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NZBC H1 CHANGES - SUMMARY

EVERYTHING YOU NEED TO KNOW ABOUT THE BUILDING ENCLOSURE.

INTRODUCTION

Timeframe of changes

- The updated NZBC Clause H1 5th Edition was introduced with optional compliance in November 2021
- It was then put into effect (with a few delays/exceptions within H1/AS1) and the old version was removed in November 2022
- The new Schedule R-values in H1/AS1 are already in effect for windows and skylights as of November 2022
- New Schedule R-values in H1/AS1 for walls, floors, and roofs are in effect as of May 2023
- Schedule R-values for windows in zones 1 and 2 (most of North Island other than central plateau, Manawatu-Whanganui, and Wellington regions) increase from their interim values to the full R-values shown in the schedule table 2.1.2.2B in November 2023

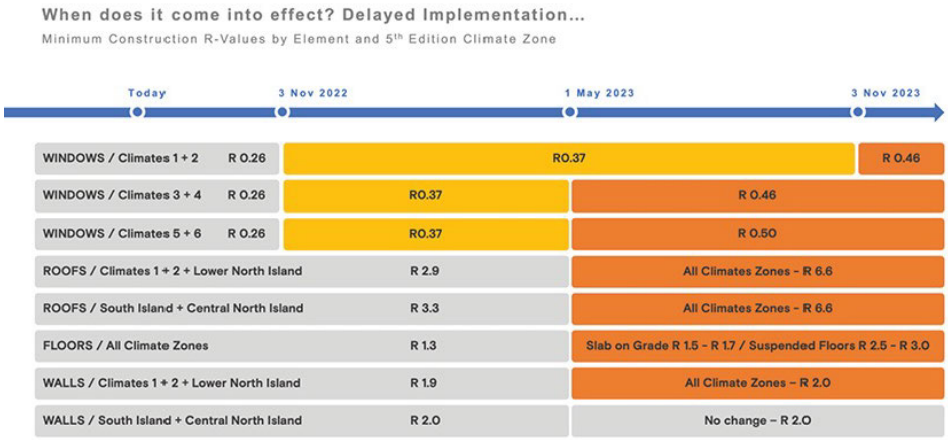


Image source: Context Architects

What items have changed?

1. More climate zones
2. R-value increases
3. Glazing ratios for compliance pathways
4. Window R-value calculation method
5. Floor R-value calculation method
6. Location of calculation methods
7. Non-envelope items such as HVAC and lighting efficiency, and amount of natural light

What items still need to change?

1. Thermal bridging
2. Airtightness/blower door testing
3. Installation detail of windows
4. Shading/overheating/cooling load
5. Coordination of envelope performance/airtightness and HVAC
6. Vapour control/interstitial condensation
7. Occupant comfort and interior air quality
8. Storage and distribution of domestic hot water

HOW CAN OCULUS HELP WITH YOUR H1 COMPLIANCE?

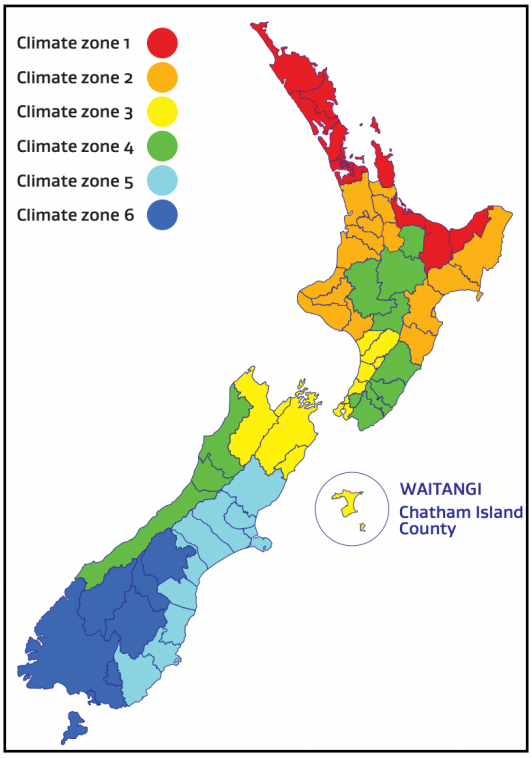
- **Energy modelling**
- **H1 compliance reports for schedule/ calculation/modelling method**
- **Design review**
- **Peer review**
- **General advice**

Contact our team at info@oculusltd.co.nz to discuss your H1 requirements!

WHAT HAS CHANGED & WHAT ARE THE IMPACTS?

Climate zones

- The number of climate zones has increased from 3 to 6 (as shown on the right)
  - Northland, Coromandel, and Bay of Plenty are zone 1
  - Auckland, much of Waikato, Taranaki, Gisborne, and Hawkes Bay are Zone 2
  - Most of the SW coast of North Island, and most of the north end of the South Island are zone 3
  - Central North Island, SE coast of the North Island, and a majority of the west coast of the South Island are zone 4
  - The east sides of Canterbury and Otago are zone 5
  - Southland and Central Canterbury and Otago are zone 6
  - To view the full table click here and go to page 78 of the whole document
- This is a great improvement, because it acknowledges the complexity of NZ's climate and that temperatures, humidities, and weather patterns over the seasons differ greatly throughout the country. This should allow designers to refine and tailor their energy efficiency design to a much more local level
- Schedule R-values for housing (AS1/VM1) do not vary too much between zones, but there is substantial variation in non-housing (AS2/VM2)



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R-value increases

- Schedule R-values have increased.
- **Summary of R-Value increases for housing and small buildings (AS1/VM1):**
  - Roofs have made a big jump up
  - Walls haven't changed much
  - Floors have gone up slightly and the evaluation method has changed
  - Windows and glazing have changed to windows and doors, and the values have almost doubled
  - Skylights have essentially doubled as well
  - For further details refer to the tables below

OLD (NZS4218)

Table 2 – Construction R-values for buildings with any wall type

Building element	Construction R-values ($m^2 \cdot °C/W$)		
	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
Windows and glazing	R 0.26	R 0.26	R 0.26
Skylights	R 0.26	R 0.26	R 0.31

Table source: NZS4218

NEW (H1/AS1)

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

Paragraph 2.1.2.2 b), 2.1.3.1

Building element	Construction R-values ($m^2 \cdot K/W$)[1]					
	Climate zone 1	Climate zone 2	Climate zone 3	Climate zone 4	Climate zone 5	Climate zone 6
Roof[2]	R6.6	R6.6	R6.6	R6.6	R6.6	R6.6
Wall	R2.0	R2.0	R2.0	R2.0	R2.0	R2.0
Floor						
Slab-on-ground floors	R1.5	R1.5	R1.5	R1.5	R1.6	R1.7
Floors other than *slab-on-ground*	R2.5	R2.5	R2.5	R2.8	R3.0	R3.0
Windows and doors[3]	R0.46[3]	R0.46[3]	R0.46	R0.46	R0.50	R0.50
Skylights	R0.46	R0.46	R0.54	R0.54	R0.62	R0.62

Table source: H1/AS1

- **Summary of R-Value increases for commercial and large buildings (AS2/VM2) summary:**
  - Roofs have made a big jump up
  - Walls have made a big jump up
  - Floors had a decent increase
  - From no "glazing" requirements to some glazing requirements for windows and doors

- From skylights included in roof average to skylights having their own requirements
- For further details refer to the tables below

OLD (NZS4243)

Table 1 – Minimum *R*-values for schedule method (*WWR* ≤ 50 %)

Building thermal envelope component	Minimum *R*-values (m² °C/W)	
	Climate zone 1	Climate zones 2 & 3
Roof (average including glazing)	*R* 1.9	*R* 1.9
Wall	*R* 0.3	*R* 1.2
Floor	No requirement	*R* 1.3
Glazing	No requirement	No requirement

NOTE –
(1) The *R*-values given in this table are those applicable to the reference building as described in this Standard.
(2) 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 enclosed perimeter with 100 mm drooped foil. Exposed floors will require additional treatment, e.g. office building with open car parking under.
(3) Climate zone boundaries are shown in Appendix A.

Table source: NZS4243

NEW (H1/AS2)

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

Table source: H1/AS2

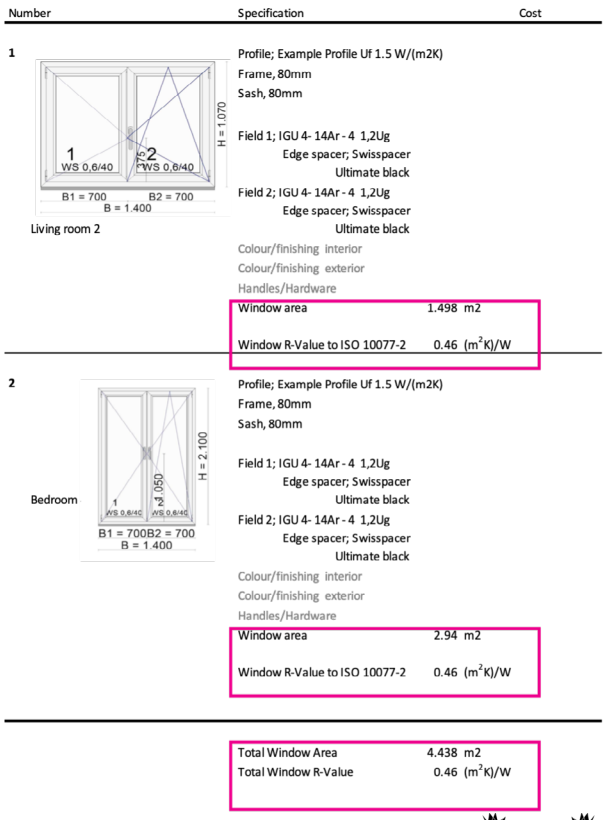
- Overall, the biggest increases for housing are the windows/skylights and the roof
- For commercial, the increases have been substantial for all assemblies and have gone from hardly any requirements to reasonable R-values

Glazing ratios for compliance pathways

- Previous version of H1/AS1 & NZS4214 (housing and small buildings) allowed for the schedule method up to 30% glazing and calculation method up to 40% glazing, but there were exceptions allowing calculation method up to 50%
- New version only allows schedule method up to 30% glazing and calculation up to 40% glazing
- New version now requires further evaluation to use schedule method based on:
  - East/south/west facing glazing must also be max 30%
  - Skylight area must be below greater of 1.5m2 or 1.5% of roof area
  - Opaque door area must be below greater of 6m2 or 6% of total wall area
- Ratios for H1/AS2 & NZS4243 (commercial and large buildings) are unchanged at max 50% for both schedule and calculation method

Window R-value calculation method

- Previous version of H1 referenced tables within NZS 4218 for R-values of typical glazing/joinery types
- Now it's more nuanced and needs to consider glass and framing
- Each window's thermal transmittance (Uw) must be calculated to include the glazing transmittance (Ug) to BS EN 673 and the frame transmittance (Uf) to ISO 10077-2
- R-value of the window (Rw) is calculated as the inverse (1/Uw)
- Average window R-value for the building is then calculated based on area
- **On the right you can see an example calculation**
- Window suppliers can and should supply all of the values and calculations as a WEERS report
- For housing, H1/AS1 Schedule and calculation method allows use of table E1.1.1. for generic glazing/joinery R-values, but these values lack nuance and are not recommended



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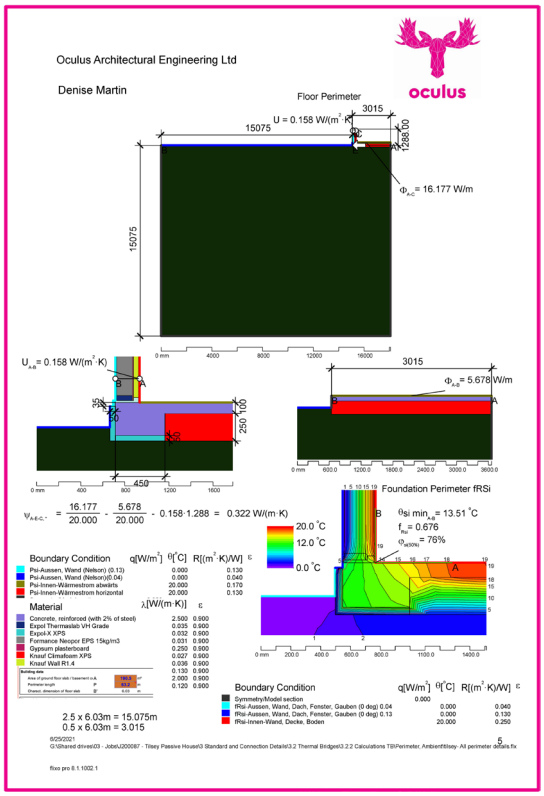
Floor R-value calculation method

- There are now heaps of tables to choose R-values from, which account for:
  - 2 wall types (masonry veneer cladding or not)
  - Slab to perimeter ratio
  - Thickness of wall
- These tables provide compliance, but lack nuance and become increasingly skewed with larger slab to perimeter ratio
- H1/VM1 appendix F allows for a much more accurate calculation of slab R-value based on slab area R-value and slab edge Psi value
- **On the right you can see an example calculation**



Location of calculation methods

- Most calculations and R-values came from NZS4214, NZS4218, and NZS4243
- Now the methods are mostly described within H1 AS1, AS2, VM1, and VM2

Non-envelope items

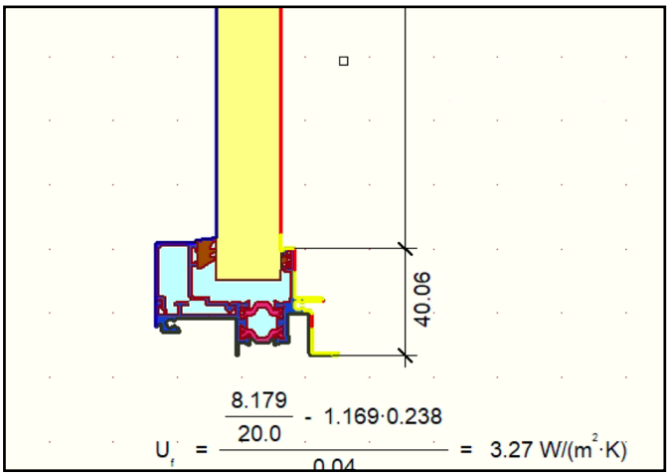
- HVAC for commercial buildings uses H1/VM3
- Artificial lighting for commercial and large buildings must comply with NZS4243.2 section 3.3

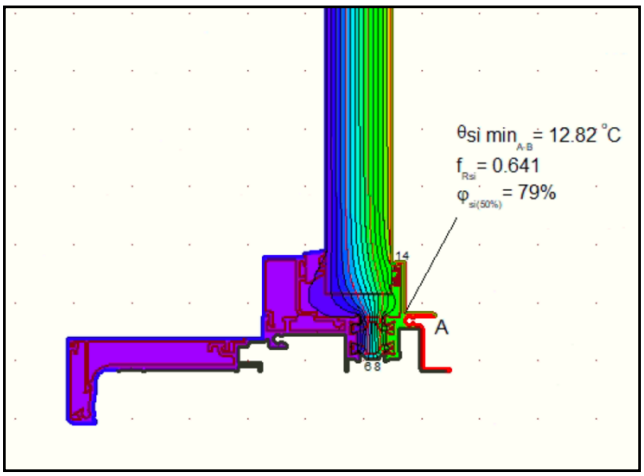
ITEMS THAT STILL NEED TO CHANGE (AND THEY LIKELY WILL WITH UPCOMING H1 UPDATES BETWEEN NOW AND 2026):

Thermal bridging

- Walls, roofs, and floors are calculated per NZS 4214, which takes into account thermal bridging through the main area of the assembly (i.e. studs in walls, joists in floors, and rafters in roofs)
- The following are not accounted for:
  - Thermal bridges at junctions between different assemblies
  - Thermal bridges at corners or transitions within assemblies
  - Interstorey floor edges
  - Window installation details

Window and door systems – Metal with thermal break (aluminium, steel)





Airtightness/Blower door testing

- It is mentioned in section 2.2, but there are no maximums or benchmarks listed, and there is no provision for testing after construction, so improvements will not be expected
- **Below is all that's required by clause H1, currently:**

2.2 Airflow

2.2.1 Control of airflow

2.2.1.1 **Housing, 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.

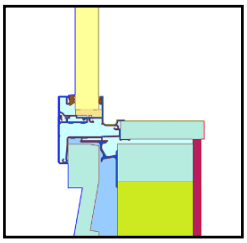
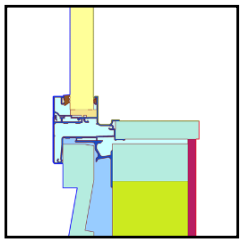
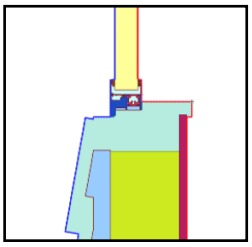
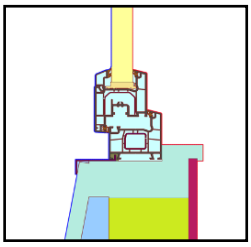
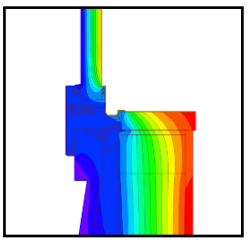
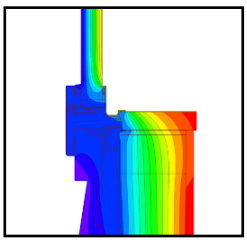
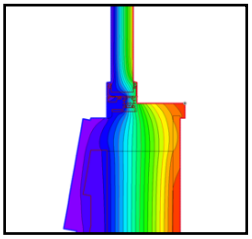
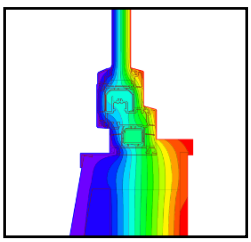
COMMENT:

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.

Table source: H1/AS1

Installation detail of windows

- As mentioned in thermal bridging, window installation details are not accounted for
- Current E2/AS1 window details show windows installed protruding from the wall assembly on a WANZ bar, which allows much more thermal bridging at window perimeter than a recessed detail
- Location of air seals and weather seals also influence thermal bridging, as exterior air can reach further into the building
- Airtightness of window installation detail can also affect energy efficiency as uncontrolled air infiltration/exfiltration carries a great deal of energy

Non - thermally broken frame installed outside	**Thermally broken frame installed outside**	**Thermally broken frame installed tucked in**	**uPVC frame installed inside**
			
			

Shading/ overheating/ cooling load

- It is mentioned in section 2.3, but there are no maximums or benchmarks listed, or any calculation methods required, so it will likely be ignored.
- **On the right is all that is currently required.**
  No requirements, just "measures should include", which will unfortunately be ignored by many designers.

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.

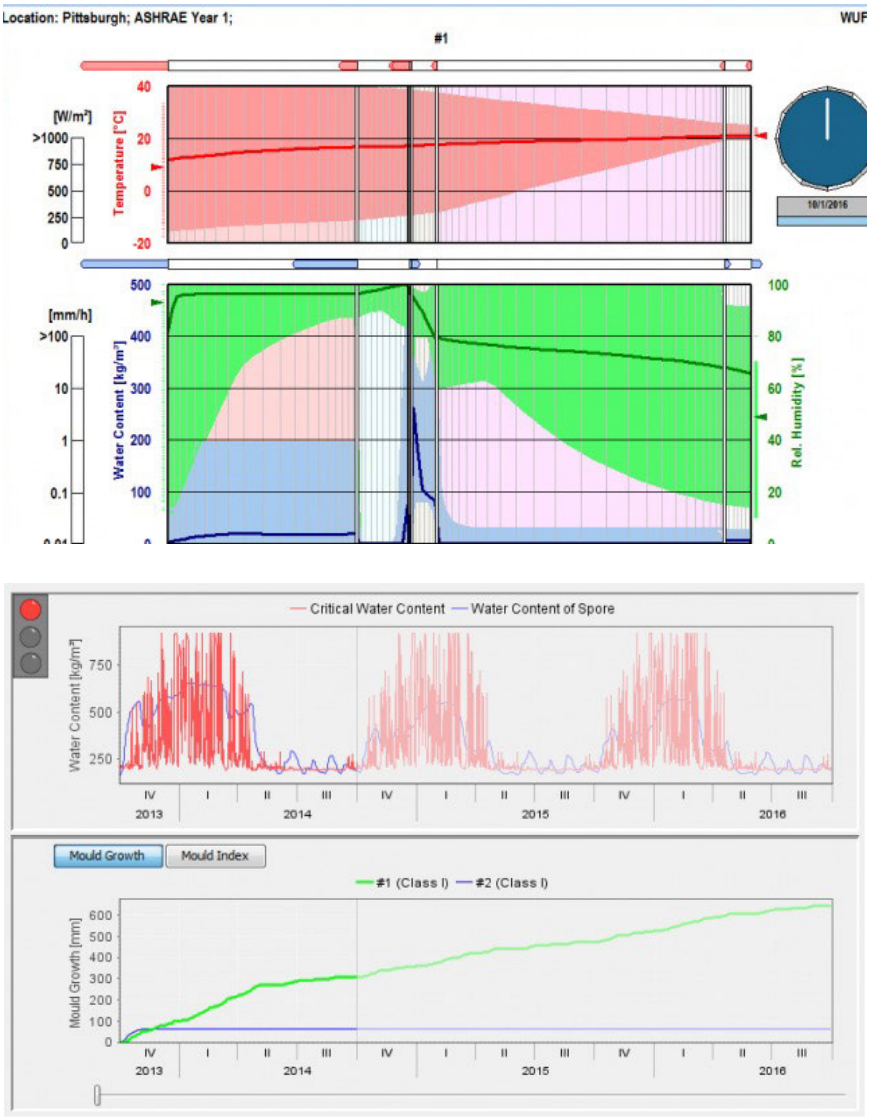
Table source: H1/AS1

Coordination of envelope performance/airtightness and HVAC

- HVAC for commercial buildings is calculated using VM3, but does not easily tie in with energy efficiency and airtightness of envelope
- If airtightness were taken into account, HVAC could be downsized
- HVAC efficiency for housing is not yet factored into H1

Vapour control/interstitial condensation

- This is not mentioned at all in H1
- Higher R-values and thicker assemblies with thicker insulation could lead to interstitial condensation or "dew point issues" if airtightness and vapour control are not analysed
- Better R-value and more insulation keeps the interior warmer, but makes the exterior side of the wall colder. Warm and relatively moist interior air must be prevented from flowing through the wall and condensing
- Vapour flow through wall must be considered for durability
- **Below are examples of WUFI temperature, humidity, water content, and mould growth checks, which are essential to prevent interstitial condensation**



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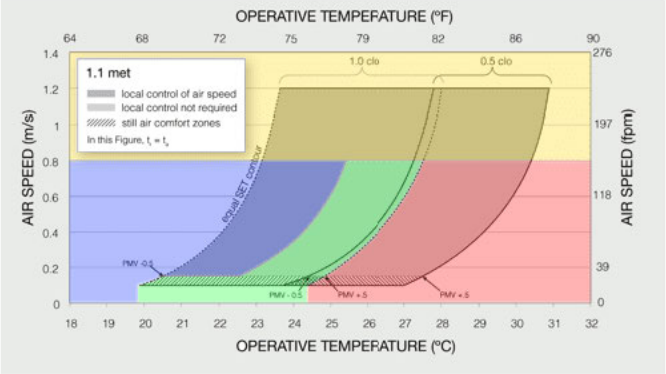
Occupant comfort and interior air quality

- These are not mentioned in H1
- Without specifying min/max temperatures, min/max relative humidity, or min/max CO2 levels, there is no benchmark to achieve and no levels to check
- Specifying comfort levels would lead to better outcomes and would ensure that energy efficiency is met while also maintaining a healthy interior environment rather than achieving efficiency by allowing the interior to overheat or overcool
- **Below is a graph from ASHRAE** (the American Society of Heating, Refrigerating, and Air-Conditioning Engineers) showing the relationship between temperature, humidity, and airspeed and how they impact on indoor comfort levels:



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Storage and distribution of domestic hot water

- Hot water fixtures are mentioned and must have a certain energy efficiency per the relevant NZ standard, but this is only the production of hot water
- Tanks and pipes lose heat, and without specifying a certain amount of insulation these losses can add up to a lot of wasted energy

Heat pump water heater

Image source

Inline water heaters

Image source

Image source

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