

Calculation Method Summary Sheet

(H1 Energy Efficiency)

Address:	House/Flat/Unit No.: _____ Street: _____ Suburb: _____
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Climate Zone:	Climate Zone 2 Note: all Wellington Regions are Climate Zone 2)
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Construction Type:	Solid Timber / Solid / Non Solid (circle applicable construction type/s)
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Reference Building Heat Loss (HL_{ref}) see guidance notes for commentary				
Building Envelope Component	Description: (Eg: timber frame studs @400 ctrs with mineral wool insulation)	Area A _{ref} (m ²)	R _{ref} Value (Refer Replacement tables H1/AS1 – Zone 2)	HL _{ref} = A _{ref} / R _{ref}
Roof:				
Walls:				
Floors:				
Glazing: (< 30%)				
Glazing: (> 30%)				
Glazing: (Skylights)				
Reference Building Total Heat Loss (HL_{ref})				

Proposed Building Heat Loss (HL_{pro}) see guidance notes for commentary				
Building Envelope Component:	Description: (Eg: Roof 1: Long run iron, skillion roof, 250mm rafters at 600 ctrs with mineral wool insulation. Roof 2: Seedum "Green Roof" on butyl rubber over rigid foam insulation.	Area A _{pro} (m ²)	R _{pro} Value (no less than 60% R _{ref} value)	HL _{pro} = A _{pro} / R _{pro}
Roof 1				
Roof 2				
Roof 3				
Wall 1				
Wall 2				
Wall 3				
Floor 1				
Floor 2				
Floor 3				
Glazing 1				
Glazing 2				
Glazing 3				
Skylight 1				
Skylight 2				
Proposed Building Total Heat Loss (HL_{pro})				

Final check: Is HL_{pro} ≤ HL_{ref} ?	(circle applicable) Yes / No
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Applicant Guidance Notes:

This form is for Building Consents that use the Calculation Method ([NZS 4218](#) section 3.2) to show compliance.

The calculation method requires that the heat loss of the proposed building is no worse than that of a reference building having identical dimensions and functions to the proposed building. This allows flexibility in the R values of each building component to accommodate different design solutions.

Special Note: R value tables in [NZS 4218](#) are to be replaced with those in compliance document [clause H1](#).

The Calculation Method may be used where:

- Greater design flexibility is required than the schedule method eg: more than 30% glazing.
- The total area of glazing (including skylights) is $\leq 50\%$ of the total wall area

Note: 1) The calculated area of glazing includes the frame as the R value refers to the whole glazed element.

2) Total wall area is calculated from the overall dimensions including glazing elements eg: $4\text{m} \times 5\text{m} = 20\text{m}^2$

Where the design exceeds these parameters, either the design can be altered or the modelling method can be used.

Construction Type: This determines which R value tables are applicable.

- **Non Solid Construction:** Includes Timber/Metal frame, Brick Veneer and non Masonry Cavity based type building constructions (refer [H1/AS1](#) Table 1).
- **Solid Timber Construction:** Includes Lockwood and Log House type constructions (refer [H1/AS1](#) Table 2a)
- **Solid Construction:** Includes Masonry, Concrete, Earth Wall type constructions (refer [H1/AS1](#) Table 2b).
- **Heated Walls, Ceiling and Floors:** Includes embedded pipes, under floor electrical heating elements, but excludes floor coverings eg: carpet and underlay (refer [H1/AS1](#) Table 3).

Reference Building Heat Loss Calculation: This is a summary of a compliant building having identical dimensions and functions to the proposed building. Reference R values are derived from the tables in [H1/AS1](#) as described in the construction types. The total heat loss will be the sum of each of the components - HL_{ref}

- Set the reference R values for each building component (refer tables [H1/AS1](#))
- Set Wall Area as either 70% of Total Wall Area, or actual wall area, whichever is **LOWER**. (This will give designers using 30% or less glazing, maximum flexibility in the other building components)
- Set glazing area as either 30% of total wall area, or actual window area, whichever is **HIGHER**. (This will give designers using 30% or less glazing, maximum flexibility in the other building components)
- Use glazing and skylight R-values from Replacement Table 4 refer [H1/AS1](#).

Note: 1) Non-glazed areas of door openings greater than 3m^2 are treated as wall.

2) An R value of 0.26 maybe used for traditional leadlight glass if the total area is $\leq 2.6\text{m}^2$

Proposed Building Heat Loss Calculation: This lists the various building components and designed building component R values. The heat loss of each individual component will be calculated using the area of the component and its achieved design R value. The sum of these components will be the total heat loss of the building – HL_{pro} .

Note: 1) R values must be no less than 60% of the R values of the corresponding schedule values.

2) The area of glazing (including skylights, light tubes & door panels) must be $\leq 50\%$ of the total wall area.

3) Non-glazed areas of doors openings greater than 3m^2 are treated as wall.

4) For traditional leadlight glass an R value of 0.26 maybe used if the total area is $\leq 2.6\text{m}^2$

5) R values for glazing $\geq 30\%$ and $\leq 50\%$ have a higher rating (refer Replacement Table 4 [H1/AS1](#))

Manufacturers should be providing standard details that have been tested to [NZS 4214](#) and meet the performance requirements of [clause H1](#) or [NZS 4218](#). Any tests or appraisals should be submitted with the application as Supporting Technical Data.

R values for a number of common products and installation techniques can also be found in the [BRANZ: "House Insulation Guide"](#).

Worked Example:

Residential single storey house in Zone 2:

Multi-clad rusticated weatherboard and horizontal metal cladding on timber frame. Stud height 2.4m. Length 7m, Width 12m, windows 32m² and a single glazed set of bifold doors 7m². Profiled metal roof with hip ends. Concrete raft slab foundation and suspended wooden floor.

Component Analysis

Roof Area:	12m _{Length} x 7m _{Width} = 84m ² _{Roof Area}
Floor Area:	12m _{Length} x 7m _{Width} = 84m ² _{Floor Area}
Total Wall Area:	2.4m _{Stud Height} x (7m _{East Wall} + 12m _{South Wall} + 7m _{West Wall} + 12m _{North Wall}) = 91.2m ² _{Total Wall Area}
Total Area Vertical Glazing:	32m ² _{Windows} + 7m ² _{Bifold Doors} = 39.0m ² _{Total Vertical Glazing Area}
Wall Area:	91.2m ² _{Total Wall Area} - 39.0m ² _{Total Vertical Glazing Area} = 52.2m ² _{Wall Area}
Total Glazing to Wall ratio:	(39.0m ² _{Total Vertical Glazing Area} / 91.2 m ² _{Total Wall Area}) x 100% = 42.8%
Glazing ≤ 30% Wall Area:	30% x 91.2m ² _{Total Wall Area} = 27.4m ² _{Glazing ≤ 30%}
Glazing > 30% ≤ 50% Wall Area:	39.0m ² _{Total Glazing Area} - 27.4m ² _{Glazing ≤ 30%} = 11.6m ² _{Glazing > 30% ≤ 50%}

Reference Building Calculation

$$HL_{Ref} = HL_{Ref\ Roof} + HL_{Ref\ Floor} + HL_{Ref\ Wall\ Area} + HL_{Ref\ Glazing\ \leq\ 30\%} + HL_{Ref\ Glazing\ >\ 30\%\ Wall\ Area}$$

HL _{Ref Roof} :	= 84m ² _{Total Roof Area} / 2.9 _{Roof R Value} = 29.0
HL _{Ref Floor} :	= 84m ² _{Floor Area} / 1.3 _{Floor R Value} = 48.0
HL _{Ref Wall Area} :	= 52.2m ² _{Wall Area} / 1.9 _{Wall R Value} = 27.5
HL _{Ref Glazing ≤ 30% wall area} :	= 27.4m ² _{Total Vertical Glazing Area ≤ 30%} / 0.26 _{Glazing ≤ 30% wall area R Value} = 105.4
HL _{Ref Glazing ≥ 30% wall area} :	= 11.6m ² _{Total Vertical Glazing Area ≥ 30%} / 0.31 _{Glazing ≥ 30% wall area R Value} = 37.4

Reference Building¹ Heat Loss (HL_{ref}) see guidance notes for commentary				
Building Envelope Component	Description: (Eg: timber frame studs @400 ctrs with mineral wool insulation)	Area A_{ref} (m²)	R_{ref} Value² (Refer Replacement tables H1/AS1)	HL_{ref} = A_{ref} / R_{ref}
Roof:	Constructed to meet the required R value in suitable materials	84.0	2.9	29.0
Walls:	Constructed to meet the required R value in suitable materials	52.2	1.9	27.5
Floors:	Concrete Slab foundation	84.0	1.3	64.6
Glazing: (< 30%)	Double Glazed Windows	27.4	0.26	105.4
Glazing: (> 30%)	Double Glazed Windows	11.6	0.31	37.4
Glazing: (Skylights)	None	-	-	-
Reference Building Total Heat Loss (HL_{ref})				263.9

Assumption notes:

- 1) The Reference Building refers to a building having the same physical properties of the proposed building and is compliant.
- 2) Construction is a Non Solid Type therefore Table 1 applies. Refer 2nd column – “Climate Zone 2”

Proposed Building Calculation

In addition to the above building description the owner has asked the Architect to reuse some single glazed bifold doors from an old homestead she used to live in and wants to use some natural wool insulation in the walls and ceilings if possible. The calculation method will allow for such design flexibility.

Component Analysis (the following areas apply for each building component type)

Roof 1 Area:	84.0m ² _{Roof}
Wall 1 Area:	20.0m ² _{Weatherboard}
Wall 2 Area:	32.2m ² _{Metal Clad}
Floor 1 Area:	59.0m ² _{Concrete Floor}
Floor 2 Area:	25.0m ² _{Timber Floor}
Glazing 1 (windows):	32.0m ² _{DG Windows}
Glazing 2 (Doors):	7.0m ² _{Bifold Doors}

Proposed Building Calculation

$$HL_{Pro} = HL_{Roof} + HL_{Floor 1} + HL_{Floor 2} + HL_{Wall 1} + HL_{Wall 2} + HL_{Glazing 1} + HL_{Glazing 2}$$

HL _{Roof} :	= 84.0m ² _{Roof} / 2.9 _{Roof R Value} = 29.0
HL _{Wall 1} :	= 20.0m ² _{Weatherboard} / 1.9 _{Wall 1 R Value} = 10.5
HL _{Wall 2} :	= 32.2m ² _{Metal Clad} / 1.9 _{Wall 2 R Value} = 16.9
HL _{Floor 1} :	= 59.0m ² _{Concrete Floor} / 1.3 _{Floor 1 R Value} = 45.4
HL _{Floor 2} :	= 25.0m ² _{Timber Floor} / 1.3 _{Floor 2 R Value} = 19.2
HL _{Glazing 1} :	= 32.0m ² _{DG Windows} / 0.26 _{Glazing 1 Area R Value} = 123.1
HL _{Glazing 2} :	= 7.0m ² _{Bifold Doors} / 0.16 _{Glazing 2 Area R Value} = 43.8

$$HL_{Pro} = 287.9$$

Problem: This *is more than* the HL_{Ref} of 263.9 so the proposed building is **not compliant**.

Solution: Try *increasing* the Roof insulation to R3.4 and the Double Glazing to R0.34 and recalculate.

HL_{pro} = 254.6 this *is less than* 263.9 therefore the proposal **is compliant**, congratulations!

Proposed Building Heat Loss (HL_{pro}) see guidance notes for commentary				
Building Envelope Component:	Description: (Eg: Roof 1: Long run iron, skillion roof, 250mm rafters at 600 ctrs with natural wool insulation. Roof 2: Seedum "Green Roof" on butyl rubber over rigid foam insulation.	Area A _{pro} (m ²)	R_{pro} Value (no less than 60% R _{ref} value)	HL_{pro} = A _{pro} / R _{pro}
Roof 1	Corrugated iron roof on purlins over building wrap and mesh. Ceiling joists @ 400 ctrs with 100mm mineral fibre insulation between and 100mm over joists @ 90° to Joists	84	3.4	24.7
Wall 1	Rusticated Weatherboards on timber studs @ 400ctrs, with natural wool fibre insulation and plasterboard lining.	20	1.9	10.5
Wall 2	Horizontal corrugated iron on timber studs @ 400ctrs, with natural wool insulation and plasterboard lining.	32.2	1.9	16.9
Floor 1	Concrete slab 200mm thick	59	1.3	45.4
Floor 2	Matai floor boards, on 200x50mm joists @ 400ctrs with 100mm EPS insulation	25	1.3	19.2
Glazing 1	Double Glazed wooden casement windows	32	0.34	94.1
Glazing 2	Traditional single glazed bifold doors	7	0.16	43.8
Skylight 1	n/a	-	-	-
Proposed Building Total Heat Loss (HL_{pro})				254.6

Replacement Table 1: Non-solid construction – minimum R-values for schedule method (only where area of glazing is 30% or less of total wall area)

Building thermal envelope component	Minimum R-values (m ² °C/W)		
	Climate zone 1	Climate zone 2	Climate zone 3
Roof	R 2.9	R 2.9	R 3.3
Wall	R 1.9	R 1.9	R 2.0
Floor	R 1.3	R 1.3	R 1.3
Glazing (vertical)	R 0.26	R 0.26	R 0.26
Glazing (skylights)	R 0.26	R 0.26	R 0.31

NOTE:

- (1) The R-values given in this table are those applicable to the reference building as described in this Standard (NZS 4218).
- (2) Climate zone boundaries are shown in Appendix B (of NZS 4218).
- (3) If the sum of the area of glazing on the East, South and West facing walls (see Appendix H of NZS 4218) is more than 30% of the total wall area of all of these walls, then the calculation or modelling method shall be used.
- (4) Carpets or floor coverings are not included in the floor R-value. The floor R-value is met by concrete slab-on-ground and suspended floors with continuous closed perimeter with 100 mm draped foil. Exposed floors will require additional treatment (e.g. pole houses).
- (5) The R-values for glazing refer to whole window R-values (glass and frame). The values in this table are for a standard WERS window (see Appendix G of NZS 4218). Any proposed area of glazing shall be considered to have an R-value as given in Appendix G (of NZS 4218).
- (6) There are no R-value requirements for the opaque parts of a door or a door set.
- (7) Total area of skylights must be no more than 1.2 m². The calculation or modelling methods must be used for designs where the total area of skylights is more than 1.2 m².
- (8) An R-value of 0.26 m² °C/W may be used for traditional leadlight glass when the total area of leadlight glass is no greater than 2.6 m² and either the schedule method or calculation method is used.

Replacement Table 2(a): Solid timber construction – alternative minimum R-values for schedule method (only where area of glazing is 30% or less of total wall area)

Building thermal envelope component	Minimum R-values ($\text{m}^2 \text{ } ^\circ\text{C/W}$)					
	Climate zone 1		Climate zone 2		Climate zone 3	
	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Roof	R 3.5	R 3.5	R 3.5	R 3.5	R 3.5	R 3.5
Walls – external 75 mm thick and timber framed internal walls	R 1.3	R 1.0	R 1.4	R 1.1	R 1.6	R 1.2
Walls – external 60 mm thick and solid timber internal walls 45 mm thick	R 1.0	R 0.8	R 1.3	R 1.0	R 1.6	R 1.2
Walls – external 90 mm thick and solid timber internal walls 45 mm thick	R 1.0	R 0.8	R 1.2	R 0.9	R 1.4	R 1.1
Walls – external 60 mm thick and solid timber internal walls 60 mm thick	R 1.0	R 0.8	R 1.2	R 0.9	R 1.4	R 1.1
Floor	R 1.3	R 1.3	R 1.3	R 1.3	R 1.3	R 1.3
Glazing (vertical)	R 0.26	R 0.31	R 0.26	R 0.31	R 0.26	R 0.31
Glazing (skylights)	R 0.26	R 0.31	R 0.26	R 0.31	R 0.31	R 0.31

NOTE:

- (1) The R-values given in this table are those applicable to the reference building as described in this Standard (NZS 4218).
- (2) Climate zone boundaries are shown in Appendix B (of NZS 4218).
- (3) If the sum of the area of glazing on the East, South and West facing walls (see Appendix H of NZS 4218) is more than 30% of the total wall area of all of these walls, then the calculation or modelling method shall be used.
- (4) Carpets or floor coverings are not included in the floor R-value. The floor R-value is met by concrete slab-on-ground and suspended floors with continuous closed perimeter with 100 mm draped foil. Exposed floors will require additional treatment (e.g. pole houses).
- (5) The R-values for glazing refer to whole window R-values (glass and frame). The values in this table are for a standard WERS window (Appendix G of NZS 4218). Any proposed area of glazing shall be considered to have an R-value as given in Appendix G (of NZS 4218).
- (6) There are no R-value requirements for the opaque parts of a door or a door set.
- (7) Total area of skylights must be no more than 1.2 m^2 . The calculation or modelling methods must be used for designs where the total area of skylights is more than 1.2 m^2 .
- (8) An R-value of 0.26 $\text{m}^2 \text{ } ^\circ\text{C/W}$ may be used for traditional leadlight glass when the total area of leadlight glass is no greater than 2.6 m^2 and either the schedule method or calculation method is used.
- (9) The R-values specified in Options 1b, 2b and 3b may only be used in the schedule method, i.e. shall not be used in the calculation or modelling methods.
- (10) When using R-values for either Options a or b, in relation to any of the three climate zones, all R-values for that option shall be used, i.e. roof, wall, floor and glazing. The R-values for a single building component shall not be substituted from one option to another.
- (11) At least 85% of internal walls must be solid timber when using the wall R-values for solid internal and external walls.
- (12) Table 2(a) allows buildings of solid timber construction to have lower R-values than buildings of non-solid construction, due to the benefits of appropriate use of thermal mass. Thermal mass must be used in conjunction with good passive design to increase comfort and reduce energy use. Use of the R-values in table 2(a) requires that the thermal mass is accessible, i.e. inside the insulated building envelope. If additional bulk insulation material is required to achieve the R-values in this table, this insulation must be installed on the outside of the wall.

Replacement Table 2(b): Solid construction (excluding solid timber) – alternative minimum R-values for schedule method (only where area of glazing is 30% or less of total wall area)

Building thermal envelope component	Minimum R-values ($\text{m}^2 \text{ }^\circ\text{C/W}$)					
	Climate zone 1		Climate zone 2		Climate zone 3	
	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Roof	R 3.5	R 3.5	R 3.5	R 3.5	R 3.5	R 3.5
Wall	R 0.8	R 0.8	R 1.0	R 0.9	R 1.2	R 1.0
Floor	R 1.5	R 1.3	R 1.5	R 1.3	R 1.5	R 1.3
Glazing (vertical)	R 0.26	R 0.31	R 0.26	R 0.31	R 0.26	R 0.31
Glazing (skylights)	R 0.26	R 0.31	R 0.26	R 0.31	R 0.31	R 0.31

NOTE:

- (1) The R-values given in this table are those applicable to the reference building as described in this Standard (NZS 4210).
- (2) Climate zone boundaries are shown in Appendix B (of NZS 4210).
- (3) If the sum of the area of glazing on the East, South and West facing walls (see Appendix H of NZS 4210) is more than 30% of the total wall area of all of these walls, then the calculation or modelling method shall be used.
- (4) Carpets or floor coverings are not included in the floor R-value. The floor R-value is met by concrete slab-on-ground and suspended floors with continuous closed perimeter with 100 mm draped foil. Exposed floors will require additional treatment (e.g. pole houses).
- (5) The R-values for glazing refer to whole window R-values (glass and frame). The values in this table are for a standard WERS window (Appendix G of NZS 4210). Any proposed area of glazing shall be considered to have an R-value as given in Appendix G (of NZS 4210).
- (6) There are no R-value requirements for the opaque parts of a door or a door set.
- (7) Total area of skylights must be no more than 1.2 m^2 . The calculation or modelling methods must be used for designs where the total area of skylights is more than 1.2 m^2 .
- (8) An R-value of $0.26 \text{ m}^2 \text{ }^\circ\text{C/W}$ may be used for traditional leadlight glass when the total area of leadlight glass is no greater than 2.6 m^2 and either the schedule method or calculation method is used.
- (9) The R-values specified in Options 1b, 2b and 3b may only be used in the schedule method, i.e. shall not be used in the calculation or modelling methods.
- (10) When using R-values for either Options a or b, all R-values for that option shall be used, i.e. roof, wall, floor and glazing. The R-values for a single building component shall not be substituted from one option to another.
- (11) Table 2(b) allows buildings of solid construction to have lower R-values than buildings of non-solid construction, due to the benefits of appropriate use of thermal mass. Thermal mass must be used in conjunction with good passive design to increase comfort and reduce energy use. Use of the R-values in table 2(b) requires that the thermal mass is accessible, i.e. inside the insulated building envelope. If additional bulk insulation material is required to achieve the R-values in this table, this insulation must be installed on the outside of the wall.

Replacement Table 3: Heated walls, ceilings or floors – minimum R-values for the schedule method

Building thermal envelope component	Minimum values for climate zones 1, 2 and 3 ($\text{m}^2 \text{ }^\circ\text{C/W}$)
Heated ceiling (R_{OUT})	R 3.5
Heated wall (R_{OUT})	R 2.6
Heated floor (R_{OUT})	R 1.9

where

$$R_{\text{IN}}/R_{\text{OUT}} < 0.1$$

and

R_{IN} is the thermal resistance between the heated plane and the inside air

R_{OUT} is the thermal resistance between the heated plane and the outside air.

NOTE:

Carpets or floor coverings are not included in the floor R-value. Floor coverings, e.g. carpet or cork, will reduce the efficiency of the heated floor.

Replacement Reference building – area of glazing R-values
Table 4:

Building thermal envelope component	Minimum R-values ($\text{m}^2 \text{ }^\circ\text{C/W}$)		
	Climate zone 1	Climate zone 2	Climate zone 3
Area of vertical glazing up to 30% of total wall area	0.26	0.26	0.26
The proportion of the area of vertical glazing over 30% of total wall area	0.26	0.31	0.34
Glazing – skylights	0.31	0.31	0.34

NOTE:

- (1) See Appendix G (of NZS 4218) for options to achieve the window R-values in this table. The R-values in Appendix G (of NZS 4218) shall be accepted, except where a higher R-value can be demonstrated by calculation or measurement using NZS 4214 or an internationally accepted computer software program.
- (2) An R-value of $0.26 \text{ m}^2 \text{ }^\circ\text{C/W}$ may be used for traditional leadlight glass when the total area of leadlight glass is no greater than 2.6 m^2 and either the schedule method or calculation method is used.
- (3) Total area of glazing over 50% of total wall area may cause excessive heat gain and/or heat loss, and the modelling method shall be used in these cases.
- (4) Non-glazed areas of door openings greater than 3 m^2 are treated as wall.
- (5) This table 4 applies to both solid and non-solid construction.