

# Technical Manual



**PRÎMA** *flex*<sup>TM</sup>



## Multi Functions Board

Eco-friendly fibre cement flat sheets for ceiling, eaves & soffit lining, wall cladding, flooring, partition, roof sarking, water tank support and permanent formwork.

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## 1.1 General

### 1.1.1 Composition

**PRIMAflex™** is a lightweight, autoclaved cellulose fibre cement sheet manufactured in accordance with the:-

- **MS 1296** – Fibre-cement flat sheets – Product specification and test methods (First revision)

The basic composition is portland cement, cellulose fibre, ground sand and water. A variety of standard lengths and widths are made available to suit specific application. **PRIMAflex™** sheets do not contain asbestos fibre or glass fibre.

### 1.1.2 Applications

**PRIMAflex™** board is recognised by the construction industry professionals for its quality, reliability and durability. The typical applications include ceiling lining for building's interior / exterior, eaves / soffit lining, external claddings to walls and gable ends, internal partition, flooring board, roof sarking and permanent formwork. Sheets thickness suitable for each application is listed on the **Table 1.1** below:-

**Table 1.1: Applications and thickness of board**

Applications	Recommended Thickness (mm)								
	3.2	4.5	6	7.5	9	12	16	24	32
Ceiling	•	•	•						
Eaves / soffit lining	•	•	•						
Cladding (Wall / Gable End)			•	•	•	•			
Internal Partition			•	•	•	•			
Roof Sarking			•	•	•	•	•		
Flooring						•	•	•	•
Permanent Formwork						•	•	•	•

### 1.1.3 Standard Sizes

**PRIMAflex™** board standard sizes and the approximate weight per piece are shown in the **Table 1.2** below.

**Table 1.2: Standard size and weight of board**

Thickness (mm)	Mass per Sheet; kg		
	610 x 1220	1220 x 1220	1220 x 2440
3.2	3.18	6.35	12.70
4.5	4.66	9.33	18.65
6.0	6.25	12.50	25.01
7.5	-	-	32.30
9.0	-	-	38.90
12.0	-	-	52.20
16.0	-	-	67.00
24.0	-	-	99.38
32.0	-	-	132.00

**Note:**

1. Weights per sheet are shown for sizes available ex stock.
2. Other sizes are available on special order and sales may be subject to special conditions

## 1.2 Certifications

**PRIMAflex™** fibre cement boards are Sirim certified to **MS 1296**. They are also approved by Jabatan Bomba dan Penyelamat Malaysia for building applications requiring Class 'O' building materials as stipulated in the Uniform Building By-law, Malaysia (UBBL). **PRIMAflex™** is also listed in the IKRAM's Senarai Bahan / Barangan Binaan Tempatan.

## 1.3 Properties

### 1.3.1 Physical Properties

The typical average values of **PRIMAflex™** physical properties are as follow:-

**Table 1.3: Physical properties of board**

Properties	Typical Values	Standards
Apparent Density (Dry)	1300kg / m <sup>3</sup>	MS 1296
Moisture Content at Equilibrium	7%	MS 1296
Thermal Conductivity, k Value	0.24W/mK	ASTM C518
Thermal Insulation, R value (Calculated based on tested k value)	3.2 mm – 0.013 m <sup>2</sup> K/W	-
	4.5 mm – 0.019 m <sup>2</sup> K/W	
	6.0 mm – 0.025 m <sup>2</sup> K/W	
	7.5 mm – 0.031 m <sup>2</sup> K/W	
	9.0 mm – 0.038 m <sup>2</sup> K/W	
	12.0 mm – 0.050 m <sup>2</sup> K/W	
	16.0 mm – 0.067 m <sup>2</sup> K/W	
	24.0 mm – 0.100 m <sup>2</sup> K/W	
Flexural Strength (Saturated)	Average > 7Mpa	MS 1296
	32.0 mm – 0.133 m <sup>2</sup> K/W	
Sound Transmission Class (Estimated)	3.2 mm – 21 dB	-
	4.5 mm – 23 dB	
	6.0 mm – 25 dB	
	7.5 mm – 26 dB	
	9.0 mm – 28 dB	
	12.0 mm – 30 dB	
	16.0 mm – 32 dB	
	24.0 mm – 35 dB	
	32.0 mm – 36 dB	

**Note:**

1. Apparent density shall not be used to calculate the mass of board in kg/m<sup>2</sup>.
2. Equilibrium Moisture Content (EMC) of 7% is achieved at temperature of 27°C ± 2°C and relative humidity of 65 to 95%.
3. Some values are rounded to the nearest decimal point.
4. Other board properties are available upon request.

### 1.3.2 Fire Resistance

**PRIMAflex™** has been tested in accordance with **BS 476**; fire tests on building material and structure. The test results are as follow:-

#### British Standards

- Fire Propagation (**BS 476 Part 6**) - Index of Performance, I = 0  
- Sub-index, I = 0
- Surface Spread of Flame - **Class 1**  
Flame (**BS 476 Part 7**) (No ignition)

Under the UBBL Malaysia 1984, Clause 204, a material is classified as meeting the "Class 'O' – Surface of no flame spread" requirement if when tested to **BS 476 Part 6**, has an Index of Performance not exceeding **12** and a sub-index (i) not exceeding 6. **PRIMAflex™** is deemed non-combustible in accordance with the Building Code of Australia.

## 1.4 Durability

### 1.4.1 Water Resistance

**PRIMAflex™** has been subjected to rigorous tests and subsequently demonstrate high degree of resistance to prolonged moisture exposure that could lead to premature system failure. The following tests have been conducted:-

- **MS 1296**
  - Warm water (**Clause 6.1**)
- **AS/NZS 2908.2**
  - Water permeability (**Clause 8.2.2**)
  - Frost resistance (**Clause 8.2.3**)
  - Warm water (**Clause 8.2.4**)
  - Heat-rain (**Clause 6.5**)
  - Soak-dry (**Clause 8.2.5**)




Unless otherwise specified, frames to receive boards should be straight, true and level. Cladding, lining or floor board will not straighten excessively distorted or warped frame. Warping may remain visible after boards are applied onto distorted frame. The suggested maximum acceptable frame straightness tolerances are as below:-

- Maximum **3mm** over **1200mm** length or
- Maximum **4mm** over **3000mm** length, measured in any direction

## 2.2 Fasteners

The table below shows the type of fasteners suitable for fixing **PRIMAflex™** to timber or steel framing. Fasteners for fixing boards are not required for suspended ceiling application.

**Table 2.1: Fastener fixing to timber support**

Fixing to Timber Support	Board Thickness
Galvanised Fibre Cement Nail	
2.0mm Ø x 25mm	3.2mm and 4.5mm
2.0mm or 2.8mm Ø x 30mm	6mm and 7.5mm
2.0mm or 2.8mm Ø x 40mm	9mm and 12mm

**Table 2.2: Fastener fixing to light gauge steel support**

Fixing to Light Gauge Steel Support	Board Thickness
Self-Embedding Head/ Self-Drilling Winged Screw	
No. 7 x 22mm	6mm
No. 8 x 32mm	7.5mm, 9mm, 12mm and 16mm
No. 8 x 45	24mm, 32mm

### Note:

1. Drive nail head flush with board surface.
2. Screw head must be embedded approximately 0.5mm below sheet surface.
3. If the above specified fasteners are not available, alternative fasteners with similar size/ dimension can be used but the overall durability of the system might be compromised.
4. Patch screw points with suitable exterior grade compound and sand them prior to painting.
5. Screw fixing is only suitable for 6mm board only.
6. Nails and screws must be suitably coated to the intended applications.
7. Please obtain approval from Hume Cemboard Industries (HCI) Technical Department for other types of screw and nail which are not being specified in this manual.

## 2.3 Fastener Fixing Distance

When fixing **PRIMAflex™** to timber or steel framing, fasteners must be located as follow:-

**Table 2.3: Fastener fixing distance**

Fastener Location	Cladding, Ceiling & Eaves Linings	Flooring & Roof Sarking
From edges	12mm	12mm to 15mm
From corners	50mm	50mm
At perimeter	200mm	300mm
Elsewhere	300mm	400mm

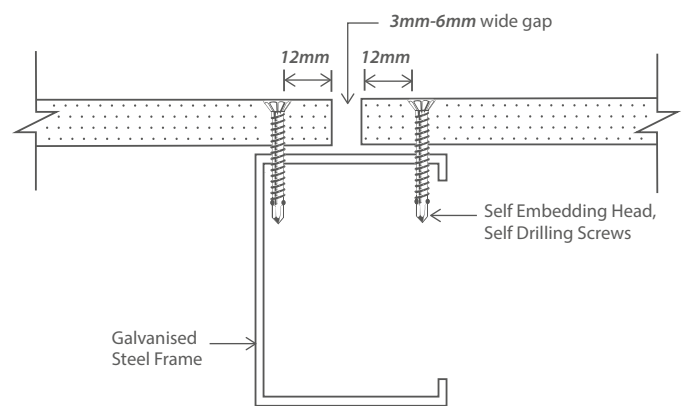
### Note:

No fasteners required for suspended ceiling and permanent formwork application.

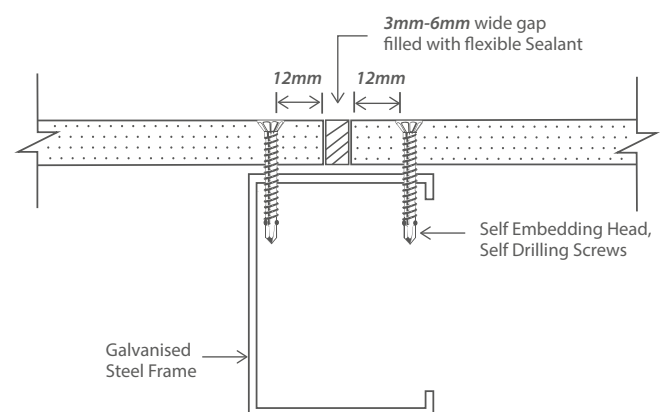
## 2.4 Jointing

**PRIMAflex™** board may be joined using the methods below:

1. The board edges may be joined closely to produce a neat butt joint as shown in **Figure 2.2**.
2. An expressed joint may be formed by providing **3 to 6mm** gap between **PRIMAflex™** sheets. See **Figure 2.5**.
3. Jointing system which include sealant joint with **3 to 6mm** gap between boards is illustrated in **Figure 2.6**.
4. Timber batten may be use to cover the joint as well as to serve as a feature. Refer **Figure 2.7**.
5. When **PRIMAflex™** is applied as internal wall lining, the joint may also be decorated with aluminium extruded profile as shown in **Figure 2.8**.



**Figure 2.5: Expressed Joint**



**Figure 2.6: Sealant Joint**

### Note:

1. Sealant must be of flexible and paintable type such as exterior grade polyurethane or acrylic gap sealant.
2. For best result, cover sheet edges with masking tape prior to applying the gap sealant.

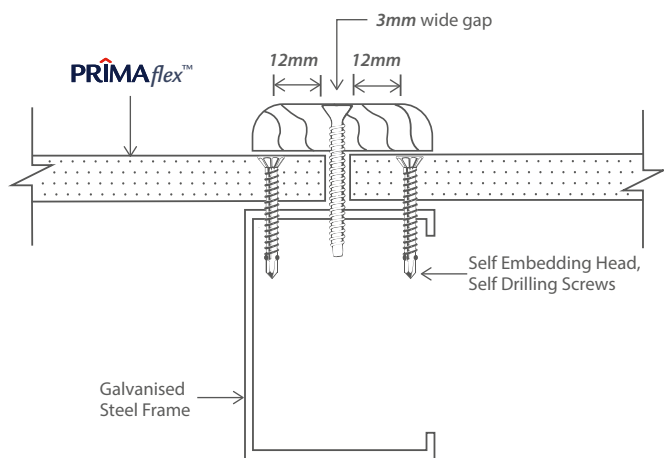


Figure 2.7: Timber Joint

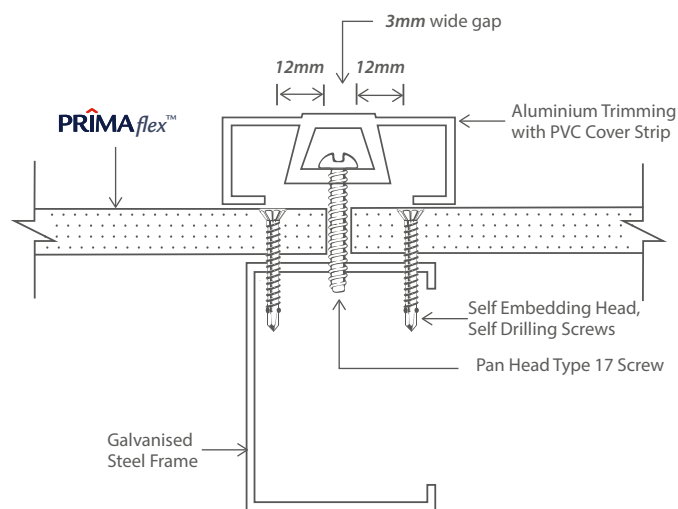


Figure 2.8: Aluminum Extrusion Joint

## 2.5 Finishes

### 2.5.1 Paint

This section is only applicable for applications requiring paint finishes or coating systems. For best result, decorate **PRIMAflex™** board with a layer of suitable primer and a minimum two coats of quality water-based acrylic Paint. Coating should be of a vapour permeable type. Other types of coatings such as Polyurethane or Epoxy Paints are also suitable, but require special preparations. In all cases, coating manufacturer's recommendations should be adhered to. Upon installation, boards applied externally must be coated within **90** days. Do not leave board surface uncoated.

Ensure **PRIMAflex™** is dry and free from dust, grease or other contaminant before applying finishing coat.

### 2.5.2 Other Finishes

This section is only applicable for lightweight flooring application only. For dry area applications, ceramic tiles can be fixed directly onto **PRIMAflex™** board. For wet area applications, apply a layer of waterproofing membrane on **PRIMAflex™** before fixing the ceramic tiles. Use flexible Tile Adhesive, the Tile Adhesive normally comes in 2 parts, - ready mix cementitious cement and latex-based liquid solution. Refer to tile adhesive manufacturer for recommendation. Normal portland or composite cement / sand mortar is not recommended.

Board joints must be sanded if flexible materials such as vinyl tiles are to be applied onto **PRIMAflex™** board. All gaps and fastener points must be covered with cementitious plaster-based patching compound.

For general office use, carpet is also a suitable for flooring finishing material.

### 2.5.3 Patching Compound

If necessary, apply Patching Compound to cover screw points. Use cementitious plaster-based Patching Compound compatible with concrete products. For external application, exterior grade Patching Compound must be used.

When it is necessary to seal gaps between board joints, use flexible/ paintable Polyurethane (PU) Sealant or Modified Silicone (MS) sealant. This Sealant should also be used to patch Screw Points when **PRIMAflex™** is used as wet area flooring system. Always refer to sealant manufacturer for recommendations.

## 2.6 Maintenance

Periodic inspection and maintenance of the paint coating system must be performed as specified by the paint manufacturer. All joints, sealant and wall surfaces must be checked for cracks to prevent the intrusion of water. Make good any defects in accordance with the systems outlined in this manual and good trade practice.

### 2.6.1 Precautionary Measures

**PRIMAflex™** boards must always be kept dry prior to installation. When boards have been installed, ensure the construction is carried out until the installation of final roof covering material (i.e. metal roofing sheet). If roof section cannot be completed on the same day, installed boards must be protected against rain water or other source of moisture. Should incomplete roof section become wet, allow the components to dry before fixing the final roof covering material. Excessive moisture/ water trapped within the roof system will degrade its overall performance and durability.

### 3.1 General

This system entails the synergy of superior quality **PRIMAflex™** ceiling board and proprietary suspended metal framing systems, typically fabricated using pre-finished aluminium or light gauge galvanised steel. Apart from its inherent superior water resistant attribute, **PRIMAflex™** board is also resistant to sagging over a long period of time. Suspended ceiling systems are normally used in commercial and office buildings.

*Note: This ceiling system is not recommended for eaves area or applications subject to high wind pressure since the ceiling boards are not mechanically fixed to the framework.*

### 3.2 Support Grid & Board Size

3.2mm, 4.5mm and 6mm thick **PRIMAflex™** boards are suitable for suspended ceiling systems. Boards are supplied pre-cut to the standard sizes below to fit the designated support grid dimension.

**Table 3.1: Support grid and board size**

Support Grid Size	<b>PRIMAflex™</b> Board Size
600mm x 600mm	595mm x 595mm
610mm x 610mm	603mm x 603mm
600mm x 1200mm	595mm x 1195mm
610mm x 1220mm	603mm x 1213mm

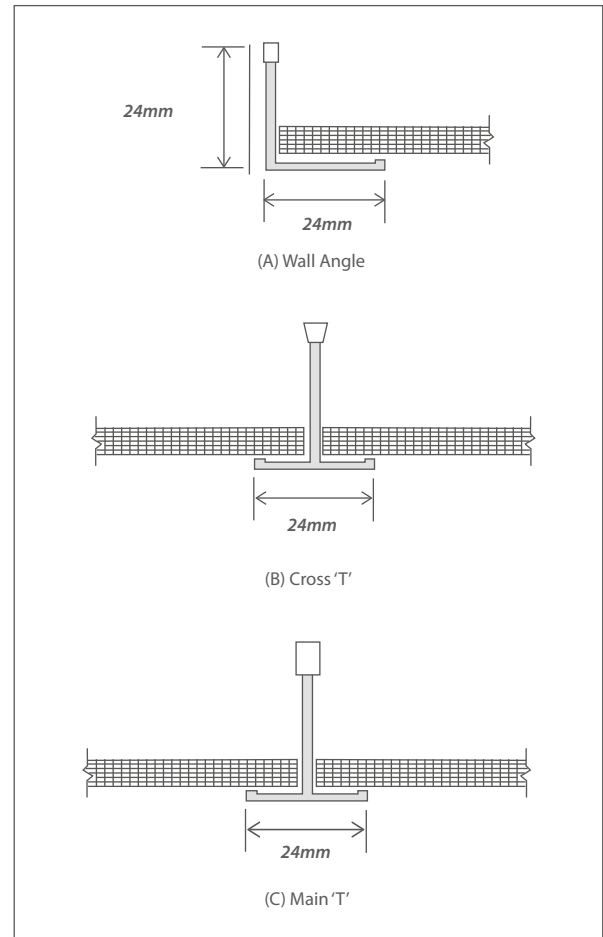
### 3.3 Framing System

Boards are simply supported at all four edges using proprietary suspended ceiling framing system incorporating **main 'T'**, **cross 'T'** and perimeter wall angle. These framing components are suspended using hangers, and the hangers are then connected to the main structural element (beam, rafters/ truss, or reinforced concrete slab) using suitable fasteners. Refer to **Figure 3.1** and **3.2**.

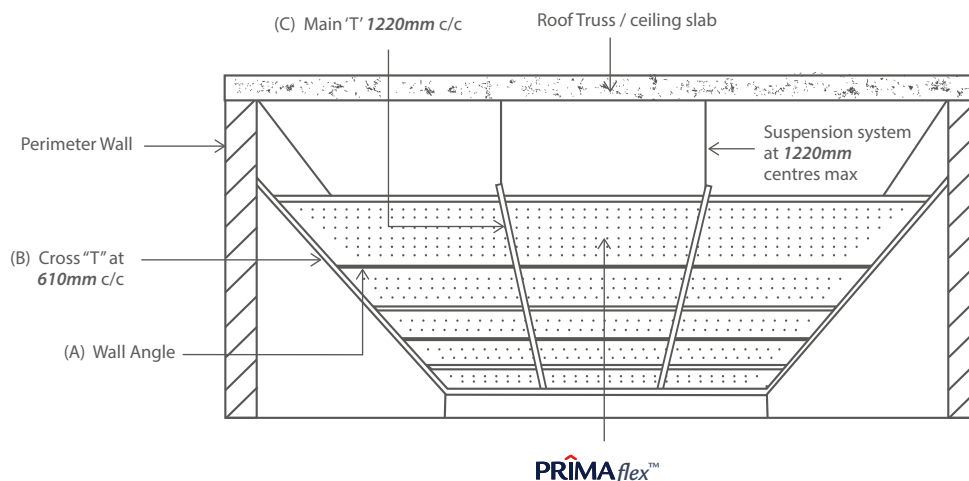
Framing system must be installed as per respective manufacturer's written instructions. Generally, the framing system is designed to carry fibre cement board with thickness of up to **6mm**. Always consult relevant supplier/ manufacturer for the maximum recommended load that can be applied to the framing system. This ceiling system does not utilise any mechanical fasteners for fixing the ceiling boards.

### 3.4 Accessories

Any ceiling accessory such as recess boxed-lights shall be supported independently by providing additional hangers (suspension rods/ wires). Consult light or accessory manufacturer for the recommended installation method.



**Figure 3.2 – System Overview**



**Figure 3.1 – Framing Components**



## 4 Fixed Ceiling Eaves/ Soffit Linings

### 4.1 General

The exceptionally flat and smooth surface, ease of handling have made **PRIMAflex™** board the ideal choice for nail-on / screw-on ceiling systems. Additionally, **PRIMAflex™** is also suitable to be applied as eaves or Soffit Lining due to its ability to withstand exterior weather conditions. Boards up to **6mm** thick are recommended for these applications. However, thicker boards may be used if other design criteria need to be satisfied. **3.2mm** and **4.5mm** thick boards are recommended for residential units up to two storey buildings. For high rise accommodation such as apartments and condominiums, **6mm** thick board should be applied.

### 4.2 Board Layout

For Ceiling, Eaves and Soffit Lining applications, **PRIMAflex™** ceiling board can be fixed across or parallel to the supporting frame. Board joints must coincide with centre of supporting frames. Refer **Figure 4.1**.

### 4.3 Installation

This installation method entails securing **PRIMAflex™** board onto a rigid steel/ timber framework by using nails or screws. Framing is normally spaced at **610mm** centers maximum but it must be adjusted to incorporate gaps at board joint if necessary. To ensure proper fastener head embedment, screw fixing is only recommended when using a minimum of 6mm thick board only. Screw heads will remain proud if board thickness is less than **6mm**.

**Table 4.1: Support framing distance for ceiling**

**SUPPORT FRAMING CENTRE DISTANCE (mm)**

Board Thickness	Ceiling & Eaves/ Soffit Lining	
	Joist	Trimmer
3.2mm	610	610
4.5mm	610	610
6.0mm	610	1220

**Note:**

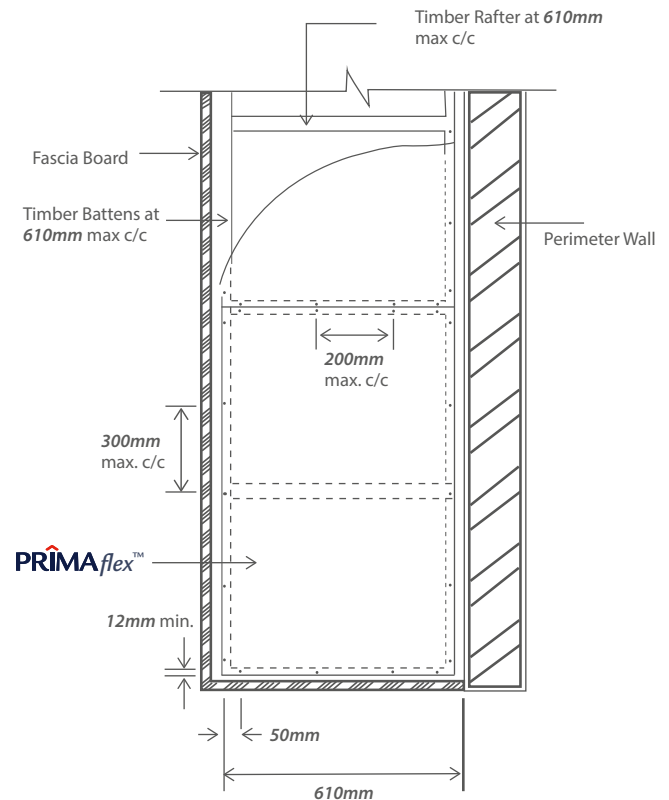
1. All board joints must be supported and secured to the framework.
2. Joists are the primary continuous support that provides structural integrity of the ceiling system.
3. Trimmers are the secondary support where board edges are secured to, and normally positioned at 90° angle with respect to the joists.

### 4.4 Joints & Wall Junctions

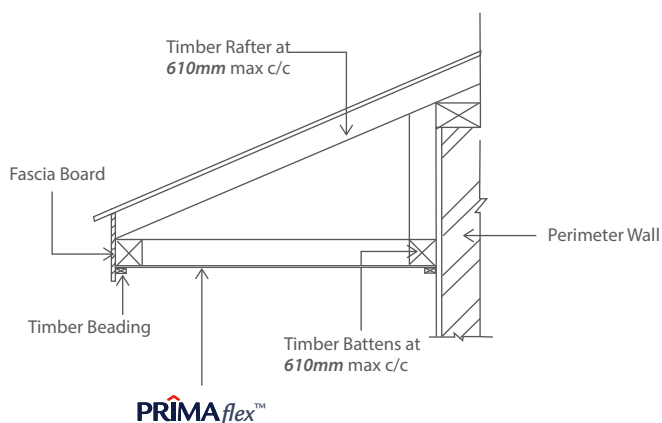
Ceiling to wall junction can be decorated with angle trim or timber mould.

### 4.5 Details

The following diagrams represent typical details that cover the majority situations. Contact HCI if you require specific details that are not covered in this section.



**Figure 4.1 – Ceiling Board Installation**



**Figure 4.2 – Flat Eaves / Soffit**



**Figure 4.3 – Raked Eaves**



### 5.1 General

**PRIMAflex™** wall cladding offers the strength, durability and stability of concrete product – coupled with the versatility of a panel product. Refer to **Table 1.1** for the recommended board thickness for specific application.

**PRIMAflex™** may also be used as internal wall lining (partitioning) for applications not requiring flush joint or seamless joint finishing. For flush joint finishing, refer to **PRIMAflex™** product catalogue.

### 5.2 Good Building Practices

#### 5.2.1 Ground Clearance

Boards must be installed clear of the ground level by a minimum of **150mm** to provide for adequate protection against constant contact with ground water. This would prevent boards from getting saturated, which may result in coating adhesion failure. Refer to **Figure 5.1**.

#### 5.2.2 Flashing

Provide flashing at internal & external corners, around door / window opening. On the ground floor (or in situation where slab underside is in direct contact with soil), provide a damp-proof course before laying the bottom tracks. Refer to **Figure 5.2**.

#### 5.2.3 Sarking / Sisalation

While it is not a mandatory requirement by the Malaysia UBBL, it is a good building practice to provide a layer of vapour impermeable sarking material (building foil) to the exterior side of wall framing prior to installation of **PRIMAflex™** cladding board. Reflective sarking such as foil-backed building wrap will improve the thermal resistant of a wall system and also protect against water ingress due to pressure differential between internal and external environment. Install sarking material as per manufacturer's instruction. Sarking is highly recommended when insulation slab such as mineral wool is placed in the wall cavity. This is done to prevent accumulation of moisture within the insulation material which would affect the overall performance of the system assembly.

### 5.3 Installation

#### 5.3.1 Board Layout

When applied as external wall and gable end claddings, **PRIMAflex™** may be installed vertically or horizontally, ensuring sheet joint coincides with the centre of supporting frame. Where possible, sheet should be installed as such that the horizontal joints are kept at a minimum level. Refer to **Figure 5.3**.

#### 5.3.2 Framing

Framing timber is typically **50mm x 75mm** or **50mm x 100mm**. In the recent years, the use of light gauge metal frame system for the construction of light weight building systems is increasingly becoming more prevalent. Boards can be fixed to light-gauge C-channels or top-hat section. Refer to framing supplier for more information. Refer to **Figure 2.4** for general installation detail.

### 5.4 Joints & Corners

#### 5.4.1 Horizontal Joints

Horizontal joints occur when a building height exceeds the length of a full size sheet or when a building is more than one storey high. At horizontal joints, boards must be supported and secured to framework (nogging). Provide preformed PVC or galvanised steel flashings to all **PRIMAflex™** horizontal joints. Flashings should be fixed to noggings at **200mm** centres. Refer to **Figure 5.4**. Board joint can also be covered with sealant mould or timber joint as shown on **Figure 2.6** and **2.7**.

#### 5.4.2 Corners

Internal and external corners can be decorated with timber trim. Refer to **Figure 5.5**. Alternatively, aluminum **50mm x 50mm** corner angle can also be used. Refer **Figure 5.6**.

### 5.5 Details

The following diagrams represent typical details that cover the majority situations. Contact HCI if you require specific details that are not covered in this section.

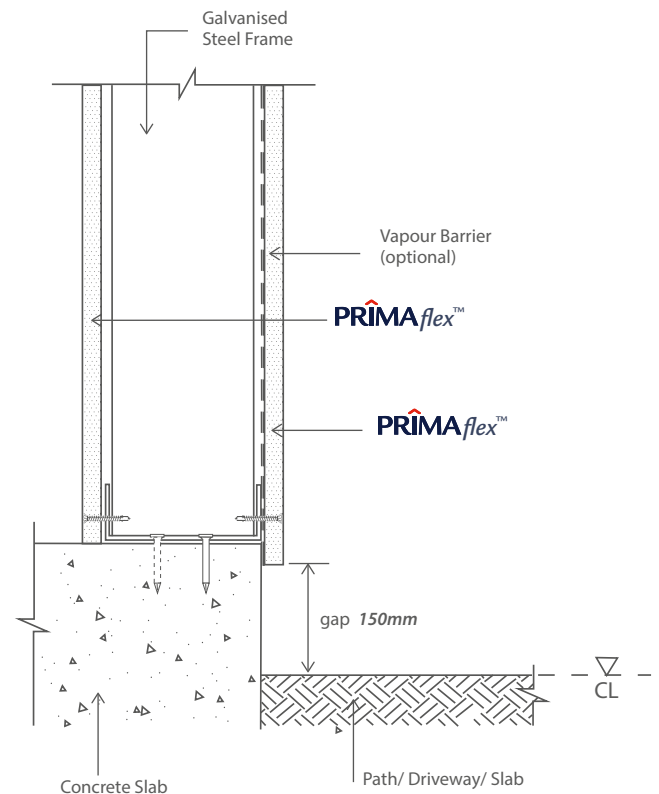


Figure 5.1 – Ground Clearance

Table 5.1: Support framing distance for cladding

Support Framing Centre Distance (mm)		Maximum Frame Spacing	
Sheet Thickness	Application	Stud	Nogging
4.5mm	Gable Ends	407	
6.0mm & 7.5mm	Wall cladding, Gable Ends & Partition	610	1220
9mm & 12mm	Impact Resistant Wall	610	

**Note:**

1. For timber frame construction, noggings should be provided at mid-height (approximately 1220mm to 1500mm apart) to provide stability.
2. For steel frame construction, noggings must be provided as per manufacturer's recommendation.
3. Fastening to noggings is not necessary unless at board joints.
4. Nogging must be provided at board horizontal joints.
5. All board joints must be supported and fastened to the framework.

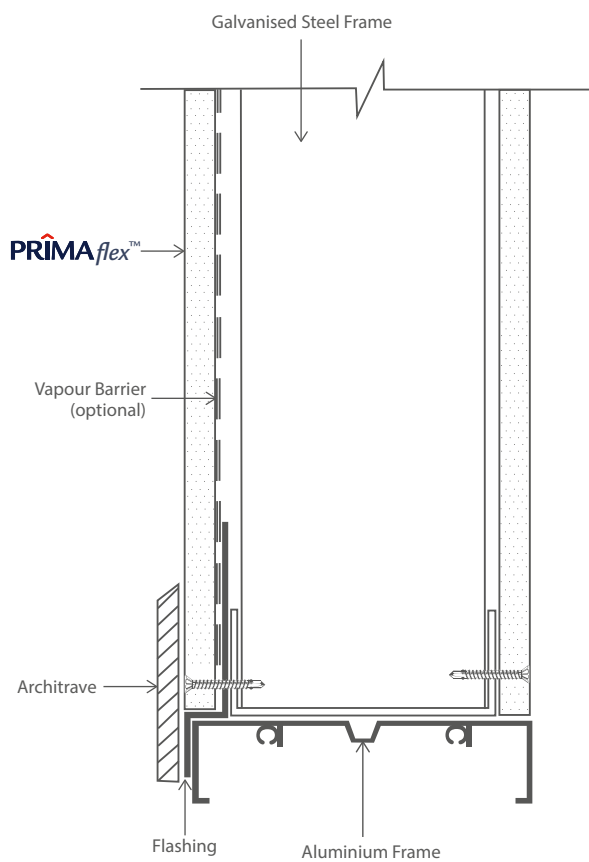


Figure 5.2 – Flashing Requirement

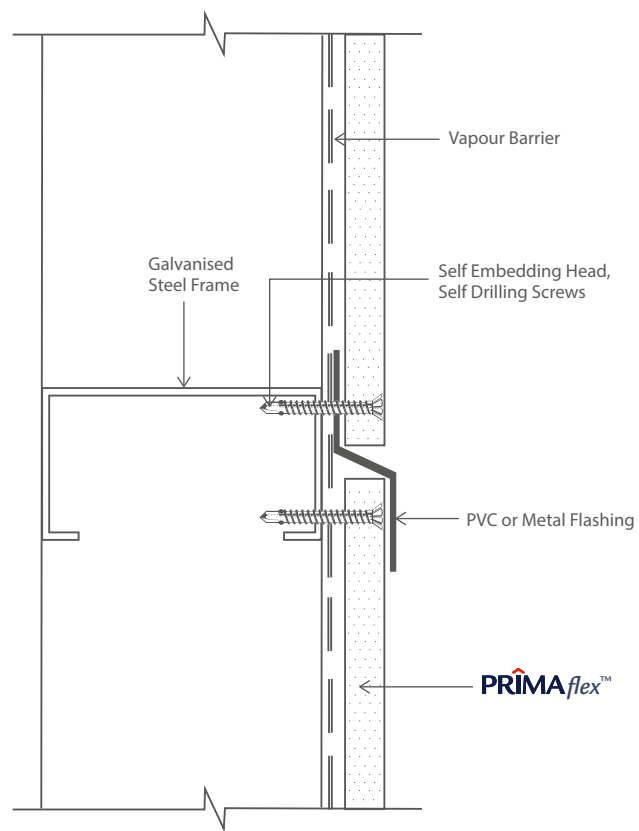


Figure 5.4 – Horizontal Joint

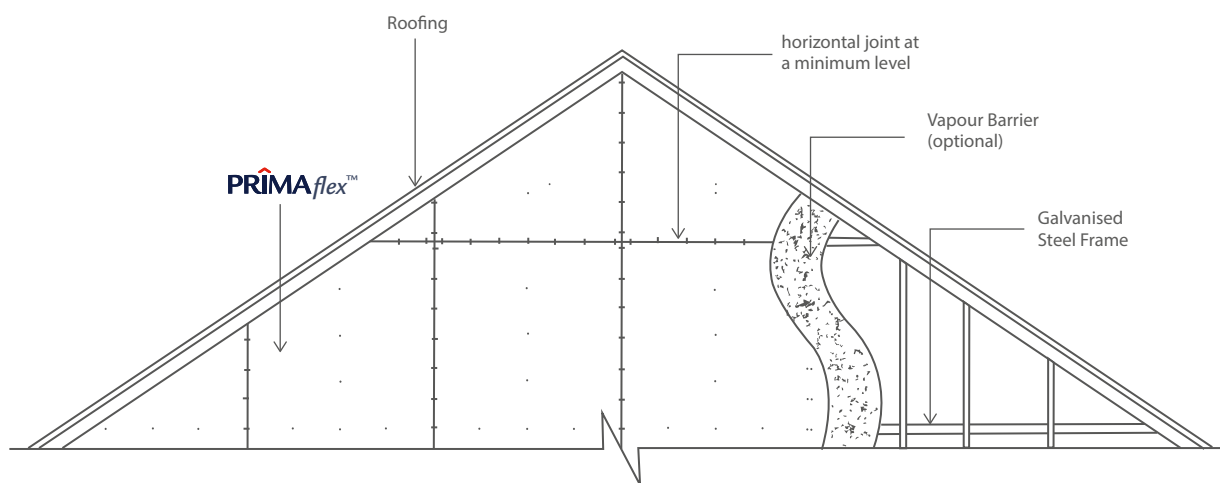


Figure 5.3 – External Wall & Gable End Cladding

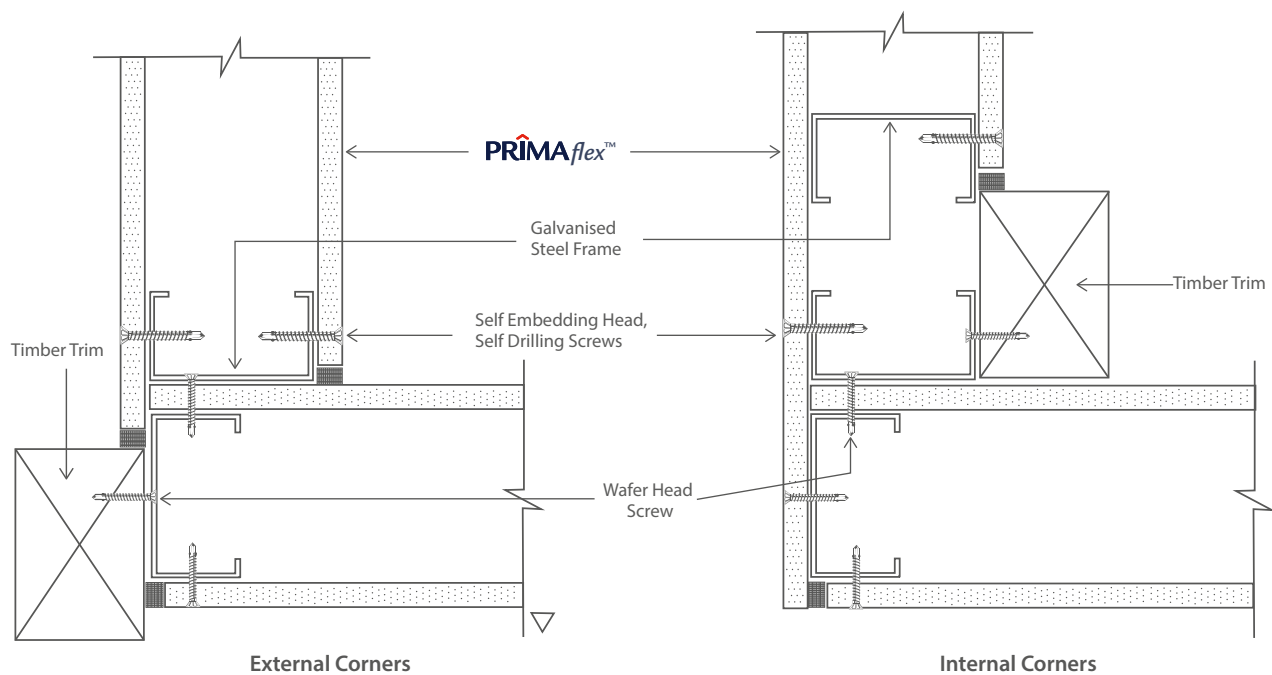


Figure 5.5 – External / Internal Corners (Timber Trim)

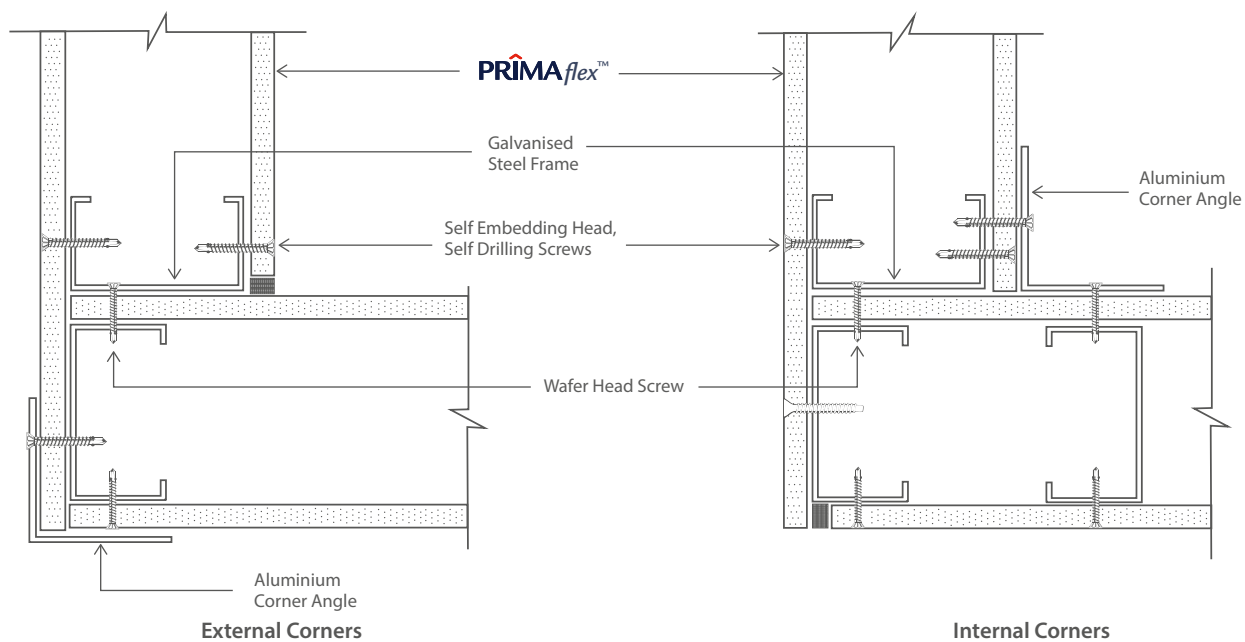


Figure 5.6 – External / Internal Corners (Aluminum Angle Trim)

## 6 Roof Sarking/ Underlay

### 6.1 General

**PRIMAflex™** roof sarking / underlay are roof systems that incorporate the installation of **PRIMAflex™** board as an underlay for roofing sheets, supported by light gauge metal deck, purlins, rafters or roof trusses. The heat insulation property can further be improved by providing a layer of reflective foil. The roof sarking / underlay provide practical solution when higher acoustic and thermal insulation properties are required. The thermal and sound insulation properties of the systems can be engineered to meet specific design criteria. For more information, contact our Technical Services Department.

Its unique combination of physical, mechanical and acoustic properties makes **PRIMAflex™** board an excellent choice for roof sarking applications particularly for residential, commercial and industrial buildings.

### 6.2 Design Consideration

#### 6.2.1 Acoustic & Thermal Insulation

Generally, a minimum of 6mm thick **PRIMAflex™** board can be used. Sound and thermal insulation values of the composite roof systems can be improved by using thicker board (*up to 16mm*), multi-layer design, incorporation of insulation slab (i.e. rockwool). The sound and thermal insulation values of the proposed systems can be estimated using standard acoustic software and standard calculation method.

#### 6.2.2 Typical Roof Systems

Typical composite roof systems incorporating **PRIMAflex™** board for residential and commercial building are shown in **Figure 6.1** and **6.2**. These systems are estimated to achieve the STC rating of **35 dB** and **45dB** respectively.

*Note: The roof section details shown should be used as a guide only. The actual performance of the roof system is also highly dependent on other components, such as metal roofing, water proofing material or insulation materials. Thus, early engagement (at initial design stage) with roof system specialist and relevant consultant are highly recommended to ensure the targeted performance criteria are achievable.*

#### 6.2.3 Load Capacity

**PRIMAflex™** board can be utilized as a working platform during the construction period. When designed to cater for a specific Uniformly Distributed Load (UDL) and Concentrated Load (CL), the table below may be used as a guide to select suitable **PRIMAflex™** board thickness.

The load table shall not be used as sole criterion to assess the actual load carrying capacity of the roof composite system. As each roof system is unique, physical test must be performed to evaluate the actual performance of the system especially when **PRIMAflex™** is applied in conjunction with other material such as high-density insulation slab and metal roofing.

### 6.3 Installation

#### 6.3.1 Framing

Generally, boards are supported with light gauge steel C-channels or Z sections spaced at **610mm** centres maximum. In other systems, boards can also be applied onto corrugated metal decking. When it is inevitable to increase the support spacing to more than **610mm** centres, it is recommended that physical assessment to be conducted to evaluate the suitability of **PRIMAflex™** boards applied in such manner.

#### 6.3.2 Fixing Board

For best result, always lay **PRIMAflex™** boards across the supporting structure. Fix fasteners at a minimum of **15mm** from board edge and **50mm** from board corner. Ensure that fasteners are spaced at **300mm** centres maximum at board perimeter and **400mm** centres maximum at intermediate framework. If roof system encompasses multi-layer board application, board joints between layers should be staggered. Refer to **Figure 6.3**.

#### 6.3.3 Joint

For residential application, board should be laid with its edges in moderate contact. For large area applications such as commercial buildings, it is recommended to provide **2mm to 3mm** gap at **PRIMAflex™** board joint to cater for board movement. If required, seal board joints with flexible sealant. Use only sealant that is compatible with cement based material and any other roof component. In all cases, refer to sealant manufacturer's instruction and compatibility.

### 6.4 Details

The following diagrams (**Figure 6.1**, **6.2** and **6.3**) show typical details where **PRIMAflex™** boards are used as a component in the roof composite system. Some of the special roof components that are proprietary to Roof Specialists may not be shown in these diagrams. Contact HCI if you require specific details that are not covered in this section.

**Table 6.1 : Load capacity for roof sarking**

Joist Spacing @ 300mm / 305mm centre			Joist Spacing @ 400mm / 406mm centre		Joist Spacing @ 600mm / 610mm centre	
Thickness	UDL	CL	UDL	CL	UDL	CL
6mm	0.5kN/m <sup>2</sup>	0.25kN	0.5kN/m <sup>2</sup>	0.15kN	0.1kN/m <sup>2</sup>	0.05kN
	51kg/m <sup>2</sup>	25kg	51kg/m <sup>2</sup>	15kg	10kg/m <sup>2</sup>	5kg
9mm	5.0kN/m <sup>2</sup>	1.0kN	2.0kN/m <sup>2</sup>	0.5kN	0.5kN/m <sup>2</sup>	0.25kN
	510kg/m <sup>2</sup>	102kg	204kg/m <sup>2</sup>	51kg	51kg/m <sup>2</sup>	25kg
12mm	10.5kN/m <sup>2</sup>	2.25kN	5.0kN/m <sup>2</sup>	1.25kN	1.25kN/m <sup>2</sup>	0.5kN
	1070kg/m <sup>2</sup>	229kg	510kg/m <sup>2</sup>	127kg	127kg/m <sup>2</sup>	51kg
16mm	19.3kN/m <sup>2</sup>	5.6kN	10.7kN/m <sup>2</sup>	3.1kN	3.4kN/m <sup>2</sup>	1.4kN
	1,967kg/m <sup>2</sup>	571kg	1,091kg/m <sup>2</sup>	316kg	347kg/m <sup>2</sup>	143kg

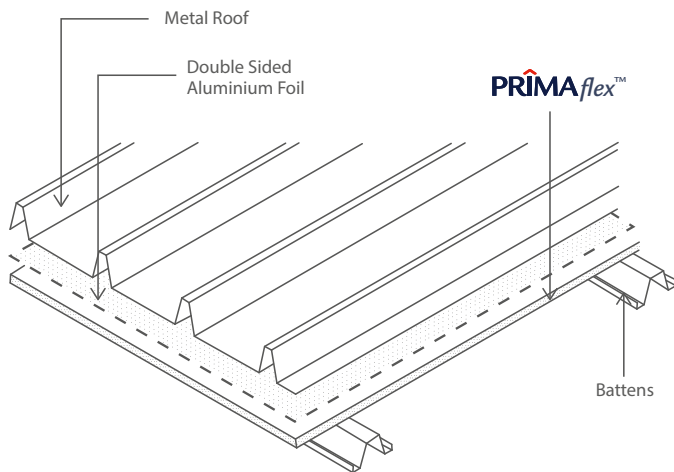


Figure 6.1 – Typical Residential Roof Section

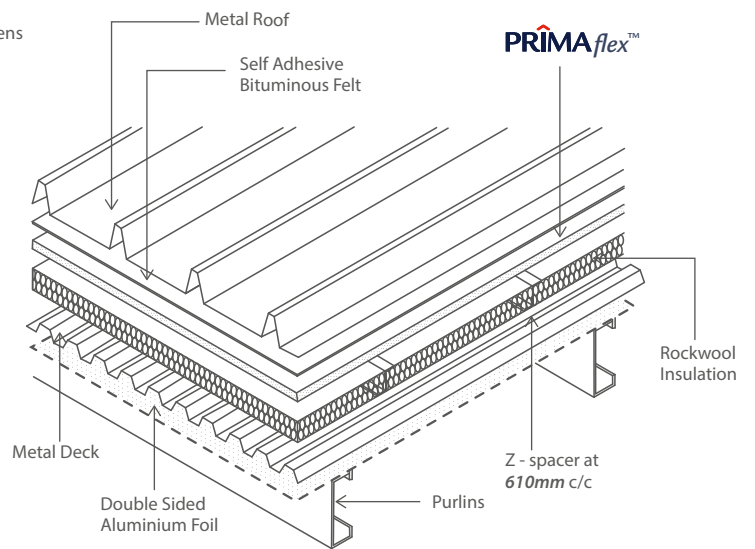


Figure 6.2 – Typical Commercial Roof Section

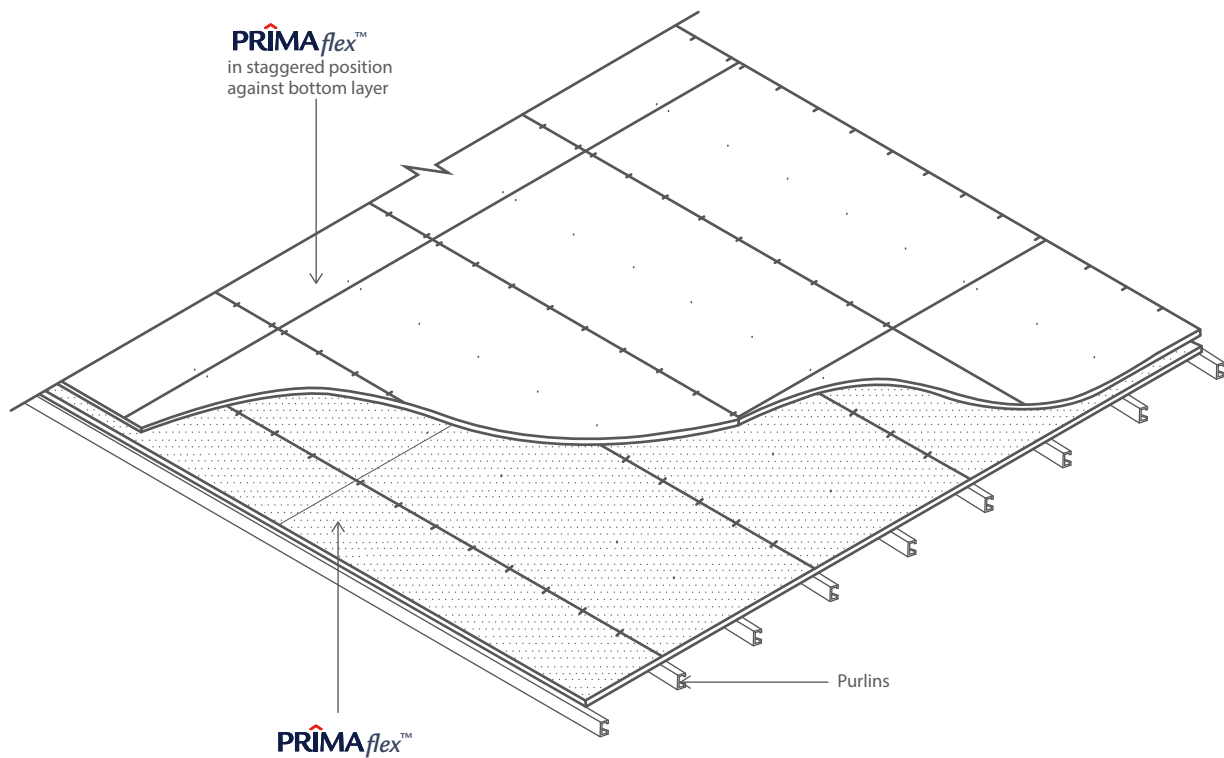


Figure 6.3 – Multi-layer Board Installation Method for Roof Sarking

## 7 Flooring

### 7.1 General

**PRIMAflex™** is suitable for the construction of lightweight platform / floor system for residential, commercial as well as industrial buildings. The floor system can be designed to meet specific load requirements based on the intended use. These load requirements are generally described in the local building code such as UBBL.

The system uses **12mm, 16mm, 24mm and 32mm** thick **PRIMAflex™** fastened onto timber or steel framing system. These boards are manufactured in standard sizes of **1220mm x 2440mm**.

### 7.2 Design Consideration

#### 7.2.1 Framing

Framing for flooring can be constructed either of steel or timber, or a combination of both materials. The general requirements are describes as follows:-

- Lay floor boards across the joists (primary support), preferably in a staggered configuration.
- Trimmers / runners must be installed at approximately **1220mm** centres to support the floor board edges.
- Where floor board is cut to allow for opening, provide additional support not more than **50mm** from the edges of the opening.
- Ensure all board edges are adequately fastened to the support.
- Refer to **PRIMAflex™** Load Selection **Table, 7.1 and 7.2** for recommended joist spacing.

The steel framing system is generally mild steel square / rectangular section or structural timber. Framing must have at least **45mm** width in order to provide adequate fastener's landing at floorboard joint.

It is the responsibility of the structural engineer to ensure the framing system in which **PRIMAflex™** flooring boards will be laid on will perform under the design load. Generally, framing structure is designed to cater for a maximum deflection of **L/250** of span under the service load. For floor to be finished with rigid material such as natural stone, please consult with HCI Technical Department.

#### 7.2.2 Load Tables

The tables below serves as a guide in the selection of **PRIMAflex™** board thickness and joist spacing for flooring applications. The use of these tables shall be in line with good building practice. It is recommended that the entire fixing requirement stated in this manual be adhered with to ensure the workability floor system. A uniformly distributed load of **1.2kN/m²** has been factored in to cater for floor finishes.

#### 7.2.3 Designing the Floor

This section provides basic guidance to designers in selecting the appropriate board thickness and support span based on the intended use of the floor system.

**Table 7.1 : Span vs. Load (Dry Area Applications)**

Joist Spacing @ 300mm / 305mm centre			400mm / 407mm centre		600mm / 610mm centre	
Thickness	UDL	CL	UDL	CL	UDL	CL
12mm	9.60kN/m²	2.35kN	3.75kN/m²	1.30kN	-	-
	979kg/m²	240kg	382kg/m²	133kg	-	-
16mm	18.00kN/m²	5.50kN	9.50kN/m²	3.00kN	2.25kN/m²	1.40kN
	1835kg/m²	56kg	968kg/m²	306kg	229kg/m²	143kg
18mm	21kN/m²	4.2kN	13kN/m²	3.4kN	5kN/m²	2kN
	2140kg/m²	428kg	1325kg/m	346.5kg	509kg/m²	203.8kg
20mm	30kN/m²	9.0kN	15.5kN/m²	4.1kN	5.2kN/m²	3.12kN
	3058kg/m²	917kg	1580kg/m²	417.8kg	530kg/m²	318kg
24mm	42.00kN/m²	13.00kN	23.0kN/m²	7.90kN	9.25kN/m²	4.50kN
	4281kg/m²	1325kg	2345kg/m²	805kg	943kg/m²	459kg
32mm	76.00kN/m²	23.25kN	42.25kN/m²	14.00kN	17.75kN/m²	7.75kN
	7747kg/m²	2370kg	4307kg/m²	1427kg	1810kg/m²	790kg

**Table 7.2 : Span vs. Load (Wet Area and External Applications)**

Joist Spacing @ 300mm / 305mm centre			400mm / 407mm centre		600mm / 610mm centre	
Thickness	UDL	CL	UDL	CL	UDL	CL
12mm	5.50kN/m²	1.25kN	1.75kN/m²	0.80kN	-	-
	561kg/m²	127kg	178kg/m²	82kg	-	-
16mm	10.75kN/m²	3.50kN	5.25kN/m²	1.75kN	0.75kN/m²	0.75kN
	1096kg/m²	357kg	535kg/m²	178kg	76kg/m²	76kg
18mm	15kN/m²	3kN	7.8kN/m²	2.08kN	3kN/m²	1.2kN
	1529kg/m²	305.8kg	795kg/m²	212kg	305.8kg/m²	122.3kg
20mm	17.6kN/m²	5.28kN	9kN/m²	3.6kN	4kN/m²	1.68kN
	1794kg/m²	538kg	917kg/m²	366kg	407.7kg/m²	171kg
24mm	25.50kN/m²	8.00kN	13.75kN/m²	4.75kN	5.25kN/m²	2.75kN
	2599kg/m²	815kg	1402kg/m²	484kg	535kg/m²	280kg
32mm	47.35kN/m²	14.50kN	25.75kN/m²	8.75kN	10.50kN/m²	4.75kN
	4827kg/m²	1478kg	2625kg/m²	892kg	1070kg/m²	484kg

**Note:**

1. Dry and Wet Bending Strength (MOR) for **PRIMAflex™** are 16N / mm² and 10N/mm² respectively.
2. Dry and Wet Modulus of Elasticity (MOEs) **PRIMAflex™** are 8,000N / mm² and 5,000N / mm² respectively.
3. Minimum factor of safety under the bending strength of 3.0 has been factored in the recommended loads.
4. Allowable maximum deflection is limited to L / 250 of joist spacing.
5. Concentrated load is applied over an area of 300mm x 300mm square.
6. The above values are nominal joist spacing. Actual joist and trimmer spacing must incorporate the allowance for 1mm to 2mm gap at board joints and 5mm gap at expansion joint.
7. Refer to HCI should the design require other particular attention not covered in this manual.

- Step: 1 Determine the actual usage (i.e. Houses, Institutional Buildings, Offices, etc.) of the floor system.
- Step: 2 Refer to the UBBL for the minimum UDL and CL for the intended application.
- Step: 3 Determine the type of finishing material to be applied on the floor board, including other components such as adhesive, cement mortar, e.t.c. The weight of these materials must be added to the UDL value obtained in step 2. Cement mortar of 25mm thickness typically weighs **0.57kN/m<sup>2</sup>**.
- Step: 4 Select the suitable joist spacing that meets the minimum UDL (plus weight of finishing material) & CL stated in Step 3.

### 7.3 Installation

The following installation method serves as a guide for installer. Refer to **Figure 7.1** and **Figure 7.2** for typical floor board installation detail.

1. Ensure that the framing system is designed and constructed in accordance with applicable standards, building codes and acceptable building practices. Floor joists and trimmers must be true and level.
2. Lay **PRIMAflex™** board in a staggered configuration and laid across the floor joist.
3. A gap of about **6mm** between **PRIMAflex™** and the wall is recommended along the perimeter of the floor system. Board joint can be butt or sealant joint by referring to **Figure 2.2** or **2.6** respectively.
4. Refer to **Table 2.3** for fasteners fixing distance and detail.
5. Fill gap between sheet joint and patch all fastener points using suitable cementitious patching compound. For wet area application, use wet area sealant or polyurethane sealant.

### 7.4 Joint & Intersection Details

#### 7.4.1 Expansion Joint

Provide expansion joint at **6.1m** centres maximum if any one (or more) of the following occurs:-

- a. Floor area to be tiled exceeds 6.1m in width or length
- b. Floor changes in direction
- c. **PRIMAflex™** sheet adjoins other floor systems such as concrete slab.

Provide a minimum of **6mm gap** at expansion joint. Seal gap with suitable sealant. The expansion joint gap must be carried up

vertically to provide a complete break at board joint and the finishing material. Do not apply finishing material over the expansion joint. Refer to **Figure 7.3**.

### 7.5 Finishes

- **PRIMAflex™** floor may be finished with non-rigid finished such as carpet, vinyl tiles, linoleum and other flexible materials can be used provided that the overall floor deflection is limited to **L/250** of floor span under the service load.
- Rigid floor finishing material such as ceramic tile can also be used provided that the overall floor deflection is limited to **L/360** of floor span under the service load.
- For wet area application and exterior decking, apply waterproofing material before laying the finishing material (i.e. ceramic tiles).

### 7.6 Waterproofing

#### 7.6.1 Wet Area

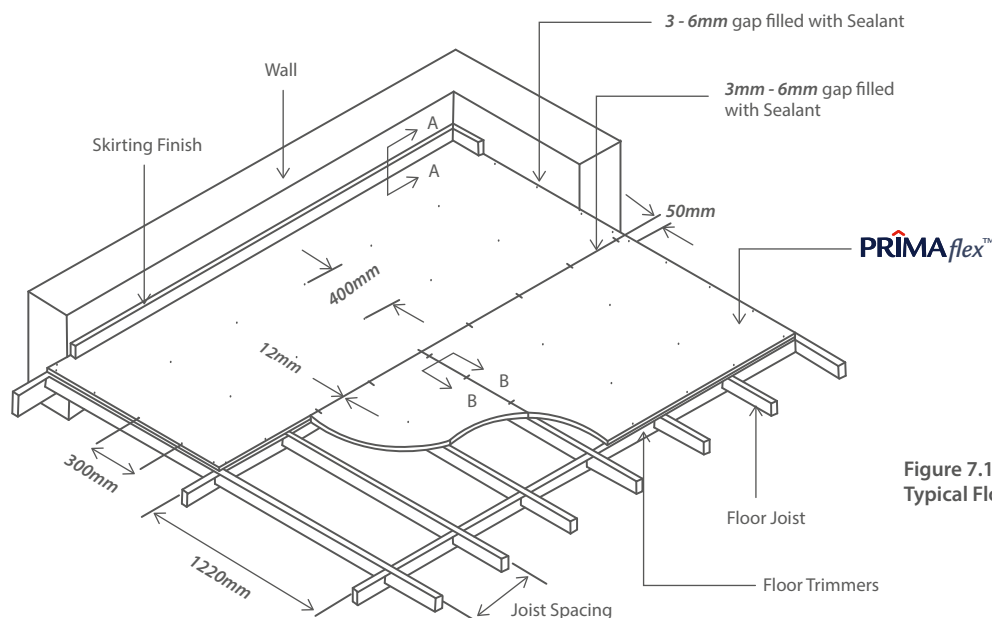
Prior to applying ceramic / homogeneous tiles in wet area application, gaps between sheets and screw points must be covered with suitable wet area polyurethane sealant. Apply a layer of compatible waterproofing material onto **PRIMAflex™** floor board. Lay a layer of cement / sand mortar bed to form appropriate gradient approximately **1%** to channel the water to the waste trap. Mortar bed must be nominally **30mm** minimum thick and not less than 20mm at floor waste. At floorboard joint, mortar bed must be reinforced with centrally embedded **150mm** wide (gauge **1mm** diameter) galvanised wire mesh. Then, install tiles with suitable tile adhesive. Refer to waterproofing and tile adhesive manufacturers for recommendations. In all cases, wet area waterproofing must satisfy the minimum requirements set by the local building regulations and/or acceptable building practices. Typical sectional details of wet area application using **PRIMAflex™** sheets are shown in **Figure 7.4**.

#### 7.6.2 External Decking

For exterior decking use subjected to natural weathering, **PRIMAflex™** floor boards must be protected with waterproofing material before applying any finishing material. Adjust floor support to allow a minimum of **2% fall** (slope).

### 7.7 Details

The following diagrams show typical details of **PRIMAflex™** lightweight floor system. Contact HCL if you require specific details that are not covered in this section.



**Figure 7.1 – Typical Floor Board Installation**



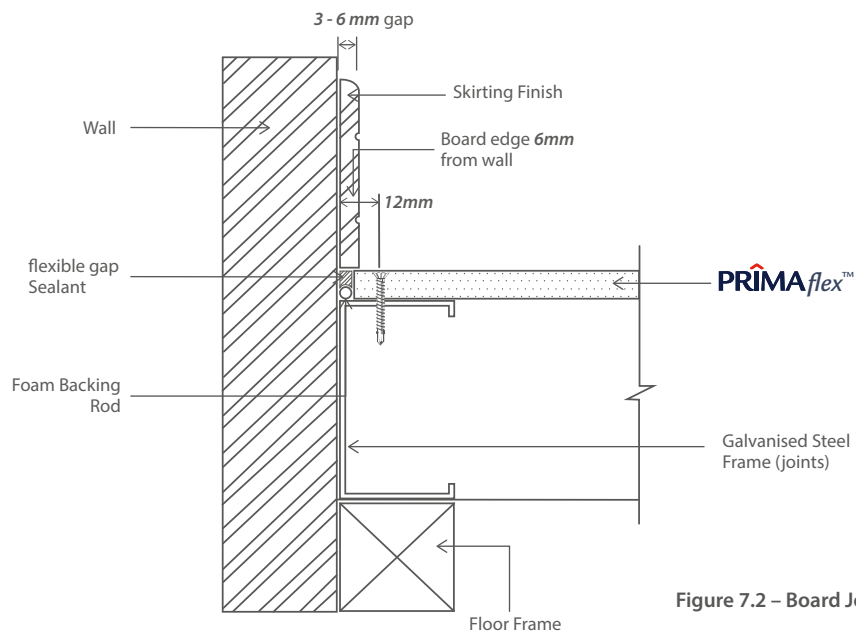


Figure 7.2 – Board Joint (Dry Area)

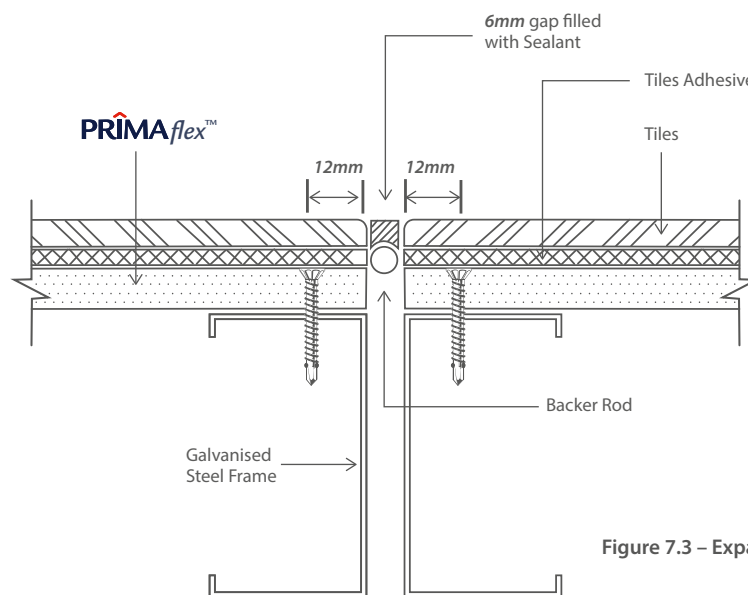


Figure 7.3 – Expansion Joint (Tiled Floor)

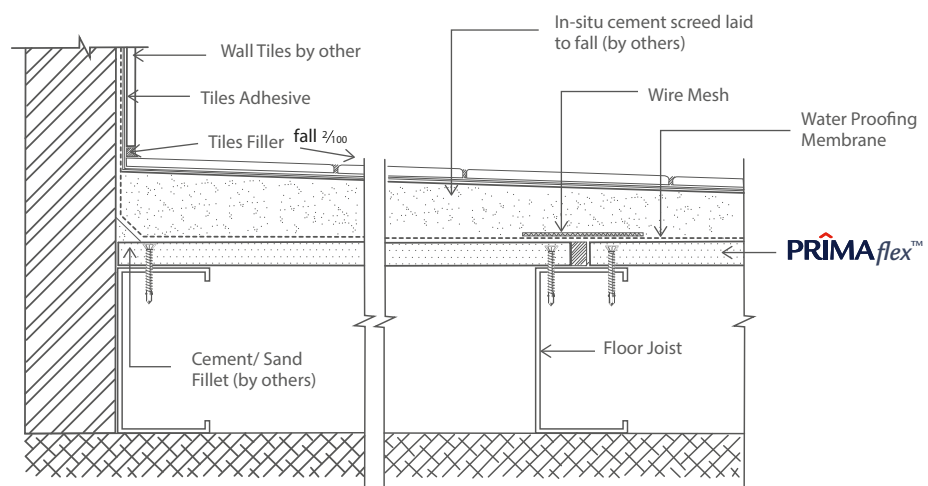


Figure 7.4 – Wet Area Waterproofing

### 8.1 General

**PRIMAflex™** board serves as better alternative to conventional plywood formwork. It provides temporary support to which fresh concrete is poured to form reinforced concrete slab. It is recommended to be applied as permanent formwork in the construction of bridges, flyovers, floor and approach slab for elevated MRT / LRT stations and many other usages.

The key advantages are:-

- No propping is required
- Faster than conventional formwork method
- Eliminate / minimize labour for dismantling formwork
- Suitable for bridge construction with limited excess
- Will not rot & resistant to termite attack
- Aesthetically pleasing

### 8.2 Design Consideration

**PRIMAflex™** permanent formwork boards are supplied in a standard size of **1220mm x 2440mm**. Boards can be cut at the project site to the required sizes to fit to the void (between beams) before steel bar reinforcement is tied and subsequently concrete is poured to form deck slab. Board must be kept dry prior to installation. Refer to the load table below for the appropriate span and concrete thickness.

**Table 8.1: Loading table for Permanent Formwork**

Board thickness	Recommended maximum clear span (mm)								
	400	500	600	700	800	900	1000	1100	1200
Concrete thickness (mm)									
12mm	310	170	100	-	-	-	-	-	-
16mm	-	360	220	150	100	-	-	-	-
18mm	-	400	230	140	100	-	-	-	-
20mm	-	-	300	185	115	-	-	-	-
24mm	-	-	-	-	300	230	170	130	-
32mm	-	-	-	-	600	440	350	280	220

Requires Water proofing on surface contact which Wet Concrete

#### Note:

1. Clear span refers to the net edge-to-edge distance between beams. This is the area where **PRIMAflex™** board provides temporary support for the fresh concrete that forms the deck slab.
2. A minimum factor of safety (in bending) of 2.0 has been incorporated in the design calculation.
3. An allowance of 1.5kN/m<sup>2</sup> of working load has been incorporated in the design calculation.
4. Concrete density is assumed at 25kN/m<sup>3</sup>.
5. **Waterproofing material** must be applied onto both surfaces and all board edges.
6. Do not apply in area where **PRIMAflex™** will be 'exposed to standing water' or 'continuously in contact with water'.
7. Fresh concrete must be poured at the 'beam' area and progressively spread to other area to form the required 'slab thickness'.
8. Accumulation of 'fresh concrete' in excess of the recommended thickness, particularly at the mid-span of **PRIMAflex™** board may result in failure.

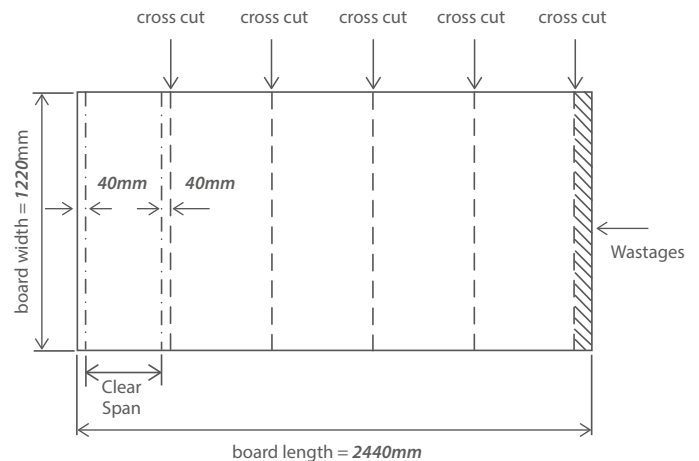
### 8.3 Cutting & Installation

The following describes a step-by-step instruction to a successfully application of **PRIMAflex™** permanent formwork. Any deviation from the recommended steps below may result board failure and personal injury.

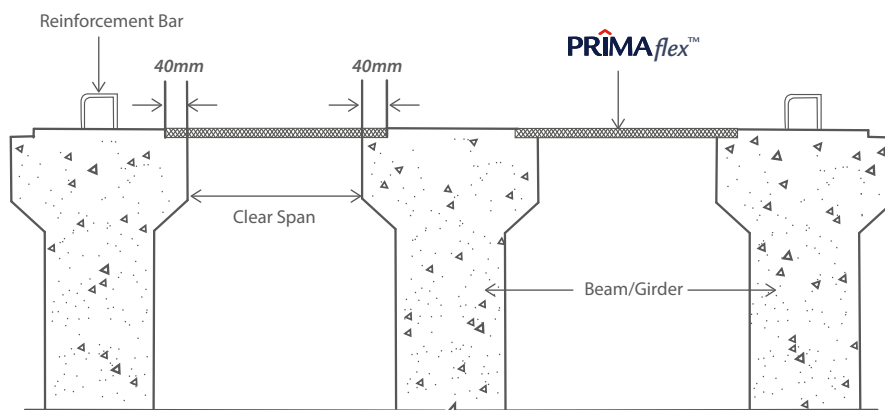
1. Select that suitable board thickness based on the information in **Table 8.1**.
2. To obtain the permanent formwork width, add **80mm** (allowance of **40mm** support at each side) to the clear span.
3. Cut **PRIMAflex™** PFW board across the **2440mm** side, forming a panel size of **1220mm x "Clear Span + 80mm"**. Board must be cut as shown in **Figure 8.1**.
4. Position the cut panel centrally with its **1220mm** edges running parallel to, and resting on the beam edges.
5. The remaining boards are laid into position with their edges in moderate contact with each other.
6. Install the reinforcing steel bar as per relevant construction drawings.
7. Pour fresh concrete to form the slab, ensuring no excessive accumulation of fresh concrete at the mid-span of **PRIMAflex™** board.

### 8.4 Details

The following diagrams show typical details of **PRIMAflex™** permanent formwork application. Ensure particular attention with respect to the board cutting and requirement for waterproofing (if required) are adhered to. Contact HCI if you require specific details that are not covered in this section.



**Figure 8.1 – Board Cutting Method**



**Figure 8.2 – Single Span Formwork System**

## 9 Working Instructions

### 9.1 Cutting

**PRIMAflex™** sheets can be cut using common power assisted tools such as circular saw equipped with a diamond-tipped cutting blade. This operation must be carried out in a well-ventilated area only. Do not wet the sheet or the saw blade during cutting process. Power tools fitted with dust-extracting attachments are recommended. A dust mask and safety goggle must always be worn when cutting, drilling or grinding the sheet.

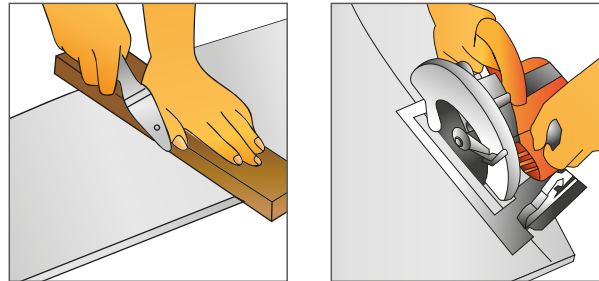


Figure 9.1: Score and Snap Method (left), Machine Cut (right)

### 9.2 Penetrations

Round holes can be formed by drilling a series of smaller holes around the perimeter of the proposed opening, and subsequently tapping the waste piece out carefully. Trim the rough edges with rasp if required. Use suitable high-speed heavy duty drill bit. Rectangular or square openings can be achieved by using power assisted circular saw.

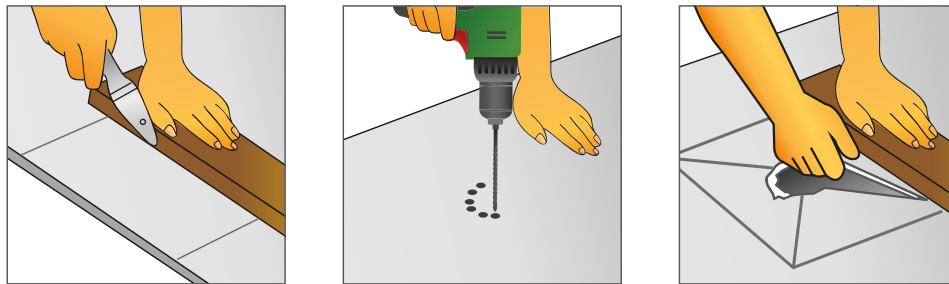


Figure 9.2: Notching and penetration

### 9.3 Handling & Storage

Always lift sheets vertically, on-edge and lengthwise. Store **PRIMAflex™** neatly on a flat surface supported evenly on bearers spaced at **600mm** centres maximum, clear from ground to avoid damage and moisture ingress. Store under cover and ensure **PRIMAflex™** is dry prior to fixing. Never install damp or wet sheets as they are prone to shrinkage and subsequently may lead to joint failure. Damp or wet sheets must be allowed to dry to equilibrium moisture content before fixing.

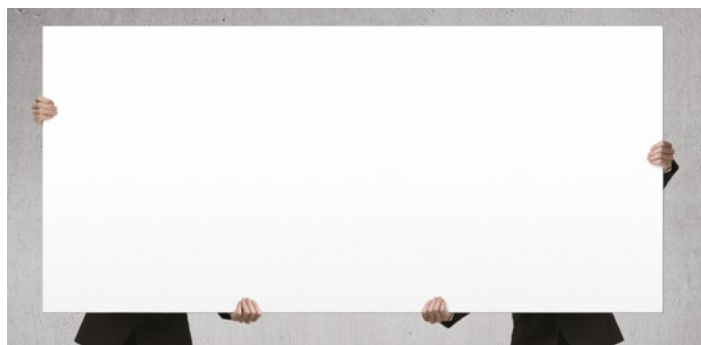
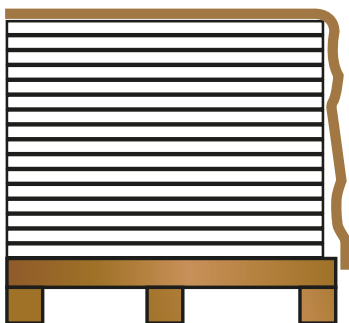


Figure 9: Handling

Table 10.1: Accessories by HCI


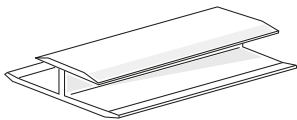


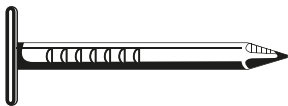



Items	Properties
	<b>Self-embedding head, self-drilling 'wing teks' screws</b> [For fixing <b>PRIMAflex™</b> to galvanized light gauge steel thickness of <b>0.55mm</b> to <b>1.5mm</b> ] No. 8 x 1/8"
	<b>PVC Jointer</b> [For jointing <b>7.5mm</b> thick <b>PRIMAflex™</b> when off-support end joints are preferred]
	<b>Score and Snap Knife</b> [For cutting <b>PRIMAflex™</b> - straight cut only]

Table 10.2: Accessories by others suppliers

Items	Properties
	<b>Galvanised Wire Nails</b> [For nailing to timber support where nail heads to remain exposed external side] <b>2.8mm</b> diameter x <b>30mm</b> long and <b>40mm</b> long
	<b>Flat Head Roofing Nails</b> [For nailing to timber support where nail heads to be concealed by the successive planking] <b>2.8mm</b> diameter x <b>30mm</b> long and <b>40mm</b> long
	<b>Sealant Gun</b> [Tools for extruding sealant from its cartridge]
	<b>Paintable/flexible Polyurethane Sealant</b> [For sealing gap at plank joints] <b>300mL</b> cartridge
	<b>Exterior Grade Water-based Acrylic Paint</b> (Top coats for finishing of exposed surface) Note: The exact specification of these products of their standard packaging may be different. Refer to the respective.



#### WARRANTY

Hume Cemboard Industries Sdn Bhd ("the Company") warrants that it will at all times ensure that the products referred to herein ("the Products") shall be supplied by it to the purchaser free of any manufacturing defects and defective materials used in their manufacture.

In the event and if contrary to this assertion the Products prove to be defective, whether as a result of manufacturing defects or arising from the Company's use of defective materials, the Company will supply replacement Products. The Company shall, however, have the option and may choose to reimburse the purchaser the purchase price of the Products instead. The Company shall not be liable for any economic or consequential losses arising from any use of defective Products.

This warranty shall be void unless the purchaser has, in its handling and installation of the Products, complied with the recommendations contained in this brochure and other good building practices expected of a reasonable purchaser.

#### ADVISORY NOTE

Successful installations of Hume Cemboard Industries Sdn Bhd's Products depend on a large number of factors that are outside of the scope of this brochure. Particular design, detail, construction requirements and workmanship are beyond the control of the Company. As such, Hume Cemboard Industries Sdn Bhd's warranty does not extend to non-usability of Products or damage to Products arising from poor or defective designs or systems or poor quality of workmanship in the installation of Products.



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