Design and Installation of Exterior Timber Wall Cladding

Design and Building Practices

Note changes to this standard may be required to be compliant with proposed NCC 2025 condensation provisions. The ABCB is reviewing potential changes and will advise the FWPA accordingly.

Draft Version 7 November 2024

Type here

Contents

2 PREFACE

This Standard aims to provide installers, designers and manufacturers with general solutions for designing and installing hardboard, plywood and profiled timber exterior wall cladding.

3 SCOPE AND GENERAL

3.1 SCOPE

This Standard specifies requirements, materials, construction, and installation practices for external timber cladding systems used in low-rise residential, non-residential and non-habitable structures. The accepted timber and wood-based cladding systems that are manufactured to their relevant product standard are -

(1) Hardboard - AS/NZS 1859.4
(2) Structural plywood - AS/NZS 2269.0 and AS/NZS 2271
(3) Profiled timber cladding systems and
    (a) Softwood - AS 4785.1
    (b) Cypress - AS 1810
    (c) Hardwood - AS 2796.1

The specific requirements intend to provide solutions for the structural fixing of the cladding to the substrate and to meet the National Construction Code's Performance Requirements.

- Volume One: B1P1 Structural reliability, B1P2 Structural resistance, F3P1 Weatherproofing and F8P1 Condensation and water vapour management
- Volume Two: H1P1 Structural Stability and Resistance, H2P2 Weatherproofing and H407 Condensation and water vapour management

3.2 APPLICATION

This Standard shall be used in conjunction with AS/NZS 1170 series and AS 4055 where appropriate. The specification is unsuitable for cladding installed at wind speed greater than the Ultimate limit state wind of 50 m/s, construction below the flood hazard level in flood hazard areas, or assessed to have a site risk factor greater than 20 (refer to Clause 5.6.2).

Notes:

1. The specification contained within this Standard is intended to meet the NCC performance requirements for structural fixing of timber cladding systems, structural reliability and weatherproofing.
2. Cladding systems may have additional requirements beyond the scope of this Standard, for example, applications within bushfire-prone areas.

3.3 NORMATIVE DOCUMENTS

The following are the normative documents referred to in this Standard:

Note:

1. Documents referenced for informative purposes are listed in the Bibliography.

AS

1810 Timber - Seasoned cypress pine - Milled products

2334 Steel nails – Metric sizes

2796.1 Timber - Hardwood - Sawn and milled products, Part 1: Product specification;

3566 Self-drilling screws for the building and construction industries

3566.1 Part1: General requirements and mechanical properties

3700 Masonry Structures

3959 Construction of buildings in bushfire-prone areas

4055 Wind loads for housing

4387 Electroplated coating of zinc on steel fasteners with imperial threads

4773.1 Masonry in small buildings Design

4773.2 Masonry in small buildings, Part 2: Construction

4785.1 Timber - Softwood - Sawn and milled products, Part 1: Product specification

5604 Timber - Natural durability ratings

AS/NZS

1170 Structural design actions

1170.0 Part 0: General principles

1170.1 Part 1: Permanent, imposed and other actions

1170.2 Part 2: Wind actions

1170.3 Part 3: Snow and ice actions

1214 Hot dipped galvanised coatings on threaded fasteners (ISO metric coarse thread series) (ISO 10684:2004, MOD)

1604.1 Preservative-treated wood-based products - Products and treatment

1734 Aluminium and aluminium alloys - Flat sheet, coiled sheet and plate

1859.4 Reconstituted wood-based panels - Specifications, Part 4: Wet process fibreboard

2269.0 Plywood - Structural – Specifications

2271 Plywood and blockboard for exterior use

Australian Building Codes Board

National Construction Code, Building Code of Australia Volumes 1 and 2

3.4 NOTATIONS

The following symbols are used in this Standard.

B = Breadth of the member

D = Depth of the member

3.5 DEFINITIONS

3.5.1 Cavity wall construction

A wall system with a continuous internal cavity, 20 mm or more in cross-section width, drained and bottom-vented.

3.5.2 Climate Zone

Means an area defined in the NCC for specific locations having a range of similar climatic characteristics.

3.5.3 Cladding board

A narrow timber board used in a cladding system.

3.5.4 Cladding system

Wall cladding, accessories and fasteners are defined by a single profile, thickness, timber species or reconstituted, fastener type and size, fastener spacing and various spans.

3.5.5 Cyclone regions

Wind Regions C and D as defined in AS/NZS 1170.2 or site classifications C1 to C4 in AS 4055.

3.5.6 Direct fix cladding wall

It means a wall with cladding attached directly to the wall framing or structural substrate without the use of a drainage cavity.

3.5.7 Drainage Cavity

A 20 mm minimum cavity between the interior side of the cladding envelope and the substrate, with the purpose of allowing water to escape and provide air circulation.

3.5.8 Fastener spacing

The maximum distance between fasteners is measured along the centre-line of the supporting member.

3.5.9 Hand-driven nail

Means a nail driven by a hand hammer.

3.5.10 Hardboard wall cladding board

Cladding boards made from hardboard which are generally installed horizontally and categorised by installation method and face profile cut. The following are the common types of timber cladding profiles.

3.5.10.1 Overlapping hardboard cladding boards

Straight-cut hardboard cladding boards are generally 9.5 mm thick, with rounded edges installed by overlapping with different profiles and rebates.

Figure 1: Overlapping Hardboard Cladding Board

3.5.10.2 Rebated hardboard cladding boards

A rebated hardboard cladding boards are generally of 9.5 mm thickness, with rounded edges installed by overlapping with different profiles and rebates.

Figure 2: Rebated Hardboard Cladding Board

3.5.10.3 Self-locking hardboard cladding boards

A rebated hardboard cladding boards are generally of 9.5 mm thickness, with sharp edges installed by overlapping and the rebate locking to the next board. The board may contain grooves cut at nominal spacings.

Figure 3: Self-locking Hardboard Cladding Board

3.5.10.4 Shingle hardboard cladding boards

Hardboard cladding boards are generally of 9.5 mm thickness, profiled as overlapping shingles.

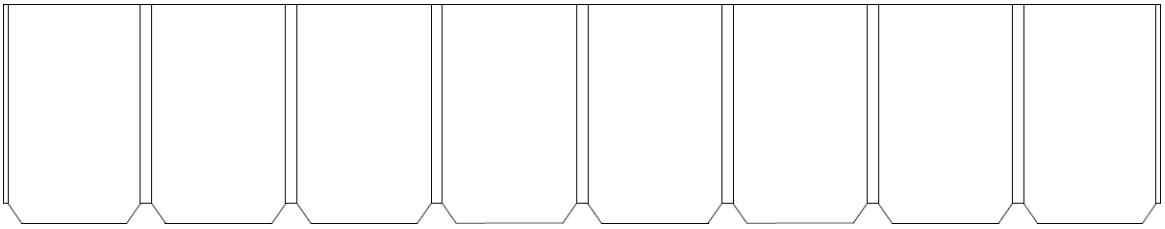


Figure 4: Shingle Hardboard Cladding Board

3.5.10.5 Hardboard cladding board with spline

The spline inserted into the overlapping hardboard cladding boards acts as an additional concealed fastener while self-gauging the board overlap.

Figure 5: Hardboard Cladding Board with spline

3.5.11 Hardboard sheet wall cladding

A cladding panel made from hardboard. The panel can vary in length and is generally 9.5 mm thick. The sheet contains grooves cut at nominal groove spacings.

Figure 6: Hardboard sheet wall cladding

3.5.12 Low rainfall intensity

An area with a 5-minute rainfall intensity for an annual exceedance probability of 5% of not more than 125 mm/hour.

3.5.13 Machine nail

Means a nail driven by a machine.

3.5.14 Non-cyclone regions

Wind Regions A and B as defined in AS/NZS 1170.2 or site classifications N1 to N4 in AS 4055.

3.5.15 Pliable building membrane

Means a water barrier as classified by AS/NZS 4200.1.

3.5.16 Secret (concealed) fastened profile

A cladding fixed by a secret (hidden) nail, screw, staples, bracket or clips, etc.

3.5.17 Serviceability limit state

State that corresponds to a condition beyond which specified service criteria for a structure or structural elements is no longer met.

3.5.18 Shall

Indicated that a statement is mandatory.

3.5.19 Should

Indicates a recommendation.

3.5.20 Spacer Batten

Battens used between the cladding and the structural substrate and the cladding fastener are not dependent on the batten for support. Generally, cladding is fixed through the spacer batten to the underlying structural substrate.

3.5.21 Structural Batten

Battens that are required to support the load from the cladding.

3.5.22 Timber Cladding profiles

Timber cladding profiles are generally described by the method of overlapping their long edge and the shape of the outward-facing surface. The following are the common types of timber cladding profiles.

3.5.22.1 Bevel (splayed)

Tapered or beveled timber so that its upper edge is thinner than its lower and lapped in laying to cover the horizontal joint between adjoining pieces.

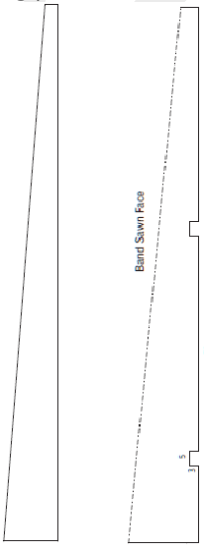


Figure 7: Bevel (Splayed) profiled timber cladding boards

3.5.22.2 Tongue and Groove

Profiled solid timber has a joint type in which one board features a groove (or slot), and the other side of the board has a tongue.

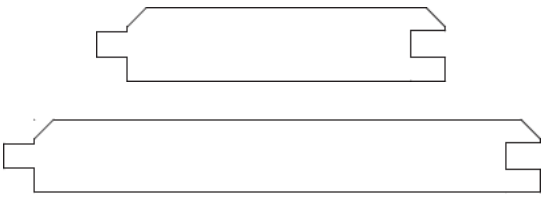


Figure 8: Tongue and Grooved profiled timber cladding boards

3.5.22.3 Rebated

The upper edge of the board is thinner than the lower lead edge, and the lower edge is rebated so that it overlaps the top edge of the next board.

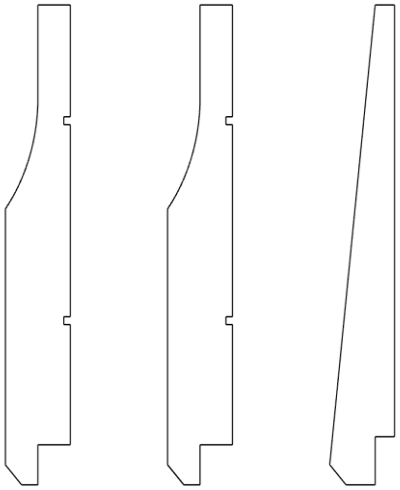


Figure 9: Rebated profiled timber cladding boards

3.5.22.4 Outward-facing surface.

The primary outward-facing surface profiles are:-

Flat

Figure 10: Flat faced Rebated profiled timber cladding boards Rusticated

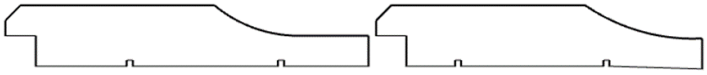


Figure 11: Rusticated faced Rebated profiled timber cladding boards Shiplap

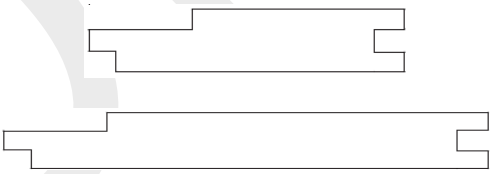


Figure 12: Shiplap-faced Tongue and Grooved profiled timber cladding boards Log Cabin – Round or flat, either single or double

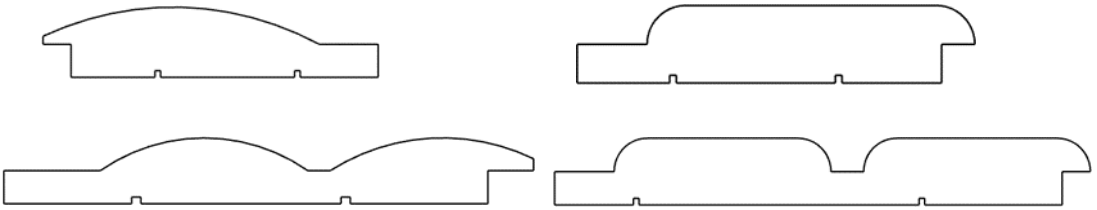


Figure 13: Log Cabin faced Rebated profiled timber cladding boards

3.5.23 Seasoned

Timber in which the average moisture content is between 10 and 15%.

NOTE:

1. Seasoned timber is sometimes referred to as ‘dry’, ‘air-dried’ or ‘kiln-dried’ timber.
2. Moisture content can exceed 15% due to variables such as storage conditions, weather and relative humidity.
3. The seasoned milled timber products manufacturing Standards (AS 2796.1 and AS 4785.1) have a moisture content range requirement that differs from the above definition of seasoned. This moisture content range is only relevant at the time of milling.

3.5.24 Stress Grade

A classification assigned to structural timber or wood products indicates a suite of characteristic values of strength and stiffness properties suitable for structural design.

3.5.25 Unseasoned

Timber in which the average moisture content exceeds 25%.

NOTE: Unseasoned timber is sometimes referred to as ‘green’ timber.

3.5.26 Water control Layer

Means a pliable building membrane or the exterior cladding when no pliable building membrane is present.

3.5.27 Water Sensitive Materials

Means materials with an inherent capacity to absorb water vapour, including non-preservative or natural durable timber, plasterboard, plywood, oriented strand board and the like.

3.5.28 Weatherboards

Bevelled or splayed cladding boards.

4 MATERIALS

The material used to manufacture cladding systems (cladding and battens) shall be determined based on an assessment of their suitability for this purpose. This assessment shall include consideration of structural properties (substructure, i.e. frame or battens), any characteristics that affect the fixing performance, adhesive, dimensional tolerances, species, moisture content, and preservative treatment or corrosion protection shall also be considered.

For the purpose of this Standard, the following materials manufactured in accordance with the following Standards are deemed acceptable.

4.1 ALUMINIUM

Aluminium for the purpose of fixings, brackets, and joiners shall conform to the requirements of AS/NZS 1734.

4.2 STAINLESS STEEL

Stainless steel shall conform to the requirements of ASTM A240, ASTM A276, ASTM A666, EN-10088-1 or JIS G4305, as applicable.

4.3 STEEL

The material shall be metallic-coated steel, conforming to the requirements of AS 1397 for minimum coatings Class Z450, AZ50 or AM125.

The level of corrosion protection provided shall take into consideration weather exposure, contact with preservative-treated timber, moisture and the presence of salt.

The minimum corrosion protection that shall be applied to fixings and similar structural connections shall be Z 275.

4.4 TIMBER

The following products shall meet the requirements of this Standard where they comply with this clause.

(i) Hardboard conforming to AS/NZS 1859.4
(ii) Structural plywood conforming to AS/NZS 2269.0, AS/NZS 2271, and
(iii) Profiled timber cladding systems, conforming to
    a. Softwood AS 4785.1
    b. Cypress AS 1810, and
    c. Hardwood AS 2796.

Notes:

1. Unseasoned and seasoned products should not be mixed
2. Where mixed species are used, the species used should have similar shrinkage characteristics.
3. Cladding profiles should be sourced from one supplier, as dimensional variations may occur between manufacturers.
4. Where cladding is used for the building's bracing requirements, the durability of the cladding used for bracing needs to be in line with the expected design life of the building.

The rebate dimensions described in AS 1810, AS 2796, and AS 4785.1 shall be replaced with Clause 4.4.1.

4.4.1 Rebates and Overlaps in Timber Cladding

A timber cladding board or sheet is acceptable for use as a water control layer where the minimum overlap or rebate is achieved for each timber cladding type.

4.4.1.1 Rebates and overlaps in Hardboard Cladding when used as a water control layer

There are no solutions for hardboard cladding used as a water control layer.

> Note: Hardboard cladding system required the use of the pliable building membrane as the water control layer.

4.4.1.2 Rebates and overlaps in Plywood Cladding when used as a water control layer

The minimum overlap in plywood sheet is 20 mm.

4.4.1.3 Rebates and overlaps in Timber Profiled Cladding when used as a water control layer

The overlap in bevelled or splayed timber weatherboards, rebated cladding or tongue and grooved timber profile shall be a minimum of the following.

Bevelled or Splayed timber weatherboards—

(a) For material up to 18 per cent moisture content, as follows
  (i) Hardwood – 30 mm
  (ii) Softwood – 20 mm

(b) For material greater than 18 per cent moisture content
  (i) Hardwood and softwood (other than Western red cedar and cypress) – 30 mm
  (ii) Western red cedar and cypress – 20 mm.

Rebated Cladding fixed horizontally

(b) For material up to 18 per cent moisture content, as follows
  (i) Hardwood and softwood boards up to and including 150 mm in width – not less than 13 mm.
  (ii) Hardwood and softwood boards exceeding 150 mm in width – not less than 20 mm.

(a) For material greater than 18 per cent moisture content, as follows
  (i) Hardwood and softwood boards of any width – not less than 20 mm.

Rebated Cladding fixed other than horizontally

For hardwood and softwood of any width or moisture content – not less than 20 mm.

Tongue and Groove Cladding

(a) For hardwood and softwood of any width or moisture content – not less than 16 mm.

4.4.2 Rebates and overlaps in Timber Profiled Cladding when not used as a water control layer

No minimum overlaps or rebate limits exist for cladding not used as the water control layer.

4.5 Other Materials

Materials that are not specifically referred to may be used, provided they fulfil all other requirements of this Standard.

5 DESIGN

5.1 SCOPE

This Section sets out the selection and requirements for the design of cladding systems. A design carried out in accordance with this Section shall meet the requirements of this Standard. Alternatively, a first principle design, meeting the requirements of Section 5 of this Standard, can be carried out.

Notes:

1. This Section requires the specification of the supporting structure in order to define the capacity of the cladding and fasteners, but the scope of this Section does not cover the design of the supporting structure.
2. The supporting structure under the loading conditions it has been designed for should be stable in its own right.
3. The cladding system is not designed to carry loads from accessories fixed to the cladding, e.g., air-conditioning units, vents, antennas, photovoltaics, or similar.

5.2 LOADING

The cladding and its fastenings to the supporting substrate shall be designed to withstand the loads derived from the actions specified in AS/NZS 1170.1, AS/NZS 1170.2 and AS/NZS 1170.3 when combined in accordance with the load combinations in AS/NZS 1170.0, for the particular circumstances in which the cladding and fastening system is to be used.

5.2.1 Imposed actions

Imposed actions for the wall cladding shall be applied as defined in AS/NZS 1170.1.

Note:

1. Imposed actions are generally self-weight.
2. Where the cladding acts as a barrier, additional loads are applicable.

5.2.2 Wind actions

Wind actions shall be designed in accordance with AS/NZ 1170.2 or AS 4055. Wind actions shall include local pressure factors at edge regions or the building's edge or corners.

Where timber cladding is used in Wind Regions C and used in conjunction with windows and doors to seal the entire building, the cladding type shall be capable of resisting impact loading from windborne debris determined in accordance with AS/NZS 1170.2.

5.2.2.1. Wind Class comparison to Design gust wind speed

AS 4055 provides 10 wind classes incorporating both noncyclonic (N) and cyclonic (C) winds that have associated design gust wind speeds (Vh) for the serviceability and ultimate limit states, as for Table 5.1.

Table 5.1 DESIGN GUST WIND SPEED (Vh) FOR CLASSIFICATION

Wind Class		Design gust wind speed (Vh) at height (h) m/s	
Regions A and B (noncyclonic)	**Regions C and D (cyclonic)**	**Serviceability limit state (Vh,s)**	**Ultimate limit state (Vh,u)**
N1	-	26	34
N2	-	26	40
N3	C1	32	50
N4	C2	39	61
N5	C3	47	74
N6	C4	55	86

5.2.3 Snow and ice actions

Design for loads from the accumulation of snow shall conform to AS/NZS 1170.3.

AS/NZS 1170.3 does not address loads from hail impact or accumulation of hail.

5.3 Recording Of Material And Installation Specification

Material and installation specifications shall be recorded in the design documentation.

Design documentation shall include the following.

(b) A statement that the design meets the requirements of this Standard.
(c) Specification of the cladding board or panel
    1. Cladding board or panel type (hardboard or plywood)
    2. Timber species (if applicable)
    3. Profile of cladding board or sheet type
    4. Dimension, specification and configuration of fasteners
    5. Cladding spans (e.g. span dimension and direction)
(d) Design wind pressure or classification.
(e) A statement that indicates what element is being used as the water control layer, i.e., timber cladding or pliable building membrane.
(f) A statement that indicates what element is supporting the cladding, either structural battens or the structural substrate, i.e., wall framing or mass timber.
(g) Limitations on the attachment of auxiliary items.

5.4 Substructure

5.4.1 Timber

Designed and constructed in accordance with the following relevant Australian Standard/s, as below,

(a) Design of timber structures: AS 1720.1.
(b) Residential timber-framed construction – noncyclonic areas: AS 1684.2.
(c) Residential timber-framed construction – cyclonic areas: AS 1684.3.
(d) Residential timber-framed construction – noncyclonic areas (simplified): AS 1684.4.

Where timber framing is located within a drainage cavity, such as battens, they shall be at least above-ground natural durability Class 2 or H3 treated in accordance with AS/NZS 1604.1. Each batten shall span at least three supporting elements.

Note: Where an envelope preservative treated is used, reinstatement of treatment around cuts, notches, etc., is required.

5.4.2 Steel

It is satisfied for steel framing if it is designed and constructed in accordance with one of the following:

(a) Residential and low-rise steel framing:
  (i) Design: NASH Standard' Residential and Low-Rise Steel Framing' Part 1.
  (ii) Design solutions: NASH Standard' Residential and Low-Rise Steel Framing' Part 2.
(b) Steel structures: AS 4100.
(c) Cold-formed steel structures: AS/NZS 4600.

5.4.3 Masonry

It is satisfied for masonry if it is designed and constructed in accordance with one of the following:

(a) Masonry Structures AS 3700; or
(b) Masonry in small buildings Design Parts 1 and 2: AS 4773.1 and AS 4773.2;

5.5 Location of the Primary Water Control Layer

The water control layer shall be the timber cladding where it meets Clause 4.4.1 and is installed in accordance with Sections 4, 5, 6 and 7.

Where the timber cladding cannot meet all parts of Clause 4.4.1, the water control layer shall not be the timber cladding itself. Where this is the case, a pliable building membrane complying with AS/NZS 4100.1 shall be installed on the exterior side of the outermost water-sensitive materials in accordance with AS/NZS 4100.2. In addition, a drainage cavity of no less than 20 mm in width shall separate the pliable building membrane and the cavity side of the timber cladding is required.

5.6 Direct Fixed Cladding or Cavity Construction

The use of direct fixed cladding is satisfied if the exterior wall system complies with Clauses 5.10.1 and 5.10.2.

Commentary

The use of cavity wall construction or direct fix claddings is driven by risk, from exposure to conditions that may be conducive to moisture ingress and condensation forming.

5.6.1 Water-sensitive materials used in the construction of an exterior wall system

Where water-sensitive materials, such as non-durable timber framing, non-durable plywood and OSB bracing, plasterboard, glass wool insulation, and the like, are used in any part of the exterior wall construction, direct fixed exterior cladding requires a pliable building membrane complying with AS 4200.1 and installed in accordance with AS 4200.2 placed between the water-sensitive material and the exterior cladding.

Timber or engineered wood products are considered not to be a water-sensitive material when it has an above-ground durability rating of 2 in accordance with AS 5604 or is preservative treated to H3 in accordance with AS/NZS 1604.1.

Commentary

The use of pliable building membrane over water-sensitive material is a requirement of NCC Clause Volume One – F8D3 (2) and Volume 2 Part 10.8.1 (2)

5.6.2 NCC Risk Factor and Score

An assessment of the risk shall be calculated from Table 5.2 for the wall cladding system under

consideration. Additional assessments shall be conducted wherever the building differs from another part. These include a change in the number of storeys, exposure conditions of the roof/wall junction, eaves width, envelope complexity, and the addition of a deck, veranda, or balcony.

Where the risk assessment is found to be:

5.6.2.1. less than or equal to 6, cladding can be direct fixed to the structural substrate or have a cavity between the cladding and structural substrate.

5.6.2.2. For risk assessments of 7 to 20 inclusive, a cavity is to be provided between the cladding and structural substrate.

5.6.2.3. For risk assessment greater than 20, this condition is outside this Standard's scope, and expert advice is required.

Table 5.2 Risk Factors and Scores

Risk factor	Category	Risk severity	Score
Wind Region	Region A (AS/NZS 1170.2)	Low to medium	0
	Region B (AS/NZS 1170.2)	Low to medium	0
	Region C (AS/NZS 1170.2)	High	1
	Region D (AS/NZS 1170.2)	Very high	2
Number of storeys	One storey	Low	0
	Two storeys in part	Medium	1
	Two storeys	High	2
	More than two storeys	Very high	3
Roof/wall junctions	Roof-to-wall junctions are fully protected	Low	0
	Roof-to-wall junctions partially exposed	Medium	1
	Roof-to-wall junctions fully exposed	High	3
	Roof elements finishing within the boundaries formed by the external walls	Very high	5
Eaves width	More than 600 mm for single storey	Low	0
	451-600 mm for single storey	Medium	1
	More than 600 mm for two storey		
	101-450 mm for single storey	High	2
	451-600 mm for two storey		
	More than 600 mm for the above two storeys		
	0-100 mm for single storey	Very high	5
	0-450 mm for two storey		
	Less than 600 mm for above two storey		
Envelope complexity	Simple shape with single cladding type	Low	0
	Complex shape with not more than two cladding types	Medium	1
	Complex shape with more than two cladding types	High	3
	As for high-risk but with fully exposed roof-to-wall junctions	Very high	6
Decks, verandas and balconies	None	Low	0
	Timber slat deck or porch at ground level	Medium	2
	Timber slat deck attached at the first or second floor		
	Fully covered in plan view by the roof		
	Balcony exposed in plan view at first-floor level	High	4
	Balcony cantilevered at first-floor level		
	Balcony exposed in plan view at second-floor level or above	Very high	6
	Balcony cantilevered at second-floor level or above		

Table Notes:

1. The table is based on NCC Volume One Table F3V1a and Volume Two Table H2V1a.
2. Eaves width is measured horizontally from the external face of any wall cladding to the outer edge of any overhang, including fascia and external gutters.
3. Barriers to prevent falling and parapets are considered as 0 mm eaves.

5.7 Condensation Management and Water Vapour Management

Where the deemed-to-satisfy provision of the National Construction Code Volume One or Two, Condensation and water vapour management can't be met, Appendix A provides a list of cladding systems verified to meet the NCC performance requirement through computer modelling. Cavity and directed fixed cladding systems modelling solutions are not provided for Climate Zones 1 and 8. Where cladding systems are in Climate Zones 1 and 8, unique design and modelling are required in accordance with the National Construction Code.

Note:

1. Climate Zones locations are specified in the National Construction Code.
2. The suitability of a generic cladding system to prevent condensation may not be possible for all climate zones.

5.8 Spacer and Structural Battens

The requirements for the use of a spacer or structural battens depend on their application and if they are intended to support a load.

5.8.1 Spacer Battens

Spacer battens shall be made from any one or a combination of materials referred to in Section 4. Timber spacer battens are not required to have a stress grade.

These battens afford a means to provide a gap between the substrate framing and cladding, and they do not perform a structural role; refer to Figure 14. Spacer battens shall align directly over the substrate framing or base structural wall (cross-laminated timber and masonry). Any fastener used shall transverse through the batten and fixed into the structural substrate below it. Refer to Section 6 for fasteners and fixings. All spacer battens shall be placed over all installed vapour- permeable pliable building membranes.

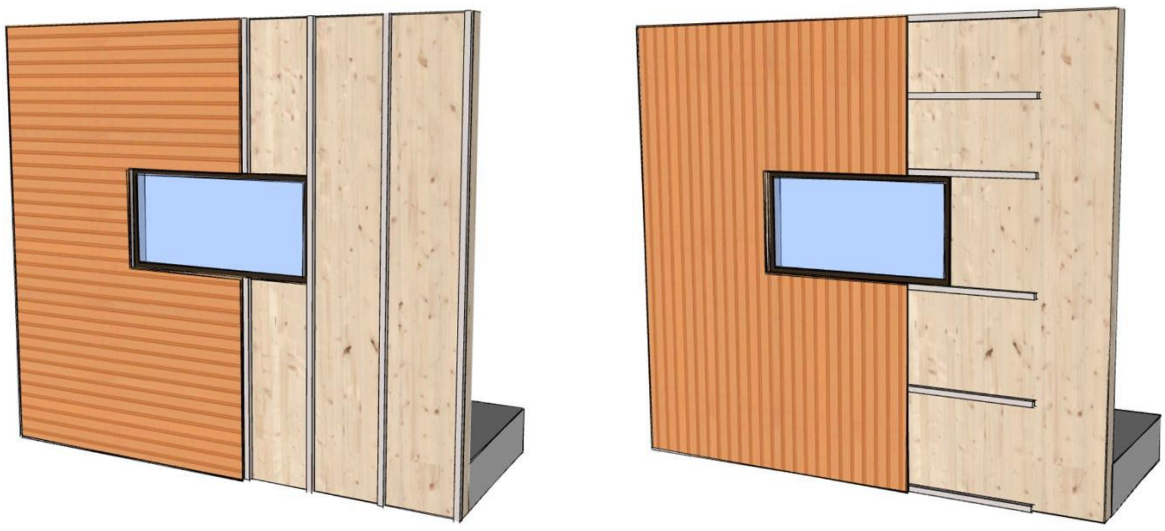


Figure 14: Spacer battens used over a structural masonry or CLT substrate

Notes:

1 Battens run vertically for most cladding and sheet-based systems. This batten direction allows for moisture movement by gravity and maintains a controlled ventilation path.

2 The vapour-permeable pliable building membrane is not shown for clarity.

5.8.2 Structural Battens

Structural battens are used to support the cladding directly without the cladding fastener transversing the batten into the substructure, refer to Figure 15.

Structural battens shall be steel or timber and have the appropriate durability, refer to B9.1 & Section 5.4.1. All structural battens shall be placed over all installed vapour-permeable pliable building membranes. Refer to Section 7 for fasteners and fixings.

(1) Timber structural battens are required to have a minimum batten thickness of 35 mm.

(2) Steel structural battens are required to have a minimum batten thickness of 20 mm.

For the design of structural battens,

(1) Timber – AS 1684 Roof battens supporting roof only – sheet roof, for the wind classification and stress grade.

(2) Steel – Design solutions: NASH Standard' Residential and Low-Rise Steel Framing' Part 2.

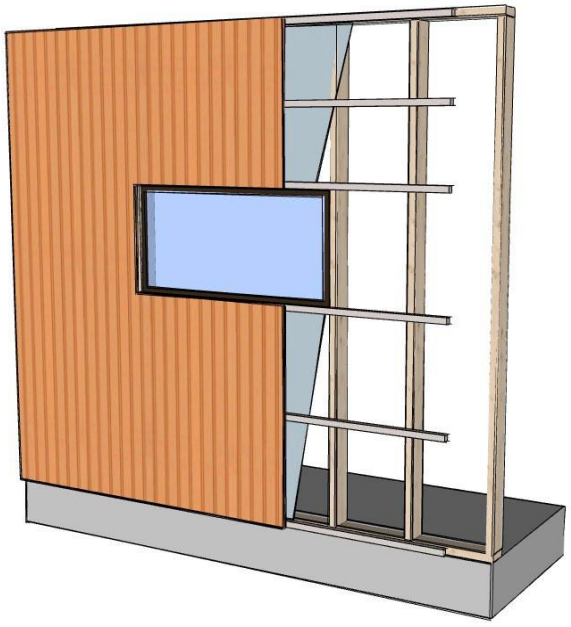


Figure 15: Structural battens used for vertical cladding over a framed structural wall

Commentary

Structural battens are used predominately for diagonal and vertical cladding on wall framed substructure.

5.9 Diagonal or Vertical Timber Profiled Cladding

Cladding boards fixed in a vertical or diagonal manner shall use full-length boards wherever practical. Where butt joints are unavoidable, then butt joints in vertical boards shall be angle cut at 45 degrees across ends to minimise moisture uptake in board end grain. When profiled timber cladding is fixed vertically, boards shall be installed with the tongue or non-rebated end facing the prevailing weather direction.

Where profiled timber cladding is fixed diagonally, the direction of fixing shall not cause water to drain into the internal corner or stop.

For diagonal cladding, the structural battens shall be closer spaced to maintain the maximum fixing spacing.

Note: Fixing spacing is measured along the cladding board.

5.10 Clearance Between Cladding and Ground

(1) The minimum clearance, refer to Figure 16, from the bottom of the timber wall cladding to the adjoining finished ground level shall be—

(a) 100 mm in low rainfall intensity areas or sandy, well-drained areas; or

(b) 50 mm above impermeable (paved or concreted) areas that slope away from the building; or

(c) 150 mm in any other case.

(2) Wall cladding shall extend a minimum of 50 mm below the bearer or lowest horizontal part of the suspended floor framing.

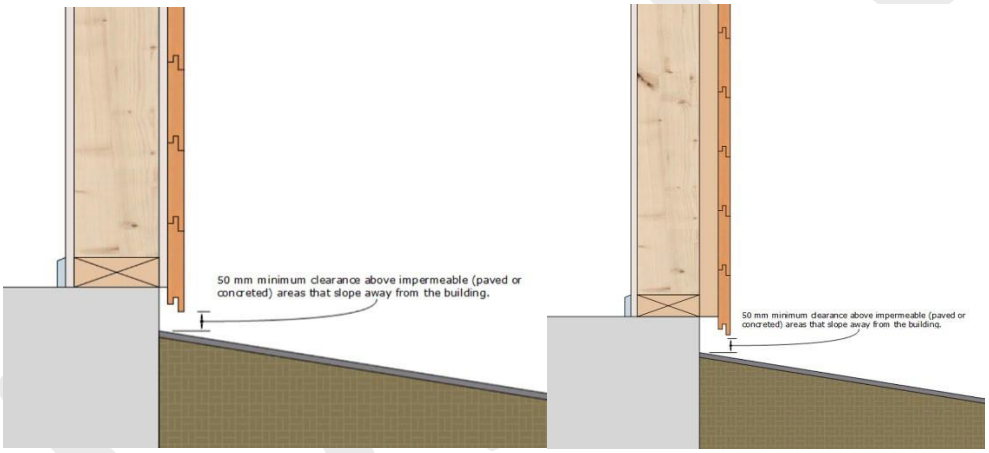


Figure 16: Minimum clearance of cladding above final ground levels and finishing below the bottom plate

Note:

1. The clearance requirements are equivalent to the NCC Vol 2 provision 7.5.7.
2. Greater clearance may be required to adhere to manufacturer warranty or termite guidelines.

6 INSTALLATION OF TIMBER CLADDING

This Section sets out the installation requirements for cladding systems. It is satisfied if it is constructed in accordance with the following Clause 6.1 to 6.6.

6.1 EXPANSION GAP

It is satisfied if the cladding system complies with Clauses 6.1.1 to 6.1.4.

6.1.1 Bevelled or splayed timber weatherboards profiled cladding

(a) Between adjacent boards – long edge
No expansion joint is required.

(b) Cladding boards that abut solid elements (corners) or other material, or if there is a change in the cladding direction, expansion gaps are required as follows.

(ii) Cladding boards up to 3.0 m long – an expansion gap of 2 mm.

(iii) Cladding boards over 3.0 m long – an expansion gap of 4 mm.

6.1.2 Tongued and grooved and rebated timber profiled cladding

(a) Between adjacent boards,
The overlap of two adjacent boards shall have an expansion gap of

(i) Up to and including board widths of 150 mm – 2 mm.

(ii) Board widths greater than 150 mm – 3 mm.

(b) Where cladding boards that abut solid elements (corners) or other material, or if there is a change in the cladding direction, minimum expansion gaps are required as follows.

(i) Cladding boards up to 3.0 m long – an expansion gap of 2 mm.

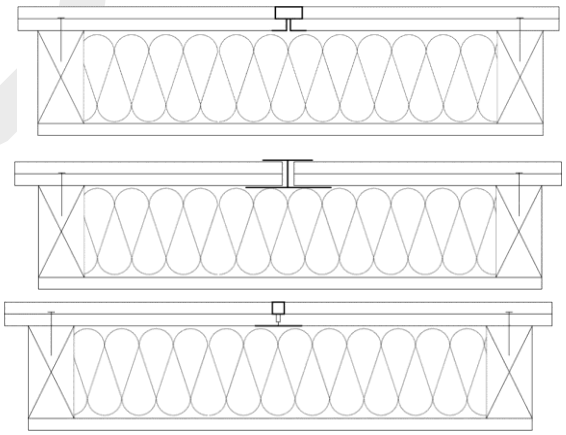
(ii) Cladding boards over 3.0 m long – an expansion gap of 4 mm.

6.1.3 Hardboard Cladding Board

(a) Between adjacent boards – long edge
No expansion joint is required.

(b) Cladding boards butt end on end, and where a plastic or metal joiner is used

No expansion gap is required when plastic or metal joiners between the boards is used.



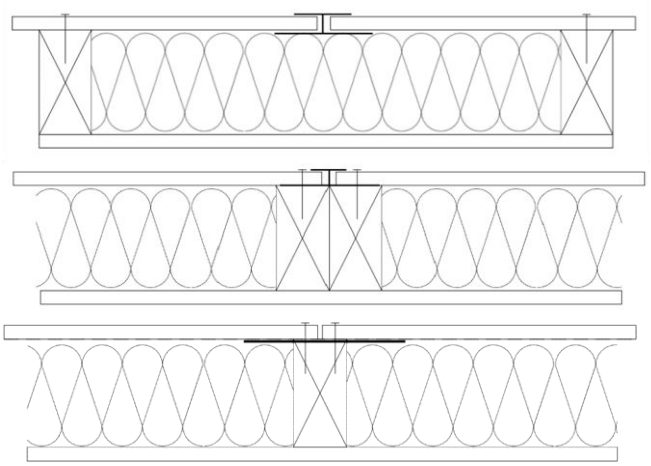


Figure 17: Various Hardboard cladding board profiles with plastic or metal Joiner

(c) Cladding boards butt end on end, and no plastic or metal joiner and they abut solid elements (corners) or other material, or if there is a change in the cladding direction- unpainted joints

For a maximum continuous board length of 5.5 m, a minimum 3.0 mm expansion gap is required. The expansion gap shall have a flashing placed directly behind the expansion gap.

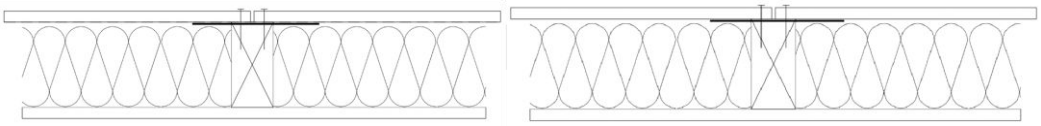


Figure 18: Hardboard cladding board expansion gap without joiner

(d) Cladding boards butt end on end, and where a concealed plastic or metal joiner is used

For a maximum continuous board length of 11 m, a minimum 9.5 mm expansion gap is required.

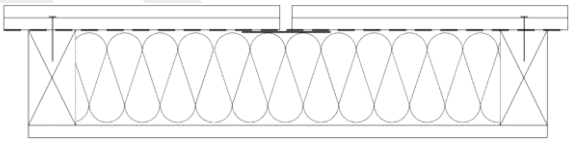


Figure 19: Hardboard cladding board expansion gap with Concealed Joiner

6.1.4 Sheet Cladding Hardboard and Plywood

(a) Horizontal joints

Horizontal joints shall be a minimum of the following. The expansion gap shall have a flashing placed directly behind the expansion gap and detailed in accordance with Clause 6.1.5.

Fixings shall be placed at the top and bottom of the horizontal join.

(1) Hardboard – horizontal joints shall be a minimum of 10 mm.

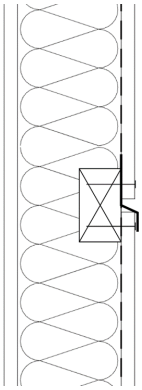


Figure 20: Sheet Cladding Hardboard Joint

(2) Plywood –
Horizontal joints shall be a minimum of 5 mm.

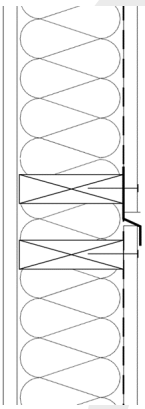


Figure 21: Sheet Cladding Plywood Horizontal joint

(b) Vertical Joint
Vertical joints shall be a minimum of the following.

(1) Unpainted Hardboard sheets

Vertical joints shall be a minimum of 2 mm.

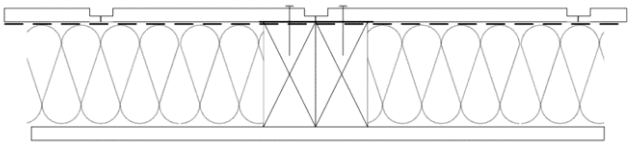


Figure 22: Hardboard sheet cladding Vertical Butt Joint (unpainted only)

(2) Painted Hardboard sheets

A plastic or metal joiner shall be used to join them.

(c) Vertical hardboard joint with a metal joiner

No expansion gap is required when plastic or metal joiners are used between the boards.

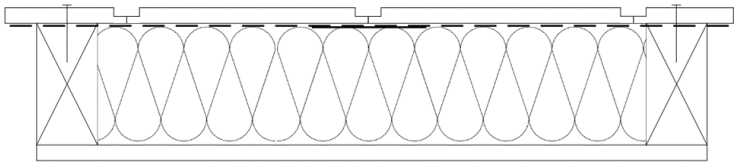


Figure 23: Hardboard sheet cladding Vertical Joint with metal joiner

(d) Vertical Plywood joint
Vertical joints shall be a minimum of 3 mm

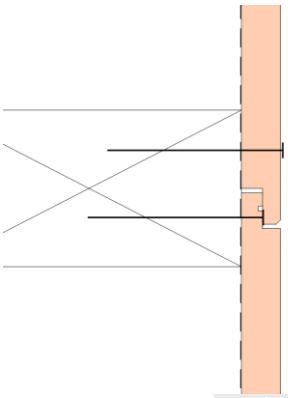


Figure 24: Sheet Cladding Hardboard and Plywood Horizontal Joint

6.1.5 Storey to Storey Expansion Joint

For all timber cladding systems (profiled timber, hardboard and plywood) used over one or more storeys or a gable end wall exceeding 3.0 m in height, a dedicated expansion gap of 10 mm is required at every storey and under the window sills. A gap of at least 10 mm between cladding boards or panels. The gap formed shall be covered by flashing so that the top part of the flashing is under the uppermost cladding board or sheet, and the lower part of the flashing overlaps on top of the cladding board or panel below, refer to Figure 25. The expansion gap shall occur at the top of each storey wall; refer to Figures 26 and 27. Where an expansion gap is required for gable end walls, the expansion gap shall occur in the same plain as for the storey high expansion gap.

Where a rebated or tongue and grooved and panel cladding systems are used, a face nailing or screwing shall be fixed to the first board or panel above the expansion gap.

For beveled or splayed profile cladding, an additional face nailing or screwing shall be fixed to the top of the board below the expansion gap.

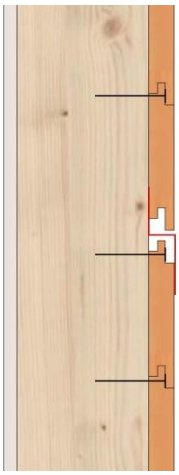


Figure 25. Storey to Storey Expansion Joint for Profiled Timber Cladding

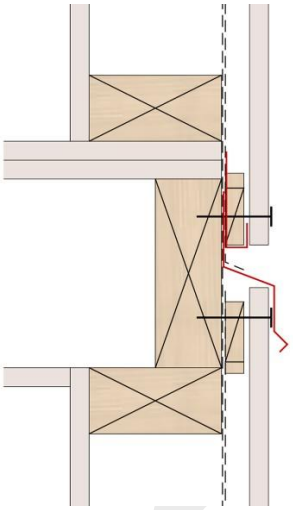


Figure 26: Storey to Storey Expansion Joint for plywood non-continuous cladding

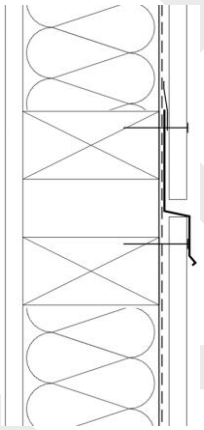


Figure 27: Storey to Storey Expansion Joint for Hardboard

6.2 Flashing to Openings

6.2.1 Flashing to Openings of Class 1 and 10 Buildings

For Class 1 and 10 buildings, refer to National Construction Code's Housing Provisions Clause 7.5.6.

6.2.2 Flashing to Openings of Class 2 to 9 Buildings

Openings in external wall cladding exposed to the weather shall be flashed with materials complying with AS/NZS 2904 and in accordance with the following:

(a) Flashings shall be provided to the bottom, tops and sides of openings, except as permitted by (d), and shall be installed so that the flashing—

(i) extends not less than 110 mm beyond the reveals on each side of the opening where practicable; and

(ii) is attached to the window and wall substrate, and

(iii) at the top and bottom of the opening, drains to the outside face of the water control layer. See Figure 28.

(b) Joins in the flashing shall—

(i) overlap by not less than 75 mm in the direction of flow; and

(ii) be securely fastened at intervals of not more than 40 mm; and

(iii) have sealant installed between laps.

(c) The method of flashing shall be suitable for the framing or substrate and cladding used and any reveal for the window or door system or any architrave or finishing trims that may be installed.

(d) The top of an opening, flashing shall be omitted where it is adequately protected by an eave of a width more than 3 times the height of the cladding above the opening, refer to Figure 29.

(e) Flashings shall be securely fixed at least 25 mm under the cladding and extend over the ends and edges of the framing of the opening.

(f) Flashing is required directly behind all expansion gaps.

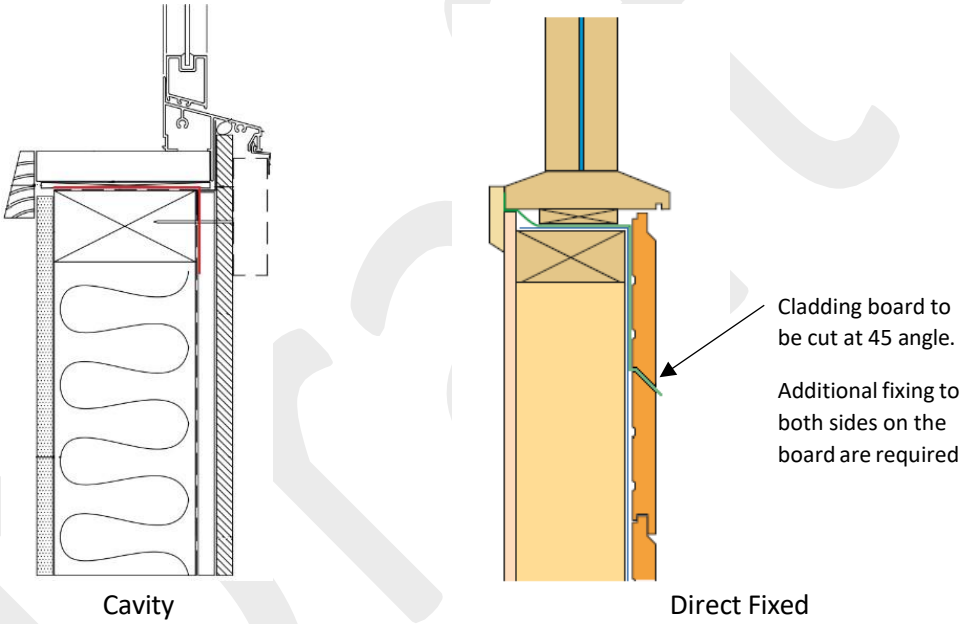


Figure 28: Flashing to the bottom of a window opening draining into a cavity or the external layer

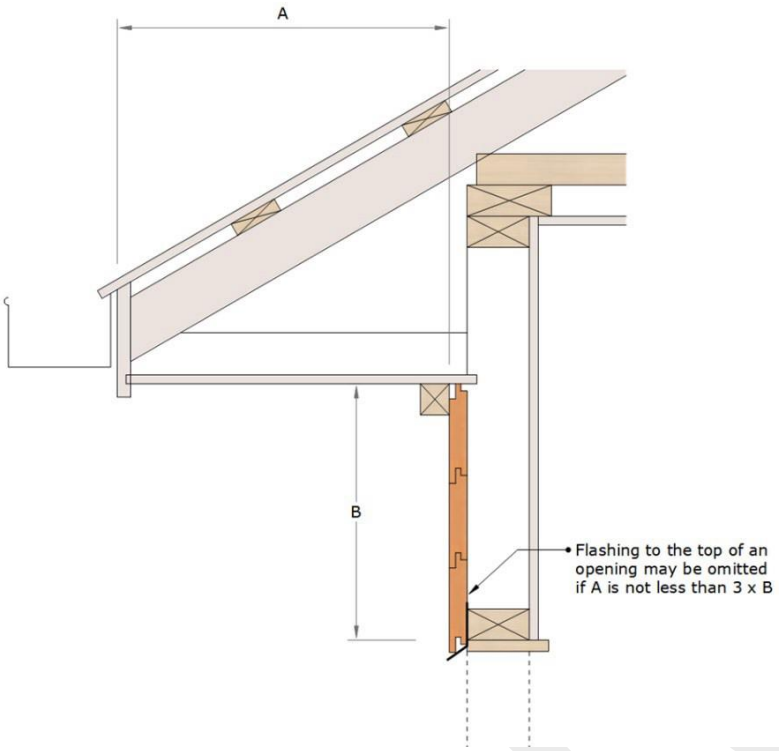


Figure 29: Fashing to the top of a window opening

6.3 Corner Details of Cladding

Where the timber cladding is used as a water control layer, internal and external corners shall be detailed to prevent moisture from infiltrating behind the cladding.

Where timber mouldings are used either as a covering or butt joint, they shall be fixed in front of sheet flashing, as illustrated in Figures 30, 31 and 32 for an internal corner and Figures 33, 34, 35 and 36 for external corners.

Where folded sheet metal corner details are used, the flashing shall be omitted.

All installed wall cladding to internal or external metal corner trims shall have expansion gaps in accordance with Clause 6.1.

6.3.1 Corner details - Horizontal over cavity

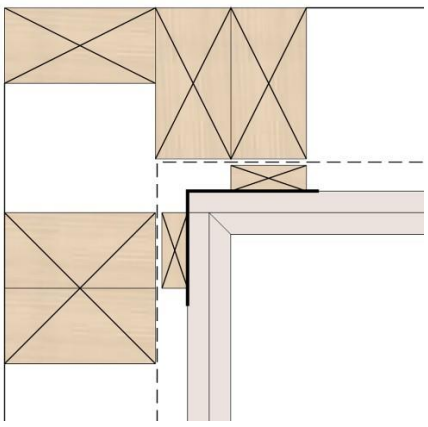


Figure 30: Internal Corner Detail

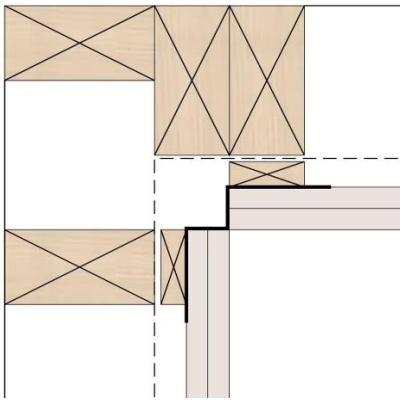


Figure 31: Internal corner details

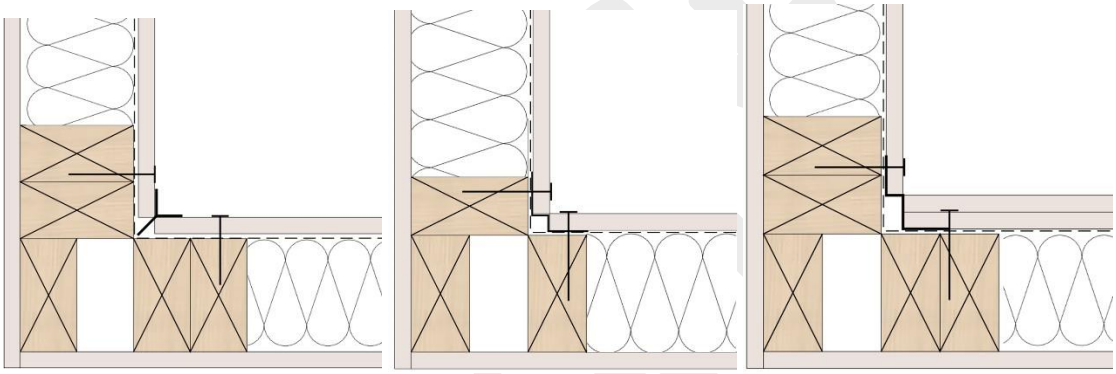


Figure 32: Hardboard Internal metal corner example details

6.3.2 Corner details - Vertical over cavity

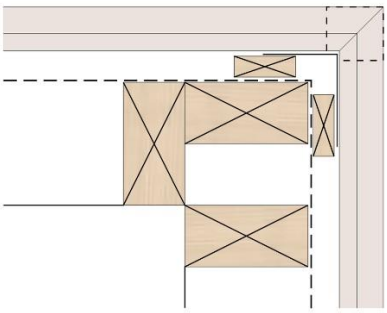


Figure 33: External corner detail over cavity

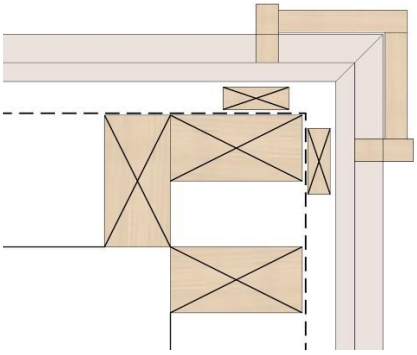


Figure 34: External corner detail over cavity

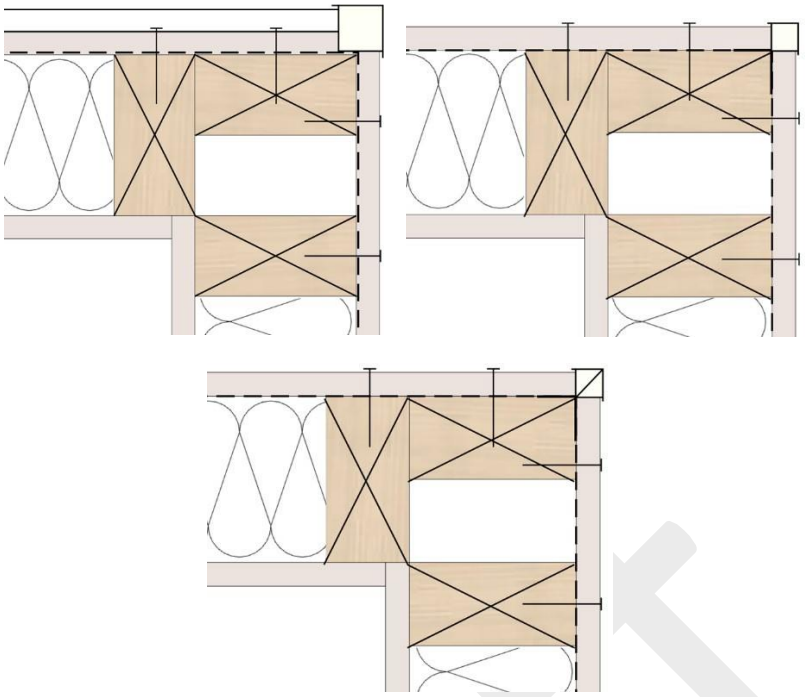


Figure 35: External metal corner example details

6.3.3 Corner details - Horizontal direct fix

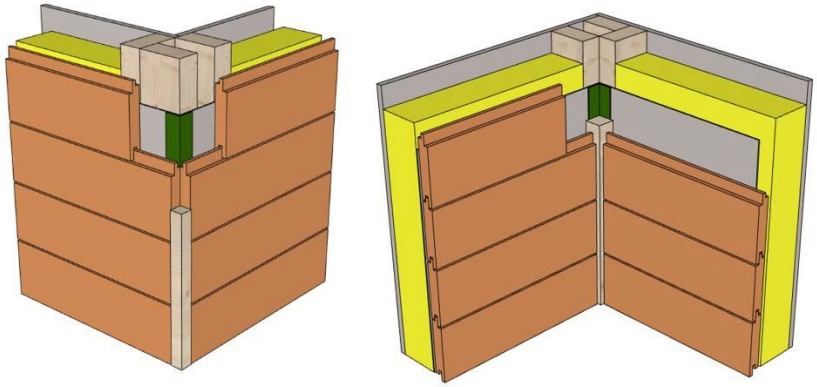


Figure 36: Internal and External corner details - Horizontal installation and direct fixed

6.4 Joint and Gap Sealing - Cladding Used as a Water Control Layer

All joints or gaps in profiled timber cladding or panels used as the water control layer, including stopped ends, shall have any joints and gaps corked by a sealant that has a service life the same or greater than the intended paint finish and has a flexibility of at least 100 per cent. The exception is for storey-to-storey expansion gaps that are flashed.

A waterproof membrane or flashing shall also be placed directly behind all gaps requiring sealing. The membrane or flashing shall continue past the top, bottom and along the join for at least 50 mm.

6.5 Cavity Closure

The base of all cavities shall be closed with a flashing that allows venting of the cavity and moisture to escape.

The flashing shall be at a minimum of 15 mm from the bottom edge of the board or panel.

Note: The opening size of slots in the cavity closure flashing may require to have a minimum gap size when located in bushfire-prone areas. Refer to AS 3959.

6.6 Service Penetrations

All services or the like that penetrate the cladding shall have flashed in accordance with Figure 37.

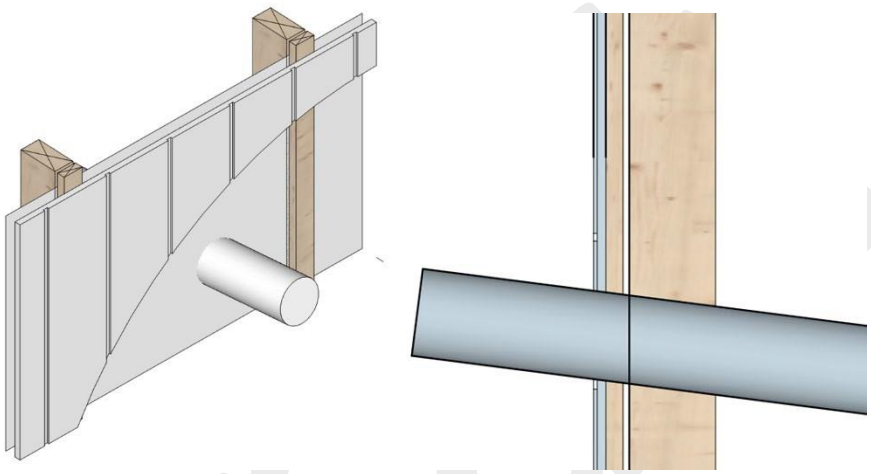


Figure 37: Flashing of service penetration through the cladding

7 FIXING OF TIMBER CLADDING TO THE SUBSTRATE

Compliance with Section 6 for wall cladding is achieved if it is installed in accordance with -

(i) 7.1 for structural battens,
(ii) 7.2 for timber profiled board cladding,
(iii) 7.3 for hardboard board cladding,
(iv) 7.4 for hardboard sheet wall cladding; and
(v) 7.5 plywood sheet wall cladding

7.1 STRUCTURAL BATTEN

The fastener size and type specified for cladding to the structural batten shall be used to fix the structural batten to the substrate. The exception is for a nailed solution, where two nails shall be used at each joint.

Note: The fixing method for cladding to batten and batten to the substrate is not required to be the same.

7.2 TIMBER-PROFILE WALL BOARD CLADDING

It is satisfied for a timber profiled wall board cladding is fixed in accordance with the following.

(1) The first fastener shall be as close as possible to the long edge of the cladding boards but shall not penetrate the tip or thinner edge of the cladding board beneath. Allow a 5 mm gap between the overlapping cladding board underneath; refer to Figure 38.

(2) Where more than one fastener is required, they shall be spaced across the board's face and kept 25 mm from any long edge. In addition, the fastener shall be offset by a minimum of one diameter of the fastener when the fastener opposes each other.

(3) Fastener shall be located in the structural framing or substrate, nogging or structural batten and be sized or have properties to receive the fastener.

Note: Some fasteners have minimum material properties requirements. These requirements are discussed at each fastener type.

(4) Where butt joints occur in a cladding board, a fastener shall be installed into each board end, and the minimum edge distance for nailing at butt joints or board ends shall be 12 mm.

(5) Fastener described in Tables 7.1 and 7.2 is the minimum diameter of the fastener. Fasteners with larger diameters may be used, where consideration of splitting the timber cladding and the substrate is given, i.e. pre-drilling the hole.

(a) Timber substrate

The fasteners' minimum diameter and number of fasteners required per joint for the relevant wind classification or wind speed in accordance with Table 7.1.

(i) Nails
   a. Hardwood structural substrate – 2.8 mm flat head with a plain shank.; or

b. Softwood structural substrate – 2.8 mm flat head with a ring or annular threaded.

(ii) Staples
   a. Hardwood structural substrate – minimum staple diameter of 1.25 mm; or
   b. Softwood structural substrate – minimum staple diameter of 1.25 mm with a ring or annular threaded.

(iii) Screws – One screw No.8 Gauge.

(iv) The fastener shall penetrate 30 mm into structural framing, nogging, structural batten or structural element (CLT) with a minimum J5 or JD5 timber joint group.

(v) Machine nails may substitute hand-driven nails with the same nail diameter and shank type. Where a smaller diameter or different shank type is proposed, the capacity of the machine nail shall be equivalent or better than the minimum nail specified.

(vi) Where a spacer batten is used in cavity construction, the fastener shall be placed through the batten and fixed into the structural substrate.

(vii) Uncoated copper or steel fixings shall not be used for Western Red Cedar (silicon bronze, Monel metal, stainless steel, or hot-dipped galvanised are suitable).

(viii) Fasteners shall not rely on the batten for structural support unless designed as a structural batten.

(ix) Where cavity construction is used, fasteners shall be longer to account for the cavity width to obtain minimum fastener depth.

Note: When fastening into battens only, care is required not to penetrate the pliable membrane.

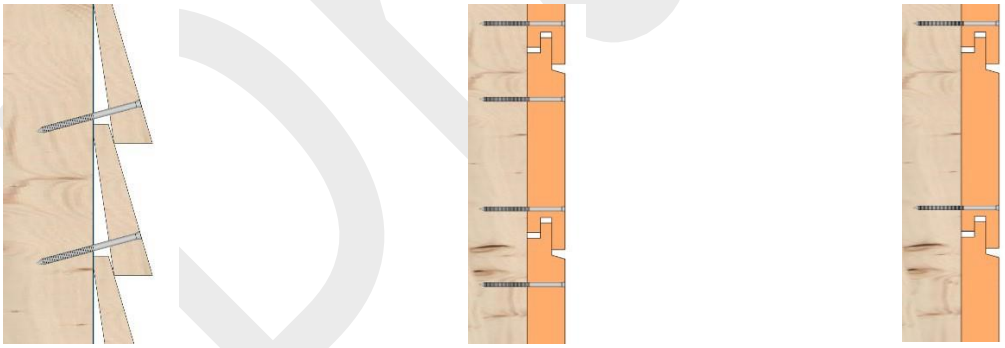


Figure 38: One or Two Fasteners in Profiled Timber Cladding

Table 7.1: Minimum Fastener Fixings for Various Wind Classification – Timber Substrate

			Minimum Face Cover Width											
			200 < 150			150 to < 100			100 to < 75			≥ 75		
Wind Classification or Ultimate Limit State Design gust wind speed (m/s)	Maximum Stud spacing (mm)	Cladding Location	Fastener Type											
			Nail	Staple	Screw	Nail	Staple	Screw	Nail	Staple	Screw	Nail	Staple	Screw
N1 or 34 (Region A and B)	450	Within 1200 mm of edge	1	1	1	1	1	1	1	1	1	1	1	1
		General	1	1	1	1	1	1	1	1	1	1	1	1
	600	Within 1200 mm of edge	1	1	1	1	1	1	1	1	1	1	1	1
		General	1	1	1	1	1	1	1	1	1	1	1	1
N2 or 40 (Region A and B)	450	Within 1200 mm of edge	1	1	1	1	1	1	1	1	1	1	1	1
		General	1	1	1	1	1	1	1	1	1	1	1	1
	600	Within 1200 mm of edge	2	2	1	1	1	1	1	1	1	1	1	1
		General	1	1	1	1	1	1	1	1	1	1	1	1
N3 or 50 (Region A and B)		Within 1200 mm of edge	2	2	1	1	1	1	1	1	1	1	1	1
		General	1	1	1	1	1	1	1	1	1	1	1	1
	600	Within 1200 mm of edge	2	2	1	2	2	1	1	1	1	1	1	1
		General	2	2	1	1	1	1	1	1	1	1	1	1
C1 or 50 (Region C and D)	450	Within 1200 mm of edge	2	2	1	2	2	1	1	1	1	1	1	1
		General	2	2	1	1	1	1	1	1	1	1	1	1
	600	Within 1200 mm of edge	3	3	1	3	3	1	2	2	1	1	1	1
		General	2	2	1	2	2	1	1	1	1	1	1	1

(b) Steel substrate

The fasteners' minimum diameter and one fastener are required per joint for the relevant wind classification or wind speed in accordance with;

(i) Screws – No.8 Gauge

(i) Steel framing members shall have a base metal thickness (BMT) not less than that required for a roof batten in NASH standard.

(ii) The fastener shall penetrate not less than two full screw threads through steel structural framing or nogging.

(iii) Where cavity construction is used, the fastener shall be placed through the batten and fixed into the structural framing or noggings.

(iv) Uncoated copper or steel fixings shall not be used for Western Red Cedar (silicon bronze, Monel metal, stainless steel, or hot-dipped galvanised are suitable).

7.2.1 Secret Fixing Tongue and Grooved Timber Profiled Cladding

(1) Where a tongue and groove timber profiled cladding has a secret fastener fixing facility; refer to Figure 39, the cladding shall be fixed using a combined fastener and adhesive.

(2) The fasteners' minimum diameter and number of fasteners required per Joint for the wind classification or wind speed in accordance with Clauses 7.1 and 7.2 except for nail solution up to a Wind Speed of N3 and a board width of 110 mm.

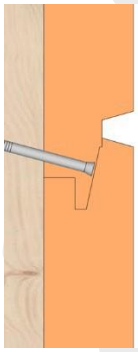


Figure 39: Secret Nailed Tongue and grooved cladding fixed to a timber substrate

(3) The limit for nail fasteners should accommodate only one fastener per joint. Larger nail sizes designed to first principle or screws may be used for higher wind speeds regions.

Note: The adhesive should be durable for the intended application.

7.2.2 End-matched timber cladding

Timber cladding may be joined between spans where a machined tongue and grooved are milled into the profile, or a plastic or metal joiner is provided.

7.3 Hardboard Wall Cladding Boards

It is satisfied for hardboard cladding if it is fixed in accordance with the following.

(1) Fasteners shall not be within

a. Overlapping cladding boards with spline
   i. Top edge - 15 mm minimum from the board edge.
   ii. Bottom edge - not applicable

b. Overlapping cladding boards without spline
   i. Top edge - 12 mm minimum from the board edge.
   ii. Bottom edge - 12 mm minimum from the board edge.
   iii. End - 12 mm minimum from the board edge.

c. Rebated cladding boards – semi concealed

i. Top edge - 15 mm minimum from the board edge.
ii. Bottom edge - 30 mm minimum from the board edge.
iii. End - 12 mm minimum from the board edge.

d. Rebated cladding boards – traditional
i. Top edge – not applicable
ii. Bottom edge - 30 mm minimum from the board edge.
iii. End - 12 mm minimum from the board edge.

e. Shingle
i. Top edge - 10 mm minimum from the board edge.
ii. Bottom edge - 30 mm minimum from the board edges.
iii. Board end - 12 mm minimum from the board edge.

(2) Fasteners shall be located at every stud or equivalent structural member.
(3) When butt-joining cladding boards, fasteners shall be installed on either side of the joint
(4) The fasteners described in Tables 7.2 and 7.3 is the minimum diameter of the fastener.
(5) Fasteners with larger diameters described in Tables 7.2 and 7.3 may be used, where consideration of splitting the timber cladding and the substrate is given, i.e. pre-drilling the hole.
(6) The fixing methods described in Tables 7.2 and 7.3 are relevant for on and off-stud joining methods for timber frames.
(7) The spans of the cladding board shall be continuous spans of 2 spans or greater. Simply supported spans shall not be permitted.
(8) The Traditional rebated cladding board shall have fasteners at a maximum of 140 mm apart.

(a) Timber substrate

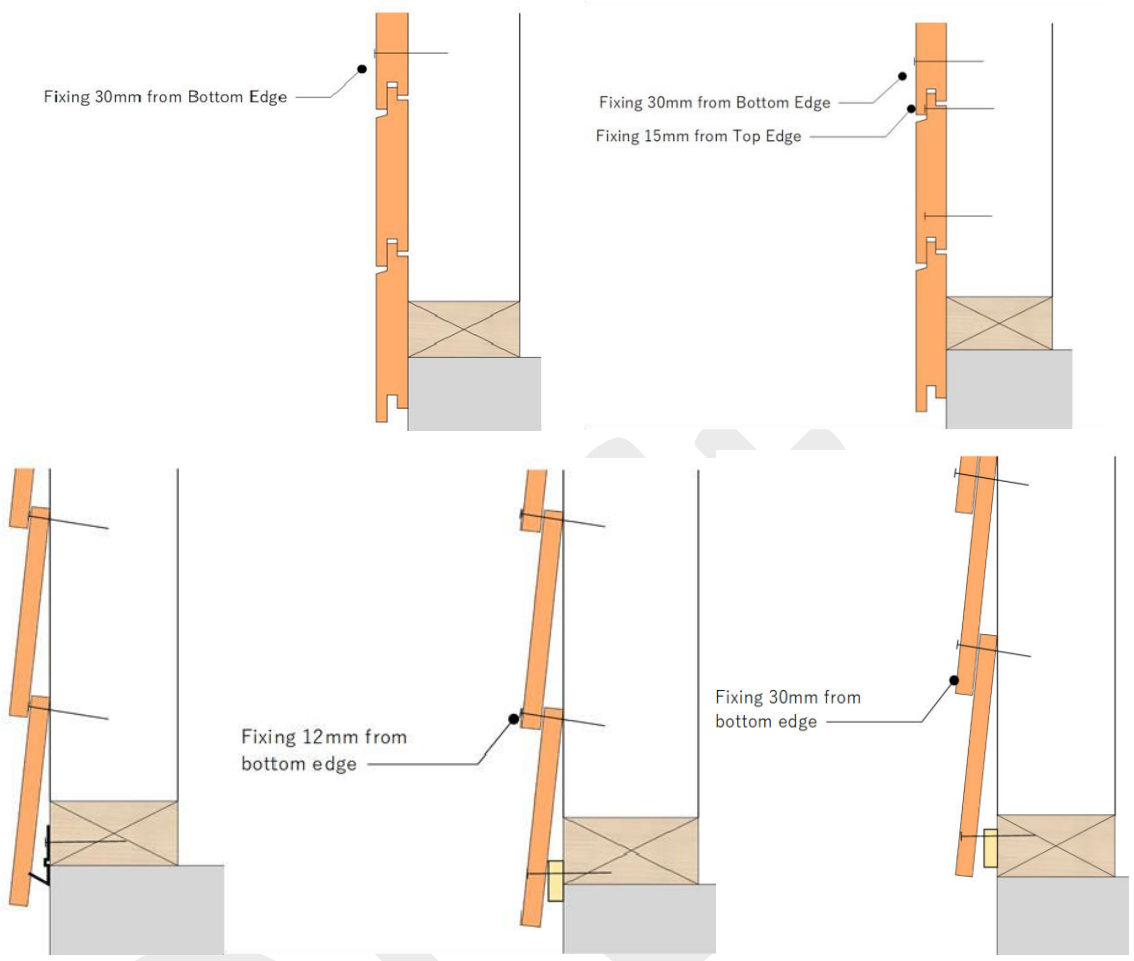
The fasteners' minimum diameter and number of fasteners required per joint for the relevant wind classification or wind speed in accordance with Table 7.2.

(i) Nails into textured hardboard only
a. Hardwood substrate –
i. Machine nail: 2.0 mm with lost head and plain shank Stainless Steel,
ii. Hand-driven 2.5 mm Class 4 or Stainless Steel flat head with a plain shank.; or
b. Softwood substrate –
i. Machine nail: 2.0 mm with lost head and plain shank Stainless Steel,
ii. Hand-driven 2.5 mm Class 4 or Stainless Steel flat head with a plain shank – Table 7.2; or

(ii) Screws – One screw of 4.0 mm shank diameter or 5.0 mm thread diameter.
(iii) The fastener shall penetrate 30 mm into structural framing, nogging or structural batten.
(iv) Where a spacer batten is used in cavity construction, the fastener shall be placed through the batten and fixed into the structural framing or noggings.
(v) Stainless steel fasteners shall be used for unpainted boards.
(vi) Fasteners shall not rely on the batten for structural support unless it's a structural batten.
(vii) Where cavity construction is used, fasteners shall be longer to account for the cavity to ensure minimum penetration is achieved.
(viii) Nails shall be finished flush to the surface and not be punched and filled.

Note: When fastening into battens only, care is required not to penetrate the pliable membrane.

(vix) When using countersunk screws, they shall be countersunk 2 mm below the board surface and filled with a high-quality, acrylic-based flexible paintable filler.



Overlapping with spline Overlapping Shingle

Figure 40: Fasteners Edge distance in Hardboard cladding boards

Table 7.2 Residential Wind Table based on AS 4055 Minimum Fastener Fixings – Timber Substrate

				Maximum Stud Spacing (mm)	
Cladding Type	**Fastener Type**	**Nail pattern**	**Wind Zone**	**General Areas**	**Within 1,200 of the building's corners**
Overlapping with and without Spline	Nail	Per Figure 40	N1, N2, N3, C1	600	600
Rebated cladding boards	Nail	Per Figure 40	N1, N2, N3, C1	600	600
Self-locking	Nail	Per Figure 40	N1, N2, N3, C1	600	600
	Nail		N1, N2, N3, C1	600	600
	Countersunk Screw		N1, N2	600	600
			N3, C1	600	450
Shingles	Nail	Per Figure 40	N1, N2, N3, C1	600	600

Notes:

1. Span/150 serviceability limit state deflection criteria.

(b) Steel substrate

The fasteners' minimum diameter and number of fasteners required per joint for the wind classification or wind speed, in accordance with Table 7.3.

(i) Steel framing members shall have a base metal thickness (BMT) not less than that required for a metal roof batten.

(ii) Screws –

a. Steel frame 0.55 BMT – one screw with thread diameter minimum of 4.2 mm (8 gauge) and stud spacing,

b. Steel frame 0.75 BMT – screw thread diameter minimum of 4.8 mm (10 to 16 gauge) and stud spacing.

(iii) The fastener shall penetrate not less than two full screw threads through steel structural framing or nogging.

(iv) Where thermally broken cavity construction is used, the fastener shall be placed through the batten and fixed into the structural framing.

Table 7.3 Residential Wind Table based on AS 4055 Minimum Fastener Fixings – Steel Substrate

				Maximum Stud or Fastener Spacing (mm)	
Cladding Type	**Fastener Type**	**Minimum Base Metal Thickness of Frame (mm)**	**Wind Zone**	**General Areas**	**Within 1200 of the building corners**
Overlapping with or without Spline	Fibre cement Screw	0.55	N1, N2, N3, C1	600	600
Rebated cladding boards	Fibre cement Screw	0.55	N1, N2, N3, C1	600	600
Self-locking	Fibre Cement	0.55	N1, N2, N3, C1	600	600
	Countersunk coarse	0.75	N1, N2, N3, C1	600	600
Shingles	Fibre cement Screw	0.55	N1, N2, N3, C1	600	600

Notes

1. Span/150 serviceability limit state deflection criteria.

7.4 HARDBOARD SHEET WALL CLADDING

It is satisfied for hardboard cladding is fixed in accordance with the following.

1. Fasteners shall not be within 12 mm of board edges
2. Fasteners shall not be installed in the sheet grooves
3. Fasteners shall be fastened at 150 mm centres at the top and bottom of the panel and wall edges per Table 7.4
4. Fasteners shall be installed based on board type as per Figure 41.
5. When butt joining fasteners shall be installed on either side of the stud joint at 150 mm centres
6. Fasteners shall be installed at noggings.

7. Fasteners described in Tables 7.4 and 7.5 is the minimum diameter of the fastener. Fasteners with larger diameters may be used, where consideration of splitting the timber cladding and the substrate is given, i.e. pre-drilling the hole.

(a) Timber substrate

The fasteners' minimum diameter and number of fasteners required per joint for the wind classification or wind speed in accordance with Table 7.4.

(i) Nails into textured hardboard only

a. Hardwood substrate –
   i. Machine nail: 2.0 mm with lost head and plain shank Stainless Steel,
   ii. Hand-driven 2.5 mm Class 4 or Stainless Steel flat head with a plain shank,; or

b. Softwood substrate –
   i. Machine nail: 2.0 mm with lost head and plain shank Stainless Steel,
   ii. Hand-driven 2.5 mm Class 4 or Stainless Steel flat head with a plain shank; or

(ii) Screws – thread diameter – 4.8 mm (10 gauge).

(iii) The fastener shall penetrate 30 mm into structural framing, nogging or structural batten

(iv) Machine nails may substitute hand-driven nails where the capacity is shown to be equivalent or better.

(v) Where a spacer batten is used in cavity construction, the fastener shall be placed through the batten and fixed into the structural framing or noggings.

(vi) Stainless steel fasteners shall be used for unpainted boards

(vii) Fasteners shall not rely on the batten for structural support unless designed accordingly.

(viii) Where cavity construction is used, fasteners shall be longer to account for the cavity to ensure minimum penetration is achieved.

(ix) When fastening into battens only, care is required not to penetrate the pliable membrane.

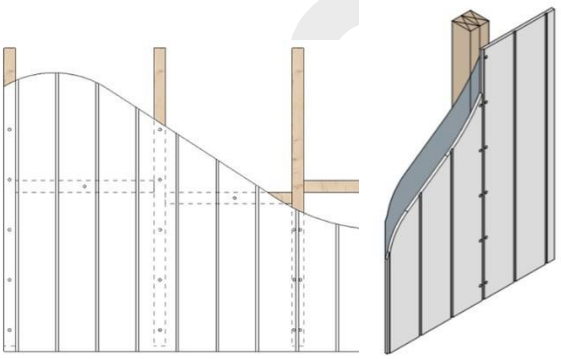
(x) Nails shall be finished flush to the surface and not be punched and filled. Punching will significantly reduce the holding capacity of the fastener.

(xi) When using countersunk screws, these may be countersunk 2 mm below the board surface and filled with a high-quality, compatible and paintable filler.

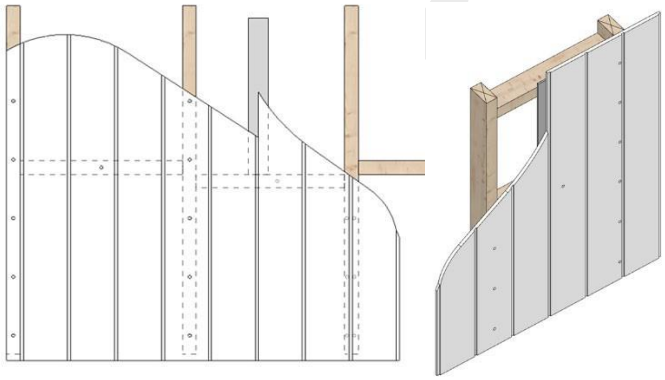
(xii) The above tables are relevant for on and off stud joining methods for timber frames.

Table 7.4 Residential Wind Table based on AS 4055 Minimum Fastener Fixings - Timber Substrate

				Maximum Stud Spacing (mm)	
Fastener	**Maximum perimeter fixings (mm)**	**Maximum Fastener spacing at intermediate studs and noggings (mm)**	**Wind Zone**	**General Areas**	**Within 1200 of building corners**
Nail	150	300	N1, N2	600	600
			N3, C1	600	450
		150	N1, N2, N3, C1	600	Panel face groove spacing 75 mm – 450, remainder at 600
Countersunk Screw	150	300	N1	600	600
			N2	600	400
		150	N1, N2	600	600
			N3, C1	600	450



On stud butt join (unpainted)



Off-stud using a metal joiner

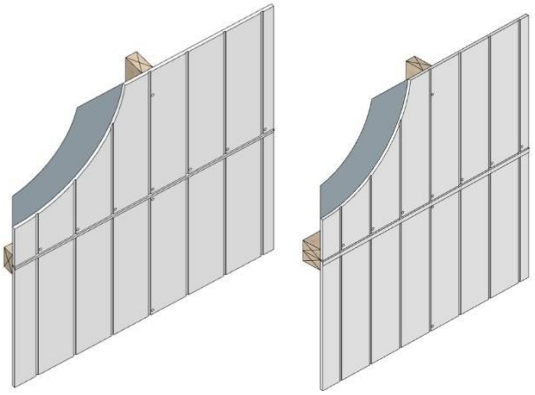


Figure 41: Fasteners in Hardboard sheets

(b) Steel substrate

The fasteners' minimum diameter and number of fasteners required per joint for the wind classification or wind speed in accordance with Table 7.5.

(i) Steel framing members shall have a base metal thickness (BMT) not less than that required for a metal roof batten.

(ii) Screws –

a. Steel frame 0.55 BMT – one screw with thread diameter minimum of 4.2 mm (8 gauged) and stud spacing.
b. Steel frame 0.75 BMT – screw thread diameter minimum of 4.8 mm (10 to 16 gauged) and stud spacing.

(iii) The fastener shall penetrate not less than two full screw threads through steel

structural framing or nogging.

(iv) Where thermally broken cavity construction is used, the fastener shall be placed through the batten and fixed into the structural framing.

Table 7.5 Residential Wind Table based on AS 4055 Minimum Fastener Fixings – Steel Substrate

				Maximum Stud Spacing (mm)	
Fastener	**Maximum perimeter fixings (mm)**	**Maximum Fastener spacing at intermediate studs and noggings (mm)**	**Wind Classification**	**General Areas**	**Within 1200 of building corners**
Fibre Cement Screw	150	300	N1, N2	600	600
			N3, C1	600	450
		150	N1, N2, N3, C1	600	Panel face groove spacing 75 mm – 450, remainder at 600
Countersunk coarse C3 Screw	150	300	N1, N2	600	600
			N3, C1	600	450
		150	N1, N2, N3, C1	600	Panel face groove spacing 75 mm – 450, remainder at 600

Notes:

1. Span/150 serviceability limit state deflection criteria.

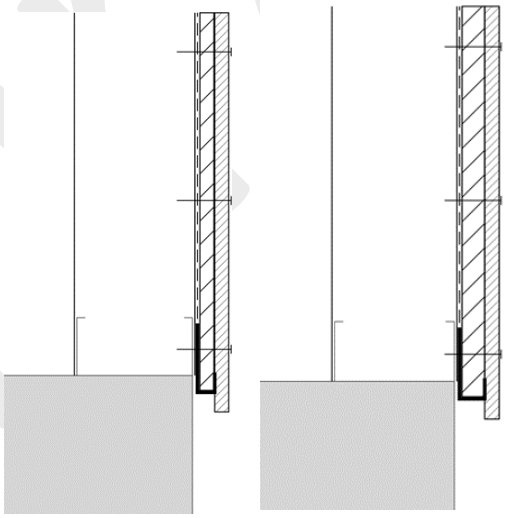


Figure 42: Fixing of wall cladding on a steel frame

7.4.1 End-matched timber profiled cladding

Hardboard cladding may be joined between spans where metal joiners are provided.

7.5 STRUCTURAL PLYWOOD WALL CLADDING

(a) All sheet edges shall be fully supported by substrate framing. Add noggings to wall framing where horizontal joins occur.
(b) Studs shall not exceed 600 mm centres.
(c) Single spans of plywood shall not exceed 600 mm (e.g. below windows or balustrades).
(d) Be fixed in accordance with Clause 6.5.1.
(e) An extra stud is required at internal corners for ventilated cavities.
(f) All plywood sheets shall be installed vertically; that is, the direction of the face veneer grain is vertical.

7.5.1 Fasteners and Fixing Spacing of plywood Cladding

(a) Spacing of fasteners in accordance with Table 7.6.
(b) The minimum fasteners size is
    (i) Timber frame
        a. Hand-driven 2.8 mm flat head nail
        b. Machine-driven 2.87 mm D Head
    (ii) Steel frame
        a. 2.8 mm 10-16
(c) Wall cladding may be fixed through timber or metal battens attached to the wall frame so long as the fasteners penetrate not less than 30 mm into timber framing and shall penetrate not less than two full screw threads through steel structural framing or nogging for steel framing.
(d) Fixings shall be positioned a minimum of 7 mm from the edge of the sheet and not less than 50 mm from the edge of all corners.
(e) Where lapped joint plywood is used,
    a. The fastener shall not be placed in a lap and be a minimum of 7 mm away from the position where the full plywood panel width occurs, refer to Figure 43.
    b. Fastener in bottom lap after the weather groove. No fastener shall be used within the weather groove.

Notes

1. Fastener sizes are minimal. Large diameters that don't split the plywood could be used.
2. Where plywood cladding Is intended to have the structural bracing capacity, refer to AS 1684 for fixing spacing and type.

Table 7.6: Stud and fixing spacings for plywood wall cladding equal to or greater than 6.5 mm thick

Wind Classification	Maximum stud spacing (mm)	Maximum nail spacing within 1.2 m of the external corners of the building (mm)	Maximum nail spacing elsewhere
N1	600	Body: 200, Edges: 100	Body: 200, Edges: 150
N2	600	Body: 200, Edges: 100	Body: 200, Edges: 150
N3	600	Body: 150, Edges: 100	Body: 200, Edges: 150

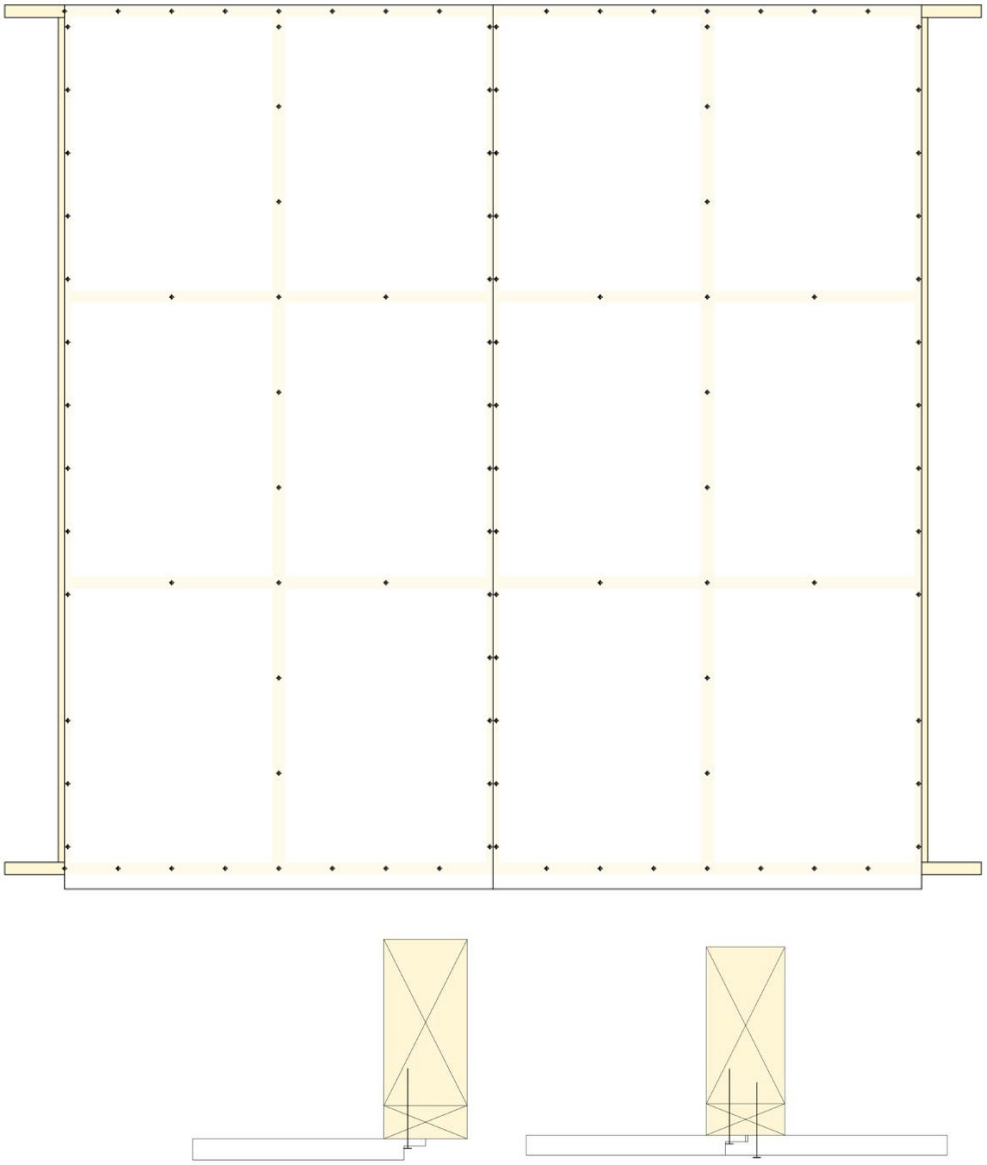


Figure 43: Plywood fixing spacing

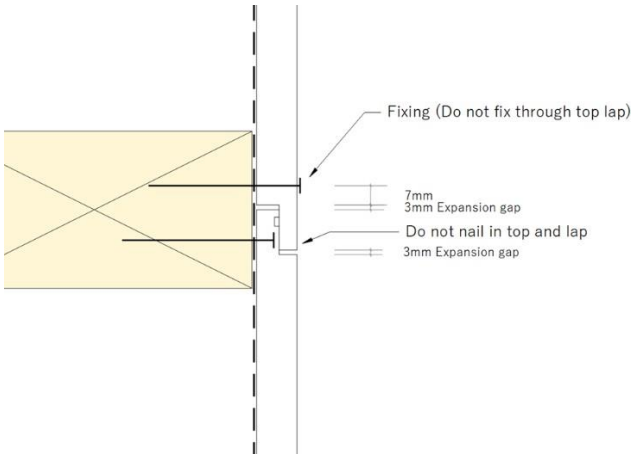


Figure 44: Vertical Joint - lapped

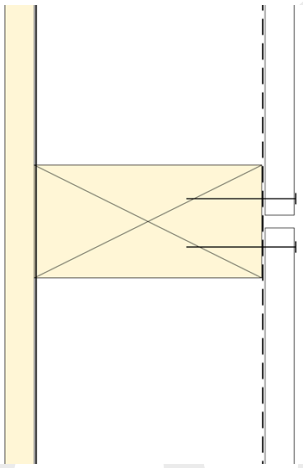


Figure 45: Vertical Joint Square Edge

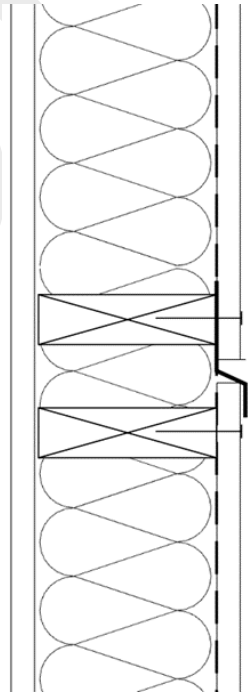


Figure 46: Horizontal Joint

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CSIRO. Water penetration testing to the Verification method V2.2.1 (weatherproofing), of the National Construction Code (NCC), on timber weatherboard cladding cavity systems, Report Number DTF1099, 2017

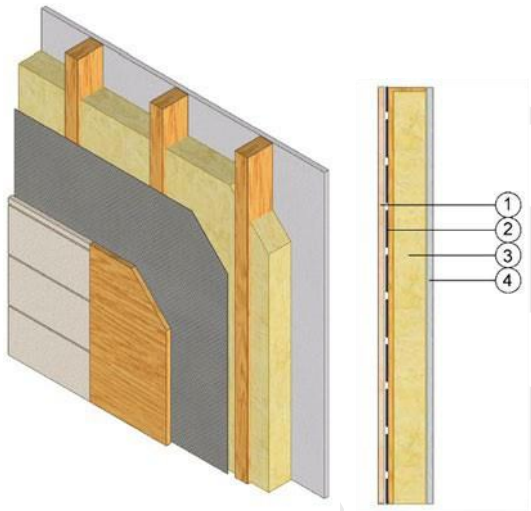
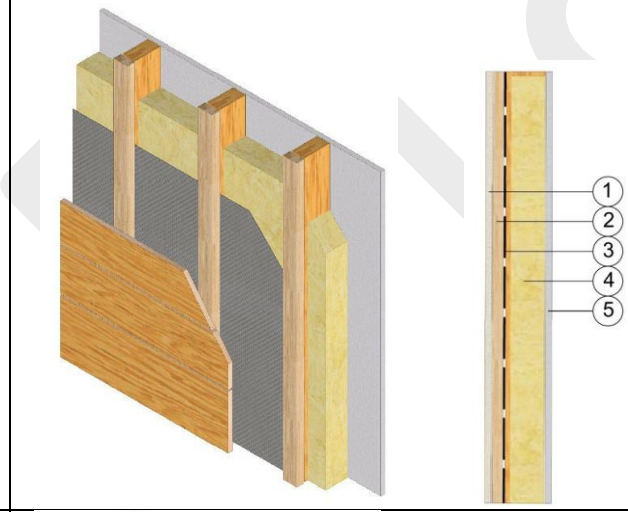
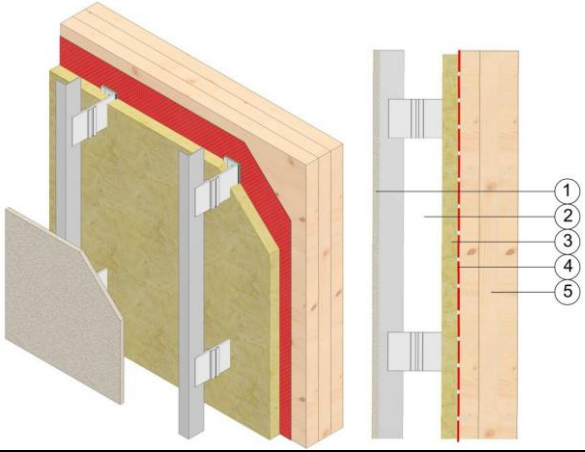
CSIRO, Water penetration testing to the Verification method V2.2.1 (weatherproofing), of the National Construction Code (NCC), on timber weatherboard direct fix cladding wall systems, Report Number DTF1098, 2017

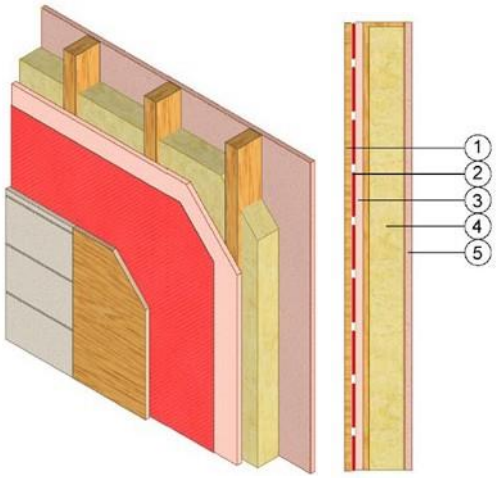
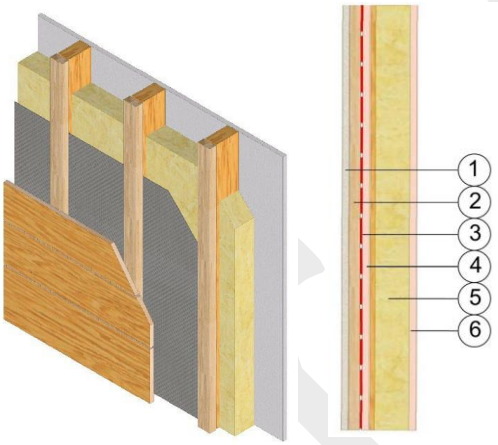
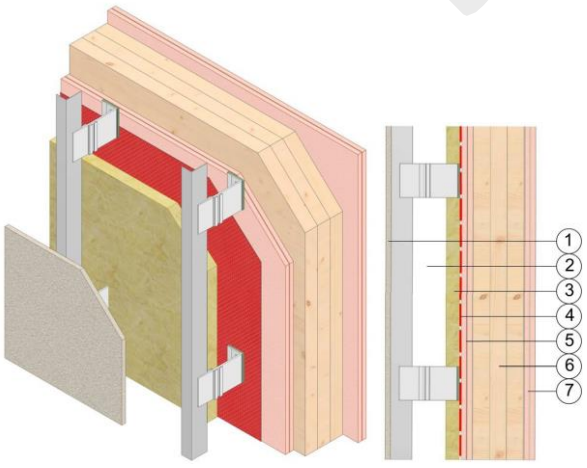
Speckel, Hygrothermal Simulations, 2023

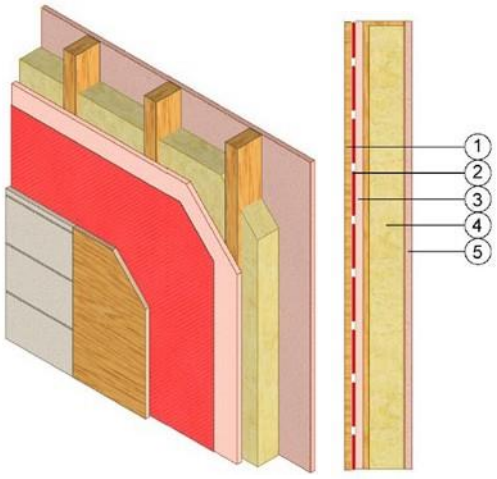
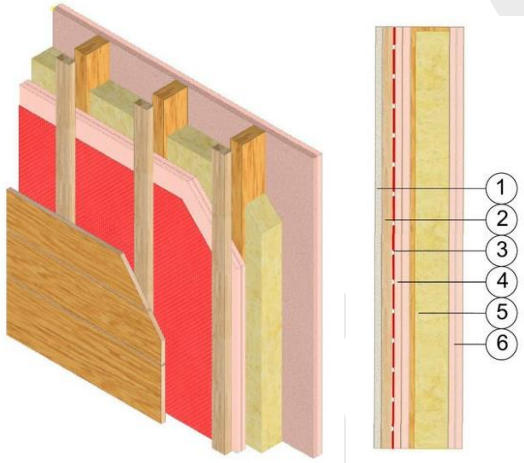
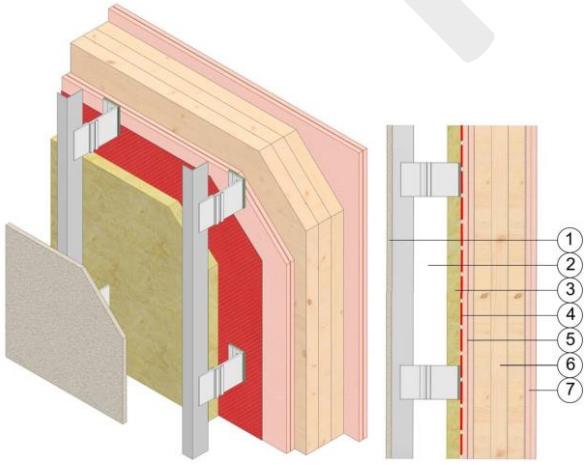
APPENDIX A – EXTERIOR CLADDING SYSTEMS THAT MEET THE NCC CONDENSATION REQUIREMENT (NORMATIVE)

The National Construction Code contains requirements to reduce moisture-related issues due to condensation. The following timber cladding system has been verified by modelling to meet the NCC requirements. (Speckel, Hygrothermal Simulations, 2023)

Table A1: Solution for Housing and Low-rise Buildings

Cladding System	System Configuration			Acceptable Climate Zone
Housing or Non-fire-rated Walls				
Direct Fixed Timber Cladding Construction over Timber Frame Substrate		1	Timber cladding (profiled boards or panels)	2, 3, 4, 5, 6 and 7
		2	I.0 mm Class 4 pliable building membrane	
		3	Timber framing and 90 mm glasswool	
		4	10 mm plasterboard	
Timber Cladding Cavity Construction over Timber Frame Substrate		1	Timber-profiled boards or panels	2, 3, 4, 5, 6 and 7
		2	20 mm air space, slightly ventilated (8 ACH)	
		3	I.0 mm Class 4 pliable building membrane	
		4	Timber framing and 90 mm glasswool	
		5	10 mm plasterboard	
Timber Cladding Cavity Construction over Mass Timber Substrate		1	Timber-profiled boards or panels	2, 3, 4, 5, 6 and 7
		2	20 mm air space, slightly ventilated at (8 ACH)	
		3	60 mm stonewool R1.76	
		4	I.0 mm Class 4 pliable building membrane	
		5	90 mm CLT	

Cladding System	System Configuration			Acceptable Climate Zone
Low-rise Fire-Rated Exterior Wall (Not intending to comply with the NCC's Fire-protected Timber Concession)				
Direct Fixed Timber Cladding Construction over Timber Frame Substrate		1	Timber cladding (profiled board or panels)	2, 3, 4, 5, 6 and 7
		2	I.0 mm Class 4 pliable building membrane	
		3	16 mm fire-protective plasterboard	
		4	Timber framing and 90 mm glasswool	
		5	16 mm plasterboard	
Timber Cladding Cavity Construction over Timber Frame Substrate		1	Timber-profiled boards or panels	2, 3, 4, 5, 6 and 7
		2	20 mm air space, slightly ventilated (8 ACH) and vertical battens	
		3	I.0 mm Class 4 pliable building membrane	
		4	16 mm fire-protective plasterboard	
		5	Timber framing and 90 mm glasswool	
		6	10 mm plasterboard	
Timber Cladding Cavity Construction over Mass Timber Substrate		1	Timber-profiled boards or panels	2, 3, 4, 5, 6 and 7
		2	20 mm air space, slightly ventilated at (8 ACH)	
		3	60 mm stonewool R1.76	
		4	I.0 mm Class 4 pliable building membrane	
		5	2 x 13 mm fire-protective	
		6	90 mm CLT	
		7	2 x 13 mm fire-protective plasterboard	

Substrate	System Configuration			Acceptable Climate Zone
Mid-Rise Exterior Walls intended to comply with the NCC's Fire-protected Timber Concession				
Direct Fixed Timber Cladding Construction over Timber Frame Substrate		1	Timber cladding (profiled board or panels)	2, 3, 4, 5, and 6
		2	I.0 mm Class 4 pliable building membrane	
		3	16 mm fire-protective plasterboard	
		4	Timber framing and 90 mm glasswool	
		5	16 mm plasterboard	
Timber Cladding Cavity Construction over Timber Frame Substrate		1	Timber-profiled boards or panels	2, 3, 4, 5, and 6
		2	20 mm air space, slightly ventilated (8 ACH) and vertical battens	
		3	I.0 mm Class 4 pliable building membrane	
		4	16 mm fire-protective plasterboard	
		5	Timber framing and 90 mm glasswool	
		6	10 mm plasterboard	
Timber Cladding Cavity Construction over Mass Timber Substrate		1	Timber-profiled boards or panels	2, 3, 4, 5, and 6
		2	20 mm air space, slightly ventilated at (8 ACH)	
		3	60 mm stonewool R1.76	
		4	I.0 mm Class 4 pliable building membrane	
		5	2 x 13 mm fire-protective plasterboard	
		6	90 mm CLT	
		7	2 x 13 mm fire-protective plasterboard	

Note: Where additional plasterboard or difference thickness is required within the system for increased fire resistance, the addition of the plasterboard is not likely to detriment the system's performance.

APPENDIX B – BUILDING PRACTICES (INFORMATIVE)

This Section provides information on practices for the installation of timber cladding systems.

B1 RECEIVING CLADDING

Upon receipt of the cladding, inspecting the parcel of cladding is recommended to ensure that the product is the correct profile or panel, species and quantity ordered.

If the cladding is delivered damaged, it should not be installed. Contact the supplier as soon as practicable. Cladding manufacturers or suppliers are not generally required to replace damaged cladding once it has been installed or altered in any way.

It is recommended that the cladding be installed as quickly as possible after receiving it to prevent the risk of variation in the product's moisture content, which may lead to warping in the boards or variation in size.

B2 SITE STORAGE

As far as possible, plan the delivery of timber elements to minimise the time they are stored on-site. Where timber elements should be stored, they should be stored in a well-ventilated and drained sheltered location, protected from direct exposure to the weather, refer to Figure B1. The timber elements should be kept off the ground using bearers (gluts/dunnage) at least 150 mm from well-drained and even ground. The ground should be well-drained and free of obstacles, debris, and vegetation so that water does not settle. Place a waterproof membrane directly on the ground or construct a gravel pad if the ground is continuously wet.

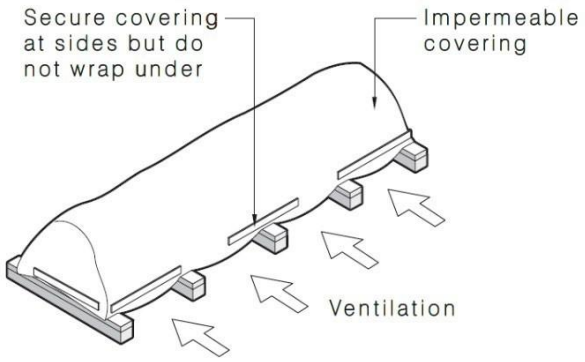


Figure B1: Stored Timber Elements

The timber elements could be covered with suitable covering or tarpaulins if sheltered storage is unavailable. The cover should be placed to preclude moisture whilst maintaining good air circulation in and around the timber. Do not tuck the wrap or trap under the stack of timber. If the wrap or trap is damaged, make it good with tape or remove it and protect it with a new impermeable covering or tarpaulins.

A vapour-permeable wrap is recommended when free air movement is not possible under a trap or wrap. Impermeable wraps without adequate ventilation may cause condensation. This situation often occurs when factory-wrapped timber elements are stored on construction sites.

B3 Preparation

Before installing the cladding, check that the board or panel's width is equal to or very close (+/- 3 mm) to the specified width. A significant difference would indicate that the moisture content of the boards or panel is unusually high or low and that fixing should not proceed until the moisture content of the boards is within an acceptable range.

At the time of fixing, the moisture content of the substrate should not exceed 15%. This maximum moisture content should avoid problems caused by timber movement, shrinkage, and condensation and to ensure the satisfactory application of paints and stains.

Remove all dirt, dust or any contaminants from the board surface. Fill any defects or damage with an approved filler, including punched nail holes. Sand any uneven surfaces. Recoat bare timber areas exposed through cutting or notching with an approved treatment re-sealer.

To avoid the primer paint coat from being seen after the top coat has been installed, it is recommended that the primer be colour-matched to the top coat. For pre-prime boards in zones where overlap in the cladding profile occurs, the pre-primed boards should have a top coat applied to zones of overlap prior to fixing to the substrate.

B4 Wall Straightening and Corrections

The wall to be covered in cladding should generally be flat. Significant differences in the evenness between two or several adjacent battens will warp the wall cladding, and the resulting ripples may be visible depending on the light. Significant ripples could also seriously constrain the fastening systems used to hold the cladding in place. Corrections are recommended when the amplitude of the ripples is greater than 5 mm for one batten compared to two adjacent battens.

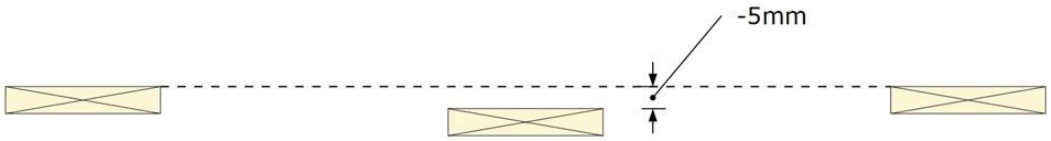


Figure B2: Substrate maximum out of alignment

B5 Cappilar Groove in Windows and Door

If using timber windows and doors, it is important that the groove underneath the sills, which prevents water from entering the cavity by capillary action, is clear of the external cladding. See Figure B3 below. If fixing cladding over a cavity, the additional width of the cavity should be considered in window and door sizing.

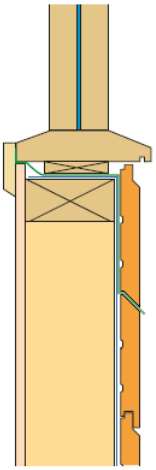


Figure B3: Capillary grove under timber window sills kept clear of cladding

B6 Adhesives

Any adhesive used to assist in the fixing of cladding should be exterior rated. The adhesive manufacturer's instructions for use should be observed for optimum results.

First, apply beads of exterior-rated adhesive to framing (or battens) sufficient for the installation of five (5) boards at any one time. Locate the first board and nail. Observing concealed fixing procedures, nail the following boards, taking care to drive or punch the nails so as not to obstruct fitting the next board.

Secret fasting at an oblique angle in a position to conceal the fixing under the overlapping edge of the following board.

Adhesives are not recommended for hardboard cladding products.

B7 Plywood

When laying up on framing, start at framing corners and work across the wall.

Where cuts are made into enveloped preservative-treated panels, the cut edges should be coated with a brush on timber preservatives. Cut edges should be placed at the top of the sheet to avoid rain drips soaking into cut end grains.

Priming the bottom edges and the back (rear) of the sheets to a height of 150 mm is recommended.

Fasting into battens that are not installed over studs or noggings may puncture the building wrap.

B8 Profiled Timber Cladding

The recommended method of fixing is with only one fastener at each batten or stud crossing to secure the board to the battens or studs. With most profiles, the fastener is driven through the lower quarter of the width of the board. However, for some profiles, the fastener is driven through the central region of the width of the board. For most profiles, it is important that only one fastener be used at each batten or stud so that each board can expand or shrink in width individually during seasonal weather changes. The next board is fixed similarly, and the second board's lower edge holds the first board's upper edge in place. The fastener in one board should not penetrate the

adjacent board.

Where machine nailing is used, care should be taken to ensure that excess pressure does not distort the boards and that nails are not countersunk greater than 3 mm. Cladding should be fastened wherever possible so that the boards are free to shrink and swell individually.

Cladding should be fixed at centres measured along the board at not more than 650 mm. The fastener at the butt should be pre-drilled. Unseasoned sawn weatherboards should have a minimum lap of 30 mm.

B9 Durability of Metal Fasteners and Battens

Corrosion of metal fasteners needs to be considered in terms of the fastener's exposure type. Most timber connections and fasteners have an 'exposed' portion (exposed to the atmosphere) and an 'embedded' portion (embedded in the timber). The moisture content of the timber will dictate corrosion of the embedded portion of the fastener, the timber's natural 'pH', the availability of oxygen and any electrolytic action that may be facilitated via other influences such as a preservative treatment of the timber, e.g. a copper-based preservative treatment; refer to the section 8.10.

All of the above factors dictate corrosion of the 'exposed' portion of the fastener but can also be influenced by air-borne contaminants such as salt deposition and, in industrial areas, other chemicals.

The following are different environments with differing corrosion behaviour.

- Sea Spray Zone - Less than 1km from a surf coast or 100 m from bayside areas.
- Coastal Zone - 1km to 10km from a surf coast or 100 m to 1 km from bayside areas.
- Industrial Zone - Close proximity to industrial complexes where corrosive gases may be emitted, e.g. Port Pirie and Newcastle.
- Special Hazard Zone - The environment within a building may also adversely affect the durability of connectors. For example, enclosed swimming pools, fertiliser sheds, tanneries, chemical plants, piggeries, poultry sheds, and similar structures may cause rapid corrosion of galvanised metal products and may also impact stainless steel. Corrosion in these buildings should require special attention and is beyond the scope of this Data Sheet.
- Low Hazard Zone - Generally, locations that are not described by the above.

Section 4 of this Standard describes suitable materials for timber cladding systems and their product standard. The product Standards provide requirements to improve the service life of these materials.

B10 Preservative Treated Timber and Fasteners

In the presence of moisture, copper-based timber preservatives such as CCA, ACQ and Copper Azole may cause increased corrosion of metal fasteners. In these situations, galvanised metal connectors require additional coatings such as epoxy paint or epoxy coated (fusion coated) to isolate the zinc in galvanising from the copper in the timber treatment; alternatively, stainless steel should be used.

LOSP timber preservatives have a negligible effect on corrosion rates, and no special additional corrosion considerations are required for LOSP preservatives treated timber.