

Introduction to Acceptable Solution E2/AS1 External Moisture





Purpose of this document

This document is intended to be an introduction to Acceptable Solution E2/AS1 (third edition, 2004) for those already broadly familiar with the building controls regime. It:

- summarises the scope
- presents information on risk assessment
- summarises some of the new material found in E2/AS1.

This Introduction to E2/AS1 can never replace the Acceptable Solution or even cover all the subject matter, but it has the advantage of rapidly introducing readers to some of the important material contained in the source document. In particular, some of the new material covered in this booklet highlights significant areas of change that will need to be managed by designers, builders and building officials. This introduction can therefore be considered as both a training tool and a prompt to manage some of the issues that will arise as E2/AS1 is introduced.

It is expected that readers of this booklet will take a more in-depth look at the material presented by referring to E2/AS1 itself. References are included throughout this booklet to relevant paragraphs.

This document is intended as guidance only. While the BIA has taken care in preparing the document, it should not be relied upon as establishing compliance with all the relevant requirements of the Building Act or Building Code in any situation that may arise. This document is not an Approved Document. It may be updated from time to time. The latest version is available from the BIA website at www.bia.govt.nz

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Introduction

This revision of E2/AS1 grew out of the Overview Group on the Weathertightness of Buildings, which reported to the BIA in 2002. This report (commonly called the Hunn Report) called for a range of weathertightness issues to be addressed.

In particular, the Hunn Report recommended that the Approved Document for Clause E2 External Moisture of the Building Code be revised to include more details on how to achieve weathertightness. It was argued that a revised E2/AS1 would help to address concerns regarding present practices, and would assist in providing guidance to the industry on what is acceptable practice.

The revised E2/AS1 is one of several measures intended to address weathertightness issues. Other measures include the revision of B2/AS1, the Acceptable Solution for Durability and, looking ahead, the requirements for accredited Building Consent Authorities, the Licensed Building Practitioner regime and other changes proposed in the Building Bill currently before Parliament.

Philosophy underpinning E2/AS1

A significant portion of E2/AS1 is new material, including a section on the assessment of risk. This approach has been developed by the BIA from work done by two Canadians, Don Hazledon and Paul Morris, who developed a simple concept called 'the 4Ds' to describe the basic principles of water management in buildings.

Don Hazledon and Paul Morris based their concept on observations of the causes of building leaks and subsequent decay problems in Vancouver. There are many similarities between the problems seen in Vancouver and those in New Zealand and the 4Ds concept is just as applicable here.

The 4Ds are ranked in order of importance. They are:

- Deflection
- Drainage
- Drying
- Decay resistance.

Deflection is basically keeping water away from sensitive areas where it might enter a building. The most obvious example is eaves on a roof. Except under extremely windy situations or where buildings are tall, eaves reduce the amount of rain hitting a wall and flowing over windows and penetrations. Other examples are cap flashings and head flashings. Deflection should keep the vast majority of water from getting past the outer cladding.

Drainage is the provision of paths for any water that does get past the outer cladding to be removed quickly before it can cause damage to the wall components. A drained cavity, as is used with masonry veneer, is a good example. The provision of a sill tray flashing to remove water that leaks through joinery is another.

Drying removes any water that does not drain directly from behind the cladding. Drying is predominantly by ventilation but, where ventilation rates are very low, diffusion of water vapour will also contribute.

Decay resistance was the fourth D proposed by the Canadians, but 'durability' is the more commonly used term in New Zealand as it covers fixings and insulation as well as timber. This D states that materials used to construct the wall should have the appropriate durability for the anticipated environment within the wall.

Ideally a building should have a balanced design that incorporates all four Ds. A classic example is the simple single-storey house with a hipped roof and brick veneer cladding. As fashions and designs change, the amount of protection afforded by each of the individual Ds will change. A basic principle is that when you reduce the protection provided by any one of the 4Ds, it must be compensated for by increasing the protection provided by one or more of the other Ds. It is crucial to note that the 4Ds are ranked in order of importance. It is more effective to keep water out than to drain and dry it when it gets in, or to try and make the wall components last in a wet environment.

Recent developments in the Approved Documents for Clause B2 Durability and E2 External Moisture emphasise the importance of the 4Ds and add more robustness to buildings. Durability is addressed in the Acceptable Solution B2/AS1 by requiring treatment for exterior framing in most situations. The new E2/AS1 requires increased drainage and drying potential in buildings where deflection is limited or the overall risk of weathertightness problems is high. The Verification Method E2/VM1 tests the ability of a cladding to keep water out by deflection and to drain out any water that gets past the cladding.

Keeping the simple 4Ds concept in mind when designing, constructing and inspecting buildings will help ensure buildings are weathertight. It will also assist when evaluating Alternative Solutions, as the basic principles form a logical framework for the examination of B2 and E2 compliance.



1: Scope

This section details the buildings that are included in and excluded from the scope of the E2/AS1 document, and the qualifications required for installers.

E2/AS1 Reference:

Reference.....
Paragraph 1.1 – Construction included

Inclusions

The Acceptable Solution covers the weathertightness of the building envelope for:

- buildings within the scope of Clause 1.1.2 of NZS 3604 and up to three storeys,
- buildings based on NZS 3604 but with specific engineering design.

Reference.....
Paragraphs 3.2 – Roof claddings and
3.3 – Wall claddings

Claddings scoped

The table below shows the claddings outlined in the E2/AS1 document. Any other claddings are beyond the scope of E2/AS1.

Type of cladding	Covered in E2/AS1
Roof	The following roof cladding systems are covered: <ul style="list-style-type: none">• masonry tiles• pressed metal tiles• profiled metal• membrane roofing.
Wall	The following wall cladding systems are covered: <ul style="list-style-type: none">• masonry veneer• stucco• timber weatherboards• fibre cement weatherboards• profiled metal• fibre cement sheet• plywood sheet• EIFS.

Reference.....
Paragraph 1.2 – Construction excluded

Exclusions

The Acceptable Solution does not cover:

- outbuildings such as garages and other unlined structures
- steel-framed buildings
- buildings with spread-of-flame requirements
- buildings with acoustics requirements
- buildings requiring provisions for snow melt
- buildings, components or junction details that require specific weathertightness design.

Qualifications

The Acceptable Solution requires that the installer of the roof and wall claddings listed below must be approved by the manufacturer or a New Zealand agent. The means of identifying an approved installer could include that:

- the installer carries an identity card and presents it on request
- the installer provides a copy of their approval to a building official
- the cladding manufacturer or New Zealand agent publishes a list of approved people (eg, on a website).

The table below outlines the qualifications/skills that would ideally be held by installers. In all cases, except for pressed metal roof cladding, installers should have successfully completed, or demonstrated skill to the level of, an NZQA recognised course (such as the ones noted).

	Material	Installer details
E2/AS1 Reference: Reference..... Paragraph 8.2.2	Masonry tile roof cladding	A trained tiler approved by the tile manufacturer or the New Zealand agent (in the case of imported tiles). Course: An appropriate roof tiling course, such as the National Certificate in Concrete Tile Roofing.
Reference..... Paragraph 8.3.2	Pressed metal tile roofing	A trained installer approved by the tile manufacturer or the New Zealand agent (if tiles are imported).
Reference..... Paragraph 8.4.2	Profiled metal roof cladding	A trained installer approved by the manufacturer or the New Zealand agent (if cladding is imported). Course: The Roofing Industry Training Organisation (RITO) offers an appropriate qualification.
Reference..... Paragraph 8.5.2	Butyl rubber and EPDM membrane cladding	A trained installer approved by the manufacturer or the New Zealand agent (if cladding is imported).
Reference..... Paragraph 9.2.2	Masonry veneer	A trained installer approved by the manufacturer or the New Zealand agent (if veneer is imported).
Reference..... Paragraph 8.3.2	Solid plaster/stucco	A trained and experienced applicator. Course: A BCITO qualification meets the required level.
Reference..... Paragraph 9.6.2	Profiled metal wall cladding	A trained installer approved by the manufacturer or the New Zealand agent (if cladding is imported). Course: The RITO offers an appropriate qualification.
Reference..... Paragraph 9.7.10.2	Flush-finished cladding (Fibre cement sheet)	A trained installer approved by the supplier of the jointing and finish system. Course: The BCITO National Certificate in Proprietary Plaster Cladding Systems – Fibre Cement is recommended.
Reference..... Paragraph 9.9.2	EIFS cladding systems	A trained applicator approved by the manufacturer or the New Zealand agent (if system is imported). Course: The BCITO National Certificate in Proprietary Plaster Cladding Systems – EIFS.



2: Weathertightness risk factors

Section 3 of E2/AS1 underpins the whole document. An understanding of section 3 is vital if E2/AS1 is to be successfully used.

Section 3 of E2/AS1 enables buildings to be classified into risk categories and requires different cladding solutions depending on a building's risk score. It includes three examples of how to carry out a weathertightness risk analysis. These examples are not repeated here, but it is recommended that they be reviewed before undertaking the risk assessments outlined in E2/AS1.

E2/AS1 Reference:

Reference.....
Paragraph 3.1 – Establishing the risk

Establishing the risk

A risk assessment allows the risks related to various features to be aggregated, resulting in a risk score for the design. Figure 1 from E2/AS1 'How to assess risk' shows the process to be followed. Table 1 from E2/AS1 'Definitions of risk' sets out the definitions of risk levels relating to the location and design features of the building.

Figure 1 from E2/AS1: How to assess risk

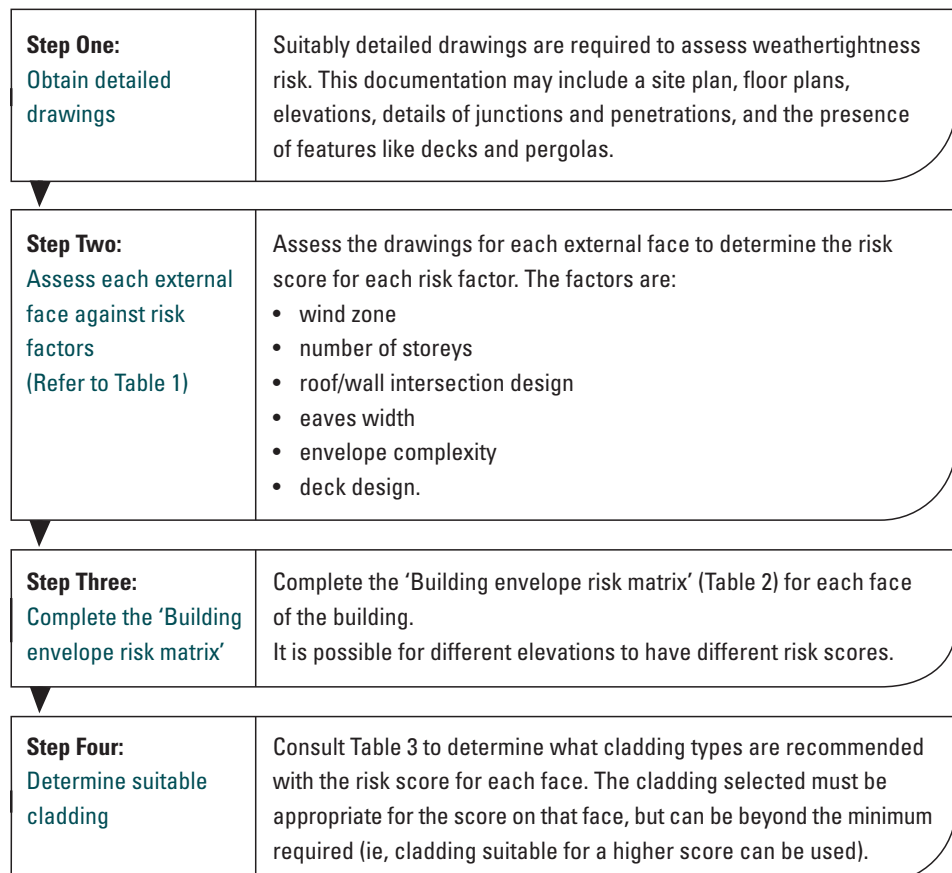


Table 1 from E2/AS1: Definitions of risk

Risk factor	Risk	Detail
A: Wind zone	Low	Low wind zone as described by NZS 3604
	Medium	Medium wind zone as described by NZS 3604
	High	High wind zone as described by NZS 3604
	Very high	Very high wind zone as described by NZS 3604
B: Number of storeys	Low	One storey
	Medium	Two storeys in part
	High	Two storeys
	Very high	More than two storeys
C: Roof/wall intersection design	Low	Roof-to-wall intersection fully protected (eg, hip and gable roof with eaves)
	Medium	Roof-to-wall intersection partly exposed (eg, hip and gable roof with no eaves)
	High	Roof-to-wall intersection fully exposed (eg, parapets or eaves at greater than 90° to vertical with soffit lining)
	Very high	Roof elements finishing within the boundaries formed by the exterior walls (eg, lower ends of aprons, chimneys etc)
D: Eaves width ⁽¹⁾	Low	Greater than 600 mm at first floor level
	Medium	450 – 600 mm at first floor, or over 600 mm at second floor level
	High	100 – 450 mm at first floor, or 450 – 600 mm at second floor level
	Very high	0 – 100 mm at first floor, or 100 – 450 mm at second floor level, or 450 – 600 mm at third floor level ⁽²⁾
E: Envelope complexity	Low	Simple rectangular, L, T or boomerang shape, with single cladding type
	Medium	More complex, angular or curved shapes (eg, Y or arrowhead) with single cladding type
	High	Complex, angular or curved shapes (eg, Y or arrowhead) shapes with multiple cladding types
	Very high	As for high risk, but with junctions not covered in C or F of this table (eg, box windows, pergolas, multi-storey re-entrant shapes etc)
F: Deck design	Low	None, timber slat deck or porch at ground level
	Medium	Fully covered in plan by roof, or timber slat deck attached at first or second floor level
	High	Enclosed deck exposed in plan or cantilevered at first floor level
	Very high	Enclosed deck exposed in plan or cantilevered at second floor level or above

NOTES:

- 1 Eaves width measured from external face of wall cladding to outer edge of overhang, including gutters and fascias.
- 2 Balustrades and parapets count as 0 mm eaves.

E2/AS1 Reference:Reference.....
Paragraph 3.1.2 – The risk score

Risk score

Table 2 'Building envelope risk matrix' sets out the risk matrix that shall be used to define the risk score. A risk score is calculated for each elevation of the building.

Claddings are then selected from Table 3 'Suitable wall claddings' according to the risk scores, or the highest risk score may be used for all walls.

Table 2 from E2/AS1: Building envelope risk matrix

Risk factor	Risk severity								subtotals for each risk factor
	low	score	medium	score	high	score	very high	score	
Wind zone (per NZS 3604)	0		0		1		2		
Number of storeys	0		1		2		4		
Roof/wall intersection design	0		1		3		5		
Eaves width	0		1		2		5		
Envelope complexity	0		1		3		6		
Deck design	0		2		4		6		
Total risk score:									

(Enter the appropriate risk severity score for each risk factor in the score columns. Transfer these figures across to the right-hand column. Finally, add up the figures in the right-hand column to get the total risk score.)

Table 3 from E2/AS1: Suitable wall claddings

Suitable wall claddings ⁽¹⁾		
Risk score	Direct fixed to framing	Over 20 mm minimum drained cavity
0 – 6	a) Timber weatherboards – all types b) Fibre cement weatherboards c) Vertical profiled metal ⁽³⁾ – corrugated and symmetrical trapezoidal only d) Fibre cement sheet ⁽⁴⁾ e) Plywood sheet f) EIFS	a) Masonry veneer ⁽²⁾ b) Stucco c) Horizontal profiled metal ⁽³⁾ – corrugated and trapezoidal only
7 – 12	a) Bevel-back weatherboards b) Vertical board and batten c) Vertical profiled metal ⁽³⁾ – corrugated only	a) Masonry veneer ⁽²⁾ b) Stucco c) Horizontal profiled metal d) Rusticated weatherboards e) Fibre cement weatherboards f) Fibre cement sheet g) Plywood sheet h) EIFS
13 – 20	a) Vertical profiled metal ⁽³⁾ – corrugated only	a) to h) as above i) Bevel-back weatherboards
Over 20	a) Redesign the building to achieve a lower score, or b) Specific design: <ul style="list-style-type: none"> • The design may need changing to reduce the risk. • The territorial authority or building certifier will require more comprehensive details and documentation providing evidence of weathertightness. • The territorial authority, building certifier, designer or owner may require more inspections. • A third party audit of design by a weathertightness expert may be required. 	

Notes:

- 1 The wall claddings in this table are limited to those covered in the Acceptable Solution.
- 2 Traditional masonry veneer as per SNZ HB 4236, with minimum 40 mm cavity.
- 3 Refer to Figure 38 of E2/AS1 for profiles.
- 4 Except stucco over a fibre cement backing.



3: New content

This section outlines a selection of new content in E2/AS1. The selection is not exhaustive – E2/AS1 contains a large amount of material and readers should consult the Approved Document for a complete overview.

E2/AS1 Reference:
 Reference.....
 Paragraphs 8.1.5 – Underlays and
 9.1.7 – Building wrap

Roof underlays and building wrap properties

- Requirements for roof underlays are stated in 8.1.5.
- Requirements for wall underlays are stated in 9.1.7.

Both paragraphs in E2/AS1 refer to Table 23. Although similar to Table 11.1 in NZS 3604, Table 23 contains more information.

The table below outlines the properties of roof underlays and building wraps.

Table 23 from E2/AS1: Properties of roof underlays and building wraps

Application	Absorb-ency	Vapour resistance	Water resistance	pH of extract	Shrinkage	Mechanical
Category: Roof underlay (includes bitumen and fire-retardant paper-based products)						
All roofs. Direct fixed non-absorbent claddings. ⁽¹⁾	≥100 g/m ² AS/NZS 4201: Part 6	≤7 MN s/g ASTM E96 B	≥100 mm AS/NZS 4201: Part 4	≥6.0 and ≤9.0	≤0.5% AS/NZS 4201: Part 3	Edge tear and tensile strength to AS/NZS 4200
Category: Wall wrap (includes building papers and synthetic wall wraps)						
All cavity walls and direct fixed absorbent claddings ⁽²⁾ eg, timber, fibre cement etc	No require-ment	≤7 MN s/g ASTM E96 B	≥20 mm AS/NZS 4201: Part 4	≥6.0 and ≤9.0	≤0.5% AS/NZS 4201: Part 3	Edge tear and tensile strength to AS/NZS 4200
Category: Rigid sheathing (plywood⁽³⁾ and fibre cement sheet)						
Direct fixed non-absorbent claddings ⁽⁴⁾	≥100 g/m ² AS/NZS 4201: Part 6	≤7 MN s/g ASTM E96 B	≥20 mm AS/NZS 4201: Part 4	≥6.0 and ≤9.0	NA	NA

Application	Absorb- ency	Vapour resistance	Water resistance	pH of extract	Shrinkage	Mechanical
Category: Rigid sheathing (plywood⁽³⁾ and fibre cement sheet)						
Direct fixed absorbent claddings and claddings over a cavity ⁽⁴⁾	No require- ment	≤7 MN s/g ASTM E96 B	≥20 mm AS/NZS 4201: Part 4		NA	NA
Category: Air barrier						
Where no internal linings	≥100 g/m ²	≤7 MN s/g ASTM E96 B	≥20 mm AS/NZS 4201: Part 4	≥6.0 and ≤9.0	≤0.5% AS/NZS 4201: Part 3	Edge tear strength AS/NZS 4200 90N Air resistance BS 6538: Part 3: ≥0.1 MN s/m ³
Category: DPC/DPM						
All applications – there will be separate thick- nesses depend- ing on use		≥90 MN s/g ASTM E96 B				

Notes:

- 1 Used where necessary directly behind (and so in contact with) profiled metal wall cladding.
- 2 Not used in contact with profiled metal wall cladding.
- 3 Plywood to be treated in accordance with NZS 3602.
- 4 Bitumen-based products shall not be used in direct contact with LOSP-treated plywood.

E2/AS1 Reference:

Reference.....
Paragraph 4.6 – Flashing overlaps
and upstands

Metal flashing dimensions

The flashings must be accordance with the details provided in the table overleaf regarding:

- minimum slopes and covers of flashings
- overlap cover of the cladding to the flashing upstand and clearance from the bottom of the cladding to the top of the slope of the head flashing.

Readers will be familiar with Table 4.5 in NZS 3604. In the new E2/AS1 this has been split into two tables (Tables 21 and 22). A new table has been added (Table 20) which shows the acceptable materials for the different exposure locations and durability requirements.

Table 7 from E2/AS1: Metal flashings – general dimensions

Type	Description	All ⁽¹⁾	Situation 1 minimum ⁽²⁾	Situation 2 minimum ⁽³⁾
Aprons: general	Transverse flashing over roofing		130 mm ⁽⁴⁾	200 mm ⁽⁴⁾
	Parallel flashing over roofing	Two crests, finish in next trough		
Ridges/hips	Transverse flashing over roofing	Refer Aprons: general		
Changes in roof pitches	Upper lap under roofing	250 mm min.		
	Transverse flashing over roofing	Refer Aprons: general		
Barges	Overlap to barge board		50 mm ⁽⁸⁾	70 mm ⁽⁸⁾
Cappings	Overlaps to cladding Slope to top: parapet Housing – balustrade ⁽⁵⁾	5° 5°	50 mm ⁽⁸⁾	70 mm ⁽⁸⁾
Roof or deck to wall	Overlaps to roofing	Refer Aprons: general		
	Lap under cladding above Clearance below cladding Total upstand	75 mm min. 35 mm min. 110 mm min.		
Windows	Window flange clearance Cover to window flange	5 mm 10 mm ⁽⁷⁾		
Sills	Sill flashing slope ⁽⁶⁾	5°		
Heads	Head flashing slope Lap under cladding above Anti-capillary gap to cladding Total upstand	15° 35 mm min. 5 mm 40 mm min.		
Corners	Corner flashings ⁽¹⁾	50 mm x 50 mm minimum		
Inter-storey junctions	Junction flashing: slope Lap over cladding below ⁽¹⁾ Lap under cladding above Clearance under cladding Total upstand	15° 35 mm min. ⁽⁸⁾ 35 mm min. 5 mm 40 mm min.		

Notes:

- 1 Unless otherwise dimensioned in details.
- 2 **Situation 1:** In low or medium wind zones, where roof pitch is 10° or greater.
- 3 **Situation 2:** For all roof pitches in high or very high wind zones,
For all wind zones where roof pitch is less than 10°.
- 4 Excluding any soft edge or turn-down to roofing.
- 5 For buildings other than housing, slope shall be as per F4/AS1.
- 6 Where applicable, unless shown otherwise in details – for windows requiring sill flashings. Sill flashings must extend past the condensation channel.
- 7 Excluding drip edge. The aim is for at least 10 mm, but this may be reduced if necessary to account for on-site tolerances – to give an absolute minimum of 8 mm.
- 8 Excluding drip edge.

E2/AS1 Reference:

Reference.....
 Paragraph 4.3.11 – Flexible flashing tape

Flexible flashing tape

Flexible flashing tape must comply with Parts 3.2 and 4 of ICBO Acceptance Criteria AC148. It must be compatible with any adjacent building wrap or roof underlay.

The manufacturer/supplier will need to demonstrate that their product has been tested and meets this requirement. Currently there are products on the market that do not reference ICBO Acceptance Criteria AC148.

Sealants

The table below collates the references to sealants made throughout E2/AS1. While some sealants on the market have been tested to the Standards cited, many have not. Users will need to check the manufacturers’/ suppliers’ technical information to ensure sealants comply with the specifications listed below.

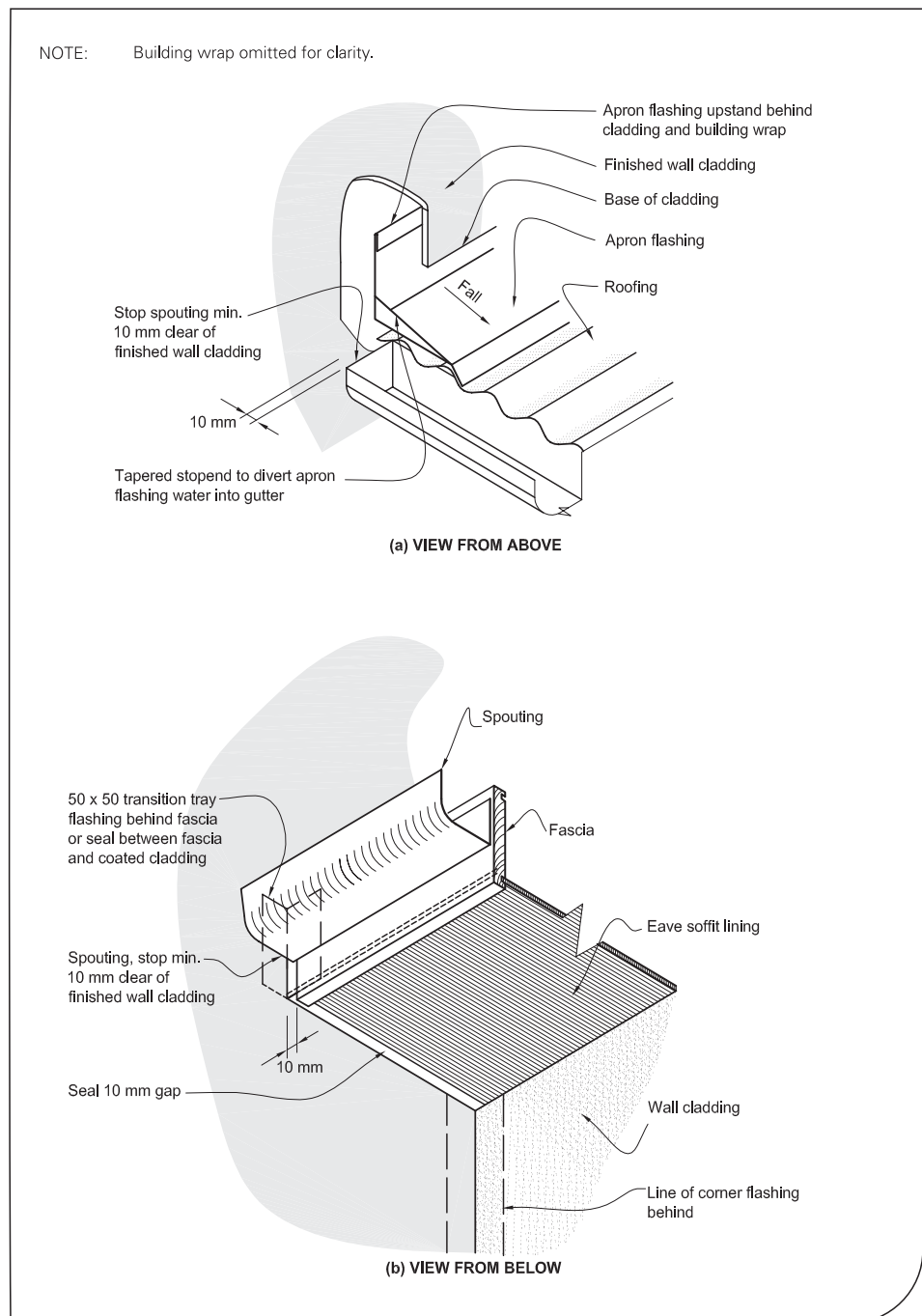
	Where used	Sealant details
	Metal flashing joints (unless otherwise specified in Paragraph 4.5.2 of the Acceptable Solution)	The neutral cure silicone sealant shall comply with: <ul style="list-style-type: none"> • Type F, Class 20LM or 25LM of ISO 11600, or • Low modulus Type II Class A of Federal Specification TT-S-00230C.
Reference..... Paragraph 7.4.5	Stanchions for handrails, signs, television aerials or similar structures	Sealant shall be compatible with the washer.
Reference..... Paragraph 8.4.11.1	Profiled metal, where end-laps are required in flashings	An 8 mm diameter bead of neutral cure sealant complying with ISO 11600 or Specification TT-S-00230C as noted above.
Reference..... Paragraph 9.1.6	Air seals	Air seals can be made of sealant complying with ISO 11600 or Specification TT-S-00230C.
Reference..... Paragraph 9.1.9.3	Pipes and service penetrations	Make weathertight by use of flashings and, where necessary, sealant complying with ISO 11600 or Specification TT-S-00230C.
Reference..... Paragraph 9.2.4.1	Clay bricks	The sealant used for control joints should comply with ISO 11600 or Specification TT-S-00230C.
Reference..... Paragraph 9.5.3.2	Laps and joints for fibre cement weatherboards	The joints will be waterproofed by hidden soakers with sealant that complies with ISO 11600 or Specification TT-S-00230C.
Reference..... Paragraph 9.6.7	Flashings for profiled metal cladding	The neutral cure sealant used shall comply with ISO 11600 or Specification TT-S-00230C.
Reference..... Paragraph 9.9.3	Exterior Insulation and Finish Systems	Part of the materials for EIFS will be a flexible polymeric neutral cure sealant approved by the cladding system supplier which complies with ISO 11600 or Specification TT-S-00230C.
Reference..... Paragraph 9.9.8	Pipes and service penetrations through the EIFS	One option for weatherproofing is a face-fitted flange at EIFS surface, sealed with a neutral cure sealant complying with ISO 11600 or Specification TT-S-00230C.

Gutter/wall junctions

The figure below displays gutter/wall junction details. Note the following.

- The upstand at the lower edge of the apron flashing may be preformed to a larger size and then trimmed on site to suit.
- The transition flashing bridges the gap at the end of the spouting to protect the soffit framing. View (b) indicates the position of transition flashing in relation to the soffit when viewed from below.

Figure 8 from E2/AS1: Gutter/wall junction

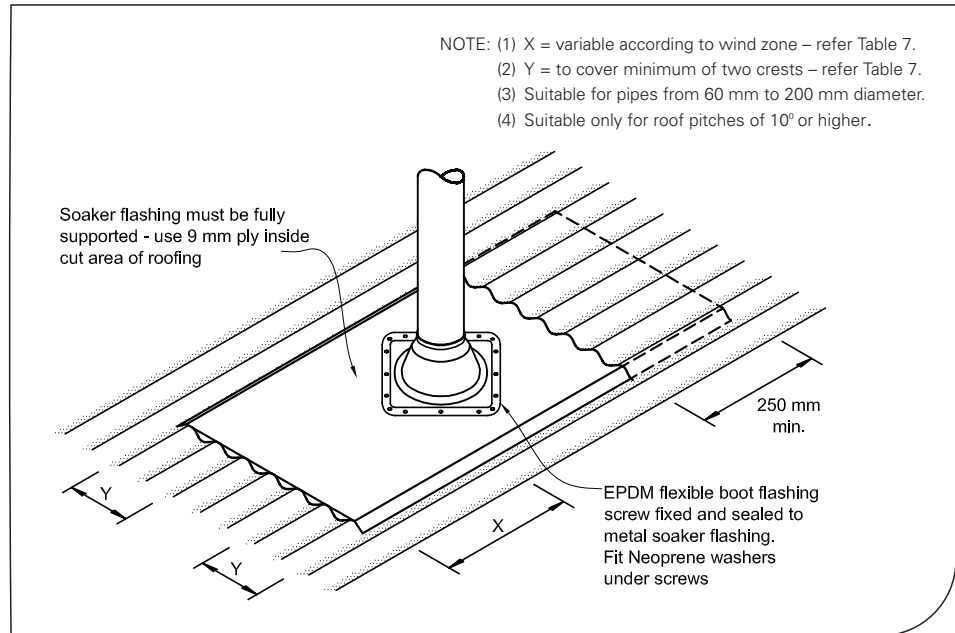


E2/AS1 Reference:
 Reference.....
 Paragraph 8.4.17 – Roof penetrations

Pipe penetrations through roof

Pipe penetrations from 60 mm up to 200 mm must be flashed using a soaker flashing and EPDM boot flashing as shown in the figure below.

Figure 54 from E2/AS1: Soaker flashing for pipe penetrations



Reference.....
 Paragraph 8.1.6 – Gutters

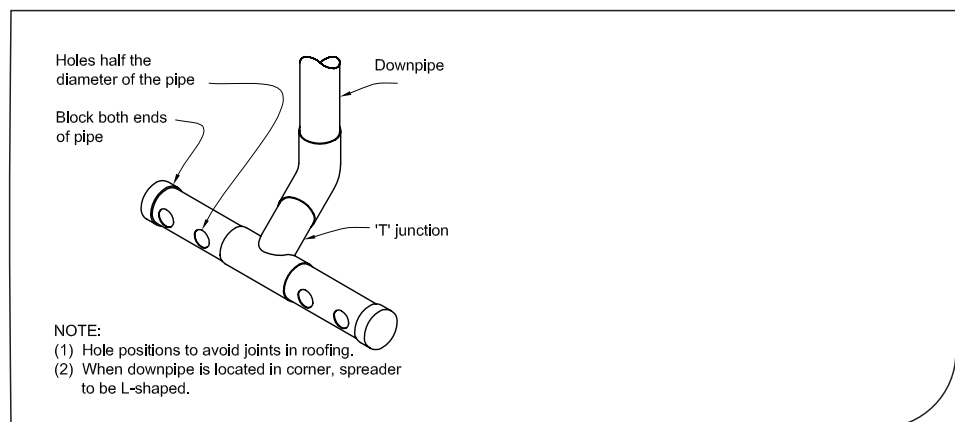
Spreaders (and limitations)

Downpipes discharging to a lower roof shall be fitted with a spreader as shown in the figure below.

A maximum catchment area of 25 m² shall be permitted to discharge via a spreader onto a lower roof area.

Spreaders shall only be used on masonry tile roofs when a roof underlay is installed.

Figure 20 from E2/AS1: Spreader for roof discharge



Membrane roofs and decks

E2/AS1 Reference:

Reference.....
Paragraph 7.1 – Thresholds for decks

Thresholds for decks

The vertical separation between the inside floor and the upper surface of the deck is noted in the table below.

Reference.....
Paragraph 7.1.1

Reference.....
Paragraph 7.1.2

Type of deck	Details
Slatted decks	For decks using spaced timber slats, a minimum gap of 12 mm shall be provided between the exterior wall and the adjacent timber slat. The level of the upper surface of the timber decking: a) shall be a minimum of 50 mm below the interior floor level for cantilevered decks, or b) may be at the same level as the interior floor for non-cantilevered decks.
Enclosed decks	The Acceptable Solution is limited to enclosed decks with a maximum area of 40 m ² . For enclosed decks, the vertical separation between the inside floor level and the upper surface of the finished deck surface shall be a minimum of 100 mm.

For more detail, see Figures 14–16 in section 7 – Decks and pergolas of E2/AS1.

Reference.....
Definitions

Enclosed deck definition

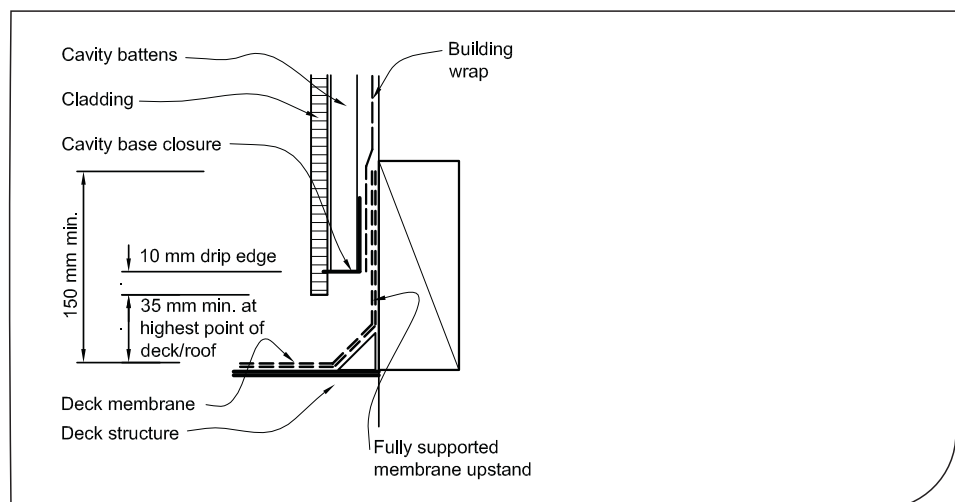
A deck, whether over an interior or exterior space, that has an impermeable upper surface and is closed on the underside. May also be known as a balcony.

Reference.....
Paragraph 7.4.3 – Balustrade-to-deck floor junction

Balustrade-to-deck floor junction

The junction of the enclosed balustrade with the floor of the enclosed deck must be made weathertight as shown in the figure below.

Figure 18 from E2/AS1: Enclosed balustrade – bottom of cladding



E2/AS1 Reference:

Reference.....

Paragraph 8.5.1 – Limitations

Limitations

It is important to note that, in relation to decks, the Acceptable Solution is limited to membranes composed of butyl or EPDM installed over substrates for (amongst other factors) decks with a maximum area of 40 m² and with no downpipe direct discharge to the deck.

Reference.....

Paragraph 8.5.3 – Plywood substrates

Compatibility with membrane

The compatibility of LOSP-treated plywood must be checked with membrane suppliers. If using plywood containing copper-based preservatives, check the compatibility of adhesives and membranes with copper with the product manufacturers.

Reference.....

Paragraph 8.5.4 – Butyl and EPDM

Membrane specifications for butyl rubber and EPDM rubber

- a) Minimum thickness:
 - i) 1 mm for roofing or when used for decks with a protective wearing surface, or
 - ii) 1.5 mm with no protective surface, and
- b) Comply with the following parts of Table 1 in ASTM D6134:
 - i) tensile strength
 - ii) elongation
 - iii) water absorption
 - iv) water vapour permeance, and
 - v) heat aging followed by:
 - a. tensile strength
 - b. elongation.

Adhesives, primers and seam tapes for use with butyl rubber or EPDM membranes shall be part of a complete system approved by the manufacturer or supplier of the membrane.

Reference.....

Paragraph 8.5.9.1 – Handrails

Handrail fixings through membrane

Fixing of posts for handrails into membrane roofs or decks is not covered by the Acceptable Solution. Note that:

- any fixing of posts into membrane roofs or decks will require specific weathertightness design
- the fixing of posts into tiles over a membrane is particularly risky and should be avoided.

Reference.....

Paragraph 9.1.8.2 – Requirements

Cavities

Where a drained cavity is required, it shall:

- a) be installed over building wrap or rigid sheathing that:
 - i) complies with the roof underlays and building wrap properties table (see Table 23, page 10), and
 - ii) is fixed to wall framing
- b) be formed using vertical cavity battens

- c) restrict air movement between the drained cavity and:
 - i) floor, wall and roof framing
 - ii) attic roof space
 - iii) subfloor space
- d) be drained and open to the exterior at the bottom of cavities
- e) use vermin-proofing at the cavity base
- f) use cavity spacers, where fixing is required between cavity battens, and
- g) not use horizontal cavity battens (as these obstruct the air flow in cavities).

E2/AS1 Reference:

Reference.....
 Paragraph 9.1.9.3 – Pipes and service penetrations

Pipes and service penetrations

Acceptable methods of flashing pipes and a meterbox are shown below.

Figure 68 from E2/AS1: General pipe penetration

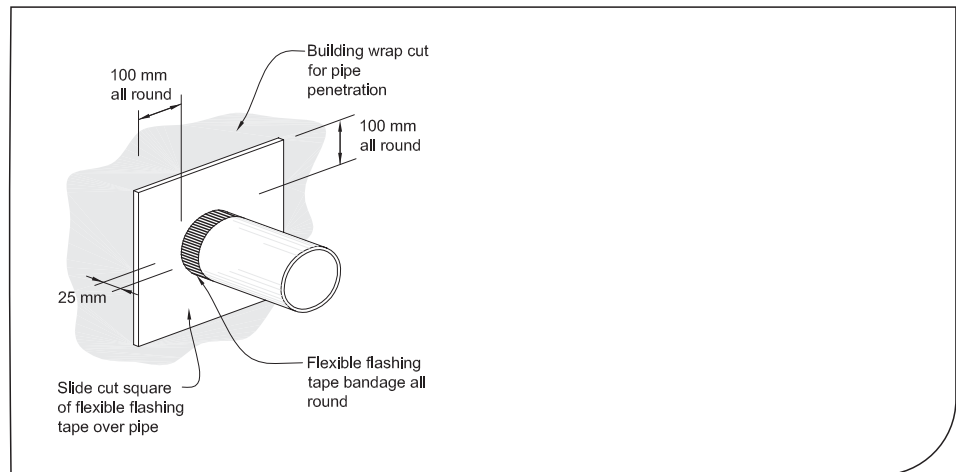
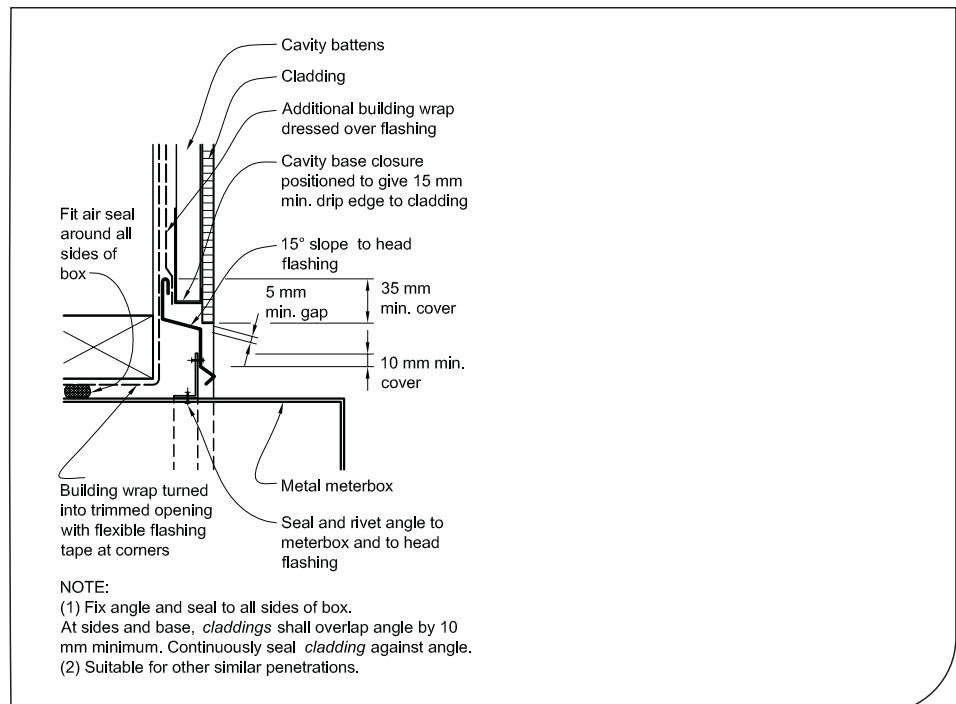


Figure 69 from E2/AS1: General meterbox

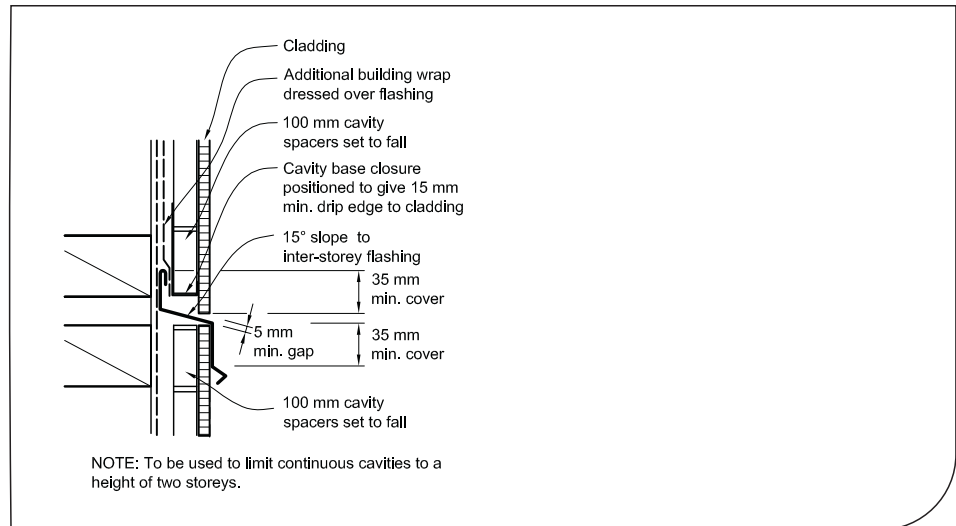


E2/AS1 Reference:
 Reference.....
 Paragraph 9.1.9.4 – Inter-storey junctions

Inter-storey cavity base closure

For walls over two storeys, an inter-storey flashing bridging the drained cavity must be used, as shown below.

Figure 70 from E2/AS1: General inter-storey junctions

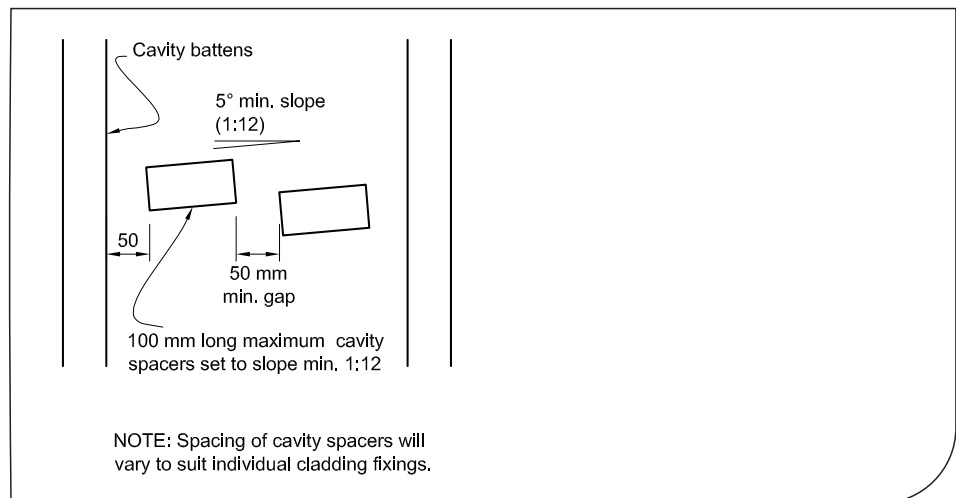


Reference.....
 Paragraph 9.1.8.2 – Requirements

Cavity spacers

Cavity spacers should be used where fixing is required between cavity battens, as shown below (see also Paragraph 9.1.8.2 f) and g)).

Figure 67 from E2/AS1: Cavity spacers

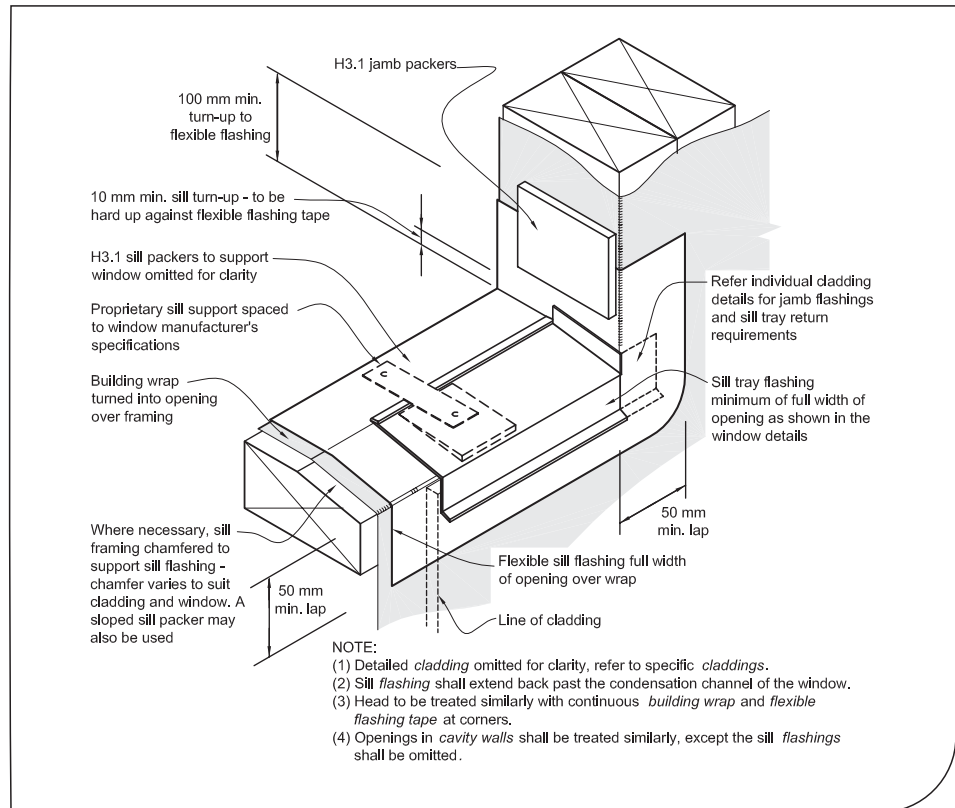


E2/AS1 Reference:
 Reference.....
 Paragraph 9.1.10.2 – Treatment
 of opening

General window opening

The following figure shows the treatment of the window opening for direct fixed wall claddings (note that wall claddings over drained cavities will be as shown below, except there will be no sill flashing).

Figure 72 from E2/AS1: General window opening



Reference.....
 Paragraph 9.1.10 – Windows and doors

Windows and doors

Window details specific to particular claddings are given in Paragraphs 9.2 to 9.9. Door details shall be based on window details.

Reference.....
 Paragraph 9.1.10.1 – Scope

Scope

This Acceptable Solution is limited to hinged windows and doors and does not cover bi-fold, sliding and other non-hinged profiles. Due to their window profiles, non-hinged windows and doors shall require specific weathertightness design.

E2/AS1 Reference:

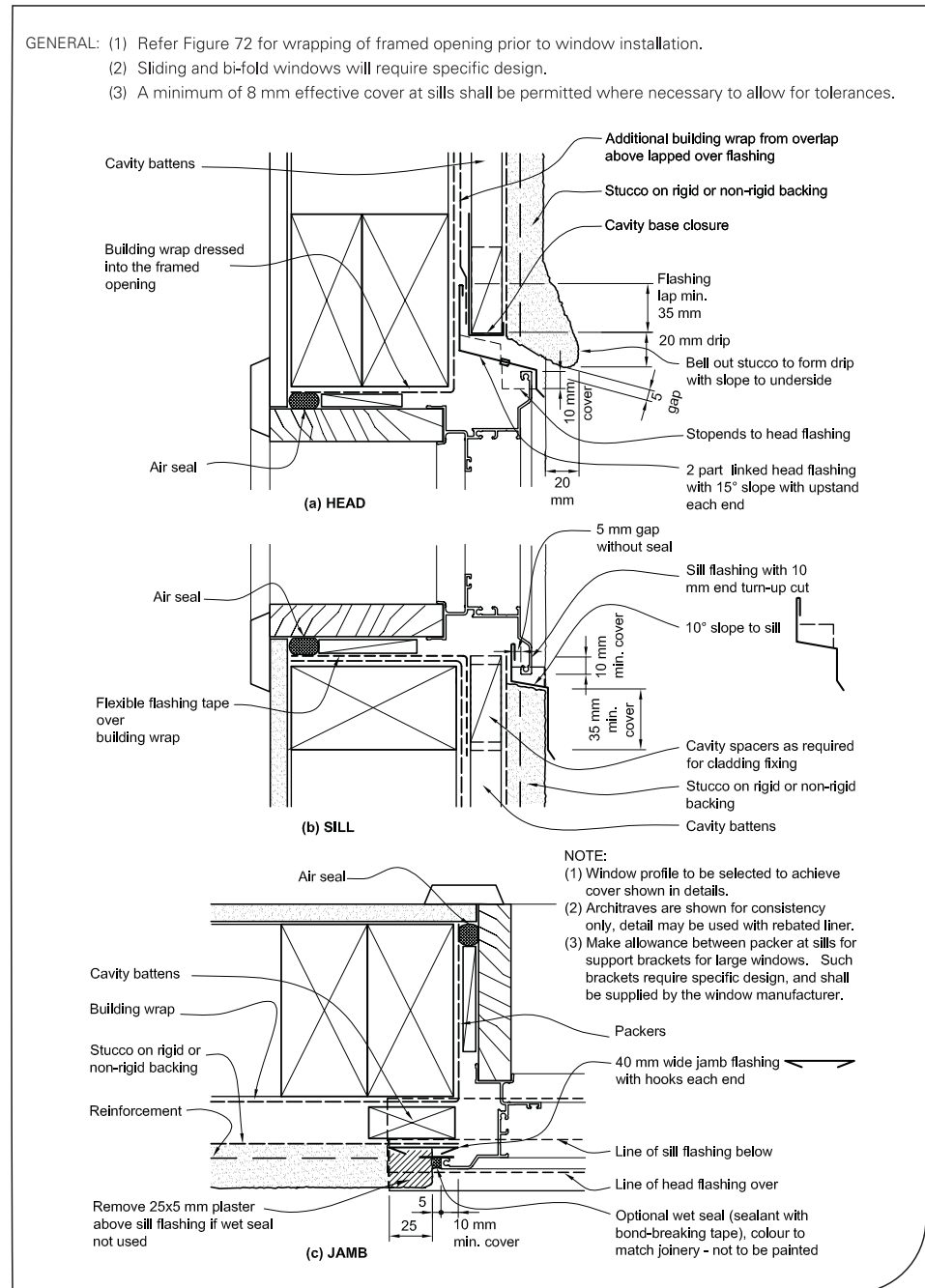
Reference.....
Paragraph 9.3.11 – Windows and doors

Windows in stucco cladding

Windows and doors in stucco cladding must be installed as shown in the figure below.

Refer to the previous figure for wrapping of framed opening prior to window installation.

Figure 76 from E2/AS1: Windows in stucco cladding



E2/AS1 Reference:

Reference.....
Paragraph 9.4 – Timber weatherboards

Reference.....
Paragraph 9.4.4.4 – External corners

Reference.....
Paragraph 9.4.4.5 – Internal corners

Reference.....
Paragraph 9.4.6 – Windows in direct fixed weatherboards

Reference.....
Paragraph 9.6 – Profiled metal

Reference.....
Paragraph 9.7 – Fibre cement sheet

Reference.....
Paragraph 9.7.5 – Corners

Reference.....
Paragraph 9.7.7.1 – Windows – direct fixed

Reference.....
Paragraph 9.7.8.1 – Flush-finished topped balustrades

Timber weatherboards

Note the following in relation to timber weatherboards.

- A back flashing is required on external corners with mitred timber weatherboards (see Figure 78).
- A corrosion-resistant corner flashing shall be fitted behind the weatherboards at some internal corners (see Figure 79).
- A sill flashing is required for all direct fixed weatherboard systems (see Figures 81, 82, 83 and 84).

Profiled metal wall claddings

This section of the Acceptable Solution provides comprehensive flashing details that are not easily summarised here. Importantly, note that:

- horizontal profiled metal wall cladding must be fixed over a drained cavity
- vertical profiled metal wall cladding does not need to be fixed over a cavity system, but must be direct fixed to framing over a roof underlay.

Fibre cement sheet

Fibre cement sheet claddings shall be either direct fixed to framing over a building wrap or fixed over a drained cavity, depending on the risk score as calculated in section 3 (see pages 6-9).

Note the following.

- Back flashings are required on some internal and external corners (see Figures 111 and 112).
- Sill flashings are required for direct fixed systems (see Figure 115).

Flush-finished topped balustrades

Where the tops to enclosed balustrades are formed using flush-finished fibre cement, they shall have a minimum fall of 10° (1:6), and be wrapped as shown in Figure 117 of E2/AS1 with a waterproofing membrane, approved by the supplier of the jointing and finish system. The membrane shall be fully protected by the coating and shall:

- comply with the requirements of AS/NZS 4858 Table 8, Parts (a) to (e), except that bleach and detergent immersion set out in Appendix A1 shall not be required
- be applied by a trained applicator, approved by the supplier of the jointing and finish system.

Manufacturers/suppliers will need to demonstrate their product has been tested to the requirements above.

E2/AS1 Reference:

Reference.....
Paragraph 9.7.10.2 – Flush-finished cladding

Flush-finished cladding

Flush-finished fibre cement must be finished with a textured finish system and must:

- comply with BRANZ EM 4 ('Evaluation Method' for jointing systems for flush-finished fibre cement sheet), when tested with the specific fibre cement substrate and jointing system used for the cladding
- have all components approved by the supplier of the jointing and finish system.

Note: Where a topcoat of paint over the finish is required to provide weather protection, it shall be a latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730.

Manufacturers/suppliers will need to demonstrate their product has been tested and meets the above criteria.

Reference.....
Paragraph 9.9 – EIFS

Exterior Insulation and Finish Systems (EIFS)

This Acceptable Solution sets the minimum standard for EIFS. However, extra elements deemed suitable by the system supplier should not be excluded on the basis of the Acceptable Solution.

Note also:

- Suppliers of EIFS cladding systems shall demonstrate their systems meet the tensile-adhesion performance requirements of ASTM E2134: 2001 (the standard test method for evaluating the tensile-adhesion performance of an EIFS).
- Where necessary to maintain weathertightness, EIFS shall be finished with a latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730.

Reference.....
Paragraph 9.9.6 – Coating

Reference.....
Paragraph 9.9.6.3. – Finish coats

Manufacturers/suppliers will need to demonstrate their product has been tested and meets the above criteria.

E2/AS1 Reference:

Reference.....
Verification Method E2/VM1

Verification Method

E2/VM1 outlines the Verification Methods used to test weathertightness. The details are summarised here.

Reference.....
E2/VM1 – Section 1

Cladding systems of buildings

Compliance with NZBC E2.3.2 for cladding systems of buildings, including junctions with windows, doors and other penetrations is attained using the weathertightness testing procedure of AS/NZS 4284: 1995 Testing of Building Facades. (Note that this test is modified as it was originally developed for commercial buildings.) The three test series are outlined below.

Series	Details
One	Static water penetration: Test pressure 330 Pa, duration 15 minutes. Cyclic water penetration: <ul style="list-style-type: none"> • Test pressure 150-300 Pa, duration 5 minutes. • Test pressure 300-600 Pa, duration 5 minutes.
Two	Water management tests: Static water penetration, test pressure 50 Pa, duration 15 minutes. Water management tests: Cyclic water penetration: <ul style="list-style-type: none"> • Test pressure 150-300 Pa, duration 5 minutes. • Test pressure 300-600 Pa, duration 5 minutes.
Three	Wetwall test: Static water penetration, test pressure 50 Pa, duration 15 minutes.

Reference.....
E2/VM1 – Section 2

Pitched roofing systems

Pitched roofing systems over a ventilated roof space of 15° pitch or more are verified in line with Appendix C of AS 2050. Compliance is based on a comparison with a control roofing system described in the Standard.

Reference.....
E2/VM1 – Section 3

Skillion roofs and commercial and industrial roofing

Skillion roofs and commercial and industrial roofing have no specific method of verification.



This document has been designed to introduce the reader to the Acceptable Solution on External Moisture, E2/AS1 which details a major change in building practice. Further information and training on E2/AS1 can be obtained at the BIA/BRANZ seminar series running in June-July 2004 and October-November 2004. Updates on E2/AS1 will be posted on the BIA website at www.bia.govt.nz/e/publish/weathertightness.shtml

For full details on the changes to E2/AS1, readers should always refer to the Approved Documents which provide extensive information. Orders can be placed via the Victoria University Book Centre at www.bookcentre.co.nz/bia/

Alternatively, phone 0800 370 370 or email BIA-vubc@bookcentre.co.nz



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