



James Hardie

Bracing



Fixing Manual

HardiBrace™ Sheet Bracing
HardiFlex™ Sheets
HardPlank™ Weatherboards
HardiTex™ Base Sheets
PanelClad™ Sheets
PineRidge™ Lining
PrimeLine™ Weatherboards
Versilux™ Lining
Villaboard™ Lining

James Hardie products and their applications

Products	Applications														
	Bathroom Construction	Bracing	Columns	Commercial Flooring	Facade Systems	Decking	Decorative	Eaves & Soffits	External Cladding	Fencing	Fire & Acoustically Rated Walls	Internal Lining	Screens	Underlay	Washroom Partitions
Architectural Columns			✓				✓								
Ceramic Tile Underlay												✓		✓	
CMX™ System		✓							✓		✓				
D3-ComTex™ Panel					✓						✓				
HardiBrace™ Sheet Bracing		✓													
HardiFence™ System (WA & SA)										✓					
HardiFlex™ Eaves Lining 4.5mm								✓							
HardiFlex™ Sheets		*						✓	✓		*				
HardiGlaze® Swirl Sheets	✓											✓			
HardiGlaze® Tile Sheets	✓											✓			
HardiGroove™ Lining	✓							✓				✓			
HardiPanel™ Compressed Sheets	✓			✓	✓	✓							✓		✓
HardiPanel™ Compressed Panels 9mm					✓										
HardiPlank™ Cladding		✓							✓		✓				
HardiScreen™ Lattice							✓								
HardiTex™ Base Sheets		✓							✓		✓				
PanelClad™ Sheets		✓							✓		✓				
PineRidge™ Lining		✓									✓	✓			
PrimeLine™ Weatherboards		✓							✓		✓				
Shingled Siding									✓						
Versilux™ Lining		*						✓			*	✓			
Villaboard™ Lining	✓	✓						✓			✓	✓			
Vinyl & Cork Underlay											✓			✓	

* 6mm sheet only

Information on James Hardie fibre cement products and systems and their applications, is just a phone call away. Contact the

James Hardie CustomerLink™ Service Centre
on 13 1103, 7am to 7pm (EST), seven days a week.

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This manual reflects the experience that James Hardie has gained from working with builders, designers and architects, and is designed to be practical and easy to follow.

As market leaders in fibre cement manufacture, James Hardie regularly updates its literature to keep up with changing design trends, products and system development. We update our manuals to make products easier to install, by incorporating feedback we receive from the marketplace.

For specific advice relating to other systems, contact the James Hardie CustomerLink™ Service Centre on 131103, or call your local James Hardie sales representative.

All dimensions given in the diagrams are in millimetres (mm) unless noted otherwise.

How To Use This Manual

- If you're familiar with bracing design methods and structural framing codes, then all you'll need from this manual is the design bracing capacities of our cladding products on:
 - Timber frames without cyclone rods (Table 1);
 - Timber frames with cyclone rods (Table 4);
 - Steel frames (light or medium gauge) (Table 5).
- If you require guidance in using the new timber framing code, *AS 1684-1999*, and/or are designing bracing resistance in non-cyclonic areas, then you should concentrate on Section 2 of this manual.
- If you are designing bracing resistance in cyclonic areas where anchor rods are required with the timber frames (eg the Queensland coast), see Section 3 of this manual.
- If you are designing bracing resistance for light or medium gauge steel frames, see Section 4 of this manual.
- Section 5 tells you how to fix HardiBrace™ Sheet Bracing to timber or steel frames.
- Section 6 provides guidance on how to work safely with James Hardie fibre cement materials.
- Section 7 provides more details on HardiBrace™ Sheet Bracing.
- Section 8 describes the components you will need to construct the bracing systems detailed in this manual.

This manual replaces the *James Hardie Bracing Fixing Manual* dated April 2001.

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:

National Manager Engineering - Sales and Marketing,
James Hardie Building Products
Fax 02 9638 9757

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1. Introduction

1.1 General

All houses 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.

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

- Section 2 introduces the new edition of **AS 1684-1999 'Residential Timber Framed Construction' (the code)**, now a Limit State document, 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 MBK (NSW) Pty Ltd (refer to their letter in Section 7). Permissible stress capacity may be obtained by dividing the ULS value by 1.5.

1.2 Bracing with Fibre Cement Cladding Products

All 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 PrimeLine™ Weatherboards, provided that fasteners pass through both planks (with the HardiLock™ fixing system, PrimeLine™ Summit and Newport Weatherboards are not suitable as bracing).

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.

1.3 Benefits of Using HardiBrace™ Sheet Bracing & Other James Hardie Cladding Products

James Hardie cladding products provide the designer, builder and homeowner with the following benefits:

High Strength

Required bracing strength can easily be achieved by using James Hardie fibre cement sheets, weatherboards and planks on timber or steel frames.

Cost Effective

The installed cost and the long-term durability of James Hardie fibre cement sheets, weatherboards and planks offer cost savings and peace of mind.

Bracing Serves as Internal or External Cladding

Using external and internal cladding products to provide bracing resistance reduces the need for extra materials and saves money.

Note: The 5mm thick HardiBrace™ Sheet Bracing described in this manual has been designed for ease of use as cavity wall bracing and is not intended for use as an external cladding material.

Ease and Speed of Construction

HardiBrace™ Sheet Bracing is easily hand or gun nailed to timber frames. A pre-marked nailing system allows quicker installation on site.

Excellent Durability

All James Hardie fibre cement products are unaffected by termites and will not rot, warp or burn when installed in accordance with our instructions.

2. Bracing for Timber Framing in Accordance with AS 1684-1999

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2.1 Design Methodology

2.1.1 The New 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 is the move to Limit State design. With regards 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 2.2 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 2.3 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).

2.1.2 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). For framing, fixing and installation of nominal bracing see Clause 5.1.

2. Structural Bracing

Also known as "designated" bracing, structural bracing is purpose-fitted bracing such as the James Hardie systems detailed in this manual.

2.2 Simplified Design Method

2.2.1 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:

- (a) Determine wind classification using Clause 1.6 of AS 1684.4;
- (b) 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);
- (c) Determine the number of bracing units required for each wind direction (use *the code* Table 8.2);
- (d) Allocate the required number of structural bracing units in conjunction with the amount of nominal bracing if necessary;
- (e) 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.

2.2.2 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.

2.2.3 Structural Bracing

Apart from using HardiBrace™ Sheet Bracing as structural bracing as per Clauses 2.2.6 and 2.2.7 below, Type A and B units can also be achieved with minimum 6mm thick JHFC sheets as detailed in Clause 2.2.8 of this manual. In this simplified method, bracing units must not be less than 900mm wide.

2.2.4 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.

2.2.5 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).

2.2.6 Type A Bracing Units

To achieve Type A bracing capacity (3kN/900mm), fix the HardiBrace™ Sheet Bracing in accordance with Figure 1, Section 5 and Clause 2.2.5 of this manual.

2.2.7 Type B Bracing Units

To achieve Type B bracing capacity (6kN/900mm), fix the HardiBrace™ Sheet Bracing in accordance with Figure 2, Section 5 and Clause 2.2.5 of this manual.

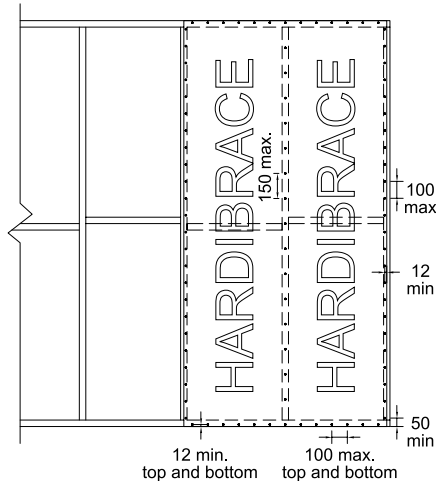


Figure 1: Type A Nailing Detail

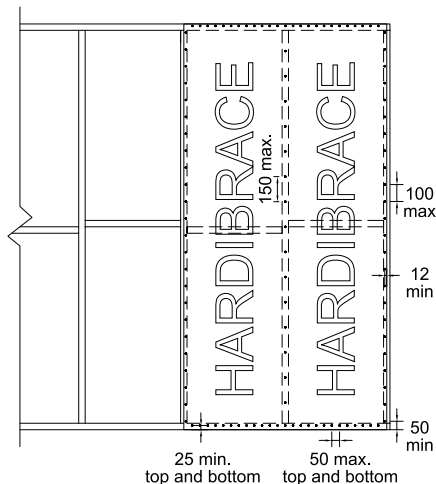


Figure 2: Type B Nailing Detail

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.

2.2.8 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 5 and Clause 2.2.5 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 5 and Clause 2.2.5 of this manual.

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

2. Bracing for Timber Framing in Accordance with AS 1684-1999 continued

2.3 Conventional Limit State Design

2.3.1 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:

- Determine the wind classification (see **the code** Clause 1.6 and AS 1170.2 or AS 4055);
- Determine the wind pressure (see **the code** Clause 8.3.2);
- Determine the area of elevation (see **the code** Clause 8.3.3 and Figure 8.2);
- Calculate racking force (see **the code** Clause 8.3.4);
- Design bracing systems (for walls, see **the code** Clause 8.3.5 and subfloors see **the code** Clause 8.3.6);
- 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);
- 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.

2.3.2 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 2.1.2 of this manual) may provide no more than 50% of the 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.

2.3.3 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.

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 & 7)	3.2
JHFC planks or weatherboards on one side only (see Figure 6 & 7)	2.0

For permissible stress capacity divide by 1.5

Notes for Table 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%.
- 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.
- If JD5 grade timber is used in the framing, then the capacity given in Table 1 must be reduced by 12.5%.
- 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.
- 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.

2.3.4 Wall Height & 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

Note: Intermediate values may be interpolated.

2.3.5 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 Width

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

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

2.3.6 Location, Distribution & 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.

2.3.7 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. Bracing for Timber Framing in Accordance with AS 1684-1999 continued

2.3.8 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 & PanelClad™ Sheets

Non-Cyclonic Areas: Sheets fixed vertically in accordance with Figure 3, Section 5 and Clause 2.3.7 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 5 and Clause 3.3 of this manual will achieve the values stated in Table 4.

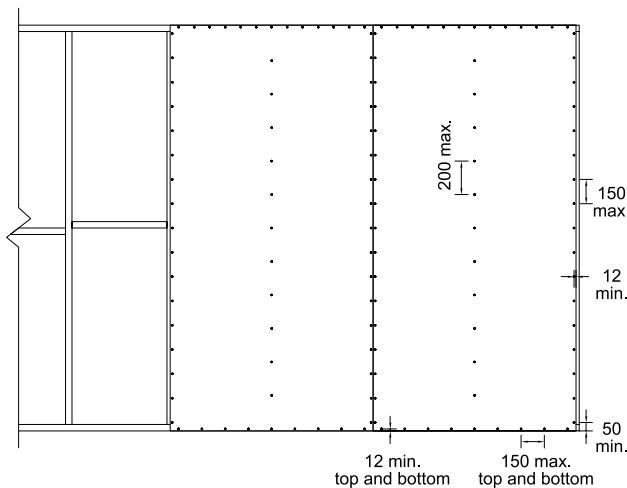


Figure 3: Nailing Detail for HardiFlex™ Sheets, PineRidge™ Lining or PanelClad™ Sheets

(b) HardiTex™ Base Sheets

Non-Cyclonic Areas: Sheets fixed vertically in accordance with Figure 4, Section 5 and Clause 2.3.7 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 5 and Clause 3.3 of this manual will achieve the values stated in Table 4.

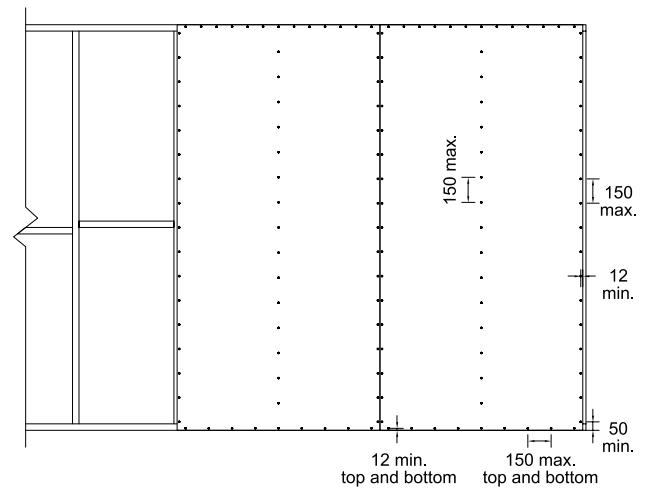


Figure 4: Nailing Detail for HardiTex™ Base Sheets

(c) Villaboard™ & Versilux™ Linings

Non-Cyclonic Areas: Sheets fixed vertically or horizontally in accordance with Figure 5, Section 5 and Clause 2.3.7 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 5 and Clause 3.3 of this manual will achieve the values stated in Table 4.

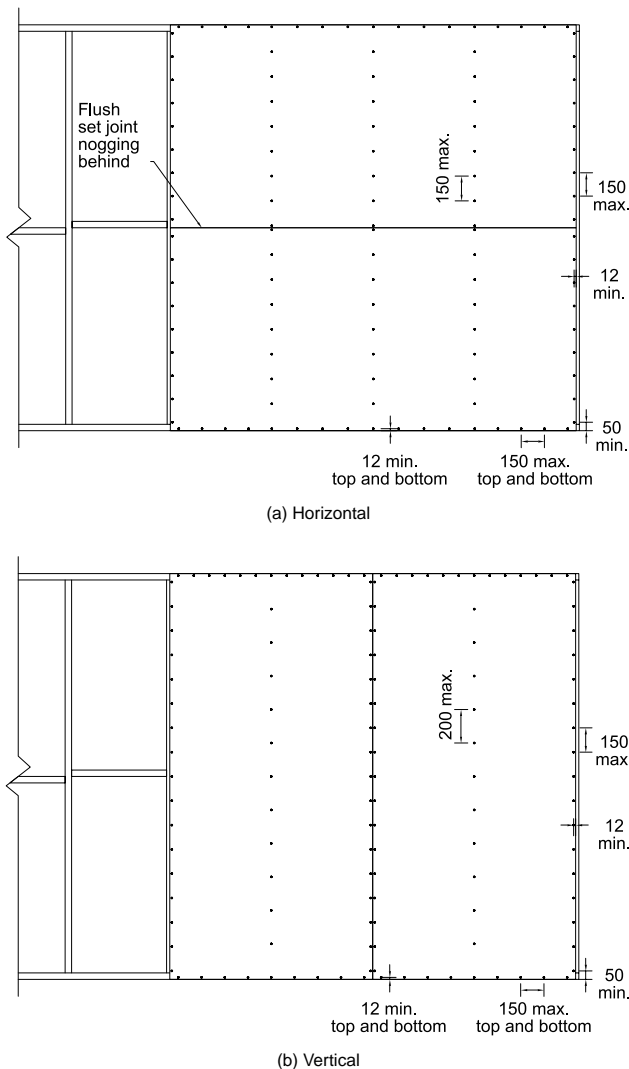


Figure 5: Nailing Detail for Villaboard™ and Versilux™ Linings

Note: For details of tiling over these wall linings, refer to the James Hardie Internal Linings Range Fixing Manual.

(d) Planks & 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 5 and Clause 2.3.7 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 5 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.

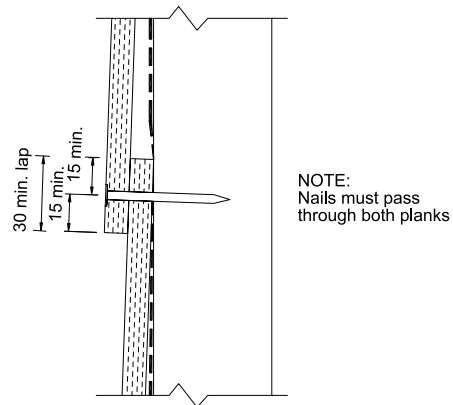


Figure 6: Nailing Detail for HardiPlank™ or PrimeLine™ Weatherboards

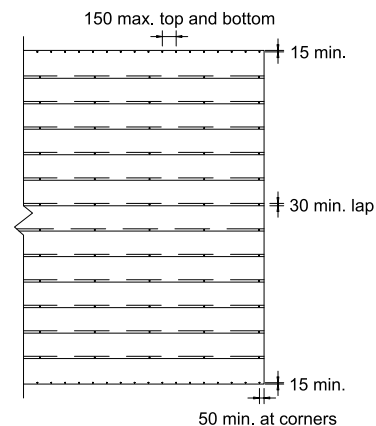


Figure 7: Nailing Spacing Detail for JHFC Planks or Weatherboards

Note:

1. PrimeLine™ Summit and Newport Weatherboards use the HardiLock™ fixing system and are not suitable for bracing.
2. PrimeLine™ Chamfer and Heritage Weatherboards are unsuitable for use as structural bracing unless fixed such that nails pass through both planks at the overlaps.

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

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 2.3.4 and 2.3.5 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 8.

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).

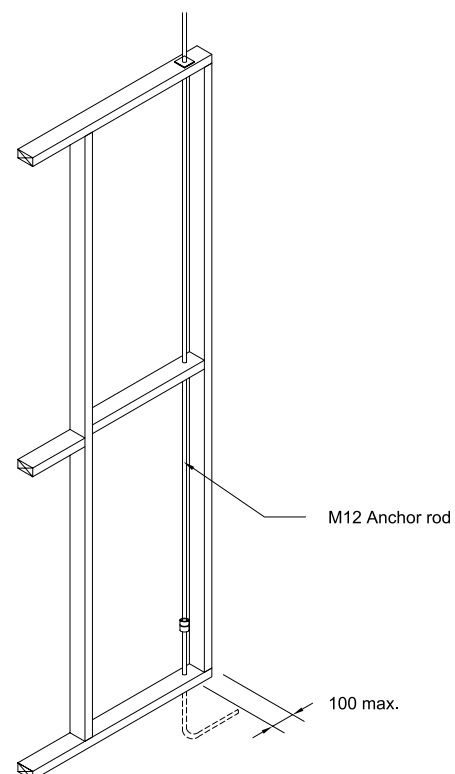


Figure 8: Anchor Rod Detail



4. Bracing for Steel Framing

12

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 Capacities

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 4.3 and Section 5 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 0.75mm light gauge steel frames:

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

0.75mm to 1.6mm medium gauge steel frames:

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

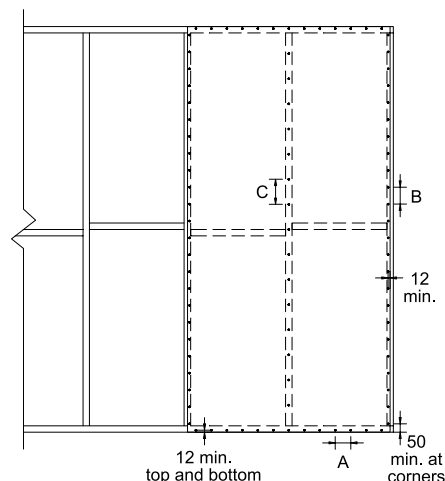


Figure 9: Screw Spacing Detail

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 riveted 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 9)	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	3.4	3.4	-	-
		450	200/200/200	-	-	-	6.0
		300	200/200/200	-	-	-	7.5
7.5mm JHFC planks or weatherboards	Single-sided	600	See Note 2 and Figures 6 & 7	2.1	2.2	-	-
		450	See Note 2 and Figures 6 & 7	-	-	-	2.4
		300	See Note 2 and Figures 6 & 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 & 7 For 6mm JHFC sheets: 200/200/200	3.9	4.0	-	-
		450	See Note 2 and Figures 6 & 7 For 6mm JHFC sheets: 200/200/200	-	-	-	6.7
		300	See Note 2 and Figures 6 & 7 For 6mm JHFC sheets: 200/200/200	-	-	-	11.0
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	-
	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	-	-
	Double-sided, fixed horizontally, joints tape set (see Note 6)	600	200/200/200	5.6	5.6	-	-

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

5. Framing, Fixing & Installation Details for HardiBrace™ Sheet Bracing

5.1 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 Fixing Manual

HardiFlex™ Sheets, PanelClad™ Sheets:
James Hardie External Cladding Range Fixing Manual

PrimeLine™ Weatherboards, HardiPlank™ Weatherboards:
James Hardie External Cladding Range Fixing Manual

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.

5.2 Framing

5.2.1 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.

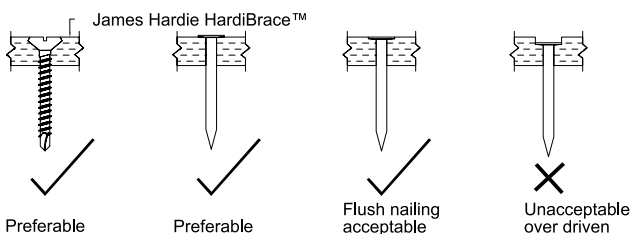


Figure 10: Nail Fastener Depth

Note: HardiBrace™ Sheet Bracing will not straighten excessively warped or distorted frames and any warping may be visible after the internal lining and external cladding are applied.

5.2.2 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'.

5.2.3 Steel

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

5.3 Fixing

5.3.1 General

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

5.3.2 Fastener Corrosion Protection

Fasteners used must have an adequate level of corrosion protection for the relevant environment, service life and conditions.

Note: Fasteners must be at least Class 3 external grade finish.

5.3.3 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 10.

5.3.4 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.

Notes to Table 6:

1. Fasteners with equivalent dimensions, (ie head size and shape, shank diameter and length to those above) may be used.
2. All fasteners are to be galvanised or suitably coated, see Clause 5.3.2.
3. Nailing guns must be fitted with flush-drive attachments.
4. Gun nailing to steel frames is NOT recommended.
5. Some nailing guns incorporate an adjustable head set to control nail depth (eg Duo-Fast Coil Nailer and Senco Coil Nailer).
6. When gun nailing, apply pressure to the face of the sheet by holding the sheet against the stud to reduce blow out at the back of the sheet.

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

Table 6: Gun Nailing	
Hitachi	Hitachi VH650 Coil Nailer
	Otter 45 x 2.2 Galv. Coil Nail
	50 x 2.2 Galv. Coil Nail 38 x 2.5 Galv. Coil Nail
Paslode	Paslode Impulse Compact Nailer (B20544)
	Paslode Impulse DekFast® 50mm M/G Value Pack (B20561V)
	Paslode Impulse DekFast® 50mm M/G Handy Pack (B20557)
Duo-Fast	Duo-Fast KD665A Coil Nailer (Part No. D40040)
	C2.7 X 32 GD Coil Nail (D41800)
	C2.5 X 45 GD Coil Nail (D41200)
	C2.5 X 50 Screw S/S Coil Nail (D41600)
Stanley-Bostitch	Bostitch N57C Coil Nailer
	Bostitch AC45P250 Gal Coil Nail
Senco	Senco SCN-60 Coil Nailer (fitted with adjustable depth of drive)
	BTN 45 ADB - 45 x 2.5 Weatherex Gal and Sencoted

5.3.5 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 11.

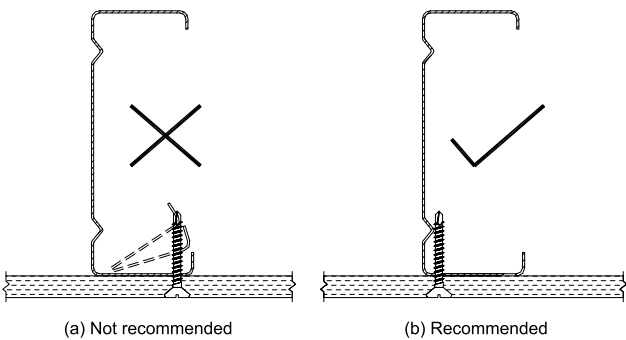


Figure 11: Screw Fastening to Steel Frame

5.3.6 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.

5.4 Installation Details

5.4.1 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 9 and Clause 4.4 for steel framing.

Note: HardiBrace™ Sheet Bracing must not be used as exposed, finished, external cladding.

5.4.2 Brick Ties

Brick ties can be installed through HardiBrace™ Sheet Bracing. Simply use a small hammer to punch a hole no greater than 50mm diameter through the sheet to allow insertion of brick ties. See Figure 12.

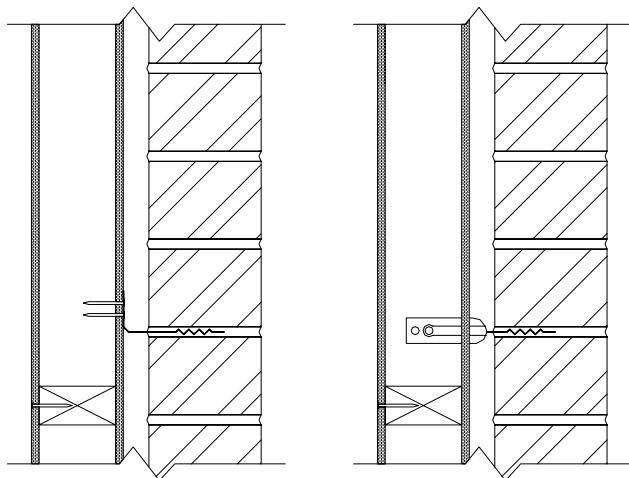


Figure 12: Brick Ties

6. Safe Working Instructions

6.1 Cutting

6.1.1 General

James Hardie products can be easily cut on site. All power cutting operations should be carried out in the open air or in a well ventilated space (see Clause 6.3).

Suitable methods for cutting sheets are:

- "Score-and-Snap";
- Hand guillotine;
- Fibreshear;
- Hand sawing;
- Power sawing.

6.1.2 "Score-and-Snap"

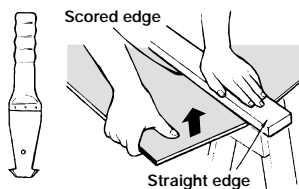
"Score-and-Snap" is a fast and efficient method of cutting using James Hardie's special tungsten-tipped "Score-and-Snap" knife.

Preferably score from the face side of the sheet or plank.

Score against a straight edge and repeat action to obtain adequate depth for a clean break - normally 1/3 of sheet thickness.

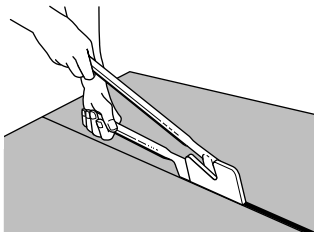
Snap upwards to achieve break.

Clean rough edges with a rasp.



6.1.3 Hand Guillotine

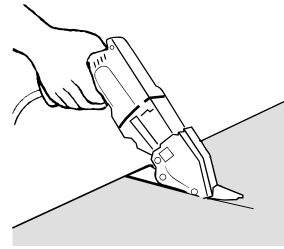
Make guillotine cut on the off-cut side of the line to allow for thickness of the blade.



6.1.4 Fibreshear Heavy Duty by Toolex

An electrically powered, fast, clean and effortless way of cutting sheets, especially around curves such as archways.

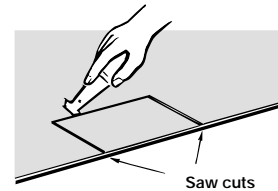
Make Fibreshear cut on the "off-cut" side of the line to allow for the thickness of the shear.



6.1.5 Hand Sawing

Hand sawing is suitable for general cutting operations or small cuts, notching or small penetrations. Preferably use an old handsaw, and a quick forward jabbing action is best.

Score along the back with the "Score-and-Snap" knife and snap upwards.



6.1.6 Power Sawing and Site Recessing

When cutting, drilling or grinding, always wear glasses and a dust mask. This can be a disposable dust mask, or a dust mask with a disposable cartridge.

All dry power cutting operations must be carried out in the open air or in well ventilated spaces and dust extraction equipment must be fitted to the dry cutting tool.

Power cutting using a dry diamond saw blade gives an acceptable edge.

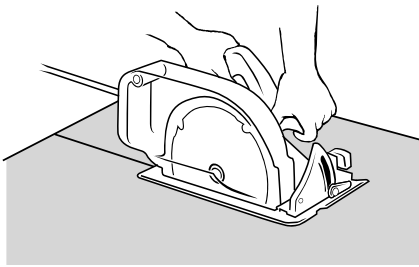
Clamp a straight-edge to the sheet and run the saw base plate along the straight edge when making the cut.

Refer to Recommended Safe Working Practices Clause 6.3 before starting any power sawing or site recessing.

6.1.7 HardiBlade™ Saw Blade

For fast, clean cutting of James Hardie fibre cement sheets we recommend the use of the James Hardie HardiBlade™ Saw Blade.

For full instructions refer to HardiBlade™ Saw Blade packaging.



6.2 Hole Forming

6.2.1 For Smooth, Clean-Cut Circular Holes

Mark the centre of the hole on the sheet.

Pre-drill a "pilot" hole.

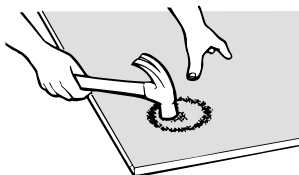
Using the pilot hole as a guide, cut the hole to the appropriate diameter with a hole saw fitted to a heavy duty electric drill.

6.2.2 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 the waste piece from the sheet face.

Tap carefully to avoid damage to sheets, ensuring that the sheet edges are properly supported.

Jig saws fitted with tungsten tipped blades can also be used.



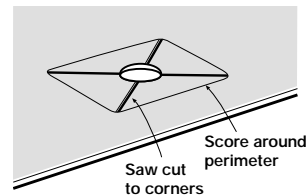
6.2.3 For Large Holes or Openings

Score deeply around the perimeter of the opening.

Form a large round hole in the centre by drilling as previously described then saw-cut from the centre towards the corners of the opening. A jabbing action is most efficient.

Tap waste pieces from face side and, if necessary, clean rough edges with a rasp. Radius corners with a half round rasp to eliminate stress points.

Seal all edges of holes with James Hardie Joint Sealant to prevent water penetration of overall structure.



Note: Do not form holes through sheets with cold chisels, heavy hammers or any other "aggressive" methods. Such forceful methods will damage sheets and may cause other problems at a later date.

6.3 Recommended Safe Working Practices

Fibre cement products contain crystalline silica. Breathing in the fine silica dust liberated when working with products such as fibre cement, clay and concrete is hazardous and may result in bronchitis, silicosis (lung fibrosis) and lung cancer. Do not breathe dust. Cigarette smoking increases silica related risks. Work safely with fibre cement sheets by following the precautions described below:

- Minimise dust when cutting products by using suitable wet saw. Contact saw manufacturer for details;
- When using power tools or abrasive hand tools on sheets, wear approved personal protective equipment, ie P1 or P2 dust mask and safety goggles;
- Contain dust during clean-up and disposal;
- These precautions are not necessary when stacking, unloading or handling fibre cement products.

	+	
Face Masks P1 or P2 type		Safety Goggles approved to AS 1337
	+	
Clean up, wet down or vacuum		Disposal containment of dust

7. Product Information

7.1 General

James Hardie Building Products are manufactured to Australian/New Zealand Standard AS/NZS 2908.2 'Cellulose - Cement Products' (ISO 8336 'Fibre Cement Flat Sheets').

HardiBrace™ Sheet Bracing, HardiFlex™ Sheets, Villaboard™ Lining, Versilux™ Lining, PanelClad™ Sheets, PineRidge™ Lining, HardiTex™ Base Sheets, PrimeLine™ Weatherboards and HardiPlank™ Cladding are classified as Type A Category 3 in accordance with AS/NZS 2908.2 'Cellulose - Cement Products'.

7.2 Basic Composition

HardiBrace™ Sheet Bracing, HardiFlex™ Sheets, Villaboard™ Lining, Versilux™ Lining, PanelClad™ Sheets, PineRidge™ Lining, HardiTex™ Base Sheets, PrimeLine™ Weatherboards and HardiPlank™ Cladding are cellulose fibre reinforced cement building sheets, weatherboards and planks.

7.3 Storage and Handling

Sheets, weatherboards and planks should generally be laid flat on a smooth level surface. Edges and corners should be protected from chipping.

To ensure optimum performance, store under cover and keep dry prior to fixing. If the products should become wet, allow to dry thoroughly before fixing.

7.4 Durability

HardiBrace™ Sheet Bracing, HardiFlex™ Sheets, Villaboard™ Lining, Versilux™ Lining, PanelClad™ Sheets, PineRidge™ Lining, HardiTex™ Base Sheets, PrimeLine™ Weatherboards and HardiPlank™ Cladding are resistant to permanent damage from water, will not rot, warp, or burn, and are unaffected by termites, when installed in accordance with the manufacturer's instructions.

Any special considerations or unusual applications should be referred to James Hardie technical staff. For advice, contact the James Hardie CustomerLink™ Service Centre on 13 1103. For full warranty explanation, refer to the warranty on the back cover of this manual.

7.5 Freeze/Thaw Conditions

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 (eg external walls in alpine regions subject to snow drifts over winter).

7.6 Fire Resistance

The Building Code of Australia deems HardiBrace™ Sheet Bracing, HardiFlex™ Sheets, Villaboard™ Lining, Versilux™ Lining, PanelClad™ Sheets, PineRidge™ Lining, HardiTex™ Base Sheets, PrimeLine™ Weatherboards and HardiPlank™ Cladding as NON-COMBUSTIBLE.

Early Fire Hazard Indices (tested to AS 1530) Part 3

Ignition Index	0
Flame	0
Heat Evolved Index	0
Smoke Developed Index	0 - 1

Our Ref: 804123-LO-14

Contact: Doug McMillan

6 April, 2001

The National Manager Engineering - Sales and Marketing
James Hardie Australia Pty Ltd
P O Box 70
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Attention: Mr Ruben Naccarelli



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Port Moresby 675 325 2322
Philippines 632 635 5367
Indonesia 62 21 831 0361

RE: CERTIFICATION OF JAMES HARDIE BRACING SYSTEMS

We certify that the Ultimate Limit State design capacities of bracing wall systems as nominated in the James Hardie "Bracing Fixing Manual" dated April 2001 have been derived from test data and methods in accordance with normal, acceptable engineering practice and principles as well as the relevant Australian Standards.

On this basis we certify the following information contained in the manual:

- Type A and Type B bracing units for timber framing as described in AS 1684 - 1999, Part 4 "Simplified Non-Cyclonic Areas" are achieved using the James Hardie fibre-cement cladding detailed at Clauses 2.2.6, 2.2.7 and 2.2.8 of the manual.
- Table 1: the structural bracing capacities of James Hardie fibre-cement cladding on **timber frames without cyclone rods**, including footnotes 1 to 5 thereto.
- Table 4: the structural bracing capacities of James Hardie fibre-cement cladding on **timber frames with cyclone rods**, including footnotes 1, 2 and 4 thereto.
- Table 5: the structural bracing capacities of James Hardie fibre-cement cladding on light gauge and medium gauge, welded **steel frames**, including footnotes 2, 3, 4 and 5 thereto.

The design capacities of bracing wall systems certified above are appropriate for use in design so as to comply with the Housing Provisions of the Building Code of Australia, Part 2.1 Structure P2.1 "Performance Requirements".

To achieve these bracing capacities, it is essential that each of the systems be constructed in strict accordance with the fixing details provided in the manual.

Other than the items listed above, the remainder of the information contained in the manual is outside the scope of this certification. The details contained in AS 1684 - 1999 "Residential Timber Framed Construction" (eg the capacity of Type A and B bracing units, tie-down requirements etc) are assumed to be correct, and are not covered by this certification.

Yours faithfully

Doug McMillan
for Cardno MBK



8. 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: 8.7kg/m ²			
Length(mm):	Width(mm):	Thickness(mm):	
2440	925	5	
	1225	5	
2725	925	5	
	1225	5	

Not available in WA. Selling Unit: Square metre (m²).

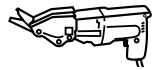
James Hardie HardiBrace™ Sheet Bracing Components



HardiDrive™ Screw

For light gauge steel frames 0.75 to 1.6mm

8g x 22mm
8g x 32mm



Fibreshear Heavy Duty by Toolex

Electric cutting tool



HardiBlade™ Saw Blade

Self sharpening ø185mm Poly diamond blade, for fast, clean cutting of James Hardie fibre cement

HardiBlade™ Saw Blade
Selling Unit: Each or Pack - 10



'Score and Snap' Knife

Tungsten tipped scoring tool for easy cutting

Components **not** supplied by James Hardie

James Hardie recommends the following products be used in conjunction with its cladding products.

James Hardie does not manufacture these products and does not provide a warranty for their use. Please contact component manufacturers for information on their warranties and further information on their products.

Fibre Cement Nail

Galvanised nails for timber

2.8mm x 30mm, 2.8mm x 40mm and
2.8mm x 50mm

Hand Guillotine

Buildex FibreTEKS®

20mm for 0.55 - 0.75mm BMT Steel



For further information on the Bracing range, or other James Hardie building products, please call the **James Hardie CustomerLink™ Service Centre on 13 1103**

Fax: 1 800 818 819

email: info@jameshardie.com.au

Warranty James Hardie Australia Pty Limited (the "Company") warrants that its products are free from defects caused by faulty manufacture or faulty materials. If any of its products are so defective, the Company will, at its option, either supply replacement products, or reimburse the purchaser for the purchase price.

The recommendations detailed in brochures produced by the Company are formulated along the lines of good building practice. However, they are not intended to be an exhaustive statement of all the relevant data. Further, as the success of the projects depends on factors outside the Company's control (eg. quality of workmanship, particular design, detail requirements, etc.), the Company accepts no responsibility for, or in connection with, the quality of the projects or their suitability when completed. Such brochures do not constitute any endorsement of any designers or builders.

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