R2.9 |
| | 3.0 | R2.5 | R2.6 | R2.8 | R2.9 | R3.0 |
| | 3.2 | R2.6 | R2.7 | R2.9 | R3.0 | R3.1 |
| | 3.4 | R2.7 | R2.8 | R3.0 | R3.1 | R3.2 |
| | 3.6 | R2.8 | R2.9 | R3.1 | R3.2 | R3.3 |
| | 3.8 | R2.9 | R3.0 | R3.1 | R3.3 | R3.4 |
| | 4.0 | R3.0 | R3.1 | R3.2 | R3.4 | R3.5 |
| | 5.0 | R3.4 | R3.6 | R3.7 | R3.9 | R4.0 |
| | 6.0 | R3.9 | R4.0 | R4.1 | R4.3 | R4.4 |
| | 7.0 | R4.3 | R4.5 | R4.6 | R4.8 | R4.9 |
| | 8.0 | R4.7 | R4.9 | R5.0 | R5.2 | R5.3 |
| | 9.0 | R5.2 | R5.3 | R5.5 | R5.7 | R5.8 |
| | ≥ 10.0 | R5.6 | R5.8 | R5.9 | R6.1 | R6.3 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2$·K/W, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) Horizontal underslab insulation with an *R-value* of 2.4 $m^2$·K/W, installed in between footings underneath the entire floor slab.

# Thermal resistance of slab-on-ground floors

**Table F.1.2.2X: Construction R-values for slab-floors with R1.0 vertical edge insulation and with R2.4 full cover underslab insulation, where the external walls do not have masonry veneer cladding**

Paragraph F.1.2.2 x)

| Insulation type | Slab area-to-perimeter ratio (1) | $R_{floor}$ ($m^2$·K/W) for different effective thicknesses of external walls on slab(2) | | | | |
|---|---|---|---|---|---|---|
| | | ≥ 90 mm to < 140 mm | ≥ 140 mm to < 180 mm | ≥ 180 mm to < 250 mm | ≥ 250 mm to < 300 mm | ≥ 300 mm |
| R1.0 vertical edge insulation(3) plus R2.4 full cover underslab insulation(4) | 1.6 | R1.7 | R1.8 | R1.9 | R2.0 | R2.1 |
| | 1.8 | R1.8 | R1.9 | R2.0 | R2.2 | R2.3 |
| | 2.0 | R1.9 | R2.0 | R2.1 | R2.3 | R2.4 |
| | 2.2 | R2.1 | R2.2 | R2.3 | R2.4 | R2.5 |
| | 2.4 | R2.2 | R2.3 | R2.4 | R2.6 | R2.7 |
| | 2.6 | R2.3 | R2.4 | R2.5 | R2.7 | R2.8 |
| | 2.8 | R2.4 | R2.5 | R2.6 | R2.8 | R2.9 |
| | 3.0 | R2.5 | R2.6 | R2.7 | R2.9 | R3.0 |
| | 3.2 | R2.6 | R2.7 | R2.8 | R3.0 | R3.1 |
| | 3.4 | R2.7 | R2.8 | R2.9 | R3.1 | R3.2 |
| | 3.6 | R2.8 | R2.9 | R3.0 | R3.2 | R3.3 |
| | 3.8 | R2.9 | R3.0 | R3.1 | R3.3 | R3.4 |
| | 4.0 | R3.0 | R3.1 | R3.2 | R3.4 | R3.5 |
| | 5.0 | R3.4 | R3.6 | R3.7 | R3.9 | R4.0 |
| | 6.0 | R3.9 | R4.0 | R4.1 | R4.3 | R4.4 |
| | 7.0 | R4.3 | R4.4 | R4.6 | R4.8 | R4.9 |
| | 8.0 | R4.7 | R4.9 | R5.0 | R5.2 | R5.4 |
| | 9.0 | R5.2 | R5.3 | R5.5 | R5.7 | R5.8 |
| | ≥ 10.0 | R5.6 | R5.8 | R5.9 | R6.2 | R6.3 |

**Notes:**

(1) The slab area-to-perimeter ratio shall be determined in accordance with Paragraphs F.1.2.3 and F.1.2.4. Where the slab area-to-perimeter ratio of the proposed floor is different from the values included in the table, the *construction R-value* shall be determined based on the nearest slab area-to-perimeter ratio in the table that is smaller than the slab area-to-perimeter ratio of the proposed floor.

(2) The effective thickness of *external walls* is the horizontal distance between the exterior concrete slab edge at floor level, and the interior wall surface.

(3) Vertical edge insulation with an *R-value* of 1.0 $m^2$·K/W, installed on all exterior vertical faces of the concrete slab / wall footing, extending from the outermost top edge down to the bottom of the wall footing.

(4) Horizontal underslab insulation with an *R-value* of 2.4 $m^2$·K/W, installed in between footings underneath the entire floor slab.

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