National Association of Forest Industries

Timber Manual
Datafile FP1

Timber External Cladding

Revised Edition
2005

Contents

Cover Photo: Grey stained western red cedar sawn weatherboards clad this striking church

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Introduction

No other cladding material can offer the design freedom, ease of handling, range of products and natural beauty of timber. Timber clad buildings can be designed to suit any environment and fit any site with a minimum of expense. The possibilities are almost limitless. They can look traditional, modern or simply unique-designed to suit the style, flair and imagination of the owner.

Modern finishes give a long lasting and attractive appearance to timber cladding and can be used to change the colour and style of timber clad buildings. It is also quick and easy to keep pace with changing fashions. The natural resilience of timber gives a built-in flexibility which helps resist stresses and strains caused by foundation movement, wind storms or seismic movement.

Timber clad buildings offer economical comfort from the tropical north to the temperate south. Whatever the climate a timber clad wall can be designed to give excellent thermal performance all year round. Its natural sound damping properties also help keep noise out of buildings and reduce reflected noise in confined outdoor spaces.

Cladding Selection

Today's designers can choose from a wide variety of timber cladding products that includes solid timber boards in a range of profiles and species, timber shingles or shakes, various types of plywood and exterior grade hardboard in plain or surface textured sheets or planks.

When choosing the type to use, there are a number of points which must be considered:

- The appearance required by architectural style
- Availability and cost
- Ease of installation and maintenance
- Prevailing climate and thermal performance required for a building, including buildings in a bush-fire prone area
- The importance of additional strength given to the structure by some types of cladding
- Local government regulations or statutory requirements

Designers should be fully informed when making their decision. Advice is available from suppliers or the Timber Advisory Services listed on the back page of this Datafile.

Preservative treated pine cladding reflects roof shapes

Design for Cladding

As with any building material, obtaining the best performance from timber cladding depends on good design, proper construction practice and correct installation. Cladding should be considered an integral part of the overall building design as it can contribute to aesthetics, comfort and structural adequacy.

The design requirements for timber clad buildings are generally the same regardless of the actual cladding material used. Any special requirements are detailed in the appropriate section of this Datafile.

To obtain the best possible performance from timber cladding, designers should give preference to building styles where cladding is sheltered by wide eaves and verandahs. This will give weather protection to the walls and, where verandahs are used, provide extra utility and increased comfort for the occupants.

Care should be taken with details at corners, and where cladding meets doors, windows and other walls. Such details must be designed and constructed to ensure that no water leaks into the structure. Provision must be made for the fixing of adequate flashing and sarking in accordance with good building practice.

Timber cladding on walls should finish clear of the ground in such a way that there is no possibility that moisture uptake may occur and may eventually cause deterioration of the cladding near the ground. Flashing may be installed to protect the bottom cladding board from moisture ingress. Where necessary cladding installation near the ground must be compatible with any installed termite protection work.

If timber cladding comes closer adjacent earth or pavement should be sloped away from the wall. During installation the bottom edge of the cladding should be cut to slope inwards and upwards from the face at an angle of 15°, to form a drip initiator, and/or the bottom cladding board should be packed out so that water will be readily shed from the cladding. Refer Figure 1.

Buildings clad with timber have many natural advantages on sites subject to high winds, extreme climate, highly reactive soils, subsidence or earth tremors. Unlike masonry and other rigid materials, the natural resilience and high strength to weight ratio of timber enables it to withstand far greater stresses and movement.

Where difficult site conditions are encountered designers should consult their local Timber Advisory Service for

Figure 1: Cladding Close to Ground

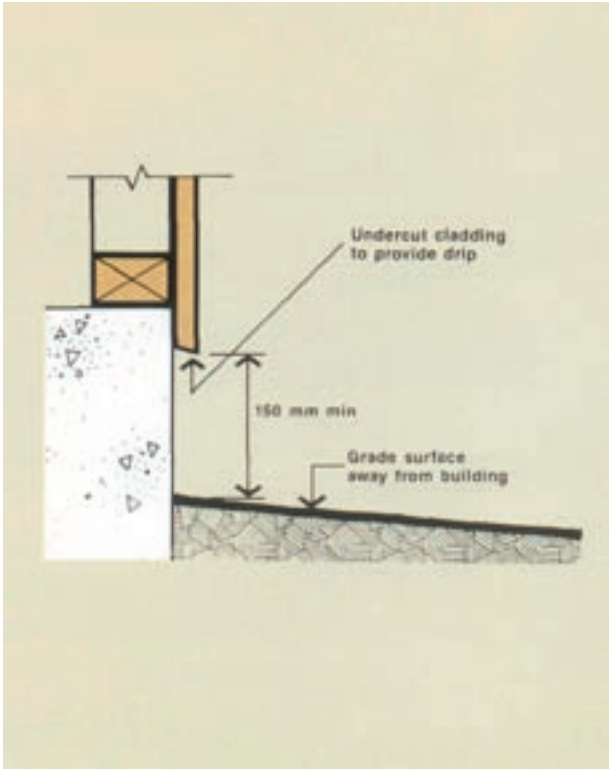
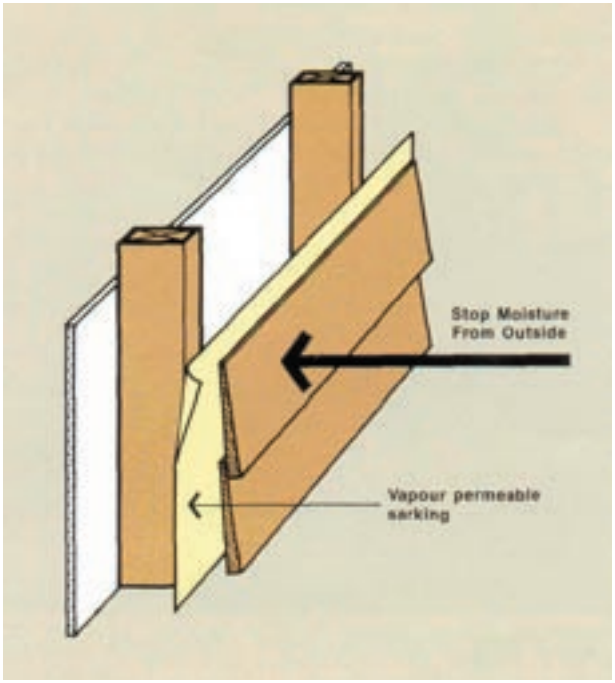


Figure 2: Wall Sarking



Stained, preservative treated, grooved plywood cladding blends with bushland setting

Sawn weatherboards finished with semi-transparent stain on multi-residential units

assistance and specialised design information.

When exposed non-vertical walls are to be clad with timber, special consideration may need to be given to detailing. Weathering may be accelerated and additional protection may need to be provided, particularly on north facing walls. When individual board cladding is used, sarking is essential and board overlap should be increased to ensure adequate protection from water entering the structure.

Sarking, Flashing and Vapour Barriers

Sarking

Sarking is a waterproof but vapour permeable flexible sheet material that is fixed directly behind timber cladding or under roofing material. Its primary function in walls is to prevent wind- and storm-driven water penetrating the cladding and to direct it back to the outside of the structure instead of it lodging within the frame. Sarking will also provide a draught proof barrier to keep wind driven rain or dust out of the wall cavity.

Sarking must be impermeable to liquid moisture yet still allow the free flow of water vapour from the back surface of the cladding. If sarking restricts the flow of vapour, timber cladding which has taken up moisture during periods of wet weather may tend to cup as the outside face dries. Only vapour permeable building paper, vapour permeable reflective foil laminate (RFL), or breather type sarking should be used. Polyethylene film, impermeable aluminium foil, or other non-permeable material should never be used as sarking immediately behind timber cladding. Building papers with fire resistant properties are also available.

Note that the manufacturers of perforated foil insulation recommend that it not be used for sarking immediately behind timber cladding.

It is good practice to use a vapour permeable sarking on the outside of studs, and directly under the timber cladding. Insulation material should be behind the sarking. Refer Figure 2. Sarking is considered essential in walls subject to high wind conditions and wind updraughts and also for use where boarding is fixed diagonally or vertically.

The use of wall sarking is not a substitute for well chosen and properly installed cladding and it should never be regarded as the principal means of weatherproofing.

Vapour permeable sarking should always be used and installed according to the manufacturers recommendations.

Flashing

While sarking is used for general waterproofing, flashing is used at corners and vertical joints, and around opening. Whereas sarking is not always used, it is essential that flashing is provided to ensure that water is prevented from penetrating the wall frame cavity. As it does not extend fully behind the cladding, non-permeable materials may be used as flashing.

Vapour barriers

The use of a separate vapour barriers depends on the type of construction, the intended use of the building and the climate at its location.

When large temperature differences exist between indoor and outdoor environments the potential for condensation of water vapour within a frame is very real.

Showers, baths, dish-washers, clothes-washers, driers, cooking, indoor plants - and even people - generate large amounts of water vapour within a building. Some of this vapour will move outward through plaster, wood and other permeable materials until it either disperses into the atmosphere (this could be the wall cavity), reaches an impermeable barrier or meets a surface cold enough for it to condense into liquid.

If water vapour is allowed to cross the cavity of a wall when outside temperatures are low, free moisture will condense on the back of the cold outer cladding or sarking. Under some conditions this will be taken up by the timber frames and cladding and may eventually lead to decay in non-durable untreated timber.

This problem can be overcome by the correct placement of a vapour barrier material such as plastic film, aluminium foil or bitumen bonded insulation.

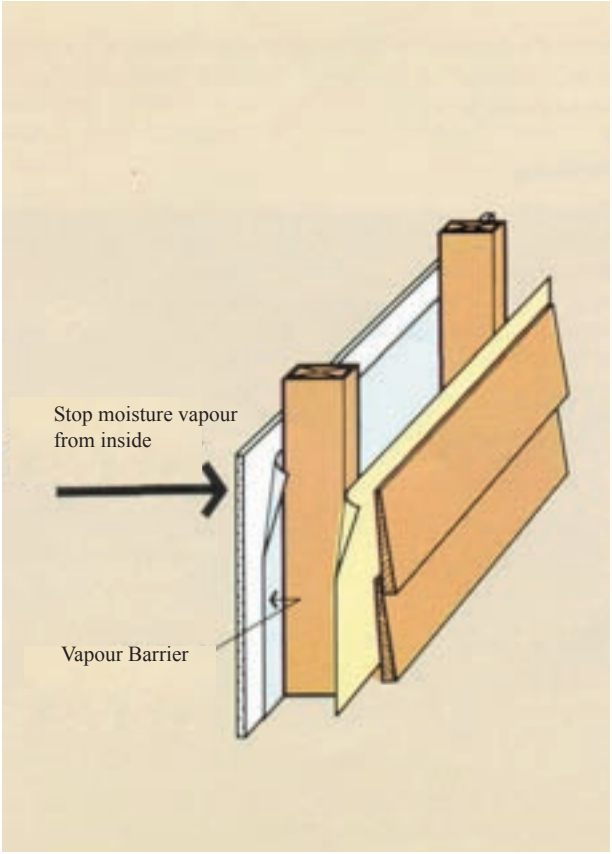
Vapour barriers must be installed in accordance with the manufacturer's recommendations or in accordance with Australian Standard AS/NZS 4200 *Pliable Building Membranes and Underlays.*

The general rule is that vapour barriers should be positioned on the warm side of all infill insulation material. Refer Figure 3. (For further information

Verandah roofs or eaves overhang provides good protection to timber cladding

Vapor permeable wall sarking

Figure 3: Vapour Barrier



see, for example, the Queensland government's Insulation and Ventilation Fact Sheet http://www.housing.qld.gov.au/builders/smart_housing.

In some areas of Australia such as snowfields, where the day conditions may be the reverse of those at night because of heat reflection from the snow, expert advice should be sought from insulation specialists experienced in these conditions.

Solid Timber Cladding

The widespread use of timber weatherboards started in America during the eighteenth century when timber frame buildings were clad with oak or cedar boards that had been split radially from logs.

In Australia, weatherboards were being used within a few years of first settlement. They were usually about 150mm wide, 25mm thick and tapered in profile. As in America they were split radially from logs, and around Sydney the most commonly used timbers were brush box, ironbark, stringybark or sheoak.

Split weatherboards of this type were commonly used and some early timber clad buildings still stand in excellent condition after more than 150 years of service.

Today, sawn timber weatherboards are available in a wide range of timber species, sizes and profiles including a sawn version of the original split weatherboard. The variety of widths and profiles, and horizontal, vertical or diagonal fixing gives designers a wide choice of finishes for their buildings.

Species, Grades and Availability

Solid timber external cladding is manufactured from many different species of either imported or local timber. Table 1 provides guidance on availability of various species throughout Australia.
Where timber clad walls will experience moderate to severe weather exposure, cladding manufactured from the highest available grade of timber should be specified and used.

Hardwood

Details of moisture content, general profiles, grade descriptions, machining grade limits and tolerances are set out in AS2796 - *Seasoned Timber – Hardwood – Sawn and Milled Products* and AS4785 *Timber – Softwood – Sawn and Milled Products*. These standards do not specify detailed profiles, cover width and overall dimensions of cladding, which vary between individual manufacturers.

When hardwood cladding is specified preference should be given to naturally durable species. Although, in southern states where timber hazard conditions are less severe, a satisfactory service life can be expected from commonly available (but naturally non-durable) eucalypts such as alpine ash, mountain ash or messmate (sold mixed as "Tasmanian oak") provided good fixing, finishing and maintenance practice is carried out.

Cypress Pine

Cypress Pine cladding has good natural durability, provided that the sapwood content is minimised or excluded. Grade descriptions are set out in AS1810 Timber - *Seasoned Cypress Pine,* or in Industry standards which can be obtained from manufacturers and suppliers.

Preservative Treated Pine

The most common species used are radiata pine, slash pine and hoop pine.

Other native conifers are also used for cladding, but because of their low natural durability they should

Early housing used verandahs to protect cladding

Sawn weatherboards - western red cedar

Table 1: Solid timber cladding – Major species

Species	SAA - Grade Specification	Availabiliy (States)						
		WA	SA	TAS	VIC	NSW	QLD	NT
ash, alpine	AS 2796	-	-	-	•	-	-	-
ash, mountain	AS 2796	-	-	-	•	-	-	-
blackbutt	AS 2796	-	-	-	-	•	•	-
box, brush	AS 2796	-	-	-	-	•	•	-
cedar, red, western	-	•	•	•	•	•	•	•
gum, blue, sydney	AS 2796	-	-	-	-	•	-	-
gum, red, forest	AS 2796	-	-	-	-	-	•	-
gum, spotted	AS 2796	-	-	-	-	•	•	-
hardwood, mixed	AS 2796	-	-	-	-	•	•	-
jarrah	AS 2796	•	•	-	-	-	-	-
oak, Tasmanian	AS 2796	-	-	•	-	-	-	-
pine, baltic	-	-	-	-	•	•	-	-
pine, cypress	AS 093	-	•	-	•	•	•	-
pine, Carribean (p.t.)	AS 1784	-	-	-	-	-	•	-
pine, hoop (p.t.)	AS 1784	-	-	-	-	-	•	-
pine, radiata (p.t.)	AS 1495	•	•	•	•	•	•	-
pine, slash (p.t.)	AS 1784	-	-	-	-	•	•	-
tallowwood	AS 2796	-	-	-	-	•	•	-

NOTES:

1. The table schedules the major species in each State; however, most species can be supplied throughout Australia, subject to order.
2 Durability class 4 and some class 3 timber species may be supplied preservative treated. See AS5604 Timber – Natural Durability Ratings

always be preservative treated before use.

For grade descriptions refer AS4785 timber – *Softwood – Sawn and Milled Products.*

Imported Timbers

The most commonly used imported cladding timber is western red cedar. Other imported timbers used for cladding include redwood and baltic pine. Western red cedar is mostly available as either sawn weatherboards up to 250mm wide, or sawn or dressed face channel; profiles up to 200mm wide.
At present there is no Australian Standard to cover the grades of western red cedar or other imported cladding timbers. Specifiers are referred to suppliers or local Timber Advisory Services for information on available grades.

Sizes and Profiles

Timber cladding is generally produced from 150mm to 200mm wide boards. Because of the increased risk of cupping or splitting, boards wider than 200mm are rarely used. The common types of weatherboard sections and their most commonly used names are illustrated in Figure 4. The dimensions, details and names of these profiles may vary slightly between various regions or manufacturers.

For complete details of sizes and profiles readily available in local areas, contact local suppliers, or the local Timber Advisory Service.

Semi-transparent stained board and batten cladding

Moisture Content

All kinds of timber will take up or lose moisture, and adjust dimensionally, in response to changes in the humidity of its environment. Refer *Datafile P1 - Timber Species and Properties*.

The actual equilibrium moisture content (EMC) will vary from place to place and from season to season, so that timber in service may have a moisture content ranging from about 6% to 18%. Timber cladding will usually be supplied as “dry”, “kiln dried” or “seasoned” and will have a moisture content in the range 10-15%. The main exception to this is some sections of western red cedar, cypress pine and hardwood weatherboards which may be supplied unseasoned.

Unseasoned cladding will shrink as it dries and allowance must be made for shrinkage by increasing the overlap of boards. Wider unseasoned boards may also develop slight cupping across the face unless restrained.

Unseasoned hardwood boards should be fixed as soon as possible after delivery. AS2796 sets down details of overlap requirements to accommodate any shrinkage that may occur in unseasoned hardwood cladding.

When machined profiles are produced from seasoned timber the design of the edge-joint will allow for movement due to seasonal changes in equilibrium moisture content. Other than exercising proper care and good workmanship during installation, no special precautions need be taken to compensate for slight expansion and contraction in service.

When fixing, it is important that nails are placed so that movement of boards caused by changes to equilibrium moisture content during different seasons, or the drying of unseasoned boards, does not create stresses sufficient to cause splitting of the timber. Individual boards must not be nailed together at the lap.

Reference governing the moisture content of timber products, including cladding should be made to AS2796, AS4785 and AS1810 as well as the *Timber Utilisation and Marketing Act* of Queensland, and the *Timber Marketing Act* of NSW.

Storage and Handling

It is important to keep timber cladding dry and clean from the timber time it is received on the building site until it is fixed and finished. Dirt and stains or water damage will not necessarily be hidden by the finishing system and may be expensive to remove – if they are removable.

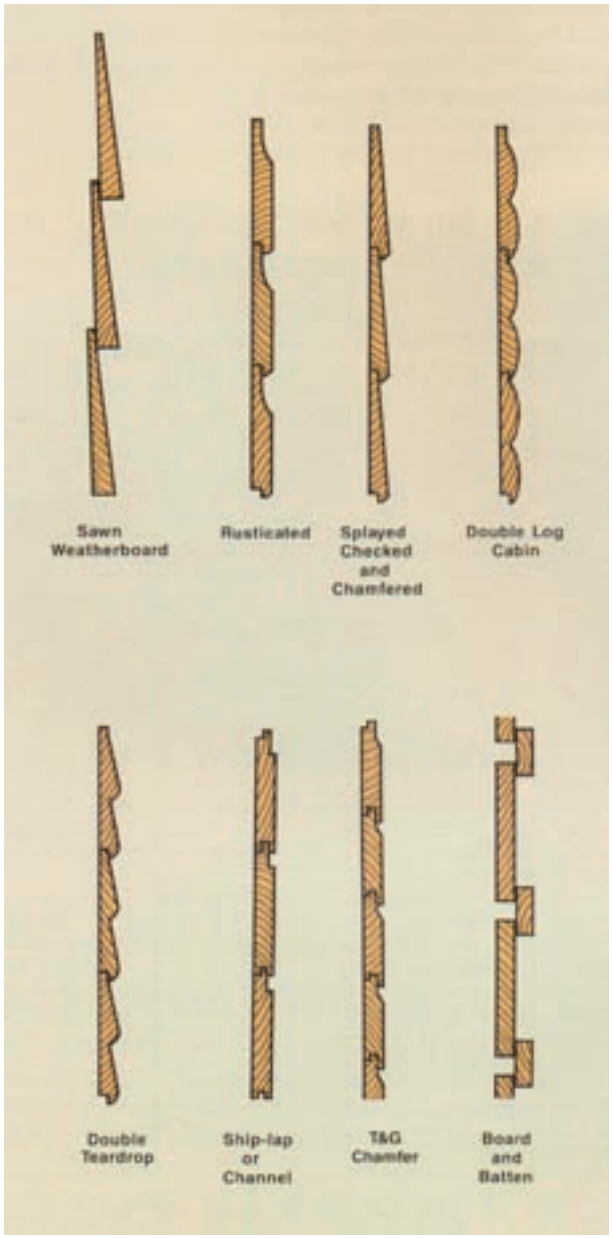
On-site storage of timber cladding, prior to fixing, should be under cover on bearers spaced at no more than 900mm centres. If outside storage cannot be avoided timber stacks should be at least 150mm clear of the ground and covered with waterproof sheet arranged to prevent rain being driven into the stack. The covers themselves should be kept just clear of the ground to allow ventilation under the stack.

Job Preparation

Pre-finishing the boards

If the cladding is to have a natural or stained finish, it should be liberally coated with water repellent preservative by either dipping or brushing on all surfaces. This practice is just as important for CCA treated pine as it is for non-preservative treated timbers. Water repellent formulations the requirements should be

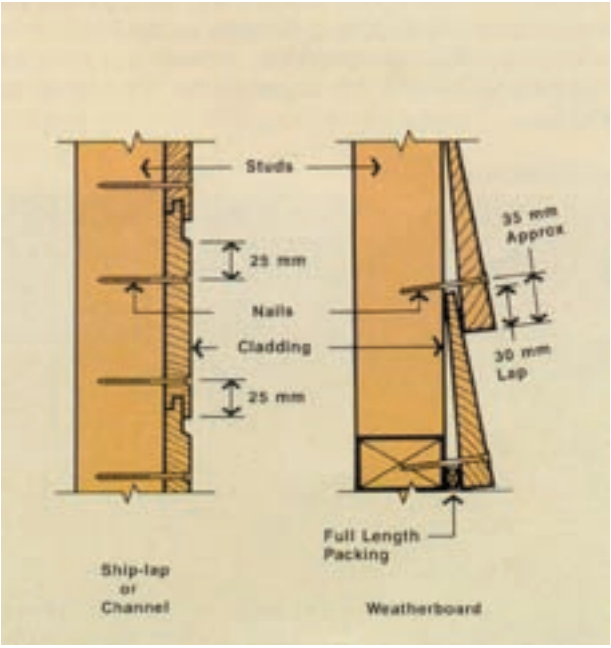
Figure 4 Cladding Profiles



Sawn weatherboards to be fixed with single nail, not through lap

Opaque finished hardwood cladding protects sea-front tourist complex

Figure 5 Typical nailing patterns



used according to the manufacturer's recommendations.

Some pigmented stain finishes cannot be applied over water repellent preservatives and compatibility of the systems should be checked before application. Refer *Datafile FM1 - Exterior Finishes for Timber.*
All freshly cut surfaces should be given supplementary treatment with water repellent before fixing.

Warning: Linseed oil or a mixture of mineral turpentine and linseed oil should never be used on timber cladding as a natural finish. Refer "Finishing and Maintenance" in this datafile.

Flashing

Before fixing, all vertical joins, window sills, heads and other openings should be adequately flashed in accordance with good building practice. Flashing should extend beyond the ends and edges of openings and be securely fixed at least 25mm under the cladding when covered by it.

Sarking and vapour barriers

Waterproof, vapour permeable sarking such as reflective foil laminate (RFL) and fire retardant breather paper should always be installed in walls subject to high wind conditions and wind updraughts. Sarking should be fixed on the outside of studs, and directly under the timber cladding. Vapour barriers, where considered necessary, should be installed on the inside of studs.

Installation

Frames should comply with the requirements of the local building authority. Preferred spacing of studs or fixing battens is 450mm and 600mm. When cladding is fixed diagonally, it should be fixed at not more than 650mm centres measured along the board, ie: vertical stud spacing of not more than 450mm centres for 45° fixed boards.

Fastenings

Selection of the correct fixing nails is important to the performance and appearance of a finished wall.

Hot dipped galvanised or other non-corrosive nails should always be used to fix timber cladding. Plain steel nails are likely to rust, causing unsightly stains and gradual deterioration of the timber around the nail, and loosening of the joint.

However, these nails may be suitable where they are punched and puttied, and the cladding is finished with an oil based paint system. Nails should be driven with care. Heavy and excessive nailing distorts the wood and may cause splitting during weather changes.

Table 2 gives a guide to the correct sizes of nails to use.

If a nailing gun is used, care should be taken to ensure that the nails are not driven too deeply and that excess pressure does not distort the boards. Cladding should be fastened so that the boards are free to shrink and swell individually and so reduce the chance of cupping, cracking and splitting. Nails should not fox fix two adjacent boards together. Refer Figure 5 for typical nailing patterns. Flathead nails may be used to provide additional restraint of treated pine and western red cedar cladding.

To avoid splitting, some cladding boards may require pre-drilling of nail holes at the ends of boards.

CCA treated pine and western cedar cladding should be fixed using hot dipped galvanised, silicon bronze, monel or stainless steel nails. Secret nailing or the use of shorter nails is not recommended because they do not provide adequate long term fastening. Deformed shank or longer nails should be used where cladding is fixed to softwood frames. Copper nails must NOT be used as the extractives from the timber will react with the copper causing them to deteriorate.

None of the building adhesives currently available are suitable for fixing solid timber cladding.

Joints between boards

Long edges: When grooved or rebated profiles are fixed horizontally or diagonally the groove must always be on the lower edge of the board (facing down) to avoid trapping water. When tongue and grooved or lapped cladding is being installed vertically, the joint should face away from the prevailing weather to reduce the ingress of windblown water. Sealers or mastic should not be used to seal edge joints.

Ends: Whenever possible, single length boards should be used on exposed walls. Short lengths of cladding can

Table 2: Recommended minimum nail sizes

Cladding Thickness	Nail Size (mm)	
	Cypress pine and Hardwood Framing	Softwood framing
15-22 mm Cypress and Hardwood	50x2.8 plain	65x2.8 plain 50x2.8 twisted
15-22 mm Softwood	50x2.8 plain 50x3.15 twisted	50x3.15 twisted
Sawn Weatherboards	60x2.8 plain 50x3.15 twisted	65x2.8 plain 50x3.15 twisted

usually be used between windows etc, or on sheltered parts of the wall under verandahs, eaves or awnings. Tight fitting joints are achieved by cutting a board slightly over length, bowing to get it into position, and snapping into place. Refer to Figure 6.

If a natural or stained finish is to be used all cut ends of boards should receive a supplementary coating of water repellent formulation before fixing.

If a paint finish is to be used, end joints should be sealed with a compatible mastic or a timber paint primer applied to the ends of boards before fixing.

Construction Details

When boards are fixed horizontally it is important to protect the ends of each board. Where cladding abuts masonry, clearance should be left to prevent moisture in the masonry from being taken up by the boards. Alternatively, ends should be sealed and the joint protected by a cover strip set in mastic. The ends of diagonal boards must be well drained and protected from water. Figure 7 illustrates some typical construction details.

Finishing and Maintenance

Refer also to *Datafile FM1 - Exterior Finishes for Timber*.

Timber cladding that is exposed but left uncoated will absorb moisture during wet weather and give off moisture in the dry. This results in swelling and shrinkage that causes small cracks, or surface "checks", or cupping of the boards. The regular use of the water repellent finishes will reduce these weathering effects.

Weathering will also change the surface colour of uncoated timber to silver grey. The greying of timber cladding will vary depending on the exposure to sun and rain of various parts of the wall. Uncoated timber remaining damp for extended periods may develop dark discolouration due to surface mould. This may also occur in persistently damp environments when the timber has been coated. Such unsightly areas may be brought back to a more acceptable appearance by the judicious use of mild bleaching agents like 1% household bleach, proprietary mould-off preparations or timber brighteners.

A natural weathered appearance is attractive to some people, and certain types of timber cladding will, with minimum finishing and maintenance, perform well. Timber specified for such applications should be a naturally durable species or CCA preservative treated softwood. Remember however that all timber requires some finishing and regular maintenance to give extended service life.

Pressure impregnation of timber with CCA preservative, whilst giving long term protection against insect attack and decay, does not prevent surface checking of the timber, colour change, or other effects of weathering.

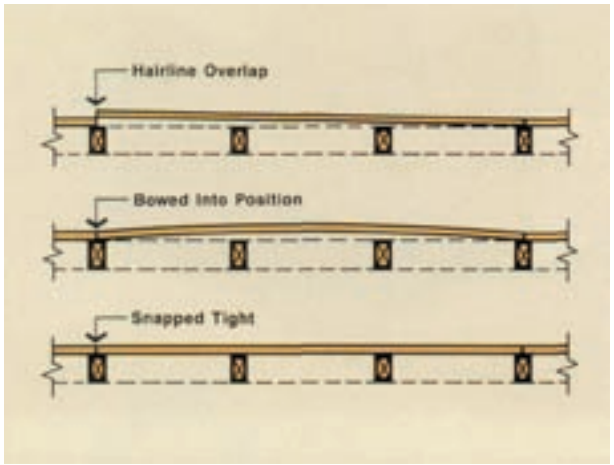
Generally, it is recommended that all timber cladding exposed to the weather be protected with a suitable coating.

WARNING: Linseed oil or mixtures containing a large proportion of linseed oil should never be used on timber cladding as a natural finish. Mould and fungi feed on the oil and will discolour the timber. Removal may be difficult and it is often necessary to scrub the cladding with a bleach and stiff brush (see above) before re-coating with an acceptable finish.

If a natural appearance is required, liberal application of a clear water repellent formulation will help to maintain the timber in good condition. Timber finished only with a clear water repellent formulation needs more frequent maintenance than stained or painted timber during the first few years of exposure. However, successive applications of these formulations over a period of time may build-up water repellent preservative compounds on the timber surface and extend the maintenance interval.

Where reliable long term performance and a high standard of appearance are required, timber cladding must be protected by the use of quality acrylic or oil based paints or stains, formulated for exterior

Figure 6: Fitting final board in each course



Versatile ply-wood caldding - grooved and sawn textured finish

Timber cladding features on this unusual house design

Figure 7: Cladding construction details

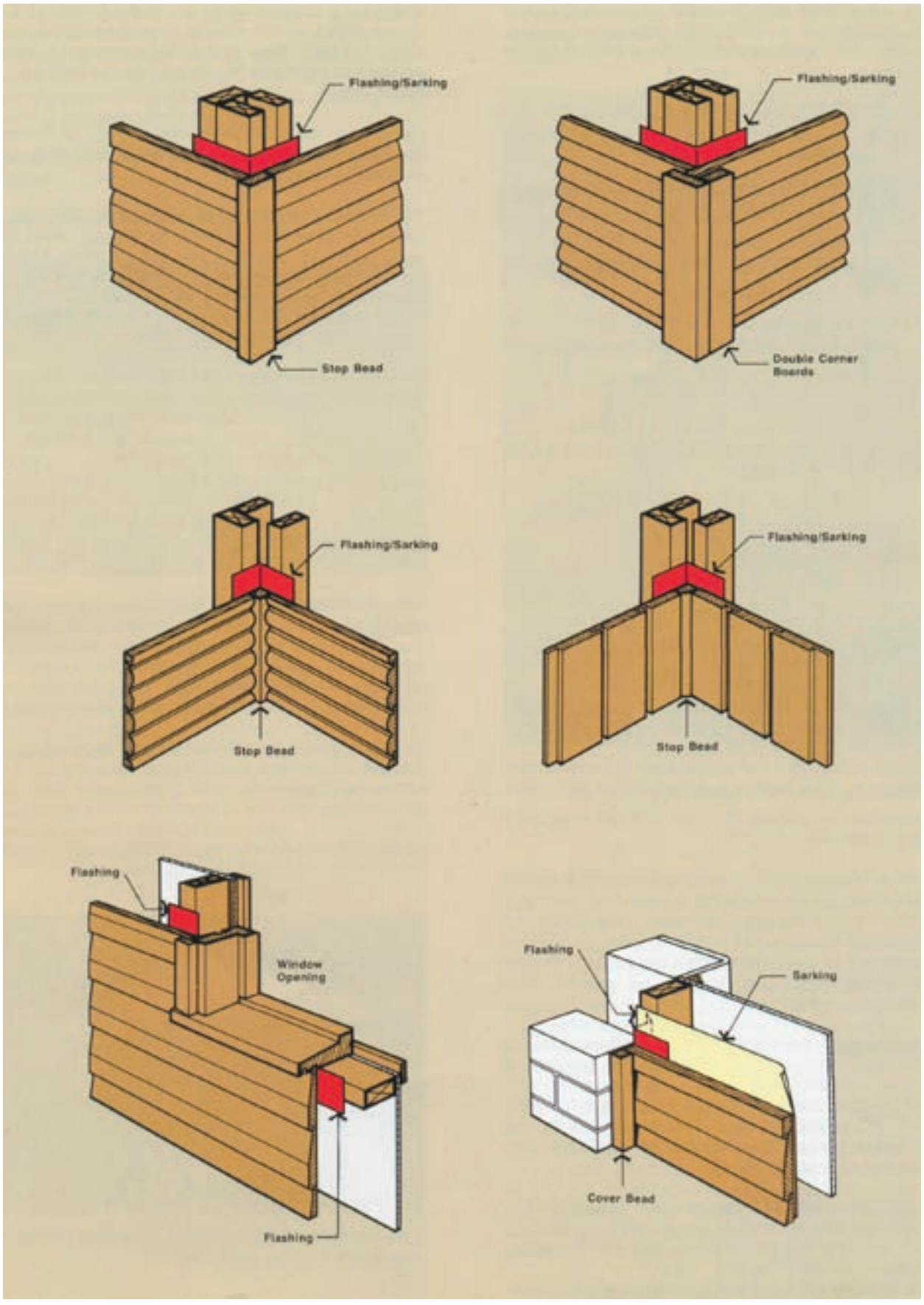
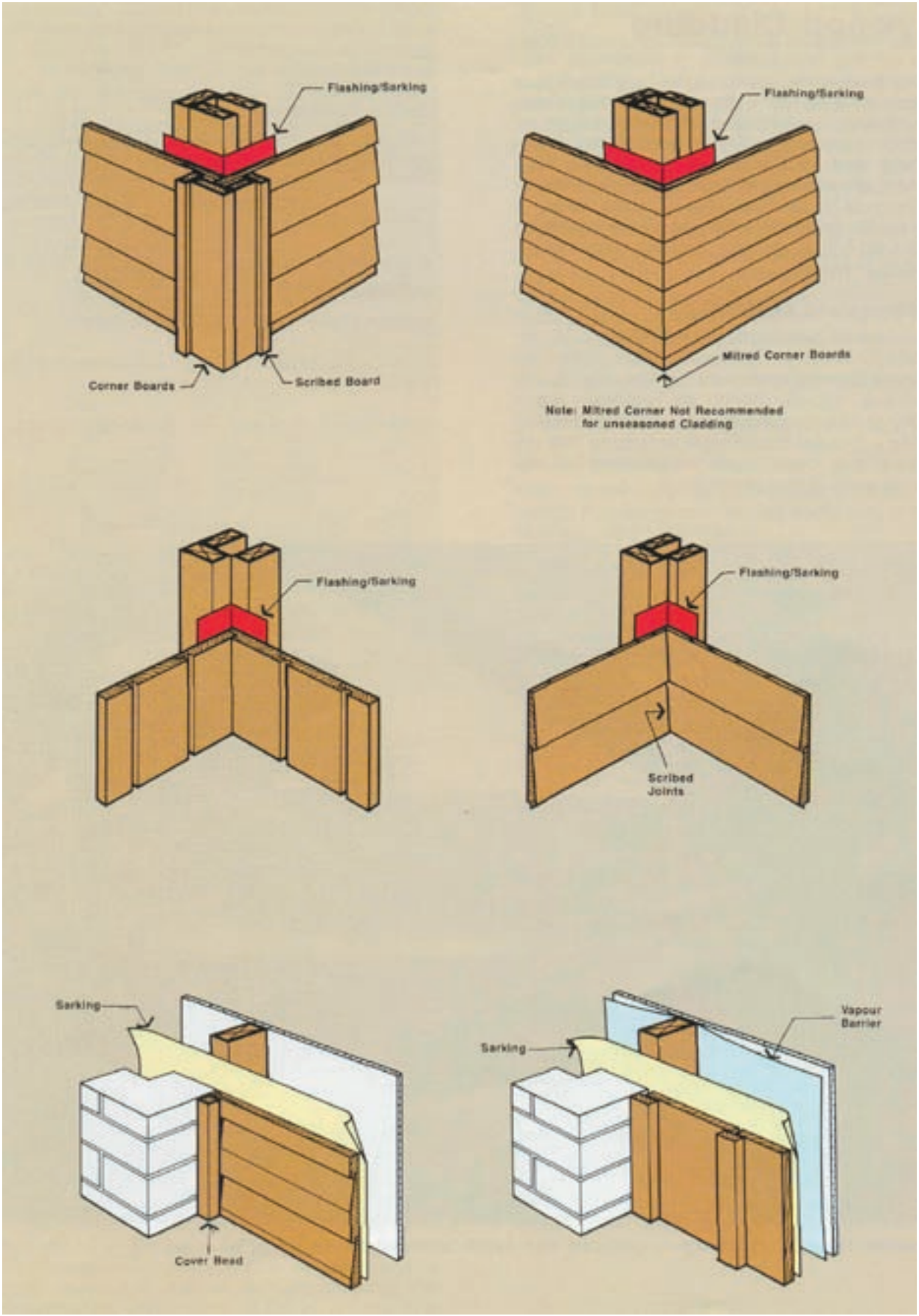


Figure 7: Cladding construction details (continued)



timber finishing, and applied in accordance with the manufacturers specifications.

The frequency of maintenance and re-finishing of painted or stained cladding will depend on the colour and type of finish being used and the amount of exposure to weather. In areas of high temperature, pale coloured finishes are recommended as they absorb less heat and thus provide greater protection to the timber.

Plywood Cladding

Plywood can be used as an attractive and economic exterior for residential, commercial, industrial and rural buildings. Plywood cladding can also provide structural bracing and roof hold-down resistance with consequent savings in building costs. Exterior plywood cladding is available in a wide variety of face veneer grades that may be profiled, grooved or plain faced or pre-surfaced with resins, plastics or metal.

Properties and Availability

Refer also to *Datafile P2 - Plywood*

Much of the plywood sold in Australia that is suitable for exterior cladding is produced within quality assurance programmes. All such material carries a relevant brand mark indicating that the product has been quality controlled to the requirements of the programme.

When plywood dies does not carry an appropriate brand mark users should satisfy themselves that it meets the requirements of AS/NZS2271-*Plywood and Blockboard for Exterior Use*.

Quality Assurance

The only recognised Plywood Quality Assurance schemes operating in Australia is that run by the Plywood Association of Australaia (PAA). All PAA quality controlled plywood is branded with the following information:

- Manufacturers name
- Product type
- Face grade, back grade, bond type

If the product type is structural the stress grade will also be shown in the brand. All PAA quality assured product is also marked with the JAS-ANZ stamp (Joint Accreditation System of Australia and New Zealand) Reefer Figure 8 for relevant certification brands.

Sheet Sizes and Thicknesses

Plywood has standard tolerances on length, width, squareness, thickness and edge straightness.

The readily available sizes of plywood cladding are:

- Standard lengths - 2400, 2440, 2700, 2740 and up to 3000mm
- Standard widths - 1200 and 900mm.
- Sheet thicknesses - A wide variety of sheet thicknesses is available. The most common thickness is 12mm

Plywood is manufactured with glue bonds to meet specific exposure conditions. For exterior use, e.g. plywood cladding, the bond should conform with AS/NZS2269 *Plywood – Structural* and AS/NZS2271 *Plywood and Blockboard For Exterior Use*.

Type A Bond

Type A bond provides a permanent, durable bond that will not break down under conditions of long term stress or exposure. A phenol formaldehyde adhesive is used and can be recognised by the characteristic dark colour of the glue lines. The Type A bond should be specified for all plywood cladding, and is essential wherever it is to be used in exposed situations.

Plywood bonded with phenolic bonds has formaldehyde emissions of 0.00 – 0.03 ppm, well below international recommended E_1 emissions level of 0.01 ppm.

Preservative Treated Plywood

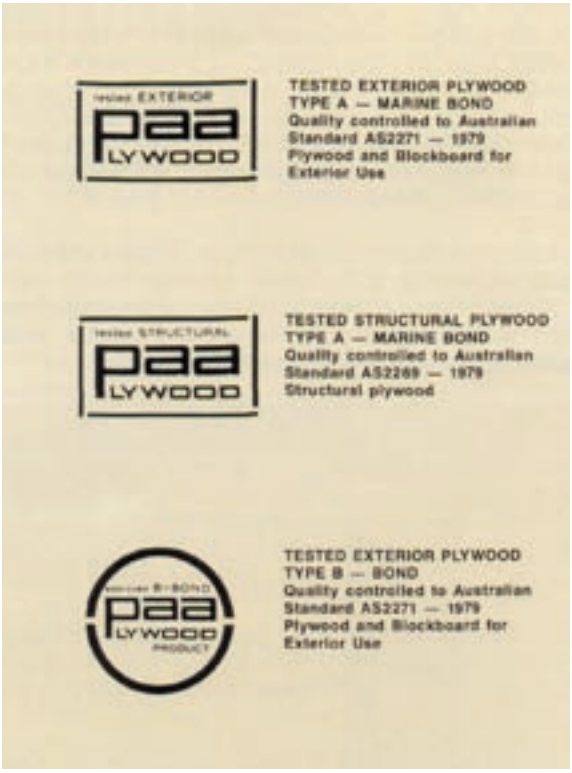
In addition to manufacturing the plywood with Type A bonds for their external use durability, the plywood may also need to be preservative treated against fungal and insect attack. The treatment should be to a minimum of hazard level H3 “outdoors above ground” as defined by AS/NZS1604 Specification for Preservative Treatment Part 3 plywood. The preservative treatments currently available are Ruply and Ammoniacial Copper Quaternary Compounds (ACQ), veneer treatment systems, and a number of pressure treatments for finished panels, including Copper Chrome Arsenate (CCA) and Light Organic Solvent Preservatives (LOSP). Refer *Datafile P4 - Timber-Design For Durability.*

For maximum long term performance the exposed face of the plywood cladding should be finished with a water repellent formulation or a 100% acrylic latex paint system. Additionally, the edges of the plywood panel should be sealed to minimise water uptake in the end grain.

Poolside shelter roffed with shingles

Preservative treated pine cladding - vertical fixing

Figure 8: Plywood quality asurance brands



Design for Plywood Cladding

Refer to Plywood Association of Australasia publication *Featuring Plywood in Buildings* for details about plywood exterior cladding, including installation, sheet sizes, and finishing.

Plywood cladding of the correct thickness and face veneer direction can be fixed over studs spaced at up to 900mm centres. However, stud spacings on new work are generally limited to 600mm so as to meet the requirements of local building authorities. When designing frames for a plywood clad structure, designers should also take into account the fixing requirements of internal lining materials and the cutting of minimum waste from standard sheet sizes.

Information on the use of plywood cladding, including bracing and tie-down capacities, is available from local Timber Advisory Services or the Plywood Association of Australasia.

Job Preparation

Storage on-site prior to fixing should be undercove5r on timber gluts spaced at maximum 600mm centres. If outside storage is unavoidable cover with waterproof materials to prevent staining.

Before fixing plywood cladding, flashing material should be fixed to the frame in accordance with good building practice, at all window sills, heads and other openings. Special pre-formed metal flashings may be available from some suppliers.

All sheet edges and edges in openings must be sealed before sheets are fixed. Care should be taken that the sealer selected is compatible with the final finish to be used on the face of the sheets. See above section on preservative treated plywood and also refer to *Datafile FM1 - Exterior Finishes for Timber.*

The use of vapour permeable sarking on the outside of studs, and directly under the timber cladding is not essential. The use of vapour barriers and reflective insulation is discussed in more detail elsewhere in this Datafile.

Installation

Sheets should be fixed to the timber building frame using 2.8mm diameter hot dipped galvanised flat head nails or no. 8 screws (no.10 to steel building frame) at 150mm spacing around sheet edges and openings, and 300mm spacing elsewhere on the sheet. Flat head nails will give a neat head appearance when driven flush with the surface of the plywood and should not be punched.

All joints must be made on a stud or fixing batten and it is important that edge detailing is correct as this is the potentially vulnerable part of the sheet.

Simple butt-joints which rely on a flexible mastic to effect a seal may break down prematurely and allow water into the edge of the sheet or the frame of the structure. A more reliable butt-joint can be made by using a cover batten over the sheet joints with the interspace filled with mastic, or to use a pre-formed metal or plastic joint cover section with a mastic sealant.

Horizontal joints between sheets should either be flashed with a “Z” shaped flashing, or the edge of the sheets rebated to give a minimum 40mm lap. Refer Figure 9. In severe conditions joints should be caulked for additional protection.

Finishing and Maintenance

Plywood cladding must be protected by the use of good quality acrylic or oil based paints and stains, formulated for exterior timbre finishing, and applied in accordance with the manufacturer’s specifications.

The frequency of maintenance and re-finishing of painted or stained cladding will depend on the colour, the type of finish being used and the amount of exposure to weather.

For full details of exterior finishing systems refer to *Datafile FM1 - Exterior Finishes for Timber.*

Hardboard Cladding

Product/Availability

An exterior grade hardboard (a compressed wood fibreboard) is manufactured in Australia to AS/NZS1859 *Reconstituted Wood Based Panels* – Specifications. Part 4. Hardboard, and is used as an exterior cladding.

It can be used in all exterior cladding applications. The manufacturer should be consulted for guidelines when using hardboard sheet cladding as structural bracing

Plywood acts as cladding and structural bracing for these holiday units

or, for construction details when diagonal or vertical application of the planks is being considered.

Hardboard exterior cladding is supplied in lengths up to 3660mm in packs containing planks boards 9.5mm thick and either 200mm or 300mm normal width. The long edges of the planks are lightly bevelled, and the face, edges and ends are factory prime coated.

Frames should comply with the requirements of the local building authority. Stud spacing should not exceed 600mm. Before fixing hardboard cladding, all window sills, heads and other opening should be adequately flashed in accordance with good building practice.

The use of vapour permeable sarking such as fire retardant breather paper, is essential in walls subject to high wind conditions and wind updraughts. Sarking should be fixed on the outside of studs, and directly under the hardboard cladding.

When vapour barrier materials such as plastic film or reflective aluminium foil insulation are used, they are generally placed on the inside stud frames directly under the interior lining sheets.

The use of sarking, vapour barriers and reflective foil insulation is discussed in more detail elsewhere in this Datafile.

Job Preparation

On-site storage prior to fixing should be under cover on timber gluts spaced at maximum 600mm centres. If outside storage cannot be avoided the planks should be covered with waterproof materials to prevent staining.

Installation

Refer also to manufacturer's data sheets for detailed explanation of fixing procedures.

Sheet hardboard is fixed in the same way as plywood cladding. Refer to section on Plywood Cladding in this Datafile. The work sequence for fixing hardboard planks is generally similar to the fixing of solid timber boards.

Planks are nailed using 50mm x 2.8mm countersunk head hot dipped galvanised nails as recommended by the manufacturer, for example, see: http://www.weathertex.com.au.

When hardboard planks are used to cover existing cladding, galvanised flat head nails of sufficient length to penetrate and hold in the frame must be used.

Internal corners can be detailed using a timber stop, or the planks can be cut and scribed to match the splay of the plank on the adjacent wall. External corners can be detailed using either a timber stop or a pre-formed metal corner available from the hardboard manufacturer.

Hardwood weather boards used in colonial renovation

For construction details, refer Figure 10.

All exposed cut ends and timber stops must be primed with a good quality primer before installation.

Finishing and Maintenance

Exterior hardboard cladding should be finish coated within 60 days of fixing. The factory applied primer sealer is compatible with most readily available paints.

Refer to manufacturers painting specifications and *Datafile FM1 - Exterior Finishes for Timber* for further details of finishing and maintenance.

Shingles and Shakes

Product/Availability

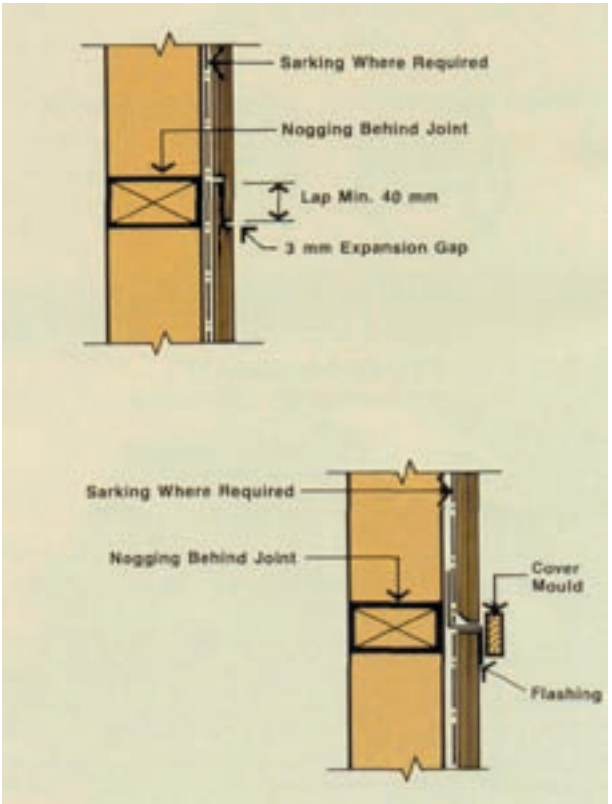
Timber shingles and shakes have established a reputation in North America and Europe as a beautiful and practical form of timber cladding for both roofs and walls.

Shingles and shakes are made in different ways and each has its own distinct appearance.

Shingles are taper sawn from blocks of timber and have a relatively smooth face and back. On the other hand, shakes are split by hand or machine along the natural grain of the wood and have a strongly textured surface. Some shakes are re-sawn to give a split face and a sawn back.

Most shingles and shakes used in Australia are made from western red cedar and are imported from Canada. Some are also produced locally from species such as rose sheoak and hardwoods. They can also be applied to exterior roofs and walls on any type of building where a solid nailing base is provided.

Figure 9: Plywood cladding - horizontal joints



Sizes and Grades

North America producers have set standard sizes for western red cedar shingles and shakes, and these sizes have been generally adopted by Australian producers.

Shingles and shakes are mostly supplies in random widths and only length and butt thickness is specified. Table 3 sets out standard lengths and thicknesses for Western red cedar shingles.

Preservative Treatment

Although the timber species chosen for shingles are well known for their natural resistance to decay, vacuum/pressure impregnation with CCA preservative in accordance with AS1604 *Specification for Preservative Treatment - Sawn and Round Timbers*, and the requirements of statutory authorities in NSW and QLD will significantly increase the service life of timber exposed to the full elements of the weather. Such preservative treatment will be effective in resisting decay and discouraging the growth of surface moulds.

Australian experience has shown that under certain circumstances the treatment of all types of timber shingles with a long lasting preservative incorporating water repellents prior to installation will improve their overall performance and increase life expectancy.

Australian Local Government regulations may restrict the use of shingles and shakes on the roofs and walls of commercial buildings even when treated with fire retardant chemical. Intending users should check with their local building authority or local Timber Advisory Service before specifying.

Specifiers requiring pre-treatment of external cladding with preservative or fire retardant chemical are referred to their shingle supplier.

Installation

Manufacturer's specifications give full details of the fixing procedures. It is essential that these procedures be carefully followed.

Shingles should be stored on-site prior to fixing under cover clear of the ground. If outside storage is unavoidable, shingles and shakes should be covered with waterproof materials to prevent staining.

Roofs

The most common use of timber shakes and shingles is as a roof cladding. Although they are usually applied in straight single courses, their application may be varied to achieve other decorative effects. Whatever the style chosen, there are certain basic details that must be followed to achieve a waterproof and durable result. Detailed information about the construction of shingle clad roofs is available from all shingle and shake suppliers.

External Walls

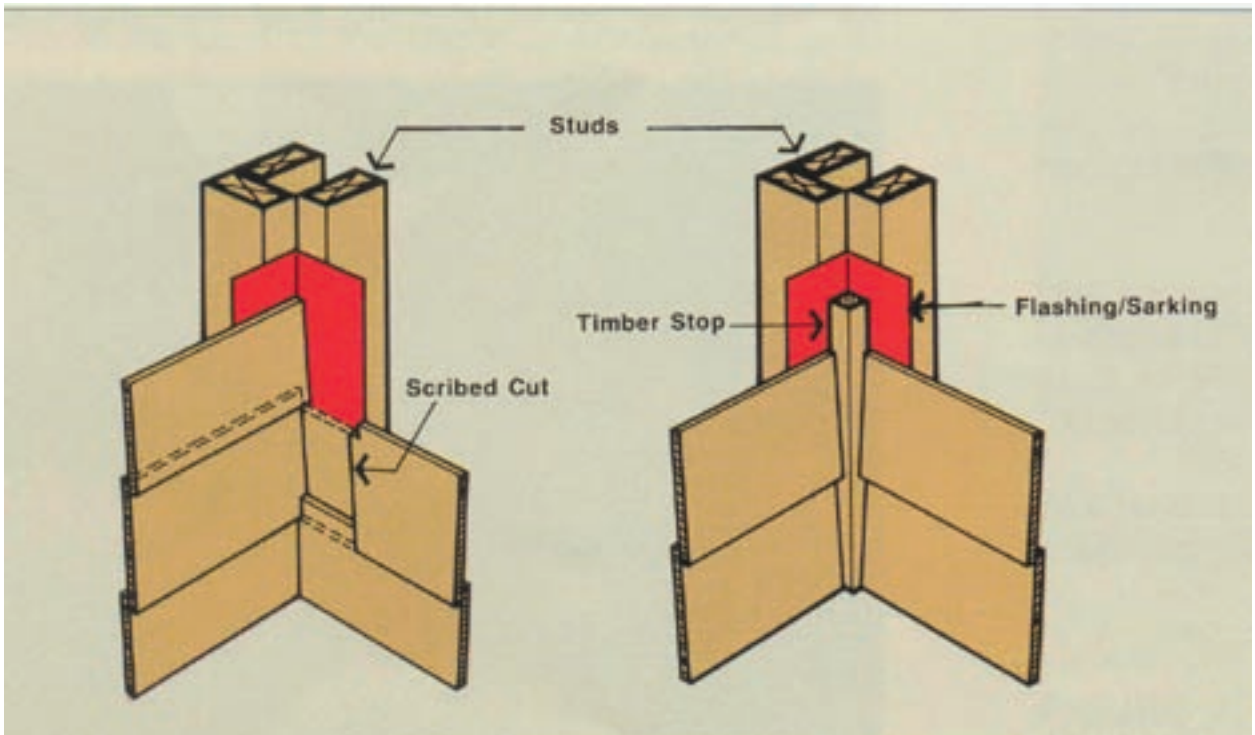
On walls, shingles and shakes are generally fixed over solid or spaced sheathing. Solid sheathing is preferred and 9mm or thicker exterior grade plywood provides a smooth, even base for fixing. Plywood also offers the added benefit of giving increased structural rigidity to the building. Spaced sheathing is usually 100 x 25mm or 150mm x 25mm softwood boarding spaced at centres approximate to shingle/shake size.

If plywood sheathing is chosen to back shingles, it should be designed to gain the structural and economic advantages of bracing and roof hold-down (see: www.paa.asn.net for the appropriate .technical information).

Before fixing either plywood or spaced sheathing, flashing material should be fixed to the frame in accordance with good building practice at all vertical joins, window sills, heads and other openings.

After the sheathing is fixed a vapour permeable fire retardant building paper must be fixed over the sheathing directly under the shingles or shakes. If reflective insulation or non-permeable vapour barrier is required, it is generally fixed to the inside face of the

Figure 10: Hardboard cladding - construction details



wall frame directly under the interior lining. The use of vapour barriers and reflective insulation is discussed in more detail elsewhere in this Datafile. Shingles are fixed over the sheathing by either the single coursing or double coursing method.

Single Coursing

Refer Figure 11.

Single coursed walls provide a weather tight exterior wall cladding with two layers of shingles at every point. In single coursing each row of shingles covers slightly more than half the previous row.

Double Coursing

Refer Figure 12.

Double course fixing of shingles gives an attractive wall characterised by wide exposures and deep shadow lines. This method offers economy because of the wide exposures of the outer shingle and the opportunity to use a utility grade shingle for the concealed under layer.

Plywood/Shingle Wall Construction

This method gives a wall with identical appearance to a conventional double coursed wall. However prior sheathing is not required, and strips of exterior plywood are used instead of shingles for the concealed under layer. This system offers economy of materials, increased strength, speed of erection and design flexibility.

Fastenings

Shingles and shakes should be fixed with wither either hot dipped galvanised, or silicon bronze nails. Mild steel, brass or copper fixings should NEVER be used with western red cedar. For general use a 30 x 2.0mm hot dipped galvanised flat head nail is satisfactory. Where special applications or re-roofing is being undertaken, the shingle supplier should be consulted.

Finishing and Maintenance

Shingles and shakes can be dipped in a water repellent preservative formulation before installation. On roofs they are often given no further treatment and weather to a soft silver-grey tone. On walls, where access for maintenance may be easier, pigmented stains may be used to retain a natural looking timber colour.

Refer *Datafile FM1 - Exterior Finishes* for Timber for further details of finishing and maintenance.

Table 3: Shingle sizes

Length (mm)	Thickness (mm) (at butt)
400	10
450	11
600	13

Hardwood weatherboards - profiled and textured

Properties of Timber Clad Walls

The issues involved in the acoustic, thermal, tie-down and bracing performance of timber clad walls, and the behaviour of walls exposed to fire are every complex. Much research has been carried out on these subjects and a large amount of detailed information is available.

The main points are summarised below, but more information is available in other Datafiles and from local Timber Advisory Services.

Sound Control

Refer also to Datafile P6 - *Timber-Sound Control*.

Timber clad walls may be required to absorb airborne sound (prevent reflection) or reduce sound transmission form from one side to the other.

Sound transmission loss through a timber clad wall is influenced both by the mass of the material in the wall, and by the type of construction. At most frequencies the sound transmission loss is directly proportional to the mass per unit are of the wall, and timber performs well when compared to other types of wall cladding.

Specialised sound control materials are available, including absorption materials, barriers, and vibration damping agents. Plywood with lead on the faces or in the core acts as an excellent barrier to sound.

Discontinuous construction techniques and the use of porous, sound absorbent materials in cavities will also reduce sound transmission.

In enclosed courtyards or playgrounds the sound absorbency of a wall may be important. Timber absorbency of a wall may be important. Timber claddings generally have a fairly high sound absorption factor when compared to other materials, and the thoughtful use of profiles and broken surfaces will further reduce reflected sound levels.

Shingles can create unusual wall finishes

Thermal Performance

Whenever there is a temperature difference between the inside and the outside of a building, heat will be transferred through walls, floors, ceilings, windows and doors.

The rate of heat transfer through a wall will be related to the difference in temperature on either side, and the resistance to head flow of the materials in between. Heat is transferred through timber clad walls by:

- direct conduction through solid materials,
- as radiant heat through cavities or
- by the movement of air within the cavities.

But whilst timber is itself a good insulator, the final thermal performance of a complete wall is dependent on much more than just the timber cladding.

The finished colour of a wall could play an important role. If walls are a dark colour and subject to direct sunlight, summer surface temperatures will be very high, increasing temperature gradients across the wall and thus increasing the rate of heat transfer.

Sheet cladding or the use eof sarking behind other cladding materials stops air movement into the cavity of the wall.

Reflective foil insulation will greatly reduce the transmission of radiant heat through the wall. Care must be taken not to create condensation problems by placing the foil membrane in the wrong part of the wall.

Still air is a good insulator and fibre insulation in wall cavities acts by preventing the formation of convection currents within the wall.

Heat movement is affected by more than just the timber clad wall. The thermal stability and comfort of rooms within a building is often affected as much - if not more - by the position and size of windows, doors and other openings.

Tie-down and Bracing

Where plywood exterior cladding will also be used to provide structural bracing and hold-down resistance to roofs, careful attention must be given to design and construction details.

To provide tie-down, external walls must be clad so that top and bottom plates are connected by plywood sheets acting in tension. The connection between floor joists and bottom plate, and top plate and rafter or truss must also be designed to complete the tie-down "chain".

Poolside shelter roffed with shingles

Note that where plywood cladding is used to give structural bracing on external walls, additional brading bracing may still be required in internal walls.

Specifications

For detailed specification clauses, reference should be made to Datafile SP1 - *Timber Specifications.*

Figure 11: Shingles - single coursing

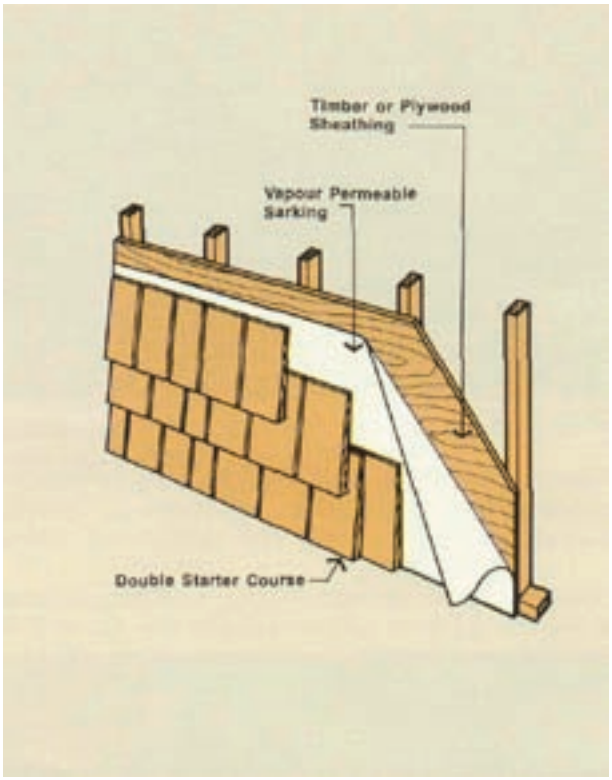
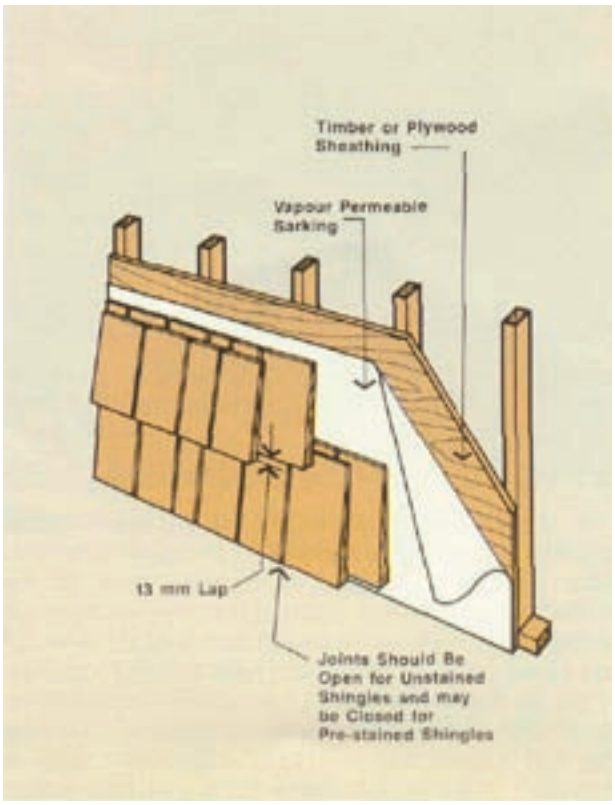


Figure 12: Shingles - double coursing



Other References

1. AS2796 Timber – Hardwood – Sawn and Milled Products, Standards Australia.
2. AS4785 Timber – Softwood – Sawn and Milled Products, .Standards Australia
3. AS1810 Timber - Seasoned Cypress Pine - Milled Products, Standards Australia
4. AS5604 Timber – Natural Durability Ratings, Standards Australia
5. AS/NZS2271,-Plywood and Blocknoard for Exterior Use, Standards Australia
6. AS/NZS2269 Plywood –Structural, Standards Australia
7. AS/NZS 4200 Pliable Building Membranes and Underlays, Standards Australia
8. AS1604 Specification for Preservative Treatment - Sawn and Round Timber, Standards Australia
9. AS/NZS1604 Specification for Preaervative Treatment. Part 3 Plywood, Standards Australia
10. AS/NZS1859 Reconstituted Wood Based Panels – Specifications. Part 4. Hardboard, Standards Australia
11. Plywood Association of Australiasia. Featuring Plywood in Buildings.

See also:

http://www.timberqueensland.com.au/

http://www.housing.qld.gov.au/builders/smart_housing/

http://www.paa.asn.net

http://www.weathertex.com.au

Plywood cladding can also act as structural shearwalls

Hardwood board and batten cladding to holiday cabins

For further information contact these timber organisations:

NATIONAL

National Association of Forest Industries
Forest Industries House
24 Napier Close
Deakin ACT 2600
Tel: 02 6162 9000
Fax: 02 6285 3855
Internet: www.nafi.com.au
Email: enquiries@nafi.com.au

Australian Plantation Products and Paper Industry Council (A3P)
Level 3, Tourism House
40 Blackall Street
Barton ACT 2600
Tel: 02 6273 8111
Fax: 02 6273 8011

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Email: admin@timberqueensland.com.au

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Fax: 02-9360 3464
Email: showroom@tdansw.asn.au

VICTORIA

Timber Promotion Council of Victoria
320 Russell Street
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Fax: 03-9255 9266
Email: tpcvic@tpcvic.org.au

TASMANIA

Tasmanian Timber Promotion Board
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Fax: 03-6224 1030
Email: fiat@southcom.com.au

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