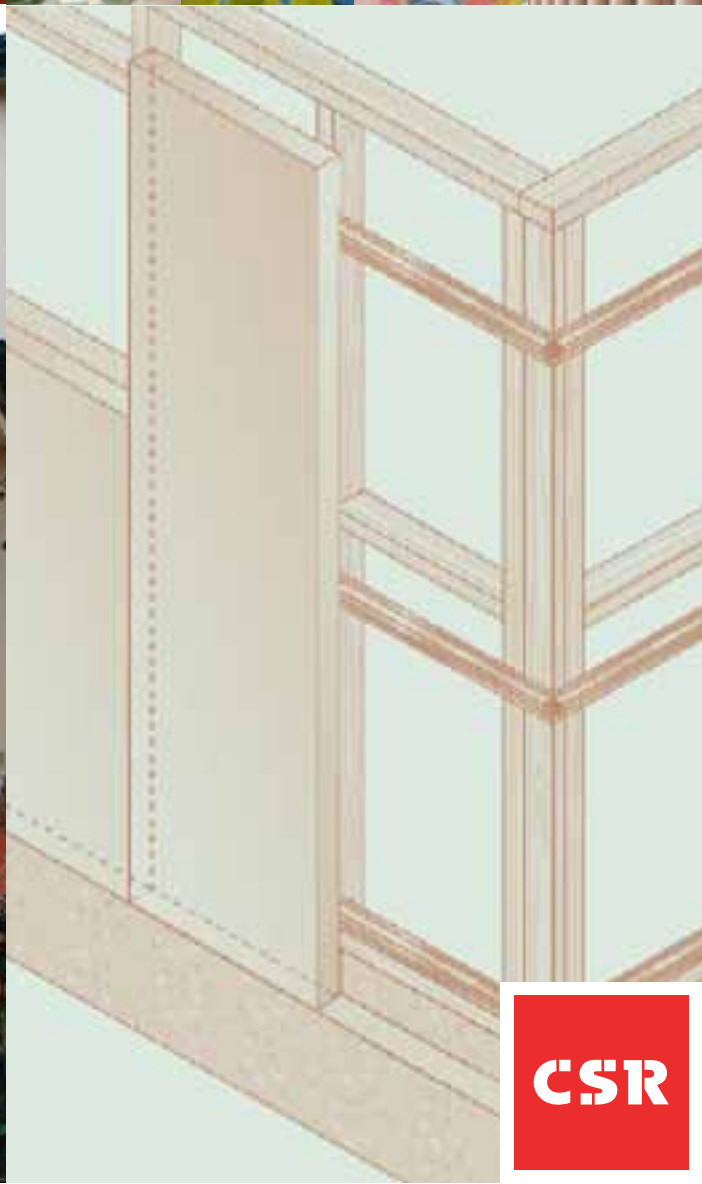
Hebel
for future living

Detached Houses & Low Rise Multi-Residential External Walls

Design & Installation Guide

PowerWall™



HEBLA097 Hebel PowerWall DLREW November 2006

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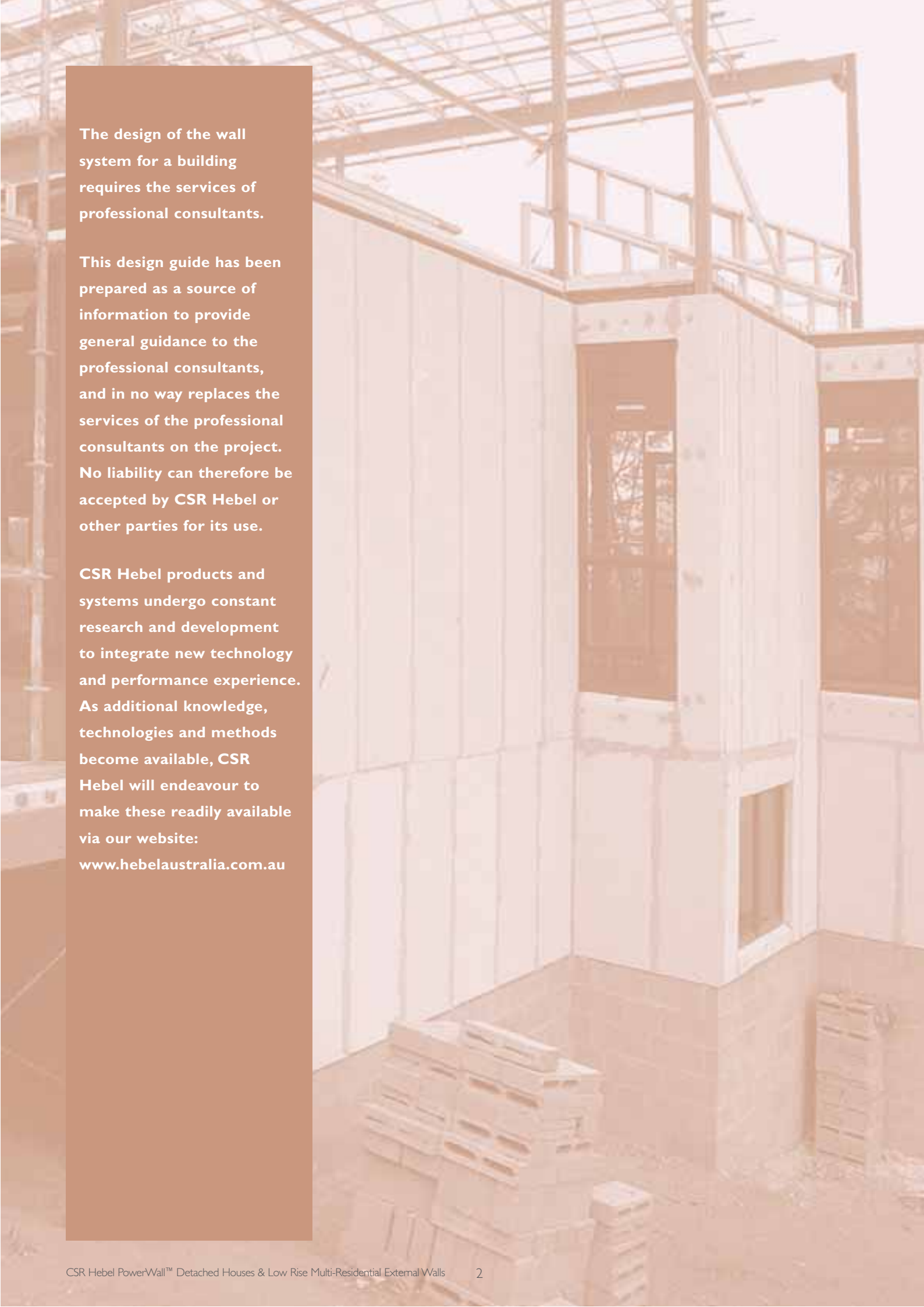

The design of the wall system for a building requires the services of professional consultants.

This design guide has been prepared as a source of information to provide general guidance to the professional consultants, and in no way replaces the services of the professional consultants on the project. No liability can therefore be accepted by CSR Hebel or other parties for its use.

CSR Hebel products and systems undergo constant research and development to integrate new technology and performance experience. As additional knowledge, technologies and methods become available, CSR Hebel will endeavour to make these readily available via our website: www.hebelaustralia.com.au

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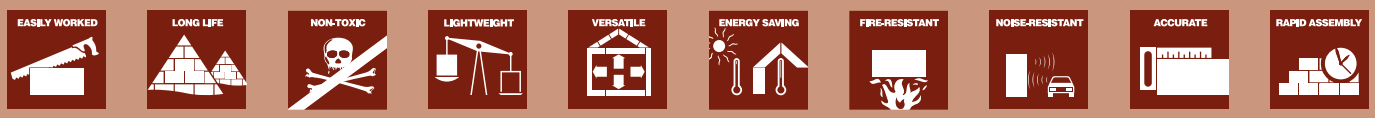


The system and performance specifications detailed in this guide are guaranteed only for laboratory tested conditions. Actual site conditions should be checked and advice obtained from an appropriate consultant. Any variations or substitution of materials or assembly requirements, or any compromise in assembly or in quality of the system components may result in failure under critical conditions.

It is the responsibility of the architectural designer and engineering parties to ensure that the details in the CSR Hebel PowerWall™ Detached Houses & Low Rise Multi-Residential External Wall Design & Installation Guide are appropriate for the intended application. The recommendations of this guide are formulated along the lines of good building practice, but are not intended to be an exhaustive statement of all relevant data. CSR Hebel accepts no responsibility for, or in connection with, the quality of the recommendations or their suitability for any purpose when installed.

CSR Hebel is continuously developing its products. This on-going development may result in changes to product specifications, range and the performance characteristics from time to time. The specifications, range and performance characteristics on which the CSR Hebel PowerWall™ Detached Houses & Low Rise Multi-Residential External Walls are based are those current in November, 2006.

1.0 Introduction

1.1 CSR Hebel

CSR Hebel is 100% owned by CSR Building Products Limited, one of Australia's leading building products companies. CSR Hebel manufactures and markets a range of lightweight Autoclaved Aerated Concrete (AAC) blocks, reinforced PowerPanels, cladding and lintels for use in the housing and commercial construction industry. CSR Hebel also sells complementary mortars, tools and accessories.

In 1989, CSR became involved with Hebel and established the Australian operation. Since then, Hebel has won wide acceptance as an innovative and environmentally friendly building material due to its speed of construction, excellent thermal/fire/acoustic properties and its design versatility.

1.2 Design Overview

As environmental consciousness and social responsibility increases, CSR Hebel is striving to exceed these ideals and set new standards in building materials and residential living.

Designed for Inner Comfort

With Hebel PowerWall™ clients can enjoy a comfortable interior in their home, and be comfortable with their choice for the environment.

Manufacture of Hebel materials uses a small fraction of the energy and natural resources used in manufacturing conventional masonry, producing almost no waste or by-products. Hebel's highly efficient insulation also saves power in heating or cooling the home.

Designed for Inner Peace

Hebel PowerWall helps you create a tranquil inner space. We have worked closely with acoustic experts and testing authorities to engineer inherently superior acoustics from our wall and floor systems. They create a sound barrier to external noise and from other rooms within the home.

Designed for Peace of Mind

Although it's remarkably lightweight, Hebel is solid and durable. Hebel PowerPanel™ is reinforced with steel for extra strength. Hebel is also extremely fire-resistant and is not a food source for termites.

Designed to Save

As they're lightweight, Hebel materials are quick to assemble, saving building time and costs. They also minimise the need for supporting materials, saving budget resources and energy.

1.3 Use Hebel for Better Framed Construction

- Using Hebel PowerPanel for your framed construction provides you with cost savings and greater floor space for the same building dimensions.
- Hebel PowerPanel is faster to install than bricks, saving on building costs.
- Hebel products are lightweight, reducing the structural load on the frame and its design requirements for supporting building materials.
- Their low weight makes Hebel PowerPanels ideal for use in difficult applications such as sloping sites. An external wall of Hebel PowerPanels is steel-reinforced, solid and secure.
- Hebel PowerPanels have better thermal efficiency than brick veneer or even double brick walls, resulting in reduced heating and cooling costs. Further thermal efficiency may be achieved by adding insulation to the frame cavity.
- Hebel is fire-resistant, with a fire rating of up to four hours.

1.4 Hebel PowerWall™

Hebel PowerWall for Detached Houses & Low Rise Multi-Residential External Walls has been designed for homes built using either timber or steel framing and can be used in new dwelling construction, extensions or re-cladding. The system consists of 75mm thick, steel-reinforced Hebel PowerPanels, fixed vertically to horizontal battens attached to the load-bearing frame. For quick, clean construction, Hebel PowerPanels can be ordered in the stock lengths of 2400mm, 2700mm and 3000mm and in widths of 300mm and 600mm. The 600mm wide PowerPanels are also available in the additional lengths of 1200mm, 2550mm and 2850mm.

Fig. 1.1 Panel Installation

2.0 Benefits

Speed

- With Hebel PowerWall, your home will reach lock-up stage sooner.
- The installation of Hebel PowerWall is very fast, especially on purpose-designed houses.
- Any competent tradesperson can easily install Hebel PowerWall. Two people can install up to 100m^2 of external wall in about three days.
- The modular design of the dwelling minimises waste.
- A standard 2400mm Hebel PowerPanel weighs about 74kg when delivered*, which two people can position. No cranes are required.

Space

- Hebel PowerWall gives you great freedom in designing your home and you can customise the style by applying coloured and textured coatings to the PowerPanels.
- A thinner external wall results in greater internal living space and design flexibility. A 50mm reduction in external wall thickness can provide about 2% extra internal space for the same external dimensions.

Solidity

- Hebel PowerWall is a solid choice. It's extremely strong, and each Hebel PowerPanel is steel reinforced.
- Capable of up to four hours fire resistance for a fire source on the PowerPanel side.
- Hebel PowerPanel does not provide a food source for vermin or termites.

Lower Energy Costs

- As with all Hebel products, Hebel PowerPanel has excellent thermal properties. This feature results in lower heating and cooling costs at no additional building expense.

Fig. 2.1 Hebel PowerWall Installed In Ground Floor

Fig. 2.2 Hebel Home

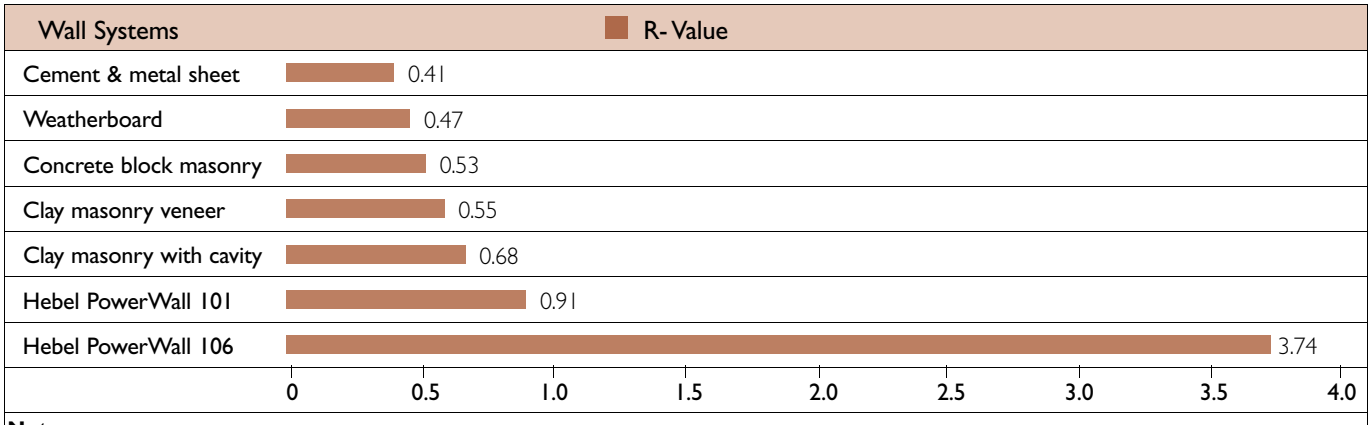
Table 2.1 Comparative Wall Thicknesses (mm)

Wall System	Wall Element Width			Total Width
	Stud	Cavity	Masonry Leaf	
Brick Veneer	70	40	110	220
Hebel PowerWall	70	20 - 25*	75	165 - 170*
Brick Veneer	90	40	110	240
Hebel PowerWall	90	20 - 25*	75	185 - 190*

* Note: Depending on top hat selection

* Calculated at 30% moisture content. At 4% equilibrium moisture content, the PowerPanel would weigh approximately 60kg.

Table 2.2 Thermal Properties of Wall Systems



Note:

- Sarking or insulation to be added to the above values where applicable to comply with BCA climate zone requirements.
- R-Values above (excluding Hebel PowerWall solution) are taken from BCA 2006.
- Refer to Table 8.1 (page 17) for Hebel PowerWall configuration and thermal insulation options.

3.0 Typical Applications

Hebel PowerWall is designed for application in the domestic, residential markets. Basically, the types of buildings that are constructed using Hebel PowerWall are detached or attached 1 or 2 storey houses, duplexes and town houses. The Building Code of Australia (BCA) generally classifies these buildings as being predominantly of Class 1 or Class 10 building structures.

Structurally, Hebel PowerWall uses Hebel PowerPanel as non-loadbearing external cladding. Each PowerPanel is steel reinforced and installed vertically and secured to steel top hat battens. The top hat battens are secured to load carrying timber or steel stud frames.

Hebel PowerFloor is a complimentary system that can be used in conjunction with Hebel PowerWall. Hebel PowerFloor can be quickly installed over timber or steel floor framing using a construction adhesive & screw fixings. For more information regarding these systems please contact CSR Hebel or visit our website **www.hebelaustralia.com.au**

Figure 3.1 shows an example of a typical home that uses Hebel PowerWall for Detached Houses & Low Rise Multi-Residential External Walls.

Fig. 3.1 Typical Home Construction Application

4.0 How to Design a Hebel PowerWall

4.1 Design Process

This section outlines the design process for determining the adequacy of Hebel PowerWall.

STEP 1: Determine the wind category, stud framing layout and PowerPanel height requirements.

STEP 2: Design Criteria. Where required identify the BCA Performance Requirements:

- Fire Resistance Level (FRL).
- Sound insulation performance (R_W values).
- Energy Efficiency (R-Value).

STEP 3: The flowchart below can be used to select a type, spacing and quantity of top hats and fixings to suit requirements.

STEP 4: Select insulation and/or sarking material to suit energy efficiency and condensation requirements.

STEP 5: Check adequacy of sound insulation and fire resistance level.

STEP 6: Complete detailed design and documentation.

4.2 Compliance With the Building Code of Australia (BCA)

All building solutions, such as walls, floors, ceilings, etc. must comply with the regulations outlined in the BCA or other authority.

The BCA is a performance based document, and is available in two volumes which align with two groups of 'Class of Building':

Volume 1 - Class 2 to Class 9 Buildings; and

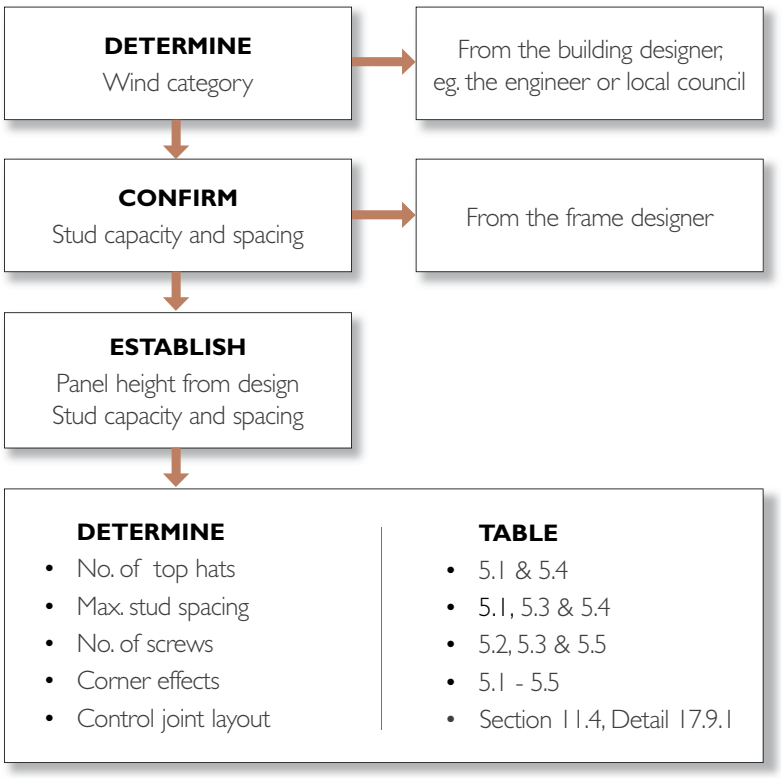
Volume 2 - Class 1 & Class 10 Buildings - Housing Provisions.

Each volume presents Regulatory Performance Requirements for different Building Solutions for various classes of buildings and performance provisions.

These Performance Provisions include: Structure; Fire Resistance; Damp & Weatherproofing; Sound Transmission & Insulation; and Energy Efficiency.

This design guide presents tables, charts and information necessary to design a Hebel PowerWall that complies with the Performance Requirements of the BCA. The designer must check the adequacy of the building solution for Performance Requirements outlined by the appropriate authority.

Fig. 4.1 Flow Chart for Design Process



5.0 Structural Provisions

5.1 Overview

Hebel PowerWall basically consists of Hebel PowerPanel secured to the framing via horizontal steel top hats. This section provides the basic information on the selection of top hat spacings for a given stud spacing and wind category, as well as considerations to assist the designer in determining the appropriate wall configuration.

The design information presented in Table 5.1 to 5.5 has been determined for the following top hat types:

- Rondo 303 – Rondo Building Services Pty Ltd.
- Lysaght Topspan 22 – Bluescope Steel Ltd.
- FastStud 24TH42.

For other brands or types of top hats, contact the manufacturer for design information. Minimum performance requirements for the metal studs, top hats, fixings and Hebel PowerPanel have been provided to assist the designer.

IMPORTANT

The design and approval of the structural framing (cold-formed steel or timber) is to be provided by the framing product manufacturer and/or project engineer.

5.2 Principles of Design

The principles on which the design is based include:

a) The lateral wind loads applied to the PowerPanels are transferred into the horizontal top hats, then to the stud frame, which should be designed in accordance with the relevant Australian Standards for the imposed loads. The frame should be designed for all bracing and hold-down requirements.

b) The design of the stud frame shall consider the weight of suspended PowerPanels (such as the upper storey of two-storey construction).

c) The system is not considered as cavity construction, as the top hat clearly bridges the cavity, hence the details show the necessity of sealing the windows and door frames, as well as applying a water resistant external coating.

d) The system specifications vary with wind load. The notation used in AS1684 Residential Timber Framed Construction has been adopted.

e) The localised effects of wind around corners of buildings have been considered in the design and included in the tables. The extent of this effect is discussed towards the end of this section.

Criteria for Corner Panels

Due to the increase of wind load around the corners of buildings, extra top hats and screws may be necessary (N3 and greater) for a distance of 1200mm in each direction from the corner.

Tables 5.1 to 5.5 identify the installation criteria in these areas, in the columns titled 'Panel Location - Corner'.

Cyclonic Loading Effects

Hebel PowerWall for Detached Houses & Low Rise Multi-Residential External Walls has been tested at the James Cook Cyclone Structural Testing Station (Report No. T5 444) in Townsville. The pullout capacity of the screw into the back of the Hebel PowerPanel is the critical element in the design. The results from the cyclic testing showed that the system, in particular the pullout load of the screw, is unaffected by the cyclic loading. The detailing presented in this design guide is satisfactory for cyclonic areas.

Earthquake Loads

Earthquake loading has not been considered in this design guide.

5.3 Design Tables

This section presents tables to assist the designer in the selection of the number of top hats and number of screws for securing the Hebel PowerPanel to the framing, for a given wind category.

IMPORTANT

The wind category is to be used as a guide. The designer should check the project wind pressure against the valves given in the tables.

Table 5.1 Number of Top Hats – Panel Supported at Base (such as slab edge or shelf angle)

Wind Category	Maximum Permissible Suction Wind Pressure (kPa)	Stud Spacing (mm)	Number of Top Hats Per Panel					
			Panel Length (mm)					
			2400		2550/2700		2850/3000	
			Panel Location		Panel Location		Panel Location	
			Typical	Corner	Typical	Corner	Typical	Corner
N2	0.42	600	3	3 (4)	3	3 (4)	4	4
N3	0.66	600	3	3 (4)	3	4	4	4
N3, C1	0.66	450	3	3 (4)	3	3 (4)	4	4
N4, C2	0.98	450	3 (4)	4 (5)	3	4 (5)	4	5 (6)
N5, C3	1.40	450	4 (5)	4 (6)	5	5 (6)	5	5 (7)

Note:

1 Figures shown in brackets are the top hats required when using RONDO 303 top hats.
2 All top hats to be spaced evenly, with top and bottom top hats installed 150mm (typical) from the end of the PowerPanel.
3 Additional top hats will be required below all window openings and above openings if a PowerPanel or sill block is to be installed in this location.
4 Corner panel location applies to PowerPanels within 1200mm of corners. Permissible wind pressures have been increased by a factor of 2 in these PowerPanel locations.

Table 5.2 Number of Screws Per Panel at Each Top Hat Location - Panel Supported at Base (such as slab edge or shelf angle)

Wind Category	Maximum Permissible Suction Wind Pressure (kPa)	Stud Spacing (mm)	Number of Screws Per Panel Per Top Hat			
			Panel Location			
			Typical		Corner	
			Top Hat Location		Top Hat Location	
			Ends	Middle	Ends	Middle
N2	0.42	600	2	2	2	2
N3	0.66	600	2	3	2	3
N3, C1	0.66	450	2	2	2	3
N4, C2	0.98	450	2	3	2	3
N5, C3	1.40	450	2	3	3	4

Note:

1 For fire rated construction a minimum of 3 screws per middle top hat is required (FRL 240/180/180 for a fire source from the PowerPanel side of the wall only).
2 Type of screw used is the 14-10x65mm Hex Head Type 17 screw, fixed from inside the building, or 14-10x100mm MP Bugle Head Batten screw, fixed from outside the building (as per Table 5.6).
3 Corner panel location applies to PowerPanels within 1200mm of corners. Permissible wind pressures have been increased by a factor of 2 in these PowerPanel locations.

Table 5.3 Number of Screws Per Panel at Each Top Hat Location - Panel Suspended at Gable Ends

Wind Category	Maximum Permissible Suction Wind Pressure (kPa)	Stud Spacing (mm)	Number of Screws Per Panel Per Top Hat		Maximum Spacing of Top Hat (mm)	
			Panel Location		Panel Location	
			Typical	Corner	Typical	Corner
N2	0.42	600	2	3	800	800
N3	0.66	600	3	4	800	650
N3, C1	0.66	450	3	4	800	650
N4, C2	0.98	450	4	4	800	450
N5, C3	1.40	450	4	4	600	350

Note:

1 Top and bottom top hats installed 150mm (typical), and 250mm (max.) from the end of the PowerPanel.
2 Top hats to be installed horizontally with PowerPanels to span vertically. Number of Screw Per Panel Per Top Hat Information is not suitable for soffits or any other areas where the PowerPanel is not vertical.
3 Corner panel location applies to PowerPanels within 1200mm of corners. Permissible wind pressures have been increased by a factor of 2 in these PowerPanel locations.

Table 5.4 Number of Top Hats – Panel Suspended from Framing (such as, second storey construction)

Wind Category	Maximum Permissible Suction Wind Pressure (kPa)	Stud Spacing (mm)	Number of Top Hats Per Panel					
			Panel Length (mm)					
			2400		2550/2700		2850/3000	
			Panel Location		Panel Location		Panel Location	
			Typical	Corner	Typical	Corner	Typical	Corner
N2	0.42	600	4	4	4	4	4	4
N3	0.66	600	4	4	4	4	4	4 (5)
N3, C1	0.66	450	4	4	4	4	4	4 (5)
N4, C2	0.98	450	4	4 (5)	4	4 (6)	4	5 (6)
N5, C3	1.40	450	4 (5)	5 (6)	5	6 (7)	5	6 (8)

Note:

1 Figures shown in brackets are the top hats required when using RONDO 303 top hats.
2 All top hats to be spaced evenly, with top and bottom top hats installed 150mm (typical) from the end of the PowerPanel.
3 Additional top hats will be required below all window openings and above openings if a PowerPanel or sill block is to be installed in this location.
4 Corner panel location applies to PowerPanels within 1200mm of corners. Permissible wind pressures have been increased by a factor of 2 in these PowerPanel locations.

Table 5.5 Number of Screws Per Panel at Each Top Hat Location - Panel Suspended from Framing (such as, second storey construction)

Wind Category	Maximum Permissible Suction Wind Pressure (kPa)	Stud Spacing (mm)	Number of Screws Per Panel Per Top Hat			
			Panel Location			
			Typical		Corner	
			Top Hat Location		Top Hat Location	
			Ends	Middle	Ends	Middle
N2	0.42	600	2	2	2	3
N3	0.66	600	2	3	3	4
N3, C1	0.66	450	2	3	3	4
N4, C2	0.98	450	2	4	3	4
N5, C3	1.40	450	2	4	3	4

Note:

1 For fire rated construction a minimum of 3 screws per middle top hat is required (FRL 240/180/180 for a fire source from the PowerPanel side of the wall only).
2 Type of screw used is the 14-10x65mm Hex Head Type 17 screw, fixed from inside the building, or 14-10x100mm MP Bugle Head Batten screw, fixed from outside the building (as per Table 5.6).
3 Corner panel location applies to PowerPanels within 1200mm of corners. Permissible wind pressures have been increased by a factor of 2 in these PowerPanel locations.

5.4 Stud Frame

The stud frame shall be designed by the steel stud manufacturer or appropriate project engineer. Hebel PowerPanel is a masonry product and the support structure should be designed to provide sufficient stiffness.

The steel stud frame shall be designed and constructed in accordance with AS3623 and AS/NZS4600 (BCA Performance Requirement) with performance requirements for the studs of:

Properties:

- Cold-formed steel studs.
- Minimum yield strength 300MPa
- Minimum thickness 0.75mm BMT.
- Coating class Z275 (see Durability).
- The designer shall specify the need for noggings.

5.5 Steel Top Hat

Other steel top hats than those referenced in this design guide shall be designed by the top hat manufacturer or appropriate project engineer.
The steel top hats shall be designed and constructed in accordance with AS3623 and AS/NZS4600 (BCA Performance Requirement) with performance requirements for the top hats, of:

Properties:

- Cold-formed steel top hats.
- Minimum thickness 0.42mm BMT.
- Minimum yield strength 300MPa.
- Coating class Z275 (see Durability).

Alternate steel top hats must have an equivalent or better performance than the top hat products outlined in Section 5.1.

5.6 Hebel PowerPanel

Design procedures for the verification of wall systems consisting of Hebel autoclaved aerated concrete (AAC) PowerPanels generally follow the design principles outlined in Australian Standard AS3600 – Concrete Structures, with the exception of cover requirements for durability and development length for reinforcement.

The strength design of the Hebel PowerPanels has been carried out using the Transformed Section Theory, as detailed in the text book, 'Reinforced Concrete' by Warner, Rangan and Hall (Longman Cheshire). The load carrying capacity of the Hebel PowerPanel is influenced by several factors, such as:

- Imposed action (wind).
- Lateral stiffness of the supporting structure (lightweight structural (cold-formed) steel framing).
  - Stud size and spacings.
  - Deflection limit.
- Height of the wall.
- Number and spacing of the top hats.
- Number of screw fixings considered effective.

5.7 Fixings

Table 5.6 outlines the connection type and requirements for constructing Hebel PowerWall detailed in this design guide. The project engineer or framing manufacturer is responsible for specification of alternative details. The minimum performance requirement of the screw is:

- Minimum screw coating class in accordance with AS3566: Class 3. (Refer Section 6.0 for Durability).

Table 5.6 Screws Types

Type of Screw	Application	Top Hat Type	Socket Type
12-11x25mm Hex Head Type 17 screw	Fix top hat to timber frame	Rondo 303 Lysaght TopSpan 22 FastStud 24TH42	5/16" Hex Mag. Socket
10-16x16mm Hex Head self drilling screw	Fix top hat to steel stud frame (1.2mm BMT max.)	Rondo 303 Lysaght TopSpan 22 FastStud 24TH42	5/16" Hex Mag. Socket
14-10x65mm Hex Head Type 17 screw	Fix PowerPanel to top hat from inside of building	Rondo 303 Lysaght TopSpan 22 FastStud 24TH42	3/8" Hex Mag. Socket
14-10x100mm MP Bugle Head Type 17 screw	Fix PowerPanel to top hat from outside of building	Rondo 303 Lysaght TopSpan 22 FastStud 24TH42	5mm Hex drive bit 50mm long

5.8 Design Considerations

5.8.1 Structural Framing Design

The use of Hebel PowerWall in two-storey construction involves a number of design issues that require attention. In conjunction with the following, refer to the Construction Details in Section 17.3 & 17.7. Note, when PowerPanels are suspended from the stud frame the project engineer shall design the frame to support the weight of the PowerPanels.

Design Tip

In order to reduce the load of the upper storey PowerPanels and make installation easier, the lower storey PowerPanels should be specified as 2700mm/3000mm in length and the upper storey PowerPanels as 2400mm in length. The vertical dimensions can be adjusted to suit.

A garage is considered 'attached' when at least one full side of the garage is connected to the main dwelling.

5.8.2 Two Storey Construction

Steel Frame Construction

Two storey construction suits a steel framed dwelling as the weight of the upper storey PowerPanels bear directly on the lower storey PowerPanels. Note, lower storey PowerPanels are to bear on the slab. However, consideration should be given to the sectional size of the lintels over openings on the lower storey. As the details reveal, only an 'Ableflex' joint is required at the horizontal PowerPanel junction between the upper and lower PowerPanels.

Timber Frame Construction

In contrast, the upper storey PowerPanels cannot rest on the lower storey PowerPanels in timber framed dwellings, due to the effects of timber shrinkage. Movements in the order of 25mm can occur in a two storey timber frame with a timber first floor. The fixing method used in Hebel PowerWall does not allow for this extent of differential movement between the external skin and the timber frame.

The allowances for shrinkage of timber framing in BCA 2006 Vol. 2, Section 3.3.1.10, by providing gaps between framing and masonry, should be adopted as a minimum.

It is therefore recommended that the upper storey PowerPanels be installed 35mm clear of the lower storey PowerPanels. During construction a temporary packer is used to separate the PowerPanels and is then removed after the PowerPanels have been screwed to the top hats.

The impact of this construction is to load the lower storey frame with the weight of the upper storey PowerPanels. In effect, an extra 51kg/m^2 (for the weight of the upper PowerPanels) is being added to the load already carried by the timber frame. The load approximates 1.2 kN/m (2.4m PowerPanel).

To simplify the design implications of this extra load, it is recommended to add an extra 1.4m of tributary width for a 90kg/m^2 Tile Roof load (for 2.4m long upper PowerPanels) for the design of the lower storey frame and timber lintels, when using AS1684.

The support of the full weight of the upper storey PowerPanels can be adequately supported by the top hat system. A full design using a safety factor of five has been undertaken and checked to confirm this. The number of top hats can be determined in Table 5.4 to support the suspended PowerPanels, and the PowerPanels screw fixed as per Tables 5.5.

5.8.3 Secondary Support Framing

There is a need for secondary support framing when:

- The layout of the main structural framing does not allow this framing to be used as a support. In this case a mullion is required to break up the span of the PowerPanel, or cleats provided to act as support and connection points for the PowerPanels.
- Around openings: the PowerPanels adjacent to the opening may not have sufficient capacity or stiffness to resist the additional loads that are re-distributed from the opening and infill PowerPanels.
- In this case angles are required to transfer the loads from the opening (window) and infill PowerPanels back to the main structural framing.

5.8.4 Bracing of the Building

The walls of the dwelling should be braced using steel cross bracing wherever possible, to allow the fixing of the PowerPanels from inside the building, such as Teco Speed Bracing. Ply or sheet bracing should be used on the external wall, if the walls are too short for the steel cross bracing (Refer AS 1684-1999). In this case, the full length of the wall should be sheeted to prevent misalignment of the PowerPanels.

Alternatively, localised strips of the sheeting can be fixed to the intermediate studs, between the areas of full sheet bracing, to maintain the PowerPanel alignment. The PowerPanels to be installed over the areas of full plywood sheeting will need to be fixed from the outside of the building using the 100mm long Bugle Head Batten screw (Refer Table 5.6). The extent of the bracing should be determined by the timber frame designer or project engineer.

NOTE

CSR Hebel does not recommend fixing Hebel PowerPanels from the inside when sheet bracing is installed. If sheet bracing is used over steel or timber frame construction then increase the length of the screw fixing the top hat to the stud by the thickness of the sheet bracing (refer to Section 5.7).

6.0 Durability

6.1 Overview

Durability means the capability of a building or its parts to perform a function over a specified period of time. It is not an inherent property of a material or component. It is the outcome of complex interactions among a number of factors, including:

- The service conditions.
- Material characteristics.
- Design and detailing.
- Workmanship.
- Maintenance.

('ABCB Guideline Document – Durability in buildings: 2003')

The following sub-sections of the durability topic are written in order to provide general guidelines in how best to provide, enhance and maintain adequate durability of Hebel PowerWall.

6.2 Maintenance and Enhancement of Durability

The durability of Hebel PowerWall can be enhanced by periodic inspection and maintenance. Inspections should include examination of the coatings, flashings and sealants. Paint finishes must be maintained in accordance with the manufacturer's recommendations. Any cracked and damaged finish or sealants, which would allow water ingress, must be repaired immediately by recoating or resealing the effected area. Any damaged flashings or PowerPanels must be replaced as for new work.

The durability of the system can also be increased by using Class 4 fixings throughout, additional treatment of steelwork, and by painting all exposed sealants to the sealant manufacturer's recommendations.

6.3 Coastal Areas

Hebel PowerWall can be used in coastal areas with additional precautions to ensure salt does not build up on the surface of the wall. For buildings, which are 200m to 1000m from a shoreline or large expanse of salt water, such as, Swan River (west of the Narrows Bridge), Sydney Harbour (east of the Harbour Bridge or Spit Bridge), one of the following is required:

- All horizontal and vertical movement joints must be appropriately caulked; or
- All walls must be sufficiently exposed from above so that rain can perform natural wash-down of the wall; or
- Walls, which are protected by soffits above, must be washed down twice per year, to remove salt and debris build-up, particularly at the joints.
- In all cases, Class 4 screws must be used.
- For buildings less than 200m from the shoreline as defined above, CSR Hebel does not recommend that Hebel PowerWall be used without project specific consultation with CSR Hebel Engineering Services.

6.4 Hebel PowerPanel

Hebel PowerPanel has many characteristics which make it a very durable product, including:

- Will not rot or burn.
- Is not a food source for termites.
- Unaffected by sunlight.
- Not adversely affected over normal temperature ranges.
- One quarter the weight of conventional concrete.
- Solid and strong with corrosion protection coated steel reinforcement.

6.5 Durability of Components

It is the responsibility of the building designer to ensure that the components, such as screws, top hat battens and other steel components, have the appropriate corrosion protection to be able to maintain their strength and integrity to suit the required design life of the project.

IMPORTANT

The top hat section specified in this guide can ONLY be used on untreated and dry timber frames. CCA treated pine or green timber frames have a deleterious effect on the top hat coatings, which can lead to corrosion. Where timber is CCA treated, provide a barrier between top hat and timber member. Refer to screw manufacturer for appropriate screw specification for this application.

When assessing durability the following documents can be referred to for guidance:

- ABCB Guideline Document – Durability in buildings: 2003.
- AS/NZS 2312: 2002 – Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings.
- ISO 9223: 1992 – Corrosion of metals and alloys – Corrosivity of atmospheres -Classification.
- AS3566: 2002 – Self drilling screws for the building and construction industries.
- AS2331 Series.

Reference to AS3566 should always be adhered to when selecting the screws corrosion resistance classification.

6.6 Wall Frames

6.6.1 Steel Frames

The designer needs to ensure that the steelwork and Hebel AAC products have adequate protective systems to ensure that durability is maintained. The durability of the stud frame can be enhanced by the provision of a membrane, such as sarking. The manufacturer of the steel stud frame can provide guidance on the appropriateness of this solution on a project-by-project basis.

IMPORTANT

The steel frame requirements outlined in the BCA Vol. 2, Part 3.4.2 should be considered in conjunction with steel frame design and construction advice from the steel frame manufacturer. These requirements consist of minimum protective surface coatings with restrictions on the location of the building and exposure condition of the steel frame.

6.6.2 Timber Frames

Information on the durability design of timber structures and components can be obtained from documents such as:

- AS 1720.1 Timber Structures, Part 1: Design Methods.
- AS 1684 Timber Framing Code.
- State timber framing manuals.
- AS 4100 Metal Connectors: Corrosion.
- AS 3600 Subterranean Termites.

Fig. 6.1 Hebel Home

Photo courtesy of Bartush Homes

7.0 Fire Resistance Performance

7.1 Overview

Hebel PowerWall can be subjected to a fire loading as the result of either an external fire source, or an internal fire source. When the wall requires a fire resistance level (FRL) rating, CSR Hebel provides the following guidance.

External Fire Source

For an external fire source, the excellent fire resistance qualities of the Hebel PowerPanel cladding protects the structural support framing, and provides a high fire resistance level for Hebel PowerWall.

NOTE

The FRL rating of the wall can be affected by the penetrations and the method adopted to protect these penetrations. A fire collar with a –/120/120 FRL rating will govern the FRL of the wall, even if the wall configuration has a FRL rating of –/180/180. Where required, the performance of the external coating when subjected to a fire loading shall meet the appropriate performance requirements outlined in the BCA. Joints & gaps need to be appropriately fire rated. Eg. vertical control joint will need fire rated sealant & horizontal joints should be blocked with compressible fire rated material.

Fire Certificates & Reports

Copies of the test reports and/or opinions can be obtained by contacting CSR Hebel. A certificate of test FSV0356 is provided in Appendix D of this guide.

Internal Fire Source

For an internal fire source the studs must be protected by the internal wall linings. Refer to CSR Gyprock Red Book™ for specifications.

External Walls in Fire – BCA Provisions

Where necessary, the designer and builder should ensure the structural support framing, its connections as well as the Hebel PowerPanel installation are satisfactory when subjected to fire conditions. The BCA Vol 2 (Part 3.7.1) outlines provisions for external walls for fire resistance in a residential building where the external wall is less than 900mm from an allotment boundary or 1.8m from another building on the same allotment. If this occurs an FRL of not less than 60/60/60 is required from the outside.

7.2 Fire Performance of Hebel PowerWall

Hebel PowerWall was tested at the CSIRO, North Ryde and a Fire Resistance Level (FRL) of 240/180/180 was achieved (refer to Appendix D). Note, the fire source was on the PowerPanel side. This excellent result enables Hebel PowerWall to be used in the following applications:

- Walls on zero line allotment blocks.
- Multi-storey residential dwellings - external walls.
- Commercial developments.
- Infill PowerPanels.

NOTE

In the above applications, each PowerPanel should be screwed as specified in this guide, except a minimum of three screws should be installed through the middle top hat into each PowerPanel (refer to the fire test certificate in Appendix D).

Fig. 7.1 Bushfire Area

7.3 Bushfire Areas

BCA 2006 Vol. 2 Part 3.7.4 describes the provisions applicable to construction in bushfire prone areas. The reference code is AS3959. Hebel PowerPanel is non-combustible and suitable for all bushfire exposure levels (refer to Appendix A.6).

7.4 Design Considerations

Fire Stop Penetrations

Penetrations through Hebel PowerPanel to accommodate pipework, electrical cabling or ductwork will have to be protected (fire stop), to prevent the spread of fire through the penetration. The penetration can be protected with proprietary products, such as:

- Fire rated sealants.
- Fire collars and intumescent wraps.
- Fire rated mortars.
- Fire rated pillows.
- Fire rated switch boxes.

CSR Hebel recommends contacting the manufacturer to obtain the appropriate product/solution and installation method for the application and wall configuration.

8.0 Energy Efficiency

8.1 Building Code of Australia (BCA)

The BCA is available in two volumes which align with two groups of 'Class of Building':

- Volume 1 - Class 2 to Class 9 Buildings; and
- Volume 2 - Class 1 & Class 10 Buildings - Housing Provisions.

Each volume presents the Performance Requirements for the efficient use of energy for internal heating and cooling in buildings. The majority of changes have been associated with the Housing Provisions.

The Performance Requirements for energy efficiency ratings are dependent upon the form of construction (i.e. walls or floors), Class of Building, and the type of areas being separated. The performance requirement is a value that is the Total R-Value, which is the cumulative total of the individual R-Values of the building system components.

8.2 Hebel PowerWall

One of the primary design objectives in planning a building is to provide a cost effective comfortable living/ working environment for the building's inhabitants. Exploiting the inherent thermal mass and insulation qualities of Hebel enables the designer to achieve this objective.

Several international comparative studies have been conducted to investigate the benefits of incorporating AAC walls in place of conventional wall systems. A common trend was the lower heating and cooling energy consumption and smaller mechanical equipment required to maintain a comfortable living environment, especially with regards to regions of mainly cold weather. The excellent performance was the result of the three characteristics – thermal mass, thermal insulation, and the air tightness of the construction.

The level of insulation provided in a wall is determined by the required Total R-Value. The higher the required Total R-Value the greater the insulation provided. Hebel PowerWall incorporating CSR Bradford insulation can provide the R-Value ratings outlined in Table 8.1.

8.3 Thermal Insulation

It is recommended that insulation materials be installed to enhance thermal insulation properties and occupant comfort. Insulation also improves the acoustic performance of the wall against outside noise.

The BCA provides Deemed-to-Satisfy Provisions for compliance and installation of the various types of insulation. The insulation should be installed in Hebel PowerWall such that it forms a continuous barrier to contribute to the thermal barrier. All insulation installed in Hebel PowerWall must comply with: AS/NZS4859.1; or AS2464.3 for loose fill insulation.

8.4 Air Tightness

As outlined in Section 8.1 the thermal performance can be influenced by many factors. Most of these are related to the design decisions and properties of the adopted materials. Construction practices can also significantly affect the performance with poor sealing, resulting in drafts. The tight construction tolerances of AAC provide a wall with low air infiltration rate. Testing at the CSIRO (Test Report DTM327) on Hebel blockwork with thin bed adhesive joints has determined an air infiltration rate of 0.3L/s (0.014% of internal volume). For PowerPanels having fewer thin bed adhesive joints, a rate less than this could be achieved.

8.5 Sarking

As well as controlling condensation and acting as an air barrier, a sarking can be used to significantly improve the thermal insulation and energy efficiency performance of a building solution. Sarking layers can alter the performance of the cavity by providing a reflection side. The design of the sarking arrangement is complex and should be performed by the appropriate project consultant.

Where the sarking layer provides a weatherproofing function, the sarking material must comply with AS/NZS4200 Parts 1 and 2.

Table 8.1 Energy Efficiency

The following tables show the performance levels required for walls and floors under the BCA and the thermal performance of the Hebel PowerWall system.

Climate Zones	1	2	3	4	5	6	7	8
External Walls **Hebel PowerWall 101** 2-3mm skim render/coating system • 75mm thick Hebel PowerPanel • 115mm wall non-ventilated cavity (non-reflective) • Min. 70mm frame • 10mm Gyprock plasterboard CD						**Total R-Value of wall system 0.91**		
Multi-Residential Class 2, 3, 4 & 9c buildings								
Minimum required R-Value for walls	**R1.4**	**R1.4**	**R1.4**	**R1.7**	**R1.4**	**R1.7**	**R1.9**	**R2.8**
Minimum added R-Value of insulation	0.49	0.49	0.49	0.79	0.49	0.79	0.99	1.89
Minimum complying PowerWall system	102	102	102	103	102	103	103	105
Detached Houses Class 1 & 10a buildings								
Minimum required R-Value for walls	**R1.9**	**R1.9**	**R1.9**	**R2.2**	**R1.9**	**R2.2**	**R2.4**	**R3.3**
Minimum added R-Value of insulation	0.99	0.99	0.99	1.29	0.99	1.29	1.49	2.39
Minimum complying PowerWall system	103	103	103	104	103	104	104	105

Hebel PowerWall System	**Added R-Value of insulation for system variations:**	**Additional Insulation**	**Total System**
PowerWall 102	Bradford EnviroSeal single sided reflective foil laminate, no insulation	R0.62	R1.53
PowerWall 103	Bradford EnviroSeal metal roof/wall double-sided reflective foil laminate, no insulation	R1.04	R1.95
PowerWall 104	Bradford Gold Insulation R1.5 wall batts only	R1.50	R2.41
PowerWall 105	Bradford Gold Insulation R2.5 wall batts only	R2.50	R3.41
PowerWall 106	Bradford EnviroSeal metal roof/wall double-sided reflective foil laminate, plus Bradford Gold Insulation R2.5 wall batts	R2.83	R3.74

Notes:
- Refer to BCA for state & territory variations.
- Refer to BCA for alternative means of satisfying the required performance levels.
- Refer to CSR Bradford product literature for design & installation requirements for the nominated reflective foil laminates and insulation.

Energy Rating Software

Energy legislation (5 stars) is changing every year and ratings software is changing to keep up. Combine this with all the variable elements in a house such as window sizes, floor space and house orientation and you have a moving landscape. Hebel provides a great springboard for walls and floors in these rating systems due to its unique thermal properties of insulation AND mass. When rating in FirstRate, AccuRate, BASIX and BERS select AAC as the wall and floor option and see why Hebel is fast becoming the all star performer. Hebel can help your project achieve 5 stars and beyond.

9.0 Sound Transmission & Insulation

9.1 Overview

Current BCA Sound Transmission and Insulation Requirements

Hebel PowerWall is primarily used in buildings that have a domestic type of activity purpose. The BCA generally classifies these buildings into class 1 or 10. The acoustic performance requirements for external walls in these buildings or their building elements are not currently stated in the BCA. If a building using Hebel PowerWall was required to provide acoustic performance, then the performance level requirements for a building envelope and elements would be set by the relevant authorities (i.e. Local Councils, client specific requirements and etc).

Design Recommendations

Acoustic design is a complex science, and there will be instances where a specialist acoustic consultant is required.

For walls requiring acoustic performance CSR Hebel recommends:

1. Engaging a reputable acoustic consultant on a project-by-project basis to provide design advice and installation inspections.
2. When selecting the appropriate components for Hebel PowerWall, the designer or specifier must be aware that the laboratory R_w values are almost always higher than the field measured values. Therefore, allowances should be made for the lower expected field values during the selection of the system.
3. Separate advice from a specialist acoustic consultant should be sought to determine the effect on acoustic performance due to any changes to Hebel PowerWall, and any required modification of the installation details pertaining to the systems.
4. Increasing cavity widths, using higher density or thicker insulation or plasterboard, will generally maintain or increase the acoustic performance of Hebel PowerWall.

9.2 CSR Sound Control Systems

The CSR External Sound Control Systems guide provides solution for various external sound environments, the home can be designed so the interior noise is reduced to a selected level. The purpose of this guide is to provide solutions for the design of new residential buildings subject to certain types of external noise.

External Noise

External, or environmental noise in urban areas is pollution that can intrude into homes. It has many sources and can have a number of undesirable impacts.

Common external noise sources include:

- Road, air and rail transport.
- Industrial operations.
- Entertainment venues.
- Sporting activity.
- Pool and garden equipment.
- Neighbourhood noise such as television, parties.
- Barking dogs and lawn mowers.

Noise Source

Noise levels from various sources have been divided into four bands measured as L_{Aeq} (see GYP 572 August - 2005):

- Quiet suburban, 50 – 55dB(A).
- Medium suburban, 55 – 60dB(A).
- Noisy suburban, 60 – 65dB(A).
- Inner city, 65 – 70dB(A).

Interior Noise Levels

The noise levels within a home that result from external noise are measured as L_{Aeq} in the same way as the noise source. The term is a measure of the loudness of a sound, with units dB(A). The A weighting indicates that the value has been filtered to focus on the frequencies to which the ear is sensitive. Note the noise levels experienced in a home are affected to some extent by the interior furnishings. An interior noise level of L_{Aeq} 35dB(A) for road, train, industrial and neighbourhood noise, selected from Australian Standard AS/NZS2107.

Acoustics – Recommended Design Sound Levels And Reverberation Times For Building Interiors, is considered the upper limit for sleeping areas in houses near minor roads and within the range recommended for houses near major roads.

Note the noise level 35dB(A) is very quiet. Occupants could expect to hold a conversation without raising their voices, listen to TV at low volume, and sleep unaffected. Windows and doors must be closed to achieve the stated result.

It is possible to choose a lower level of internal noise, however, the designer should consider the ability of a system to reach the level, the higher cost to achieve lower noise levels, and the sensitivity of the occupants to noise.

Fig. 9.1 Interior Noise Level Reduction Through CSR Sound Control System

CSR System HB1
• 90mm Timber or Steel Framing • 1 x 10mm Gyprock Soundchek™ plasterboard direct fixed to frame • Bradford SoundScreen™ R1.6 • Hebel PowerPanel™ Wall System
Acoustic Rating $R_w/R_w + C_{tr}$ - wall 60/50

CSR System HB2
• 90mm Timber or Steel Framing • 2 x 10mm Gyprock Soundchek™ plasterboard direct fixed to frame • Bradford SoundScreen™ R2.0 • Bradford EnviroSeal™ • Hebel PowerPanel™ Wall System
Acoustic Rating $R_w/R_w + C_{tr}$ - wall 63/54

For further information see page 16 and 17 of GYP572 August 2005 "Sound Control External Noise Systems".

10.0 Weatherproofing

10.1 External Finishes

Hebel PowerWall requires an appropriate external coating system and sealant detailing to ensure a water resistant and vapour permeable building envelope is achieved.

Generally, the external face of Hebel PowerWall is coated with a skim coat render, texture coating and waterproofing paint system, in accordance with the recommendations of the coating manufacturer.

Performance Requirements

The following are items to be considered when selecting a coating system:

Manufacturer approved:

- All coating systems applied to Hebel external walls should be approved by the coating manufacturer as being appropriate for coating an AAC substrate.

Surface adhesion:

- The substrate preparation and coating application should be in accordance with the coating manufacturer's specification.
- Before applying finishes in coastal areas (refer to definition), all PowerPanels must be thoroughly washed with fresh water to remove any salt residue. Refer to coating manufacturer for additional requirements.

Water resistant:

- The primary objective of the coating system is to prevent water ingress through it, yet allow vapour in and out of the AAC substrate.
- The effectiveness of the coating can be specified by the manufacturer.
- Acrylic resin coating materials have a proven water-proofing capability.

Vapour permeability:

- For the coating to allow vapour to pass through it, the coating must be vapour permeable.
- The coating system should exhibit the following performance requirement::
  $w \cdot sd \leq 0.2$ kg/($m^2 \cdot h^{0.5}$) where,
  coefficient of water absorption, $w \leq 0.5$ kg/($m^2 \cdot h^{0.5}$);
  equivalent air layer thickness of water vapour diffusion, $s_d \leq 2$m.
  The coefficient of water absorption $w \leq 0.5$ means that minimal dampness has been absorbed regardless of the time factor.
  A coating with a sd = 2m has the same diffusion characteristics as a 2m thick air layer.

Compatibility:

- Ensure the coating system is compatible with the substrates. That is, acrylic resin dispersion-based coatings may not adhere to silicone sealants.

Durability:

- The coating must be durable and not deteriorate with exposure to light (UV) and weather.

Elasticity:

- The coating must be able to bridge a 1mm minimum crack width.
- The coating manufacturer can specify the minimum design specification (thickness), so that the coating is serviceable.

IMPORTANT

This list of performance requirements indicates that a specific fit-for-purpose coating system should be adopted, and that a simple paint coating would most likely be an inadequate coating system. Variations to the coating system should be approved by the coating system manufacturer or representative.

10.2 Rendering

The rendering system for Hebel PowerWall should be a skim coat consisting of a 2-4mm flexible acrylic render (such as Hebel SkimCoat) applied with a steel trowel. The 2-4mm thickness will provide a high quality substrate for the compatible water resistant coating system which is applied over the skim coat.

Skim coating is designed to level small irregularities only, and the wall should be checked and levelled if necessary prior to application of the render. It is important to note that a texture coat is required when using skim coating systems. It is also recommended that two coats of high build acrylic coating be applied for a high quality finish. Refer to the publication, 'Hebel Render Systems' for the requirements for skim coat rendering over Hebel substrates.

CSR Hebel does not recommend cement based site mixed renders be applied to Hebel PowerWall. If an on-site cement rendering system is adopted then the renderer should ensure appropriate procedures are adopted so that a consistent quality can be achieved, and necessary meshing included in the render (i.e. at high stress areas).

10.3 Cladding System

Proprietary cladding systems can be fixed to Hebel PowerWall. Where Hebel PowerWall acts as the structural backing for the proprietary cladding. The designer should ensure the structural performance of Hebel PowerWall is adequate. Contact CSR Hebel Engineering Services for assistance.

10.4 Sealant

All movement joints and gaps between the PowerPanels and framing around windows must be caulked with an appropriate flexible polyurethane sealant. Refer to the Section 11.0 for more information on sealants.

10.5 Wall Flashings

In general, flashings shall be designed and installed in accordance with SAA - HB39 1997 - Installation Code for Metal Roofing and Wall Cladding.

10.6 Sarking

For Hebel PowerWall, sarking is only required for insulation and condensation control. Sarking must be designed and installed in accordance with AS/NZS4200 Part 1 – Materials, and Part 2 – Installation.

11.0 Design and Detailing Considerations

11.1 Building Setout

Hebel PowerWall is principally designed for modular construction. The full benefit of savings in time and cost will be fully realised when the construction is designed to suit a 300mm module. In principle, thoughtful setout on the drawing board will minimise the site-cutting of PowerPanels, which is time consuming and wasteful, as compared to the installation of stock PowerPanels.

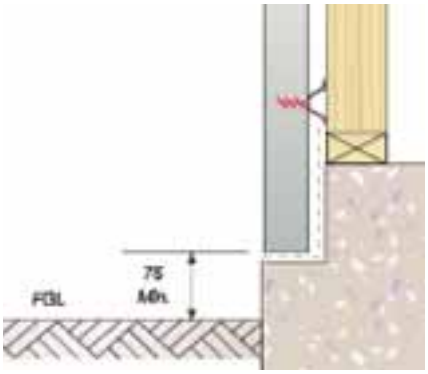
Vertical Dimensions

A few important criteria affect the vertical setout of the building:

1. A stepdown from the main slab is required for Hebel PowerPanel installation. The stepdown should be greater than 50mm deep and a maximum of 95mm wide. The actual depth of the stepdown is dependent on the height of the eaves above the slab level, and is rarely greater than 150mm. The following quick check can be used to confirm the stepdown dimensions.

Fig. 11.1 Typical Stepdown Detail

Stepdown = Panel Length - Eaves Height - 50



Example:

1. Stepdown = 2400 - 2200 - 50 = 150mm
2. Stepdown = 2700 - 2500 - 50 = 150mm

2. For all Hebel PowerPanel installation the bottom of the PowerPanel must remain 75mm above the finished ground level (FGL). This minimum distance satisfies recommendations of the current termite guidelines (refer to BCA Vol. 2, 3.1.3. and AS 3660.1). The builder should ensure that this requirement is clearly communicated to the future home owner.
3. The top of the PowerPanel should extend 50mm above the eaves to prevent any water running down between the PowerPanel and the stud frame. Attention should be given to the draining of the eaves.
4. The vertical setout and vertical dimension of the windows and other openings is not critical for Hebel PowerWall construction, as all the PowerPanels are site-cut to accommodate this setout. However, if windows are installed in the garage, they must be located up to the underside of the eaves if there are PowerPanels above (ie. in a gable wall).
5. When 2.7m or 3.0m long PowerPanels are used, a PowerPanel can be installed horizontally over the openings, with their length and width site-cut to suit. No galvanised steel angle lintel or additional top hat is required if no other PowerPanels are seated directly on top of this horizontal PowerPanel. In gables, a steel angle is required on top of the horizontal PowerPanel or additional top hats to the PowerPanels over, to carry the weight of the gable PowerPanels above. Refer to Detail 17.6.4 for further information.
6. As a guide, Table 11.1 gives the appropriate PowerPanel lengths for a variety of possible building configurations.

Fig. 11.2 Typical Eaves Detail

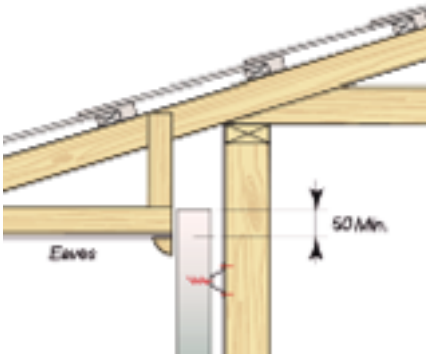


Fig. 11.3 Typical Window Head Detail

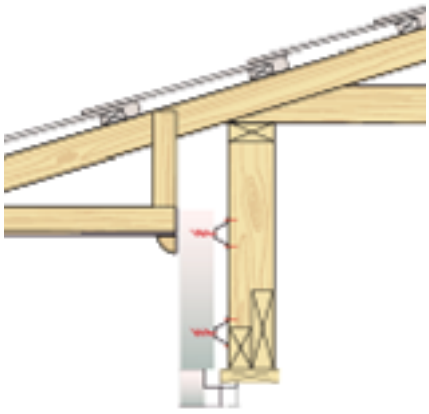


Table 11.1 Panel Lengths

Construction Type	Panel Length
2.4 ceiling with eaves	2400mm
2.4 ceiling with no eaves, gables	2700mm
2.7m / 3.0m ceiling with eaves	2700 mm / 3000mm
2.7m / 3.0m ceiling with no eaves	2700mm / 3000mm + block build up

Horizontal Dimensions

The horizontal setout of the building is vital, as incorrect drawings lead to problems with the frame and hence the PowerPanel installation. Please note the following items which require careful consideration during the building design stage.

1. Setting the building out to a 300mm or 600mm module is most important. All openings should be clearly dimensioned on the plan, as well as the exact size of the opening. Although site tolerances can be made up during the installation process, it is important to achieve an efficient layout on the drawing board first.
2. Setting up a grid across the plan will not help to achieve the required layout, as the orientation of the PowerPanels in each corner affects the setout. There are no rules to setting out a corner; however, be aware that a 10mm control joint is normally required at every corner. Therefore an 85mm offset occurs along one side (refer to Detail 17.9.1). You may choose to set a standard corner orientation. For example, joints will occur only in the side walls, and hence the offset will occur on these walls.
3. The location of all control joints should be noted on the drawing and a 10mm gap allowed in the dimensioning of the building. Refer to Section 11.4 for guidelines on the location of control joints around a building.

Fig. 11.4 Typical Modular Layout of Window

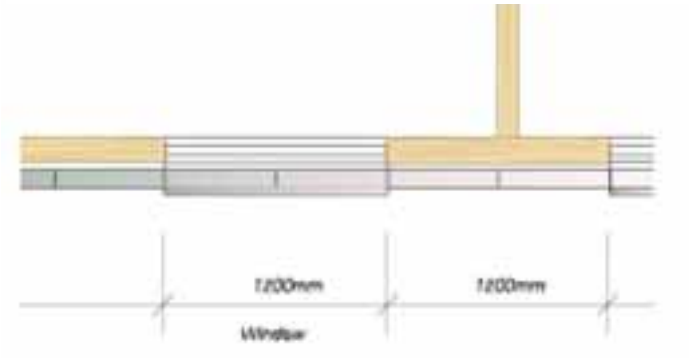
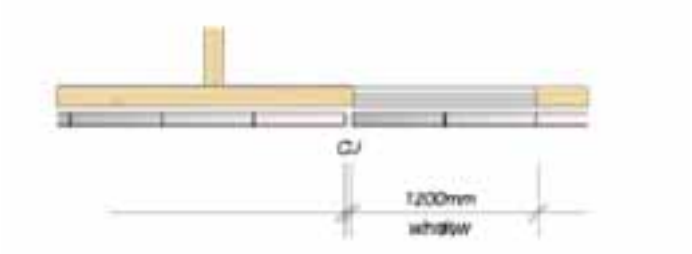


Fig.11.5 Typical Corner Detail

Fig.11.6 Typical Control Joint Detail

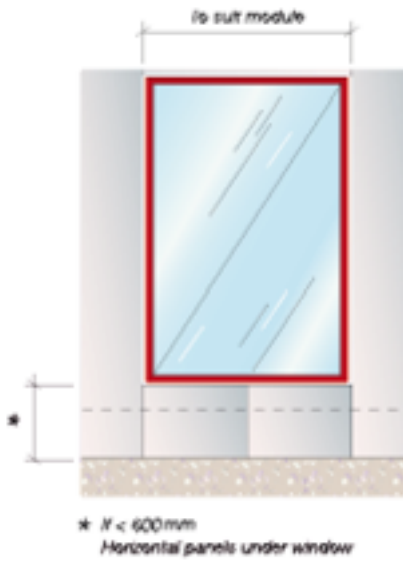


4. To assist in maintaining the modular setout of the building, windows should be ordered to suit the 300mm module. However, if the length of PowerPanel required below the sill is less than 600mm, then a site cut horizontal PowerPanel (rather than vertical PowerPanels) can be installed here and hence the width of the window is not critical. Typically, external doors and sliding doors are full height and hence their width is not critical to the module, as there are no PowerPanels required above or below, but it should be noted on the drawing. While most standard window sizes do not exactly fit the 300mm module, often being 10mm greater in size, this is easily incorporated into the construction (refer to Detail 17.8.1).

   Additionally, a number of manufacturers are prepared to supply the windows to the desired width with volume orders.

5. The distance between openings should not be less than 300mm, obviously to suit a standard PowerPanel. With regard to splays and bay windows, the same principle applies. Note that for 45° splays, a 600mm wide PowerPanel can be site-cut to a minimum width of 270mm.

Fig.11.8 Panels Below Window Detail



11.2 Termites

It is the builder's responsibility to ensure that all council and Australian code requirements are fully adhered to in regard to the design of the house for preventing termite attack. The construction details contained in this guide do not attempt to fully address the issues, due to the variation of requirements from state to state. Hebel PowerWall is ideally suited to the exposed edge method of perimeter protection. BCA 2006 Vol. 2 Part 3.1.3 deals with termite risk management and the reference code is AS3660.

Fig.11.9 Typical Bay Window Detail

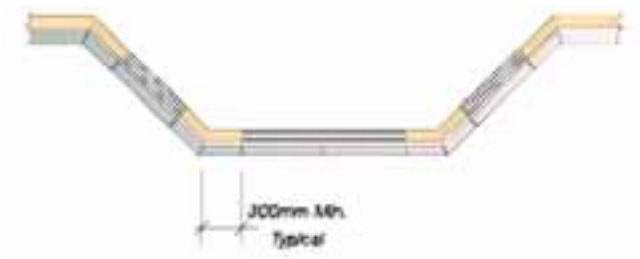
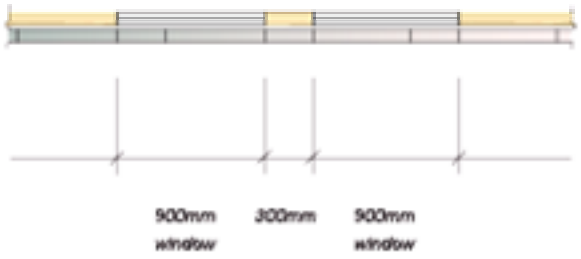


Fig.11.10 Typical Panel Layout for Window



11.3 Footings

Footings for Hebel PowerWall should comply with conventional masonry veneer construction as specified in Australian Standard AS 2870. This is a minimum requirement. Local engineering advice should always be sought, especially in areas of highly reactive ground conditions.

11.4 Movement Control Joints

During the life cycle of a building, the building and the materials that it is constructed from will move. These movements are due to many factors working together or individually, such as support structure movement (lateral sway or vertical deflection), thermal expansion and contraction and differential movements between materials. This movement, unless relieved or accommodated for, will induce stress in the materials, which may be relieved in the form of cracking.

To accommodate these movements and relieve any induced stresses, which could potentially crack the wall, movement joints need to be installed. There are two categories of joints:

- Articulation Joints (A.J.) are provided to relieve induced stresses due to support structure movement. The joints make the walls more flexible by breaking the wall into a series of small PowerPanels. Differential movement between the facade and adjacent structural elements need to be accommodated with articulation joints.
- Control Joints (C.J.), (one type is an expansion joint), are provided to relieve the induced stresses resulting from thermal expansion or contraction of the AAC, or differential movement between the AAC and another material or structure, such as abutting walls or columns of concrete or brickwork. Control joints can delineate coating shrinkage breaks.

A joint may perform the function of either an articulation joint or control joint or both.

IMPORTANT

There are restrictions provided to the maximum length of wall:

- 6 metres maximum for continuous runs of walls. However local engineering advice should always prevail.
- At most external and all re-entrant corners.

Vertical control joints should coincide with control joints in the supporting structure and anywhere that significant structural movement is expected, where the wall abuts a vertical structure, such as an existing building, or adjacent to large openings. At all control joints, the top hat should be discontinuous to allow for the effective movement of the building at these locations.

At all corners the top hat section is discontinuous and therefore a weakness exists at the vertical PowerPanel joint in these locations.

Refer to Detail 17.7.5 for a standard control joint detail, Detail 17.8.2 for a typical top hat layout across a window control joint and the drawing on Detail 17.9.1 for a typical control joint layout around a dwelling.

This design guide proposes minimum widths for the movement joints. The project engineer shall determine if the joints are sufficient to accommodate the movement of the specific project building. Typically, the vertical joint is norminally 10mm wide and filled with an appropriate backing rod and flexible polyurethane sealant. A horizontal control joint is required beneath slabs or angles to accommodate any expected deflection. The magnitude of the deflection must be verified by the building designer. Typically, the horizontal joint is nominally 20mm wide and filled with an appropriate polyurethane sealant.

11.5 Condensation

Condensation is a complex problem, and can occur under a variety of conditions, not just cold conditions. Literature on this subject is available from CSIRO/BRANZ/ASHRAE and must be consulted when building in areas where condensation is likely to occur.

In these cases, the appropriate use of a sarking as a vapour barrier or as thermal insulation, or both, can be effective in controlling condensation.

11.6 Penetrations

Small service penetrations through the PowerPanel of PowerWall should allow for differential movement between the PowerPanel and the service. All penetrations are a potential source for water ingress and should be sealed with an appropriate polyurethane sealant.

Windows

Further to the discussion on window sizes in Section 11.1 (B) (iv) the builder should also ensure that the reveal size is correct to suit PowerWall. Refer to the table below for recommendations:

The sizes above typically apply to aluminium framed windows. If timber windows are being used similar tolerances and guidelines apply. Refer to Section 17.8 for a section through the sill of a timber window.

Stud Size (mm)	Reveal Size (mm)
70	90-100
90	110-120

NOTE

The external sealant in the control joints adjacent to windows should be extended to the inside face of the wall, beyond the sealant line of the windows. No gap should exist between both sealants. This sealant configuration is recommended at similar detailing issues.

11.7 Sealants

All movement joints and gaps between the PowerPanels and infill framing or penetration framing must be filled with an appropriate polyurethane sealant. The sealant should be designed and installed in accordance with the sealant manufacturer's specifications. The specifications will provide information regarding priming the surface, geometry of sealant (width/depth ratio with width greater than depth), sealant surface profile (concave), substrate preparation, etc.

NOTE

Where different types of sealants come in contact, the designer must ensure the sealants are compatible. Typically a backing rod is used to control the depth of sealant and ensure the sealant is bonded on two sides only.

Note, the surface may require some preparation depending upon the type of sealant. CSR Hebel recommends the use of an appropriate polyurethane sealant.

For fire rated walls, an approved fire rated sealant should be used.

11.8 Wet Area Wall Construction

All wet area walls shall be lined and waterproofed in accordance with Australian Standards and to BCA requirements. CSR Gyprock Aquachek™ or CSR Cemintel™ Wallboard are suitable lining materials for wet area applications.

11.9 Non CSR Hebel Components

Components, which are not manufactured by CSR Hebel, such as CSR Gyprock plasterboard, CSR Bradford insulation and others must be designed, installed and handled in accordance with their manufacturer's guidelines and recommendations.

12.0 Design, Detailing and Performance Responsibilities

CSR Hebel engages independent testing laboratories to test and report on the performance of a wall in accordance with the relevant Australian Standards. Consultants use these reports as the basis for opinions (estimates of laboratory performance) they issue for variations or different arrangements to the tested system, and also to design and specify walls that meet appropriate criteria for a particular project. Using their experience, the consultant will make judgement about on-site installed performance of various walls. The performance levels of walls documented in this design guide are either what is reported in a test or the documented opinion of consultants. Performance in projects is typically the responsibility of:

Project Consultants (Structural, Fire, Acoustic, etc.)

These consultants are typically responsible for the following:

- Opinions on expected laboratory performance of wall configurations that vary from actual test configuration, such as substitution products and components.
- Judgements about expected field performance using laboratory test reports and practical experience.
- Design, specification and certification of structural, fire, acoustic, durability, weather tightness and any other required performance criteria for individual projects.

  This involves the design and selection of building elements, such as wall and floors and their integration into the building considering the following:

  - Interface of different building elements and to the structure/ substrate.
  - Wall and floor junctions.
  - Penetrations.
  - Flanking issues.
  - Room/building geometry.
  - Acoustic and water penetration field-testing.

Project Certifier and/or Builder

These professionals are typically responsible for:

- Identifying the performance requirements for the project in accordance with the Building Code of Australia and clearly communicating this to the relevant parties.
- Applicability of any performance characteristics supplied by CSR Hebel including test and opinions for the project.
- The project consultant's responsibilities detailed above if one is not engaged in the project.

CSR Hebel does not provide consulting services. CSR Hebel only provides information that has been prepared by others and therefore shall not be considered experts in the field. Any party using the information contained in this design guide or supplied by CSR Hebel in the course of a project must satisfy themselves that it is true, current and appropriate for the application, consequently accepting responsibility for its use.

It is the responsibility of the architectural designer and engineering parties to ensure that the details in this design guide are appropriate for the intended application. The recommendations in this design guide are formulated along the lines of good building practice, but are not intended to be an exhaustive statement of all relevant data. CSR Hebel is not responsible for the performance of constructed walls, including field performance, and does not interpret or make judgements about performance requirements in the BCA.

13.0 System Components

13.1 Hebel PowerPanel

The core component of Hebel PowerWall is the 75mm thick Hebel PowerPanel. The PowerPanel is manufactured in a range of stock sizes as detailed in the following table.

Table 13.1 Standard and Manufactured Panel Sizes

Panel Type	Panel Weight (at 51kg/m2)		
	Length (mm)	Width (mm)	
		300	600
Standard	1200	-	37
	2400	37	74
	2550	-	78
	2700	42	83
	2850	-	88
	3000	46	92

Note:
1 Average PowerPanel weight calculated at 30% moisture content.

13.2 Top Hats

The top hats are used to fix the Hebel PowerPanel to the structural support framing. Three types of top hats can be used in Hebel PowerWall. These are FastStud 24TH42, Rondo N°303, and Lysaght Topspan 22 shown in Figure 13.1. For alternative top hat types, the top hat manufacturer or project engineer will be responsible for approving the substitute product as adequate for performance requirements.

Fig. 13.1 Lysaght Topspan® 22

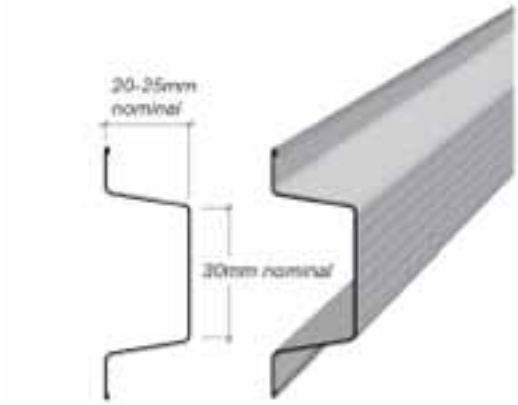


Fig. 13.2 Typical Hebel PowerPanel and Panel X-Section

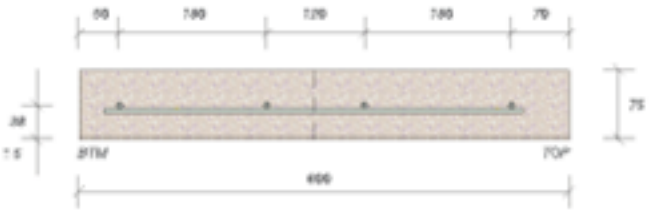


Fig. 13.3 Hebel PowerPanel

NOTE

BTM: is the smooth face

Bars: 4x4mm Ø longitudinal
& 6-8 transverse bars depending on PowerPanel length.

Tolerence: The width & thickness of the PowerPanels are manufactured to a tolerance of + or - 1.5mm.

13.3 Timber or Steel Stud Framework

All timber or steel stud framework to be supplied and installed in accordance with relevant Australian standards and project engineer's instructions.

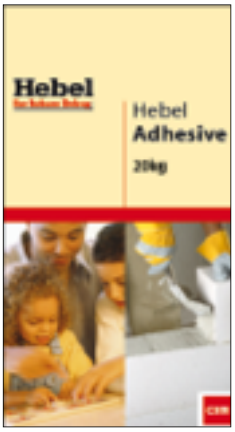
13.4 Hebel Mortar

Fig. 13.3 Hebel Mortar

Hebel Mortar (supplied in 20kg bags) when required is used as a thick bed mortar base to provide a level base for PowerPanel installation as well as providing acoustic and fire protection at the base of the PowerPanels.

13.5 Hebel Adhesive

Fig. 13.4 Hebel Adhesive



Hebel Adhesive (supplied in 20kg bags) is used for gluing the PowerPanels together at vertical and horizontal joints.

13.6 Hebel Patch

Fig.13.5 Hebel Patch

Minor Chips or damage to PowerPanels are to be repaired using Hebel Patch (supplied in10kg bags).

13.7 Anti-corrosion Coating Agent

Steel reinforcing exposed on cut PowerPanels is to be coated with a liberal application of Fentak Exposed Reinforcing Touch Up Paint (anti-corrosion agent).

Fig.13.6 Fentak Exposed Reinforcing Touch Up Paint

13.8 Flashing

In general, flashings shall be designed and installed in accordance with SAA – HB39 1997 - Installation Code for Metal Roofing and Wall Cladding.

13.9 Panel Support Packer

The PowerPanel support packer should consist of a durable material that will not degrade during the life of the structure.

13.10 Sarking

Hebel PowerWall may incorporate a sarking membrane between the top hats and steel stud support framing for condensation control or for improving the thermal insulation performance. Sarking must be designed and installed in accordance with AS/NZS4200 Part 1 – Materials, and Part 2 – Installation. Additional information on CSR Bradford products is available from the website: www.bradfordinsulation.com.au.

13.11 CSR Bradford Insulation

Hebel PowerWall incorporates CSR Bradford Insulation materials. Additional information on CSR Bradford Insulation is available from the website: www.bradfordinsulation.com.au

Fig.13.7 Bradford Insulation

13.12 CSR Gyprock® Plasterboard

Hebel PowerWall incorporates Gyprock plasterboard on the internal stud side. The type, thickness and densities of plasterboard will be as per Hebel PowerWall requirements. Additional information on Gyprock plasterboard is available from the CSR Gyprock website: www.gyprock.com.au

13.13 Backing Rod

Backing rod is used to enable correct filling of joints with sealant. It is recommended that backing rod be of open cell type to enable sealant to cure from behind. The diameter of backing rod must be appropriate for the width of the gap being filled.

13.14 Sealants

All gaps in internal and external junctions and movement joints must be caulked with appropriate polyurethane sealants. Sealants shall be installed in accordance with the sealant manufacturer's instructions.

IMPORTANT

Sealants and primers (as required) must be compatible with the substrate material, such as flashings, Hebel PowerPanel, window frame material and coatings.

13.15 External Finishes

Fig. 13.8 Hebel SkimCoat™ and Hebel HighBuild™

External finishes can be rendered systems or different type of coating systems. The manufacturer of the external finishes must confirm its suitability for application on AAC products. For more information on external finishes refer to the 'Weatherproofing' Section 10.0 of this design guide. Hebel SkimCoat and Hebel HighBuild renders are the recommended products.

13.16 Fasteners & Fixings

1. **Fixing of top hat to timber stud frame;**
   12-11x25mm Hex Head Type 17 screw
2. **Fixing of top hat to steel framing;**
   10-16x16mm Hex Head Teks screw
3. **Fixing of Hebel PowerPanel to top hat from inside of building;**
   14-10x65mm Hex Head Type 17 screw
4. **Fixing of Hebel PowerPanel to top hat from outside of building;**
   14-10x100mm MP Bugle Head Type 17 screw

Plasterboard fixings

Fix the plasterboard to the steel studs in accordance with CSR Gyprock instructions.

Fig. 13.8 Standard Fixings Used in Hebel PowerWall

14.0 System Installation

14.1 Tools and Equipment

The basic tools required to assist in the installation of the PowerPanel are shown in Figure 14.1. These may be purchased through a CSR Hebel distributor and include:

1. Mixing bucket
2. Stirrer
3. Notched trowel
4. Sanding float
5. Panel lifters

Extra equipment will also be required and includes the following:

- Power drill (clutch driven).
- Power saw with metal or diamond tipped cutting blades.
- Dust extraction system.
- Sockets for screws.
- Personal Protective Equipment (PPE) such as goggles, ear muffs/plugs and face mask, used when site cutting the PowerPanels.

Fig. 14.1 The Basic Tools and Equipment Requirements

14.2 Hebel PowerPanel Installation Sequence

1. Frames and Trusses Complete

- Install sarking and wall wrap as specified

- 2 screws/stud
- Check number of top hats required
- Extras under openings

2. Fix Top Hats

- Check overlap at corners
- Check detail around control joints, ensuring top hats are discontinuous at Control Joint locations

- Fix to bottom plate
- Cover step completely
- Lap at corners

3. Install DPC

- Corner PowerPanel installed first
- 3 screws from outside
- Check PowerPanel orientation at corners
- First PowerPanel vertical with level

- Check number of screws per top hat
- Check control joint locations

4. Install Hebel PowerPanel

- Hebel Adhesive to vertical joints

- Site-cutting to suit
- Coating of exposed reinforcement

14.2 Hebel PowerPanel Installation Sequence

5. Window Detail

- Panel hard against window frame

- Weather strip down sill
- Flashing behind PowerPanel
- Site-cut sill with slope
- Apply anti-corrosion agent

6. Prepare for Coating

- Add special feature eg. quoins etc.

- Sand joints flush

- Fill joints and patch any damage

- Fill external screw holes as required

7. Coating

- Seal windows
- Seal control joints

- Refer to specification from coating manufacturer for further details

14.3 Installation of Services

The installation of services in the building is very similar to the methods currently being used throughout the industry.

The gap between the PowerPanel and the frame, which nominally measures 20-25mm, is quite adequate to allow electrical services to be installed as usual. The electrical meter box can be face fixed to the outside of the PowerPanels, or alternatively, recessed into the stud frame through the PowerPanels. In the latter case, appropriate setout of the opening should also suit the 300mm module and all sides of the box should be sealed to the PowerPanels with an approved polyurethane sealant.

With regard to plumbing services, the hot and cold water pipes can be externally face fixed to the studs, if necessary. As Hebel PowerWall is not classified as cavity construction, this installation technique is satisfactory. The only difficulty occurs when the pipes are run vertically. In this case the pipes must be mounted between the studs, so as not to foul the horizontal installation of the top hats. Top hats are not to be cut to allow clearance for services.

Penetrations through the PowerPanel for services should be neatly filled and the joint sealed with a polyurethane sealant.

Fig. 14.2 Installed Piping Services Prior to the Installation of Hebel PowerPanel

Fig. 14.3 Neat Finishes of Installed Services

15.0 Panel Handling

15.1 Manual Handling

CSR Hebel recommends using a trolley or other mechanical apparatus to move the PowerPanels around the work site. Manual handling where people physically move a PowerPanel should be kept to a minimum, with the weight being supported by an individual kept as small as possible. Any concerns regarding the weight to be handled should be discussed with the PowerPanel installation contractor.

To minimise the possibility of manual handling injuries, CSR Hebel suggests the following:

- Use mechanical aids, such as trolleys, forklifts, cranes and levers, or team lifting to move PowerPanels.
- Keep the work place clean to reduce the risk of slips, trips and falls, which can cause injury.
- Plan the sequence of installation to minimise PowerPanel movements and avoid awkward lifts.
- Train employees in good lifting techniques to minimise the risk of injury.

15.2 Mechanically Assisted Handling

Moving and handling Hebel PowerPanel should be done as much as possible using mechanical aids such as forklifts, cranes and special PowerPanel lifting trolleys.

Guidelines for handling Hebel PowerPanel using the PowerPanel Trolley or PowerPanel lifters are detailed in Technical Bulletin Hebel PowerPanel Handling & Installation Guidelines, NoHTB791.

Fig. 15.1 Personal Protective Equipment

15.3 Health, Safety & Personal Protective Equipment (PPE)

Hebel products are cement-based, which may irritate the skin, resulting in itching and occasionally a red rash. The wearing of gloves and suitable clothing to reduce abrasion and irritation of the skin is recommended when handling Hebel products.

Approved respirators (AS/NZS1715 and AS/NZ1716) and eye protection (AS1336) should be worn at all times when cutting and chasing. Refer to the CSR Hebel Material Safety Data Sheets. Refer to the back of this Design & Installation Guide for further information regarding health and safety.

15.4 Cutting

The use of power tools when cutting concrete products may cause dust, which contains respirable crystalline silica, with the potential to cause bronchitis, silicious and lung cancer after repeated and prolonged exposure. When using power or hand tools, on Hebel products, wear a P1 or P2 respirator and eye protection. When cutting, routing or chasing Hebel products with power tools, use dust extraction equipment and wear hearing protection. Refer to the appropriate CSR Hebel MSDS. For further information, contact CSR Hebel or visit the website:
www.hebelaustralia.com.au

Reinforcement exposed during cutting is to be coated with a liberal application of Hebel corrosion protection paint.

Fig 15.2 Hebel PowerPanel Trolley

16.0 Delivery and Storage

16.1 Unloading Panels

Panels shall be unloaded and moved with only approved lifting devices. Before use, the lifting devices should be checked for the required lifting tags. Panels should be unloaded as close as possible to the intended installation area. This will increase work efficiency and minimise the need for secondary lifting.

NOTE

Secondary handling increases the risk of PowerPanel damage. The repair of damage sustained during lifting and moving is the responsibility of the lifter. Where damage is excessive, PowerPanels must be replaced.

16.2 Storage

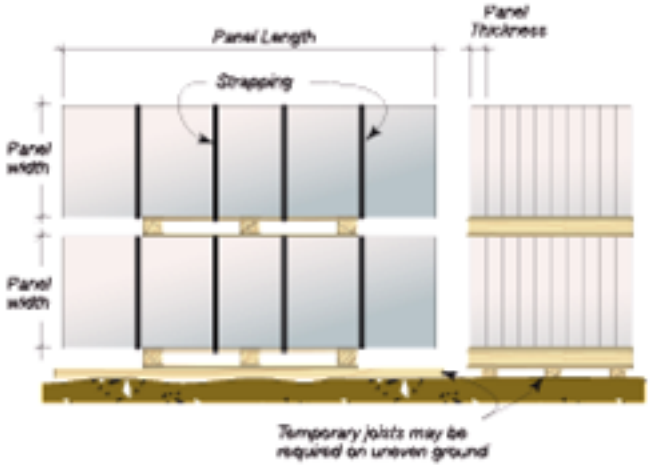
All materials must be kept dry and preferably stored undercover. Care should be taken to avoid sagging or damage to ends, edges and surfaces.

All Hebel products must be stacked on edge and properly supported off the ground, on a level platform. Panel bundles can be stacked two high. The project engineer should be consulted as to the adequacy of the structure to support the stacked bundles.

If outside, Hebel PowerPanels must be stored off the ground and protected from the weather. Only single bundles positioned on the ground can be opened. To provide a level surface, we recommend placing temporary joists beneath the supporting cleats.

Fig. 16.1 Hebel PowerPanel Shipping Bundle

Fig. 16.2 Stacking Bundles of Hebel PowerPanel

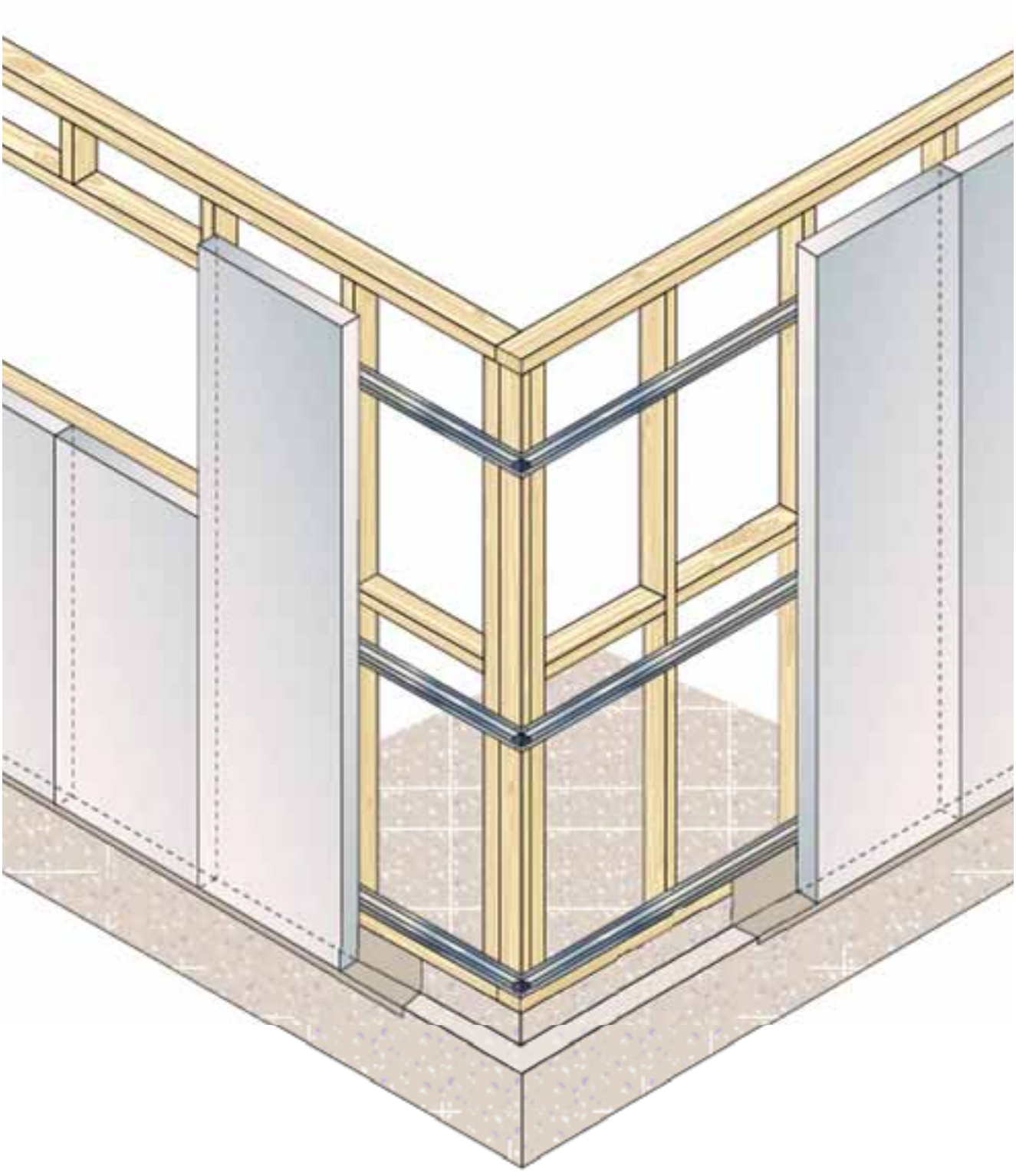


17.0 Construction Details - Hebel PowerWall 101

Please note, all dimensions in this section are in millimetres

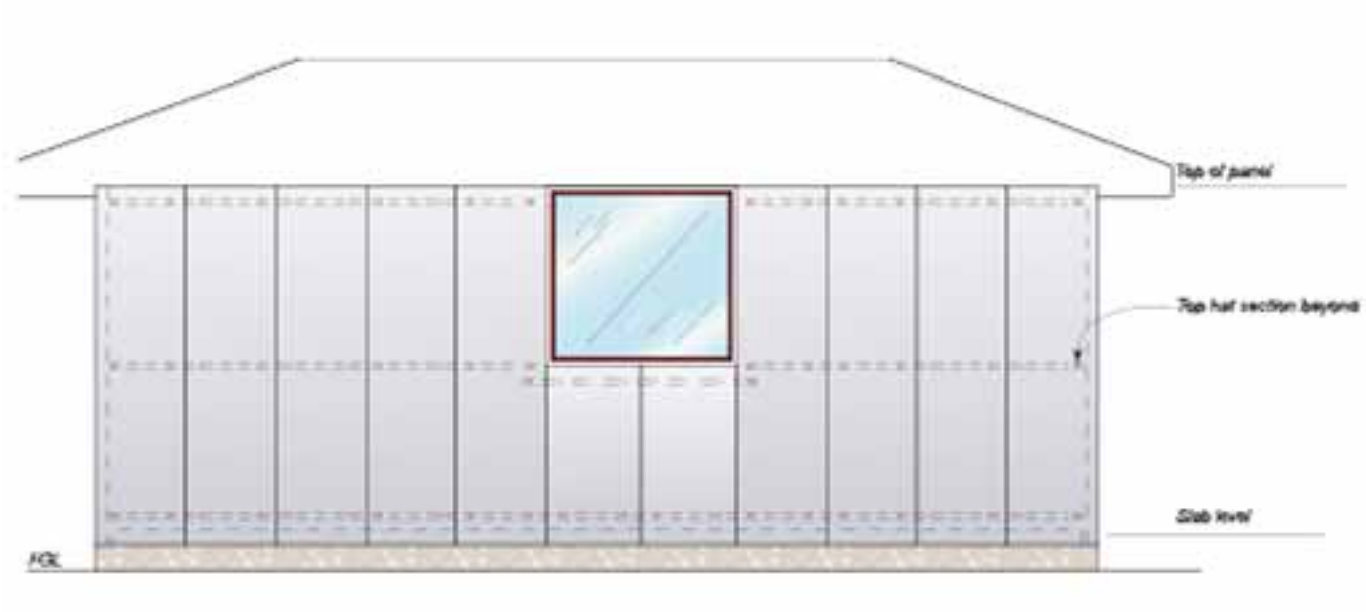
17.1 Single Storey Construction Details

Detail 17.1.1 Single Storey Construction - Isometric View Detail

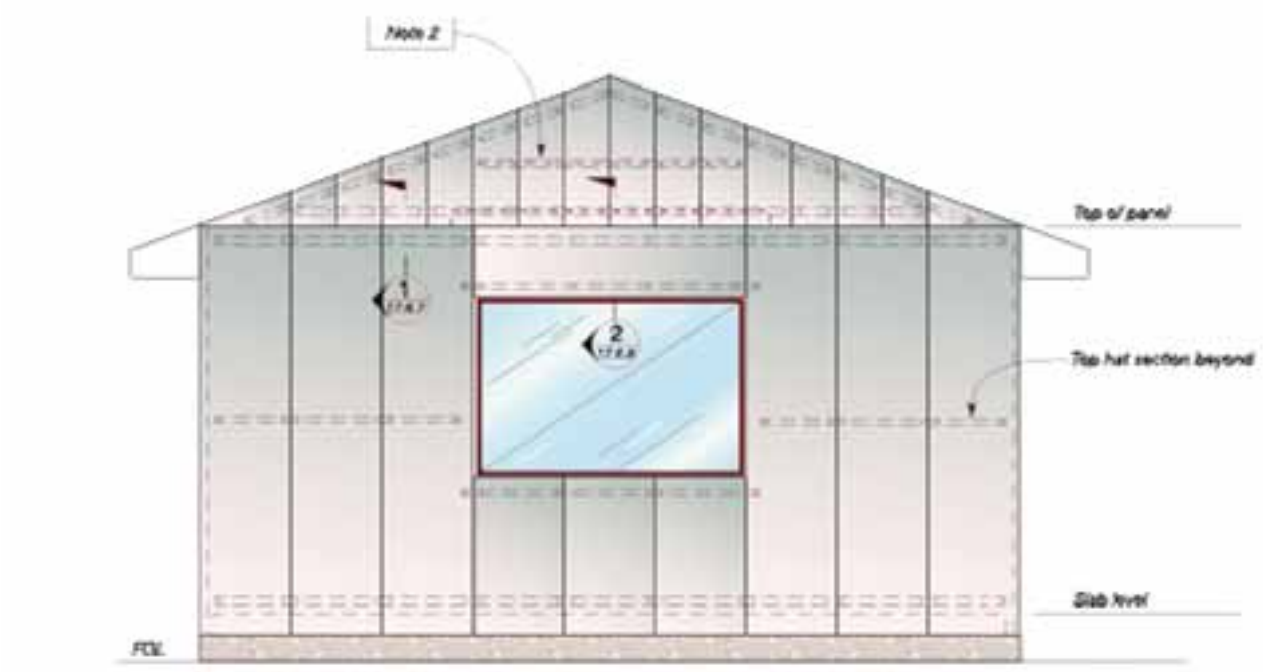


Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

Detail 17.1.2 Single Storey Construction - Hip Roof Elevation



Detail 17.1.3 Single Storey Construction - Gable End Elevation

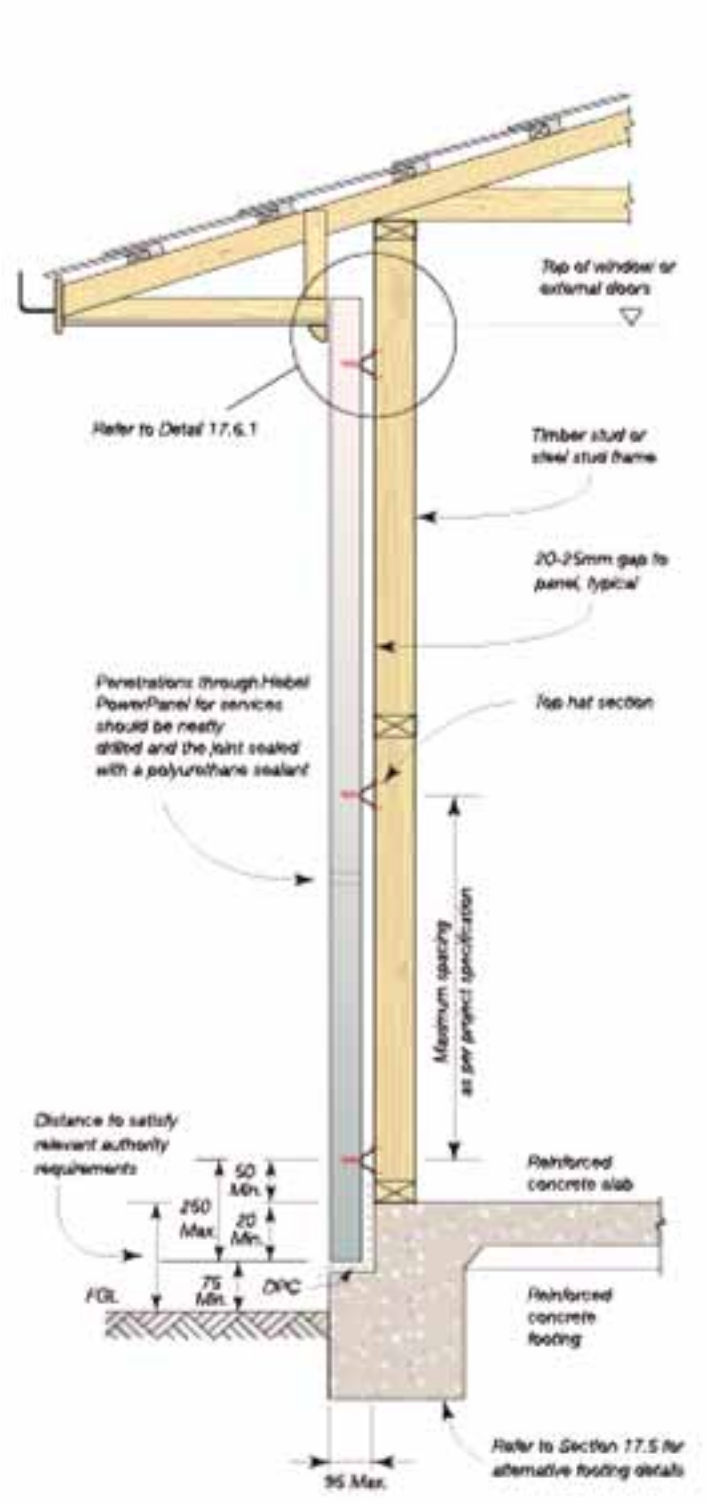


NOTE

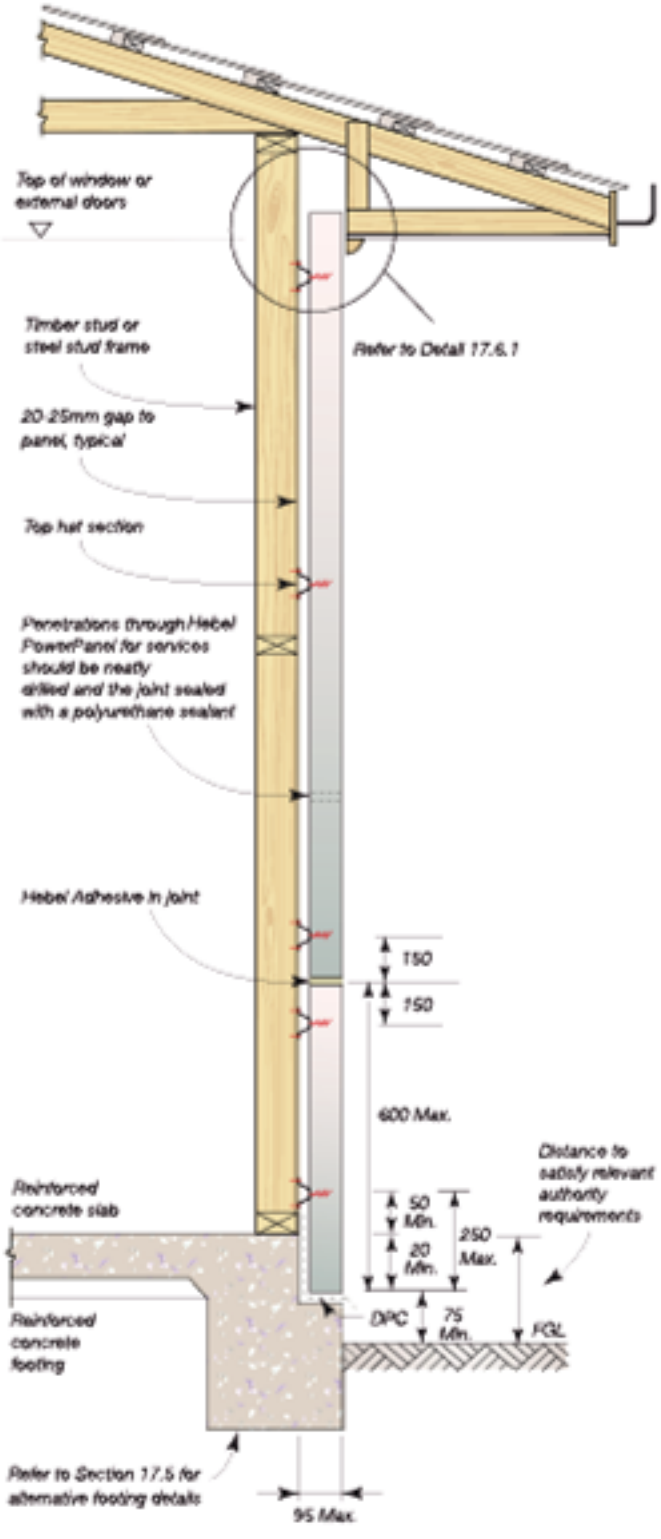
1. Number of top hats and top hat spacing to be confirmed by the building designer.
2. Additional top hats may be required, refer to Section 5.
3. These details have not shown the set-out of top hats to accomodate control joint locations. This is the responsibility of the building designer.

Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

Detail 17.1.4 Single Storey Construction - Typical Section Detail



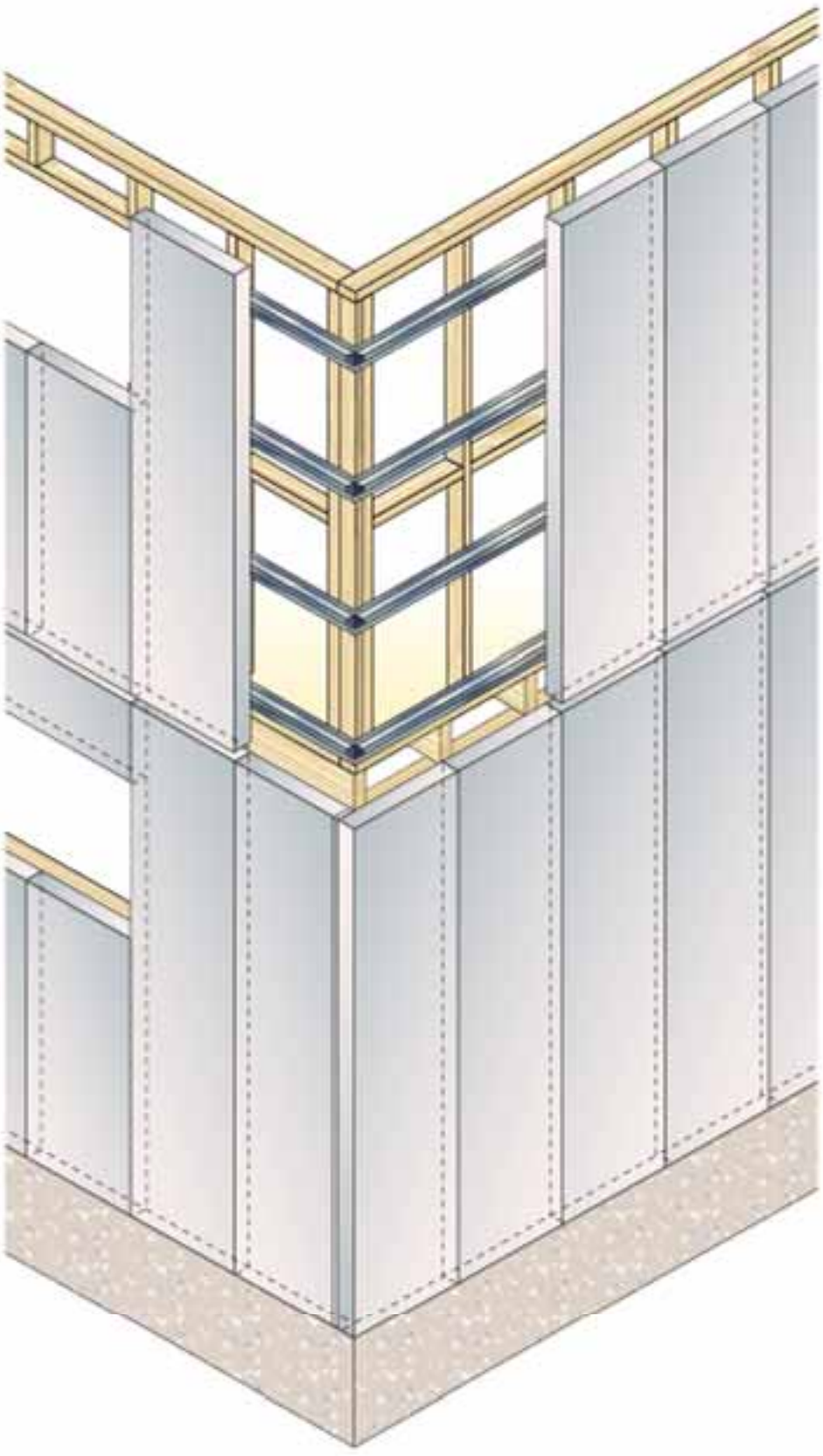
Detail 17.1.5 Single Storey Construction - High Wall Section Detail



Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

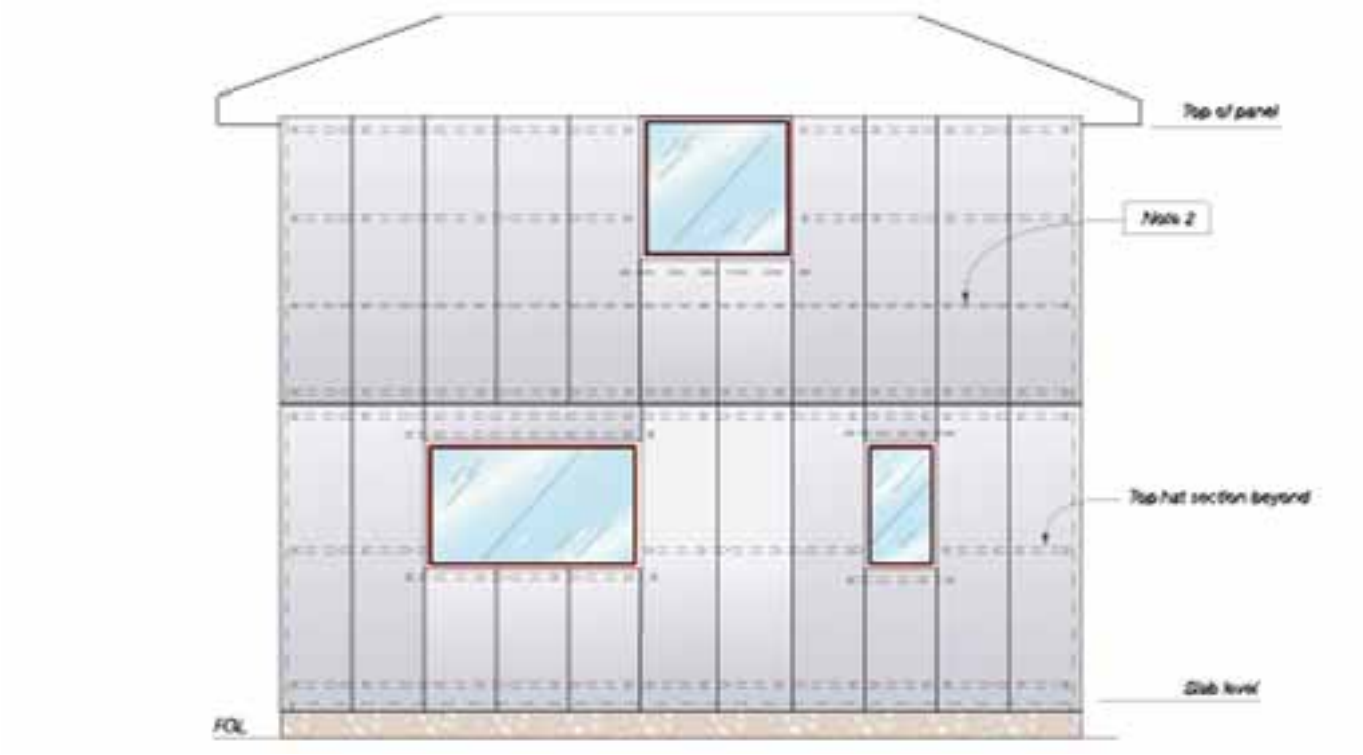
17.2 Two Storey Construction

Detail 17.2.1 Two Storey Construction - Isometric View Detail

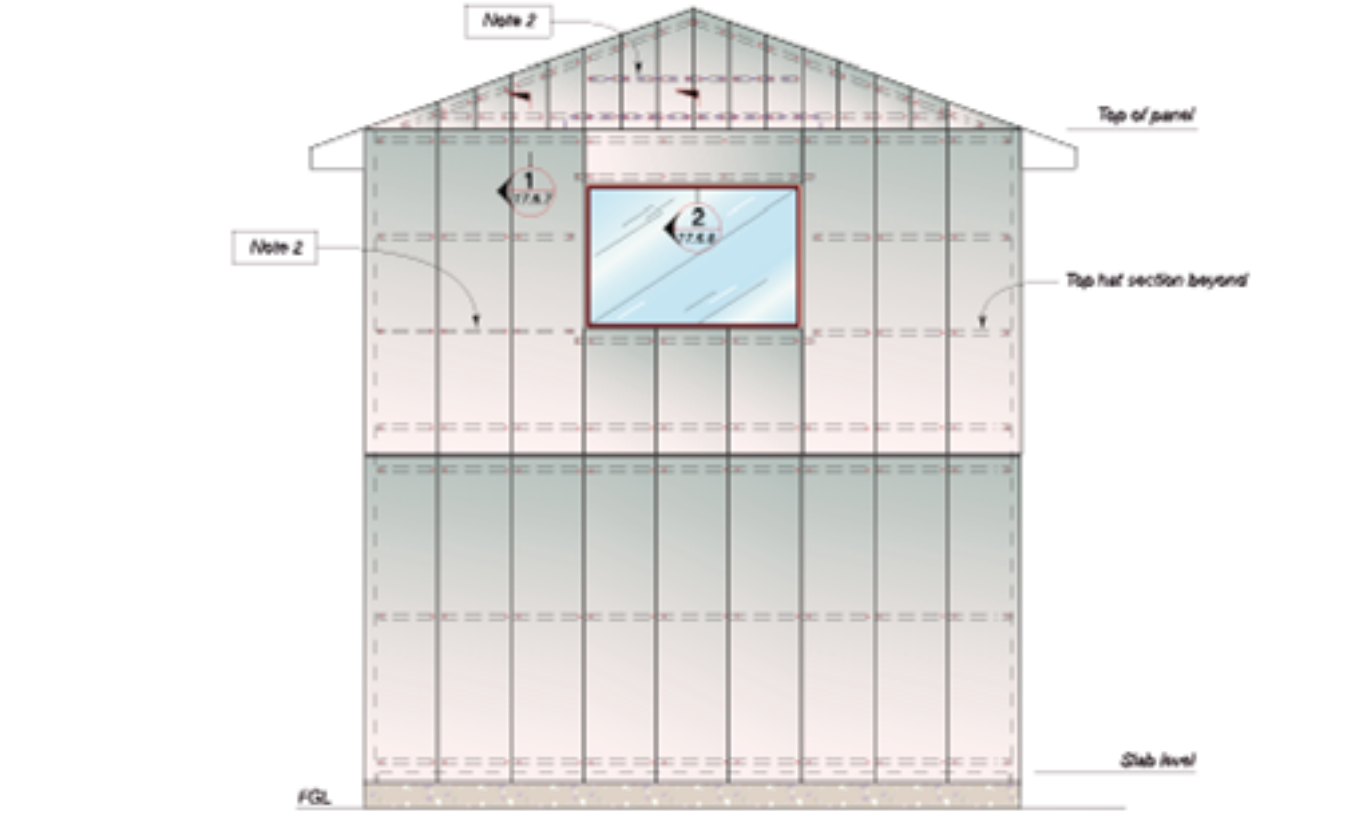


Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

Detail 17.2.2 Two Storey Construction - Hip Roof Elevation



Detail 17.2.3 Two Storey Construction - Gable End Elevation

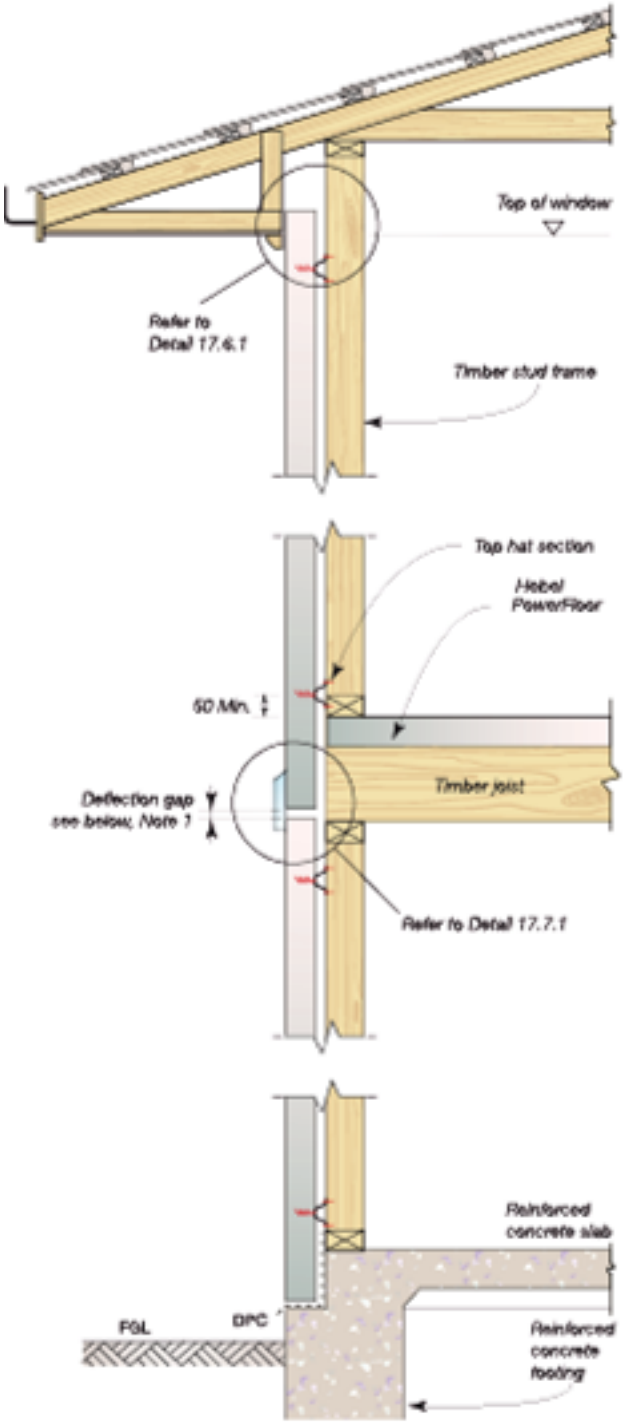


NOTE

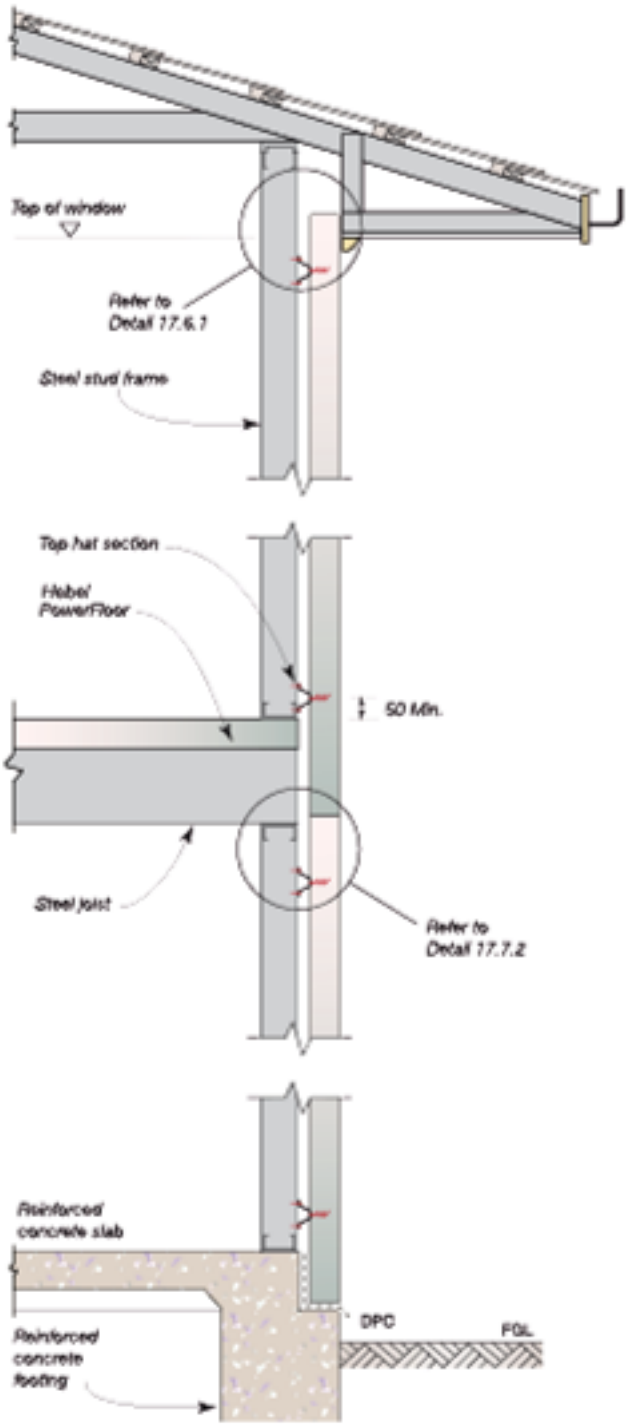
1. Number of top hats and top hat spacing to be confirmed by the building designer.
2. Additional top hats may be required, refer to Section 5.0.
3. These details have not shown set-out of top hats to accomodate control joint locations. This is the responsibility of the building designer.
4. Frame design of lower floor to allow for extra load on wall from upper PowerPanels (refer to Section 5.8.2).
5. Minimum four horizontal top hats required for upper PowerPanels.

Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

Detail 17.2.4 Two Storey Construction - Typical Timber Frame Section



Detail 17.2.5 Two Storey Construction - Typical Steel Frame Section



NOTE

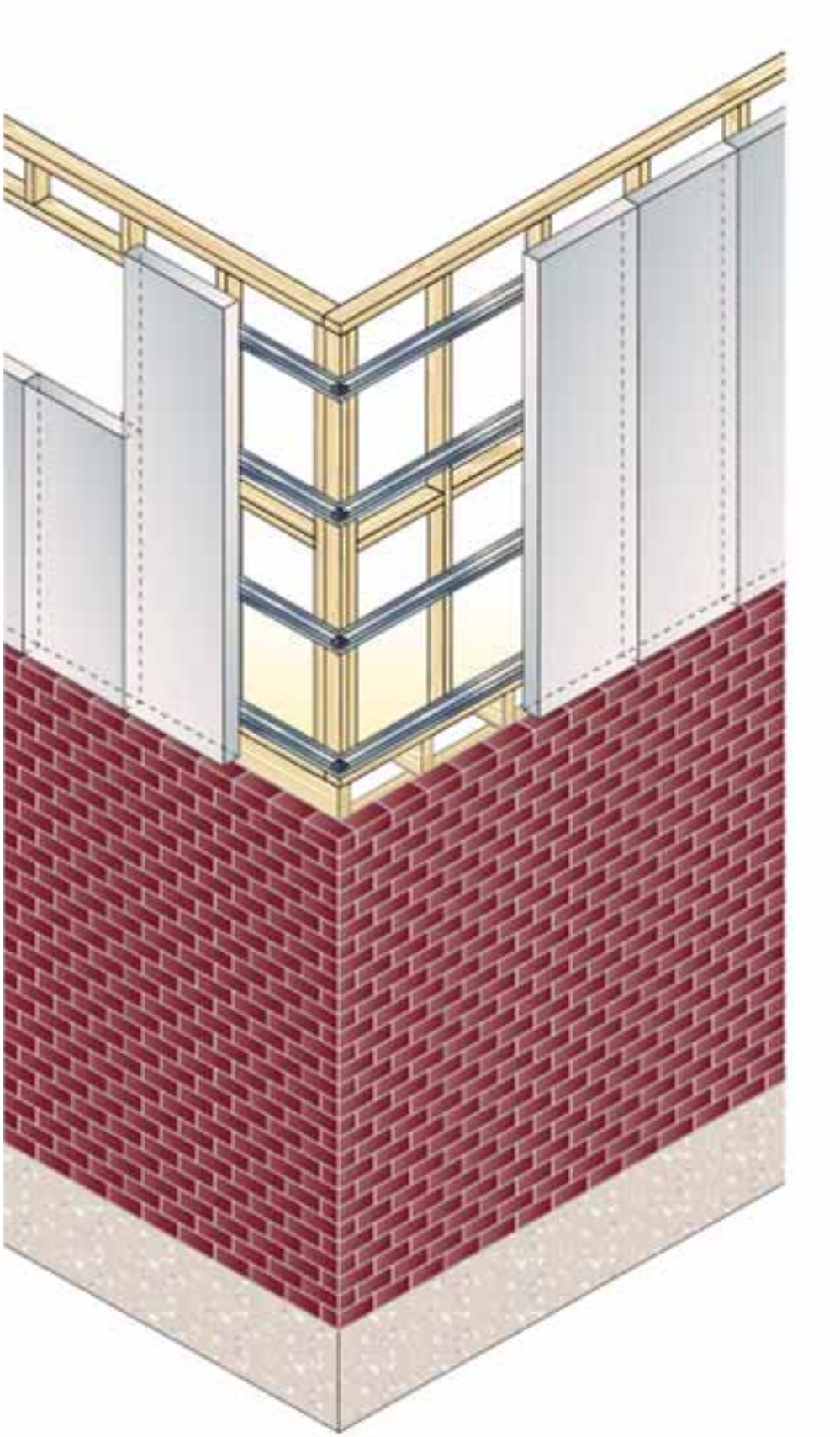
1. These gap widths can be reduced for low shrinkage floor systems. Contact the floor system manufacturer for guidance on acceptable gap width. Refer also to BCA 2006 Vol. 2, Section 3.3.1.10 and AS1684.

TYPICAL GUIDE	
Timber floor/frame	**Deflection gap**
Seasoned	25mm Min.
Unseasoned	35mm Min.

Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

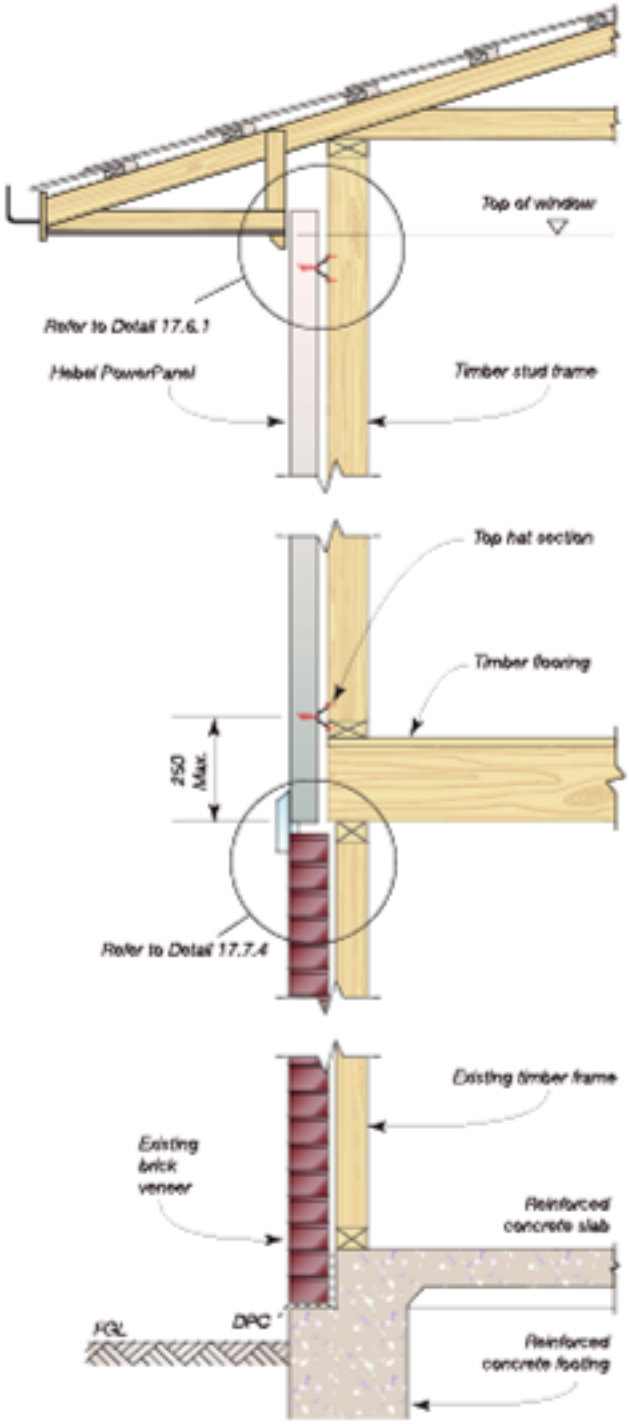
17.3 Two Storey Addition

Detail 17.3.1 Two Storey Addition - Isometric View Detail

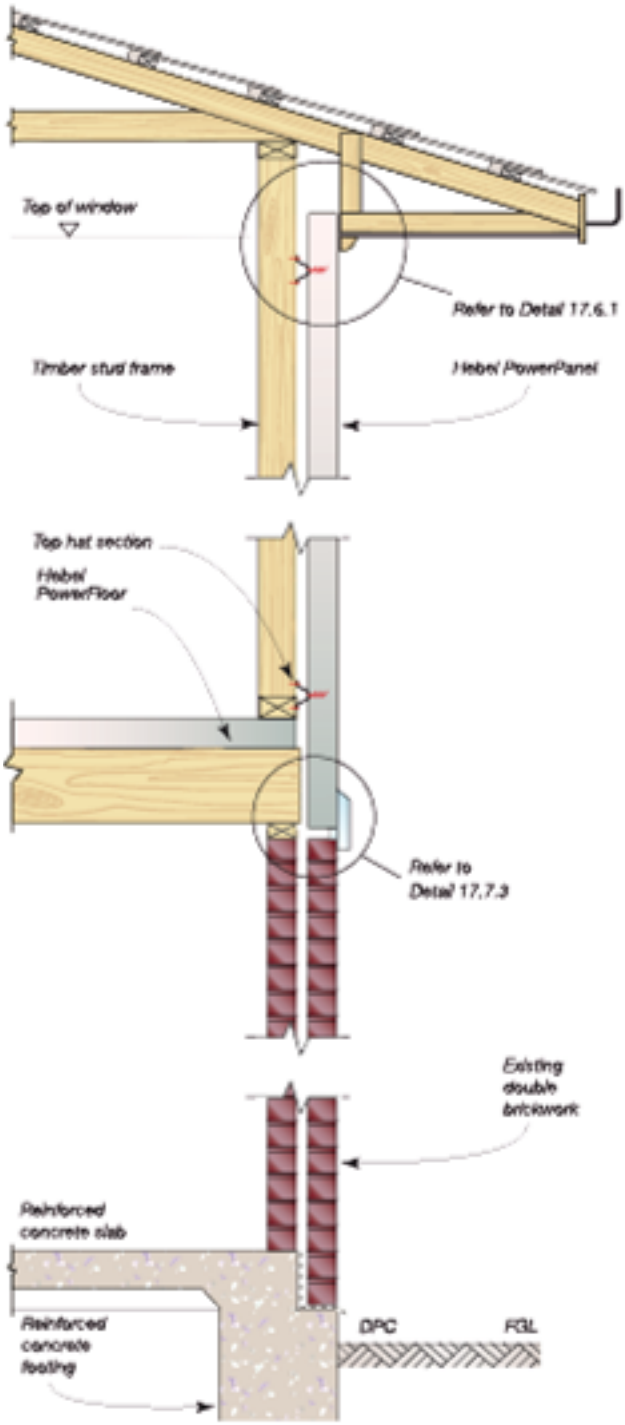


Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

Detail 17.3.2 Two Storey Additions - Typical Section with Brick Veneer Below



Detail 17.3.3 Two Storey Additions - Typical Section with Double Brick Below



NOTE

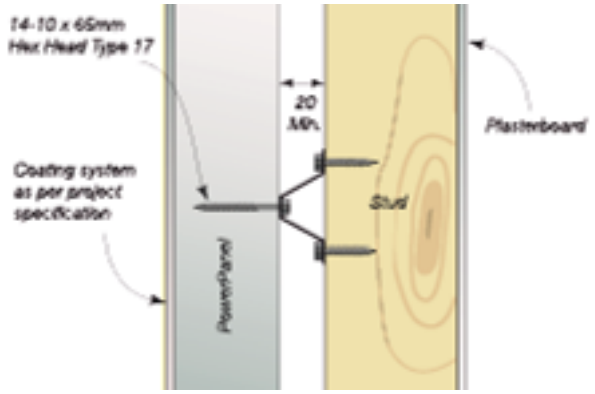
1. These gap widths can be reduced for low shrinkage floor systems. Contact the floor system manufacturer for guidance on acceptable gap width. Refer also to BCA 2006 Vol. 2, Section 3.3.1.10 and AS1684.

TYPICAL GUIDE	
Timber floor/frame	Deflection gap
Seasoned	25mm Min.
Unseasoned	35mm Min.

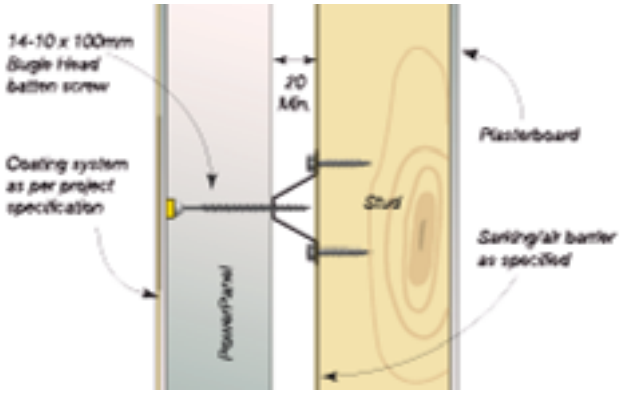
Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

17.4 Hebel PowerPanel Fixing & Installation Detail

Detail 17.4.1 Hebel PowerPanel Internal Fixing Detail



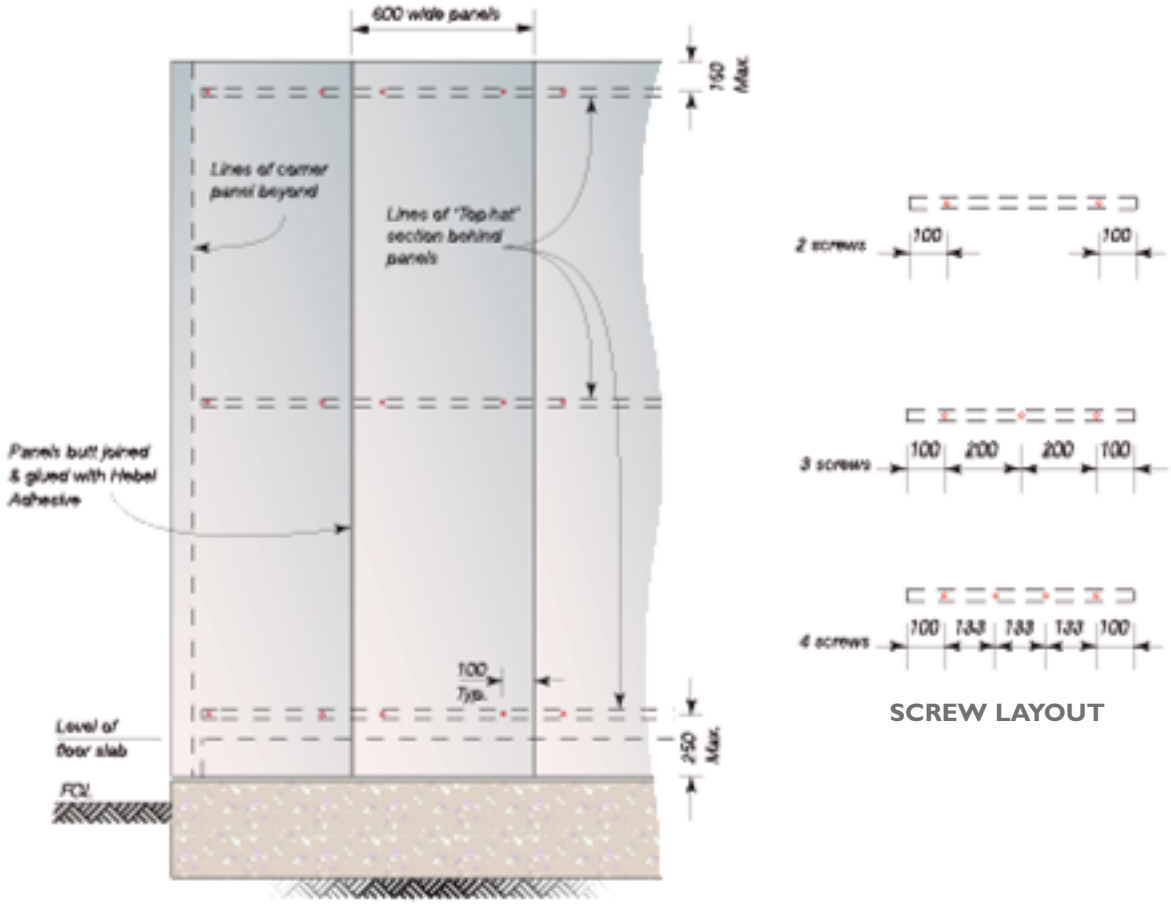
Detail 17.4.2 Hebel PowerPanel External Fixing Detail



NOTE

1. When positioning the stud frames allow 5-7mm extra cavity width for the sheet bracing between top hat and timber stud.
2. Internal Fixing Detail not suitable when sarking/air barrier or sheet bracing systems are being used.

Detail 17.4.3 Screw Layout Drawing



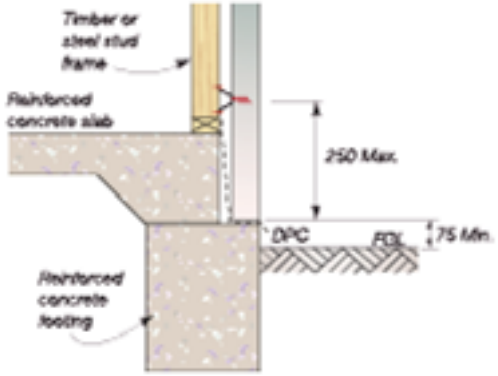
SCREW LAYOUT

POWERPANEL SETOUT - ELEVATION VIEW

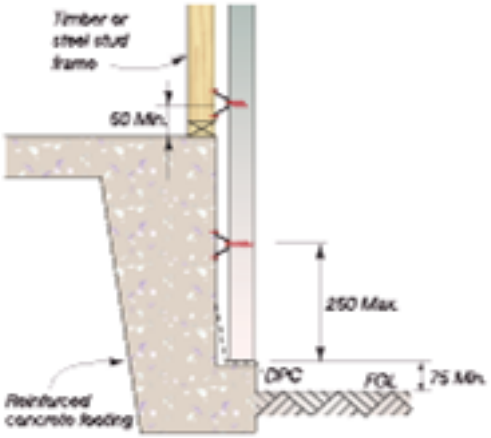
Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

17.5 Footing Junction Details

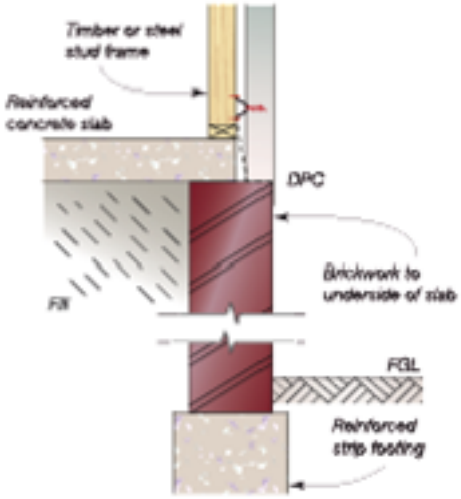
Detail 17.5.1 Footing Junction Detail 1



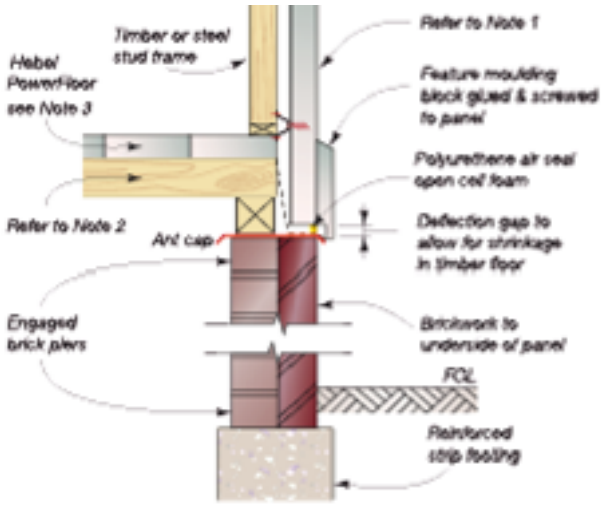
Detail 17.5.2 Footing Junction Detail 2



Detail 17.5.3 Footing Junction Detail 3



Detail 17.5.4 Footing Junction Detail 4

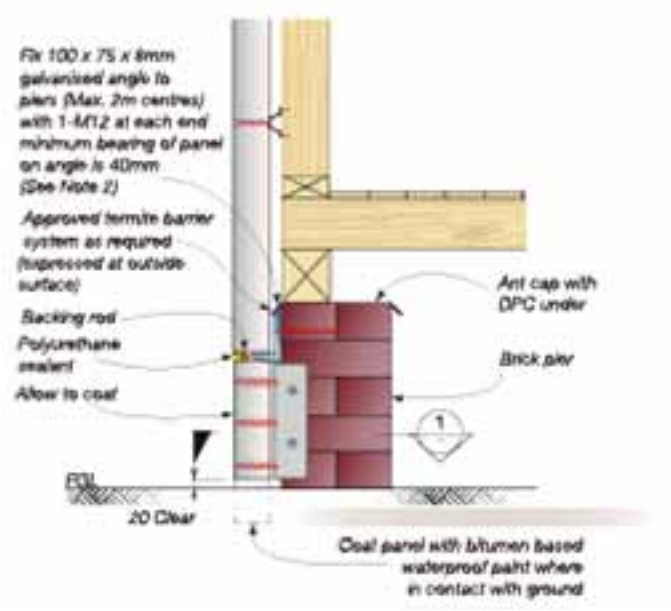


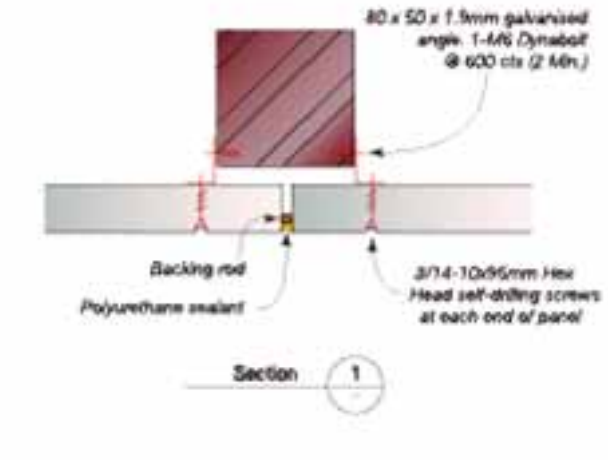
NOTE

1. Do not fix top hat to floor joists.
2. If non-shrink floor joists are used, gap may be reduced or eliminated. Seek further technical advice from the framing manufacturer.
3. Refer to CSR Hebel for Hebel PowerFloor details.
4. Refer AS3660 for termite protection.
5. When fixing top hats to concrete, contact the fixing manufacturer for details.

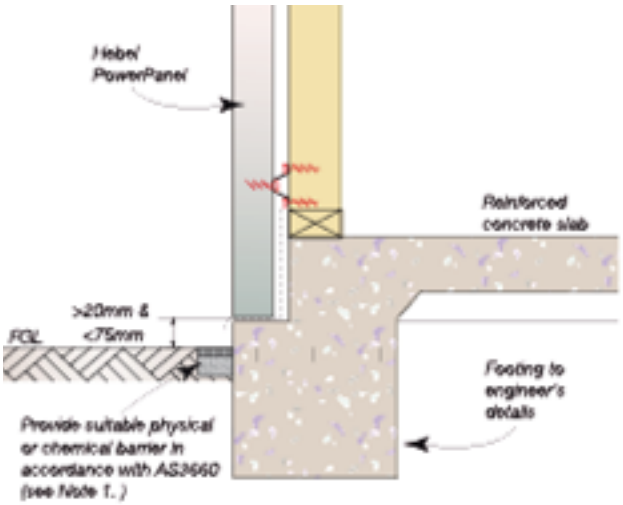
Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

Detail 17.5.5 Footing Junction Detail 5





Detail 17.5.6 Footing Junction Detail 6



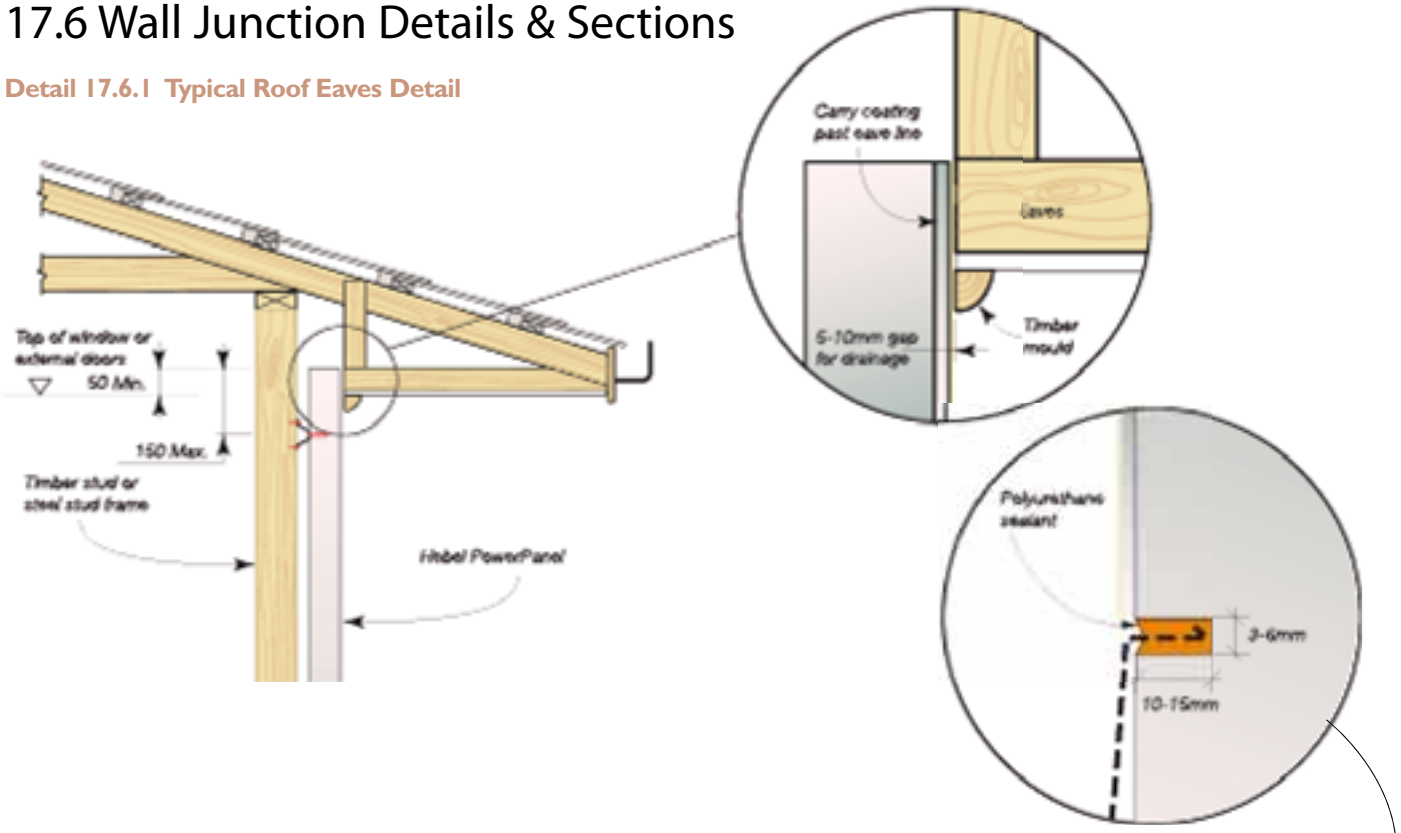
NOTE

1. Termite management to be in accordance with AS3660 & approved by the building certifier.
2. A 80x50x1.9mm galvanised angle installed in lieu of the above will require an additional top hat to be installed on the frame.

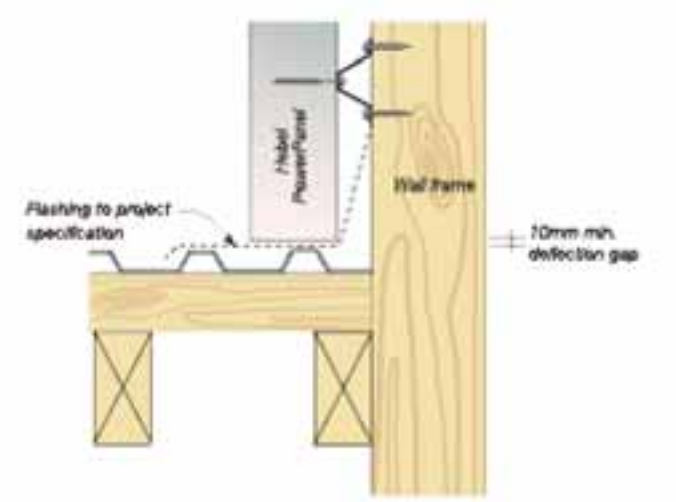
Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

17.6 Wall Junction Details & Sections

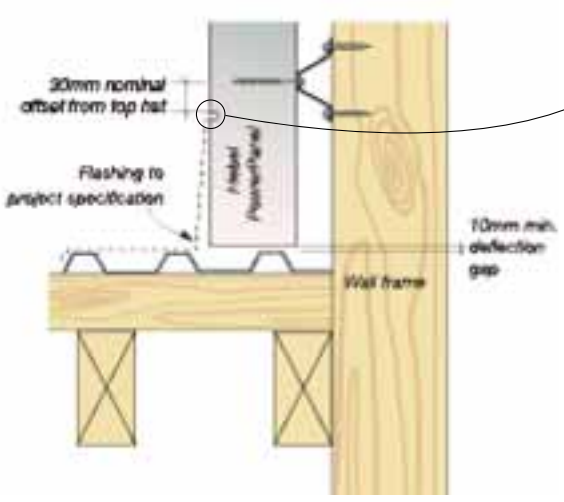
Detail 17.6.1 Typical Roof Eaves Detail



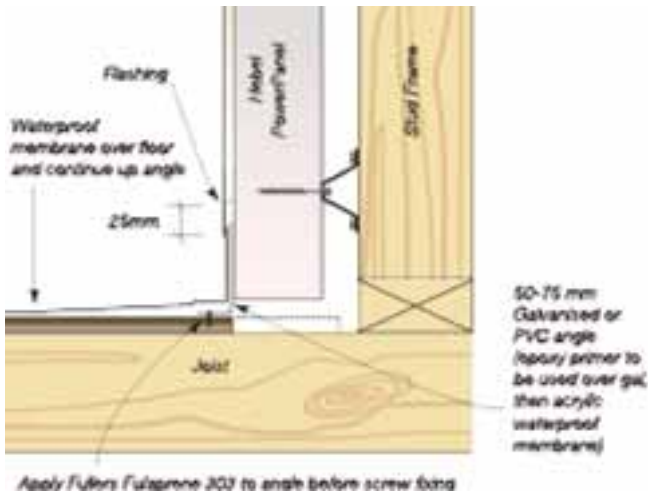
Detail 17.6.2 Roof to Wall Junction Detail - Option 1



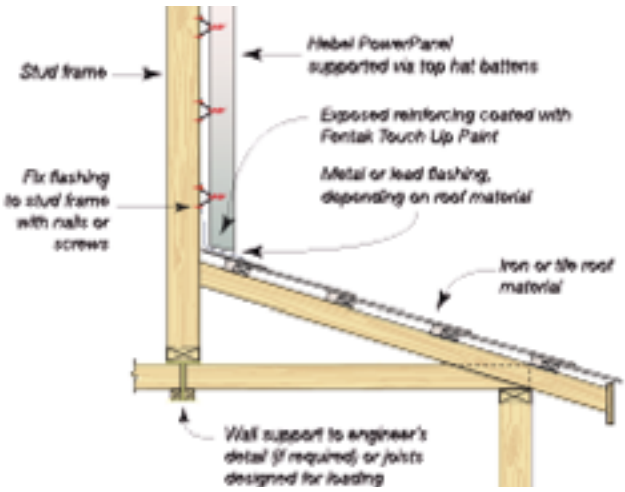
Detail 17.6.3 Roof to Wall Junction Detail - Option 2



Detail 17.6.4 Balcony Detail

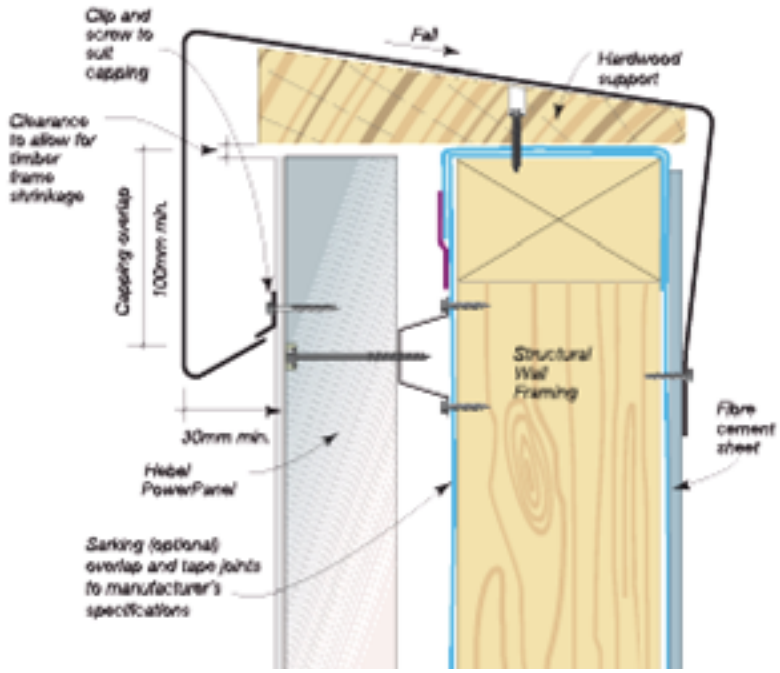


Detail 17.6.5 2nd Storey Wall Set Back Detail



Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

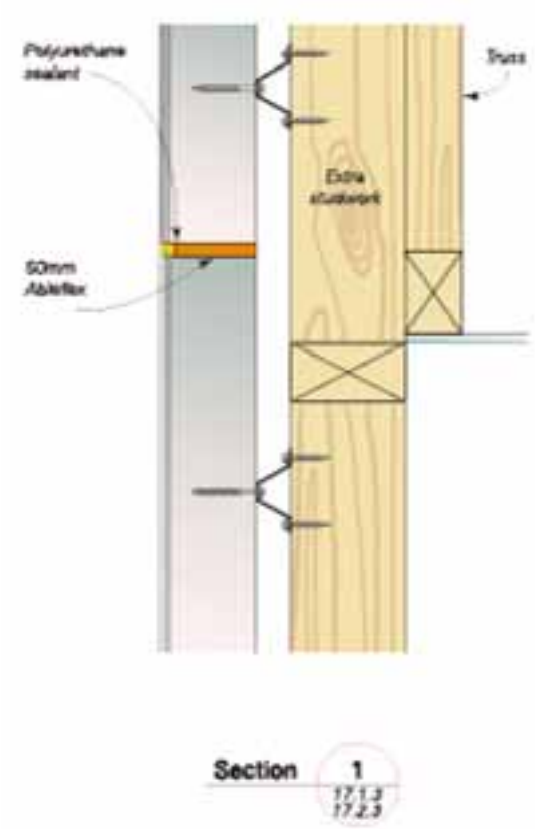
Detail 17.6.6 Parapet Capping



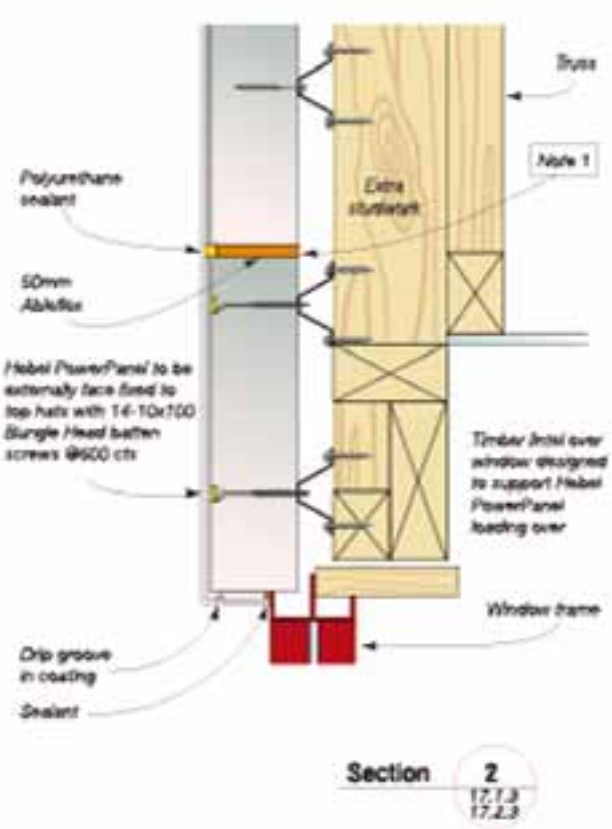
NOTE

Parapet capping shall be designed and fastened in accordance with SAA – HB39 1997 – Installation Code for Metal Roofing and Wall Cladding. Stop ends shall be incorporated to all flashings.

Detail 17.6.7 Gable End Wall Detail



Detail 17.6.8 Gable End Wall Detail - Lintel Over Window



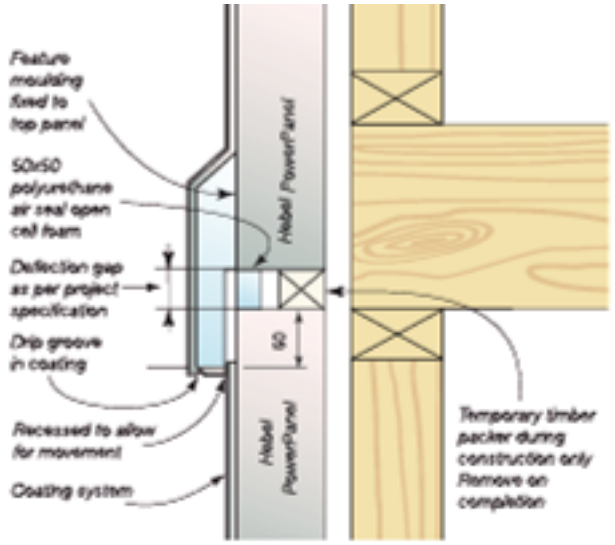
NOTE

1. Galvanised steel angle required if additional top hats are not installed.
2. Additional top hats may be required. Refer to Section 5.0.

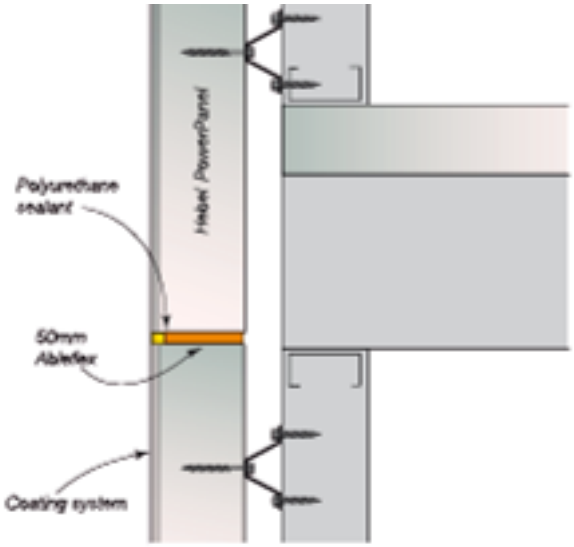
Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

17.7 Control Joint Details

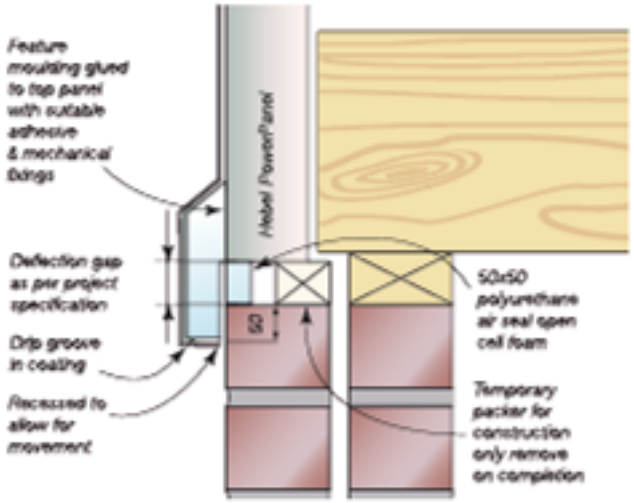
Detail 17.7.1 Typical Horizontal Control Joint - Timber Stud Frame



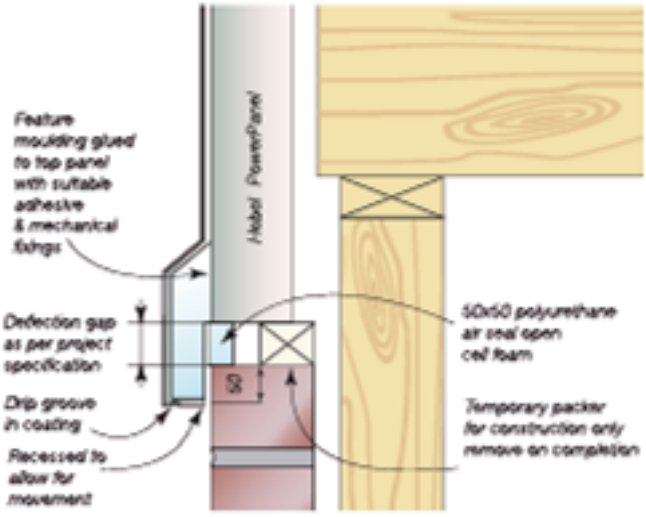
Detail 17.7.2 Typical Horizontal Control Joint - Steel Stud Frame



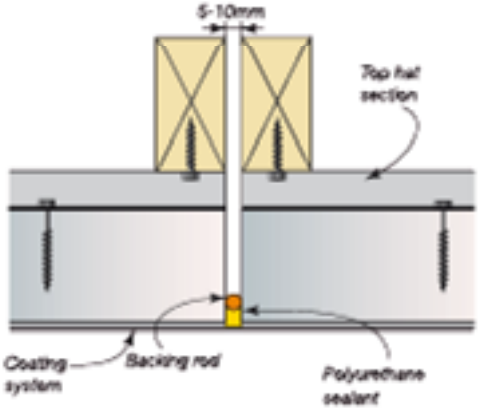
Detail 17.7.3 Horizontal Control Joint - Cavity Brickwork to Hebel PowerPanel



Detail 17.7.4 Horizontal Control Joint - Brick Veneer to Hebel PowerPanel

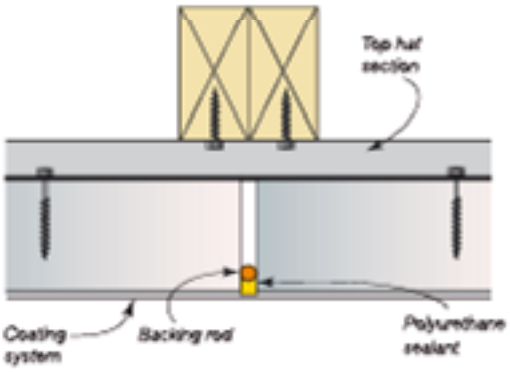


Detail 17.7.5 Typical Vertical Control Joint



PLAN VIEW

Detail 17.7.6 Typical Dummy Joint



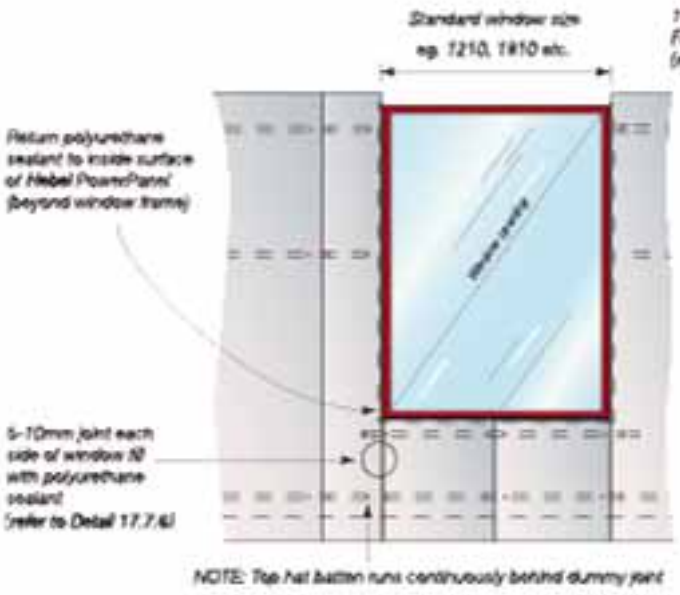
PLAN VIEW

NOTE
This is not considered a control joint

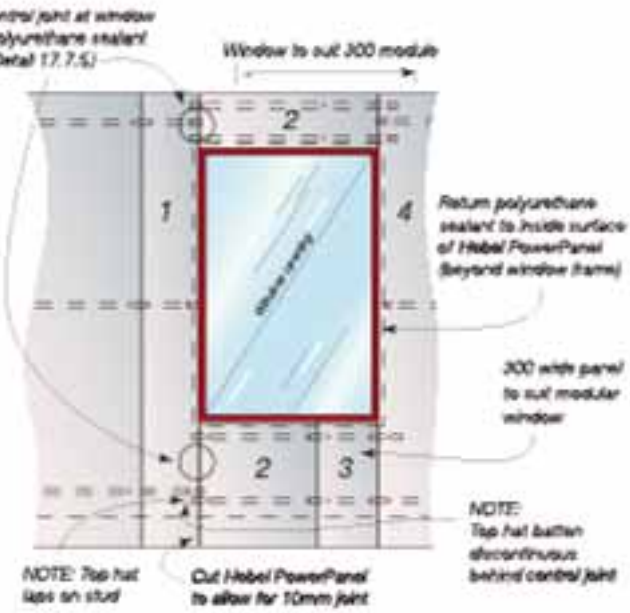
Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

17.8 Door & Window Details

Detail 17.8.1 Typical Window Detail - No Lintel Over



Detail 17.8.2 Typical Window Control Joint Detail - Lintel Over



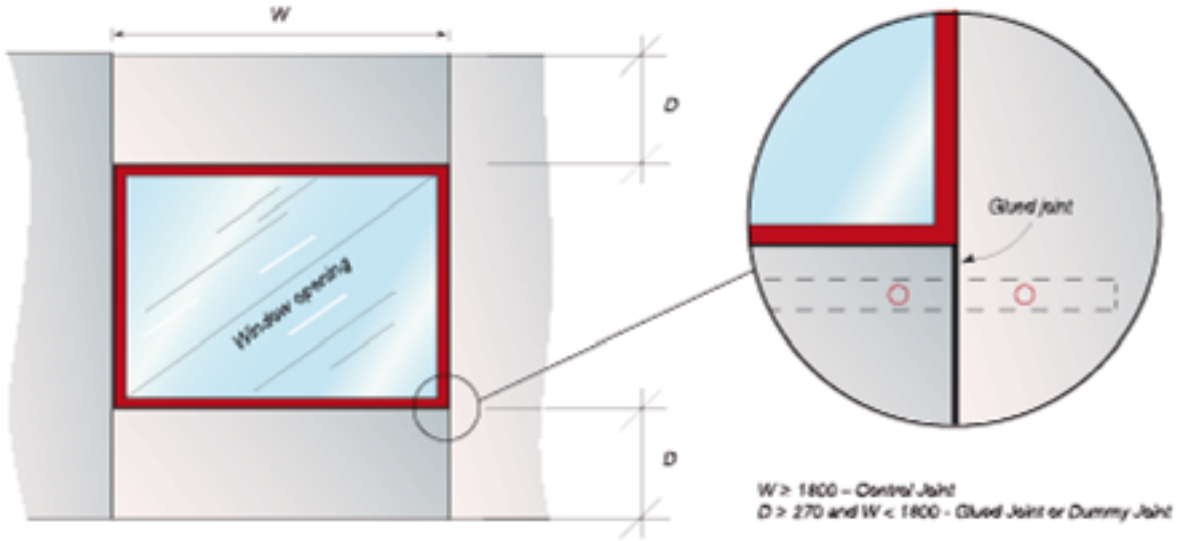
NOTE

1. The detail above DOES NOT represent a true control joint but provides a solution where the width of the window is 10-15mm wider than the total number of PowerPanels installed under the windows.
2. Detailing of coating system at dummy joint & control joint to coating system manufacturer's specification.
3. Depth and width of sealant and installation to be in accordance with the manufacturer's specification.

NOTE

1. The installation sequence of the PowerPanels around the openings should be followed as numbered above, to maintain glue thickess on the edge of the PowerPanel.
2. Detailing of coating system at dummy joint & control joint to coating system manufacturer's specification.
3. Depth and width of sealant and installation to be in accordance with the manufacturer's specification.

Detail 17.8.3 Head Sizes Detail

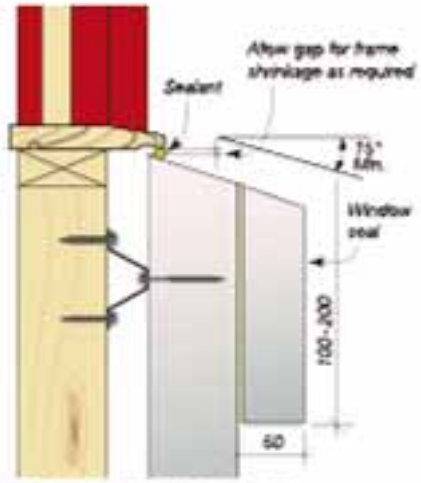


NOTE

1. If a control joint is required, it must be installed regardless.
2. For heads above hinged doors, adopt these guidelines.
3. For sliding glass doors, always place a control joint at both sides of the head.
4. For glued joint, ensure the top hats running behind the head and/or sill are fixed to the full height vertical PowerPanels.

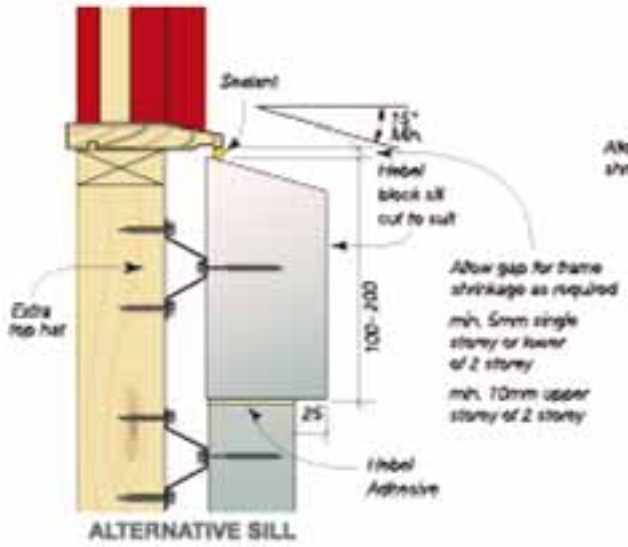
Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

Detail 17.8.4 Typical Window Sill Detail & Timber Window Frame



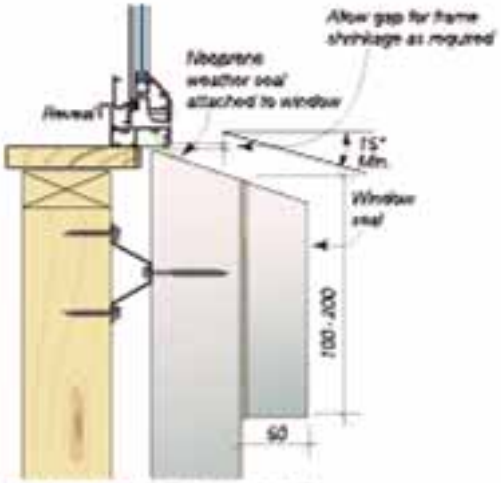
TIMBER WINDOW FRAME

Detail 17.8.5 Alternative Window Sill Detail - Timber Frame Window



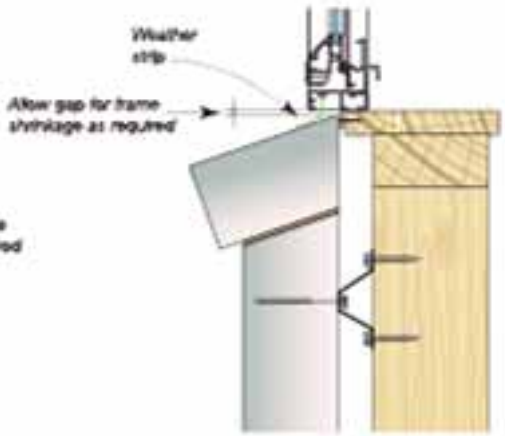
ALTERNATIVE SILL

Detail 17.8.6 Typical Window Sill Detail - Aluminium Window Frame

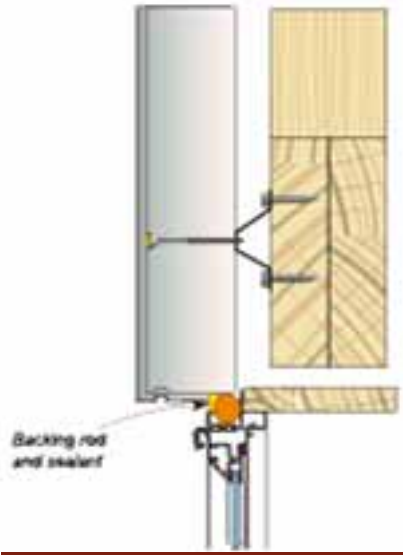


ALUMINIUM WINDOW FRAME

Detail 17.8.7 Sill Detail



Detail 17.8.7 Header Detail

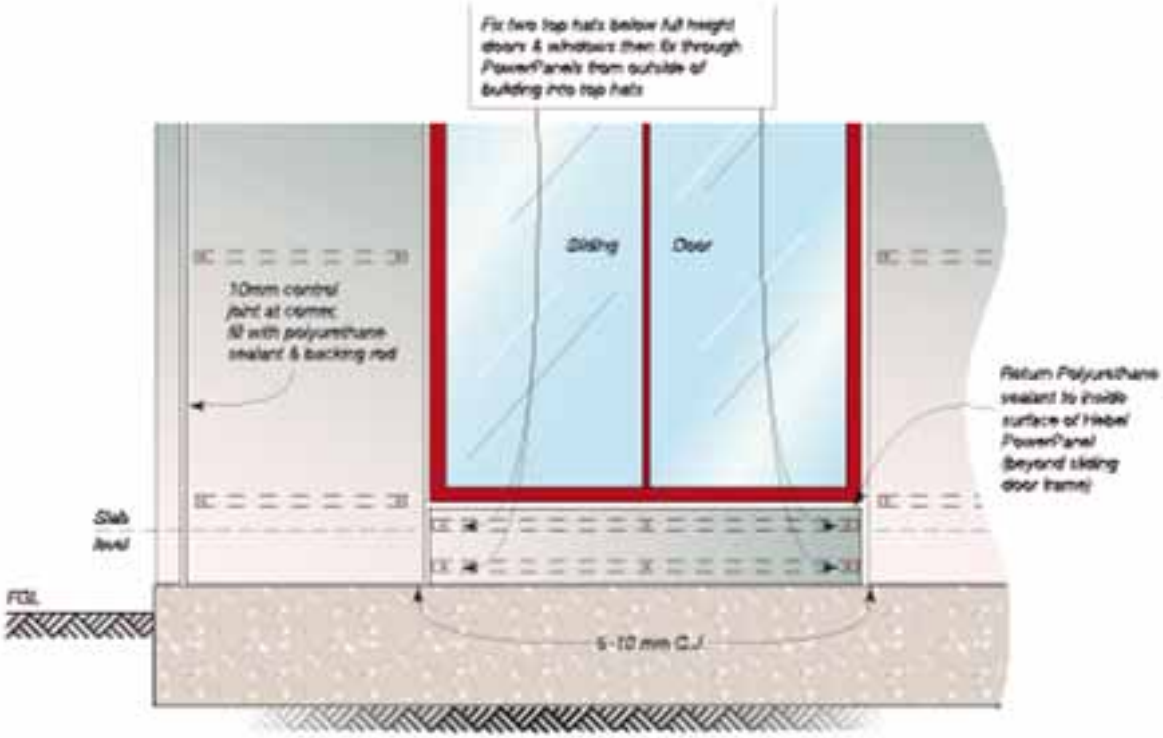


NOTE

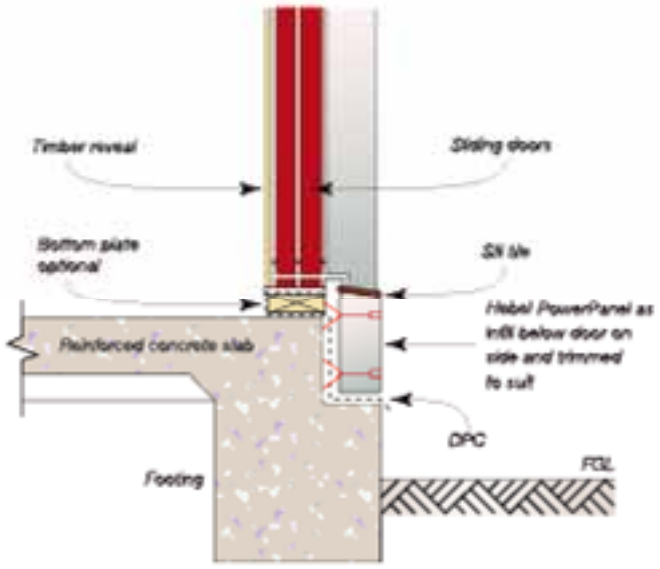
Drainage of window and door sills, in either aluminium or timber, should be directed to the outside of the building, on top of the window sill. CSR Hebel recommends waterproofing the AAC surface around the perimeter of the window opening. Provide an overlap of the waterproof coating and the external coating.

Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

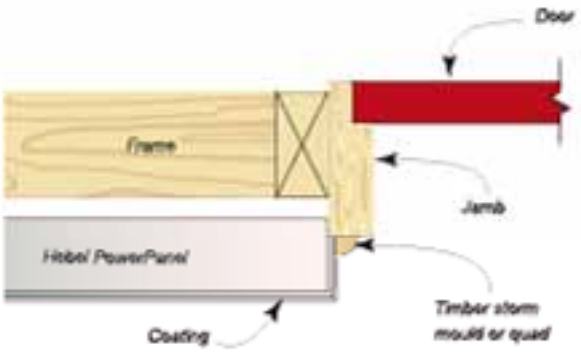
Detail 17.8.9 Sliding Door Sill Detail - Elevation View



Detail 17.8.10 Sliding Door Sill Detail - Section View



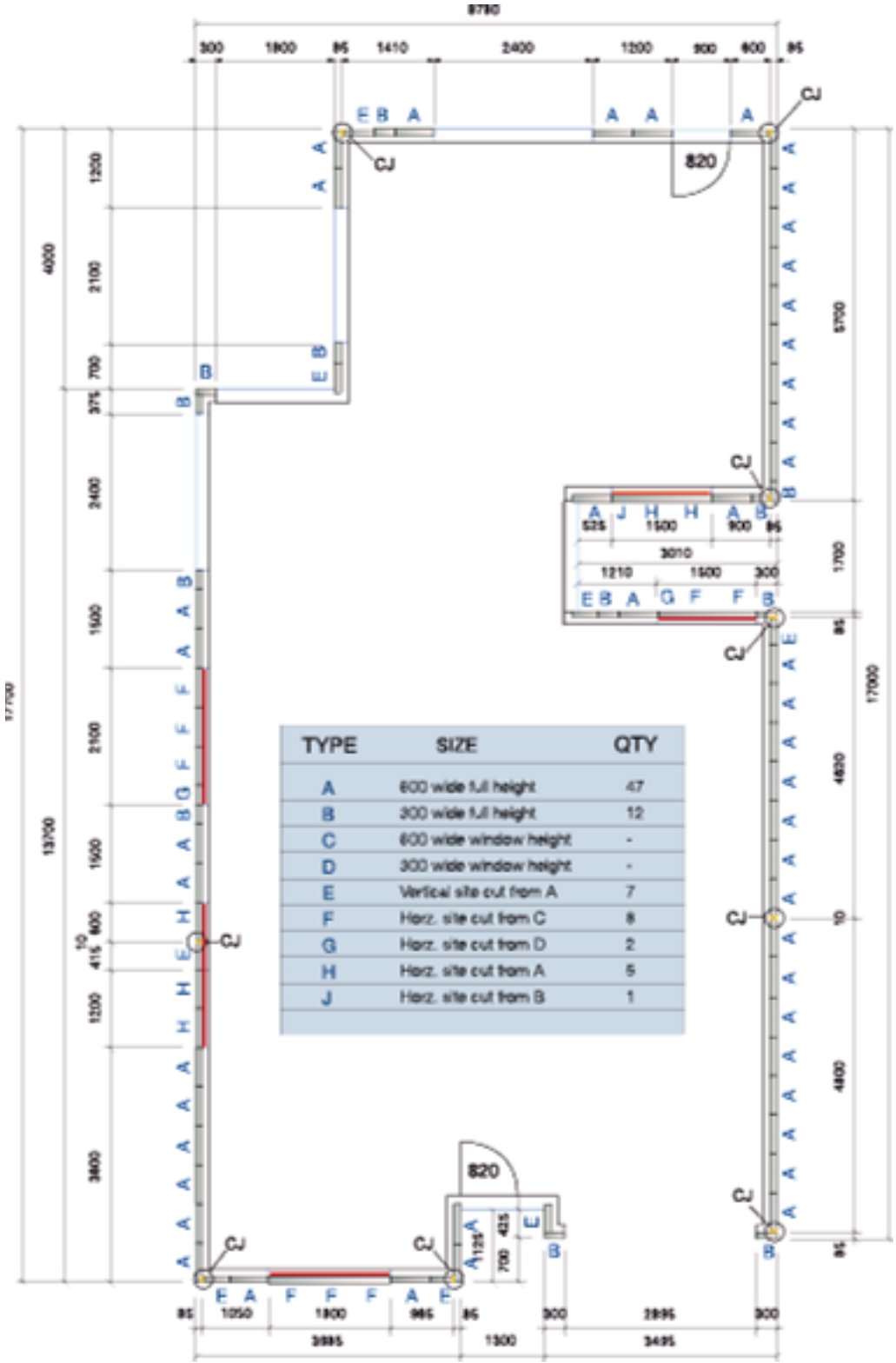
Detail 17.8.10 Timber Door - Jamb Detail



Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

17.9 Miscellaneous Details

Detail 17.9.1 Panel Layout drawing - Plan View



NOTE

1. At corners, PowerPanels can be laid out at 300mm multiples in one direction and 300mm multiples + 85mm in the other direction

PANEL TOLERANCES

2. Width of PowerPanels may vary + or - 1.5mm

Details to be read in conjuction with the current CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide

Appendix A: Hebel PowerPanel Material Properties

A.1 Manufacturing Tolerances

Length	±5mm
Width	±1.5mm
Thickness	±1.5mm
Diagonals (Max.)	5mm
Edge Straightness Deviation (Max.)	1.5mm

A.2 PowerPanel Physical Properties

- Hebel PowerPanel profile and nominal dimensions are shown in Section 13.0.
- Panel reinforcement is a single layer of steel mesh with 4 longitudinal wires of 4mm diameter.
- Nominal dry density = 510 kg/m^3.
- Average working density = 663 kg/m^3 at 30% moisture content.
- Average service life density = 561 kg/m^3 at 10% moisture content.

A.3 PowerPanel Strength Properties

- Characteristic Compressive Strength or AAC, f'_m= 2.8 MPa.
- Average Compressive Strength of AAC = 4.0 MPa.
- Characteristic Modulus of Rupture, f'_{ut} = 0.60 MPa.

A.4 PowerPanel Acoustic Properties

- Panel only with no plasterboard or other lining R_W = 36dB, R_W+C_{tr} = 33dB (refer to acoustic test ATF-676).

A.5 PowerPanel Thermal Properties

- R-Value of PowerPanel with no plasterboard or other lining = 0.51 m^2.K/W (4% moisture content).

A.6 Fire Hazard Indices

Hebel products have BCA Group Number 1 and also the following early fire hazard indices, determined in accordance with AS1530.3:1990:

Ignitability Index	0
Spread of Flame Index	0
Heat Development Index	0
Smoke Development Index	0-1

A.7 Fire Resistance Level (FRL) Ratings

For fire performance characteristics of Hebel PowerWall, refer to Section 7.0 of this guide.

Appendix B: Architectural Specification

This specification should be adopted as a guide only, and shall be superseded by the contract specifications of the project.

* Insert or select appropriate specifications.

This information can be downloaded from the CSR Hebel Website - **www.hebelaustralia.com.au**

Scope

The contractor shall furnish all material and equipment required to satisfactorily complete the installation and jointing of Hebel PowerWall where indicated in the contract specification and/or on the layout drawings.

Materials

All AAC material shall be Hebel PowerPanel as manufactured by CSR Hebel. Screws for fixing Hebel PowerPanel shall be supplied, manufactured or approved by CSR Hebel.

Timber or steel frame components shall be those as specified and designed by the project engineer or building designer.

All lining materials, fixings and finishing products shall be those manufactured and/or supplied by CSR Gyprock (or products of equivalent or better performance). Plasterboard shall be manufactured to meet the dimensional requirements of AS/NZS2588 'Gypsum Plasterboard'.

All infill material shall be, those manufactured and/or supplied by CSR Bradford (or products of equivalent or better performance).

Hebel PowerWall

The contractor shall supply and install the Hebel PowerWall * ..... system as detailed in the project drawings and or specifications, in accordance with CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide.

Hebel PowerWall framing, fixing and joints shall be designed and installed to comply with the requirements for an ***Ultimate Design Wind Pressure of *.....kPa maximum/minimum.***

The wall shall have a Fire Resistance Level rating of ***FRL** ..... / ..... / ..... for an external fire source, and/or ***FRL** ..... / ..... / ..... for an internal fire source, in accordance with the requirements of AS1530.4.

Installation shall be carried out to the level specified for a field acoustic performance of * ..... using cavity infill of * ***Bradford*** .... All movement joints shall be caulked with * ..... ***backing rod and*** * ..... ***polyurethane sealant*** installed in accordance with the sealant manufacturer's recommendations.

Wall Framing

Refer to project engineer or building designer documentation for the frame design.

Fixings

Screws to fix the Hebel PowerPanel to the top hat shall be *..... ***and*** ***class**..... Screws to fix the top hats to the stud framing shall be *..... ***and*** * ***Class*** ..... .

Air Barrier/Sarking

The air barrier/sarking shall be *..... ... . ***material***. Fixing, jointing and sealing shall be designed and installed in accordance with the manufacturer's instructions, to comply with the requirements for an ***Ultimate Design Wind Pressure of *.....kPa maximum/minimum.***

Internal Plasterboard Lining

For non fire-rated wall systems, the framing shall be lined on the internal side with ***one layer of *.....mm Gyprock®*** * ..... ***plasterboard***,
OR
For fire-rated wall systems, the framing shall be lined on the internal side with ***one layer of *.....mm Gyprock®*** * ..... ***plasterboard,*** * ***followed by a second layer of*** .....***mm Gyprock®*** ..... ***plasterboard.***
All layers shall be fixed and caulked as specified for the relevant system in the Gyprock® Steel Frame Wall System Installation Guide, NoGYP544, other relevant CSR Gyprock Technical Literature, and Rondo Building Services literature or appropriate steel frame manufacturer's literature.

Levels of Finish – Internal

All framing, plasterboard lining, jointing and finishing shall be carried out to ***Level*** ..... Level of Finish, in accordance with Gyprock® Residential Installation Guide, NoGYP547 and/or AS/NZS2589.1 'Gypsum Linings in Residential and Light Commercial Construction - Application and Finishing'.

Hebel PowerWall Finishing

Hebel PowerWall shall be externally coated with *.....***render and** *..... ***coating system***, which shall be installed to the manufacturer's recommendations.

If Hebel PowerPanel is attached to top hats by screwing from the outside, then all screw heads in
the Hebel PowerPanel shall be covered with * ***Hebel Adhesive/Hebel Patch***, *..... and shall be sanded flush with the PowerPanel surface.

Sealing and Caulking

All movement, control and abutment joints shall be caulked with *.....***backing rod and** *..... .....***polyurethane sealant** installed in accordance with the sealant manufacturer's recommendations.

Appendix C: Designer, Builder, Installer and Inspector/Supervisor Checklists

This checklist is to be read in conjunction with ALL CSR Hebel documentation including the CSR Hebel Technical Manual, CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design & Installation Guide. Safe Work Method Statements (SWMS) and technical advice from CSR Hebel. Co-ordination and compliance with specifications by the project engineer, building designer and architect where required is also compulsory. These project consultants are also responsible for incorporating this system into the subject project.

If you are not in receipt of any of these documents, please ask your CSR Hebel representative or project consultant to provide them prior to commencement of any Hebel PowerWall installation.

Project Details:_____

Wall/s Area Details:_____

Checklist - Designer

Checklist	
Slab	1. Design slab stepdown: 95mm wide, typical depth 150mm (min. 20mm). 2. Adjust engineering drawings and advise concretor.
Frame	1. Nominal total wall thickness 170mm (70mm stud) or 190mm (90mm stud). 2. Adjust documentation to suit PowerPanel system: - with openings dimensioned, - distance between openings to 300mm module, - distance from openings to corners to 300mm module and to suit PowerPanel orientation. 3. Ensure structural design of frame allows for the additional weight of the suspended PowerPanels. 4. Bracing to be steel cross bracing where possible, otherwise ply the whole wall. Framer to be informed of system requirements.
Windows	1. Windows to be ordered with correct reveal size. 2. Windows to be ordered to suit 300mm module if possible. In either case, the width should be shown on the drawings.
Features	1. Design and document any special features on the drawing, such as quoins, corbels, sills, trims, etc.
Coatings	1. Select colour and texture prior to PowerPanel installation. 2. Select colour for special features, if necessary.

Design criteria to help minimise installation costs	
Drawings	Drawings should reflect the following design items: 1. All openings dimensioned on the plan 2. Walls set out to 300mm module as much as possible 3. Orientation of PowerPanels at corners noted and allowed for in dimensions 4. Details provided on the required sill profile and any special features and position of control joints
Cutting	1. If the number of full height PowerPanels that require a full length site cut (ie. 2400mm or 2700mm) exceeds 10% of the number of PowerPanels supplied to the project, then the installation cost is likely to be higher. This percentage excludes bay windows which are typically installed as an extra.

Checklists - Builder

Checklist	
Slab	1. Ensure slab rebate formed correctly and flattened with a wood float, adjust if necessary. 2. Ensure slab edge does not protrude further than 95mm from the frame and the vertical edge of the rebate does not proceed further than 20mm from the frame, adjust if necessary.
Frame	1. Ensure frame is complete, level, plumb and installed where required for the installation of the top hats and PowerPanels, especially in the gable areas. 2. Ensure the bracing has been installed correctly, with extra ply added, to maintain the alignment of the entire wall.
Services	1. Ensure water pipes have been installed with all vertical runs located between the studs and not on the external face of the frame.
Windows	1. Ensure windows have been supplied with the correct reveal size and installed correctly.
Supplied by Builder	1. The supervisor is to organise supply of the following items to the site BEFORE the installers commence the PowerPanel installation: - DPC, - Galvanised lintels (if required), - 'Abeflex' (gables and control joints), - Sealant and foam backing rod for control joints.

NOTE

It is important that the builder understands his responsibilities as outlined in the previous two checklists and refers to the construction details in this guide, in order to ensure that the greatest benefit is achieved through the use of Hebel PowerWall and to avoid incurring additional costs.

Checklists - Inspector/Supervisor

Checklist	
Documentation	1. CSR Hebel PowerWall Architectural Specification. 2. CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design and Installation Guide.
Installation of 75mm Hebel PowerPanel	1. DPCs. 2. No. of top hats, minimum three (refer Table 5.1 and 5.4). 3. Extra top hats around openings. 4. Top hats discontinuous at control joint. 5. No. of screws per PowerPanel, minimum two per top hat (refer Table 5.2, 5.3 and 5.5). 6. Top hat clearance from plumbing, 10mm. 7. Joints all full with adhesive and flush. 8. Window detail. 9. Location and construction of control joints. 10. Minimum width of PowerPanels not less than 270mm.
Coating	1. Interface between PowerPanels and windows sealed. 2. Control joints sealed and 'V' grooved. 3. Coating of exposed reinforcement prior to coating. 4. Render and texture coatings not to bridge sealants. (i.e. at control joints).

Checklists - Installer

Checklist	
Tools and Equipment	1. Power supply. 2. Hebel tools. 3. Power drill with clutch control. 4. Circular saw with metal cutting or diamond tipped blade. 5. Panel lifters. 6. Sockets for screws. 7. Safety equipment.
Documentation	1. Architectural drawings from builder. 2. CSR Hebel PowerWall Detached Houses & Low Rise Multi-Residential External Walls Design and Installation Guide. 3. Wind category to be specified by designer.
Installation of 75mm Hebel PowerPanel	1. No. of top hats required, minimum 3 (refer Table 5.1 and 5.4). 2. Top hats screwed to stud with 2 screws/stud. 3. No. of screws per PowerPanel, minimum 6 (refer Table 5.2, 5.3 and 5.5). 4. Extra screws and/or top hats required around corners or for fire rating. 5. Joints all full with adhesive and flush. 6. Control joint locations. 7. Extra materials for sills and details (optional). 8. Clearance of top hat from plumbing services (10mm minimum). 9. Exposed reinforcement coated with anti-corrosion agent.
Extras Provided by Installer	1. M6/M12 masonry anchors for fixing angles to piers and brick sub-floor walls. 2. 600x200x50mm Hebel blocks for sills, etc, if required. 3. Anti-corrosive agent (purchased from CSR Hebel). 4. The large and small screws (optional).

Appendix D: Testing and Appraisal Certificates

Certificate of Test

No. 595

This is to certify that the element of construction described below was tested by the CSIRO Division of Building, Construction and Engineering in accordance with Australian Standard 1530. Methods for fire tests on building materials, components and structures, Part 4-1990, Fire resistance tests of elements of building construction, on behalf of

CSR Hebel Australia Pty Ltd
Level 2, 9 Help Street
CHATSWOOD NSW

A full description of the test specimen and the complete test results are detailed in the Division's report FSV 0356

Product Name: Non-Loadbearing Concrete Panel System.

Description: The specimen comprised a timber frame of 70mm x 35mm F5 soft wood studs at 430mm centres. The top plate was bolted to the specimen containing frame. The bottom plate was fixed with masonry anchors to the brick infill at the lower edge of the specimen. Steel top hat sections, BHP top span 22 ceiling baton, were fixed horizontally to the timber frame. The PowerPowerPanels, 75 mm thick and 600 mm wide were fixed to the top hat section and fixed with 14 gauge - 10 x 65 hex head type 17 class 3 screws. The individual PowerPanels were fixed with two screws through the top, three screws through the middle and two screws through the lower top hat section. The unexposed face was clad with 10mm CSR plasterboard. Details of the frame construction were as shown in drawing numbered MJ-001 by CSR Hebel Pty Ltd. The specimen had total dimensions of 2700mm in height and 3000mm in width. The specimen was built on a 300mm high brick infill wall. The specimen was unrestrained on the vertical sides. The vertical gap between specimen frame and wall was filled with compressed ceramic fibre. The specimen was tested with the PowerPowerPanel™ system exposed to the furnace.

Construction is detailed in the following:

- Drawing numbered MJ - 001, dated 31 January 1995, by CSR Hebel Australia Pty Ltd.

The element of construction described above satisfied the following criteria for fire-resistance for the period stated.

Structural Adequacy – no failure at 241 minutes.
Integrity – 232 minutes.
Insulation – 217 minutes.

and therefore for the purpose of Building Regulations in Australia achieved a FRL of 240/180/180.
The fire-resistance level is applicable for exposure to fire from the same side as the test.

Testing Officer: Clive Broadhead **Date of Test:** 22 Feburary 1995

Issued on the 7th **day of** April 1995 **without alterations or additions.**

G E Collins
for Manager, Fire Technology

Division of Building, Construction and Engineering
PO Box 310 NORTH RYDE NSW 2113 Telephone (02) 888 8888 Fax (02) 888 9335 **CSIRO**

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Somersby NSW 2250
Fax (02) 4340 3300

Designing for future living

CSR Hebel is a quality building product, and is backed by CSR Building Products Limited. Further details on engineering and building with Hebel systems are available in the CSR Hebel Design Guides and Technical Manual. To obtain a copy, or for further sales or technical assistance, please visit our website or contact our help line:

CSR Hebel Website:
www.hebelaustralia.com.au

For sales enquiries or further information, please telephone us from anywhere in Australia:

1300 369 448

Health & Safety

Information on any known health risks of our products and how to handle them safely is on their packaging and/or the documentation accompanying them. Additional information is listed in the Material Safety Data Sheet (MSDS). To obtain a copy of a MSDS, telephone 1800 807 668 or download from www.hebelaustralia.com.au > Tech Support > MSDS. Contractors are required by law to perform their own risk assessments before undertaking work. CSR Hebel has sample Safe Work Method Statements (SWMS) to assist in this. To obtain a sample SWMS, refer also to the above sources.

Performance & Certification

CSR Hebel is a business of CSR Building Products Limited A.B.N. 55 008 631 356. It is a manufacturer and supplier of CSR Hebel Autoclaved Aerated Concrete (AAC) products. Because it is a manufacturer and supplier only, CSR Hebel does not employ people qualified as Accredited or Principal Certifiers. CSR Hebel is therefore unable to provide Construction Compliance Certificates or Statements of Compliance. CSR Hebel conducts appropriate testing of its products and systems to determine performance levels. These include structural, fire and acoustic tests. Testing is conducted and certified by appropriate specialists in these fields. When using CSR Hebel products and systems in specific projects, such specialists should be consulted to ensure compliance with the Building Code of Australia and relevant Australian Standards.

Guarantee

CSR Hebel guarantees the products manufactured by itself and the systems described in CSR Hebel literature for 7 years, subject to the terms and conditions of the CSR Hebel Guarantee which can be inspected in the CSR Hebel website at www.hebelaustralia.com.au. CSR Hebel does not however guarantee the components, products or services, such as installation, supplied by others. For terms and conditions of the product guarantee, contact your CSR Hebel representative.

Disclaimer

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