Status of Approved Documents

Approved Documents are prepared by the Building Industry Authority in accordance with section 49 of the Building Act 1991. They are non-mandatory guidance documents offering only one method of compliance with specific performance criteria of the New Zealand Building Code.

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

Classified uses and defined words which are italicised in the text are explained in clauses A1 and A2 of the New Zealand Building Code.

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Note:
Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

Document Status
The most recent version of this document, as detailed in the Document History, is approved by the Building Industry Authority. It is effective from 9 February 2004 and supersedes all previous versions of this document.

New Zealand Building Code Clause E2
External Moisture

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

Clause E2—EXTERNAL MOISTURE

Provisions

OBJECTIVE
E2.1 The objective of this provision is to safeguard people from illness or injury which could result from external moisture entering the building.

FUNCTIONAL REQUIREMENT
E2.2 Buildings shall be constructed to provide adequate resistance to penetration by, and the accumulation of, moisture from the outside.

PERFORMANCE
E2.3.1 Roofs shall shed precipitated moisture. In locations subject to snowfalls, roofs shall also shed melted snow.
E2.3.2 Roofs and exterior walls shall prevent the penetration of water that could cause undue dampness, or damage to building elements.
E2.3.3 Walls, floors and structural elements in contact with the ground shall not absorb or transmit moisture in quantities that could cause undue dampness, or damage to building elements.
E2.3.4 Building elements susceptible to damage shall be protected from the adverse effects of moisture entering the space below suspended floors.
E2.3.5 Concealed spaces and cavities in buildings shall be constructed in a way which prevents external moisture being transferred and causing condensation and the degradation of building elements.
E2.3.6 Excess moisture present at the completion of construction, shall be capable of being dissipated without permanent damage to building elements.

Limits on application

Requirement E2.2 shall not apply to buildings in which moisture from outside would result in effects which are no more harmful than those likely to arise indoors during normal use.
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# References

For the purposes of New Zealand Building Code compliance, acceptable reference documents include only the quoted edition and specific amendments as listed below. Dates in brackets indicate that the Standard was reviewed and reissued without change that year.

## Standards New Zealand

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**Notes:**

- *Amend:* Updates to standards.
- *Corrigendum:* Corrective changes to standards.
British Standards Institution

BSCP 143:-
Part 5: 1964 Zinc
Part 12: 1970 Copper. Metric units
Part 15: 1973 Aluminium. Metric units
   (1986) Amend: 4473
BS 1521: 1972 Specification for waterproof building papers
   Amend: 3519
BS 3137: 1972 Methods for determining the bursting strength
   (1995) of paper and board
BS 6915: 1988 Specification for design and construction of fully
   supported lead sheet roof and wall coverings
BS 6925: 1988 Specification for mastic asphalt for building and
civil engineering (limestone aggregate)

Standards Australia

AS 2050: 1995 Fixing of roofing tiles
AS/NZS 2269: 1994 Plywood – structural
AS/NZS 4284: 1995 Testing of building façades

American Society for Testing and Materials

ASTM E96: 1992 Test methods for water vapour transmission
   of materials

Building Research Association of New Zealand

   and laying. Appendix 1

New Zealand Forest Research Institute

Measurement of moisture content of assembled timber framing: 1993

Where quoted

AS1 Table 2
AS1 Table 2
AS1 Table 2
AS1 Table 2, 5.1.3 a)
AS1 2.3.5 b)
AS1 2.5.3
AS1 Table 2

VM1 1.3.1
VM1 1.1.1, 1.2.1
AS1 1.4.1 c)
AS1 6.0.2 d)
AS1 6.0.2 a)
Definitions

This is an abbreviated list of definitions for words or terms particularly relevant to this Approved Document. 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 ascribed to it by the Building Act 1991.

**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.

**Cladding** The exterior weather-resistant surface of a building.

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

**Damp-proof course (DPC)** A narrow strip (generally up to 300 mm wide) of durable vapour barrier placed between building elements to prevent the passage of moisture from one element to another.

**Damp-proof membrane (DPM)** A sheet material, coating or vapour barrier, having a low water vapour transmission, and used to prevent water and water vapour movement through concrete in contact with the ground. (Also known as a concrete underlay.)

**Dra** A pipe normally laid below ground level including fittings and equipment and intended to convey foul water or surface water to an outfall.

**Durable** Resistant to wear and decay.

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

**Vapour barrier** Sheet material or coating having a low water-vapour transmission, and used to minimise water-vapour penetration in buildings. (Vapour barriers are sometimes referred to as damp-proof membranes.)

**Weatherboards** Any overlapping strip cladding. It may be fixed either horizontally or vertically.
Verification Method E2/VM1

1.0 Weathertightness

1.1 Domestic buildings windows, doors and cladding systems

1.1.1 The weathertightness test of AS/NZS 4284 (commonly called the SIROWET test) is a verification method for determining compliance with NZBC E2.3.2 of windows, doors and cladding systems for domestic buildings.

1.1.2 The site wind exposure zone and building height for both tests shall be as given in NZS 3604.

1.2 Commercial buildings windows, doors and cladding systems

1.2.1 The weathertightness test of AS/NZS 4284 (commonly called the SIROWET test) is a verification method for determining compliance with NZBC E2.3.2 of windows, doors and cladding systems for commercial buildings.

1.2.2 For buildings up to three stories the design wind pressure shall be appropriate for the site wind exposure zone and building height as given in NZS 3604.

For buildings over three stories and where NZS 3604 does not apply the design wind pressure shall be determined from NZS 4203.

1.3 Pitched roofing systems over a ventilated roof space of 15° pitch or more

1.3.1 Appendix C of AS 2050 provides a verification method for determining compliance with NZBC E2.3.2 of any tiled roofing system of 15° pitch or more above a roof space (i.e. not a skillion roof). Compliance is based on comparison of performance with a control roofing system described in the Standard. Compliance is achieved where the water penetration is less than or equal to the control sample. This test is also a verification method for other ventilated roofing systems or skylights with a pitch of 15° or more above a roof space.

1.4 Skillion roofs and commercial and industrial roofing

1.4.1 No specific method has been adopted for verifying compliance of skillion roofs or commercial or industrial roofing with NZBC E2.3.2.
Acceptable Solution E2/AS1

1.0 Roofs

1.0.1 Roofs shall have weatherproof cladding with adequate pitch and be constructed to prevent or control condensation in the roof space.

1.0.2 Membrane claddings shall have sealed waterproof joints. Claddings of profiled sheet material or tiles shall have joints which are waterproof or are constructed to drain any penetrating moisture to the outside.

1.0.3 All roof claddings, except those described in Paragraph 1.0.4, shall have an underlay complying with Paragraph 1.4.

1.0.4 Roof claddings for which underlays are not required are:

a) Membrane claddings, and

b) Concrete or clay interlocking tiles on a roof which:
   i) is not a skillion roof, and
   ii) is not located in a very high wind zone, as defined in NZS 3604, and
   iii) has a pitch of no less than 17°.

1.1 Pitch

1.1.1 The roof pitch shall be no less than the greater of:

   a) That given in Table 1, or

   b) That recommended by the manufacturer.

1.2 Provisions for snow

1.2.1 Specific design for preventing the ingress of snow melt water is required when:

   a) The open ground snow load \( S_0 \) as defined in NZS 4203, exceeds 1.0 kPa and the roof angle is less than 70°, or

   b) The open ground snow load \( S_0 \) as defined in NZS 4203, exceeds 0.4 kPa and the roof is constructed in a way which is likely to cause a build up of snow (internal gutters or parapets are an example).

1.3 Roof claddings

1.3.1 Roof cladding material shall comply with the relevant Standard in Table 2.

1.3.2 Roof cladding shall be installed in accordance with the relevant Standard in Table 2 or in accordance with the manufacturer’s instructions.

COMMENT:
Serious roof leaks can result from thermal movement in roof claddings. Particular attention should be applied to installing appropriate fixings, flashings and laps to avoid such problems.

1.3.3 For metal profile claddings for which installation instructions are not available, flashings and stopends shall comply with Figure 1.

COMMENT:
It is important to ensure that “proven performance” relates to the appropriate site exposure conditions. Verification method E2/VM1 is a suitable method for determining the adequacy of a roof cladding system.

1.3.4 Installation methods shall avoid creating corrosive situations arising from electrolytic action.

COMMENT:
1. Severe corrosion can be caused by having dissimilar materials in contact or from rainwater run-off from one material to another. This can be avoided by the careful selection of materials and the provision of suitable protective finishes, e.g. unpainted galvanised steel is corroded by run-off from pre-painted metal, aluminium, zinc/aluminium, plastics and glass.


1.3.5 Section 11 of NZS 3604 lists acceptable roofing materials. This Standard however does not give full information on fixings, substrate, and weatherproofing of joints and junctions, which need to be submitted as part of the building consent process.
### Table 1: Roof Pitch

<table>
<thead>
<tr>
<th>Material</th>
<th>Pitch (no less than) (note 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Corrugated and low profile metal sheet with profile height less than 20 mm:</strong></td>
<td></td>
</tr>
<tr>
<td>Long run steel or aluminium</td>
<td>8°</td>
</tr>
<tr>
<td>End lapped steel or aluminium</td>
<td>10°</td>
</tr>
<tr>
<td><strong>Metal decking and trough sections:</strong></td>
<td></td>
</tr>
<tr>
<td>i) Trapezoidal symmetrical profiles with rib heights between 20 mm and 35 mm</td>
<td>4°</td>
</tr>
<tr>
<td>ii) Trapezoidal asymmetrical profiles with rib heights between 20 mm and 35 mm</td>
<td>3°</td>
</tr>
<tr>
<td>iii) Trapezoidal symmetrical and asymmetrical profiles with rib heights between 36 mm and 60 mm</td>
<td>3°</td>
</tr>
<tr>
<td>iv) Concealed trough section profiles with rib heights:</td>
<td></td>
</tr>
<tr>
<td>Less than 30 mm</td>
<td>8°</td>
</tr>
<tr>
<td>30 mm or greater</td>
<td>3°</td>
</tr>
<tr>
<td><strong>Flat metal sheet fully supported</strong></td>
<td>3°</td>
</tr>
<tr>
<td><strong>Metal tile:</strong></td>
<td></td>
</tr>
<tr>
<td>Long run</td>
<td>10°</td>
</tr>
<tr>
<td>Lapped</td>
<td>12°</td>
</tr>
<tr>
<td><strong>Thin stone slate</strong></td>
<td>20°</td>
</tr>
<tr>
<td><strong>Timber shingle</strong></td>
<td>14°</td>
</tr>
<tr>
<td><strong>Cellulose-cement:</strong></td>
<td></td>
</tr>
<tr>
<td>Corrugated</td>
<td>7°</td>
</tr>
<tr>
<td>Slates</td>
<td>17.5°</td>
</tr>
<tr>
<td>Shingles</td>
<td>20°</td>
</tr>
<tr>
<td>Shakes</td>
<td>25°</td>
</tr>
<tr>
<td><strong>Membrane (e.g. butyl rubber)</strong></td>
<td>1.5°</td>
</tr>
<tr>
<td><strong>Bitumen strip slate</strong></td>
<td>17.5°</td>
</tr>
<tr>
<td><strong>Concrete tile</strong></td>
<td>12.5°</td>
</tr>
</tbody>
</table>

**Note:**
1. These pitches may need to be increased in snow-prone localities.

### Table 2: Roof Claddings

<table>
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<th>Material</th>
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</tr>
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<tbody>
<tr>
<td>Aluminium</td>
<td>BSCP 143: Part 15</td>
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<tr>
<td>Concrete interlocking tiles</td>
<td>NZS 4206</td>
</tr>
<tr>
<td>Copper</td>
<td>BSCP 143: Part 12</td>
</tr>
<tr>
<td>Corrugated steel</td>
<td>NZS 3403</td>
</tr>
<tr>
<td>Corrugated cellulose-cement</td>
<td>NZS/AS 2908: Part 1</td>
</tr>
<tr>
<td>Lead</td>
<td>BS 6915</td>
</tr>
<tr>
<td>Mastic asphalt</td>
<td>BS 6925</td>
</tr>
<tr>
<td>Pressed metal tiles</td>
<td>NZS 4217: Parts 1 and 2</td>
</tr>
<tr>
<td>Zinc</td>
<td>BSCP 143: Part 5</td>
</tr>
<tr>
<td>Zinc or aluminium/zinc coated steel</td>
<td>NZS/AS 1397</td>
</tr>
</tbody>
</table>
1.4 Underlay

1.4.1 Roofing underlay, where required, shall:

a) Be laid either vertically when the roof pitch is not less than 8°, or horizontally, with laps of no less than 150 mm under concrete or clay tiles, and 100 mm under other claddings. When laid horizontally upper sheets shall be lapped over lower sheets to ensure water is shed to the outer face of the underlay. Fire retardant underlays shall be lapped no less than 150 mm in all cases.

b) Have a surface absorbency greater than 100 g/m² (underlays complying with NZS 2295 meet this requirement),

c) Have a vapour transmission resistance of no more than 7 MN s/g (meganewton seconds per gram) measured using ASTM E96 procedure B or BW, and

d) Be installed in a manner which prevents ponding of water by:

   i) allowing self-supporting underlay to span no more than 1200 mm in one direction, or

   ii) allowing underlay which is not self-supporting to span no more than 300 mm in one direction unless supported by corrosion-resistant material, (polypropylene packing tape, ...
nylon string, galvanised wire or wire netting are examples which satisfy this requirement, and
iii) installing anti-ponding boards at the bottom edge of tile roofs with less than 15° pitch.

2.0 Walls

2.0.1 Walls shall have:
a) Claddings which are weatherproof,
b) Joints in the cladding or between the cladding and exterior joinery, which are weatherproof or constructed to allow penetrating moisture to drain to the outside,
c) Either building paper, complying with Paragraphs 1.4.1 b) and c), or sheathing in accordance with Paragraph 2.4.1, installed behind the cladding, unless the walls have no internal lining in which case building paper shall comply with Paragraph 1.4.1 b) only.
d) Any framing protected against deterioration through contact with concrete or masonry which is likely to be, or become, damp from the presence of moisture. The methods described in Paragraphs 4.1.2 and 4.1.3 are suitable.

2.0.2 Section 11 of NZS 3604 lists acceptable wall claddings. This Standard however does not give full information on fixings, substrate, and weatherproofing of joints and junctions, which need to be submitted as part of the building consent system.

2.1 Timber weatherboards

2.1.1 Timber weatherboards shall comply with NZS 3617.

2.1.2 They may be fixed either horizontally or vertically to the timber frame. Specific requirements for different types are as follows:

a) Lap-jointed horizontal weatherboards shall have:
i) joints made only over studs and mitred, scarfed, tight-buttoed or fitted with corrosion resistant soakers,
ii) all internal angles scribed, or fitted with soakers, or coverboards and plugs,
iii) all external angles mitred, or fitted with corrosion resistant soakers, or fitted with coverboards and scribers, or coverboards and plugs,
iv) the end grain section of all boards sealed against moisture penetration, except those, such as cedar, which can be shown to be durable in their natural state, and
v) horizontal laps (see Figure 2) of at least:
   23 mm for boards having a rebate of at least 25 mm, and
   32 mm for non-rebated boards.

b) Batten-jointed vertical weatherboards (see Figure 2) shall:
i) have weather grooves located no further than 12 mm from each edge,
ii) be installed in continuous lengths with gaps of 5 to 8 mm between boards, and
iii) have the gaps covered by 75 mm x 25 mm double grooved continuous battens.

c) Shiplap vertical weatherboards (see Figure 2) shall:
i) have weather grooves located 15 mm from each edge, and
ii) be fixed in continuous lengths with gaps between boards being no greater than 6 mm.
**Figure 2: Types of Timber Weatherboards**

Paragraph 2.1.2 a), v), b) and c)

- **Horizontal boards**
- **Vertical boards**

**Figure 3: Masonry Veneer with Suspended Timber Floor**

Paragraph 2.2.1

- **Ceiling**
- **Seal cavity off from roof space**
- **Ventilation gap under soffit (or use air bricks)**
- **Veneer ties**
- **40mm cavity**
- **Masonry veneer**
- **Building paper**
- **Seal off cavity from subfloor space**
- **Omit mortar at no greater than 1000mm centres for ventilation & draining of cavity**

*Alternative foundation details given in NZS 3604 Appendix F are acceptable provided veneer cavity is sealed off from the subfloor space.*
2.1.3 The bottom edge of timber weatherboards shall overlap the edge of the concrete floor, wallplate or bearer by no less than 50 mm, and shall be no closer than 175 mm above unpaved ground or 100 mm above paving and decks.

2.1.4 The bottom edge of weatherboards shall be free draining (i.e. not hard against foundations), and vertical weatherboards shall be undercut to form a drip edge at the bottom.

2.2 Masonry veneer

2.2.1 Masonry veneer claddings (see Figure 3) shall comply with NZBC B1.

2.2.2 Masonry veneer walls shall have a cavity between the veneer and the frame. The cavity shall:

a) Be no less than 40 mm nor more than 75 mm wide,

b) Contain no pipes or services,

c) Be sealed off from both the roof space and subfloor space, and

d) Be ventilated to the exterior air at both top and bottom of the wall. The bottom openings shall serve also to drain cavity moisture to the outside, and shall be spaced at no greater than 1000 mm centres.

2.2.3 Wall ties shall be installed in a way that prevents the transfer of water along the length of the ties from the veneer to the building paper. Ties shall be capable of passing the blotting paper test in Appendix B of NZS 4210.

COMMENT:
Attention is drawn to the requirement under B1/AS1 to ensure ties are fixed using non-impact methods, and that mortar less than 24 hours old is not subject to vibration from other building work.

2.3 Solid plaster on timber framing

2.3.1 Claddings of solid plaster on timber framing shall comply with Paragraphs 2.3.2 to 2.3.4 (see Figure 4).

COMMENT:
Useful information and guidance on solid plaster construction is given in “Good Stucco Practice” published by BRANZ.

2.3.2 The essential requirements are:

a) (i) Behind a rigid backed solid plaster cladding, studs spaced at no greater than 600 mm centres, stiffened with dwangs at no greater than 800 centres, and

(ii) Behind a non-rigid backed solid plaster cladding, studs not longer than 2400 mm, spaced at no greater than 400 mm centres, stiffened with dwangs at no greater than 800 centres,

b) A building paper or breathable building wrap (complying with Paragraph 1.4 c)), which shall be fixed directly to the studs before the battens are attached,

c) A backing of either a rigid or non-rigid sheet fixed to 20 mm thick battens, treated to Hazard Class H3 as specified in NZS 3640, with:

(i) Vertical battens at each vertical stud, and

(ii) Horizontal battens at heads and sills of openings and at eaves, fixed slightly out of horizontal (about 5 mm) and 50 mm short of vertical battens,

(iii)All battens fixed to timber framing with 60 mm x 2.8 mm hot-dipped galvanized flat-head nails at a maximum 300 centres,

d) Building paper overlaying a rigid backing to provide a slip layer,

e) Plaster and reinforcement complying with NZS 4251,

f) For the plaster finish coat to be applied only after completion of all framing and internal lining,

g) Control joints spaced at no greater than 4.0 m, both vertically and horizontally, and located:

(i) above and below the sides of door and window openings,

(ii) at inter-storey level at the underside of floor joists,

h) For the cladding system to extend no less than 50 mm below underside of bearers or wall plates supporting the ground floor joists, and

(i) The cavity between the backing and building paper shall be:

(ii) Sealed off from both the roof space and the subfloor space, and
(iii) Open at the bottom to ventilate the cavity and drain moisture to the outside. The bottom opening shall be protected from the entry of vermin.

**COMMENT:**
Poorly detailed junctions (e.g. at windows and doors) can cause problems even with a cavity. Details of junctions are needed to allow the territorial authority to fully assess for building code compliance.

2.3.3 **Rigid backings** shall be any of the following:

a) Purpose-made cellulose cement wall board or fibre-reinforced cellulose cement sheet, at least 4.5 mm thick, or

b) Construction plywood complying with AS/NZS 2269 and having a nominal thickness of no less than 7.0 mm, and treated to Hazard Class H3(b) as specified in NZMP 3640, or

c) Close-boarded diagonal timber sheathing. The boards shall be no greater than 150 mm in width, have a thickness of no less than 20 mm, be no less than 25 mm apart, and be treated to Hazard Class H3.

2.3.4 **Non-rigid backings** shall be supported against deflection under plastering by having studs spaced at no greater than 400 mm centres, and by installing behind the backing a corrosion-resistant material such as plastic tape, or galvanised wire or wire netting.
2.3.5 Non-rigid backings shall be any of the following:

a) Breather-type building paper complying with Paragraphs 1.4.1 b) and c),
b) Waterproof building paper complying with BS 1521, or
c) Other suitable material complying with NZS 4251.

2.3.6 Claddings of solid plaster on timber framing complying with NZS 4251 are an acceptable solution, except that a drained and ventilated cavity shall be required in all cases as required in Paragraph 2.3.2 above.

2.4 Sheathing

2.4.1 All framed exterior walls shall have a sheathing behind the outer cladding. The sheathing shall be either building paper or rigid sheet material, such as plywood treated to Hazard Class H3, fixed to the exterior face of the studs. Building paper is required for solid plaster cladding even where a solid backing is used.

2.4.2 Building papers

Building papers shall satisfy the requirements of roofing underlays as given in Paragraphs 1.4.1 b) and c).

2.4.3 Building paper shall:

a) Be run horizontally,
b) Be lapped no less than 75 mm at joints, with the direction of lap ensuring water is shed to the outer face of the paper,
c) Be adequately secured to plates, bearers, and studs, and
d) Extend from the upperside of the top plate to the underside of the bearers or wall plates supporting the ground joists.

2.5 Lightweight claddings

2.5.1 Behind lightweight wall claddings on sites exposed to strong winds a wind barrier of heavy duty building paper shall be provided.

2.5.2 Examples of lightweight wall claddings requiring a wind barrier in medium, high and very high wind zones (as defined in NZS 3604) are:

a) Weatherboard profiles manufactured from PVC, vinyl, steel, and aluminium.
b) Shiplap and uncoated rusticated timber weatherboards.

Examples of lightweight wall claddings requiring a wind barrier in high, and very high wind zones (as defined in NZS 3604) are:

a) Vertical PVC cladding and wall shingles.
b) Weatherboard profiles manufactured from plywood and uncoated cellulose cement.

Examples of lightweight wall claddings requiring a wind barrier in very high wind areas (as defined in NZS 3604) are:

a) Coated rusticated timber weatherboards.
b) Coated cellulose cement weatherboards.
c) Vertical board and batten.

2.5.3 Heavy duty building paper used as a wind barrier shall have, when wet, a bursting strength of no less than 500 kN/m² when tested in accordance with BS 3137. All penetrations shall be sealed and joints sealed or lapped 150 mm.

2.5.4 Solid wind barriers shall be installed as described in Paragraphs 2.5.3 c) and d) for building paper. All joints and penetrations shall be sealed.

COMMENT:
Useful information on building construction in wind prone areas is contained in BRANZ Bulletin 326 “Cladding Buildings on Exposed Sites” and Bulletin 336 “Building Papers, Wind Barriers and Vapour Barriers”.

2.6 Earth buildings

2.6.1 Earth buildings complying with NZS 4299 meet the performance criteria for E2.

3.0 Exterior Joinery

3.0.1 Windows, doors, roof lights and hatches, and the joints between them and cladding material shall be as weatherproof as the cladding itself.

3.1 Windows and doors

3.1.1 Joints between windows and doors, and the cladding shall be made weatherproof by one or a combination of the following systems:
a) Head, jamb and sill flashings,
b) Scribers,
c) Proprietary seals,
d) Sealants that are:
   i) not directly exposed to sunlight or weather,
   ii) easy to access and replace.

3.1.2 Windows shall comply with the water leakage requirements of Clause 12 of NZS 4211.

3.1.3 Windows complying in all respects with NZS 4211 are an alternative solution, but will exceed the Performance of NZBC E2.

3.2 Skylights, roof lights and roof hatches

3.2.1 Joints between skylights, roof lights and roof hatches, and roof cladding shall be made weatherproof by one or a combination of the following systems:
   a) Full perimeter flashings,
   b) Proprietary seals,
   c) Sealants forming part of a system incorporating a) or b) and that are:
      i) not directly exposed to sunlight or weather, or
      ii) easy to access and replace.

4.0 Floors

4.1 Suspended timber floors

4.1.1 Suspended timber floors shall have:
   a) Subfloor framing protected against deterioration from contact with concrete or masonry which is, or could become, damp from the presence of moisture, and
   b) All timber protected against damage from groundwater moisture. Refer to Paragraphs 4.1.4 to 4.1.9.

4.1.2 Protection of timber
Where subfloor framing timber is supported on concrete or masonry which is subject to moisture, the timber shall be either treated to Hazard Class H4, or separated from direct contact with the concrete or masonry.

4.1.3 Separation
Separation shall be achieved as shown in Figure 5, by providing a free-draining air space of at least 12 mm on each face of the timber, or by using a separating layer of damp-proof course (DPC) which shall extend at least 6 mm beyond each face of the timber. The damp-proof course (DPC) shall have a vapour flow resistance of no less than 90 MN s/g.

4.1.4 Subfloor ventilation
All suspended timber floors shall have the subfloor space ventilated. This requirement shall be met by the provision of openings in the foundation wall, at the rate of no less than 3500 mm² of net open area for every m² of floor area. The openings shall be as near as possible to the underside of plates and bearers.

4.1.5 Ventilation openings may be constructed by either one of the following methods or a combination of both:
   a) Continuous gaps, at least 20 mm wide between base boards, around the building perimeter.
   b) Perimeter wall ventilators with sufficient net open area spaced regularly, commencing 750 mm from the wall corner and at intervals of no greater than 1.8 m.

4.1.6 Adequate ventilation occurs when the subfloor airflow is not obstructed by party walls, internal foundations, attached terraces, or any other impediment, and either:
   a) No point on the ground is more than 7.5 m from a ventilation opening, or
   b) The subfloor ventilation rate is greater than 10 air changes per hour for wet sites, or 5 air changes per hour for dry sites.

4.1.7 Vapour barriers in subfloor space
Where the subfloor space can not be adequately ventilated, the ground under a suspended timber floor shall be covered...
with a vapour barrier having a vapour flow resistance of no less than 50 MN s/g, and a thickness of no less than 0.25 mm. Polyethylene film satisfies the requirement.

4.1.8 Even with a vapour barrier, ventilation openings shall have a net open area of no less than 700 mm² for every m² of floor area and be located to provide air cross-flow in the sub-floor space.

4.1.9 The vapour barrier shall be installed in a way that ensures:

a) It covers the total ground area,
b) Adjacent sheets are lapped no less than 75 mm,
c) The ground is shaped to prevent water accumulation on the vapour barrier and to drain to the exterior, and
d) It is held in place by bricks, large stones or similar method.

4.2 Concrete slab on ground

4.2.1 Every concrete floor slab cast on the ground shall have a damp-proof membrane (sometimes referred to as a vapour barrier) laid between the ground and the concrete, or between the top of the slab and a concrete floor topping no less than 50 mm thick.

4.2.2 The finished concrete floor level shall be higher than the adjacent ground (see Paragraph 4.2.5). The ground shall be shaped to carry water away from the building.

4.2.3 Damp-proof membranes (DPM)
The damp-proof membrane shall:

a) Have a water vapour flow resistance of no less than 90 MN s/g (meganewton seconds per gram),
b) Be sufficiently durable to resist damage from installation and normal worksite operations,
c) Be continuous over the whole slab area and extend under the foundation walls (as shown in Figure 6),
d) Be laid on a surface which is unlikely to damage the damp-proof membrane being used, and
e) Have penetrations by services, reinforcing or other objects sealed by taping, or by the application of a wet-applied *damp-proof membrane* material.

**4.2.4** The materials listed in Paragraph 5.1.3 are acceptable *damp-proof membranes* for concrete floor slabs.

**4.2.5 Floor level**
The height of the finished floor level above adjacent ground shall be no less than:

a) For masonry veneer wall *claddings*  
   - 100 mm if ground permanently paved  
   - 150 mm if unpaved.

b) For *cladding* other than masonry  
   - 150 mm if ground permanently paved  
   - 225 mm if unpaved.

**4.2.6 Protection of timber**
Wall framing on exterior walls shall be separated from the concrete slab by a *damp-proof course*.

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**5.0 Basements**

**5.0.1** Water or water vapour shall be prevented from penetrating to the interior face of basement retaining walls. An acceptable solution is the provision of a *damp-proof membrane* against the exterior face of the walls and drainage at the base of the walls as shown in Figure 7.

**5.1 Damp-proof Membranes (DMP)**

**5.1.1** The floor and wall *damp-proof membrane* shall be continuous to ensure effective tanking of the buried part of the *building*.

**COMMENT:**  
*Damp-proof membranes* used in basement situations are normally referred to as tanking membranes.

**5.1.2** The *damp-proof membrane* material shall:

a) Have a vapour flow resistance of no less than 90 MN s/g,
b) Have all joints and penetrations sealed, and
c) Be adequately protected against damage
during backfilling.

5.1.3 The following are acceptable damp-proof membrane materials:

a) Mastic asphalt complying with BS 6925, and which is applied in at least two layers to give a membrane thickness of no less than 30 mm under floor slabs and 20 mm on walls.
b) Modified bituminous sheet comprising modified bitumen on a polyethylene backing, with or without layers of fabric reinforcement.
c) Synthetic rubber sheet.
d) Polyethylene sheet having a minimum thickness of 0.25 mm.
e) Liquid coatings, such as bitumen or tar emulsions, and those based on epoxies or urethanes.

COMMENT:
When using liquid coatings it is essential to confirm that the rate and method of application will ensure that the relevant durability is achieved. In most cases this will be 50 years. They should not be used where the manufacturer is unable to provide an appropriate durability statement.

5.2 Drainage

5.2.1 Subsoil drainage shall be provided to divert groundwater from behind the basement wall to a drain beyond the building.

5.2.2 The subsoil drainage system shall:

a) Use a pipe of at least 100 mm diameter, with openings to collect water.
b) Have the subsoil pipe at the base of the wall below floor level,
c) Incorporate a geotextile fabric or other filter material to prevent silting of the pipe,
d) Have access for cleaning the subsoil pipe, and
e) Have for the height of the buried wall free draining backfill above the pipe.

6.0 Construction Moisture

6.0.1 Moisture contained in the building structure at completion of construction shall not be permitted to damage the building elements. Construction moisture includes the moisture contained in:

a) Timber products as a result of a treatment or manufacturing process,
b) Timber or other materials as a result of exposure to the weather, and
c) Concrete, mortar or plaster which is not completely cured.
6.0.2 Maximum acceptable moisture contents are:

a) For timber framing at the time of installing interior linings: 24% for insulated buildings or 30% for uninsulated buildings. Measurement shall be by the recommended procedure in the New Zealand Forest Research Institute publication “Measurement of moisture content of assembled timber framing”.

**COMMENT:**
Some manufacturers of lining and insulation materials recommend lower moisture contents where their products are being used.

b) For timber *weatherboards* and exterior joinery at the time of painting: 20%.

c) For reconstituted wood products: 18% at all times.

d) For concrete floors at the time of laying fixed floor coverings: sufficiently dry to give a relative humidity reading of less than 75%. Measurement shall be made in accordance with BRANZ Bulletin 330 “Thin Flooring Materials – 2 – Preparation and Laying”.
Index E2/VM1 & AS1

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

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