

Case Study

Example energy efficiency calculation

NCC 2022 Volume Two Deemed-to-Satisfy elemental provisions, climate zone 5

NCC 2022 Volume Two Deemed-to-Satisfy elemental provisions

Climate zone 5

This case study provides an example of the calculations required to demonstrate compliance with the Part H6 Energy Efficiency Performance Requirements H6P1 and H6P2 using the Acceptable Construction Practice elemental provisions in H6D2(1)(b) and H6D2(2) of NCC 2022 Volume Two. The example building is a light gauge steel framed house located in East Sydney, New South Wales. The case study shows how to calculate the requirements for the building fabric, ceiling fans and the net equivalent energy usage. Example calculations for building sealing and services are not included as no changes are proposed to these provisions in NCC 2022.

Example calculations for external glazing and shading have not been included as these may be carried out using the NCC 2022 glazing calculator as an alternative to the elemental provisions. Detailed calculations using the elemental provisions have been provided in the alternative case study for climate zone 6, Victoria.

Construction site and details

Table 1 Site and construction details (Plans in [Attachment A](#))

Building Element	Detail
Building location	NSW
NCC climate zone	5
NCC building classification	Class 1 detached house with an attached Class 10a garage
Roof & ceiling general arrangements	<ul style="list-style-type: none">Pitched with flat ceiling

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Building Element	Detail
	<ul style="list-style-type: none"> Eaves with 750mm overhang Steel framed Tiled roof – colour – Bristle Roofing “Jaspee Roja” – Solar Absorptance (SA=0.579) Downlights (to 1% of plan area of ceiling) <p>600 x 1200 roof light in ceiling of kitchen with 2m drop from ceiling to roof.</p>
External wall general arrangements	<ul style="list-style-type: none"> Steel framed brick veneer Brick colour – PGH Bricks & Pavers “Simpson” – SA ≤ 0.7 Wall height – 2400mm <p>Floor area of building Class 1 part of building = approx. 142m²</p>
Floors and subfloor wall general arrangements	<p>Concrete slab on ground</p> <p>In-screed underfloor heating to bathrooms</p>
Main type of heater	Reverse cycle non-ducted air conditioner – 3 stars (GEMS 2019)
Main type of cooler	Reverse cycle non-ducted air conditioner – 2.5 stars (GEMS 2019)
Type of water heater	Solar electric
Installed capacity of photovoltaics	No photovoltaics

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Building Element	Detail
Swimming pool	No pool
Spa	No spa

Calculations

Compliance Pathway: Compliance with the Performance Requirements is achieved as a Deemed-to-Satisfy Solution following the Acceptable Construction Practice set out in H6D2 Application of H6D2(1)(b).

Part 13.2 – Building fabric

1. Clause 13.2.1 – Building is Class 1 with an attached Class 10a garage, therefore clauses 13.2.2 to 13.2.6 and 13.2.7 apply.
2. Clause 13.2.2 – Where the following checks confirm that insulation is required, insulation shall comply with clause 13.2.2. This relates to material selection and construction / installation and is not described in detail here.
3. Clause 13.2.3 – For climate zone 5 roof minimum R-Values sub-clause (1)(e) applies.
 - a. Roof is pitched with flat ceiling, therefore Table 13.2.3f applies.
 - i. SA for tiles is 0.579 (based on product technical literature)
 - ii. Roof is considered standard (no wind driven or mechanical ventilators)
 - iii. Therefore adopt option of either:
 - A. Foil sarking installed under roof (with R-Value = 0) and R2.5 ceiling insulation, or
 - B. R3.0 ceiling insulation and no under roof insulation.

Adopt Option 1 - Foil sarking installed under roof (with R-Value = 0) and R2.5 ceiling insulation.

 - Reflective foil insulation must comply with subclause 13.2.3(3), therefore:
 - be downward facing; and
 - have an emissivity of not more than 0.05; and
 - be adjacent to a ventilated roof space of not less than 20 mm

Note, clause 10.8.3, as referenced in sub-clause 13.2.3(3), also applies here.

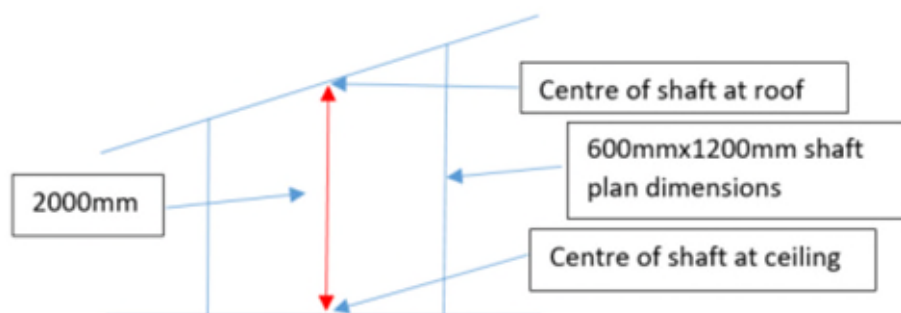
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4. Sub-clause 13.2.3(4) – Where ceiling insulation is reduced due to presence of downlights, this is compensated by increasing ceiling R-Value in accordance with Table 13.2.3s.
 - a. Area of ceiling insulation is reduced by 1%, therefore adjusted ceiling minimum R-Value = 2.9.
5. Roof is constructed from steel framing, therefore sub-clause 13.2.3(5) applies and must be addressed by either option (i) or (ii).
 - a. Adopting option (ii), for a pitched roof with flat ceiling Table 13.2.3v applies.
 - i. Minimum ceiling R-Value from Table 13.2.3f calculated above is R2.5, therefore Table 13.2.3v Options 1, 2 or 3 are acceptable.
 - ii. Adopting Option 2, an R0.51 insulation strip is required over all ceiling framing.
6. Note, sub-clause 13.2.3(6) does not apply as this roof is tiled, not from metal sheet roofing.
7. Clause 13.2.4 Roof Lights
 - a. 600mm x 1200mm has total area of 4% of the floor area of the 3m x 6m kitchen it serves, therefore meets requirements of sub-clause 13.2.4(1).
 - b. The required total system U-Value of the roof light must be ≤ 3.9 for compliance with sub-clause 13.2.4(1)(b)(ii).
 - c. For compliance with sub-clause 13.2.4(1)(b)(i) Total System SHGC is in accordance with Table 13.2.4.
 - iii. Roof light shaft index is $2000 / ((600 + 1200) / 2) = 2.22$ (see below vertical section sketch for shaft index calculation).
 - iv. Therefore, the required Total System SHGC ≤ 0.33 for roof lights serving 4% of the floor area of the room.

Figure 1 Roof light shaft schematic details



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8. Clause 13.2.5 – walls are brick veneer construction, therefore sub-clause 13.2.5(1) applies.
 - a. For climate zone 5, minimum R-Values are in accordance with Table 13.2.5i or 13.2.5j applies.
 - b. For brick veneer, Table 13.2.5i applies.
 - c. SA value for bricks is ≤ 0.7 , therefore adopt 0.7 as design value.
 - d. For 750mm roof overhang and 2400mm wall height, minimum required R-Value = 2.0.
9. Sub-clause 13.2.5(4) – Wall is steel framed, therefore thermal bridging must be addressed by either clause (i) or (ii).
 - a. In accordance with (ii), adopt an option from Table 13.2.5s to Table 13.2.5w.
 - A. For brick veneer walls in climate zone 5, adopt option from Table 13.2.5w.
 - B. Wall insulation R-Value = 2.0, therefore add a continuous installation product with an R-Value of at least R0.38 to the outer side of the frame (or R0.6 to the outer side of the frame only).
10. Clause 13.2.6
 - a. Construction is slab-on-ground, therefore (1), (2) and (3) do not apply.
 - b. Sub-clause 13.2.6(4) – an exemption applies to in-screed heating systems in bathrooms as noted in sub-clause 13.2.6(6), therefore no slab insulation is required for compliance with this clause.
11. Clause 13.2.7 – external fabric (roof, walls and slab)
 - a. Detailing to the garage area to be as per the Class 1 area of the building.

Part 13.3 – External glazing

Example calculations for glazing and external shading have not been included. These shall be in accordance with Part 13.3.2 or Part 13.3.3, or the NCC 2022 glazing calculator.

Part 13.4 – Building sealing

Example calculations are not included for building sealing as there are no changes for NCC 2022.

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Part 13.5 – Ceiling fans

1. In accordance with clause 13.5.2, ceiling fans are required as this building is in climate zone 5 in NSW.
 - a. Ceiling fans to be permanently installed and have a speed controller.
 - b. In accordance with Table 13.5.2, ceiling fans are required in daytime habitable spaces as a minimum, which for this building includes:
 - i. Dining / family room (approx. 32m² total)
 - ii. Theatre room (approx. 14m²)
 - c. Therefore ceiling fans are required as follows:
 - i. Dining / family room – minimum 2 x 1400mm
 - ii. Theatre room – minimum 1 x 900mm

Part 13.6 – Whole-of-home energy usage

1. In accordance with clause 13.6.1 this part applies to the Class 1 building only as the class 10a garage is not a conditioned space.
2. Clause 13.6.2 – Net equivalent energy usage
 - a. The net equivalent energy usage is calculated in accordance with sub-clause 13.6.2(1)(a) as follows:
 - i. $(A \times E_e) + E_p + E_s - E_R$, where
 - A. $A = 142 \times 0.0100 = 1.420$
 - B. $E_e = 1.299$ (from Table 5.2.1 in ABCB Standard : Whole-of-home efficiency factors)
 - C. $E_p = E_s = 0$ (there is no pool or spa at this dwelling)
 - D. $E_R = 0$ (no photovoltaic panels installed on roof)
 - ii. Therefore, equivalent energy usage = $(1.420 \times 1.299) + 0 + 0 - 0 = 1.84$
 - b. The allowable net equivalent energy usage is calculated in accordance with sub-clause 13.6.2(1)(b) as follows:
 - i. $A \times E_F$, where
 - A. $E_F = 1.75$ (from Table 13.6.2b)
 - ii. Therefore, allowable net equivalent energy usage = $1.420 \times 1.75 = 2.49$
 - c. The net equivalent energy usage does not exceed the allowance, therefore meets the requirements of clause 13.6.2.

Part 13.7 – Services

Example calculations are not included for building services as there are no changes proposed for NCC 2022.

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Summary of design requirements

Table 2 Summary table of design requirements

BUILDING ELEMENT	MINIMUM REQUIREMENTS	NOTES
Roof	<p>R2.9 ceiling insulation with reflective foil sarking installed under roof (foil sarking R-Value = 0).</p> <p>Insulation strip R0.51 required to the upper side of all steel roof framing to the ceiling.</p> <p>Kitchen roof light total system U-Value ≤ 3.9 and total system SHGC ≤ 0.33.</p>	<p>Foil sarking to be downward facing and have emissivity ≤ 0.05, and be adjacent a ventilated roof space of not less than 20mm.</p> <p>Insulation strip may be discrete at the thermally bridged steel framing members, or continuous across the whole area of framing.</p>
Walls	R2.0 wall insulation + an R0.6 insulation strip to the outer face of all elements of the steel wall frame.	
Slab	No requirement.	Construction is slab-on-ground with no underfloor heating (except in-screed heating to bathrooms), therefore no insulation required.
Glazing	In accordance with NCC 2022 Glazing Calculator, or NCC Volume Two Part 13.3.1.	It is expected that design will be commonly carried out using the glazing calculator, hence example calculations are not included.
Building Sealing	In accordance with NCC Volume Two Part 13.4.1.	No changes to technical content of the building sealing provisions from NCC 2019 amdt 1, hence example calculations are not included.
Ceiling Fans	2 x 1400mm ceiling fans to the dining/family room.	Other rooms are not considered daytime habitable, therefore no requirement for ceiling fans.

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BUILDING ELEMENT	MINIMUM REQUIREMENTS	NOTES
	1 x 900mm ceiling fan to the theatre room.	It is expected that ceiling fans will be installed in locations that achieve practical coverage for the expected use of those rooms.
Class 10a part (garage)	Insulation requirements to external fabric (external walls, roof, slab) as per Class 1 part noted above.	As the garage is not separated from the Class 1 part by construction having the required level of thermal performance, all insulation requirements apply to the Class 10a part as per the Class 1 part.

Notes:

1. Compliance with other NCC provisions (such as fire, waterproofing, condensation, etc.) is not considered. This shall be considered separately when determining required construction arrangements and details.
2. These requirements are considered general in nature. Specific detailing requirements as required by NCC, relevant codes and standards and supplier product technical requirements are not included (such as fit-up and installation detailing, abutting and fixing of insulation etc.). This shall be considered during design and construction.

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Attachments

Design Plans

The plans and specifications for this indicative house design used in this case study have been kindly provided by Henley Homes to assist with the consultation process on the draft NCC 2022 changes.

Figure 2 SBH04 medium detached, 1 storey, Set of 20, House10: Henley Homes - view from street

SBH04 Medium Detached, 1 storey, Set of 20, House10: Henley Homes

View from Street



Single storey residence. Consisting of Master bedroom with ensuite and WIR, Bed 2, 3 and 4, Bath, laundry, WC, 2 circulation areas, Kitchen/living/family area, home theatre and double garage.

External alfresco area

Floor area 188.40 m². Conditioned floor area of 122.9 m²

