



**MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT**
HĪKINA WHAKATUTUKI

Acceptable Solutions and Verification Methods

For New Zealand Building Code Clause
H1 Energy Efficiency



Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

A person who complies with a Verification Method or Acceptable Solution will be treated as having complied with the provisions of the Building Code to which the Verification Method or Acceptable Solution relates. However, using a Verification Method or Acceptable Solution is only one method of complying with the Building Code. There may be alternative ways to comply.

Users should make themselves familiar with the preface to the New Zealand Building Code Handbook, which describes the status of Verification Methods and Acceptable Solutions and explains alternative methods of achieving compliance.

Defined words (italicised in the text) and classified uses are explained in Clauses A1 and A2 of the Building Code and in the Definitions at the start of this document.

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**Verification Methods and Acceptable Solutions
are available from www.building.govt.nz**

New Zealand Government

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Document Status

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The previous version of this document (Amendment 2) ceases to have effect on 30 May 2017.

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 Verification Method or Acceptable Solution at any time. Up-to-date versions of Verification Methods and Acceptable Solutions are available from www.building.govt.nz

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New Zealand Building Code

Clause H1 Energy Efficiency

The mandatory provisions for building work are contained in the New Zealand Building Code (NZBC), which comprises the First Schedule to the Building Regulations 1992. The relevant NZBC Clause for Energy Efficiency is H1, as amended by:

- Building Amendment Regulations 2000 (SR 2000/119) on 26 June 2000
- Building Amendment Regulations (No 2) 2007 (SR 2007/226) on 13 August 2007
- Building (Building Code: Energy Efficiency of Temperature, Humidity, and Ventilation Systems) Amendment Regulations 2008 (SR 2008/97) on 7 April 2008, and
- Building (Building Code: Energy Efficiency of Domestic Hot Water Systems) Amendment Regulations 2008 (SR 2008/256) on 11 August 2008

Schedule 1	Building Regulations 1992	Reprinted as at 1 February 2009
Clause H1—Energy efficiency provisions		
Provisions		Limits on application
Objective		
H1.1	The objective of this provision is to facilitate efficient use of energy.	Objective H1.1 applies only when the energy is sourced from a <i>network utility operator</i> or a depletable energy resource.
Functional requirement		
H1.2	<i>Buildings</i> must be <i>constructed</i> to achieve an <i>adequate</i> degree of energy efficiency when that energy is used for—	
	(a) modifying temperature, modifying humidity, providing ventilation, or doing all or any of those things; or	Requirement H1.2(a) does not apply to <i>assembly service buildings, industrial buildings, outbuildings, or ancillary buildings</i> .
	(b) providing hot water to <i>sanitary fixtures</i> or <i>sanitary appliances</i> , or both; or	
	(c) providing artificial lighting	Requirement H1.2(c) applies only to <i>commercial buildings</i> and <i>communal non-residential buildings</i> whose floor area is greater than 300 m ² .
Performance		
H1.3.1	The <i>building</i> envelope enclosing spaces where the temperature or humidity (or both) are modified must be constructed to—	
	(a) provide <i>adequate thermal resistance</i> ; and	
	(b) limit uncontrollable airflow.	

Reprinted as at
1 February 2009

Building Regulations 1992

Schedule 1

Provisions

- H1.3.2E** *Buildings* must be constructed to ensure that their *building performance index* does not exceed 1.55.
- H1.3.3** Account must be taken of physical conditions likely to affect energy performance of *buildings*, including—
- (a) the thermal mass of *building elements*; and
 - (b) the building orientation and shape; and
 - (c) the airtightness of the building envelope; and
 - (d) the heat gains from services, processes and occupants; and
 - (e) the local climate; and
 - (f) heat gains from solar radiation.
- H1.3.4** Systems for the heating, storage, or distribution of hot water to and from *sanitary fixtures* or *sanitary appliances* must, having regard to the energy source used,—
- (a) limit the energy lost in the heating process; and
 - (b) be constructed to limit heat losses from storage vessels and from distribution systems; and
 - (c) be constructed to facilitate the efficient use of hot water.
- H1.3.5** Artificial lighting fixtures must—
- (a) be located and sized to limit energy use, consistent with the *intended use* of space; and
 - (b) be fitted with a means to enable light intensities to be reduced, consistent with reduced activity in the space.
- H1.3.6** *HVAC systems* must be located, *constructed*, and installed to—
- (a) limit energy use, consistent with the *intended use* of space; and
 - (b) enable them to be maintained to ensure their use of energy remains limited, consistent with the *intended use* of space.

Limits on application

Performance H1.3.2E applies only to *housing*.

Performance H1.3.4(b) does not apply to individual storage vessels that are greater than 700 litres in capacity.

Performance H1.3.4(c) applies only to *housing*.

Performance H1.3.5 does not apply to lighting provided solely to meet the requirements in clause F6.

Performance H1.3.6 applies only to *commercial buildings*.

New Zealand Building Code

Clause A1 Classified Uses

Reprinted as at
1 February 2009

Building Regulations 1992

Schedule 1

Clause A1 – Classified Uses

1.0 Explanation

1.0.1 For the purposes of this building code *buildings* are classified according to type, under seven categories.

1.0.2 A *building* with a given classified use may have one or more *intended uses* as defined in the Act.

2.0 HOUSING

2.0.1 Applies to *buildings* or use where there is self care and service (internal management). There are three types.

2.0.2 Detached dwellings

Applies to a *building* or use where a group of people live as a single household or family. Examples: a holiday cottage, boarding house accommodating fewer than 6 people, dwelling or hut.

2.0.3 Multi-unit dwelling

Applies to a *building* or use which contains more than one separate household or family. Examples: an attached dwelling, flat or multi-unit apartment.

2.0.4 Group dwelling

Applies to a building or use where groups of people live as one large extended family. Examples: within a commune or marae.

3.0 Communal residential

3.0.1 Applies to *buildings* or use where assistance or care is extended to the principal users. There are two types.

3.0.2 Community service

Applies to a residential *building* or use where limited assistance or care is extended to the *principal users*. Examples: a boarding house, hall of residence, holiday cabin, *backcountry hut*, hostel, hotel, motel, nurse's home, retirement village, time-share accommodation, a work camp, or camping ground.

3.0.3 Community care

Applies to a residential *building* or use where a large degree of assistance or care is extended to the *principal users*. There are two types:

- (a) **Unrestrained**; where the *principal users* are free to come and go. Examples: a hospital, an old people's home or a health camp.
- (b) **Restrained**; where the *principal users* are legally or physically constrained in their movements. Examples: a borstal or drug rehabilitation centre, an old people's home where substantial care is extended, a prison or hospital.

4.0 Communal non-residential

4.0.1 Applies to a *building* or use being a meeting place for people where care and service is provided by people other than the *principal users*. There are two types.

4.0.2 Assembly service

Applies to a *building* or use where limited care and service is provided. Examples: a church, cinema, clubroom, hall, museum, public swimming pool, stadium, theatre, or whare runanga (the assembly house).

4.0.3 Assembly care

Applies to a *building* or use where a large degree of care and service is provided. Examples: an early childhood education and care centre, college, day care institution, centre for handicapped persons, kindergarten, school or university.

5.0 Commercial

5.0.1 Applies to a *building* or use in which any natural resources, goods, services or money are either developed, sold, exchanged or stored. Examples: an amusement park, auction room, bank, car-park, catering facility, coffee bar, computer centre, fire station, funeral parlour, hairdresser, library, office (commercial or government), Police station, post office, public laundry, radio station, restaurant, service station, shop, showroom, storage facility, television station or transport terminal.

6.0 Industrial

6.0.1 Applies to a *building* or use where people use material and physical effort to:

- (a) extract or convert natural resources,
- (b) produce goods or energy from natural or converted resources,
- (c) repair goods, or
- (d) store goods (ensuing from the industrial process).

Examples: an agricultural building, agricultural processing facility, aircraft hanger, factory, power station, sewage treatment works, warehouse or utility.

7.0 Outbuildings

7.0.1 Applies to a *building* or use which may be included within each classified use but are not intended for human habitation, and are accessory to the principal use of associated *buildings*. Examples: a carport, farm *building*, garage, greenhouse, machinery room, private swimming pool, public toilet, or shed.

8.0 Ancillary

8.0.1 Applies to a *building* or use not for human habitation and which may be exempted from some amenity provisions, but which are required to comply with structural and safety-related aspects of the *building code*. Examples: a bridge, derrick, fence, free-standing outdoor fireplace, jetty, mast, path, platform, pylon, retaining wall, tank, tunnel or dam.

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References

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in these Acceptable Solutions and Verification Methods (primary reference documents) must be the editions, along with their specific amendments, listed below. Where these primary reference documents refer to other Standards or documents (secondary reference documents), which in turn may also refer to other Standards or documents, and so on (lower-order reference documents), then the version in effect at the date of publication of these Acceptable Solutions and Verification Methods must be used.

		Where quoted
Standards New Zealand		
NZS 4214: 2006	Methods of determining the total thermal resistance of parts of buildings	VM1 1.1.2, 1.4.1, AS1 1.0.5, 2.3.1
NZS 4218: 2009	Thermal Insulation – Housing and Small Buildings	VM1 1.1.1, 1.1.2 AS1 1.0.5, 1.0.6, 2.1.1, 2.2.2, 4.0.1
NZS 4243:- Part 1: 2007	Energy efficiency – large buildings. Building Thermal Envelope	VM1 1.3.1 AS1 2.2.1, 4.0.1
NZS 4243:- Part 2: 2007	Energy efficiency – large buildings. Lighting	AS1 6.1.1
NZS 4305: 1996	Energy efficiency – domestic type hot water systems	AS1 5.0.1
AS/NZS 4859:- Part 1: 2002	Materials for the thermal insulation of buildings General criteria and technical provisions	AS1 2.3.2
BRANZ LTD		
ALF 3:	The 'Annual Loss Factor' Method. A design tool for energy efficient houses, 3 rd edition (April 2000) Albrecht Stoecklein and Mark Bassett	Definitions
National Institute of Water and Atmospheric Research Ltd (NIWA)		
	Temperature Normals for New Zealand 1961-1990 by A I Tomlinson and J Sansom (ISBN 0478083343)	Definitions

Definitions

This is an abbreviated list of definitions for words or terms particularly relevant to this Compliance Document. The definitions for any other italicised words may be found in the New Zealand Building Code (NZBC) or New Zealand Building Code Handbook.

Note: Classified uses for *buildings*, as described in Clause A1 of the *Building Code*, are printed in SMALL CAPITALS in these documents. Clause A1 is reprinted at the front of this publication.

Adequate means *adequate* to achieve the objectives of the *building code*.

Approved temperature data means the temperature data contained in A I Tomlinson and J Sansom, *Temperature Normals for New Zealand for period 1961 to 1990* (NIWA, ISBN 0478083343).

Building has the meaning given to it by sections 8 and 9 of the *Building Act 2004*.

Building Code means the regulations made under section 400 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 performance index (BPI) in relation to a *building*, means the *heating energy* of the *building* divided by the product of the *heating degrees total* and the sum of the *floor area* and the *total wall area*, and so is calculated in accordance with the following formula:

$$\text{BPI} = \frac{\text{heating energy}}{\text{heating degrees total} \times (\text{floor area} + \text{total wall area})}$$

Construct in relation to a *building*, includes to design, build, erect, prefabricate, and relocate the *building*.

Fixture an article intended to remain permanently attached to and form part of a *building*.

Floor area, in relation to a *building*, means the *floor area* (expressed in square metres) of all interior spaces used for activities normally associated with domestic living.

Heating degrees, in relation to a location and a *heating month*, means the degrees obtained by subtracting from a base temperature of 14°C the mean (calculated using the *approved temperature data*) of the outdoor temperatures at that location during that month.

Heating degrees total, in relation to a location and a year, means whichever is the greater of the following:

- (a) the value of 12 and
- (b) the sum of all the *heating degrees* (calculated using the *approved temperature data*) for all of the *heating months* of the year.

Heating energy, in relation to a *building*, means the energy from a *network utility operator* or a depletable resource (expressed in kilowatt-hours, and calculated using the Building Research Association of New Zealand's *ALF 3, The 'Annual Loss Factor' Method, A design tool for energy efficient houses* (3rd edition, April 2000) or some other method that can be correlated with that manual) needed to maintain the *building* at all times within a year at a constant internal temperature under the following standard conditions:

- (a) a continuous temperature of 20°C throughout the *building*
- (b) an air change rate of 1 change per hour or the actual air leakage rate, whichever is the greater
- (c) a heat emission contribution arising from internal heat sources for any period in the year of 1000 kilowatt-hours for the first 50 m² of *floor area*, and 10 kilowatt-hours for every additional square metre of *floor area*

- (d) no allowance for—
- (i) carpets or
 - (ii) blinds, curtains, or drapes, on windows
- (e) windows to have a shading coefficient of 0.6 (made up of 0.8 for windows and recesses and 0.75 for site shading).

Heating month, in relation to a location, means a month in which a base temperature of 14°C is greater than the mean (calculated using the *approved temperature data*) of the outdoor temperatures at that location during that month.

Household unit

- (a) means a *building* or group of *buildings*, or part of a *building* or group of *buildings*, that is—
- (i) used, or intended to be used, only or mainly for residential purposes; and
 - (ii) occupied, or intended to be occupied, exclusively as the home or residence of not more than 1 household; but
- (b) does not include a hostel, boardinghouse, or other specialised accommodation.

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*.

Intended use in relation to a *building*,—

- (a) includes any or all of the following:
- (i) any reasonably foreseeable occasional use that is not incompatible with the *intended use*:
 - (ii) normal maintenance:
 - (iii) activities undertaken in response to *fire* or any other reasonably foreseeable emergency; but
- (b) does not include any other maintenance and repairs or rebuilding.

Network utility operator means a *person* who—

- (a) undertakes or proposes to undertake the distribution or transmission by pipeline of natural or manufactured gas, petroleum, biofuel, or geothermal energy; or
- (b) operates or proposes to operate a network for the purposes of—
 - (i) telecommunications as defined in section 5 of the Telecommunications Act 2001; or
 - (ii) radiocommunications as defined in section 2(1) of the Radiocommunications Act 1989; or
- (c) is an electricity operator or electricity distributor as defined in section 2 of the Electricity Act 1992 for the purpose of line function services as defined in that section; or
- (d) undertakes or proposes to undertake the distribution of water for supply (including irrigation); or
- (e) undertakes or proposes to undertake a drainage or sewerage system

Person includes—

- (a) the Crown; and
- (b) a corporation sole; and
- (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*.

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.

Thermal resistance the resistance to heat flow of a given component of a *building element*. It is equal to the air temperature difference (°C) needed to produce unit heat flux (W/m²) through unit area (m²) under steady conditions. The units are °Cm²/W.

Total thermal resistance The overall air-to-air *thermal resistance* across all components of a *building element* such as a wall, roof or floor.

(This includes the surface resistances which may vary with environmental changes eg 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:

- (a) the *wall area* of the *building*; and
- (b) the area (expressed in square metres) of all vertical glazing in *external walls* of the *building*.

Wall area, in relation to a *building*, means the area (expressed in square metres) of internally-exposed *external walls*, including any door openings, of the *building*.

Wharenui A communal meeting house having a large open *floor area* used for both assembly and sleeping in the traditional Maori manner.

Verification Method H1/VM1

1.0 Building Thermal Envelope

This Verification Method can be used for HOUSING, COMMUNAL RESIDENTIAL, COMMUNAL NON-RESIDENTIAL and COMMERCIAL *buildings*.

1.0.1 For determining the insulation requirements of the *building* envelope, *buildings* other than HOUSING are classified as being either small or large. A small *building* is any *building* with a net lettable area no greater than 300 m². A large *building* is any *building* with a net lettable area greater than 300 m².

Note that NZBC H1.3.1(a) (temperature and humidity control) does not apply to ASSEMBLY SERVICE *buildings*, INDUSTRIAL *buildings*, OUTBUILDINGS, or ANCILLARY BUILDINGS.

1.0.2 In *buildings* containing both INDUSTRIAL and other classifications, the non-industrial portion shall be treated separately according to its classification. For example, in a *building* containing both INDUSTRIAL and COMMERCIAL occupancies, the COMMERCIAL area shall meet the NZBC energy efficiency requirements.

1.0.3 Text boxes headed '**COMMENT:**' occurring throughout this document are for guidance purposes only.

1.1 Modelling of housing and small buildings

1.1.1 The modelling method described in NZS 4218 section 4.3 is a Verification Method for NZBC Clause H1.3.1(a) for the following types of *buildings*:

- a) Housing, regardless of total floor area, and
- b) Small buildings other than housing having a net lettable area no greater than 300 m².

1.1.2 The modelling method described in NZS 4218 section 4.3 is a Verification Method for NZBC Clause H1.3.2E.

1.1.3 Delete clause 4.3.1.

COMMENT:

1. HOUSING includes detached dwellings, multi-unit dwellings such as *buildings* which contain more than one separate household or family, e.g. an apartment *building*, and also group dwellings, e.g. a *whareniui*.
2. The restrictions in clause 4.3.1 of NZS 4218, on when the Modelling Method must be used, do not form part of the requirements in H1/AS1 (i.e. sections 3, 4.1 and 4.2). Clause 4.3.1 of NZS 4218 is deleted from H1/VM1 solely to avoid doubt, and should not read as implying that requirements in H1/VM1 are in any way applicable to H1/AS1.

1.2 Building performance index for housing

1.2.1 Compliance with NZBC Clause H1.3.2E (*Building Performance Index or BPI*) satisfies NZBC Clause H1.3.1(a).

COMMENT:

1. The NZBC has no requirement for the maintenance of interior temperatures except as required by NZBC G5 for old people's homes and early childhood centres. The 20°C stated in the definition of *heating energy* is for calculation purposes only.
2. 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 (greater R-value) than that required to satisfy energy efficiency provisions alone.
3. For *buildings* in alpine areas, there may be benefits in using higher levels of insulation than that required to meet the requirements of NZBC.
4. ALF 3.2, published by BRANZ, calculates the *BPI*. Note that the ALF procedures are intended for detached dwellings and are not suitable for multi-unit dwellings.

1.3 Modelling of large buildings other than housing

1.3.1 The modelling method described in NZS 4243.1 section 4.4 is a Verification Method for NZBC Clause H1.3.1(a) for *buildings* other than HOUSING having a net lettable area greater than 300 m².

COMMENT:

1. If artificial lighting is included when applying the modelling method of NZS 4243.1 section 4.4, there is no need to comply separately with NZS 4243.2 section 3.3 or 3.4.
2. Note the limits on application to NZBC Clause H1.2(a) and H1.2(c).

1.4 Determining thermal resistance

1.4.1 The *thermal resistance (R-values)* of *building elements* may be verified by using NZS 4214.

COMMENT:

1. The BRANZ 'House Insulation Guide' provides thermal resistances of common building elements and is based on calculations from NZS 4214.

Acceptable Solution H1/AS1

1.0 General

1.0.1 This Acceptable Solution can be used for HOUSING, COMMUNAL RESIDENTIAL, COMMUNAL NON-RESIDENTIAL and COMMERCIAL *buildings*.

1.0.2 This Acceptable Solution does not include the use of foil insulation.

1.0.3 For determining the insulation requirements of the *building* envelope, *buildings* other than *housing* are classified as being either small or large. A small *building* is any *building* with a net lettable area no greater than 300 m². A large *building* is any *building* with a net lettable area greater than 300 m².

1.0.4 In *buildings* containing both *industrial* and other classifications, the non-industrial portion shall be treated separately according to its classification. For example, in a *building* containing both *industrial and commercial* occupancies, the *commercial* area shall meet the NZBC energy efficiency requirements.

1.0.5 Text boxes headed '**COMMENT**' occurring throughout this document are for guidance purposes only.

COMMENT:

- Note that NZBC H1.3.1(a) (temperature and air-tightness) does not apply to *assembly service buildings, industrial buildings, outbuildings, or ancillary buildings*.
- NZBC H1.3.5 (artificial lighting) applies to *commercial and communal non-residential buildings* with a net lettable area greater than 300 m².

2.0 Building Thermal Envelope

2.1 Housing and small buildings

2.1.1 *Construction* in accordance with NZS 4218 section 3 and section 4.1 or 4.2 (as modified by Paragraphs 2.1.3 to 2.1.7) satisfies NZBC H1.3.1(a) for *housing* of any size and all *buildings* having a net lettable area no greater than 300 m².

2.1.2 *Construction* in accordance with NZS 4218 sections 3 and section 4.1 or 4.2 (as modified by Paragraphs 2.1.3 to 2.1.7) satisfies NZBC H1.3.2E for *housing* of any size, including multi-unit dwellings.

COMMENT:

- Common walls or common floors/ceilings that separate adjacent conditioned spaces in a multi-unit *building* are not required to form part of the thermal envelope. A single thermal envelope may be used to enclose all the conditioned spaces within the *building*, or multiple thermal envelopes may be used, provided all conditioned spaces are enclosed.
- When the common walls or floors/ceilings are not considered to be part of the thermal envelope, they are not required to achieve the *R-values* specified in NZS 4218. However, the maximum area of glazing (which is a percentage of the *total wall area* of the thermal envelope) will be smaller, due to the lower *total wall area* of the single thermal envelope.

2.1.3 Clause 3.1.2 in NZS 4218 shall be replaced as follows:

"3.1.2 Recessed luminaires shall comply with the Electricity Safety Regulations 2010."

2.1.4 Comment C3.1.2 in NZS 4218 shall be replaced as follows:

"COMMENT: Recessed luminaires that can be safely abutted to, or covered with, insulation must be used in order to comply with the Electricity (Safety) Regulations 2010. NZS 4246 provides good practice guidance on installing insulation around recessed luminaires. Ceiling access hatches often form part of the thermal envelope and therefore should be insulated."

2.1.5 Insert a new paragraph at the end of section 3.2 in NZS 4218, as follows:

"Concrete slab-on-ground floors are deemed to achieve a construction *R-value* of 1.3, unless a higher *R-value* is justified by calculation or physical testing".

COMMENT:

1. The *R-value* of concrete slab-on-ground floors increases as the area:perimeter ratio increases. Large uninsulated slabs (larger than 100 to 150 m²) typically have area:perimeter ratios high enough to result in *R-values* greater than R1.3. Small concrete slabs may not achieve an *R-value* of 1.3 but can be assumed to comply for the purposes of this Acceptable Solution.
2. The construction *R-value* of concrete slab-on-ground floors must be established by calculation or physical testing when the required *R-value* exceeds R1.3 (e.g. floors with embedded heating systems).

2.1.6 Clause 4.2.1 in NZS 4218 shall be replaced as follows:

"The calculation method shall only be used where the glazing area is 50% or less of the total wall area."

2.1.7 After the third sentence of Clause 4.2.7 in NZS 4218, insert a new sentence as follows:

"If A_{Door} is greater than 6 m² and 6% of the total wall area, then in equation 1, A_{Door} shall be set to the difference between A_{Door} and the greater of 6 m² or 6% of the total wall area"

COMMENT:

1. Section 4.2 "Calculation method" of NZS 4218 compares the proposed building with the "reference building" which is insulated in accordance with Tables 2, 3 or 4. This method permits roof, wall, floor and glazing insulation combinations which differ from these Tables, but the building must perform at least as well as the "reference building".
2. 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 (greater *R-value*) than that required to satisfy energy efficiency provisions alone.
3. Tables 3 and 4 in NZS 4218 allow buildings with high thermal mass to have lower *R-values* than buildings with frame construction. This recognises benefits in the thermal performance when thermal mass is used appropriately. To be beneficial thermal mass must be integrated into the building with sound passive solar design.

4. NZS 4246 Energy Efficiency – Installing Bulk Thermal Insulation in Residential Buildings provides guidance to ensure that insulation is installed correctly and will perform as intended.

2.2 Large buildings other than housing

2.2.1 Construction in accordance with:

- NZS 4243.1 section 4.2 or
- NZS 4243.1 section 4.3 or
- NZS 4218 section 3 and 4.1 or
- NZS 4218 section 3 and 4.2

satisfies the requirements of NZBC H1.3.1(a) for the *thermal resistance* of the *building envelope* in large *buildings* other than *housing* having a net lettable area greater than 300 m².

2.3 Determining thermal resistance

2.3.1 Acceptable methods for determining the *thermal resistance (R-values)* of *building elements* are contained in NZS 4214.

2.3.2 Acceptable methods for determining the *thermal resistance (R-values)* of insulation materials are contained in AS/NZ 4859.1.

COMMENT:

The BRANZ House Insulation Guide provides thermal resistances of common building components and is based on calculations from NZS 4214.

3.0 Control of Airflow

3.0.1 To satisfy the requirements of NZBC H1.3.1(b), *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:

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.

4.0 Control of Solar Heat Gain

4.0.1 The requirements of NZBC H1.3.3(f) are satisfied by complying with either NZS 4218 section 3 and section 4.2 or 4.3 for small *buildings*, or NZS 4243.1 section 4.2 or section 4.3 for large *buildings* (see Paragraph 1.0.3 for definitions of small and large *buildings*).

5.0 Hot Water Systems

5.0.1 Hot water systems complying with NZS 4305 satisfy the requirements of NZBC H1.3.4 for the provision of hot water to *sanitary fixtures* and *sanitary appliances*.

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 NZBC.
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.

6.0 Artificial Lighting

6.1 Commercial and Communal Non-Residential Buildings

6.1.1 Artificial lighting energy consumption in COMMERCIAL, COMMUNAL NON-RESIDENTIAL *buildings* having a net lettable area greater than 300 m² shall comply with NZS 4243.2 section 3.3 or section 3.4 to satisfy the requirements of NZBC H1.3.5.

Index H1/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Building

commercial	VM1 1.0, 1.0.2, AS1 1.0.1, 1.0.4, 1.0.5, 6.1.1
communal non-residential	VM1 1.0, AS1 1.0.1, 1.0.5, 6.1.1
communal residential	VM1 1.0, AS1 1.0.1
housing	VM1 1.0, 1.0.1, 1.1.1, 1.1.3, 1.3 AS1 1.0.1, 1.0.3, 2.1.1, 2.1.2, 2.2.1
detached dwellings	VM1 1.1.3, 1.2.1
multi-unit dwellings	VM1 1.1.3, 1.2.1, AS1 2.1.2
group dwellings	VM1 1.1.3
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industrial	VM1 1.0.1, 1.0.2, AS1 1.0.4, 1.0.5
large buildings	VM1 1.0.1, 1.3, AS1 1.0.3, 2.1.5, 2.2.1
small buildings	VM1 1.0.1, 1.1.1, AS1 1.0.3, 2.1, 4.0.1

Building construction

thermal envelope	VM1 1.0, AS1 2.0, 2.1.2
thermal resistance (R-value)	VM1 1.4.1 AS1 2.2.1, 2.3.1, 2.3.2

Energy efficiency provisions

airflow control	AS1 3.0
artificial lighting	VM1 1.3.1, AS1 1.0.5, 6.1.1
building performance index	VM1 1.2.1
hot water systems	AS1 5.0.1
internal moisture	VM1 1.2.1, AS1 2.1.7
solar heat gain	AS1 4.0

