

# Weather-tightness and Durability Requirements for School Property

For

- Project Managers
- Designers
- Contractors
- Principals and Boards of Trustees

Ministry of Education  
Revised - June 2014  
Amended – August 2014

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# Introduction

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## A. Background

In recent years a large number of school buildings have suffered building envelope weather-tightness failure and the Crown faces a significant cost for remedial work.

The most common causes have been identified and this **Weather-tightness and Durability Requirements for School Property** publication (the **Requirements**) is the result and it:

- focuses on those aspects of construction that have contributed to the failures and for which the Ministry now has specific requirements
- prohibits the use of some materials or features and restricts the use of others
- replaces the Ministry's previous Weather-tightness requirements for schools April 2011 publication which focussed on the major risks to school property,
- covers all design features and materials that are known to create weather-tightness or premature durability failure.

The Ministry has engaged the services of a **Building Enclosure Specialist (BES)** to peer-review the construction details of projects that contain specific materials or features to help ensure that the building's envelope is weather-tight and appropriately durable.

Contact details of the BES may be obtained from any Ministry Regional office.

## B. Scope

These Requirements apply to:

- general school buildings ie administration, teaching spaces, gyms, halls
- buildings to a maximum of 2 storeys (with height measured from lowest ground level adjacent to the building). Buildings above this height shall have the following submitted to BES
  - full envelope construction details
  - structural Design Features Report.

They do not apply to:

- ancillary buildings (ie storage sheds, non-integral garages)
- covered walkways, canopies, shelters etc.

The envelope of specialist buildings (ie enclosed swimming pools) requires design input from personnel who can demonstrate appropriate experience with the building type. Full envelope construction details for these buildings shall be submitted to the BES.

## C. Compliance

Building envelopes shall not contain materials or features that are **not permitted**.

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### Materials or features which are not permitted, are shown with red background .

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Where the building envelope includes materials or features whose use is **restricted**, full construction details for these items shall be submitted to the BES.

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### Materials or features which are restricted, are shown with blue background .

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Where the design of any item does not comply with any clause or detail in these **Requirements**, full construction details for these items shall be submitted to the BES.

## D. How to use this document.

This document is intended for Project Managers, Designers, Principals and Boards of Trustees.

If you are...	You should...
Project Manager	<ul style="list-style-type: none"> <li>• understand the technical aspects of these <b>Requirements</b></li> <li>• ensure Designers are aware of, and comply with them</li> <li>• at completion of Detailed Design, receive Appendix A from Designer together with               <ul style="list-style-type: none"> <li>○ construction details of materials or features whose use is Restricted</li> <li>○ construction details for any item that does not comply with any detail or clause in these <b>Requirements</b></li> </ul> </li> <li>• submit these details to the <b>BES</b></li> <li>• ensure that documentation has been modified to address any concerns identified by the <b>BES</b> before calling tenders</li> <li>• receive Weather-tight / Durability Review Sign-off Report from the <b>BES</b></li> <li>• submit the report to MoE prior to calling tenders</li> <li>• ensure that the Contractor is aware of the specific areas of the project where these <b>Requirements</b> apply</li> </ul>
Designer	<ul style="list-style-type: none"> <li>• understand these <b>Requirements</b></li> <li>• at completion of Detailed Design, provide Project Mgr with               <ul style="list-style-type: none"> <li>○ Appendix A</li> <li>○ construction details of materials or features whose use is Restricted (with Technical info if appropriate)</li> <li>○ construction details for any item that does not comply with any detail or clause in these <b>Requirements</b> (with Technical info if appropriate)</li> </ul> </li> <li>• modify the documentation to address any concerns identified by <b>BES</b></li> <li>• ensure that the Contractor is aware of the specific areas of the project where these <b>Requirements</b> apply</li> </ul>
Principal or BoT member	<ul style="list-style-type: none"> <li>• have a general understanding of these <b>Requirements</b> and the responsibilities of The Project Manager and Designer</li> <li>• ensure that Project Manager is aware of them</li> <li>• understand the Concept, Developed and Detailed Design stages of project documentation</li> <li>• understand the effect that selection of materials / components can have on future maintenance budgets</li> </ul>

## **E. Materials and Features whose use is Restricted**

Prior to commencing **Developed Design** stage, Designer shall alert the Project Manager, to any materials or features whose use is **Restricted** by these *Requirements*, which will form part of the design.

At completion of **Detailed Design**, Designer shall provide the Project Manager with finished construction details of these elements for submission to the BES for a Weather-tightness / Durability Review.

To avoid delays, all information required for the BES to fully understand details, junctions etc, must be provided. Materials, flashings, wraps, air seals, etc shall be fully described, detailed, dimensioned etc.

Designers may wish to engage with the BES earlier in the design process to determine:

- information required
- any criteria that will reduce the likelihood that details will need to be modified
- the time that is likely to be required for the Review (so that this is anticipated in the overall project timeline).

After assessing the information submitted, the BES may identify aspects considered at-risk, which require further consideration / modification by the Designer, to improve weather-tight or durability performance. Rationale supporting the requirement and guidance to resolve the risk, will be provided.

## **F. Check Sheet.**

The Weather-tightness / Durability Check Sheet (Appendix A) shall be completed by the Designer and submitted to the Project Manager at completion of Detailed Design.

## **G. Sign-off Report.**

At completion of the Review process, the BES will provide the Project Manager and Ministry Weather-tight Coordinator with a Weather-tightness / Durability Sign-off Report:

- summarising the review process that was undertaken
- confirming that the Designer's responses to items raised, were satisfactory
- confirming that there are now reasonable grounds to believe that the design of features reviewed, complies with sound weather-tightness practice and where specific materials have been used, they should have appropriate durability.

## **H. Review Process.**

### **Designer**

- submits Appendix A to Project Manager
- identifies (from the **Requirements**) those materials or features requiring a Review and submits finished construction documentation for them, to Project Manager.

### **Project Manager**

- forwards documentation to Building Enclosure Specialist together with:
  - School name
  - School ID
  - Project name
  - Project ID (provided by MoE).

### **Building Enclosure Specialist**

- Requests approval to commence Review from Ministry's Weather-tight Coordinator.

### **Ministry's Weather-tight Coordinator**

- Authorises BES to undertake Review.

### **Building Enclosure Specialist**

- Assesses details and identifies any aspects requiring further detail / information / consideration / amendment.

## Designer

- Amends materials / features as necessary to the Building Enclosure Specialist's satisfaction.

## Building Enclosure Specialist

- Provides Weather-tightness / Durability Sign-off Report once there are reasonable grounds to believe envelope is weather-tight and specific materials should be appropriately durable.

## I. Submission to the Ministry.

The Project Manager shall submit the following information to the appropriate Ministry personnel, when seeking approval to call tenders:

- sufficient documentation to confirm that the project complies with (and does not exceed) the scope of work approved by the Ministry
- copy of Weather-tightness / Durability Check Sheet (Appendix A)
- copy of Weather-tightness / Durability Sign-off Report from BES, for those projects that have required a Review.

## J. Responsibility for Weather-tightness and appropriate Design.

The Ministry encourages innovative designs but buildings with complex floor plans, complex roofs or complex elevations:

- cost more
- introduce greater risk of weather-tightness failure.

Designers shall:

- provide building envelopes which minimise:
  - irregular or complex junctions
  - junctions between different cladding materials and profiles
  - features that will affect the durability of elements or materials
- select envelope materials that will:
  - minimise maintenance requirements
  - minimise whole-of-life costs
  - deliver appropriate performance throughout the life of the building.

The ability to:

- remove contaminants that will affect a materials durability
- maintain the envelope to ensure warranty requirements are met

are important considerations for Designers.

While the involvement of the Building Enclosure Specialist is provided as an aid to ensuring appropriate performance, overall responsibility for detailing an envelope that is weather-tight under all weather conditions and materials perform appropriately over the life of the building, remains solely with the Designer.

## K. Amendments to Design, Materials Substitutions etc

The Project Manager shall draw to the attention of all personnel involved with the construction, that any party who makes changes to any aspect of the contract documentation (Specification / Materials selection / Construction details) relating to the building's envelope, without obtaining the Designer's prior approval in writing, will assume

full responsibility for the weather-tightness and durability performance of the feature and that of any abutting construction.

This process of substitution may involve re-submitting to the BES for further review.

The designer should take the following into account when considering a substitution:

- level of detail provided on the substitute product
- shop drawings (where appropriate) to show how the installation will be carried out
- product characteristics (strength, air leakage, assembly etc) as appropriate
- the risk associated in departing from a known product (or one which has been thoroughly researched at the design stage).

It is particularly relevant to the selection / substitution of a branded window system where the designer has implied (but not nominated) a brand by the CAD details used and the contractor wishes to nominate its own preference, which may not be an equivalent.

A precise specification is needed in the contract documentation.



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## Section 1: Surface Water

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### 1.1 Overland Flow Paths

To protect against water damage when drainage systems become blocked or over-loaded, and in all developments where siteworks or re-contouring of the ground is being undertaken, configure site levels to provide stormwater overland flow paths away from buildings.

Always be aware of the cut ground levels (CGL) and the finished ground levels relative to the buildings lowest RL or finished floor level (FFL).

Expert advice from a Civil Engineer may be required.

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## Section 2: Retaining Walls

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### 2.1 Retaining Walls as a Separate Structure

A retaining wall shall be provided:

- where the level of adjacent ground is above that required in Section 3 below. The retaining wall shall be separated from the exterior wall of the building by a minimum distance of 1.5 metres. The ground between the retaining wall and the building shall meet the surface finish, height and fall requirements of NZBC.
- where the ground below a suspended timber floor is excavated as per clause 4.1 below.

### 2.2 Retaining Walls as an integral part of Building Envelope

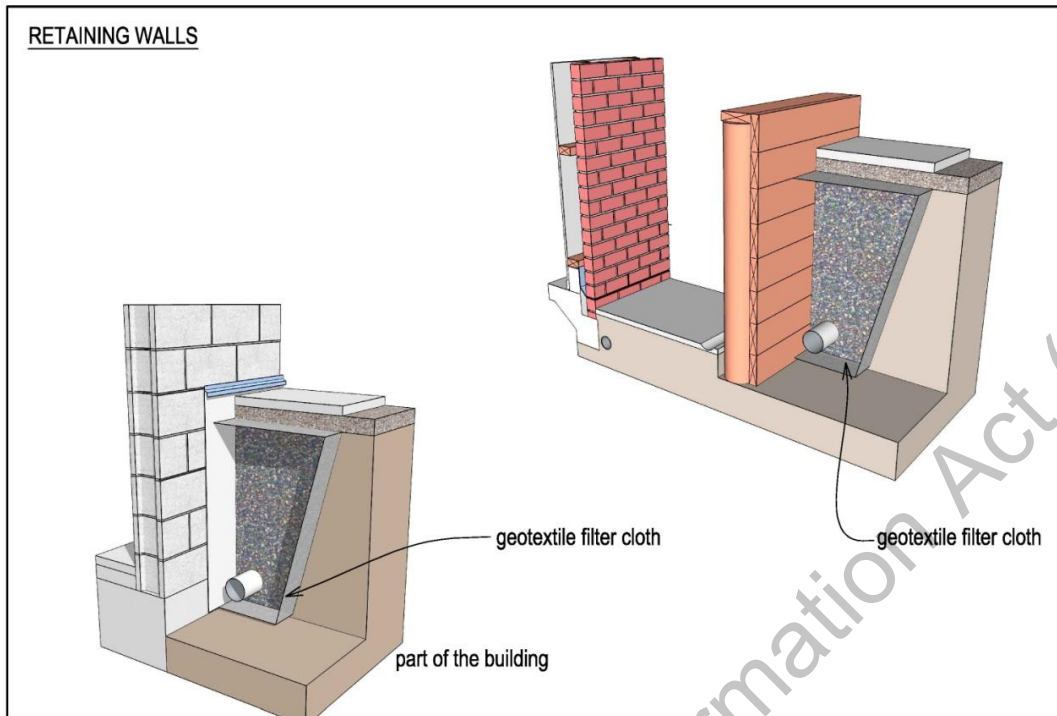
**Liquid applied products are not permitted as a means of waterproofing retaining walls that form part of the building envelope.**

**Using the wall of a building to retain adjacent ground is a Restricted design element.**

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Where a separate structure is not provided and the external wall of the building retains the adjacent ground, water ingress shall be prevented as follows.

- Apply proprietary sheet tanking-membrane to exterior of wall:
  - possessing a Code-Mark certificate
  - holding valid BRANZ Appraisal certificate.
- Protect:
  - top of membrane with a flashing chased into wall and sealed
  - surface of membrane with proprietary drainage mat, fibre cement or polystyrene sheet.
- Provide:
  - perforated subsoil drain with:
    - invert at the highest point 150mm (min) below floor level
    - fall of 1:200(min) to silt-trap end-outlet
    - access to the ends for water-jet cleaning
  - polypropylene filter cloth to separate existing ground from backfill material
  - clean and free draining backfill material
  - filter cloth to separate any topsoil placed over backfill material.
- Direct surface water away from the wall with mowing strip (refer Section 3 below) and if necessary provide a surface drain to its edge.



### Section 3: Concrete Slab on Grade

**Slot-drain channels are not permitted at the base of external walls**  
(except as noted below)

There is a risk that dampness in channels may raise the moisture level in the adjacent wall cavity.

Where new buildings are constructed with a concrete floor slab, the finished floor level (above the finished level of adjacent ground - 150 or 225mm as per NZBC) shall be set so that drainage channels or concrete nibs are not required.

Drainage channels (complying with NZBC) may be fitted at Accessible Entries where adjacent paved surface is raised to provide level-entry threshold ( $\leq 20\text{mm}$ ).

The total building perimeter including landscaped areas, shall have a minimum 500mm wide strip of permanent paving set 150mm below FFL with 30mm fall away from building. An edge drainage channel (complying with Fig 7.12 NZS 3604:2011) shall be provided if this gradient is not maintained for 1m

Finished surface of landscaped areas (FGL) shall be no higher than the outer edge of the permanent paving.

### Section 4: Suspended Timber Floors

#### 4.1 Sub-floor Areas

Where the ground floor is supported on piles, subfloor areas:

- shall not be excavated or set below adjacent ground unless an impervious retaining wall is employed

- shall be graded or provided with surface drainage to prevent water ponding
- shall be overlaid with 250 micron polyethylene sheets with all joints lapped and taped. Sheets shall be fitted tight to piles (and perimeter walls where present).

Polythene may be omitted where subfloor ventilation (fully compliant with requirements of NZS3604) is provided on all 4 sides of the building (note restrictions imposed in 4.3 below).

Vents in subfloor foundation walls shall be vandal resistant with care taken to ensure that the required free-ventilation area is achieved.

#### **4.2 Sub-floor Fixings**

All fixings for sub-floor areas shall be Type 304 stainless steel.

#### **4.3 Slatted Decks**

Where a slatted deck (ie rain permeable) is positioned adjacent to a piled building, provide a sub-floor wall (without ventilation openings) to separate it from the subfloor area to prevent dampness from below the deck entering the building sub-floor area. (Polythene ground overlay will be required under the building as ventilation is not provided on all 4 sides).

#### **4.4 Flooring**

In any situation where there is a risk of intermittent dampness in sub-floor areas, plywood flooring shall be used (refer clause 5.3.2 for treatment).

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## **Section 5: Exterior Walls**

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**The following wall types are not permitted for building envelopes:**

- Walls that are curved.
- Walls that have a primary structure other than timber, steel, concrete or concrete block.

**The following wall type is a Restricted design element:**

- Walls that are not vertical.

### **5.1 Blockwork**

**Honed-face structural concrete blockwork is not permitted for exterior walls of interior spaces.**

Honed-face blocks rely on a clear coating to display their unique appearance, but the on-going integrity of the clear coating cannot be readily visually assessed.

Honed-face block veneer may be used, but must be protected by an anti-graffiti coating to minimum height of 3m.

**Stack-bonded concrete blockwork is not permitted for exterior walls of interior spaces.**

Laying in this manner has not proven to be as crack-resistant as running (stretcher) bond.

**Concrete blockwork forming the exterior walls of interior spaces is a Restricted design element.**

Additional Observation by a Structural Engineer is required at all stages of block laying and grouting.

The base course of blockwork shall be set in a rebate 50 -100mm below finished floor level.

All blockwork shall be laid and solid-filled under the supervision of a Brick and Block Licensed Building Practitioner.

A rain-screen cladding fixed over a cavity:

- is mandatory on the exterior face of blockwork which supports a concrete upper floor
- is encouraged in other circumstances, because blockwork is considered prone to transfer moisture when, over time, cracks occur through settlement, coatings degrade etc.

All blockwork (without a rain-screen) forming the exterior walls of interior spaces, shall be coated on the exterior face with a pigmented (ie not clear-coated so that the integrity of the coating can be visually assessed) acrylic high-build elastomeric water-proofing paint system (formulated to fill surface pores, bridge fine cracks etc) to achieve a dry film-build of 180 microns minimum.

Additional Observation and film thickness measurement is required during the application of the high-build membrane, to ensure appropriate film-build is achieved.

## 5.2 Concrete

**The use of concrete (precast or cast insitu) for exterior walls is a Restricted design element.**

Walls constructed of this material do not require a rain-screen on cavity.

Walls constructed to be watertight by fully complying with **CCANZ CP 01:2014 Weathertight Concrete and Concrete Masonry Construction cl 4.5 Watertight Concrete:**

- must be protected by an anti-graffiti coating to minimum height of 3m
- may be clear coated with Silane or Siloxane water repellent sealers to protect and enhance remaining surfaces.

Clear coatings will require regular re-coating to maintain the integrity of the surface.

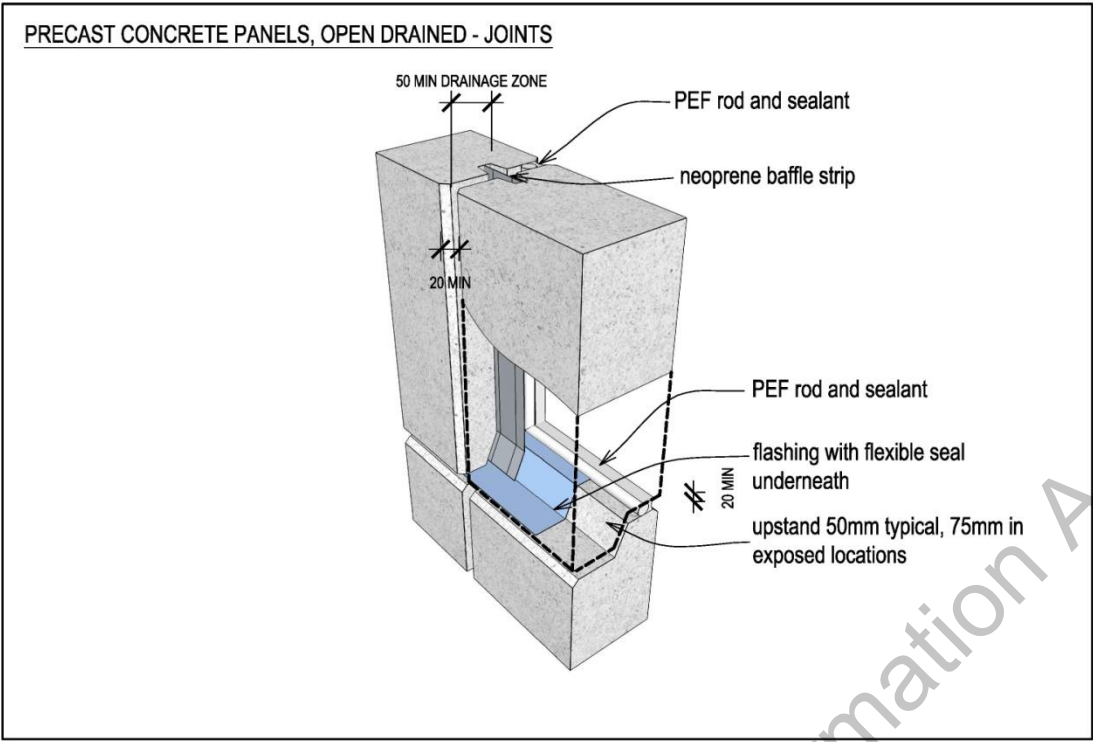
All other concrete walls shall be coated on the exterior face with:

- a pigmented acrylic high-build elastomeric paint system to achieve a dry film build of 180 microns
- a pigmented acrylic paint system to achieve a dry film build of 80 microns.

Precast panels shall be minimum 125mm thick.

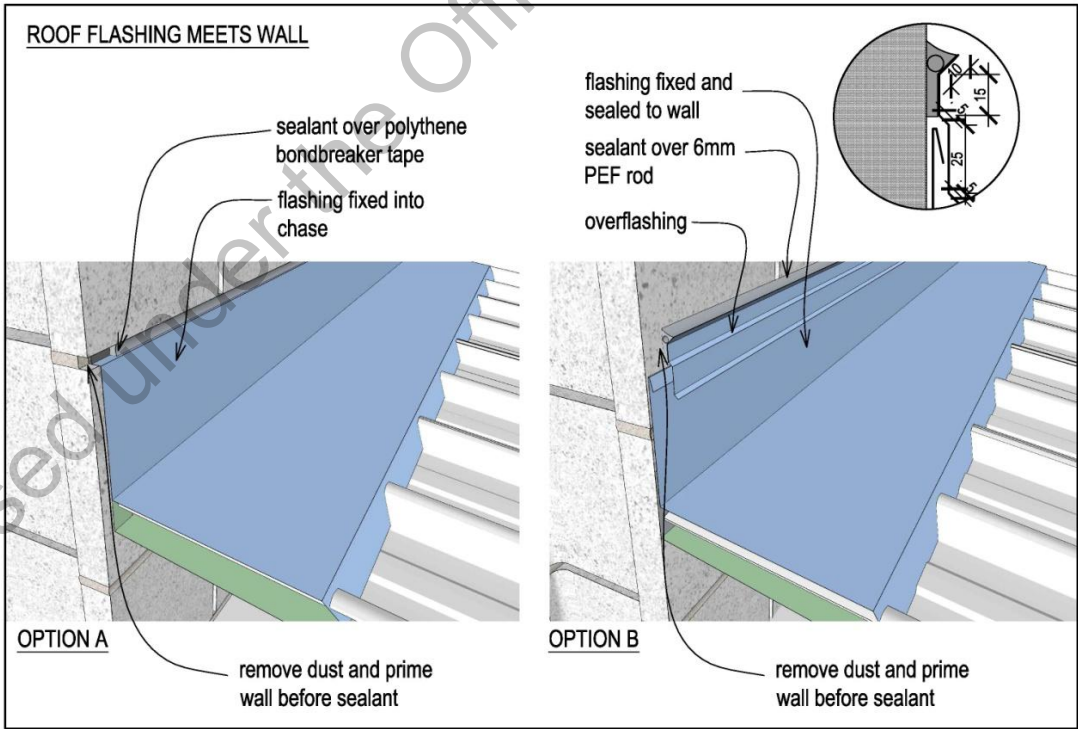
Panel joints shall be:

- front sealed with the joint able to drain at the base (ie finishing above surrounding paving level)
- back sealed (to create effective air-seal and establish pressure moderation).



The flashing of roofs (or other surfaces) which abut precast panels, require particular attention (particularly at vertical panel joints which are inevitably recessed).

Option B (shown below) is less preferred because sealant is exposed to elements with consequential degradation over time.



### 5.3 Timber or Steel Framing – Design Principles

These principles apply without exception, (irrespective of the cladding material chosen), to:

- new buildings
- extensions to existing buildings.

Refer below for circumstances where a cavity may be omitted when altering an existing building.

All timber and steel framed exterior walls shall be detailed to incorporate.

#### Exterior Rain-screen cladding

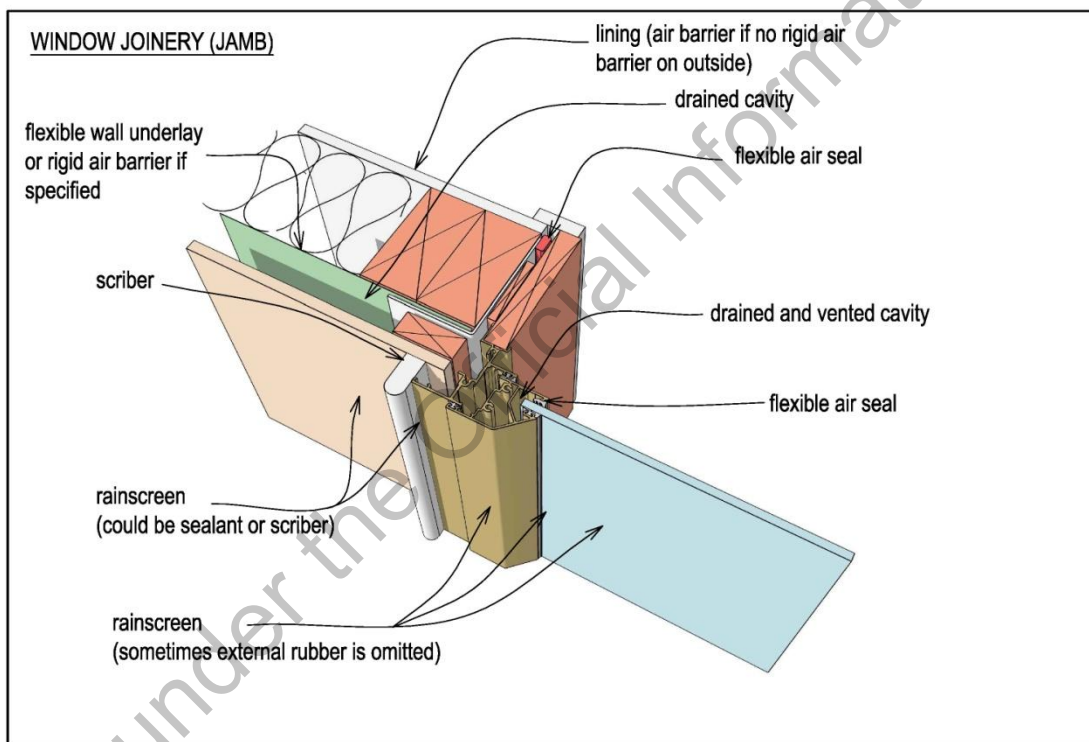
- to deflect all / majority of moisture.

#### Drained cavity with top ventilation

- drained to allow any moisture that penetrates the rain screen to escape
- top vented to assist drying by allowing air movement, to aid evaporation.

#### Internal air barrier

- to reduce air pressure differential between the drained cavity and exterior, to prevent air pressure driving moisture into the building.



An **Exemption** from the requirement to provide a cavity may be given for alterations to existing buildings that have been constructed without a cavity, such as where:

- windows are being removed and in-filled to match an adjacent surface
- existing cladding is being replaced with an alternative type.

In these circumstances:

- any new wall framing that is required shall be H3.2
- the permitted cladding type shall be determined by the Risk Score for that wall, given by NZBC E2 / AS1 Table 3.

**Window or cladding change to existing buildings constructed without a cavity, is a Restricted design element.**

**5.3.1 Timber treatment and fixings**

In all situations where copper-bearing preservatives are used (ie CCA, CQ [previously ACQ] CuAz) to achieve required treatment levels (ie H3.2), fixings shall be stainless steel (nails, staples, bolts etc).

(Galvanised steel will react with timber treated with copper-bearing preservatives and must not be placed in contact with it).

**5.3.2 Plywood Treatment**

**LOSP treated plywood is not permitted**

Plywood used as sarking shall have thickness determined by span, with minimum:

- 15mm under profiled metal roofs
- 17mm as substrate for membrane roofs
- 20mm as substrate for decks.

Plywood shall have the following minimum treatment and fixings shall be stainless steel.

**50 year durability**

Use	Exposure	Treatment
Sub-floor foundations	In contact with ground	H5
Rigid air barrier	Protected / risk of moisture penetration	H3.2 CCA
Bracing - Sub-floor	Protected / exposed to ground atmosphere	H1.2
- Exterior walls	Protected / risk of moisture penetration	H3.2
- Interior walls	Protected	None
Flooring – Dry areas	Protected / exposed to ground atmosphere	None
- Wet areas	Protected / exposed to ground atmosphere	H3.1
Sarking	Protected / risk of moisture penetration	H3.2
Support (valley boards etc)	Protected / risk of moisture penetration	H3.2

**15 year durability**

Exterior finishing	Exposed / not in ground contact	H3.2
Cladding	Exposed / not in ground contact	H3.2
Exterior stairs, floor surfaces etc (easily replaced)	Exposed / not in ground contact	H3.2
Interior Stairs	Protected	None

**5 year durability**

Interior finishing, joinery etc (easily replaced)	Protected	None
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**5.3.3 Cavity Construction**

Cavities shall be:

- compartmentalised to provide separation from cavities on opposite sides of walls (ie where parapets occur) and on adjacent walls
  - to avoid undue wind pressure differentials

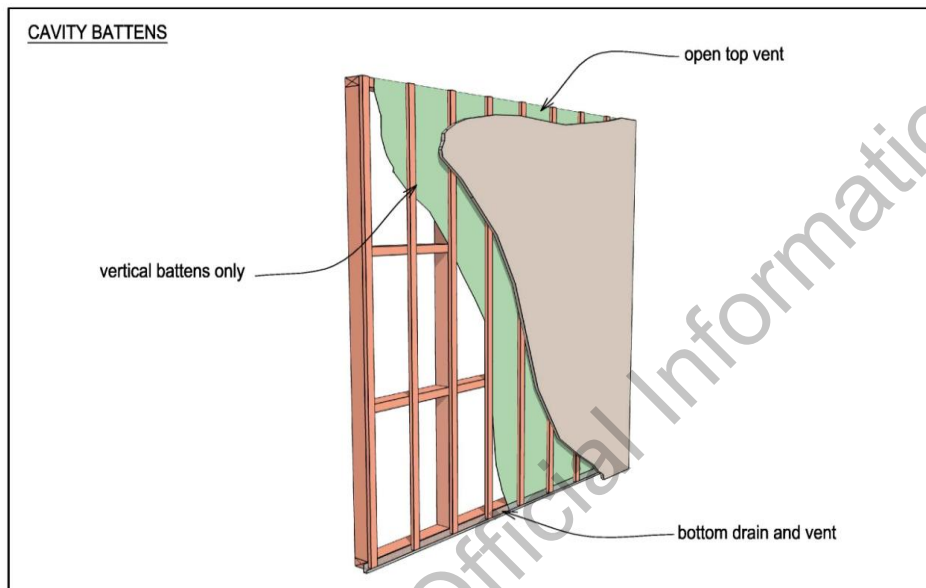
- to allow pressure equalisation / moderation to occur.
- separated from roof, subfloor and sub-deck areas
  - to allow pressure equalisation / moderation to occur
  - to avoid transfer of moisture from the ground
- top vented on buildings up to 2 storeys in height (refer below).

Cavities may be continuous for a maximum of 2 storeys in height.

Battens to provide horizontal support for cladding, flashings or wall penetrations, shall be:

- short lengths, fixed vertically with tops bevelled to shed water toward the outer face (refer below for exemption for profiled steel fixed vertically)
- installed to maintain the openness of the wall cavity (for drainage and ventilation)
- positioned to support the cladding at the centres required by the manufacturer.

Where profiled steel sheets are fixed vertically, products such as Cavity Batten Systems Ltd **Cavibat** may be fixed horizontally.



### 5.3.4 Top Venting

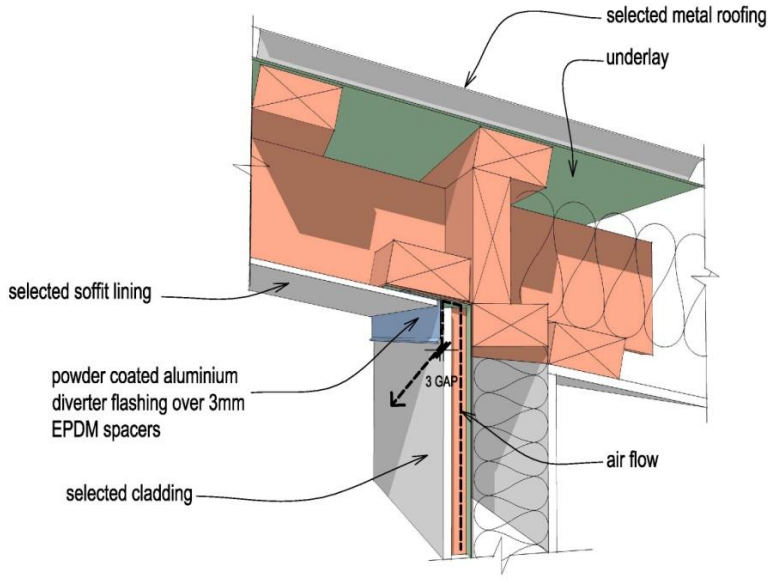
All cavities on buildings up to 2 storeys in height, shall be vented in a manner similar to that illustrated below (the Ministry has obtained Determination 2013/046 to allow top-venting).

Buildings which exceed this height:

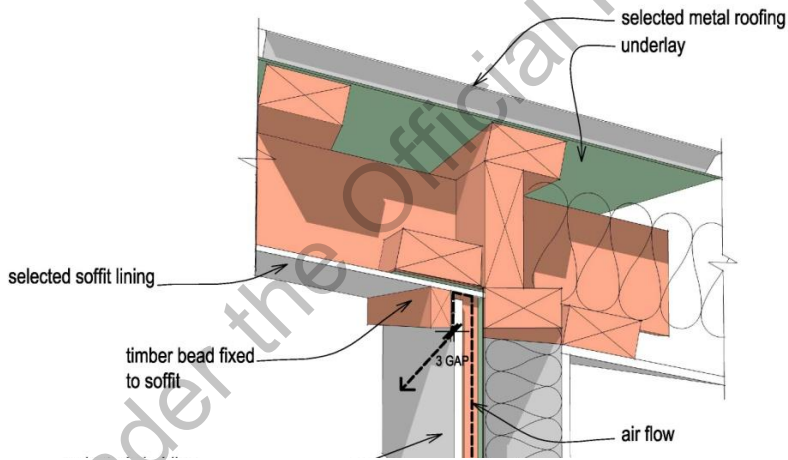
- shall only have a method of draining cavities at each floor level
- shall have full envelope construction details submitted to the BES for review.



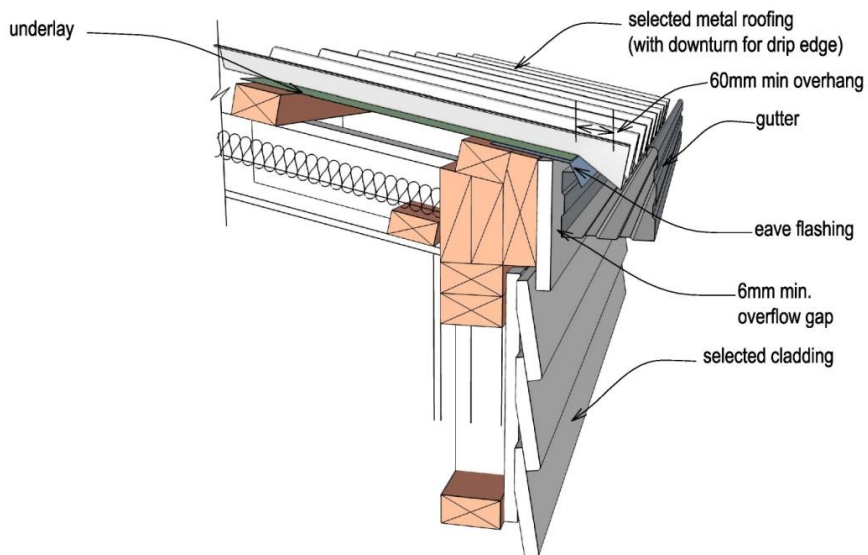
**REVERSE EAVES FLASHING**



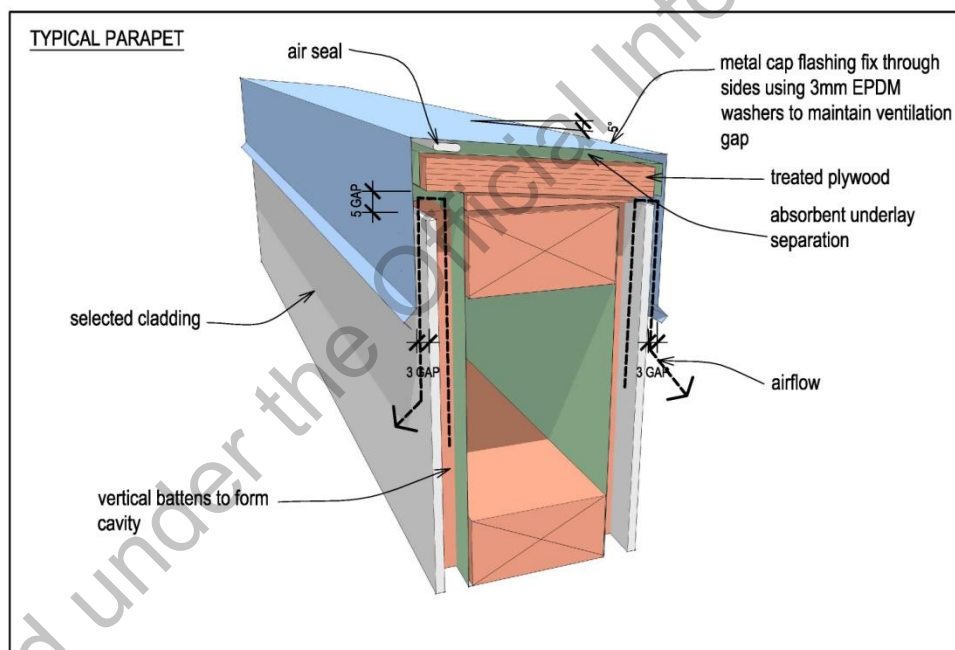
**REVERSE EAVES FLASHING**



**EXTERNAL GUTTER**



Where a parapet forms the top of a cavity, air pressure differentials between the cavities on each side of the parapet shall be prevented by an air seal placed beneath the parapet capping:



### 5.3.5 Air Barrier

#### a) If using NZS3604 and/or E2/AS1 to assess wind exposure

##### Low and Moderate wind zones

- The air barrier can be provided by interior wall linings provided sheet joints and penetrations (ie switches and socket outlets) are sealed-off

##### High, Very High, Extra High and Specific Design wind zones

- Air Barrier shall be Rigid Sheet Material in accordance with NZBC E2/AS1 Table 23.

On external walls where no internal linings are fitted (ie gable-end of roof void), an Air Barrier must be provided

- **Low and Moderate wind zones:** Flexible Wall Underlay (which meets Air Barrier requirements in E2/AS1 Table 23) may be used provided the Underlay is not likely to be damaged. Where damage is possible (stores, garages etc) a Rigid Sheet Material is required (as above)
  - **High, Very High, Extra High and Specific Design wind zones:** Rigid Sheet Material is required.
- b) **If undertaking a cladding pressure study to AS/NZS 1170 – install RAB when the ULS cladding pressures obtained are above 1000 Pa.**  
**Note: Cladding pressures include all relevant pressure coefficients and are not ‘basic pressure’**

### 5.3.6 Flexible Wall Underlay

The following products are not permitted :

- Kraft paper (including Bitumen impregnated or Fire resistant)

Flexible Wall Underlay shall:

- have a current BRANZ Appraisal
- be water resistant, absorptive (hydrophobic), permeable synthetic non-woven (Polymeric) type complying with Table 23 E2/AS1
- be laid horizontally
- have side and end laps of 150mm.

### 5.3.7 Rigid Sheet Material

Rigid sheet material shall be 7mm H3.2 plywood or 6mm fibre cement in accordance with NZBC E2/AS1 Table 23, overlaid with Flexible Wall Underlay (building wrap).

Rigid Sheet Material may be fixed to provide sheet bracing requirements.

## Section 6: Cladding

### 6.1 Ground Floor Cladding Selection

Cladding at ground floor level shall be selected to withstand impact damage.

The following products are not permitted at Ground Floor level

- Fibre-cement cladding less than 8mm thick (depth at grooves not counted)
- EIFS cladding.
- uPVC systems.

EIFS used in any other situation is a Restricted material.

All EIFS cladding shall:

- have been tested and have current BRANZ Appraisal
- be verified to E2 / VM1 (modified AS / NZS 4284 test).

All Ground Floor cladding less than 16mm thick shall be provided with:

- bottom-edge protection of timber or metal
- external-corner protection of timber or metal.

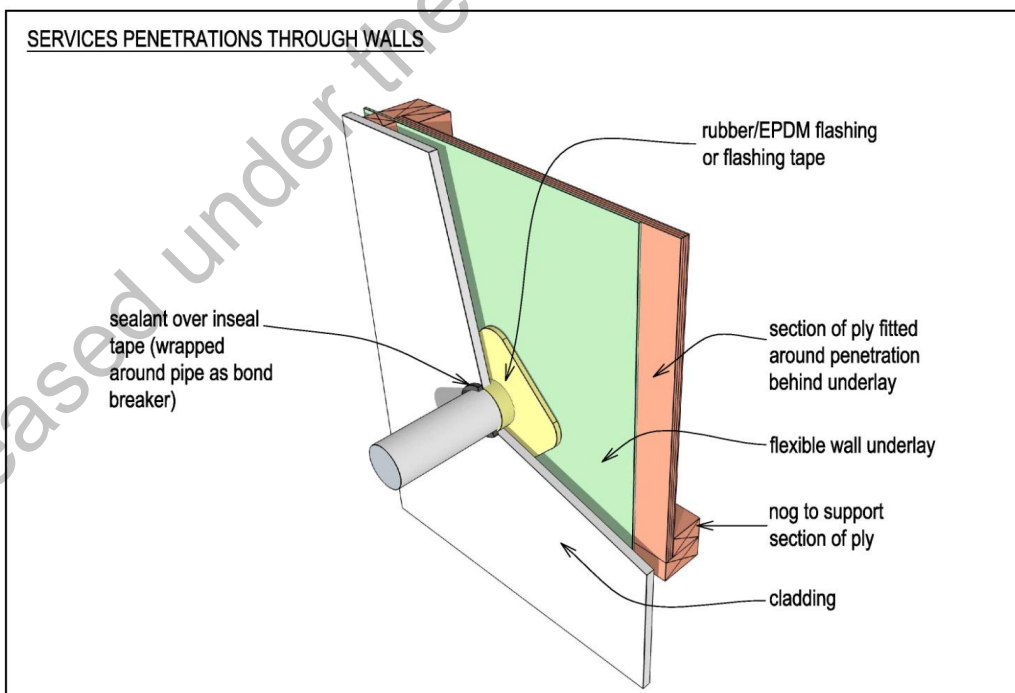


**6.2 Cladding as Bracing**

**Cladding fixed over a cavity, is not permitted to be used as wall bracing.**

**6.3 Services Penetrations through Walls**

Pipes and cables which penetrate the wall cavity and cladding, shall be sealed with Vanluk Design Ltd MG-50 or MG-100 E2 Pipe and Cable Cavity Flashing (or equivalent), as illustrated below.



**6.4**

## Metal Wall Cladding

Except where more stringent requirements are given below, metal wall cladding shall be detailed and installed to comply with NZ Metal Roof and Wall Cladding Code of Practice Version 2.2 / 2012.

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## Section 7: Roof

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The following requirements do not apply to covered ways, canopies, shelters etc which do not form part of the main building envelope.

Roof:

- shall be simple form with generous slope and overhang
- shall be designed and constructed to minimise potential for leakage
- penetrations shall be kept to a minimum
- when regular maintenance is anticipated, safe access must be provided on the roof.

All joints / junctions shall be correctly lapped and shall not rely on sealant for weather-tightness.

### 7.1 Metal Roof

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#### Curved metal roofs are not permitted

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Climate change has resulted in more intensive rainfall and as a consequence, a conservative approach to roof design and rainwater collection systems is required.

Except where more stringent requirements are given below, metal-clad roofs shall be detailed and installed to comply with NZ Metal Roof and Wall Cladding Code of Practice Version 2.2 / 2012.

#### 7.1.1 Roof pitch

The minimum roof pitch shall be as follows.

- New buildings:
  - trough and trapezoidal section roofs 5°
  - corrugated roofs 12°
- Replacement of existing roofs (except where these pitches cannot be achieved without disproportionate cost and where there has been satisfactory performance of the roof at the lower pitch):
  - trough and trapezoidal section roofs 3°
  - corrugated roofs 8°

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Re-pitched roofs which will result in windows having to be reduced in height, is a Restricted design.

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Engage with BES at an early design stage to see if a less expensive alternative exists.

Refer to clause 7.6 below for restrictions on use of valley gutters where roof pitch is less than 8°.

#### 7.1.2 Material thickness

The minimum Base Metal Thickness (BMT) for all steel roofs shall be 0.55 mm.

#### 7.1.3 Condensation and Thermal Bridging

The design of roof elements shall pay particular attention to preventing or mitigating the formation of condensation in roof cavities as a result of thermal bridging and other phenomena.

Moisture is best controlled in the spaces where it is created, by ventilation and heating

within the space.

This is particularly important where large numbers of students are present.

BRANZ research has shown that condensation may occur on the underside of metal roofs and on roof-space steel structural members:

- when suspended ceilings are fitted
- where insulation is placed on the ceiling tiles
- when water vapour is likely to be present (ie from groups of students)
- when surface temperature of metal roofing falls (ie during clear-sky radiation)
- after periods of rain (even if timber purlins are used or timber thermal-break battens are fitted to steel purlins).

Condensation that forms on the underside of the metal roofing is managed by the roof underlay which:

- initially absorbs moisture, then
- releases moisture to be evaporated when roof-cavity temperature rises.

Condensation that forms on steel purlins or roof-space structural members cannot be controlled.

#### 7.1.4 Roof Underlay

The following underlays are not permitted :

- Kraft paper (including Bitumen impregnated or Fire resistant)

Roof underlay shall:

- have a current BRANZ Appraisal
- be fully supported (mesh shall comply with Safety Mesh Standard AS/NZS 4389:1996)
- be separated from insulation by a 20mm air gap
- be water resistant, absorptive (hydrophobic), permeable synthetic non-woven (Polymeric) type complying with Table 23 E2/AS1
- have side and end laps of 150mm
- be laid horizontally (except on roofs < 80 where it may be laid vertically but all laps shall be sealed with window flashing tape):

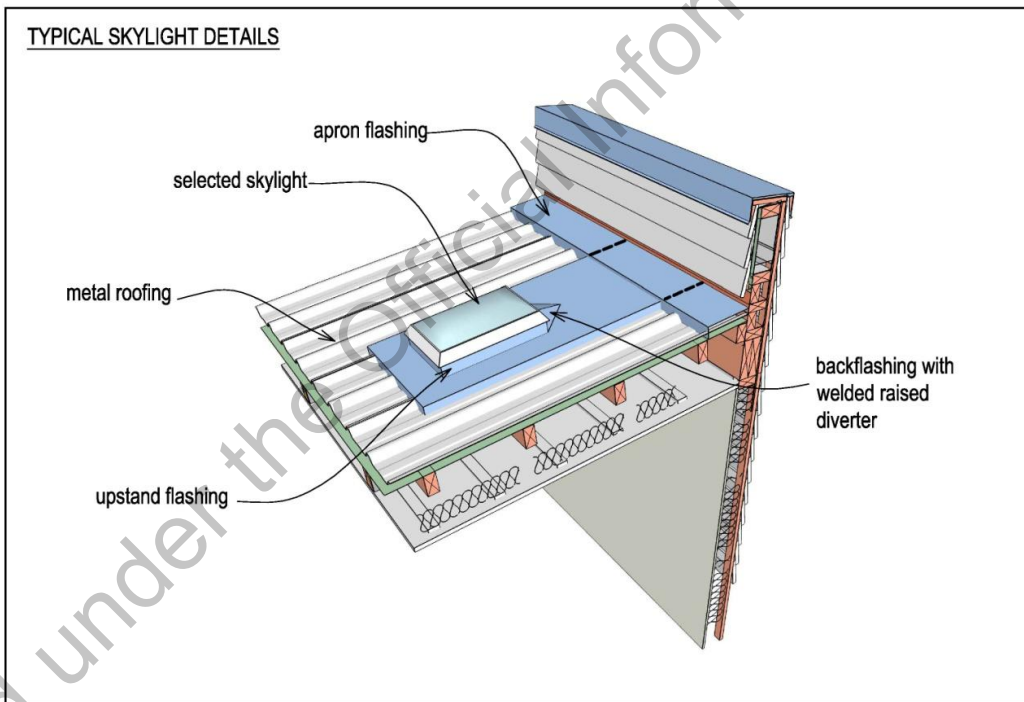
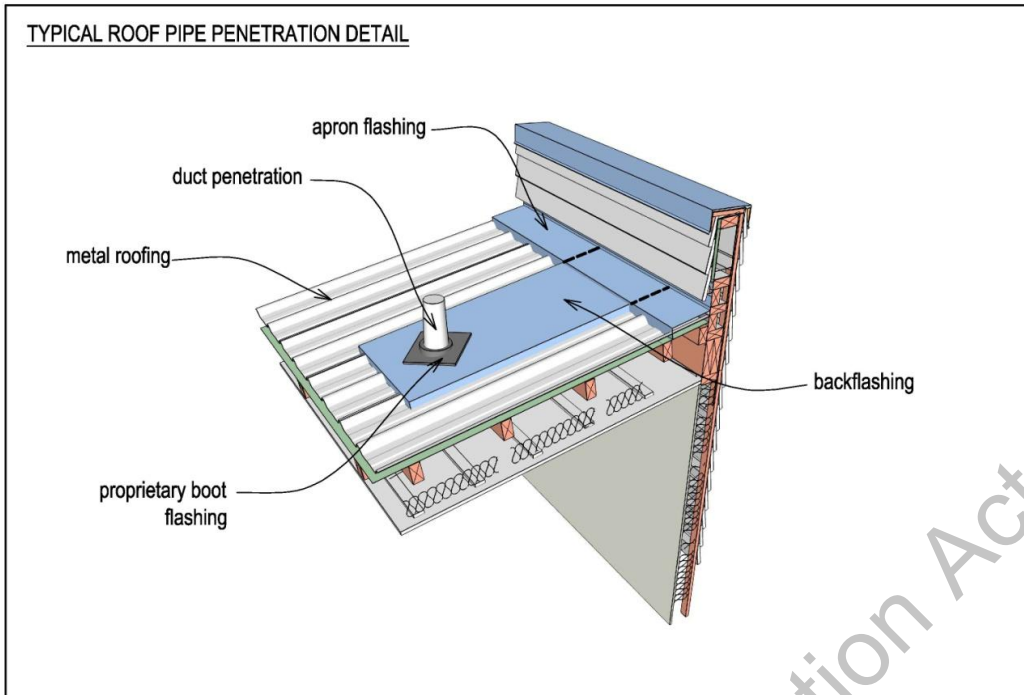
#### 7.1.5 Penetrations

Penetrations shall be kept to a minimum (leaks are often associated with roof penetrations)

- the top face of large roof penetrations (ie skylights) shall be located within 2.5m of the ridgeline to minimise the length of back flashing needed from the penetration to the ridge above it
- small penetrations (ie pipes) shall be directed within the roof structure to emerge at sensible locations.

Penetrations greater than 300 x 300mm shall be fully supported all round.

Refer to details below for typical vent-pipe and skylight flashing detail.



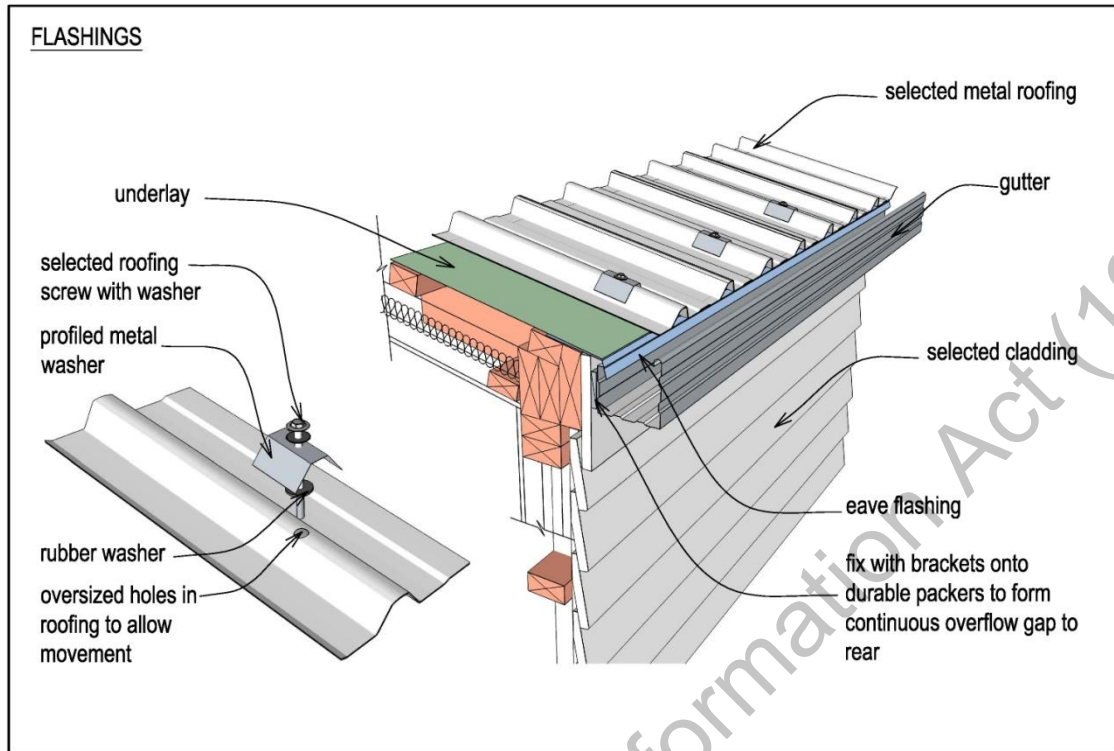
**7.1.6 Eaves**

The provision of generous eaves is encouraged.

Refer to Section 12 Durability for eaves / overhang design considerations.

Reverse-slope eaves shall be fitted with a flashing or batten as illustrated in 5.3.4 Top Venting (above).

For corrugated roofing in Wind Zones Very High and Extra High (NZS 3604), provide the eaves flashings shown below.



### 7.1.7 Flashings

Wherever possible, flashings shall be powder-coated aluminium (painted or coloursteel flashings should be avoided, particularly in protected locations ie not rain-washed).

Complex roof junctions shall have compound flashings:

- 1.6mm aluminium
- formed to-suit and welded
- painted (preferably powder-coated).

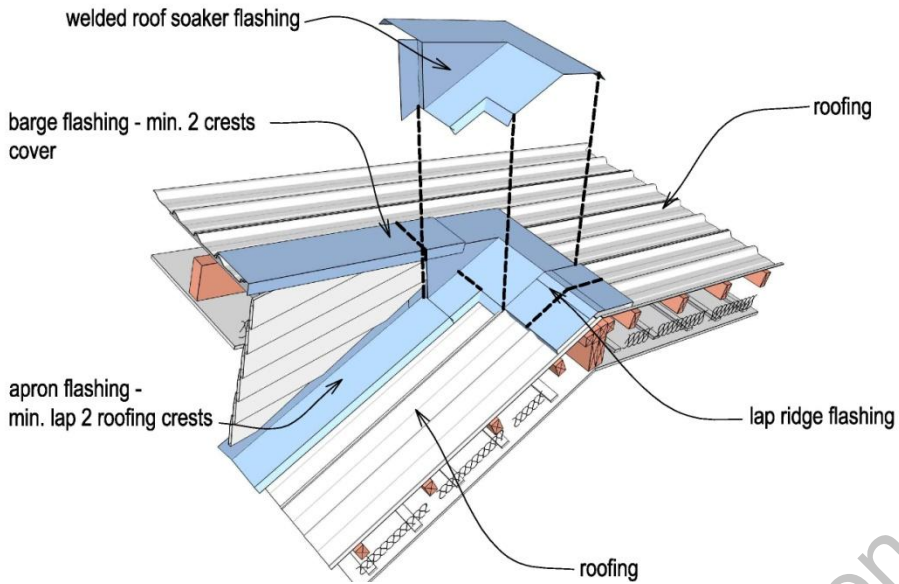
Raking barge flashings may have lapped joints (not welded).

Top fixing is only permitted on raking barge flashings.

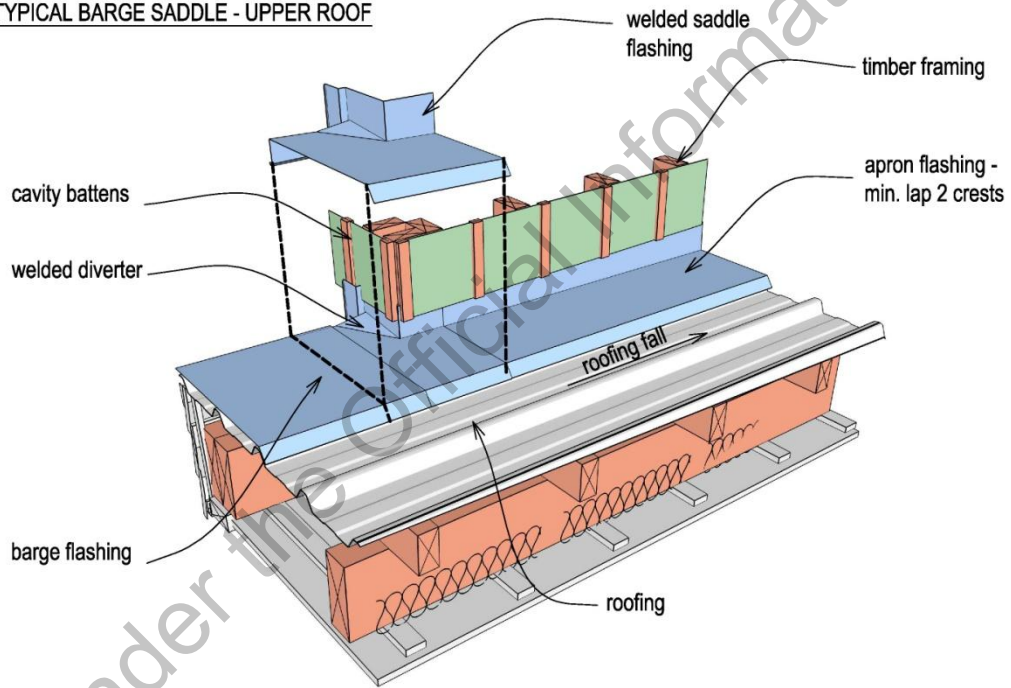
Refer below for typical details.



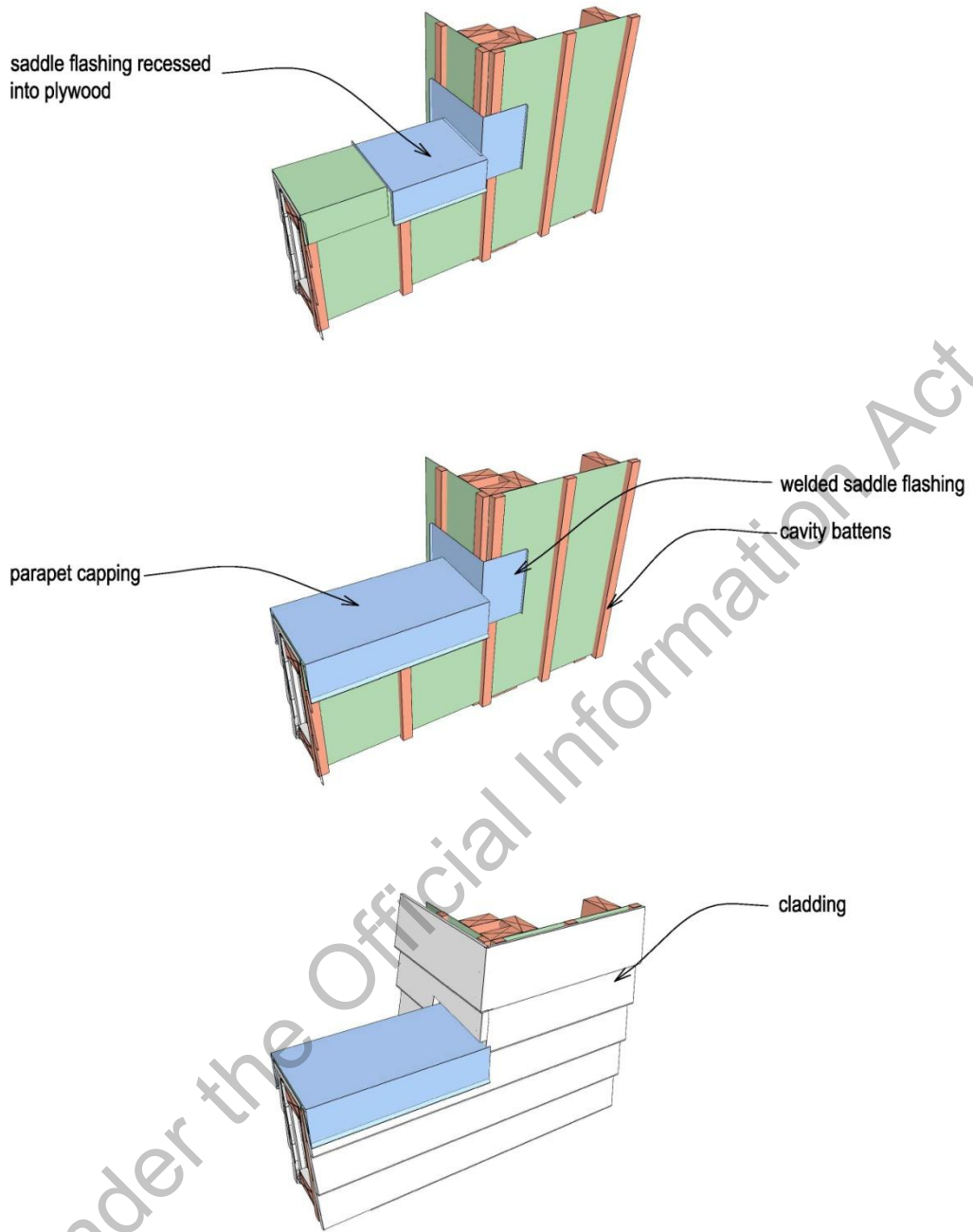
ROOF SOAKER FLASHINGS - ROOF RIDGE / BARGE JUNCTION

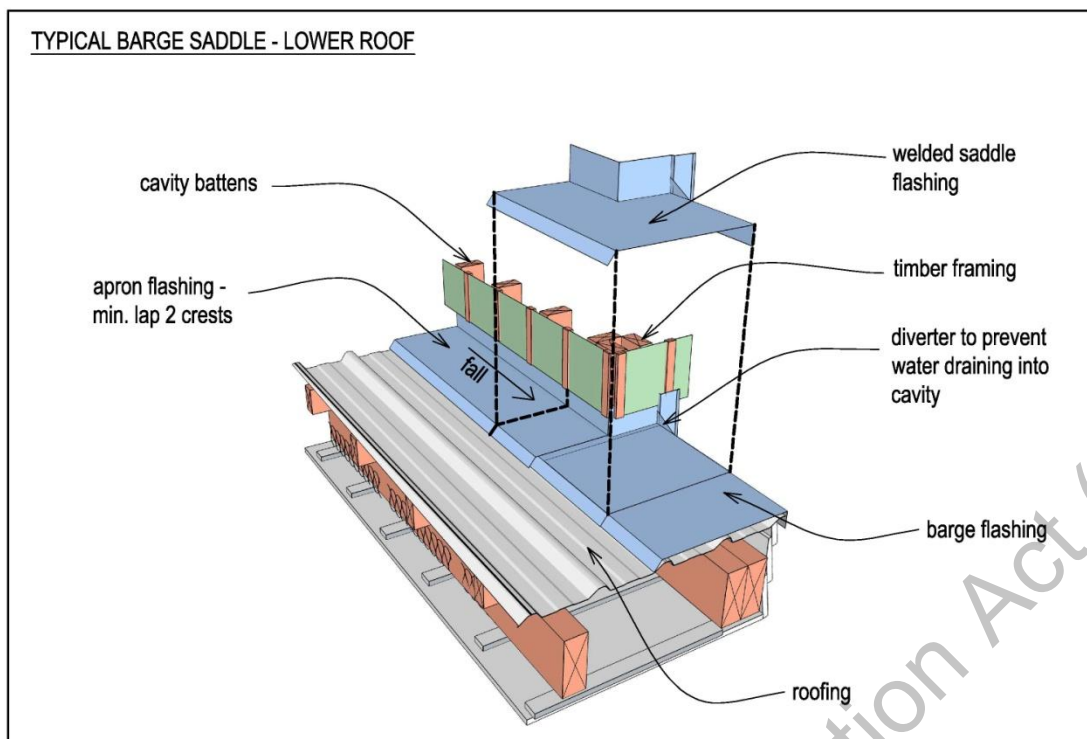


TYPICAL BARGE SADDLE - UPPER ROOF



PARAPET STEP SADDLE DETAIL





## 7.2 Membrane Roofing

**Liquid applied membranes are not permitted**

**The use of membranes for roofing or internal gutters, is a Restricted design element.**

Projects which incorporate membrane roofing require precise detailing and an increased level of attendance and observation by the Designer at the time the substrate is fitted and the membrane installed.

Where membranes are used they shall have:

- current BRANZ Appraisal
- minimum 15year material warranty
- 5 year installation warranty.

Membranes shall be selected from the following types:

- Butyl and EPDM rubber in accordance with E2/AS1, or
- 2 layer fully-bonded torch-applied reinforced modified bitumen membranes with mineral chip finish, installed in accordance with the Code of Practice for Torch-on Membrane Systems for Roofs and Decks, or
- Synthetic plastic sheet membranes such as Thermoplastic Olefins (TPOs) and PVC.

Installation of the membrane shall only be by applicators licensed by the manufacturer.

Ply substrate shall be fully protected to maintain dryness until membrane is laid.

### 7.2.1 Roof Design

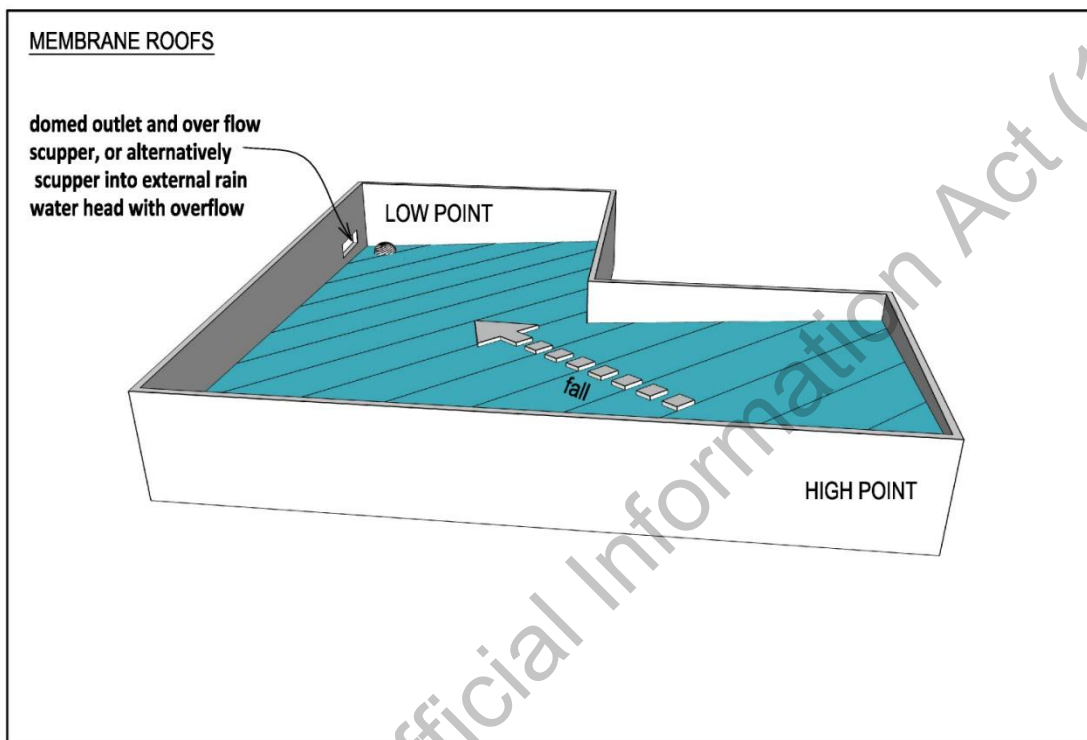
Internal gutters shall be avoided whenever possible (see below for simple roof

design without formed gutter).

Contract documentation shall show the levels of the high and low points of the substrate at all edges and changes of plane. Work the levels back from the low point of membrane at the outlet.

Membrane roofs shall have:

- minimum number of sheet joints
- minimum pitch of 1.5° (1:40).



### 7.2.2 Roof-water Outlets

The membrane shall terminate with a weir 'drip-edge' into an external rainwater head.

Outlet capacity shall accommodate twice "1 in 50-year" rainfall intensity (ie 100mm/hr for external gutters and 200mm/hr for internal gutters).

Local rainfall intensity shall be obtained from NIWA or the Territorial Authority. Suitable design methods are provided in E1 / AS1 and BRANZ Bulletin 537 Sizing Gutters and Downpipes.

### 7.2.3 Overflows

Overflows shall be provided as an opening in the rainwater head and:

- cross-sectional area of overflow shall be 1.5 times the area required for the outlet
- height shall be set so that the overflow functions before water can enter the structure, if the downpipe becomes blocked.

### 7.2.4 Testing

Blocking the outlet and flood-testing to check the integrity of the membrane is recommended before internal linings are fitted.

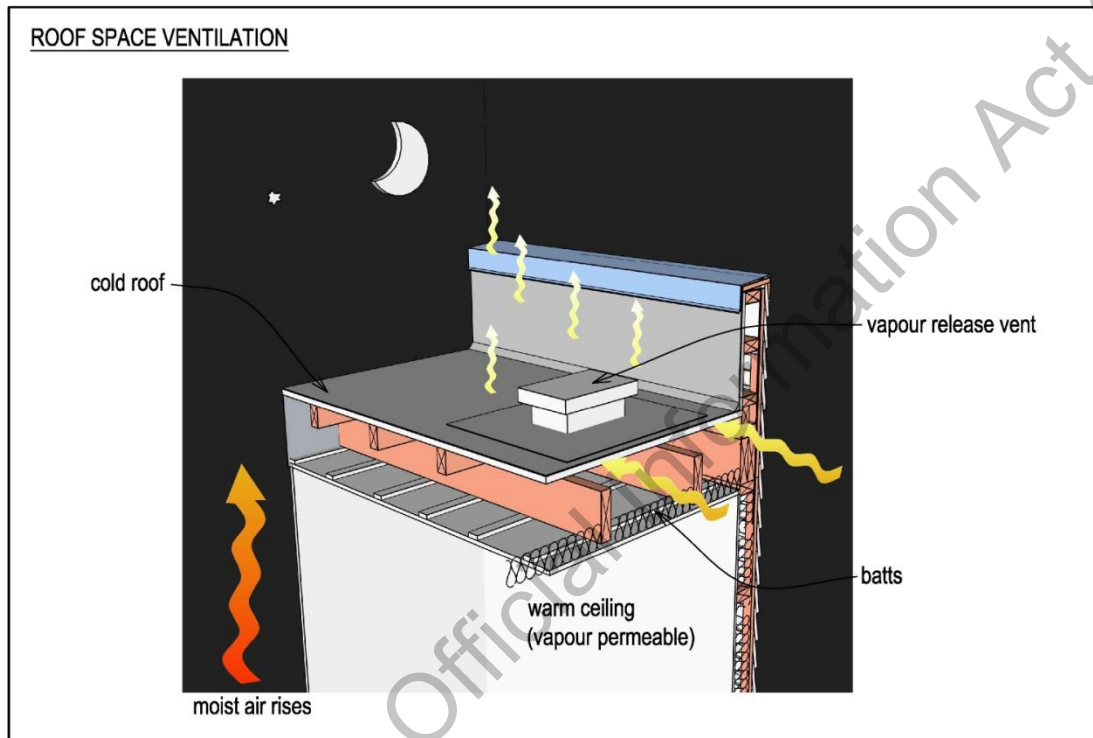
## 7.2.5 Roof-space Ventilation

Provide

- cross ventilation between the roof-space voids below the membrane substrate
- proprietary vapour vents from the voids at 1 / 40m<sup>2</sup> of roof area (minimum vent area 400 mm<sup>2</sup>)

Vents shall be designed to ensure roof remains water-tight.

Any resulting reduction in R value of thermal insulation shall be taken into account.



## 7.3 Masonry Tiles

All masonry tile roofs shall be fitted with underlay (irrespective of pitch).

## 7.4 Parapets

Parapets provide a high risk of weather-tightness failure.

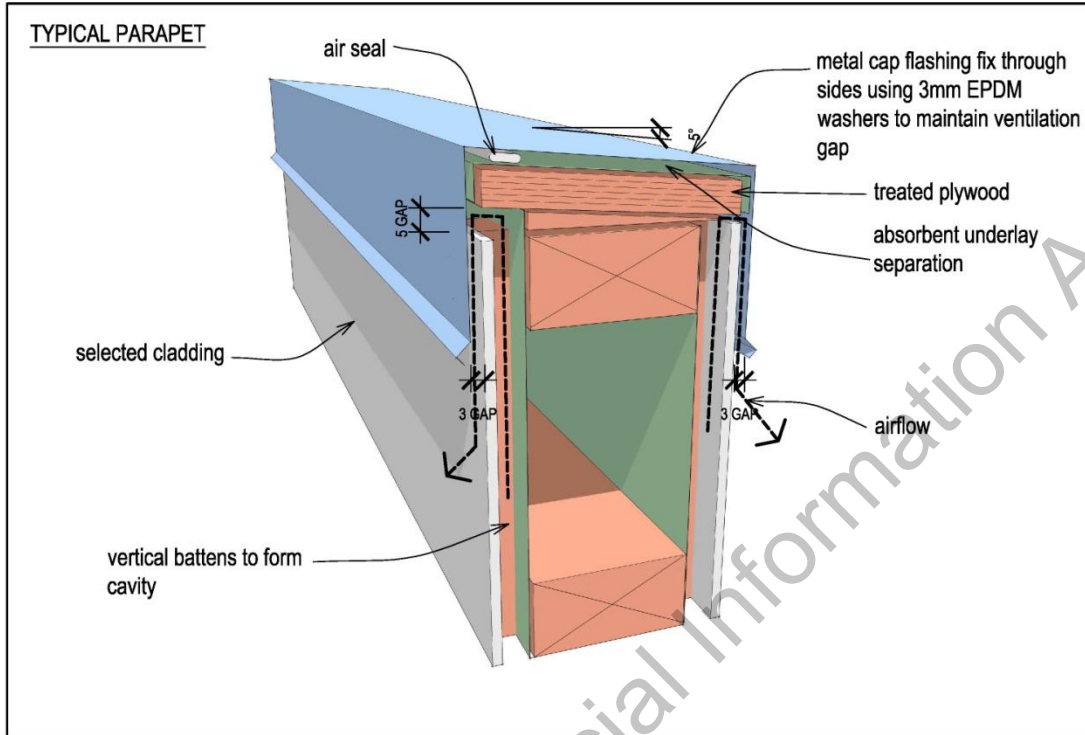
### Parapets are a Restricted design element

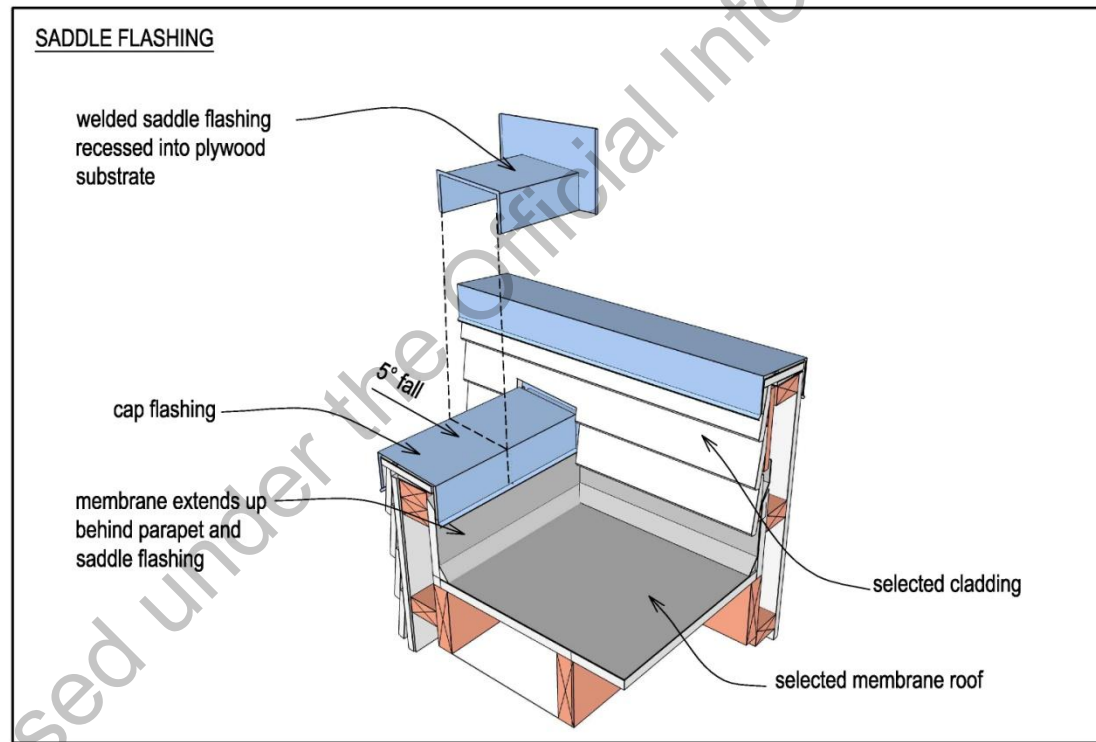
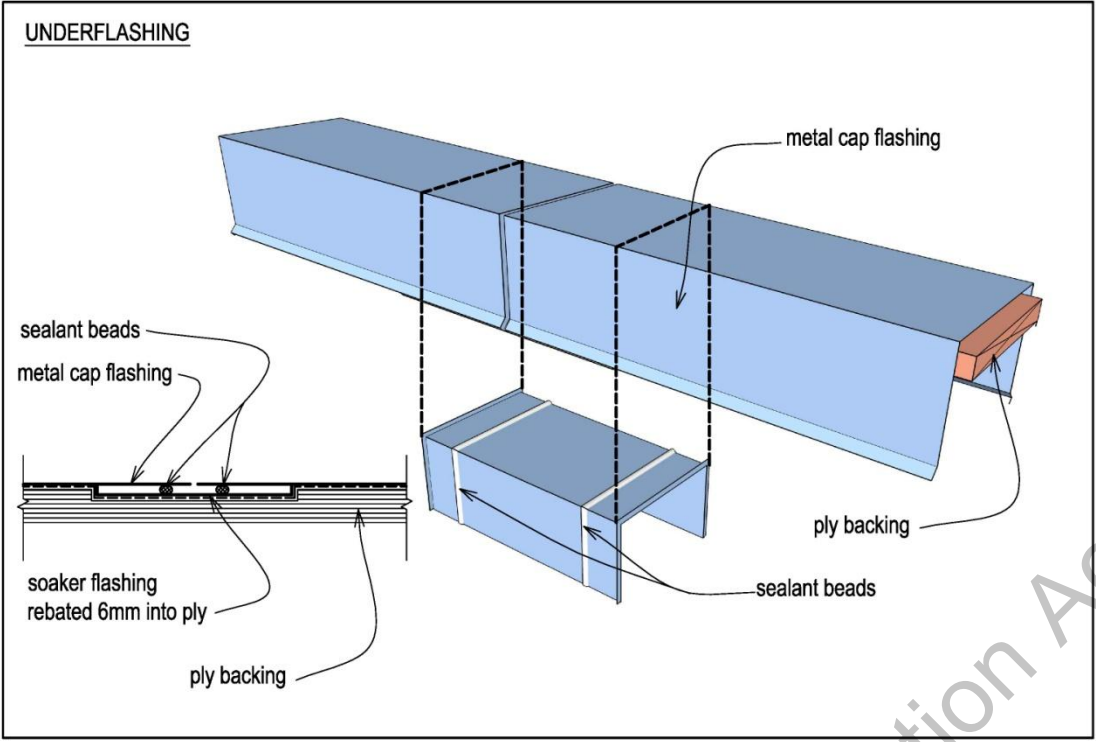
Where parapets are provided:

- cap-flashing shall be:
  - metal
  - fully supported with 5° minimum cross-fall

- secured with side fixings or concealed clips (no top fixing)
- joins and junctions shall be under-flashed with welded 1.6mm aluminium flashings, rebated into plywood substrate
- there shall be no reliance on sealant alone for weatherproofing.

Refer to the following sketches for typical details.





**7.5 Internal gutters**

Significant damage can result when an internal gutter fails.

## Internal gutters are a Restricted design element

Projects which incorporate internal gutters require precise detailing and an increased level of attendance and observation by the Designer at the time the substrate is fitted and the gutter lining installed.

Where internal gutters occur:

- welded stainless steel is the preferred gutter lining
- membrane gutter linings shall be one continuous length (ie without joints)
- fall shall be 1:100 minimum (preferably more, depending on depth)
- levels of the high and low points of the substrate shall be shown on the drawings.

### 7.5.1 Gutter Capacity

The gutter:

- design shall meet the requirements of NZBC Clause E1 – Surface Water
- capacity shall accommodate twice the “1 in 50-year” rainfall intensity.

Local rainfall intensity shall be obtained from NIWA or the Territorial Authority. Suitable design methods are provided in E1 / AS1 and BRANZ Bulletin 537 Sizing Gutters and Downpipes.

### 7.5.2 Gutter Outlets

Outlets from internal gutters shall penetrate the external wall to discharge into a rainwater head:

- full width of the gutter shall extend through the wall into the rainwater head
- gutter lining shall terminate with a drip-edge.

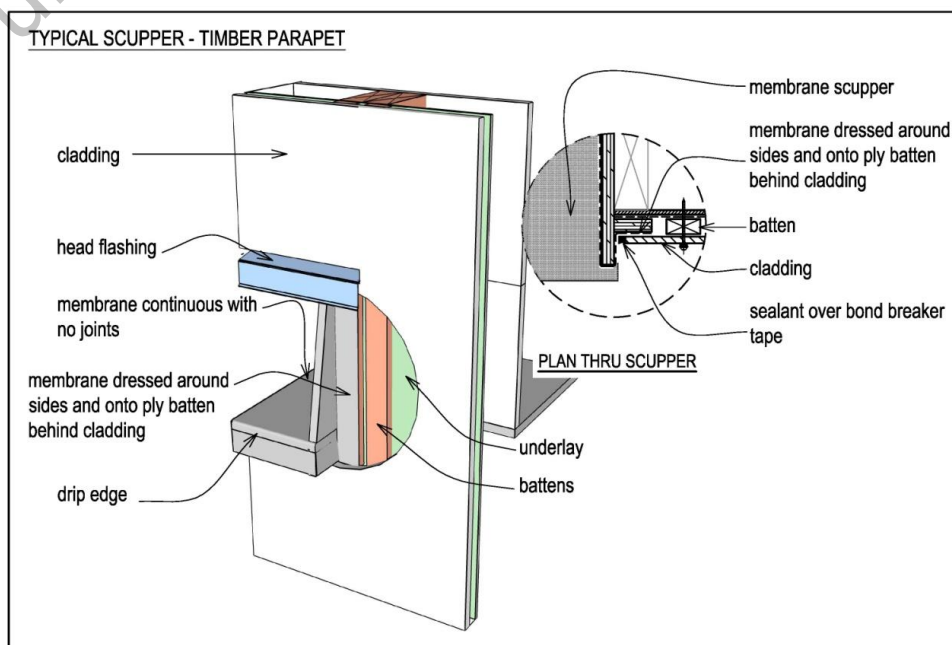
### 7.5.3 Gutter Overflows

Overflows shall be provided as an opening within the rainwater head and

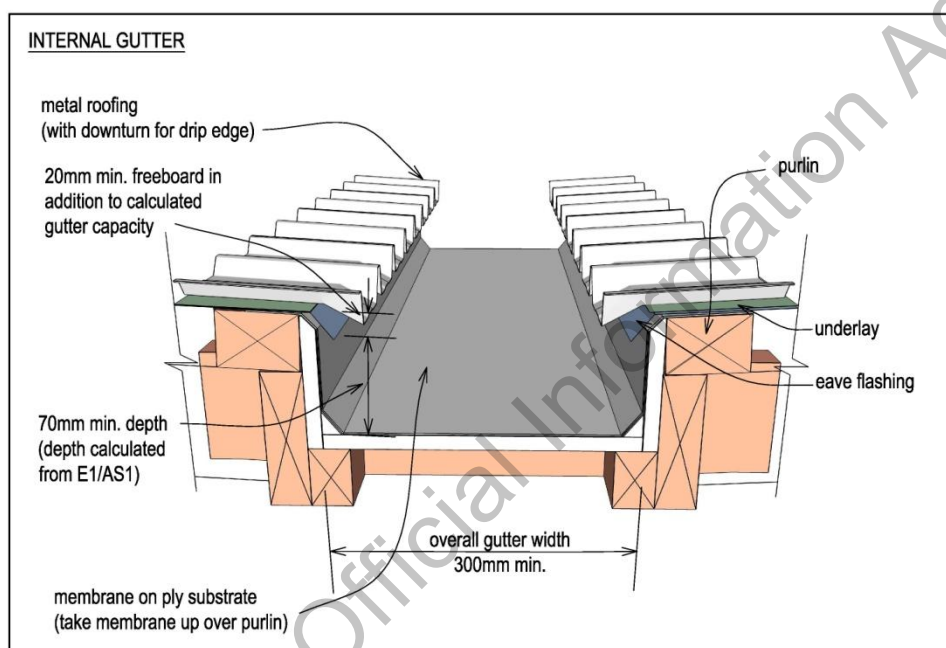
- cross-sectional area of overflow shall be 1.5 times the area required for the outlet
- height shall be set so that the overflow functions before water can enter the structure, if the outlet or downpipe becomes blocked.

### 7.5.4 Testing

Blocking the outlet and flood-testing to check the integrity of the gutter and operation of the overflow, is recommended before roofing or internal linings are fitted.







## 7.6 Valley Gutters

Valley gutters shall not be fitted where the roof pitch is less than  $8^{\circ}$  (internal gutters shall be constructed).

Refer to section 8.4.5 of NZ Metal Roof and Wall Cladding Code of Practice Version 2.2 / 2012 for valley gutter design requirements.

## Section 8 Exterior Joinery

**Circular windows are not permitted**

The following window types are Restricted design elements

- complex shapes
- raking or curved heads
- curtain wall glazing exceeding 2 storeys in height
- recessed, other than provided for in E2/AS1 (sill flashings tend to accumulate water rather than shield and drip away from opening between the window frame and sill flashing).

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## Section 9 Balconies

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The following design elements are not permitted with upper floor balconies :

- construction using cantilevered timber joists
- cantilevered glass balustrade without a handrail

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Balconies constructed over occupied spaces are a Restricted design

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**Balconies to which students have access:**

- shall be designed to discourage students from sitting on the balustrade
- shall give special attention to safety-from-falling.

**Solid Balustrades:**

- shall be constructed with tops flashed and stopped as if a roof parapet.

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## Section 10 Junctions with Existing Buildings

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Attaching new construction to an existing building, is a Restricted design element

The junction between the envelope of a new building and that of an existing, provides a potential source of water ingress, particularly when design requirements such as seismic junctions are involved.

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## Section 11 Exposed Structural Elements

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Structural (or other) elements which penetrate the exterior rain-screen, are Restricted design elements.

Penetrations through the building envelope by structural elements (ie supporting roof overhangs) are a potential source of water ingress.

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## Section 12 Durability

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Materials are expected to maintain their durability over the life of the building and not deteriorate from premature corrosion.

The following factors will affect the long term durability of materials:

- proximity to salt-laden atmosphere
- industrial atmospheric contaminants
- ability of rain to reach and wash contaminants from the surface of metals
- the characteristics of the material selected.

Eaves / overhangs are encouraged but they prevent rain reaching:

- their underside
- wall surfaces immediately below them.

Materials selected for walls under wide overhangs shall be selected / coated with this in mind.

The underside of eaves up to 900 wide shall be lined.

The following elements shall be protected with an appropriate industrial paint system (ensure that any Manufacturer's warranty remains valid):

- underside of exposed metal roofing on overhangs wider than 900mm
- exposed structural elements that are not rain washed.

Painted or coloursteel flashings should be avoided in protected locations (ie not rain-washed).

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The following details are Restricted design features.

- metal cladding on walls under eaves wider than 900mm
  - exposed metal structural elements under eaves or overhangs.
  - overhangs wider than 900mm where the underside of metal roofing is exposed.
-

# Appendix A

To be completed by the Designer and submitted to the Project Manager at completion of Detailed Design.

## Weather-tightness / Durability Check Sheet

SCHOOL NAME .....

SCHOOL I.D. ....

PROJECT NAME .....

PROJECT I.D. ....

PROGRAMME YEAR FUNDING ALLOCATED.....

FUNDING SOURCE LISTED IN PMIS.....

I / we confirm that:

- this project does not contain materials or features which are **Prohibited** in the Weather-tight and Durability Requirements for Schools – June 2014 publication
- this project does not contain materials or elements whose use is **Restricted**
- this project includes the following materials or features whose use is **Restricted** and full construction details for these items are appended

.....  
.....

- where applicable, features and elements have been designed in compliance with details and clauses in the *Requirements*
- this project includes the following features or elements that have not been designed in compliance with details or clauses in the *Requirements* and full construction details of these items are appended

.....  
.....

COMPANY .....

DESIGNER'S NAME .....

DESIGNER'S SIGNATURE .....

DATE .....