

Villaboard™ Lining

Installation Specification

October 2021 New Zealand





We value your feedback!

To continue with the development of our products and systems, we value your input. Please send any suggestions, including your name, contact details, and relevant sketches to:

Ask James Hardie™
literaturefeedback@jameshardie.co.nz

Make sure your information is up to date

When specifying or installing Hardie™ fibre cement products, ensure that you have the current manual. Additional installation information, warranties and warnings are available at **www.jameshardie.co.nz** or **Ask James Hardie™ on 0800 808 868.**

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1 Introduction

Villaboard™ Lining is a premium sanded fibre cement sheet with recessed edges for flush jointing, or square edge sheet for butt jointing. Villaboard Lining is an ideal lining for bathrooms, laundries, kitchens and other high traffic areas.

The main features of Villaboard Lining are:

- Durable internal lining suitable for wet areas
- Creates suitable surface for tiles, paint, vinyl or wallpaper
- Long edges recessed for easy flush-jointing
- Reliable impact resistant lining. Ideal for wall lining in commercial applications where walls are prone to damage
- Suitable for use in fire and acoustically rated systems

This manual covers the use of Villaboard Lining in internal wall and ceiling applications. Further information relating to Villaboard Lining is also available in the following manuals by James Hardie:

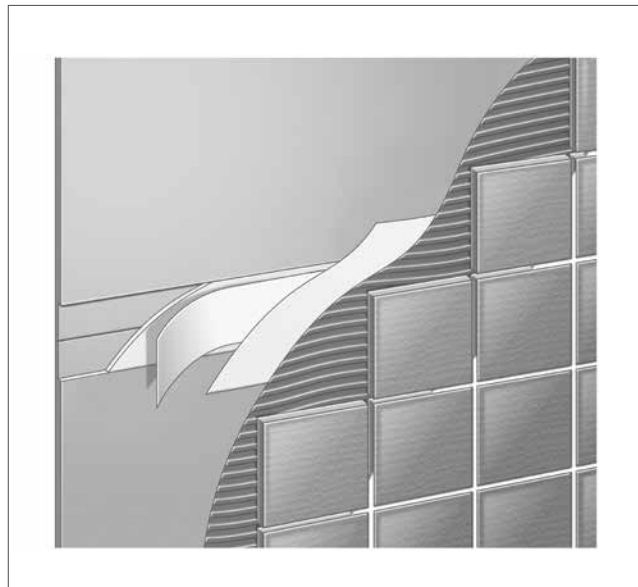
- Eaves and Soffit Linings Installation Manual.
- Fire and Acoustic Design Manual.
- Bracing Design Manual.

The specifier or other responsible party for the project must ensure the information and details in this guide are appropriate for the intended application and specific design and detailing is undertaken for areas which fall outside the scope of this documentation.

Note: Villaboard Lining is not suitable for exterior wall applications.

Make sure your information is up to date

When specifying or installing Hardie™ fibre cement products, ensure you have the current manual. If you're not sure you do, or you need more information, visit www.jameshardie.co.nz or Ask James Hardie™ on 0800 808 868.



James Hardie conducts stringent quality checks to ensure that any product manufactured falls within our quality spectrum. It is the responsibility of the builder to ensure that the product meets their aesthetic expectations before installation. James Hardie will not be responsible for rectifying obvious aesthetic surface variations following installation. James Hardie will only offer a replacement product if Villaboard Lining supplied are found to be out of its manufacturing specification.

1.1 Bracing

Villaboard Lining can be used to achieve structural bracing. For further information refer to the Bracing Design Manual.

For dry area internal applications the standard hot dipped galvanised nails can be used.

For wet area internal application stainless steel nails must be used.

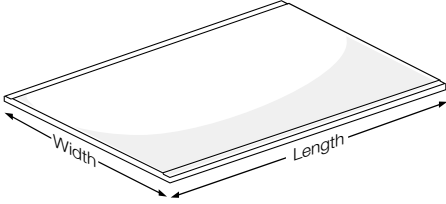
1.2 Structural Ceiling Diaphragm

Villaboard Lining can be used as structural ceiling diaphragms in accordance with NZS 3604. For further information refer to the Bracing Design Manual.

1.3 Heat Shield

9mm Villaboard Lining can be used as a heat shield. For further information refer to Heat Shield - Villaboard Lining 9mm technical supplement.

Table 1

Villaboard Lining sheet sizes				
Product	Length	Width		
		1200mm		
Smooth fibre cement internal lining for tiled and untiled applications  Villaboard Lining 6mm has no chamfer on square edge sheet. Villaboard Lining 9mm has no chamfer on square edge sheet.		2 recessed edges (long)	Square edges	
	6mm thickness			
	2400	400429	400444	
	3000	400427	400442	
	9mm thickness			
	2400	400436	400445	
	2700	400435		
	3000	400434	400059	

NOTE: All dimensions and masses provided are approximate only and are subject to manufacturing tolerances.

Table 2













Product/accessories/tools					
Components supplied by James Hardie					
Accessories	Description	Code	Accessories	Description	Code
	Hardie™ Blade Saw Blade 184mm poly crystalline diamond blade, for fast, clean cutting of Hardie™ fibre cement products.	300660		Hardie™ Base Coat Base compound for flush finished jointing.	4kg - 304490 15kg - 304491
	FibreZip® Screw M4.8 x 30mm For fastening to 0.55mm -1.0mm BMT steel frames. ® denotes a registered mark of Buildex®	Box 1000 - 303840		Hardie™ Top Coat Topping compound for flush finished jointing.	3kg - 304492 15kg - 304493
	Villadrive™ Screw 6g x 30mm For fastening to timber frames	5kg - 300993 100/jar - 300992 Collated/1000 - 300994		uPVC Perforated Corner Mould 30mm x 30mm. For finishing internal and external corners.	3000mm - 300669
	Hardie™ Drive Screw S/S 316 30mm x 7g For fastening to timber frames	100/jar - 300928		Hardie™ Jointer 6mm	3000mm - 300734 2400mm - 300730
	Control Jointer 2700	300978		Hardie™ Jointer 9mm (2 piece)	3000mm - 300736
	Hardie™ Flex Cap Mould 6mm Capping edge of Villaboard Lining	2400mm - 300539 3000mm - 300540		Hardie™ Knife Scoring tool for easy cutting.	305926

Table 3

Components not supplied by James Hardie

James Hardie recommends the following products for use in conjunction with Villaboard Lining. James Hardie does not supply these products and does not provide a warranty for their use. Please contact the component manufacturer for information on their warranties and further information on their products.

Accessories	Description	Accessories	Description
	Galvanised/Stainless steel Hardie™ Flex nails 40 x 2.8mm fibre cement nails		Adhesive sealant Sika® SikaFlex® 11FC, Bostik® Seal n Flex-1®, No more nails, Fullers™ Max Bond™ or similar
	Backing rod Backing to sealant in movement joints.		Flexible sealant For between square edge butt joints, must be compatible with waterproofing where applicable
	Perforated paper tape Joint reinforcing tape. e.g. GIB® paper tape, Strataflex® tape or similar.		Second coat trowel 200mm For installing second coats on set joints.
	Level/Straight edge For checking straightness of frame.		Finishing coat trowel For installing top coats on set joints.
	Hand guillotine Guillotine for cutting fibre cement.		Corner tool For setting of internal corners.
	Broadknife 150mm For setting of joints on Villaboard Lining.		Hawk To assist in the application of compounds especially with the use of trowels.
	Collated screw gun For speedy installation of Villaboard Lining.		Hand sander For sanding set joints.
	Hole saw For clean cut circular holes.		Notched trowel For applying tile adhesive to face of Villaboard Lining.
	Bondbreaker tape Sellotape 5850 Super Mask 18mm		Electric shear/fibreshear For cutting of Hardie™ fibre cement products.
	Wet wall cavity Wall penetrating sealing device eg Aquatite Wetwall cavity protectors		Paper faced corner mould 'Goldline™' mouldings
	Support angle To support tiles Is fixed over the lining to main frame		Waterproofing admixture Multiplast® Resin by Plaster Systems. Used in diluted form over sheet edges to control moisture suction.
	Lumberlock Studsaver		

2 Safe Working Practices

WARNING - DO NOT BREATHE DUST AND CUT ONLY IN WELL VENTILATED AREA

Hardie™ fibre cement products contain sand, a source of respirable crystalline silica. May cause cancer if dust from product is inhaled. Causes damage to lungs and respiratory system through prolonged or repeated inhalation of dust from product.

Intact fibre cement products are not expected to result in any adverse toxic effects. The hazard associated with fibre cement arises from the respirable crystalline silica present in dust generated by activities such as cutting, rebating, drilling, routing, sawing, crushing, or otherwise abrading fibre cement, and when cleaning up, disposing of or moving dust.

When doing any of these activities in a manner that generates dust, follow James Hardie's instructions and best practices to reduce or limit the release of dust.

If using a dust mask or respirator, use an AS/NZS 1716 P1 filter and refer to Australian/New Zealand Standard 1715:2009 Selection, Use and Maintenance of Respiratory Protective Equipment for more extensive guidance and more options for selecting respirators for workplaces. For further information, refer to our installation instructions and Safety Data Sheets available at www.jameshardie.co.nz.

FAILURE TO ADHERE TO OUR WARNINGS, SAFETY DATA SHEETS, AND INSTALLATION INSTRUCTIONS MAY LEAD TO SERIOUS PERSONAL INJURY OR DEATH.

Crystalline Silica is

- Commonly known as sand or quartz
- Found in many building products e.g. concrete, bricks, grout, wallboard, ceramic tiles, and all fibre cement materials

Why is Crystalline Silica a health hazard?

- Silica can be breathed deep into the lungs when present in the air as a very fine (respirable) dust
- Exposure to silica dust without taking the appropriate safety measures to minimise the amount being breathed in, can lead to a potentially fatal lung disease – silicosis – and has also been linked with other diseases including cancer. Some studies suggest that smoking may increase these risks
- The most hazardous dust is the dust you cannot see!

When is Crystalline Silica a health hazard?

- It's dangerous to health if safety protocols to control dust are not followed when cutting, drilling or rebating a product containing crystalline silica
- Products containing silica are harmless if intact (e.g. an un-cut sheet of wall board)

Avoid breathing in crystalline silica dust

Safe working practices

- ✗ NEVER use a power saw indoors or in a poorly ventilated area
- ✗ NEVER dry sweep
- ✓ ALWAYS use M Class or higher vacuum or damp down dust before sweeping up
- ✗ NEVER use grinders

- ✓ ALWAYS use a dust reducing circular saw equipped with a sawblade specifically designed to minimise dust creation when cutting fibre cement – preferably a sawblade that carries the Hardie™ Blade name or one with at least equivalent performance – connected to an M Class or higher vacuum
- ✓ Before cutting warn others in the area to avoid dust
- ✓ ALWAYS follow tool manufacturers' safety recommendations
- ✓ ALWAYS expose only the minimum required depth of blade for the thickness of fibre cement to be cut
- ✓ ALWAYS wear a properly-fitted, approved dust mask or respirator P1 or higher in accordance with applicable government regulations and manufacturer instructions
- ✓ Consider rotating personnel across cutting tasks to further limit respirable silica exposures.

Use one of the following methods for cutting Villaboard Lining 6mm:

Best

- Hardie™ Knife
- Hand guillotine
- Fibreshear

Better

Dust reducing circular saw equipped with Hardie™ Blade Saw Blade and connected to a M Class or higher vacuum.

When cutting outdoors

- ✓ Make sure you work in a well ventilated area
- ✓ Position cutting station so wind will blow dust away from yourself and others in the working area
- ✓ Rotate employees across cutting task over duration of shift
- ✓ Cut products with a Hardie™ Blade Saw Blade (or equivalent) and a dust reducing circular saw connected to a M Class or higher vacuum
- ✓ When sawing, sanding, rebating, drilling or machining fibre cement products, always:
 - Wear your P1 or higher (correctly fitted in accordance with manufacturers' instructions), ask others to do the same.
 - Keep persons on site at least 2 metres and as far as practicable away from the cutting station while the saw is in operation
 - If you are not clean shaven, then use a powered air respirator with a loose fitting head top
 - Wear safety glasses
 - Wear hearing protection
- ✓ Make sure you clean up BUT never dry sweep. Always hose down with water/wet wipe or use an M Class or higher vacuum

When cutting indoors

- ✗ Never cut using a circular saw indoors
- ✓ Position cutting station in a well ventilated area
- ✓ Cut ONLY using a Hardie™ Knife, hand guillotine or fibreshears (manual, electric or pneumatic)

- ✓ Make sure you clean up BUT never dry sweep. Always hose down with water/wet wipe or use an M Class or higher vacuum

Use the following method for cutting Villaboard Lining 9mm

Dust reducing circular saw equipped with Hardie™ Blade Saw Blade and M Class or higher vacuum.

When cutting

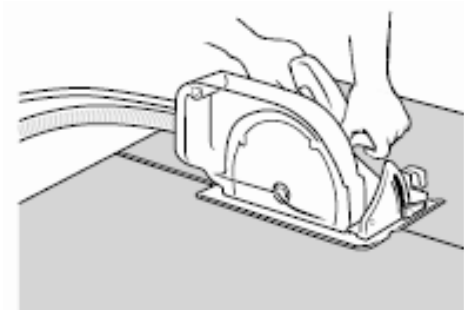
- ✓ Work outdoors only
- ✓ Make sure you work in a well ventilated area
- ✓ Position cutting station so wind will blow dust away from yourself and others in the working area
- ✓ Rotate employees across cutting task over duration of shift
- ✓ Cut products with a Hardie™ Blade Saw Blade (or equivalent) and a dust reducing circular saw connected to a M Class or higher vacuum
- ✓ When sawing, sanding, rebating, drilling or machining fibre cement products, always:
 - Wear your P1 or higher (correctly fitted in accordance with manufacturers' instructions), ask others to do the same.
 - Keep persons on site at least 2 metres and as far as practicable away from the cutting station while the saw is in operation.
 - If you are not clean shaven, then use a powered air respirator with a loose fitting head top
 - Wear safety glasses
 - Wear hearing protection
 - When others are close by, ask them to do the same
- ✓ Make sure you clean up BUT never dry sweep. Always hose down with water/wet wipe or use an M Class or higher vacuum

If concern still exists about exposure levels or you do not comply with the above practices, you should always consult a qualified industrial hygienist or contact James Hardie for further information.

Working instructions

Hardie™ Blade Saw Blade

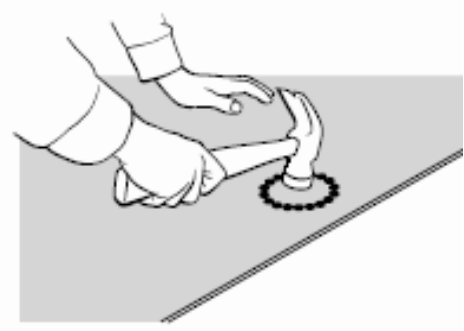
The Hardie™ Blade Saw Blade used with a dust-reducing saw is ideal for fast, clean cutting of Hardie™ fibre cement products. A dust-reducing saw uses a dust collector connected to a M Class or higher vacuum. When sawing, clamp a straight edge to the sheet as a guide and run the saw base plate along the straight edge when making the cut.



Hole forming

For smooth clean cut circular holes:

- Mark the centre of the hole on the sheet
- Pre-drill a 'pilot' hole
- Using the pilot hole as a guide, cut the hole to the appropriate diameter with a hole saw fitted to a heavy duty electric drill



For irregular holes:

- Small rectangular or circular holes can be cut by drilling a series of small holes around the perimeter of the hole then tapping out the waste piece from the sheet face
- Tap carefully to avoid damage to sheets, ensuring that the sheet edges are properly supported

2.1 Storage and delivery

Keeping products and people safe

Off loading

- ✓ Hardie™ fibre cement products should be off-loaded carefully by hand or by forklift
- ✓ Hardie™ fibre cement products should not be rolled or dumped off a truck during the delivery to the jobsite

Storage

Hardie™ fibre cement products should be stored:

- ✓ In their original packaging
- ✓ Off the ground – either on a pallet or adequately supported on timber or other spacers
- ✓ Under cover where possible or otherwise protected with a waterproof covering to keep products dry
- ✓ Flat so as to minimise bending

Hardie™ fibre cement products must not be stored:

- ✗ Directly on the ground
- ✗ In the open air exposed to the elements

James Hardie is not responsible for damage due to improper storage and handling.

2.2 Tips for safe and easy handling of Villaboard Lining

- ✓ Carry with two people
- ✓ Hold near each end and on edge
- ✓ Exercise care when handling sheet products to avoid damaging the edges/corners

3 Framing/Substrate

3.1 General

Villaboard Lining can be fixed to either timber framing, light gauge domestic type steel framing and battens fixed over masonry. The framing and substrate used must comply with the relevant building regulations and standards and the requirements of this manual.

For untiled walls the studs spacing must not exceed 600mm centres and noggings 1200 centres maximum.

For tiled wall applications studs spacing must be closed to 400mm for a 6mm Villaboard Lining, and between 400mm to 600mm centres for a 9mm Villaboard Lining. Nogs 800mm centres maximum. Refer Table 9 for further information.

At sheet joint the studs must be minimum 45mm wide.

Notes

1. Stud spacings restrict the thickness of tiles used to finish Villaboard Lining. For more information refer to the Finishes and Maintenance section on page 25.
2. In internal and external corners use a PVC perforated corner mould or paper faced rigid moulding.
3. Ensure a 6mm building tolerance gap is provided at the floor and ceiling junctions with the Villaboard Lining.

3.2 Timber

Timber framing must at a minimum comply with the requirements of NZS 3604 'Timber Framed Buildings'.

The timber framing treatment and moisture contents must comply with the requirements of NZS 3602.

3.3 Steel

The minimum size for steel stud framing should be 64mm deep x 35mm wide and 0.55mm base metal thickness (BMT) minimum.

Steel framing shall comply with the minimum stiffness requirements of NZS 3604. Refer to NASH 3405 document for further guidance on steel framing or contact steel framing supplier for information.

Steel sections shall be suitably galvanised zinc coated to comply with the durability requirements of the NZBC. Refer to framing manufacturer for further information. Studs must not be less than 35mm wide at joints.

For tiled applications it is recommended to use a 0.75mm thick steel framing to achieve the required rigidity/stiffness.

3.4 Masonry Substrate

Always ensure the substrate is given adequate time to dry out before the installation of Villaboard Lining. The wall surface must be clean, dry and free of any material that will affect the straightness of the battens. Refer to page 13 for further information.

3.5 Skillion Roof Design

When installing Villaboard Linings direct to skillion roof framing, refer to Eaves and Soffit Linings Installation Manual.

3.6 Frame Tolerances

Ensure the frame is square and work from a central datum line. Frames must be straight and true to provide a flush face to receive the sheeting.

Figure 1: Frame straightness



A suggested maximum tolerance of between 3mm and 4mm in any 3000mm length of frame will give best results. Villaboard Lining will not straighten excessively warped or distorted frames and any warping may still be visible after the internal lining is installed.

3.7 Masonry Wall

Cut Villaboard Lining approximately 12mm less than floor to ceiling height to allow for building tolerances. Ensure a 6mm building tolerance gap is provided at the floor and ceiling junctions with the Villaboard Lining. Refer to page 14 for specific substrate requirements.

3.8 Curved Walls

Villaboard Lining may be bent to accommodate curved walls. The minimum bending radii are shown below.

Table 4

Curved wall minimum bending radii		
	Along length (mm)	Across width (mm)
Villaboard Lining 6mm	1800 (1200)	2400
Villaboard Lining 9mm	3000 (1800)	4000

Notes

1. The bending radii given above require no special pre-wetting of the sheet and may be used on internal or external curves.
 2. With extra care, the sheet can be bent to the radius shown in the brackets.
- To maintain the smoothness of the curve, studs must be closed to spacings as shown below.

Table 5

Curved lining — stud spacing	
Range of radii (mm)	Stud spacing (mm)
1200 to 3000	300
Above 3000	400*

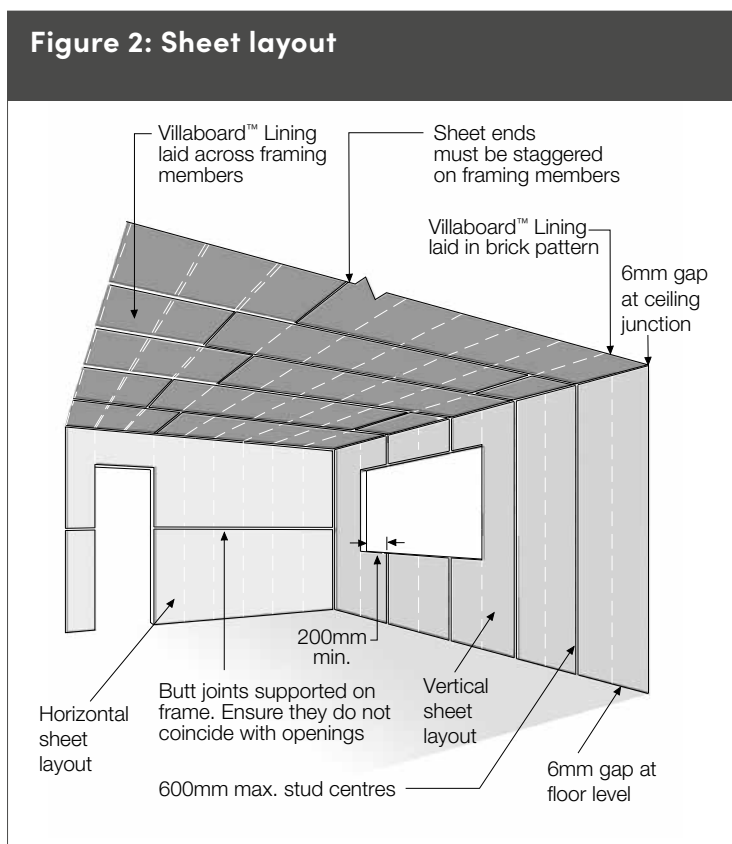
*or at one third of the sheet width, whichever is the lesser.

4 Sheet Layout

Install Villaboard Lining across the framing either vertically or horizontally.

Sheet joints must coincide with the centre line of the framing member.

At door and window openings fix sheets around the opening in a way that the sheet joints do not coincide with the edges of openings. The sheet joint must be 200mm minimum away from the opening edge. Refer to Figure 2.



Notes

1. The sheets should be installed vertically on the inner face of external walls where the exterior cladding is installed on cavity battens. For cavity construction method the nogs are generally fixed at 800mm centres max.
2. Sheets with two long edges recessed are most suitable for vertical installation.
3. When the space above the window/door is less than 250mm then a butt joint must be provided on either side of opening. Refer to Figures 15 and 16.
4. 3-4mm packers can be fixed on the framing where required to suit the window reveals or in wet areas.
5. All sheet edges must be supported by the framing.
6. Joints can be staggered.

5 Installation

5.1 General

Place 6mm packers along the floor as temporary support for sheets. This will allow for any frame movement/shrinkage. Put sheets in place as shown in Figure 3.

Ensuring the sheet is level, fix starting from the centre of sheet and working outwards to avoid any drumminess.

Provide 1-2mm gap between Villaboard Lining sheets at vertical, horizontal, internal or external corner joints.

Fix the remaining sheets in a similar sequence.

Figure 3: First sheet



Notes

1. For fastener selection and spacings see pages 10 -13.
2. Do not fix sheets to the bottom chord of roof trusses. Instead, fix to ceiling battens or furring channels.

Figure 4: Fixing remaining sheets



5.2 Fasteners

Fasteners must have the appropriate level of durability required for the intended project.

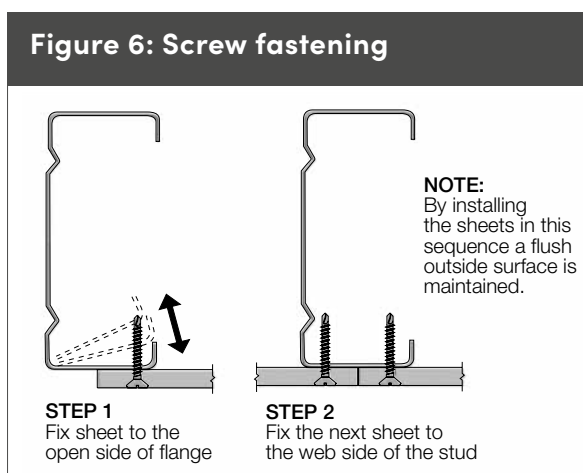
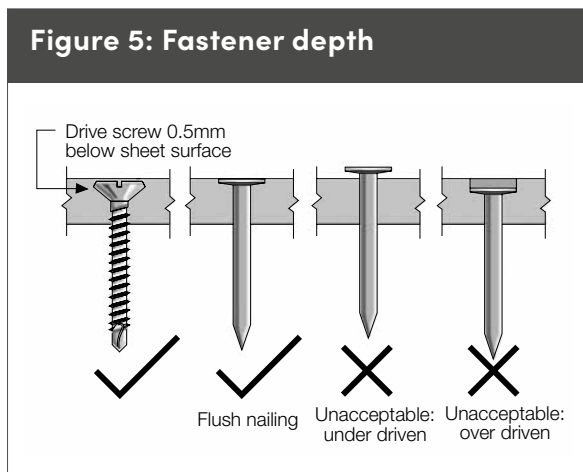
Fasteners must be fully compatible with all other material that they are in contact with to ensure the durability and integrity of the assembly.

On timber frame use Villadrive collated screws for quick installation of Villaboard Linings. Alternatively the Villaboard Lining can also be fixed with Hardie™ Drive stainless steel screws, 40 x 2.8mm Hardie™ Flex nails or 40 x 2.87mm RounDrive gun nail.

For fixing Villaboard Lining to 0.55 – 1.0mm BMT steel framing, use 30mm Buildex® FibreZip® Class 3 collated screws. These screws must not be used in sea spray zones.

Nails must be finished flush. Screws can be driven 0.5mm below the sheet surface to achieve the required finish level (Refer to Figure 5). In steel framing the fasteners should be driven as close as possible to the stud corners to avoid deflection of the stud flange, refer to Figure 6.

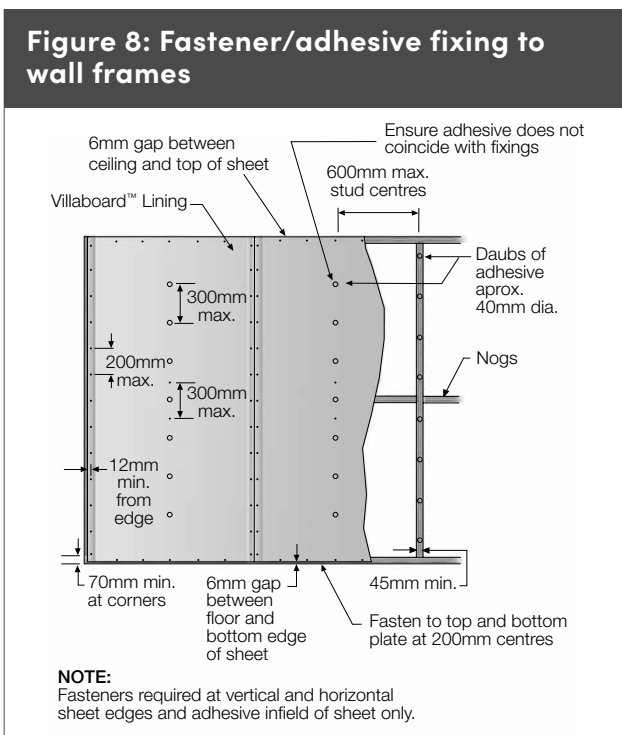
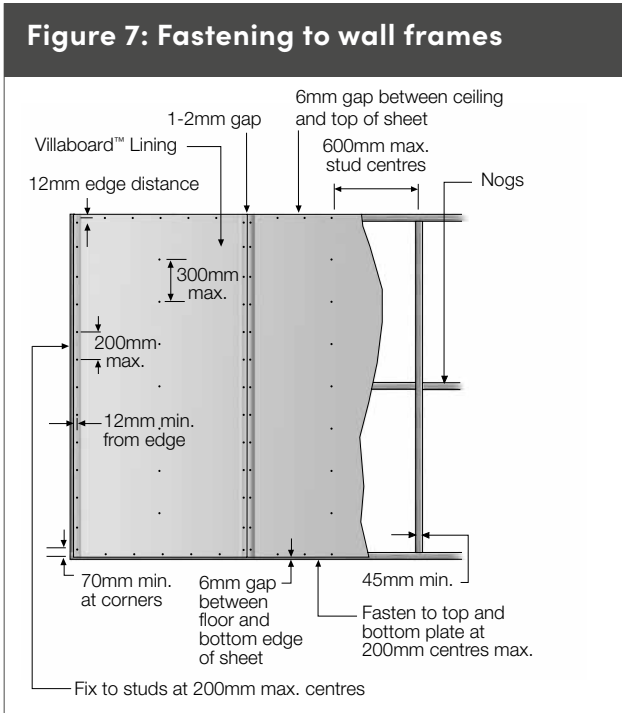
Refer to Section 6 – Step 7, for finishing of fasteners.



5.3 Fixing To Internal Walls

Untiled walls

Where Villaboard Lining is to be left untiled, the sheets can be fixed with fasteners or a combination of fasteners and adhesive, refer to Figures 7 and 8 respectively.



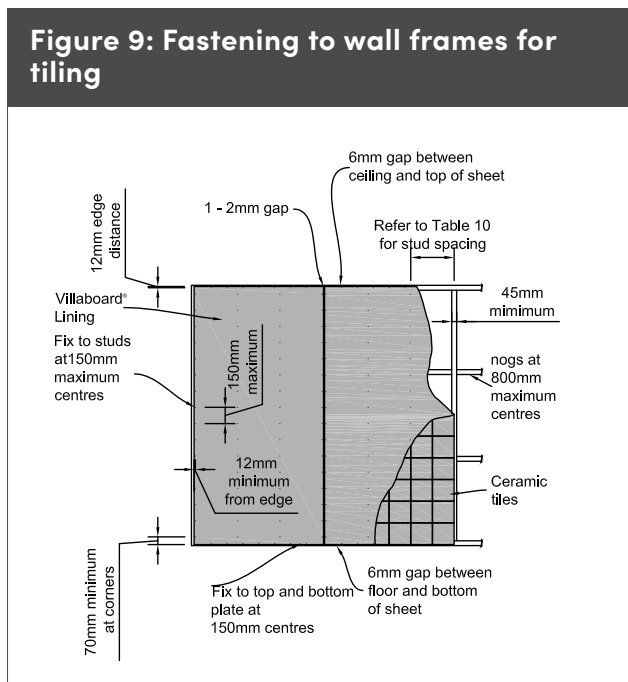
Notes

1. All surfaces to receive adhesive must be clean, free of dust, oil, etc.
2. Ensure daubs of adhesive never coincide with permanent fastener points, as adhesive shrinkage may cause fastener head protrusion.

Tiled walls

Where Villaboard Lining is to be finished with tiles, the sheets must be fixed with fasteners only as shown in Figure 9.

For tiled wall applications studs spacing must be closed to 400mm for a 6mm Villaboard Lining, and between 400mm to 600mm centres for a 9mm Villaboard Lining. Refer to Table 9 for further information.

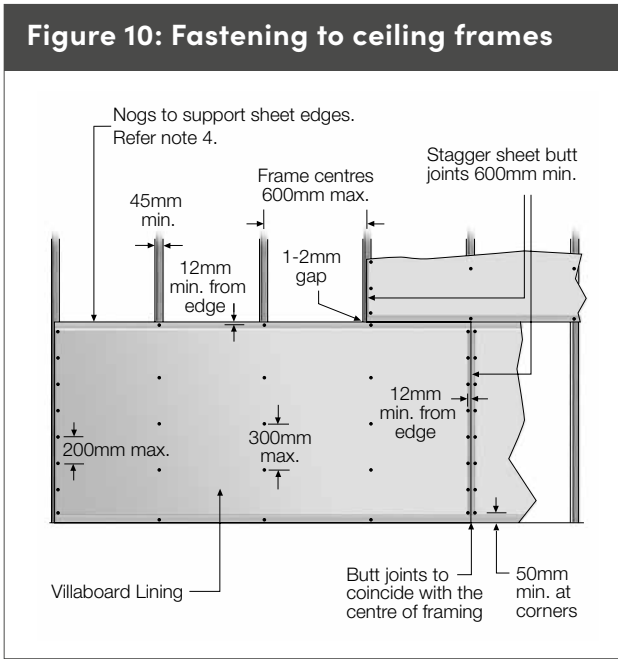


Notes

1. It is good practice to install Villaboard Lining horizontally for tiled applications.
2. When tiling in wet areas, apply water proofing membranes before tiling on walls. Ensure water proofing membranes manufacturers recommendations are followed.
3. The recessed edges are required to be stopped with Hardie™ Base Coat as per Section 6. The top coat is not required behind the tiles. The square sheet joint can be sealed with a flexible sealant before the installation of tiles. Refer to Figure 16.
4. When installed horizontally full perimeter sheet support and fixing is required. The vertical sheet joints can be staggered.
5. Fixings not to be staggered at the joint. Refer to Figure 9.
6. Fixings at 200mm centres maximum for untiled applications and 150mm centres maximum for tiled applications.

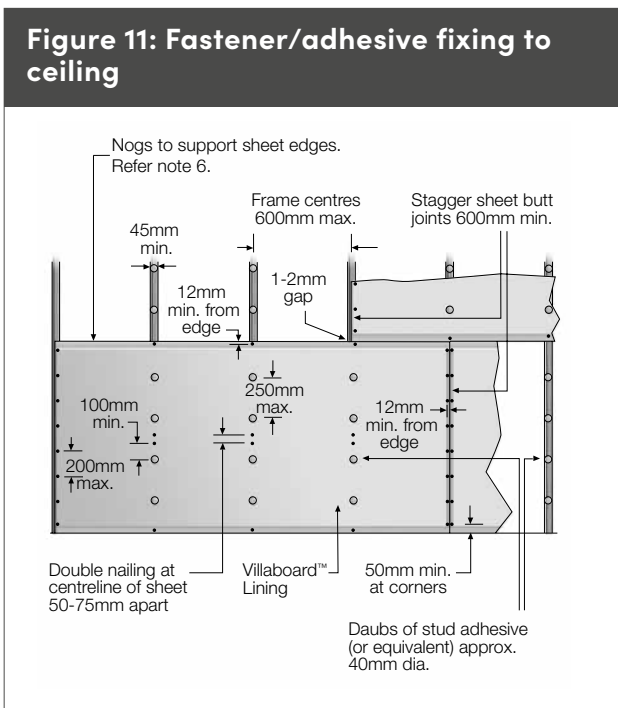
5.4 Fixing to Ceilings

For ceiling applications either the fastener or fastener/adhesive method can be used. Refer to Figures 10 and 11 respectively.



Notes

1. Do not install tiles in ceiling applications.
2. Do not fix sheets directly to the bottom chord of trusses. Batten these out first with timber battens or steel ceiling battens.
3. It is recommended that flush stopping of joints is suitable when using recessed edge Villaboard Lining.
4. When nogs not installed for perimeter support, unsupported sheet edges across the framing must be supported by back blocking using a 300-400mm wide Villaboard Lining strip adhered to rear face and centered over the joint between the framing.
5. For external soffit applications refer to the Eaves and Soffits Linings Installation Manual by James Hardie.



Notes

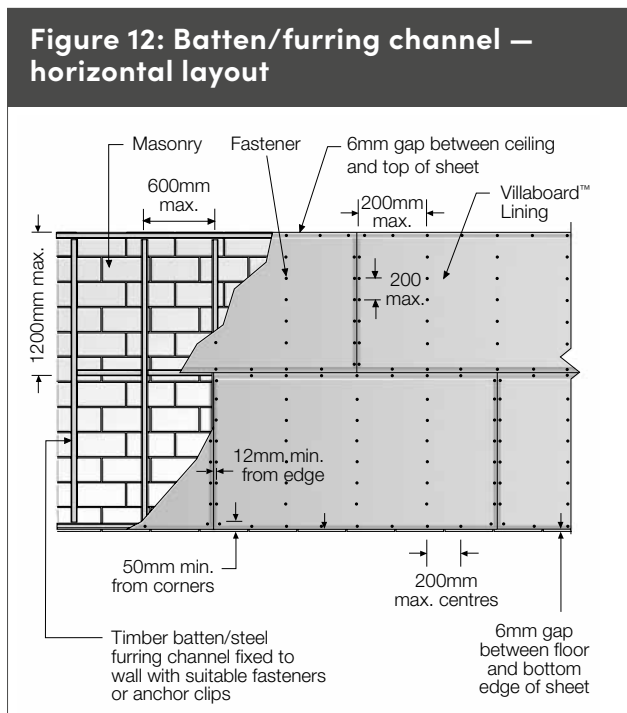
1. Do not install tiles in ceiling applications.
2. Do not use adhesive only. Ensure sheet perimeter is fastened as shown.
3. All surfaces to receive adhesive must be clean, free of dust, oil, etc.
4. Ensure daubs of adhesive never coincide with permanent fastener points, as adhesive shrinkage may cause fastener head protrusion.
5. It is recommended that flush stopping of joints is suitable when using recessed edge Villaboard Lining.
6. When nogs not installed for perimeter support, unsupported sheet edges across the framing must be supported by back blocking using a 300-400mm wide Villaboard Lining strip adhered to rear face and centered over the joint between the framing.
7. For external soffit applications refer to the Eaves and Soffits Linings Installation Manual by James Hardie.

5.5 Fixing to Masonry/Concrete wall

Villaboard Lining can be installed over masonry, concrete and Aerated Autoclaved Cement (AAC) substrates by following the requirements as explained below.

5.6 Batten/Furring channel method

1. Where substrate may be uneven and misaligned – this method allows correction of irregular surfaces; allows packing out to accommodate large surface variations.
2. Timber battens are either fixed directly to the walls, or alternatively, metal furring channel anchor clips can be used. These are attached to the wall prior to fitting the metal furring channels.
3. A 35mm deep timber batten is recommended for complete structural support and performance.
4. Where services are run over walls, deeper furring channels may be used.
5. Use suitable masonry fasteners to structurally fix timber/steel battens or recessed furring channels as shown in Figure 12.
6. Pack behind battens as required to achieve a flat surface.
7. All Villaboard Lining edges must be supported on the wall.



Notes

1. This method is suitable for tiled or untiled applications.
2. Timber battens or proprietary steel battens or furring channel sections may be used. Where space is a major consideration, use recessed furring channels which have the least section depth.
3. The spacing and fixing of anchor clips must be in accordance with the manufacturer's recommendations.
4. The sheets can also be fixed vertically using this method.
5. The depth of timber battens must be suitable for the length of fasteners used.
6. Fixings at 200mm centres maximum for untiled applications and 150mm centres maximum for tiled applications.

6 Joints

6.1 General

Villaboard Lining joints are set with proprietary jointing compounds reinforced with perforated paper tape. Both recessed edge, square edge and butt joints are finished by using the jointing products outlined in this manual.

The performance of joints is the responsibility of the installer, as this is governed by the installation practices and the standard of workmanships applied. However, James Hardie considers that the recommendations provided in Table 6 describe best practice to reduce the risk of joint cracking or other problems.

There are various factors that can affect the performance of jointing compounds on edge recessed fibre cement substrates. These factors include the framing, movement, installation quality, vibrations, moisture, humidity, temperature, etc. To achieve satisfactory joint performance these factors need to be carefully considered and understood by the installer and designer when positioning joints.

Hardie™ Base Coat has been specifically developed for use with Villaboard Lining and offers superior joint strength when compared with the gypsum jointing compound alternatives.

All site cut and site recessed sheet edges must be sealed with Dulux® Acraprime® 501/1 or Dulux® 1 Step® or similar.

In addition, provision for movement needs to be made by the installation of control joints. Refer to Figure 18.

Table 6

Jointing recommendations				
		Application	Base Compound	Topping Compound
Dry area walls	Recessed Edge	Untiled	Hardie™ Base Coat with perforated paper tape	Hardie™ Top Coat, Plaster Systems compound or Gypsum topping compound
		Tiled	Hardie™ Base Coat with perforated paper tape	N/A
	Butt Edge	Untiled	Silicone Joint	N/A
		Tiled	Silicone Joint	N/A
Wet area walls	Recessed Edge	Untiled	Hardie™ Base Coat with perforated paper tape	Hardie™ Top Coat
		Tiled or Shower Lining	Hardie™ Base Coat with perforated paper tape	N/A
	Butt Edge	Tiled or Shower Lining	Hardie™ Base Coat with perforated paper tape	N/A
			Silicone Joint	N/A

Figure 13: Vertical flush joint setout

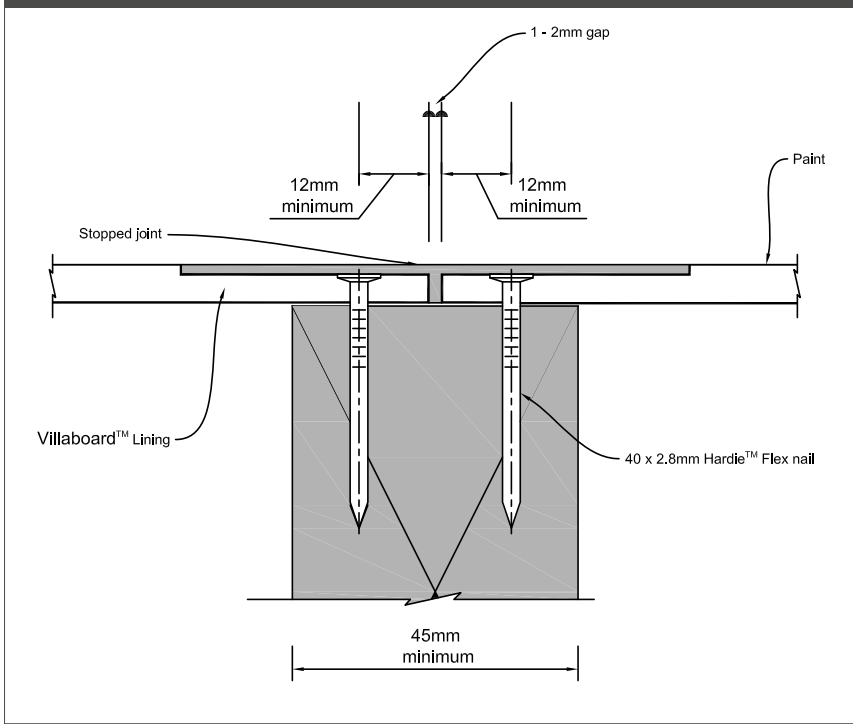
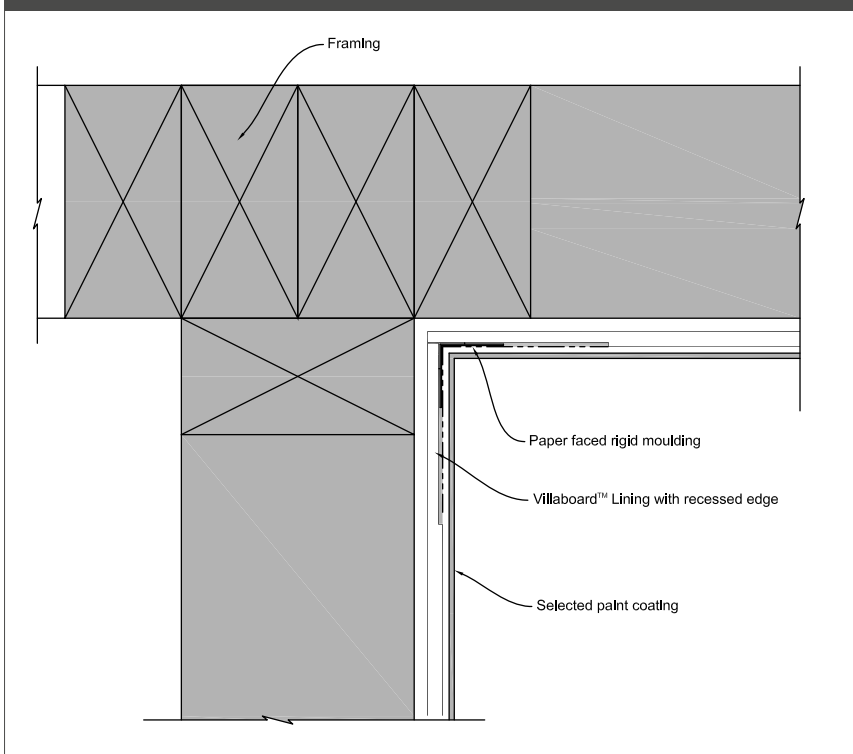
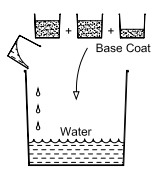
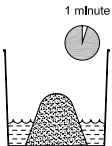


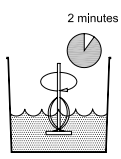
Figure 14: Wall to wall junction

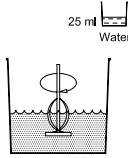


Note: When Villaboard Lining is to be tiled the corners behind the Villaboard Lining must be tied together with a Lumberlok® Stud Saver steel corner angle. Refer to Figure 22 for this angle's location.

6.2 Hardie™ Base Coat Mixing Instructions

	<p>Step 1 First, add 1 part of clean water into bucket. Then add 2½ parts Hardie™ Base Coat powder Allow to soak for 1 minute.</p> 
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	<p>Step 2 Mix for 1½ – 2 minutes using paint mixer or equivalent (approximately 2500-3000rpm). Hardie™ Base Coat is NOT like the plaster based compounds. Initial mixing will indicate a dry mix and further mixing WITHOUT further addition of water will deliver the ideal workable paste. Warning: Inadequate or over mixing can lead to poor workability and can cause performance issues. Do Not Hand Mix.</p>
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	<p>Step 3 The mix at this stage should be consistently smooth. Based on the environmental conditions i.e. temperature, humidity and wind etc you may add maximum of 25ml of water per 1kg of base coat powder in the mix at this stage to adjust workability. Mix it well. (Note: Adding excess water over the recommended amount may delay the drying of base coat and may cause joint cracking due to excessive shrinkage.) The mix should be glossy and smooth. There should be no lumps in the mix.</p>
---	---

Important notes:

1. Do not apply Hardie™ Base Coat in temperatures above 40° C or below 5° C.
2. Allow the compounds to dry before applying the next coat. The drying time will vary between 12 to 24 hours depending upon the weather conditions.
3. Site cut and site recessed sheet edges must be sealed with an acrylic sealer e.g. Dulux® Acraprime® 501/1, Dulux® 1 Step® or similar product.
4. In corners, use Hardie™ uPVC internal/external corner mould primed with Dulux® Primerlock® or similar. A 'GIB® Goldline™ Platinum' corner mould can also be used.
5. Use only perforated paper tapes in straight joints.
6. It is recommended that one (1) base coat bag is mixed in three (3) portions.
7. Before stopping the sheet edges, Multiplast® Resin or a similar product in diluted form must be applied to the sheet edges. Mix the resin as per the manufacturer's recommendations.

Product life:

Hardie™ Base/Top Coat has a shelf life of 12 months in unopened pails/bags when stored in a cool dry place.

Hardie™ Base /Top Coat has a pail/bag life of 1 month if opened pails/bags are resealed and stored in a cool dry place.

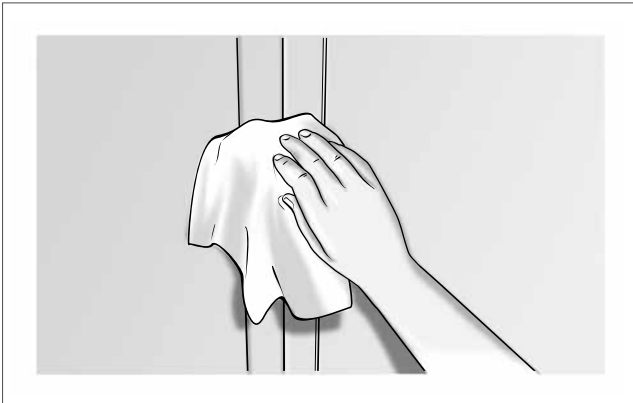
6.2.1 Compound coverage

1kg of Base Coat will provide approximately 5 lm of standard joints. 1kg of Top Coat will provide approximately 5.6 lm of standard joints.

6.3 Set recessed edge joints

Step 1 – Preparation

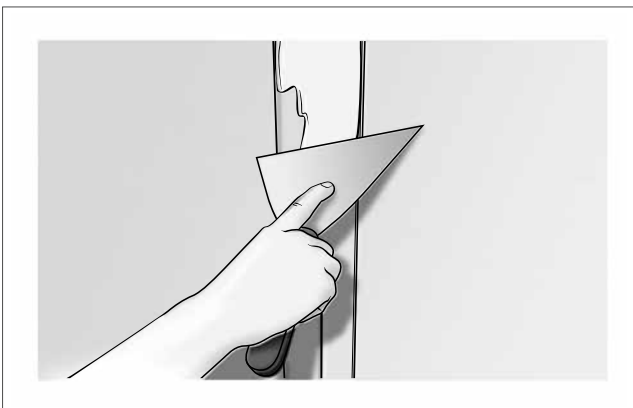
Ensure that the recesses are clean and free of dust and contaminants. Sheet edges must be sealed prior to stopping with Multiplast® Resin water proofing admixture or other similar products. If working conditions are hot and dry, dampen the area around the joint prior to working.



Note: The jointing method shown on pages 24 and 25 provides a level 4 finish. For more information about this and other finishes refer to Table 8.

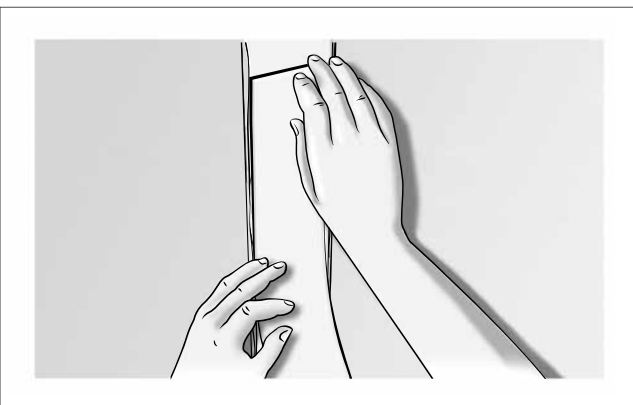
Step 2 – First coat

Apply Hardie™ Base Coat to fill the recess with a 150mm broad knife.



Step 3 – Embed tape

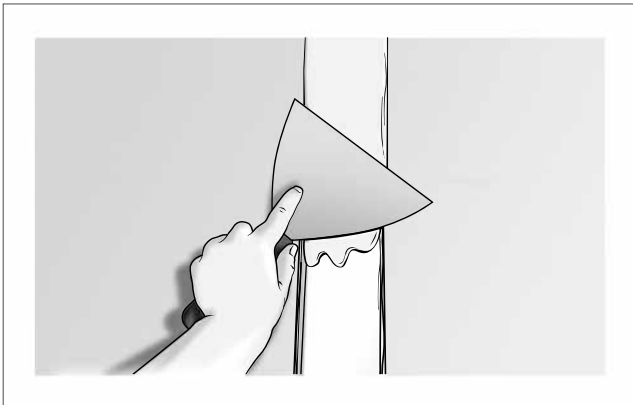
Firmly embed the perforated paper tape centrally into the joint using a 50mm broad knife. Ensure that there are no voids under the tape and remove excess compound.





Step 4 – Thin layer

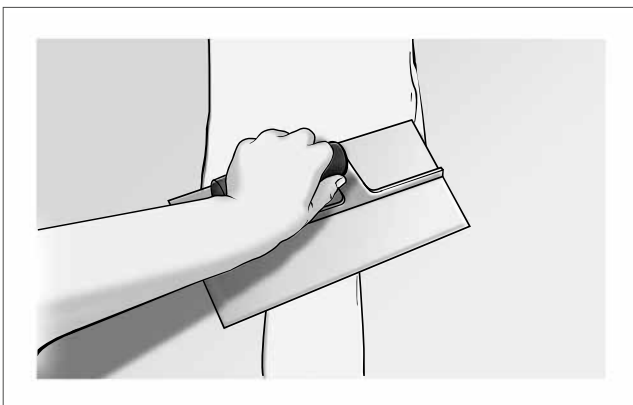
Immediately fill joint covering tape with a layer of Hardie™ Base Coat applied with a 150mm broadknife.



Note: Steps 5, 6 and 7 are only required for paint and wall paper finishes up to a level 4 finish. Refer to Table 8 for level 5 finish.

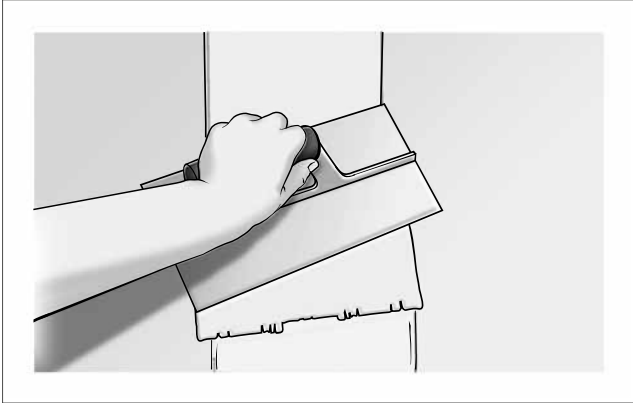
Step 5 – Second coat (untiled walls only)

When the first coat is fully dry, use a 200mm wide second coat trowel to apply the Hardie™ Base Coat. Apply this coat approximately 180mm wide, laid down over the recess and feather the edges.



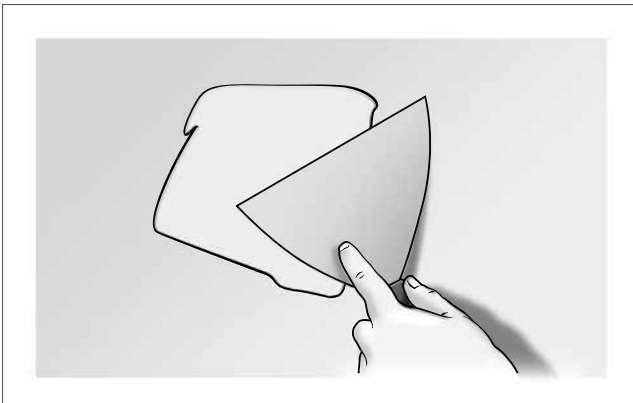
Step 6 – Finishing coat (untiled walls only)

Ensure the second coat is fully dry. Using a finishing trowel, apply a coat of Hardie™ Top Coat 280mm wide centrally over the joint and feather out the edges. Allow to dry fully before sanding.



Step 7 – Fastener heads (untiled walls only)

Apply a finishing coat of Hardie™ Base Coat to fastener heads, feathering out the edges. Allow to fully dry before sanding.

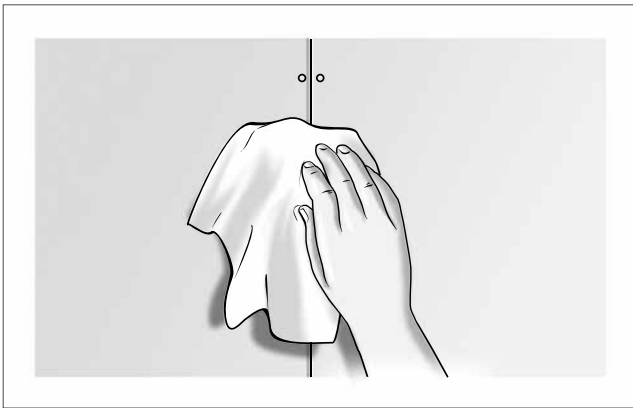


6.4 Set Square Edge Joints

As an alternative to setting the recessed edge joints, square edge Villaboard Lining can also be jointed and stopped on stud as shown below. This detail will achieve a level 3 finish.

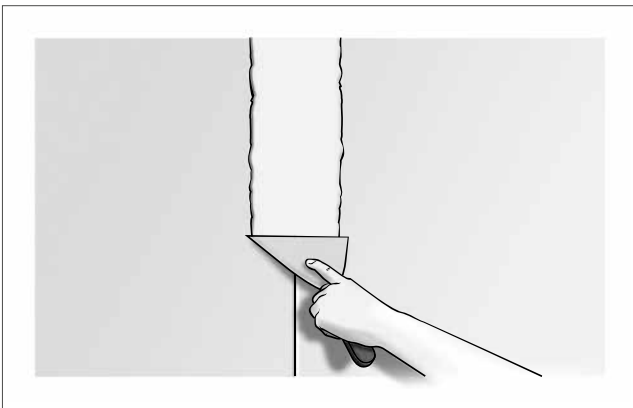
Step 1 – Preparation

When jointing un-recessed sheet joints, ensure that sheet edges are clean and free of dust and contaminants. Sheet edges must be sealed prior to stopping with Multiplast® Resin water proofing admixture or other similar products. If working conditions are hot and dry, dampen the area around the joint prior to working.



Step 2 – First coat

Apply Hardie™ Base Coat centrally over butt joint to 200mm wide with a 150mm broadknife.



Step 3 – Embed tape

Firmly embed the perforated paper tape centrally using a 50mm broadknife. Ensure that there are no voids under the tape and remove excess compound.



Step 4 – Thin layer

Immediately cover tape with a thin layer of Hardie™ Base Coat applied with a 150mm broadknife.



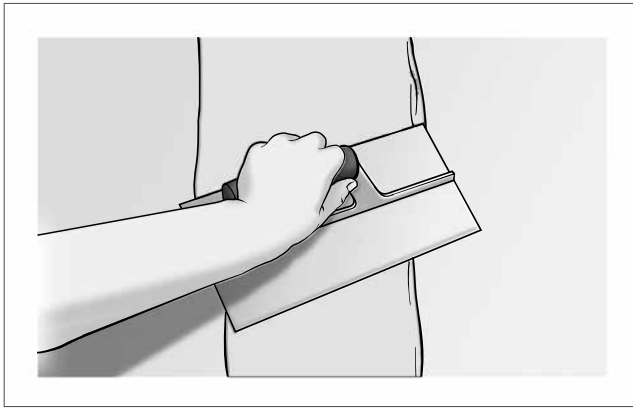
Step 5 – Second coat (untiled walls only)

When the first coat is fully dry, use a 200mm wide second coat trowel to apply the Hardie™ Base Coat. Apply this coat approximately 300mm wide.



Step 6 – Finishing coat (untiled walls only)

Ensure the second coat is fully dry. Using a finishing trowel, apply a coat of Hardie™ Top Coat 500mm wide centrally over the joint and feather out the edges. Allow to fully dry before sanding.



6.5 Butt Joint

Figure 15: Butt joint detail (dry area)

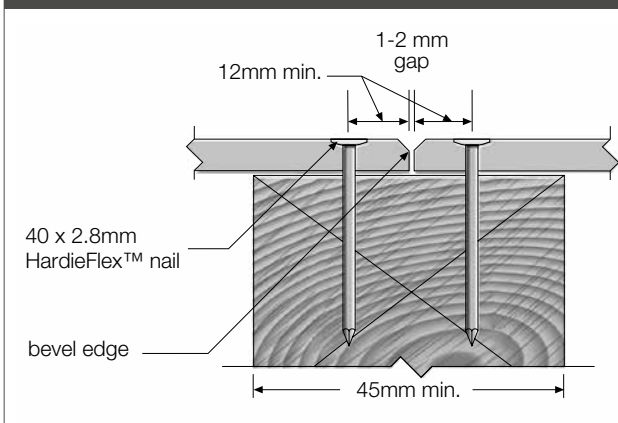
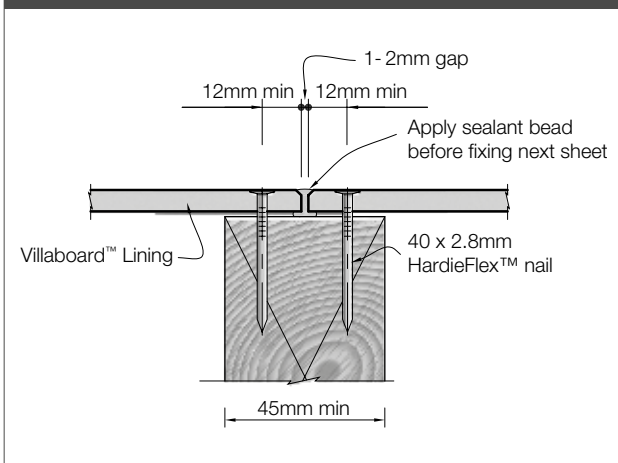
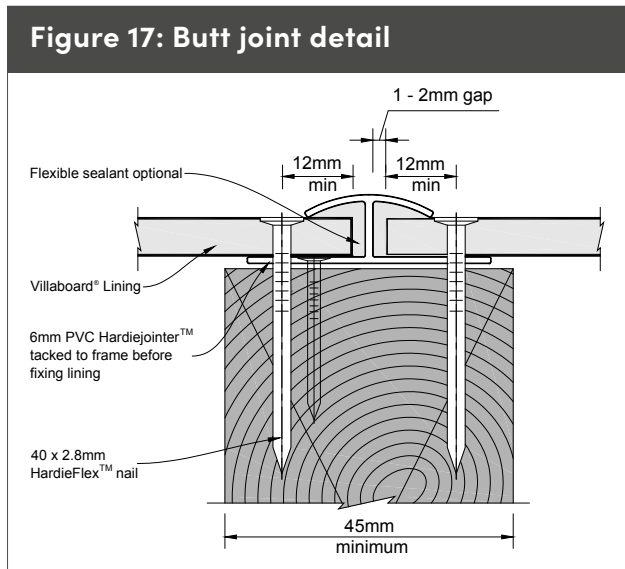


Figure 16: Butt joint detail (tiled over in dry and wet areas)



6.6 PVC Joint



Notes:

1. Use of flexible silicone sealants as per their manufacturers instructions.
2. The 6mm Hardie™ Jointer is available from James Hardie stockists.

6.7 Internal Corners

The internal corners can be formed as per one of the following two methods;

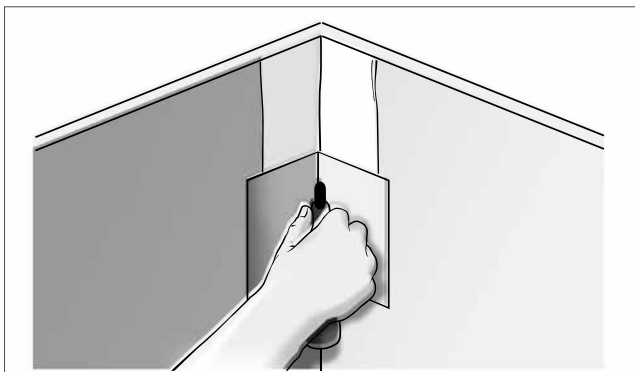
Method A:

1. Apply Hardie™ Base Coat to both sides of the corner using a 70mm broad knife. Fold the perforated paper tape to form a corner and embed it into the corner using 50mm wide corner trowel.
2. Cover the paper tape with Hardie™ Base Coat using a 100mm corner trowel. Allow the base coat to dry. This will normally take up to 24 hours depending upon the temperatures and humidity conditions.
3. Once the base coat has dried then apply a thin finishing coat over it with a corner trowel and smooth it out. Allow the compounds to fully dry before sanding.

Note: Step 3 is only required for untiled walls.

Method B:

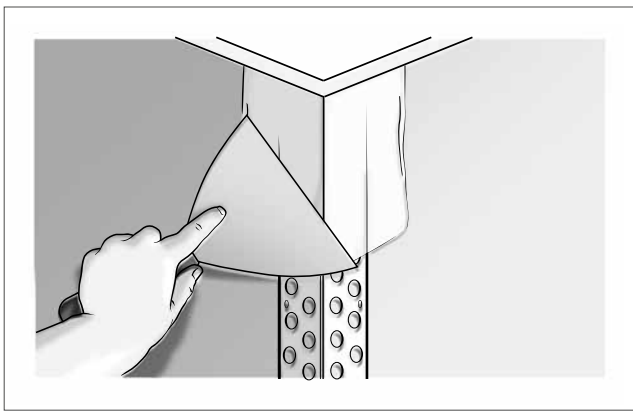
Embed and fix a paper faced rigid spine corner mould (Goldline™) in the corner and then stop over it using a Hardie™ Base Coat. Follow steps 2 and 3 mentioned above to finish the corner joint.



6.8 External Corners

Setting of external corners is required for untiled applications only as follows:

- Fit a perforated corner angle supplied by James Hardie or a paper faced rigid spine corner mould (Goldline) over the external corner and ensure straightness before fixing with Hardie™ Flex nails at 300mm centres
- Apply Hardie™ Base Coat to both sides of the corner angle to a width of 150mm using a broad knife. Allow to dry before applying a second coat
- Using a straight trowel, build up the edges to 250mm from the corner. Allow to dry
- When dry, use the straight trowel to apply a thin finishing coat, 300mm wide, to both sides of the corner angle, feathering out the edges.
- Allow to fully dry before sanding.



6.9 Control Joints

Control joints are required in long runs of Villaboard Lining walls or ceilings in either direction. These joints are designed to take up the structural movement between the sheets and the building frame. They may also be required in ceilings where they change direction or continue into passage ways. Control joints should also be provided at frame junctions/joints such as wall intersections.

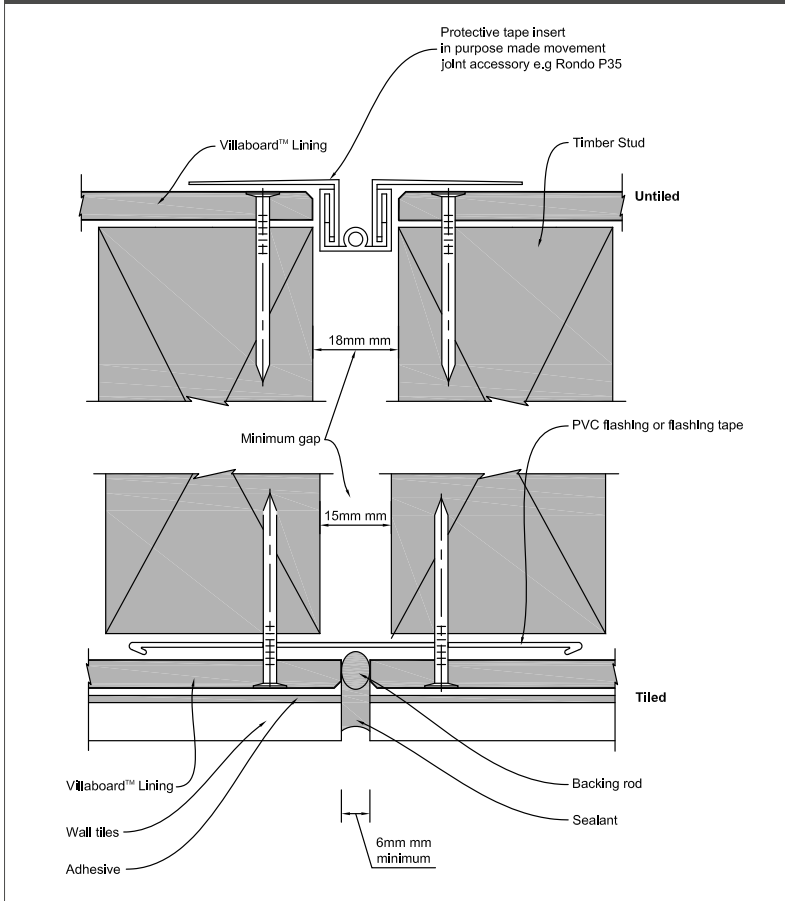
See Table 7 for maximum control joint spacings and Figure 18 for a typical detail.

Table 7

Maximum spacing for control joints (m)			
	Steel framing		Timber framing
	0.55 – 0.75mm BMT	greater than 0.75 – 1.6mm BMT	
General	9.0	6.0	7.2
Tiles walls	4.8		4.2*

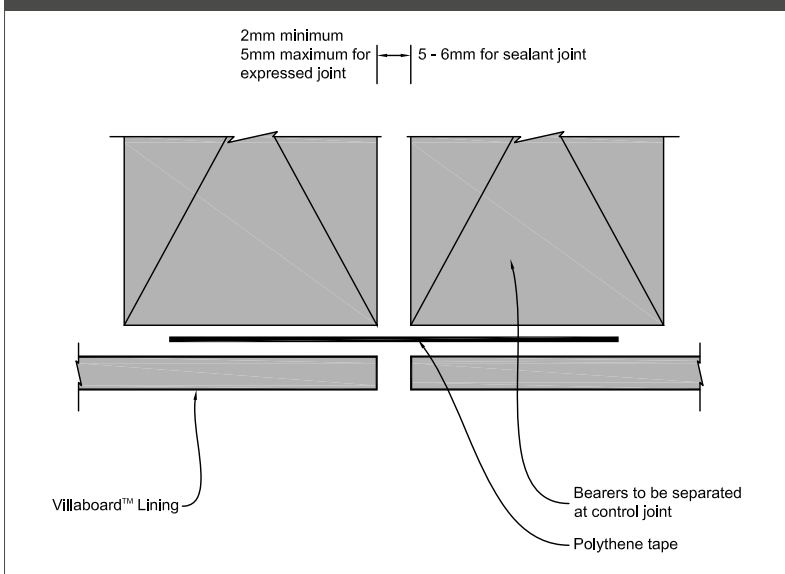
*The maximum wall area should be restricted to 10m² between control joints

Figure 18: Control joint



Notes: Alternatively a PVC control jointer supplied by James Hardie can also be used to form a control joint.

Figure 19: Control joint



Note: Alternatively a PVC control jointer supplied by James Hardie can also be used to form a control joint.

7 Wet Area Application

7.1 Bathroom Areas

Villaboard Lining is most suitable for use in wet area applications. Villaboard Lining must be covered with a waterproofing membrane in a shower application before the installation of tiles.

Note: Paints are not suitable for wet area applications (splash zone) and must not be relied upon to achieve water tightness.

7.2 Internal Swimming Pool Application

To fix Villaboard Lining in internal swimming pool areas;

- The sheets must be back and edge sealed before installation
- All recessed edge sheet joints to be stopped
- Square edge sheet joints must be formed using a 50mm Inseal tape over framing. Use a flexible sealant in the joint to seal
- Only stainless steel fasteners must be used
- Full perimeter fixing required

In addition, it is recommended that H3.1 treated timber framing and ceiling battens are used to enhance the durability considering the high condensation levels.

Figure 20: Sealing around splash zones (showers)

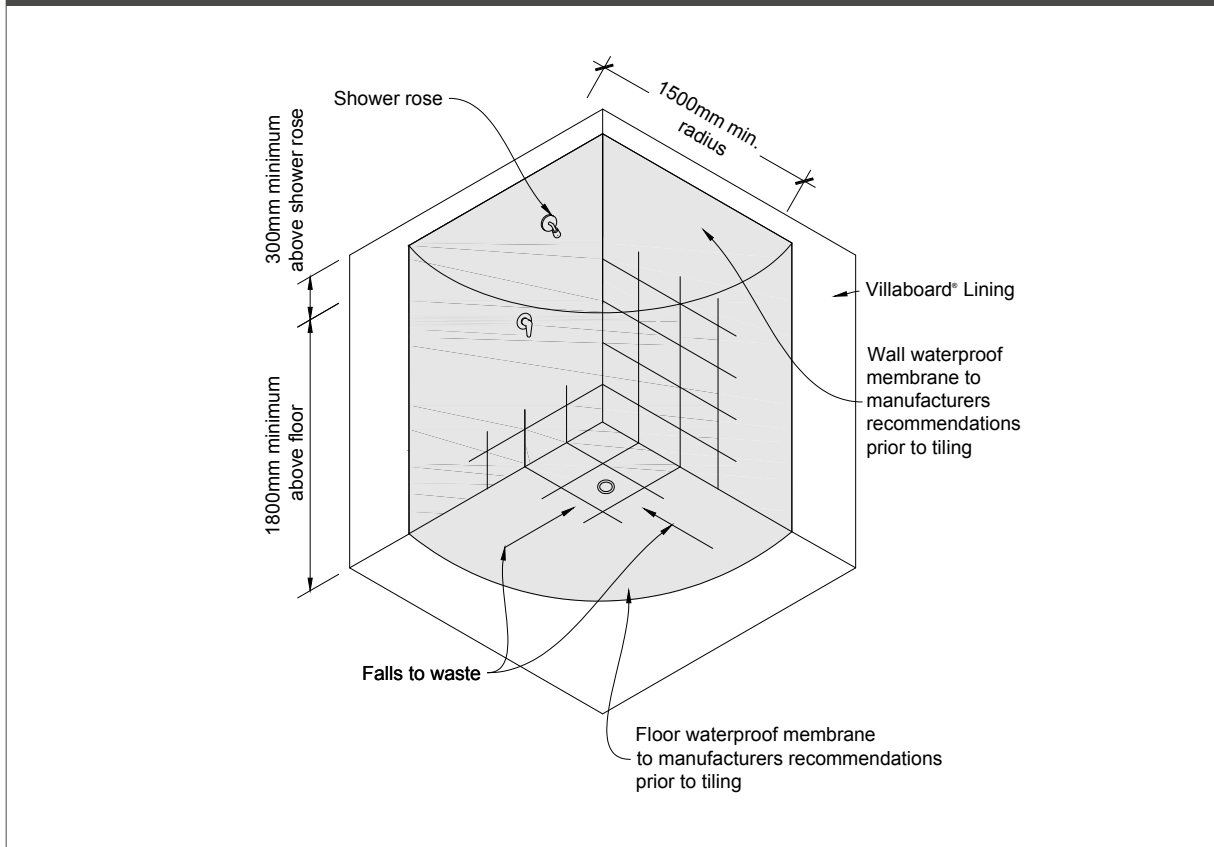
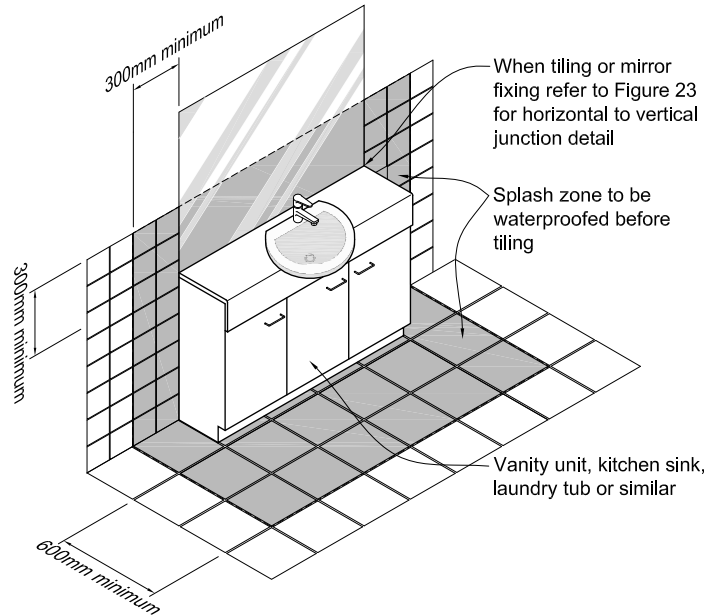


Figure 21: Sealing around splash zones



Note: The extent of floor or wall waterproofing depends on the extent of water to be splashed over these areas. Recommended area to be waterproofed outside of bath, shower or vanity is a minimum of 300mm on walls and 600mm on floors.

Figure 22: Wall to wall wet area tiled wall internal corner

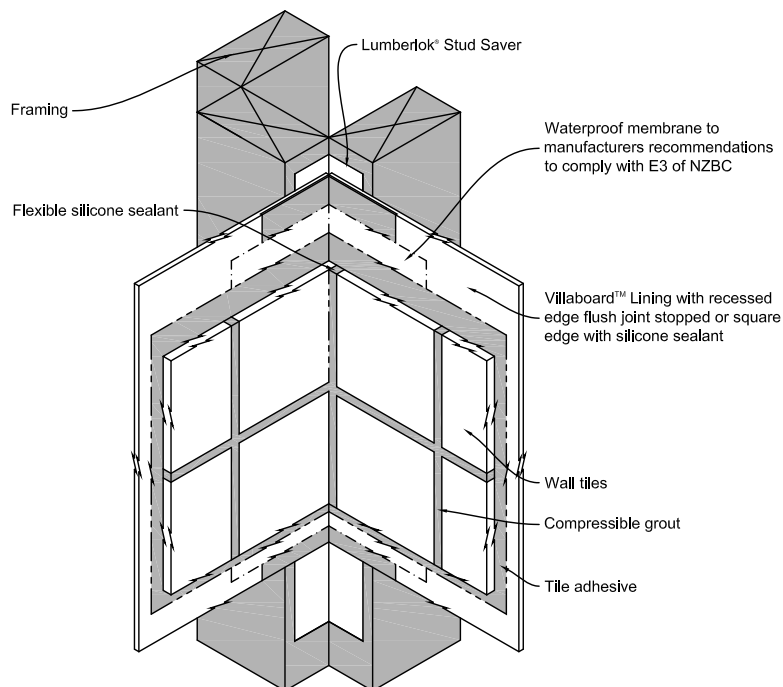
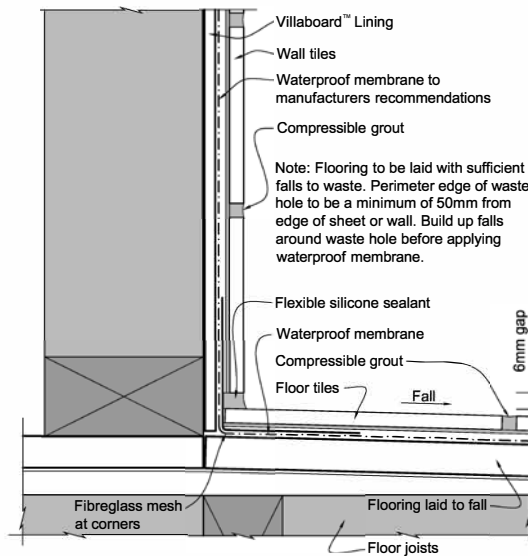


Figure 23: Wall to floor junction

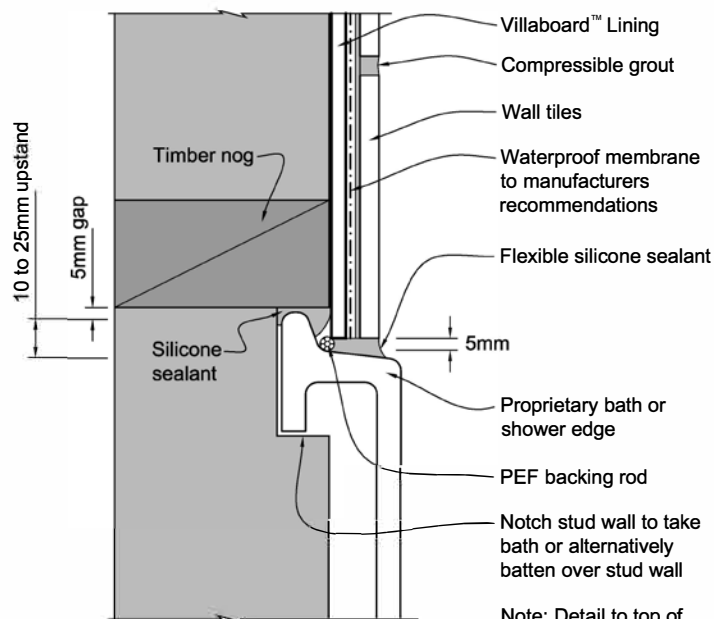


Note for screeds:

1. The thickness of screeds should be applied to achieve the desired slope in accordance with the manufacturers recommendations.
2. Clean down the surface of the sheet flooring thoroughly. Apply a coat of bonding chemical to improve the bonding of the mortar bed to the floor.
3. To prevent cracking of the floor tiles, the mortar bed must be reinforced over all joints in floor sheets with 150mm wide galvanised mesh placed centrally over joints and in the centre of bedding.
4. Control joints in the flooring must be continued through the tiles.
5. Epoxy mortar screeds may also be used.

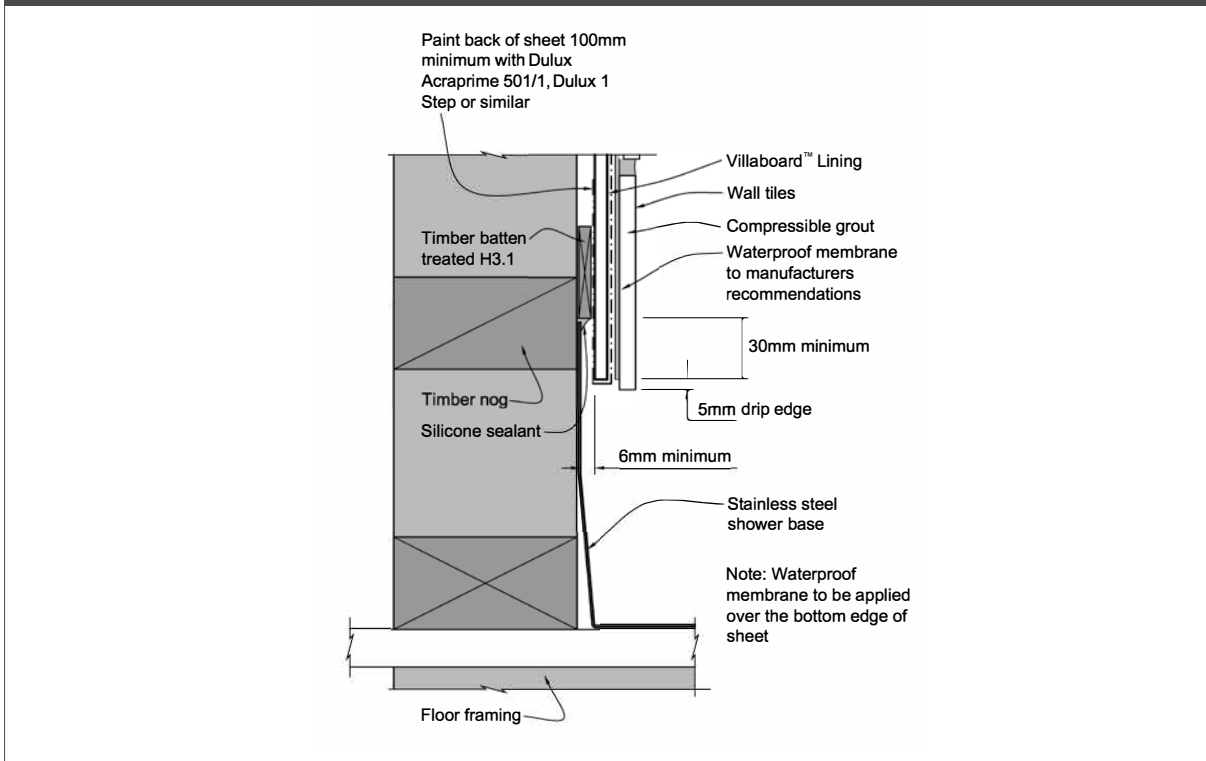
Note: Refer to Clause 8.5 for further information

Figure 24: Wall to acrylic bath/shower



Note: Detail to top of non tiled vanity or sink is similar

Figure 25: Wall to stainless steel shower



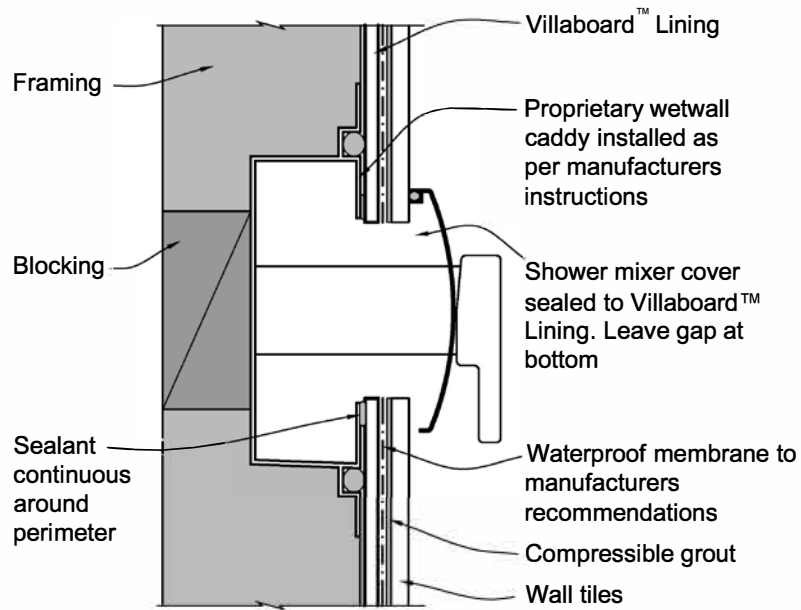
7.3 Waterproofing Membrane

A waterproofing membrane must be applied to Villaboard Lining when used in wet area or water splash area applications. A reinforcing fibre glass/band must be used in corners and walls to floor junctions. Always follow the recommendations of waterproofing membrane manufacturers. BRANZ appraised water proofing membranes are recommended for use in this application.

7.4 Wet area penetration

Sealing penetrations as per BRANZ Good Tiling Practice or as per Figure 26.

Figure 26: Wet wall caddy - optional



Note: Seal cut edges of Villaboard™ Lining

8 Finishes and Maintenance

8.1 General

Villaboard Lining is finished with either paint, tiles or wallpaper as per application requirements. The application and maintenance of these finishes must be in accordance with the manufacturer's specifications.

Notes

1. For wet areas, the waterproofing requirements of all relevant codes, standards and regulations must be met.
2. Refer to the manufacturers' specifications on application, compatibility and suitability of waterproofing membranes.

8.2 Glancing Light

In some instances, due to glancing light, set joints may be noticeable in Villaboard Lining walls, especially where paint finishes have a high gloss level. Work closely with your builder or designer to minimise this.

Artificial lighting needs to be considered in relation to walls and ceilings (e.g. down-lights in ceilings above set joints in walls). Ceilings and wall joints should run in the direction of the light source (at right angles to windows).

Where glancing light is an issue its effect can be lessened by:

- The use of curtains or blinds.
- Artificial light shading devices.
- The use of light coloured, matt finish paints.

8.3 Level of Finishes

Different levels of finishes are typically specified for different applications. Higher levels of finishes are used to address the glancing light issues with painted Villaboard Lining referred to above. A description of the various levels of finishes and the jointing/coating requirements can be found in Table 8.

Table 8

Levels of finishes			
Level of Finish	Definition*	Typical jointing/setting	Finish
0	This level of finish may be useful in temporary construction.	No stopping, taping, finishing or accessories are required. The work is confined to gluing or screwing/nailing sheets in place.	For use in areas where finishing and stopping is not considered necessary.
1	For use in plenum areas above ceilings, in areas where the work would generally be concealed, or in building service corridors and other areas not normally open to public view.	Joints and corner joints will be set with Hardie™ Base Coat reinforced with perforated paper tape.	Surface free from excess jointing compound. Tool marks and ridges are generally acceptable.
2	For use in warehouse, storage or other areas where surface appearance is not of primary concern.	Joints and corner joints will be set with Hardie™ Base Coat reinforced with perforated paper tape and Hardie™ Top Coat.	Minor tool marks and ridges are generally acceptable.
3	For use in areas which are to receive heavy or medium texture (spray or hand applied) finishes or where heavy wall paper coverings are to be applied as the final decoration. This level of finish is not generally suitable where smooth painted surfaces or light to medium wall coverings are specified.	Joints and corner joints will be set with Hardie™ Base Coat reinforced with perforated paper tape and Hardie™ Top Coat.	This level of finish must be sufficiently smooth to accept heavy vinyl, tiles or textured coatings without blemishes.
4	This is generally the accepted level of finish for domestic construction. It is used where light textures or wall coverings and smooth textured finishes and satin/flat/low sheen paints are illuminated by non-critical lighting.	Refer to flush jointing recommendations on page 16–17 and steps 1–7 recessed edge joints. All joints and corner joints will have tape embedded in Hardie™ Base Coat applied over all joints, angles, fastener heads and accessories. This application is applicable to recessed edge sheets only. The use of square edge sheets will require a high build application and coating finish.	For use where light-texture coatings, wallpaper or other lightweight wall coverings are to be applied. For painted finishes in non-critical lighting areas flat and low-sheen textured paints are to be applied. Gloss and semi-gloss paints are not generally suitable over this level of finish as any minor blemish will show under critical light. The weight, texture and sheen level of wall coverings applied over this level of finish must be carefully evaluated. Joints and fasteners must be adequately concealed if the wall-covering material is lightweight, contains limited pattern, has a gloss finish, or any combination of these features is present. Unbacked vinyl wall coverings are not suitable over this level of finish.
5	This level of finish is for use where gloss or semi-gloss paints are specified or where critical lighting conditions occur on satin, flat or low sheet paints.	Refer to page 16 steps 1–4 for jointing. Final Hardie™ Base Coat application should be feathered out to approximately 200mm + each side of the joint. Then a full skim coat of Hardie™ Top Coat must be applied over entire sheet surface in order to achieve a uniform finish. This application is applicable to recessed edge sheets only. The use of square edge sheets will require a high build application and coating finish.	This level of finish is for use where gloss, semi-gloss, low-sheen or non-textured paints are specified or where critical lighting conditions occur.

*Reference: AS/NZS 2589.1: 'Gypsum lining in residential and light commercial construction – Application and finishing. Part 1: Gypsum plasterboard'

8.4 Paint Finishes

Prior to the application of paint finishes, remove any residual sanding dust and ensure the surface is suitable for paint application.

Always follow the paint manufacturer's recommendations for paint suitability, mixing and application.

Note: Use of a 'sealer coat' or 'preparation undercoat' is recommended.

8.5 Tiled Applications

Before commencing tiling it is suggested that you refer to the BRANZ 'Good Tiling Practice' guide to fully understand the substrate preparation/installation before tiling, also refer to Table 9 for Villaboard Sheet thickness, stud spacing and tile thickness.

Refer to Clause 5.3 Tiled Walls for fixing Villaboard Lining to framed walls.

Control joints must be provided to accommodate thermal/framing movement and stresses which will generate during the life of the building. Control joints must be carried out through the tiles to the exterior face. Refer to Figure 18.

James Hardie only recommends the use of flexible tile adhesive for tile applications. Refer to adhesive manufacturer for suitability and application information. The size of tiles used over Villaboard Lining are restricted based on thickness of sheet. Refer to Table 9 below.

Square edge sheets can be used for tiled applications. The sheet joint can either be stopped as per Figure 13 or it can be filled with a sealant as per Figure 16.

Note

1. Do not tile ceilings.
2. Tiling must not exceed 3m in height.
3. Provide control joints as per Table 7.
4. The Villaboard Lining joints can be staggered.

Table 9

Villaboard thickness (mm)	Tile thickness (mm)	Sizes		Stud spacing
		Maximum tile weight per m2 (kg)	Tile size max	
6	< 8mm	Up to 15	300 x 300mm	400mm centres maximum
9	> 8mm	15 - 30	300 x 600mm/ 400 x 400mm	600mm centres maximum
9	> 8mm	31 - 60	300 x 600mm/ 400 x 400mm/ 300 x 900mm/ 600 x 600mm/ 900 x 900mm	400mm centres maximum

Support angles are required to transfer the weight of tiles to the framing.

A support angle must be fixed at the base of the wall into the bottom plate. When tiling the full height of the wall, it is recommended that an intermediate support angle fixed into framing is also used to support the weight of tiles. The overall mass of tiles and the support required must be considered and the c/c distance between the support angles should be reduced for tiles thicker than 18mm. Refer to Table 10 for recommended spacing of angle supports.

Table 10

Guidance for consideration	
Tile weight per m² (kg)	Vertical spacing of support angles (metres, max.)
20 - 30	1.6
31 - 42	1.2
43 - 60	0.8

8.6 Maintenance

James Hardie recommends that the cleaning and maintenance of all finishes be undertaken regularly as per the recommendations of the manufacturer. Joints must also be maintained and be free of dirt and grime. Special attention must be given to water proofing membranes and tile adhesives. These must be suitable for the intended application and compatible with other materials they are used in conjunction with.

9 Product Information

9.1 General

Villaboard Lining is a cellulose fibre reinforced cement building product. The basic composition is Portland cement, ground sand, cellulose fibre and water.

Villaboard Lining is manufactured to AS/NZS 2908.2 'Cellulose-Cement Products Part 2: Flat Sheets' (ISO 8336 'Fibre Cement Flat Sheets').

Villaboard Lining is classified Category 3, Type B in accordance with AS/NZS 2908.2.

For Safety Data Sheets (SDS) visit www.jameshardie.co.nz or Ask James Hardie on 0800 808 868.

9.2 Product Mass

Based on equilibrium moisture content the approximate mass of Villaboard Lining is:

- 6mm thick – 8.3kg/m²
- 9mm thick – 12.4kg/m²

9.3 Durability Resistance to Moisture/Rotting

Villaboard Lining has demonstrated resistance to permanent moisture induced deterioration (rotting) and has passed the following tests in accordance with AS/NZS 2908.2:

- Heat rain (Clause 6.5)
- Water permeability (Clause 8.2.2)
- Warm water (Clause 8.2.4)
- Soak dry (Clause 8.2.5)

9.4 Fire Properties

Maximum service temperature for the Villaboard Lining is 60°C.

Villaboard Lining sheet has been tested for heat release rate as per AS/NZS 3837 and the product has a Heat Release Rate below 50 kw/m² and is classified as a non-combustible material.

Villaboard Lining has a 'Group Number' classification of 1-S as per the requirements of clause C of the NZBC.

Product Warranty

James Hardie New Zealand Limited (“James Hardie”) warrants for a period of 15 years from the date of purchase that the Villaboard™ Lining (the “Product”), will be free from defects due to defective factory workmanship or materials and, subject to compliance with the conditions below, will be resistant to cracking, rotting, fire and damage from termite attacks to the extent set out in James Hardie’s relevant published literature current at the time of installation. James Hardie warrants for a period of 15 years from the date of purchase that the accessories supplied by James Hardie will be free from defects due to defective factory workmanship or materials.

Nothing in this document shall exclude or modify any legal rights a customer may have under the Consumer Guarantees Act or otherwise which cannot be excluded or modified at law.

CONDITIONS OF WARRANTY:

The warranty is strictly subject to the following conditions:

- a) James Hardie will not be liable for breach of warranty unless the claimant provides proof of purchase and makes a written claim either within 30 days after the defect would have become reasonably apparent or, if the defect was reasonably apparent prior to installation, then the claim must be made prior to installation;
- b) this warranty is not transferable;
- c) the Product must be installed and maintained strictly in accordance with the relevant James Hardie literature current at the time of installation and must be installed in conjunction with the components or products specified in the literature. Further, all other products, including coating and jointing systems, applied to or used in conjunction with the Product must be applied or installed and maintained strictly in accordance with the relevant manufacturer’s instructions and good trade practice;
- d) the project must be designed and constructed in strict compliance with all relevant provisions of the current New Zealand Building Code (NZBC), regulations and standards;
- e) the claimant’s sole remedy for breach of warranty is (at James Hardie’s option) that James Hardie will either supply replacement product, rectify the affected product or pay for the cost of the replacement or rectification of the affected product;
- f) James Hardie will not be liable for any losses or damages (whether direct or indirect) including property damage or personal injury, consequential loss, economic loss or loss of profits, arising in contract or negligence or howsoever arising. Without limiting the foregoing James Hardie will not be liable for any claims, damages or defects arising from or in any way attributable to poor workmanship, poor design or detailing, settlement or structural movement and/or movement of materials to which the Product is attached, incorrect design of the structure, acts of God including but not limited to earthquakes, cyclones, floods or other severe weather conditions or unusual climatic conditions, efflorescence or performance of paint/coatings applied to the Product, normal wear and tear, growth of mould, mildew, fungi, bacteria, or any organism on any Product surface or Product (whether on the exposed or unexposed surfaces);
- g) all warranties, conditions, liabilities and obligations other than those specified in this warranty are excluded to the fullest extent allowed by law;
- h) if meeting a claim under this warranty involves re-coating of Products, there may be slight colour differences between the original and replacement Products due to the effects of weathering and variations in materials over time.

Disclaimer: The recommendations in James Hardie’s literature are based on good building practice, but are not an exhaustive statement of all relevant information and are subject to conditions (c), (d), (f) and (g) above. James Hardie has tested the performance of the Villaboard™ Lining when installed in accordance with the Villaboard™ Lining installation manual, in accordance with the standards and verification methods required by the NZBC and those test results demonstrate the product complies with the performance criteria established by the NZBC. However, as the successful performance of the relevant system depends on numerous factors outside the control of James Hardie (e.g. quality of workmanship and design) James Hardie shall not be liable for the recommendations made in its literature and the performance of the relevant system, including its suitability for any purpose or ability to satisfy the relevant provisions of the NZBC, regulations and standards, as it is the responsibility of the building designer to ensure that the details and recommendations provided in the relevant James Hardie installation manual are suitable for the intended project and that specific design is conducted where appropriate.

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