

STRUCTURAL BRACING

HARDIBRACE® SHEET BRACING, HARDIFLEX® SHEET,
HARDIPLANK® WEATHERBOARD, LINEA™ WEATHERBOARD,
HARDITEX® BASE SHEET, PANELCLAD® SHEET, PINERIDGE® LINING,
VERSILUX® LINING AND VILLABOARD® LINING

AUSTRALIA
APRIL 2006

DESIGN MANUAL



James Hardie®

1 INTRODUCTION

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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:

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1.1 GENERAL

All buildings require bracing against lateral forces due to wind (and in some instances earthquake). Due to current design trends (open plan spaces, wider window openings etc), the role of bracing is becoming more critical. This is particularly so for houses built on the coastal fringe of Australia north of Latitude 30° (Coffs Harbour in the east, and Green Head in WA) where designs have to cater for cyclonic winds.

This manual describes how to achieve the necessary bracing requirements in timber- and steel-framed houses using HardiBrace® sheet bracing and other James Hardie fibre cement cladding products.

When using products other than HardiBrace sheet bracing ensure that this manual is read in conjunction with the relevant technical specification or installation manual for that product.

For ease of use, the core of this manual has been divided into three parts:

- Section 2 explores **AS 1684-1999 'Residential Timber Framed Construction' ('the code')**, and gives fixing details and bracing capacities for HardiBrace sheet bracing and other James Hardie fibre cement cladding products in accordance with the design requirements of this standard;
- Section 3 gives fixing details and bracing capacities for HardiBrace sheet bracing and other James Hardie fibre cement cladding products fixed with **anchor rods** (normally used in high wind and cyclonic areas) to **timber frames**;
- Section 4 provides fixing details and bracing capacities for James Hardie fibre cement cladding products fixed to **steel frames**.

Unlike previous James Hardie literature on this subject, this manual does not contain design aids for calculating wind forces and bracing units. AS 1684-1999 provides adequate information on fixing of bracing panels to the structural frame.

This manual must be used as a guide only to, but not as a substitute for, AS 1684-1999 because it may be subject to regular amendments and individual designs in this manual may vary from these.

All design capacities quoted are Ultimate Limit State (ULS) figures and have been certified by consulting engineers, Cardno (NSW) Pty Ltd. Permissible stress capacity may be obtained by dividing the ULS value by 1.5.

The specifier or other party responsible for the project must ensure the details in this specification are appropriate for the intended application and that additional detailing is performed for specific design or any areas that fall outside the scope and specifications of this manual.

Make sure your information is up to date

When specifying or installing James Hardie products, ensure you have the current manual. If you're not sure you do, or if you need more information, visit www.jameshardie.com.au or Ask James Hardie™ on 13 11 03.

1.2 BRACING WITH FIBRE CEMENT CLADDING PRODUCTS

Fibre cement (FC) cladding on double-sided or single-sided wall systems can provide resistance against lateral forces or racking shear.

When fixed in accordance with this manual, and properly coated in external applications, thicker cladding products can provide bracing capacity to buildings as well as serving as a wall cladding.

Apart from HardiBrace sheet bracing, the design tables in this manual provide bracing values for other James Hardie cladding products of 6mm or greater thickness. These are:

1. 6mm HardiFlex® sheets;
2. 6mm Villaboard® and Versilux® linings;
3. 6mm PanelClad® sheets and PineRidge® lining;
4. 7.5mm HardiTex® base sheets;
5. All thickness and widths of HardiPlank® and Linea™ weatherboards, provided that fasteners pass through both planks (see note below).

IMPORTANT NOTE

For simplicity, items 1 to 4 will be referred to in the design tables as 6mm JHFC sheets and item 5 as JHFC planks and weatherboards.

2 BRACING FOR TIMBER FRAMING IN ACCORDANCE WITH AS 1684-1999

2.1 TIMBER FRAMING CODE

AS 1684-1999 'Residential Timber Framed Construction' ('the code'), is an extensive revision of the earlier code of practice. It has been issued in four parts:

Part 1: Design criteria

Part 2: Non-cyclonic areas

Part 3: Cyclonic areas

Part 4: Simplified non-cyclonic areas

The main change was the move to Limit State design. With regard to structural bracing, the former Type A and Type B bracing units have been placed into AS 1684.4, the simplified design procedure, which is covered in Clause 2.3 of this manual. In the simplified method, the number of bracing units is determined directly from tables relating to the shape of the building and bracing units are then assigned according to the rules of the code.

Structural bracing using the conventional Limit State design method is covered in Section 8 "Racking and Shear Forces" of both Part 2 and Part 3 of the code. This is covered in Clause 2.4 of this manual. In this method, the total racking force is determined from tabulated data and bracing walls are designed on the basis of their actual kN/m bracing capacity.

Note that throughout the code the wind classifications of AS 4055 'Wind Loads for Housing' have been used:

- In Part 2, the pressures have been tabulated for non-cyclonic wind classifications N1 to N4 (with N5 and N6 ignored);
- In Part 3, the pressures have been tabulated for cyclonic wind classifications C1 to C3 (with C4 ignored).

2.2 TYPES OF BRACING

The code describes two types of bracing against lateral load:

1. Nominal bracing

Nominal bracing is defined as (a) any wall framing lined with fibre cement sheets (or other materials) not fixed in accordance with this manual, and/or (b) with the frames nominally fixed to the floor and the roof or ceiling frame (ie not tied down in accordance with this manual). The capacity depends on whether the simplified design method (Section 2.3 of this manual) or the conventional design method (Section 2.4 of this manual) is used. For framing, fixing and installation of nominal bracing, refer to Clause 8.1.

2. Structural bracing

Also known as "designated" bracing, structural bracing is purpose-fitted bracing such as the James Hardie systems detailed in this manual. Fixing must be as per the instructions given in this manual.

2.3 SIMPLIFIED DESIGN METHOD

2.3.1 Limitations, procedure and other rules

The simplified method given in AS 1684.4 applies only to Class 1 and Class 10 Buildings as defined by the Building Code of Australia (BCA). Clause 1.6 of AS 1684.4 elaborates these limitations as follows:

- single- and two-storey dwellings only;
- a maximum wind classification of N2 (ie non-cyclonic);
- a maximum width of building of 12m excluding eaves;
- a maximum wall height of 2700mm;
- a maximum rafter overhang of 750mm;
- a maximum roof pitch of 30°;
- a maximum rafter spacing of 900mm for tile roofs and 1200mm for sheet roofs;
- spacing of bracing elements not to exceed 9m;
- there are certain maximum building masses for floor framing, wall framing and roof framing.

This would cover the vast majority of homes in urban areas south of 30° latitude.

The design procedure shall be as follows:

- Determine wind classification using Clause 1.6 of AS 1684.4;
- Determine the appropriate house elevation option for single or upper storey or the lower storey of a two-storey building for both wind directions (use the code Figure 8.3);
- Determine the number of bracing units required for each wind direction (use the code Table 8.2);
- Allocate the required number of structural bracing units in conjunction with the amount of nominal bracing if necessary;
- Distribute the bracing units evenly (see the code Figures 8.4 and 8.5).

Other rules and allowances that need to be considered include the following (refer to the code Clause 8.3.2.3 for full details):

- Bracing may be a combination of Type A and/or Type B structural bracing units and/or nominal bracing;
- Nominal bracing shall not constitute more than 50% of the required bracing for each wind direction or in each storey;
- Where structural bracing occurs in the same section of wall as nominal bracing, the nominal bracing in that section of wall shall not be considered as contributing to the house bracing requirements;
- Generally a minimum of two structural bracing units (Type A or Type B) shall be provided in each overall length of external wall in each storey, located as closely as possible to the external corners (see the code for rules of exceptions);
- One Type B unit equals two Type A units;
- Bracing units need to be installed at right angles to the wall area of elevation (ie parallel to wind direction) for which the bracing was defined.

Clause 1.7(f) of AS 1684.4 states that the design capacities are 3kN per 900mm for Type A bracing units and 6kN per 900mm for Type B. These are Ultimate Limit State (ULS) figures.

2.3.2 Nominal bracing

Cladding not fixed in accordance with this manual, or wall frames not connected to the structure in accordance with this manual, is nominal bracing. Respectively a 7m length of single-sided nominal bracing or a 4m length of double-sided nominal bracing constitutes one Type A bracing unit.

2.3.3 Structural Bracing

Apart from using HardiBrace sheet bracing as structural bracing as per Clauses 2.3.6 and 2.3.7 below, Type A and B units can also be achieved with minimum 6mm thick JHFC sheets as detailed in Clause 2.3.8 of this manual. In this simplified method, bracing units must not be less than 900mm wide.

2.3.4 Bracing panels wider than 900mm

Bracing units are generally based on a standard width of 900mm. For wider walls than this, the bracing capacity is increased in direct proportion to the installed width divided by 900. For example, a 1200mm wide section is equivalent to 1200/900 or 1.33 times the bracing resistance of the 900mm unit.

2.3.5 Tie-down requirements

In order to provide structural bracing resistance, the bracing panels must be adequately tied-down to the floor system. For tie-down requirements, refer to AS 1684.4 Clause 8.3.2.7 (bottom) and Clause 8.3.2.8 (top).

2.3.6 Type A bracing units

To achieve Type A bracing capacity (3kN/900mm), fix the HardiBrace sheet bracing in accordance with Figure 1, Section 8 and Clause 2.3.5 of this manual.

2.3.7 Type B bracing units

To achieve Type B bracing capacity (6kN/900mm), fix the HardiBrace sheet bracing in accordance with Figure 2, Section 8 and Clause 2.3.5 of this manual.

2.3.8 Other James Hardie cladding products

Type A or Type B bracing capacities may be achieved with other James Hardie cladding products:

- To achieve **Type A** bracing capacity with 6mm JHFC sheets as defined at Clause 1.2 of this manual, fix sheets in accordance with Figure 1, Section 8 and Clause 2.3.5 of this manual;
- To achieve **Type B** bracing capacities with 6mm JHFC sheets as defined at Clause 1.2 of this manual, fix sheets in accordance with Figure 2, Section 8 and Clause 2.3.5 of this manual.

The bracing rules and methods of determining the required number of bracing units remains the same as previously described.

2.4 CONVENTIONAL LIMIT STATE DESIGN

2.4.1 Design procedure

For a building outside the scope of the simplified method, use the procedure given in both AS 1684.2 and AS 1684.3. In both parts of the code, Clause 8.3.1 states that bracing shall be designed and provided for each storey of the house (and subfloor where required) in accordance with the following procedure:

- (a) Determine the wind classification (see the code Clause 1.6 and AS 1170.2 or AS 4055);
- (b) Determine the wind pressure (see the code Clause 8.3.2);
- (c) Determine the area of elevation (see the code Clause 8.3.3 and Figure 8.2);
- (d) Calculate racking force (see the code Clause 8.3.4);
- (e) Design bracing systems (for walls, see the code Clause 8.3.5 and subfloors see the code Clause 8.3.6);
- (f) Check even distribution and spacing (see the code Clauses 8.3.6.6 and 8.3.6.7 and the code Tables 8.18 and 8.19);
- (g) Check connection of bracing to roof/ceilings and floors (see the code Clauses 8.3.6.9 and 8.3.6.10).

Instead of proportioning bracing units required versus those provided, the actual racking shear capacities of the bracing panels are added up and made to exceed the total racking force calculated. All pressures and forces are Ultimate Limit State (ULS) figures.

2.4.2 Nominal bracing

The two categories, structural wall bracing and nominal wall bracing, exist in this method too and the same rules apply in that nominal bracing (as defined at Clause 2.2 of this manual) may provide no more than 50% of the total required bracing capacity.

The ULS capacity of nominal bracing walls is given by the code as 0.45kN/m for single-sided walls and 0.75kN/m for double-sided walls. The minimum length for which nominal bracing capacity may be claimed is 450mm.

TABLE 1

ULS DESIGN BRACING CAPACITY OF JAMES HARDIE FIBRE CEMENT CLADDING ON TIMBER FRAMES (kN/m)	
HardiBrace sheet bracing fixed with standard nail pattern (see Figure 1)	3.3
HardiBrace sheet bracing fixed with close-nailed pattern (see Figure 2)	6.6
6mm JHFC sheets, single-sided, fixed vertically as per standard HardiBrace sheet bracing (see Figure 1)	3.3
6mm JHFC sheets, single-sided, fixed vertically as per close nailed HardiBrace sheet bracing (see Figure 2)	6.6
6mm JHFC sheets, single-sided, fixed vertically, (see Figure 3,4 or 5b), or horizontally with set joints (see Figure 5a)	2.8
6mm JHFC sheets double-sided, fixed vertically (see Figure 3, 4 or 5b)	4.0
6mm JHFC sheets double-sided, fixed horizontally with set joints (see Figure 5a)	4.0
6mm JHFC sheets, fixed vertically (see Figure 3, 4 or 5b) or horizontally with joints set (see Figure 5a) + (JHFC planks or weatherboards on other side (see Figures 6 and 7)	3.2
JHFC planks or weatherboards on one side only See Figures 6 and 7	2.0
Linea weatherboards on one side of frame only using face fixing method (see Figure 8)	3.4
Linea weatherboards on one side of frame using face fixing method (see Figure 8) + 6mm JHFC sheets, fixed vertically (see Figure 3, 4 or 5b), or horizontally with joints set (see Figure 5a)	4.1

For permissible stress capacity divide by 1.5

NOTES FOR TABLE 1

1. If the bracing panel occurs in isolation within a length of wall and is not connected to any cross-wall, then the capacity given in Table 1 must be reduced by 30%.
2. For definition of 6mm JHFC sheets see the note at Clause 1.2 of this manual. Thicker sheets are assumed to provide at least the tabulated value.
3. If JD5 grade timber is used in the framing, then the capacity given in Table 1 must be reduced by 12.5%.
4. Butt joints are permitted in vertical sheets provided that both sheet edges are fixed to a nogging with fasteners at the same spacing as nominated for the top and bottom edges.
5. For horizontally fixed sheets, if edges at a butt joint are not fixed to a nogging behind the joint, then the joint needs to be properly tape-set in order to claim the tabulated design bracing capacity.

2.4.3 Structural Bracing

Table 1 provides the ULS design capacities for the James Hardie fibre cement products that may be used as designated structural bracing in this procedure.

Where greater bracing capacities are required, anchor rods may be used and the values in Table 4 (in Section 3 of this manual) claimed.

2.4.4 Wall height and capacity modification

The capacity of bracing walls is given for a standard wall height of 2700mm and decreases as the height increases. Refer to Clause 8.3.6.4 of both Parts 2 and 3 of the code, interpreted as in Table 2.

TABLE 2

REDUCTION FACTORS FOR HEIGHT	
PANEL HEIGHT (mm)	BRACING REDUCTION FACTOR
2700	1.0
3000	0.9
3300	0.8
3600	0.75

Intermediate values may be interpolated.

2.4.5 Panels less than 900mm wide

Generally the minimum width of a designated bracing panel is 900mm, although exceptions are permitted with reference to Clause 8.3.6.5 of both Parts 2 and 3 of the code. This is interpreted in Table 3.

TABLE 3

REDUCTION FACTORS FOR HEIGHT	
LENGTH OF NARROW BRACING PANEL (mm)	BRACING REDUCTION FACTOR
900	1.0
800	0.83
750	0.75
700	0.66
600	0.50
500	0.33
450	0.30

Ensure that an intermediate stud is used for bracing panels over 600mm in width.

2.4.6 Location, distribution and spacing of bracing walls

Refer to Clause 8.3.6.6 of both Parts 2 and 3 of the code for required location and distribution and Clause 8.3.6.7 for spacing rules.

2.4.7 Tie-down requirements

In order to achieve structural bracing resistance (as defined at Clause 2.1.2 of this manual) the bracing panel needs to be tied into the structure. For tie-down requirements, refer to Clause 8.3.6.9 (top of wall) and Clause 8.3.6.10 (bottom of wall) in both Parts 2 and 3 of the code.

2.4.8 Other James Hardie cladding products

The 6mm JHFC sheet products (as defined at Clause 1.2 of this manual) as well as the plank and weatherboard range provides structural bracing capacity as given in Table 1. Fixing details for the different products are given below.

(a) HardiFlex sheets, PineRidge lining and PanelClad sheets

- Non-cyclonic areas: sheets fixed vertically in accordance with Figure 3, Section 8 and Clause 2.4.7 of this manual will achieve the bracing capacities stated in Table 1.
- Cyclonic areas: sheets fixed vertically along with anchor rods in accordance with Figure 3, Section 8 and Clause 3.3 of this manual will achieve the values stated in Table 4.

(b) HardiTex base sheets

- Non-cyclonic areas: sheets fixed vertically in accordance with Figure 4, Section 8 and Clause 2.4.7 of this manual will achieve the bracing capacities stated in Table 1.
- Cyclonic areas: sheets fixed vertically along with anchor rods in accordance with Figure 4, Section 8 and Clause 3.3 of this manual will achieve the values stated in Table 4.

(c) Villaboard and Versilux linings

- Non-cyclonic areas: sheets fixed vertically or horizontally in accordance with Figure 5, Section 8 and Clause 2.4.7 of this manual will achieve the bracing capacities stated in Table 1.
- Cyclonic areas: sheets fixed vertically or horizontally along with anchor rods in accordance with Figure 5, Section 8 and Clause 3.3 of this manual will achieve the values stated in Table 4.

(d) Planks and weatherboards external cladding

- Non-cyclonic areas: The bracing capacity stated in Table 1 applies to all JHFC planks and weatherboards, when fixed in accordance with Figure 6, Section 8 and Clause 2.4.7 of this manual.
- Cyclonic areas: The bracing capacity stated in Table 4 applies to all JHFC planks and weatherboards, when fixed along with anchor rods in accordance with Figure 6, Section 8 and Clause 3.3 of this manual.
- In both the above cases, JHFC planks and weatherboards must be fixed at 150mm maximum centres along top and bottom plates as shown in Figure 7. For Linea weatherboard however, this figure must be 75mm.
- For Linea weatherboard fixing, see Figure 8.

3 BRACING FOR TIMBER FRAMING WITH ANCHOR RODS

3.1 INTRODUCTION

This section details James Hardie fibre cement sheet cladding used for bracing with timber framing and anchor rods, specifically for winds in cyclonic areas. These rods provide resistance against uplift forces and add to the racking capacity of the wall panels.

Bracing capacities quoted in this section were proved by testing in consultation with the James Cook Cyclone Structural Testing Station.

3.2 BRACING RESISTANCE CAPACITIES

Table 4 provides the ULS design bracing capacities of HardiBrace sheet bracing, 6mm JHFC sheets, JHFC planks and weatherboards used with anchor rods when fixed in accordance with the relevant parts of this manual.

TABLE 4

ULS DESIGN BRACING CAPACITY OF JAMES HARDIE FIBRE CEMENT CLADDING ON TIMBER FRAMES WITH ANCHOR RODS (kN/m)	
HardiBrace sheet bracing fixed with standard nail pattern (see Figure 1)	6.6
HardiBrace sheet bracing fixed with standard nail pattern (see Figure 1) + 6mm JHFC sheets other side, fixed vertically (see Figure 3, 4 or 5b), or horizontally with set joints (see Figure 5a)	10.0
6mm JHFC sheets, single-sided, fixed vertically (see Figure 3, 4 or 5b) or horizontally with set joints (see Figure 5a)	5.3
6mm JHFC sheets, double-sided, fixed vertically (see Figure 3, 4 or 5b) or horizontally with set joints (see Figure 5a)	7.3
JHFC planks or weatherboards (see Figure 6 and 7) + 6mm JHFC sheets other side, fixed vertically (see Figure 3, 4 or 5b) or horizontally with set joints (see Figure 5a)	6.6
JHFC planks or weatherboards, single-sided (see Figure 6 and Figure 7)	2.4
Linea weatherboards on one side of frame only using face fixing method (see Figure 8)	5.6
Linea weatherboards on one side of frame using face fixing method (see Figure 8) + 6mm JHFC sheets, fixed vertically (see Figure 3, 4 or 5b), or horizontally with joints set (see Figure 5a)	6.8

For permissible stress capacity divide by 1.5

NOTES FOR TABLE 4

- For definition of 6mm JHFC sheets see Clause 1.2 of this manual. Thicker sheets are assumed to provide at least the tabulated value.
- The tabulated bracing strengths relate to 600mm maximum stud centres.
- The capacities apply to bracing sheets up to 2700mm high and not less than 900mm wide. If different, refer respectively to Clauses 2.4.4 and 2.4.5 of this manual.
- For horizontally fixed sheets, if edges at a butt joint are not fixed to a nogging, then the joint needs to be properly tape-set in order to claim the tabulated design bracing capacity.

3.3 ANCHOR ROD DETAIL AND TIE-DOWN

Anchor rods must be 12mm diameter, full-length mild steel (M12) rods tying the wall top plate through the frame cavity to the sub-structure.

A standard 38mm diameter flat round washer must be used under each nut.

Anchor rods must be placed at both ends of each section of the bracing wall and at not more than 2.4m centres.

Anchor rods must be located within 100mm of the adjacent face of the stud ends. See Figure 9.

Between anchor rods, one M10 hold-down bolt must be provided at a maximum of 1.2m centres to further fix the bottom plate to the sub-structure.

Fixing of the timber frames into the structure (ie "tie-down") must comply with government building regulations and/or AS 1684.3-1999. Refer to the code Clauses 8.3.6.9 (top) and 8.3.6.10 (bottom).

4 BRACING FOR STEEL FRAMING

4.1 INTRODUCTION

Extensive testing conducted at the James Hardie R&D laboratory and at the James Cook Cyclone Structural Testing Station has formed the basis of the information and the design capacities quoted in this section.

4.2 BRACING RESISTANCE CAPACITY

Table 5 shows the bracing capacity of HardiBrace sheet bracing and other James Hardie cladding products when fixed to 0.55mm and 0.75mm light gauge steel frames or 1.2mm and 1.6mm medium gauge, welded steel frames.

NOTE

Only the values tested are shown in Table 5. Other values may, in certain instances, be interpolated with experience and due diligence.

The bracing capacities are achieved by using the fixing methods outlined in Clause 4.4 and Section 8 of this manual.

Design capacities were determined in accordance with AS 3623-1993 for 2700mm high panels unless noted otherwise.

The minimum length of a bracing wall or panel must be 900mm. The maximum wall length to which the capacities apply is 3600mm.

4.3 FRAMING CONNECTIONS

0.55mm to 0.95mm light gauge steel frames:

The studs need to be fixed to the top and bottom tracks by screws, rivets, bolts or mechanical crimping.

1.0mm to 1.6mm medium gauge steel frames:

The connections may be welded or rivetted, noting that the design bracing capacity is 20% lower for the rivetted frames.

4.4 TIE-DOWN REQUIREMENTS

0.55mm to 0.95mm light gauge steel frames:

Provide M10 minimum hold-down bolts with 50 x 50 x 3mm distribution washers at the two outside frame studs and M6 minimum hold-down bolts with 32mm diameter 2.5mm thick round washers at the interior studs. All bolts to be placed within 45mm of the stud.

0.95mm to 1.6mm medium gauge steel frames:

Provide M12 minimum hold-down bolts with 75 x 70 x 6mm distribution washers at 900mm centres and within 70mm of the face of studs.

NOTES FOR TABLE 5

1. HardiBrace sheet bracing must not be used as exposed, finished, external cladding.
2. Bracing capacity can only be claimed for JHFC plank or weatherboard cladding if screws pass through both planks. See Figure 6.
3. For rivetted frames of 1.2 and 1.6mm gauge, the tabulated bracing capacities must be multiplied by a factor of 0.8.
4. For definition of 6mm JHFC sheets see Clause 1.2 of this manual. Thicker sheets are assumed to provide at least the tabulated value.
5. Butt joints are permitted in vertical sheets provided that both sheet edges are fixed to a nogging with fasteners at the same spacing as nominated for the top and bottom edges.
6. For horizontally fixed sheets: if edges at a butt joint are not fixed to a nogging, then the joint needs to be properly tape-set in order to claim the tabulated design bracing capacity.
7. For external sides of walls, 6mm Villaboard lining must be replaced by properly coated 6mm HardiFlex or 7.5mm HardiTex sheets.

TABLE 5

ULS BRACING CAPACITY OF JAMES HARDIE FIBRE CEMENT CLADDING ON STEEL FRAMES							
MATERIAL	FIXING DETAILS	STUD SPACING (mm)	SCREW SPACING (mm) A/B/C (See Figure 10)	BRACING CAPACITY (kN/m)			
				Light gauge steel frames		Welded steel frames (see Note 3)	
				0.55mm BMT studs	0.75mm BMT studs	1.2mm BMT studs	1.6mm BMT studs
5mm HardiBrace sheet bracing (see Note 1)	Single-sided, fixed vertically, joints (if any) not set	600	100/100/150	5.4	6.0*	-	-
		450	100/100/150	6.0	6.2	-	8.5
		300	100/100/150	-	-	-	8.8
7.5mm HardiTex base sheet	Single-sided, fixed vertically, joints (if any) not set	600	200/200/200	3.6	3.8	-	-
		450	200/200/200	-	-	-	5.1
6mm JHFC sheets (see Note 4) (see Note 7)	Single-sided, fixed vertically, joints (if any) not set	600	200/200/200	3.0	3.3	-	-
		450	200/200/200	-	-	5.8	6.0
		300	200/200/200	-	-	-	7.5
7.5mm JHFC planks or weatherboards	Single-sided	600	See Note 2 and Figures 6 and 7	2.1	2.2	-	-
		450	See Note 2 and Figures 6 and 7	-	-	-	2.4
		300	See Note 2 and Figures 6 and 7	-	-	-	3.6
	Double-sided, internal lining 6mm JHFC sheets (see Note 4), fixed vertically (joints not set, see Note 5) or horizontally (joints tape set, see Note 6)	600	See Note 2 and Figures 6 and 7 For 6mm JHFC sheets: 200/200/200	3.9	4.0	-	-
		450	See Note 2 and Figures 6 and 7 For 6mm JHFC sheets: 200/200/200	-	-	-	6.7
		300	See Note 2 and Figures 6 and 7 For 6mm JHFC sheets: 200/200/200	-	-	-	-
6mm JHFC sheets (see Note 4) (see Note 7)	Single-sided, fixed horizontally, joints not set	600	200/200/200	2.4	2.7	-	-
		600	200/200/200	4.2	4.5	-	-
	Double-sided, fixed vertically, joints (if any) not set	600	200/200/200	5.6	5.7	-	-
		450	200/200/200	-	-	6.0	7.8
		300	200/200/200	-	-	-	11.0
	Double-sided, fixed horizontally, joints not set	600	200/200/200	3.8	4.2	-	-
600		200/200/200	5.6	5.6	-	-	
16mm Linea weatherboard	Single-sided	600	See Note 2 and Figure 8	3.6	3.6	-	-
	Double-sided, internal lining 6mm JHFC sheets (see Note 4), fixed vertically (joints not set, see Note 5) or horizontally (joints tape set, see Note 6)	600	See Note 2 and Figure 8. For 6mm JHFC sheets 200/200/200	4.5	4.5	-	-

* For 2700mm high frames, this figure is 5.4kN/m

5 SAFE WORKING PRACTICES

NOTE

The information in this section is relevant for HardiBrace sheet bracing only. For other products refer to the relevant technical specification or installation manual.

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

James Hardie products contain sand, a source of respirable crystalline silica which is considered by some international authorities to be a cause of cancer from some occupational sources. Breathing excessive amounts of respirable silica dust can also cause a disabling and potentially fatal lung disease called silicosis, and has been linked with other diseases. Some studies suggest smoking may increase these risks. During installation or handling: (1) work in outdoor areas with ample ventilation; (2) minimise dust when cutting by using either 'score and snap' knife, fibre cement shears or, where not feasible, use a HardiBlade® saw blade and dust-reducing circular saw attached to a HEPA vacuum; (3) warn others in the immediate area to avoid breathing dust; (4) wear a properly-fitted, approved dust mask or respirator (e.g. P1 or P2) in accordance with applicable government regulations and manufacturer instructions to further limit respirable silica exposures. During clean-up, use HEPA vacuums or wet cleanup methods - never dry sweep. For further information, refer to our installation instructions and Material Safety Data Sheets available at www.jameshardie.com.au. FAILURE TO ADHERE TO OUR WARNINGS, MATERIAL SAFETY DATA SHEETS, AND INSTALLATION INSTRUCTIONS MAY LEAD TO SERIOUS PERSONAL INJURY OR DEATH.

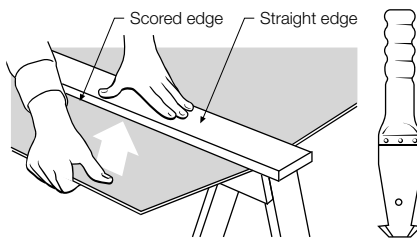
WORKING INSTRUCTIONS

Refer to recommended safe working practices before starting any cutting or machining of product.

Score and snap

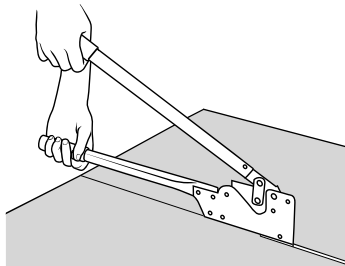
Score and snap is a fast and efficient method of cutting James Hardie building products using James Hardie's special tungsten tipped score and snap knife.

Preferably score on the face side of the product. Score against a straight edge and repeat the action to obtain adequate depth for clean break – normally one third of sheet thickness. Snap upwards to achieve break. Smooth any rough edges with a rasp.



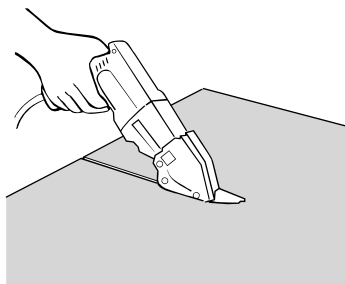
Hand guillotine

Make guillotine cut on the off-cut side of line to allow for the thickness of the blade.



Fibreshear

An electrically powered, fast, clean and effortless way of cutting James Hardie building products, especially around curves such as archways. Make fibreshear cut on the 'off-cut' side of the line to allow for the thickness of the shear.



JAMES HARDIE RECOMMENDED SAFE WORKING PRACTICES

CUTTING OUTDOORS

1. Position cutting station so wind will blow dust away from the user or others in working area.
2. Use one of the following methods based on the required cutting rate:
 - Best**
 - Score and snap
 - Hand guillotine
 - Fibreshear
 - Better**
 - Dust reducing circular saw equipped with HardiBlade® saw blade and HEPA vacuum extraction.
 - Good**
 - Dust reducing circular saw equipped with HardiBlade® saw blade.

CUTTING INDOORS

- Cut only using score and snap, hand guillotine or fibreshears (manual, electric or pneumatic).
- Position cutting station in a well-ventilated area.

DRILLING/OTHER MACHINING

When drilling or machining you should always wear a P1 or P2 dust mask and warn others in the immediate area.

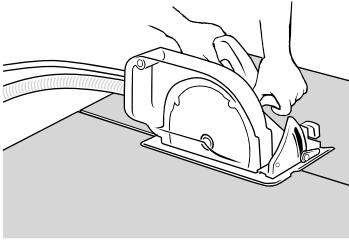
IMPORTANT NOTES

1. For maximum protection (lowest respirable dust production), James Hardie recommends always using "Best" - level cutting methods where feasible.
2. NEVER use a power saw indoors.
3. NEVER use a circular saw blade that does not carry the HardiBlade® logo.
4. NEVER dry sweep - Use wet suppression or HEPA vacuum.
5. NEVER use grinders.
6. ALWAYS follow tool manufacturers' safety recommendations.

P1 or P2 respirators should be used in conjunction with above cutting practices to further reduce dust exposures. Additional exposure information is available at www.jameshardie.com.au to help you determine the most appropriate cutting method for your job requirements. 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.

HardiBlade® saw blade

The HardiBlade® saw blade used with a dust-reducing saw and HEPA vacuum extraction allows for fast, clean cutting of James Hardie fibre cement products. A dust-reducing saw uses a dust deflector or a dust collector which can be connected to a vacuum system. 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.



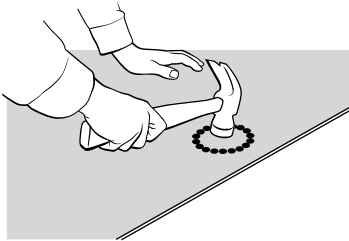
HOLE-FORMING

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 the sheet edges are properly supported.



STORAGE AND HANDLING

To avoid damage, all James Hardie building products should be stored with edges and corners of the sheets protected from chipping.

James Hardie building products must be installed in a dry state and protected from rain during transport and storage. The product must be laid flat under cover on a smooth level surface clear of the ground to avoid exposure to water, moisture, etc.

QUALITY

James Hardie conducts stringent quality checks to ensure any product manufactured falls within our quality spectrum. It is the responsibility of the builder to ensure the product meets aesthetic requirements before installation. James Hardie will not be responsible for rectifying obvious aesthetic surface variations following installation.

6 PRODUCT INFORMATION

NOTE

The information in this section is relevant for HardiBrace sheet bracing only. For other products refer to the relevant technical specification or installation manual.

6.1 GENERAL

HardiBrace sheet bracing, is a cellulose fibre reinforced cement building product. The basic composition is Portland cement, ground sand, cellulose fibre and water.

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

HardiBrace sheet bracing is classified Type A, Category 2 in accordance with AS/NZS 2908.2 'Cellulose-Cement Products'.

For Material Safety Data Sheets (MSDS) visit www.jameshardie.com.au or Ask James Hardie™ on 13 11 03.

6.2 PRODUCT MASS

Based on equilibrium moisture content the approximate mass of HardiBrace sheet bracing is 6.7kg/m².

6.3 DURABILITY

6.3.1 Resistance to moisture/rotting

HardiBrace sheet bracing has demonstrated resistance to permanent moisture induced deterioration (rotting) by passing the following tests in accordance with AS/NZS2908.2:

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

6.3.2 Resistance to fire

HardiBrace sheet bracing is suitable where non-combustible materials are required in accordance with C1.12 of the Building Code of Australia.

HardiBrace sheet bracing has been tested by CSIRO and is classified as a Group 1 material in accordance with Specification C1.10a of the BCA.

HardiBrace sheet bracing has the following early fire hazard indices (tested to AS 1530 Part 3).

EARLY FIRE HAZARD INDICES (TESTED TO AS1530) PART 3

Ignition index	0
Flame spread index	0
Heat evolved index	0
Smoke developed index	0 - 1

6.3.3 Resistance to termite attack

Based on testing completed by CSIRO Division of Forest Products Report Numbers FP349 and FP274 James Hardie fibre cement has demonstrated resistance to termite attack.

6.4 ALPINE REGIONS

In regions subject to freeze/thaw conditions, fibre cement external cladding must be painted. In addition, fibre cement cladding must not be in direct contact with snow and/or ice build up for extended periods, e.g. external walls in alpine regions subject to snow drifts over winter.

Tested for resistance to frost in accordance with AS/NZS2908.2 Clause 8.2.3.

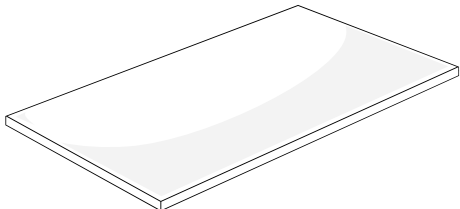
7 COMPONENTS

The following checklist describes the components required to install HardiBrace sheet bracing.

Timber or steel framing may be used, but must comply with relevant building regulations and standards and the requirements of this manual.

Mass includes timber packing for transport.

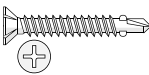

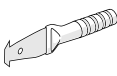
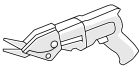
HARDIBRACE SHEET BRACING SIZES (5mm THICKNESS)

	Description: square edge, pink sheet.		
	Mass: 6.7kg/m ²		
	Length (mm):	Width (mm):	Thickness (mm):
	2440	925 1225	5 5
2725	925 1225	5 5	

Not available in WA.

Selling unit: square metre (m²).

JAMES HARDIE HARDIBRACE SHEET BRACING COMPONENTS

	HardiDrive® screw For light gauge steel frames 0.75mm to 1.6mm thick NOTE: Contact your fastener manufacturer for fasteners with suitable corrosion resistance.	8g x 22mm 8g x 32mm
	HardiBlade® saw blade 185mm poly diamond blade, for fast, clean cutting of James Hardie fibre cement.	HardiBlade® saw blade Selling unit: each
	JH score and snap knife Tugsten tipped scoring tool for easy cutting.	
	Fibreshear Electric cutting tool.	

COMPONENTS NOT SUPPLIED BY JAMES HARDIE

Fibre cement nail Galvanised nails for timber	2.8mm x 30mm, 2.8mm x 40mm and 2.8mm x 50mm
Buildex FibreTEKS® For light gauge steel frames 0.55 to 0.75mm thick <small>® denotes a registered mark of Buildex</small>	N° 8 x 20mm

8 FRAMING, FIXING AND INSTALLATION DETAILS FOR HARDIBRACE SHEET BRACING

8.1 GENERAL

This section sets out the framing, fixing and installation recommendations for HardiBrace sheet bracing.

For framing, fixing and installation recommendations for **other James Hardie cladding products** mentioned in this manual, refer to the following manuals:

- Villaboard lining, Versilux lining, PineRidge lining:
James Hardie internal lining range Fixing Manual
- HardiTex base sheets:
James Hardie HardiTex system Technical Specification
- HardiFlex sheets, PanelClad sheets:
James Hardie external cladding Technical Specification
- HardiPlank® cladding:
James Hardie external cladding Technical Specification

NOTE

To achieve structural bracing using these products, you must use the fastener spacing and hold-down recommendations of this manual instead of those set out in the individual James Hardie fixing manuals.

TABLE 6

GUN NAILING NOTES				
COIL NAILER		NAILS		
Manufacturer	Name	Manufacturer	Name	Size
Hitachi	VH650 coil nailer	Otter	Galv. coil nail	38mm x 2.5mm dia. 45mm x 2.2mm dia. 50mm x 2.2mm dia.
Paslode	Impulse compact nailer (B20544)	Paslode	Impulse DekFast® 50mm Value Pack (B20561V)	50mm x 2.87mm dia.
			Impulse DekFast® 50mm Handy Pack (B20557)	50mm x 2.87mm dia.
Duo-Fast	KD665A coil nailer (Part No. D40040)	Duo-Fast	C27/32 GD coil nail (D41800)	32mm x 2.7mm dia.
Stanley-Bostitch	N80C coil nailer	Stanley-Bostitch	AC45P250 gal coil nail	45mm x 2.5mm dia.
Senco	SCN-60 coil nailer (fitted with adjustable depth of drive)	Senco	BTN 45 ADB Weatherex Gal and Sencoted	45mm x 2.5mm dia.

NOTES

1. Fasteners with equivalent dimensions, (ie head size and shape, shank diameter and length to those above) are acceptable for use.
2. All fasteners are to be galvanised or suitably coated for intended external application.
3. Nailing guns must be fitted with flush drive attachments.
4. Some nailing guns incorporate an adjustable head set to control nail depth (eg Duo-Fast coil nailer and Senco coil nailer.)
5. When gun nailing, apply pressure to the face of the cladding by holding the cladding against the stud to reduce blow out at back of the sheet.

Nail gun manufacturers have supplied the information contained in this table. Should a nail gun model or nail shown in the table not be available, please contact the relevant nail gun manufacturer for advice.

If the nail gun overdrives sheets, contact nail gun manufacturer for advice.

8.2 FRAMING

8.2.1 General

HardiBrace sheet bracing can be fixed to either timber or domestic steel framing. The framing used must comply with the relevant building regulations and standards and the requirements of this manual.

Frames must be straight and true to provide a flush face to receive the sheeting.

8.2.2 Timber

Use only seasoned timber. Unseasoned timber must not be used as it is prone to shrinkage and can cause sheets to move.

'Timber used for house construction must have the level of durability appropriate for the relevant climate and expected service life and conditions; that is exposure to insect attack or to moisture, which could cause decay'.

Reference AS1684.2 'Residential Timber Framed Construction'.

8.2.3 Steel

The base metal thickness (BMT) of a steel frame must be between 0.55mm and 1.6mm.

8.3 FIXING

8.3.1 General

You must select a fastener that is suitable for the type of frame you are using.

8.3.2 Fastener corrosion protection

Fasteners must have the appropriate level of durability required for the intended project. This is of particular importance in coastal areas, areas subject to salt spray and other corrosive environments.

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

Contact fastener manufacturers for more information.

NOTE

Fasteners must be at least Class 3 external grade finish.

8.3.3 Fixing depth

Nail sheets and boards in accordance with the nailing details shown in this manual. Do not overdrive the nails. Proud nailing is desirable, but flush head nailing is acceptable. See Figure 11.

8.3.4 Fastening to timber

Use 2.8 x 30mm hot-dipped galvanised fibre cement nails when hand nailing.

HardiBrace sheet bracing can be gun-nailed onto timber frames using flat head nails. Suitable combinations are shown in Table 6.

8.3.5 Fastening to steel

For steel framing of thickness 0.55mm to 0.75mm BMT, 20mm Buildex FibreTEKS self drilling screws.

For steel framing of thickness 0.75mm to 1.6mm. Use 8g - 22mm or 8g - 32mm HardiDrive® grey external grade screws.

Fasteners should be screwed as close as possible to the stud corners to avoid deflection of the stud flange. See Figure 12.

8.3.6 Screw gun specification

Use variable speed screw guns with high torque, a maximum speed of 2500rpm, fitted with a depth control attachment.

Set the depth control attachment to avoid overdriving. As the screw thread begins to pull into the steel frame, drop the revs back to bed the head flush with the surface of the sheet.

8.4 INSTALLATION DETAILS

8.4.1 General

HardiBrace sheet bracing can be used for cavity bracing in brick veneer construction or internally in locations such as behind built-in full-height cupboards or robes.

For fastener spacings and hold-down recommendations, refer in this manual to:

- Clause 2.2 for the simplified design method or Clause 2.3 for the conventional Limit State design method for timber framing;
- Clauses 3.2 and 3.3 for timber framing with cyclone rods;
- Figure 10 and Clause 4.4 for steel framing.

NOTE

HardiBrace sheet bracing must not be used as exposed, finished, external cladding.

8.4.2 Brick ties

Brick ties can be installed through HardiBrace sheet bracing. Simply refer to the hole forming recommendations in Section 5. Ensure the hole is not greater than 50mm diameter through the sheet to allow insertion of brick ties. See Figure 13.

9 DETAILS

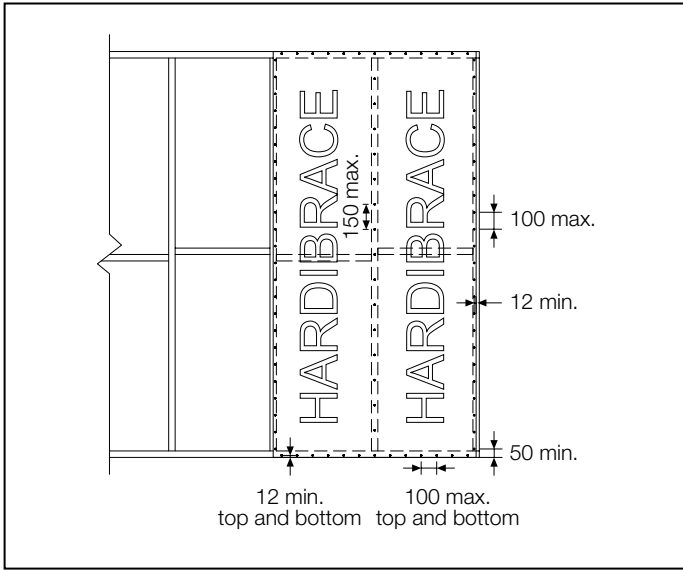


FIGURE 1 TYPE A NAILING DETAIL

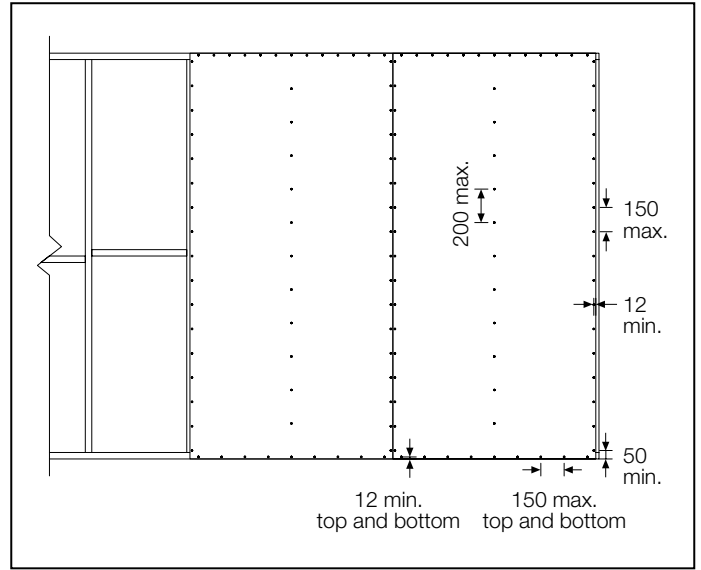


FIGURE 3 NAILING DETAIL FOR HARDIFLEX SHEETS, PINERIDGE LINING OR PANELCLAD SHEETS

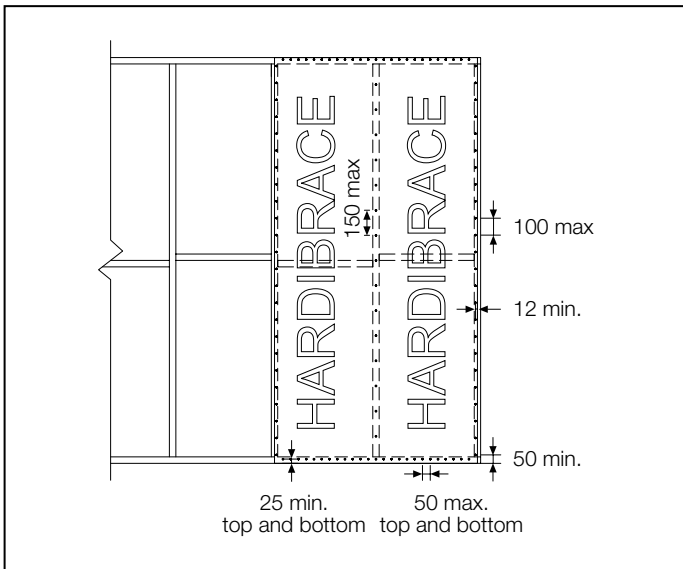


FIGURE 2 TYPE B NAILING DETAIL

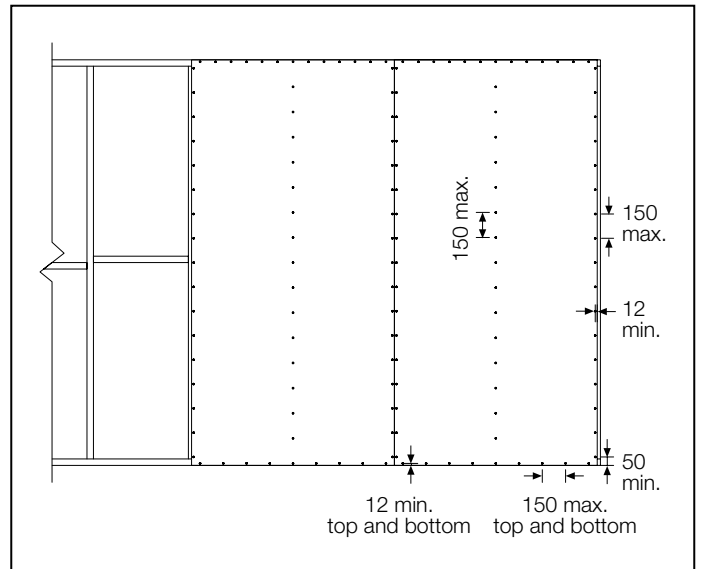


FIGURE 4 NAILING DETAIL FOR HARDITEX BASE SHEETS

NOTE
Nails along the top and bottom plates should be 25mm from the edge of the sheet for 50mm thick plates. When 38mm nominal thick plates are used, reduce edge distance to 20mm.

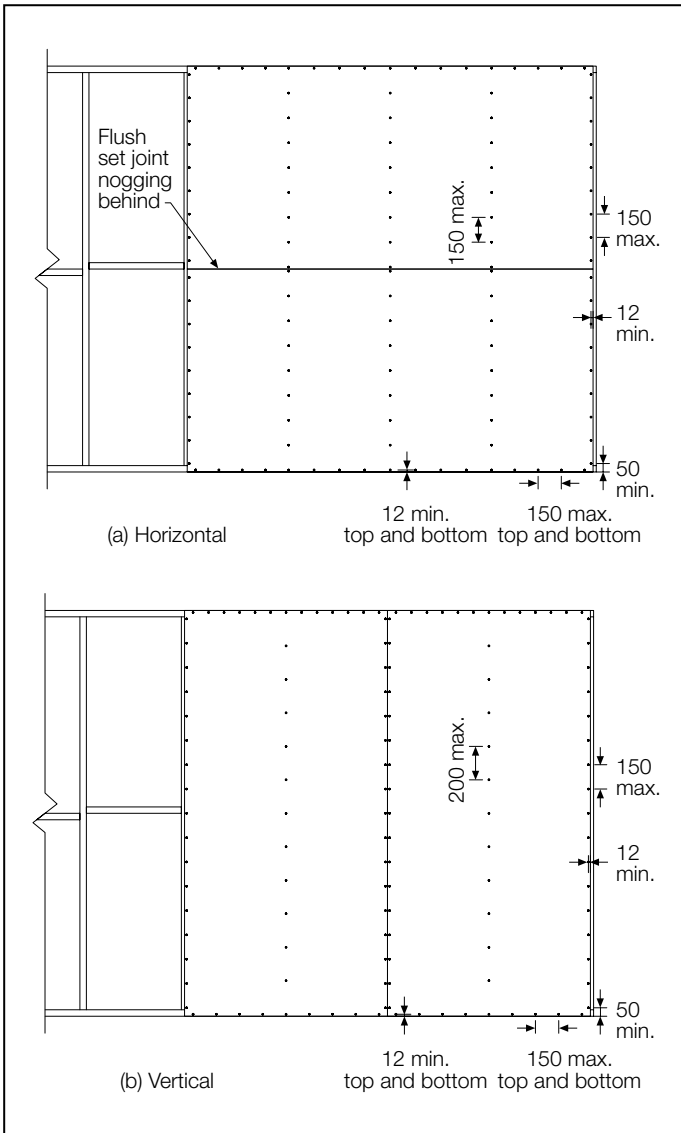


FIGURE 5 NAILING DETAIL FOR VILLABOARD SHEETS OR VERSILUX LINING

NOTE

For details of tiling over these Villaboard linings, refer to the James Hardie Villaboard lining Installation Manual.

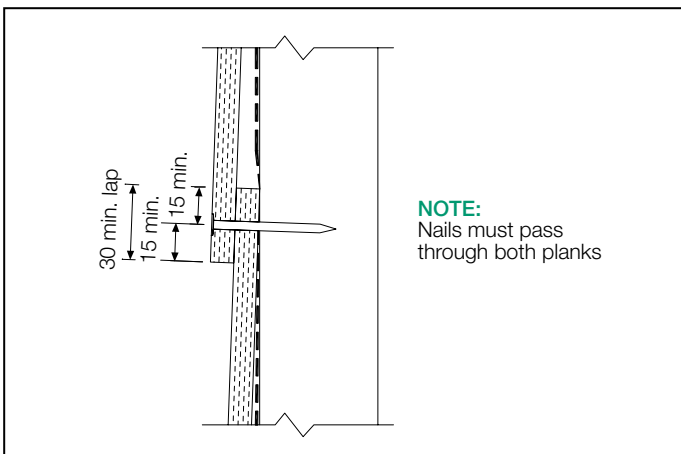


FIGURE 6 NAILING DETAIL FOR HARDIPLANK

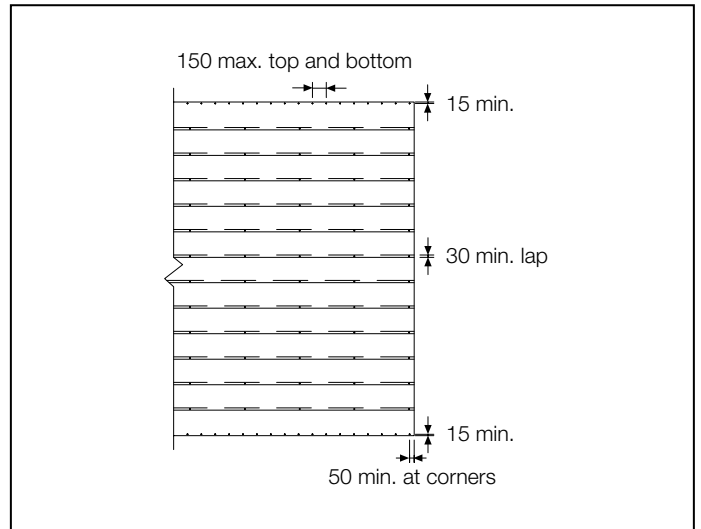


FIGURE 7 NAILING SPACING DETAIL FOR JHFC PLANKS OR WEATHERBOARDS

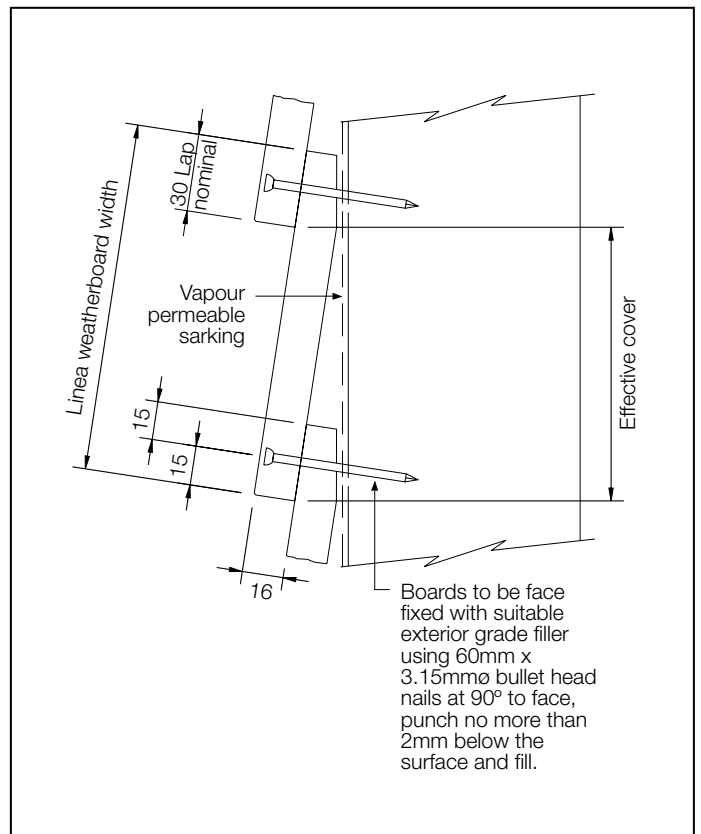


FIGURE 8 NAILING DETAIL FOR LINEA WEATHERBOARDS

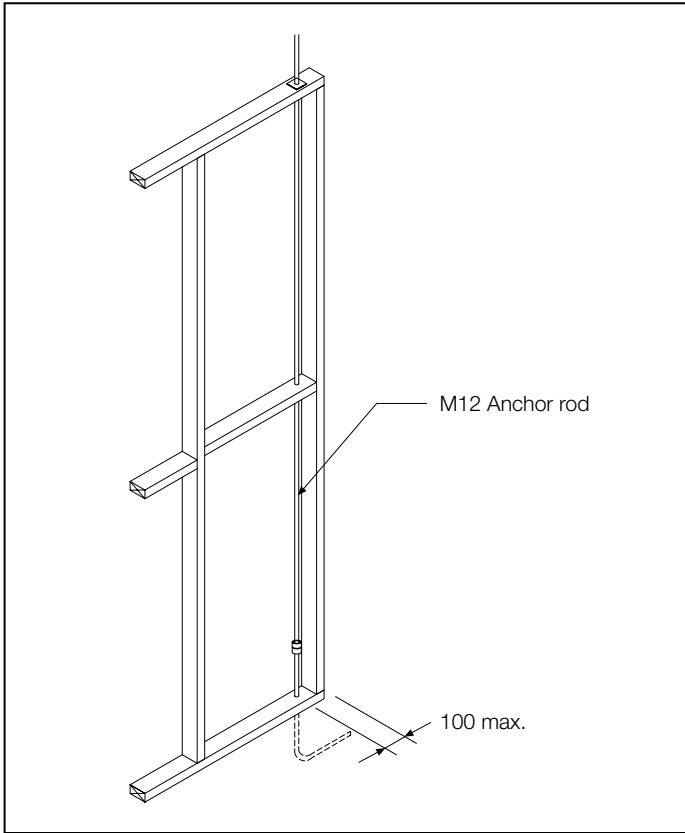


FIGURE 9 ANCHOR ROD DETAIL

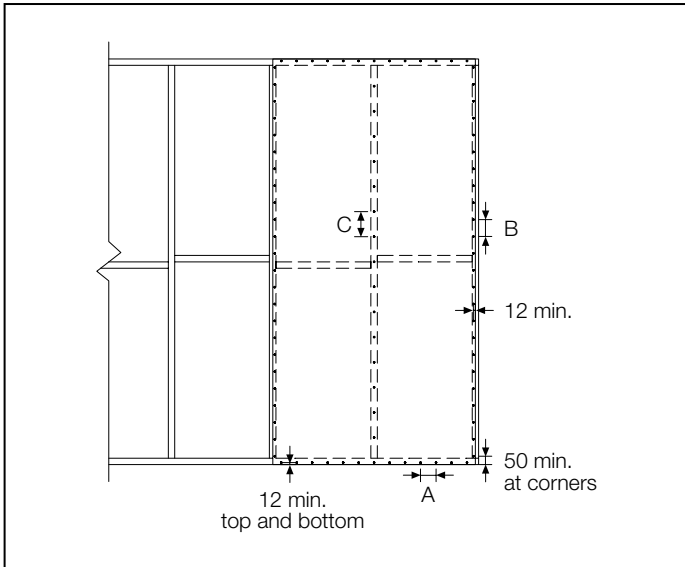


FIGURE 10 SCREW SPACING DETAIL

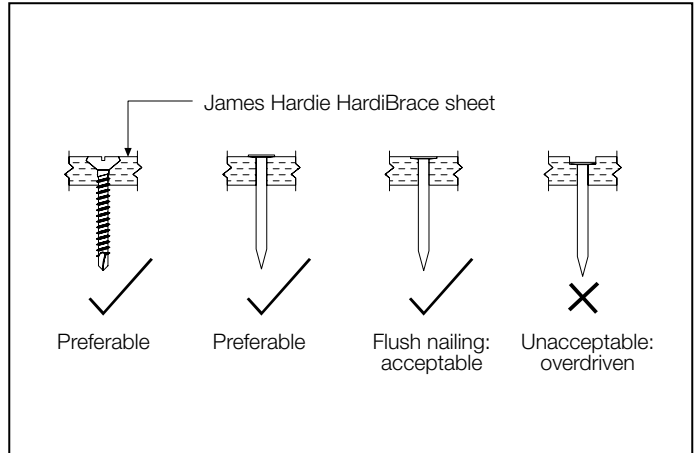


FIGURE 11 NAIL FASTENER DEPTH

NOTE

HardiBrace sheet bracing will not straighten excessively warped or distorted frames and any warping may be visible after the internal lining is applied.

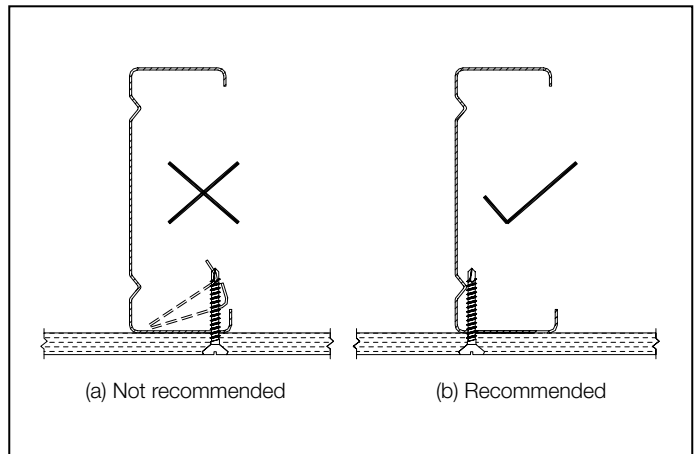


FIGURE 12 SCREW FASTENING TO STEEL FRAME

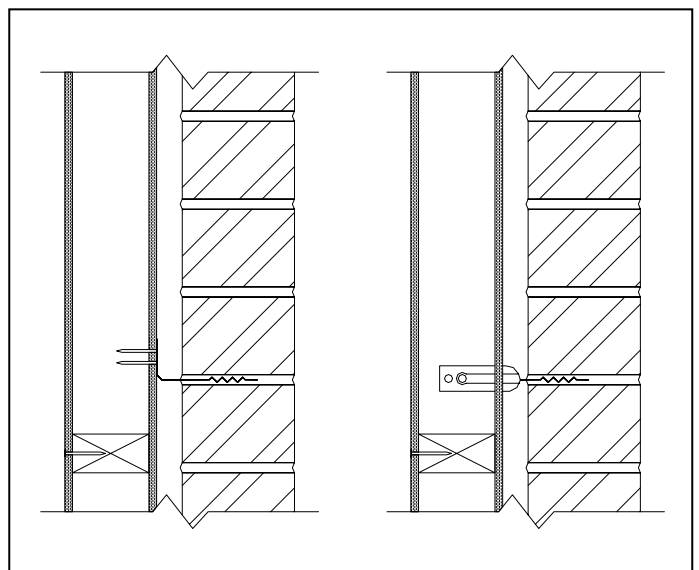


FIGURE 13 BRICK TIES

10 WARRANTY

James Hardie Australia Pty Limited ("James Hardie") warrants to the first purchaser of the product and the last purchaser prior to installation of the product for a period of 10 years from the date of purchase that the HardiBrace® sheet bracing (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 12 months 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 Trade Practices 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. To obtain copies of such literature contact Ask James Hardie on 13 11 03. 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 BCA, 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. Further, as the successful performance of the relevant system depends on numerous factors outside the control of James Hardie (eg quality of workmanship and design) James Hardie shall not be liable for the recommendations in that literature and the performance of the relevant system, including its suitability for any purpose or ability to satisfy the relevant provisions of the Building Code of Australia ("BCA"), regulations and standards.

Ask James Hardie™

CUSTOMERLINK® SERVICE CENTRE

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