Acceptable Solutions and Verification Methods

For New Zealand Building Code Clause

E3 Internal Moisture
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.

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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

The most recent version of this document (Amendment 7), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 5 November 2020 and supersedes all previous versions of this document.

The previous version of this document (Amendment 6) will cease to have effect on 3 November 2021.

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 E3 Internal Moisture

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

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<td>(a) Safeguard people against illness, injury, or loss of amenity that could result from the accumulation of internal moisture; and</td>
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<td>(b) Free water overflow penetratiing to an adjoining household unit; and</td>
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<td>(c) Damage to building elements being caused by the presence of moisture.</td>
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Provisions

E3.3.4 Wall surfaces adjacent to sanitary fixtures or sanitary appliances must be impervious and easily cleaned.

E3.3.5 Surfaces of building elements likely to be splashed or become contaminated in the course of the intended use of the building, must be impervious and easily cleaned.

E3.3.6 Surfaces of building elements likely to be splashed must be constructed in a way that prevents water splash from penetrating behind linings or into concealed spaces.

Limits on application
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Amend 7 Nov 2020
References

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in this Verification Method and Acceptable Solution (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 this Verification Method and Acceptable Solution must be used.

Standards New Zealand

NZS 4214: 2006 Methods of determining the total thermal resistance of parts of buildings

BS EN 274:- Waste fittings for sanitary appliances
   Part 2: 2002 Test methods

British Standards Institution

Building Research Association of New Zealand

BRANZ House Insulation Guide: 1995

Where quoted

AS1 Definitions, 1.1.2

AS1 2.0.2

AS1 1.1.3
Definitions

This is an abbreviated list of definitions for words or terms particularly relevant to this Verification Method and Acceptable Solution. The definitions for any other italicised words may be found in the New Zealand Building Code Handbook.

**Adequate** 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 and 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.

**Concealed space** Any part of the space within a building that cannot be seen from an occupied space.

**COMMENT:** This term includes any ceiling space, roof space, space under a raised floor (such as computer rooms, floors, or stages), plenums, spaces under a tiered floor, “left-over spaces” created when some structural element or the like has been covered in; small service or duct spaces within the volume of a firecell and the like, but not a protected shaft.

**Construct** in relation to a building, includes to build, erect, prefabricate, and relocate; and construction has a corresponding meaning.

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

**Floor waste** An outlet located at the low point of a graded floor or in a level floor designed to receive accidental or intentional discharges.

**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.

**Household unit**

a) means any 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 one household; but

b) does not include a hostel, boarding house or other specialised accommodation.

**Impervious** That which does not allow the passage of moisture.

**Insulating material** A material that has a thermal conductivity of less than 0.07 W/mK.

**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.

**Person with a disability** means a person who has an impairment or a combination of impairments that limits the extent to which the person can engage in the activities, pursuits, and processes of everyday life, including, without limitation, any of the following:

(a) a physical, sensory, neurological, or intellectual impairment:

(b) a mental illness.

**Plumbing system** Pipes, joints and fittings laid above ground and used for the conveyance of foul water to the foul water drain, and includes vent pipes.
**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*.

**COMMENT:**
Toilets, urinals, bidets, baths, showers, basins, sinks and tubs are examples of common *sanitary fixtures*.

**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 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, e.g. temperature and humidity, but for most purposes can be regarded as having standard values as given in NZS 4214.)
Verification Method E3/VM1

No specific methods have been adopted for verifying compliance with the Performance of NZBC E3.
1.0 Prevention of Fungal Growth

1.0.1 Fungal growth (mildew) is avoided by minimising internal condensation. Condensation is avoided or reduced by maintaining the correct balance between interior temperature and ventilation. Insulation assists in maintaining interior temperatures at a suitable level.

1.0.2 The New Zealand Building Code does not specify minimum heating requirements except for old people's homes and early childhood centres. Occupants will determine their own methods and levels of heating. Typically it is necessary and sufficient, for condensation control in winter, to keep interior temperatures 5°C to 7°C above exterior temperatures in a ventilated space.

1.1 Thermal resistance

1.1.1 R-values for walls, roofs and ceilings shall be no less than:

a) For light timber frame wall or other framed wall constructions with cavities, 1.5.

b) For single skin normal weight masonry based wall construction without a cavity, 0.6.

c) For solid timber wall systems no less than 60 mm thick, 0.6.

d) For roof or ceilings of any construction, 1.5.

1.1.2 R-values shall be determined using the methods in NZS 4214. Laboratory test samples shall be truly representative of the wall, roof or ceiling system, including any provision for reducing thermal bridging.

1.1.3 Materials and installation

The BRANZ House Insulation Guide provides examples of acceptable wall, roof and ceiling constructions to satisfy the requirements of Paragraph 1.1.1.

COMMENT:
The BRANZ House Insulation Guide gives constructions for a range of R-values. It is essential to choose the correct R-values from these shown in the tables in order to comply with this Acceptable Solution.

1.1.4 For the construction to be acceptable:

a) Building paper shall extend from the upper side of the top plate to the underside of the bearers or wall plates supporting the ground floor joists.

b) Deleted

c) There shall be no perimeter gaps between the insulating material and the framing members.

d) Where steel framing is used in Housing and Communical Residential building uses a thermal break with a minimum R-value of 0.25 m²°C/W shall be provided at the outside face of each steel framing member. Expanded polystyrene (EPS) strips, 10 mm thick provide an R-value of 0.25 m²°C/W. Other materials or methods may be used to provide the minimum R-value of 0.25 m²°C/W.

e) If foil insulation is used it must be placed on the lining side of studs, not the cladding side.

COMMENT:
1. Frame construction with 10 mm plaster board linings and a single layer of foil has an R-value of approximately 0.9 and does not satisfy Paragraph 1.1.1.

2. Surface condensation can be a problem where vapour barriers are needed for buildings enclosing very warm or wet areas such as spa pools, saunas and swimming pools, or buildings in a very cold environment such as ski lodges and mountain huts. These situations are not covered by this Acceptable Solution and require specific design.

3. Thermal breaks should be specifically designed for steel framed buildings that are not covered by Building Code Clause E3 Internal Moisture. That is where:
   i) the building use is not Housing or Communal Residential, and
   ii) the moisture load is greater than in Housing, and the building use has high occupant moisture load (eg, schools), and
   iii) there is a temperature differential from inside to outside that is sufficient to cause condensation on steel framing members.

1.1.5 Insulation for energy efficiency

Insulation satisfying the energy efficiency requirements of NZBC H1 cannot automatically be assumed to meet the R-values for internal moisture requirements of Paragraph 1.1.1.
COMMENT:
Insulation to prevent condensation relates to thermal resistance of the building element in question (e.g. wall or roof). Insulation for energy efficiency relates to the building as a whole, and the requirement can be met in different ways. It is possible, for example, to obtain sufficient energy efficiency in a building by heavily insulating the floor and ceiling with no insulation in the walls. This would not satisfy the requirement for this acceptable solution because there would not be sufficient insulation in the walls to minimise condensation.

1.2 Ventilation
1.2.1 Ventilation shall be provided naturally or mechanically to comply with G4/AS1.

1.3 Condensation control
1.3.1 In buildings classified as Housing or Communal residential which are not air conditioned, metal-framed windows with single glazing shall be constructed with a means of condensation disposal. An acceptable method is the provision of a condensation collection channel which, either discharges the water to the outside or is of sufficient capacity to hold the water, without overflowing, until it evaporates.

1.3.2 Condensation channels shall have closed ends and no openings which permit ponded water to contact building elements susceptible to moisture. Where provision is made for drainage to the outside, drainage outlets shall have the capacity to expel all condensed water and shall have means of preventing condensed water from being blown back by wind pressure.

1.3.3 Condensation channels and drainage outlets shall be able to be cleaned. The minimum clear dimensions of collection channels shall be 10 mm wide by 5 mm deep.

COMMENT:
1. Condensation can be reduced by good ventilation. Windows incorporating passive ventilators, particularly those with full perimeter ventilation, are effective in reducing condensation.
2. While a 10 mm condensation channel width is normally adequate to prevent overflowing, it is awkward to clean adequately. A more practical width is 20 mm.

2.0 Overflow

2.0.1 If a sanitary fixture is located where accidental overflow could damage an adjoining household unit or other property, then either:

a) Containment and floor wastes that meet the requirements of Paragraphs 2.1.1 and 2.2.1 shall be provided, or

b) The exemption for household kitchen sinks and laundry tubs with integrated overflows that meet Paragraph 2.0.2 shall apply.

2.0.2 Household kitchen sinks and laundry tubs that have an integrated overflow with a minimum flow rate of 0.25 l/s do not require additional overflow provision such as containment and a floor waste where:

a) The maximum flow rate from the inlet tap(s) is less than the flow rate of the integrated overflow for that sink or tub, or

b) The water supplies to the inlet tap(s) for that sink or tub are fitted with proprietary flow restrictors (such as cartridges) to limit the tap flow rate to less than the flow rate of the integrated overflow for the sink or tub.

Integrated overflows shall be tested and verified in accordance with BS EN 274 to determine their minimum flow rates.

COMMENT
Specifiers applying for building consents will need to demonstrate that integrated overflows have been tested and verified as meeting the minimum flow rate in accordance with BS EN 274. Manufacturers may be able to supply this information.

2.0.2.1 For multiple tubs or sinks installed in a kitchen or laundry and served by a single tap, either:

a) Each individual tub and sink shall have its own integrated overflow complying with Paragraph 2.0.2, or

b) A secondary tub or sink shall have a controlled overflow path into a main tub or sink which has an integrated overflow complying with Paragraph 2.0.2.
2.0.3 Containment and floor wastes are not required solely to account for the failure of a sanitary appliance component or hose, where the flexible discharge hose from the sanitary appliance can be directly connected into the plumbing system either by mechanical fastening to a fixture trap spigot, or by direct insertion into an open standpipe or a laundry tub waste hose connection port.

COMMENT:
This Acceptable Solution does not regard the failure of a component (e.g. a washer) or hose (e.g. burst hose) of a sanitary appliance as an accidental overflow.

Compliance of the spigot, open standpipe, or laundry tub waste hose connection port with NZBC Clause G13 Foul water is outside the scope of this Acceptable Solution.

2.1 Containment

2.1.1 Containment provided to satisfy Paragraph 2.0.1 a) may be achieved by using impervious floor coverings which:

a) Are continuous and coved or joints sealed where they meet the wall (See Figure 1), and

b) Extend to the doorway and all walls of the room, or to at least 1.5 m from all sanitary fixtures and sanitary appliances in open-plan rooms.

COMMENT:
Additional protection to adjoining household units and other property may be provided by the use of construction details that provide more complete prevention of the passage of overflow water at doorways and open plan areas. However, doing so will exceed the requirements of this Acceptable Solution.

2.2 Floor wastes

2.2.1 Floor wastes provided to satisfy Paragraph 2.0.1 b) shall comply with NZBC Clause G13. A graded floor is not essential in this situation.

COMMENT
Acceptable Solutions G13/AS1 and G13/AS3 contain provisions for floor wastes that comply with NZBC Clause G13 Foul water.
3.0 Watersplash

3.1 Lining materials

3.1.1 Floors
The following finishes to floors satisfy the performance for impervious and easily cleaned surfaces in spaces containing sanitary fixtures or sanitary appliances. In open plan spaces this surface shall extend at least 1.5 m from all sanitary fixtures and sanitary appliances:

**COMMENT**
The requirement for impervious and easily cleaned floor surfaces applies to spaces such as kitchens, bathrooms, laundries and toilet facilities. This requirement applies regardless of whether containment is required by Paragraph 2.0.

a) Integrally waterproof sheet material (e.g. polyvinylchloride) with sealed joints and sealed or coved at edges where watersplash may occur.

b) Ceramic or stone tiles having 6% maximum water absorption, waterproof grouted joints, and bedded with an adhesive specified by the tile manufacturer as being suitable for the tiles, substrate material and the environment of use. Edges of the tiled area where watersplash may occur must be sealed or coved, and tiles must be laid on a continuous impervious substrate or a membrane specified by the manufacturer as being suitable for the tiles, substrate material and the environment of use.

c) A slab-on-grade concrete floor having a steel trowel or polished finish, sealed at edges where watersplash may occur, when used in a domestic laundry within a garage, or in a building that contains only sanitary facilities.

**COMMENT:**
Other floor finishes may also be capable of satisfying the performance for impervious and easily cleaned, if installed in a manner that prevents gaps or cracks within the finish and at any parts of its perimeter that are exposed to watersplash, and/or if the surface is sealed with a suitable durable coating. However such other finishes are outside the scope of this Acceptable Solution.

3.1.2 Walls
The following linings and finishes to walls satisfy the performance for impervious and easily cleaned surfaces in areas adjacent to sanitary fixtures or sanitary appliances, or otherwise likely to be splashed in the course of the intended use of the building:

a) Integrally waterproof sheet material (e.g. polyvinylchloride) with sealed joints.

b) Ceramic or stone tiles having 6% maximum water absorption, waterproof grouted joints, and bedded with an adhesive specified by the tile manufacturer as being suitable for the tiles, substrate material and the environment of use.

c) Sheet linings finished with a semi-gloss or gloss coating or a hard-wearing low-sheen latex paint containing mould inhibitors.

d) Water resistant sheet linings finished with decorative high pressure laminate or factory applied polyurethane or resin, and installed with impervious joints (see Figure 2).

**COMMENT:**
Other wall linings and finishes may also be capable of satisfying the performance for impervious and easily cleaned, if installed in a manner that prevents gaps or cracks within the finish and at any parts of its perimeter that are exposed to water splash, and/or if the surface is sealed with a suitable durable coating. However such other finishes are outside the scope of this Acceptable Solution.

3.2 Joints

3.2.1 Joints between sanitary fixtures and impervious floor finishes
Where sanitary fixtures abut impervious floor finishes, the base of the fixture must be sealed to the impervious floor finish.
3.2.2 Joints between fixtures and wall linings
Where baths, basins, tubs or sinks abut impervious linings, the joint between fixture and lining shall be sealed to prevent water penetration to concealed spaces or behind linings. (See Figures 3 (a) and (b).)

3.3 Showers and urinals
3.3.1 Showers
All shower spaces shall have impervious floors or floor finishes and impervious wall linings or wall finishes.

The impervious shower wall linings or wall finishes shall extend up the wall to the higher of 1800 mm above the shower floor, or 50 mm above the shower rose.

The top edge of impervious shower wall linings or wall finishes shall be sealed to the wall behind (or to the ceiling if full height) to prevent condensation penetrating behind the shower wall linings or wall finishes.

Penetrations in the shower wall for tapware, mixers, roses etc. shall be waterproofed with a proprietary flange system or with sealant (refer Figure 6), installed in a way that allows easy access when replacing washers, ceramic discs and o-rings.

COMMENT
Some tapware manufacturers have specific product installation requirements that are additional to the use of sealant around the tapware penetration.

3.3.1.1 Shower floor materials
Within shower enclosures, or within a 1500 mm horizontal radius from the shower rose where there is no shower enclosure such as a wall, screen, door or curtain (see Figure 5), one of the following materials or finishes to floors shall be used:

a) Plastic or stainless steel shower trays
b) Integrally waterproof sheet material (e.g. polyvinylchloride) with sealed joints, and coved at edges
c) Ceramic or stone tiles having 6% maximum water absorption, waterproof grouted joints, and bedded with an adhesive specified by the tile manufacturer as being suitable for the tiles, substrate material and the environment of use. The shower must also have tiled walls (see Paragraph 3.3.1.2 c)), and tiles must be laid either:
i) Within a shower tray specified by the manufacturer as being suitable for the tiles; or
Figure 3: Baths, Basins, Tubs and Sinks, Joints against Wall Linings
Paragraph 3.2.2

(a) Junctions of bath and wall
(b) Tub, sink and basin
ii) On a membrane specified by the manufacturer as being suitable for the tiles, substrate material and the environment of use.

### 3.3.1.2 Shower wall lining and finish materials

Within shower enclosures or within a 1500 mm horizontal radius from the shower rose where there is no shower enclosure such as a wall, screen, door or curtain (see Figure 5), one of the following linings and finishes to walls shall be used:

a) Plastic shower wall liners, either as a single component without joints, or installed with waterproof joints

b) Integrally waterproof sheet material (e.g. polyvinylchloride) with sealed joints.

c) Ceramic or stone tiles having 6% maximum water absorption, waterproof grouted joints, and bedded with an adhesive specified by the tile manufacturer as being suitable for the tiles, substrate material and the environment of use. Tiles must be laid on a membrane specified by the manufacturer as being suitable for the tiles, substrate material and the environment of use.

d) Water resistant sheet linings finished with decorative high pressure laminate or factory applied polyurethane or resin, and installed with impervious joints (see Figure 2).

### 3.3.1.3 Showers over baths

For showers over baths, the bath rim must have a minimum height of 15 mm, and the shower wall lining shall lap over and be sealed to the rim of the bath. Either the bath rim must be recessed into the wall framing, or the shower lining must be packed out to suit the rim. A bath mould or flashing shall not be used for showers over baths.

#### COMMENT

Notches to recess the rim of a bath into the wall framing may require the use of over-sized framing members to ensure that the notches do not detrimentally affect structural performance of the wall.

### 3.3.2 Shower enclosures

Shower floors and bases may be constructed with or without upstands, and where installed for use by people with disabilities shall have level thresholds.

#### 3.3.2.1 When enclosures, such as walls, screens, doors or curtains are used they shall be continuous from floor level or top of upstand to 1800 mm minimum above floor level and not less than 50 mm above the shower rose.

#### 3.3.2.2 Where shower trays are used, the junction between tray and wall linings shall be constructed in accordance with Figure 4 (a) or (b).

#### 3.3.2.3 Where the shower floor has no upstand or where a wall, screen, door or curtain is omitted, the floor shall have a fall of no less than 1:50 towards the floor waste. The fall shall apply to the floor area within a radius of 1500 mm taken from a point vertically below the shower rose, or from any wall within that radius. (See Figure 5.)

### 3.3.3 Urinals

Impervious wall shall extend horizontally at least 300 mm beyond each side of the urinal and vertically from floor level to a height of 1500 mm.
Figure 4: Shower Trays
Paragraphs 3.3.1 and 3.3.3

(a) Stainless steel shower tray

(b) Moulded plastic shower tray

(c) Tiled shower tray

Figure 5: Wall and Floor Coverings to Unenclosed Showers
Paragraphs 3.3.1 and 3.3.5

(a) Plan

(b) Section
Figure 6: Examples for waterproofing through shower walls
Paragraph 3.3.1

(a) Shower head or flexible hose connection using sealant

(b) Shower mixer using proprietary system (example only)

(c) Shower mixer using sealant

Amend 7
Nov 2020
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All references to Verification Methods and Acceptable Solutions are preceded by VM or AS respectively.

Condensation channels ........................................ AS1 1.3
Energy efficiency .................................................. AS1 1.1.5

**Internal moisture**
- condensation .................................................. AS1 1.0.1, 1.1.5, 1.3
- fungal growth .................................................. AS1 1.0.1

Overflow .......................................................... AS1 2.0
- containment ..................................................... AS1 2.0.1, 2.0.2, 2.0.3, 2.1, Figure 1
- floor wastes .................................................... AS1 2.0.1, 2.0.2, 2.0.3, 2.2

People with disabilities ........................................ AS1 3.3.2

Steel framing ...................................................... AS1 1.1.4 d)

Thermal break ..................................................... AS1 1.1.4 d)

Thermal resistance, materials and installation .............. AS1 1.1

Ventilation ........................................................ AS1 1.0.1, 1.2

Watersplash ........................................................ AS1 3.0
- basins ............................................................ AS1 3.2.2, Figure 3
- baths .............................................................. AS1 3.2.2, Figure 3
- joints in linings ............................................... AS1 3.2, Figure 2
- lining materials ............................................... AS1 3.1, Figure 1
- sinks .............................................................. AS1 3.2.2, Figure 3
- showers .......................................................... AS1 3.3.1, 3.3.2, Figures 4, 5 and 6
- tubs ............................................................... AS1 3.2.2, Figure 3
- urinals ............................................................. AS1 3.3.3

Windows ............................................................ AS1 1.3.1