

# Marley Minimum Fixing Specification

The Minimum Fixing Specifications given in this document is intended to assist the specifier and roof tiler in Southern Africa to determine the minimum recommended installation and tile fixing specification for each terrain category, basic design wind speed, building type, roof pitch, building height, length of roof slope and other local parameters.

**Please note:** Due to global warming there has been a shift in weather patterns leading to increased storm and cyclone activities inland and in coastal regions. Weather conditions throughout Southern Africa, and in the rest of the world, are becoming increasingly more unpredictable and difficult to forecast, therefore

**IT IS ALWAYS GOOD PRACTICE TO IMPROVE ON THE MINIMUM SPECIFICATIONS IN ALL CASES AND RAISE THE SAFETY FACTOR OF THE ROOF.**

## UNDERTILE MEMBRANE AND RADIANT BARRIERS:

Modern practice and wind tunnel tests have demonstrated that a roofing underlay (membrane or radiant barrier) is a fundamental part of a tiled roof at pitches below 26° and above 45°, and at all pitches in exposed and coastal areas. The use of a suitable membrane is recommended in all cases. It is mandatory where indicated further in the tables.



## WIND LOADS

In the past many roofs survived by virtue of their deadweight resistance and reserves of structural strength. Today, lighter weight materials and the more sophisticated design of modern roofs make the roof covering more susceptible to wind damage.

SANS 10160-1989 (Code of Practice for the General Procedures and Loadings to be adopted for the Design of Buildings - Section 4) provides the basic data for the calculation of wind loads which buildings should be capable of withstanding.

When the wind blows at 90° to a building it is slowed down against the face, with a consequential build-up of pressure. At the same time, it is deflected and accelerated around the end walls and over the roof with a consequential reduction in pressure - i.e. suction on these areas.

The faster the wind the greater the suction force. Wind speed is proportional to the local pressure gradient and a number of factors influence the stream of air - topography, landscape, configuration of the building group and shape of the building can all contribute to a pulsating wind load of high intensity over a short period of time (fig 1, 2 & 3).

Fig. 1

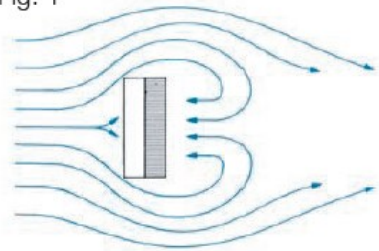
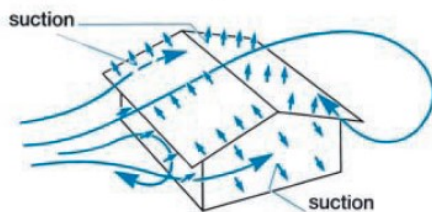


Fig. 2

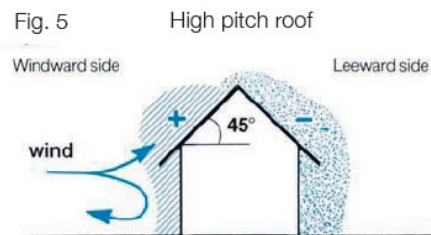
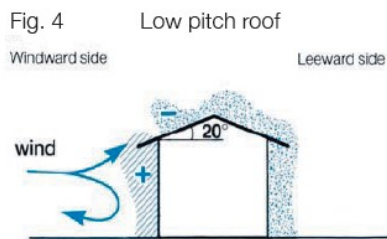


Fig. 3



When considering the wind forces acting on pitched roofs, on the windward slope the pressure is dependent on the pitch. When the roof angle is less than  $30^\circ$  the windward slope can be subjected to severe suction or negative pressure (fig 4).

Roofs steeper than  $35^\circ$  generally present sufficient obstruction to the wind for a positive pressure to be developed on their windward slopes. Even here, though, there is an area near the ridge where suction is developed. The leeward slopes are always subject to suction, though this is not usually as strong as that produced near the windward edge (fig. 5)

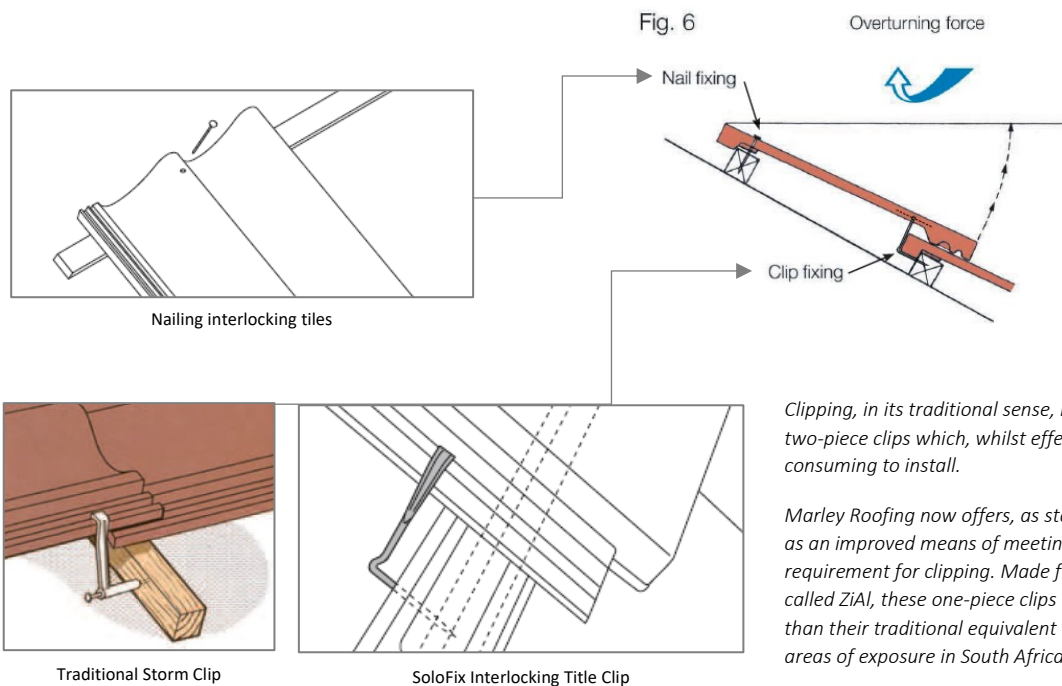


## MECHANICAL FIXING – WHERE AND WHY TO NAIL OR CLIP...

Under strong wind gusts the suction force on the roof tiles may be in excess of the mass of the tiles, thus requiring them to be securely fixed to prevent them from being lifted from the building. Wind tunnel tests have also shown the benefits provided by the undertile membrane in resisting upward wind loads. No reliance should be placed on the shear or tensile strength of mortar to hold ridge tiles and monoridge tiles on steep or vertical hips or at any place where there is a risk of differential movement. This means that mechanical fixing of tile fittings at ridges and hips is also necessary to prevent them from being dislodged.

Within the general roof area, the tensile strength and pull out resistance of nails become important. It is proven that at lower pitches tile clips (**Marley's traditional Plastic Storm Clips or SoloFix Metal Clips**) provide resistance to the applied lifting force more successfully than nails which, due to their closeness to the pivot line where the nib touches the batten, cannot resist the uplift force created at the tail. (fig. 6)

At steeper pitches it is also important to prevent the tiles from being dislodged and from rattling under wind gusting.



## SIZE OF NAILS AND CLIPS TO PROFILE

It is important to use the correct nail and clip size in relation to the profile being installed.

### Galvanised Clout Tile nails:



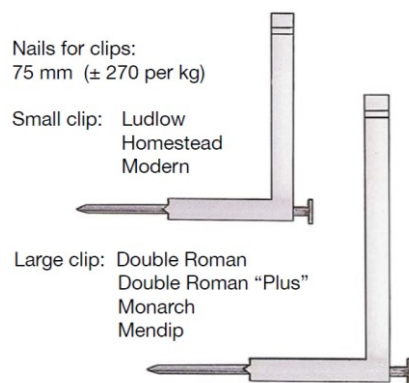
Monarch	90 mm (± 210 per kg)
Mendip	75 mm (± 270 per kg)
Double Roman	75 mm (± 270 per kg)
Double Roman "Plus"	75 mm (± 270 per kg)
Ludlow	63 mm (± 295 per kg)
Homestead	63 mm (± 295 per kg)
Modern	50 mm (± 385 per kg)

### Serrated nails for Rake Verge tiles:



75 mm (± 280 per kg)

### Storm Clips:



### SoloFix Clips:

75 x 48:	Double Roman Double Roman Plus Mendip Homestead
65 x 48:	Ludlow Modern
85 x 48:	Monarch Bold roll Clay profiles



## FIXING OF HIP/VALLEY CUT TILES

We strongly recommend the use of Marley Kro Clips to secure cut tiles for hips and valleys to prevent slip-out of these tiles. Using the kro clip, press the cut hip/valley tile into the kro clip clamp and tap with a hammer to grip and secure the clamp onto the cut tile. The secured kro clip is then attached to the hip/valley batten/rafter by wrapping the attached wire around a secured nail that has been nailed to the hip batten.

## DRY FIXING SOLUTIONS

> Marley Dry Ridge Kits – the items within each kit is also available to purchase separately

> Inland Ridge Kit - for gable to gable roofs with no hips: 1 x 10m Ridge roll, 27 x Ridge tile clips (Terracotta or Slate), 14 x Ridge Tree brackets

> Inland Ridge & Hip Kit – for roofs with hips: 1 x 10m Ridge roll, 27 x Ridge tile clips (Terracotta or Slate), 14 x Ridge Tree brackets, 30 x Crow Clips

> Coastal Ridge Kit – for gable to gable roofs with no hips using the double batten ridge fixing method: 1 x 10m Ridge roll, 27 x Ridge tile clips (Terracotta or Slate)

> Coastal Ridge & Hip Kit – for gable to gable roofs with hips using the double batten ridge fixing method: 1 x 10m Ridge roll, 27 x Ridge tile clips (Terracotta or Slate), 30 x Crow Clips

Recommended temperature of fixing – above 5°C.

Recommended storage – not exceeding 35° C

### > **Dry Ridge Installation Method**

- 1.The surface of the roof tiles must be clean, dry, free of dust and grease.
- 2.Lay the Marley Under tile membrane or Radiant Barrier in the normal manner.
- 3.If ventilation is required set back 5-30mm on both sides from the apex to create air ventilation
- 4.Temporarily install top battens on either side of rafters/trusses apex to first and second rafter/truss 50mm from the apex.
- 5.Install three roof tiles to both top battens. Place the ridge tile on top of the roof tiles to gauge required height of ridge batten and ridge batten tree from top of apex. Temporarily hold the ridge batten tree 38mm from the underside of the ridge tile. Allow gap of 38mm for 38mm x 38mm ridge batten installation. Measure the distance between the apex and the underside of the ridge batten tree bracket. Generally, the gap between the rafter apex and bottom of the galvanised ridge tree is +/- 60mm, subject to different tile profiles
- 6.Remove the top battens and install the first ridge batten tree by bending its legs to match the pitch of rafters/trusses. Secure with galvanised nails or screws through provided holes in ridge tree legs.
- 7.Repeat this process on the other gable end. Secure a taut gut line between both ridge batten trees to achieve correct height of intermediate ridge trees. Install all intermediate ridge batten trees to rafters/trusses apex with galvanised nails. Permanently replace the top battens to all rafters/trusses
- 8.Install the ridge batten into ridge batten trees with 30mm galvanised nails or screws into holes provided
- 9.Install all roof tiles or slates in accordance to Marley fixing specifications
- 10.Roll out ridge roll and centre up with ridge batten. Secure with small galvanised or stainless-steel nails/staples to ridge batten at 1-meter intervals
- 11.Peel off the protective tape from the butyl adhesive and press down to top side of roof tiles on both sides of the ridge. Carefully adjust the corrugated edges into the valley/water channels of the tiles/slates profile
- 12.Overlap ridge rolls by 50mm to prevent water ingress

13. Place the first ridge tile (the first tapered ridge tile requires a 20mm spacer under the trailing edge to compensate for lack of previous tile overlapping. This ensures a straight ridge line of ridge tiles. The same rule applies to Hip starters.

14. Secure each ridge tile with a ridge tile clip. Secure ridge tile clips in place with galvanised or stainless-steel screws to a depth of 25mm into the ridge batten. Secure every 4th ridge tile with a galvanised or stainless-steel appropriate length screw to a depth of 25mm into the ridge batten.

**Dry Ridge for hips** – temporarily fix the ridge-tree brackets in spaces between battens onto the hip rafter. As per above method (points 5 and 6) - gauge the height of the ridge tree. Once height has been established, bend and secure permanently with nails. As per above (point 8), install the ridge batten into the Ridge Tree. Using the kro clip, press cut hip tiles into the crow clip clamp and tap with a hammer to grip and secure the clamp into the cut tile. The secured kro clip is then attached to the hip batten by wrapping the attached wire around a secured nail that has been nailed to the hip batten. Continue with instructions (9 to 14) to finish dry ridge hip installation.

**Dry Ridge Double Batten System for Coastal Hip and Coastal Ridge Kits** – Secure a 38mm x 38mm batten directly onto each rafter/truss/hip rafter by nailing two 75mm wire nails – one from the top left and the other from the top right - diagonally across the top of the batten into each of the rafters/trusses. Place another 38mm x 38mm batten on top of the secured 38mm x 38mm ridge batten. As per above method, fix the upper top batten to the bottom ridge batten by nailing two 75mm wire nails diagonally across from the top of the batten into the bottom ridge batten. Continue with points 9 to 14 to complete dry ridge installation.

### **CRITICAL FACTORS:**

To ensure the satisfactory performance of a roof in a given locality it is imperative to use the correct fixing specification, using the Marley Fixing tables on the following pages. There are six critical factors which must be considered for each concrete tile roof installation:

1. The building type
2. The roof pitch
3. The terrain category
4. The regional basic design wind speed
5. The height of the roof from ground to ridge
6. The length of the roof slope (rafter length)

Factors 1, 2, 3, 4 and 5 shown in the Fixing tables must be compounded to read off correctly your minimum specification.

### **Exceptional rafter lengths:**

Where exceptionally long rafter lengths are encountered, the fixing specification must be carefully assessed according to the roof pitch.

On very long rafter lengths the tile headlap must be increased as required, especially at the lower part of the slope where the roof sheds a large volume of rain water.

This also applies to the lower area of the roof on split roof slopes and pagoda (Balinese) roofs.

### **Additional fixing:**

In extremely severe or adverse situations more stringent or special fixing specifications are required. These situations are for instance:

- > Complex roof designs in semi-exposed or exposed areas.
- > Steep pitches, vertical tiling and monopitch roofs in areas with heavy traffic (shopping malls, schools etc).

### **Special fixing specifications (all areas) may include:**

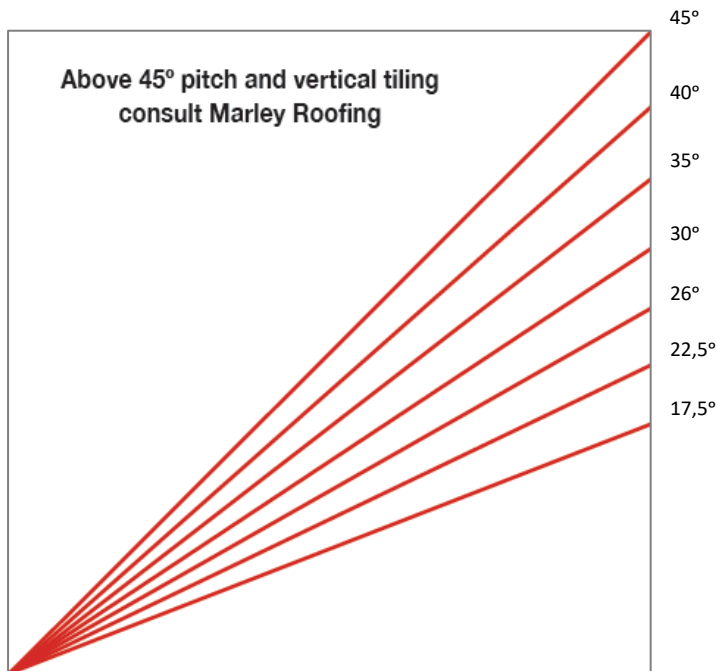
- > Using serrated nails or screws instead of normal fixing nails.
- > Double fixing in the pan of the tiles in addition to normal fixing.
- > Additional fixing holes in the tiles and fittings to be drilled on site as required.

**Western Cape coastal region: Use only serrated tile nails in all cases for fixing.**



## **CRITICAL FACTOR - THE ROOF PITCH**

The bold red lines show the roof pitch angles used in the Marley Fixing Tables



**Marley contoured profiles: Minimum roof pitch with 100 mm tile headlap 17,5° with 75 mm tile headlap 26°**

**Marley Modern slate tile: Minimum roof pitch with 100 mm tile headlap 26°**

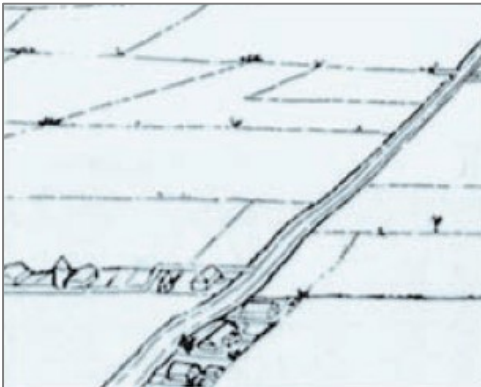
The minimum roof pitch and minimum tile headlap have been determined arbitrarily to ensure optimum performance of the roof and must be strictly adhered to. The minimum tile headlap must not be reduced under any circumstance. It is always better to raise the safety factor of the roof by adding one course of tiles and increasing the tile headlap.

In very exposed areas the tile headlap may also be increased. However, increased headlap is not as effective as a steeper pitch.

## CRITICAL FACTOR - TERRAIN CATEGORIES

As defined in SANS 10160-1989

Category 1



Exposed open terrain with few or no obstructions and in which the average of any object surrounding the structure is less than 1,5 m. This category includes open sea coasts and flat, treeless plains with little vegetation other than grass.

Category 2



Open terrain with well scattered obstructions having heights generally between 1,5 m and 10 m. This category includes most parklands and under developed sparsely built-up outskirts of towns and suburbs. The regional wind speed shown on the following page is based on this category 2.

Category 3



Terrain with numerous closely spaced obstructions having the size of domestic houses. This category includes well-wooded areas and suburb, town and industrial areas, fully or partially developed.

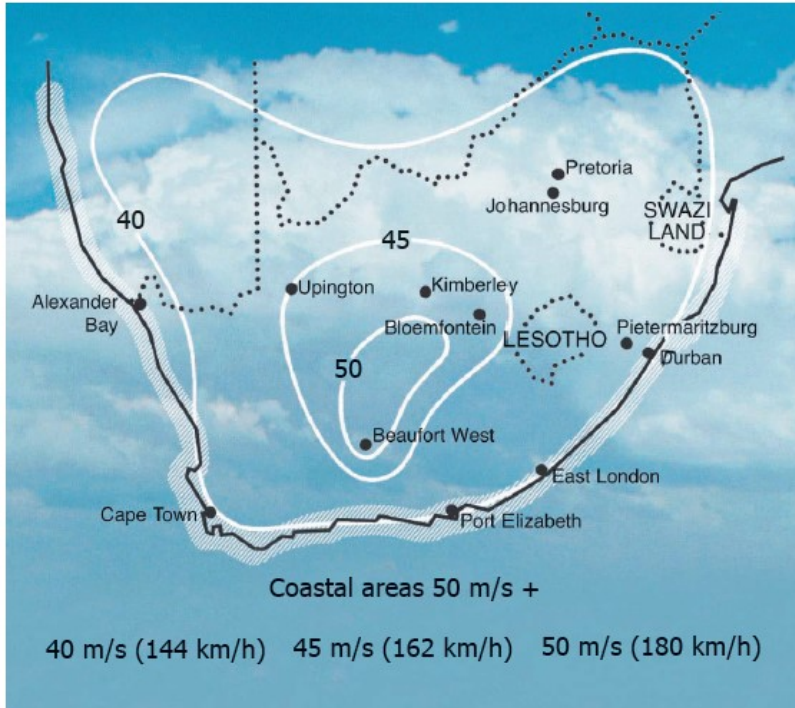
Category 4



Terrain with numerous large, high, closely spaced obstructions. This category includes large city centres.

## CRITICAL FACTOR – REGIONAL BASIC DESIGN WIND SPEED

As defined in SANS 10160-1989



The values given here are based on a statistical analysis of data gathered by the Weather Bureau of the Department of Transport over many years at a number of stations throughout the Republic.

To obtain wind speeds for intermediate locations, either use linear interpolation or use the higher value isopleth.

**Please note!** Where local wind speed records of sufficient duration and reliability are available to the designer in a given locality, these may be used to determine the local wind speed instead of the value derived from this map, provided that lower wind speeds are not adopted without approval of the local authority.

In local areas where there is knowledge of the occurrence of high wind gusts and severe lifting forces (i.e. certain coastal areas, highveld storm areas, wind funnelling or other adverse effects) interpolation must be done to the highest value.

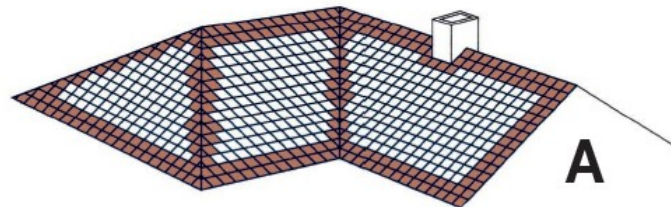
## MINIMUM FIXING SPECIFICATIONS

Refer to each individual tile specification for minimum roof pitch and minimum headlap.

### A

#### Unexposed roof situations Perimeters only

Mechanically fix two courses of tiles at eaves and verges (or the full overhang whichever is greater) and at ridges, and one adjacent full tile at valleys, hips and abutments. Cut tiles at valleys, hips and abutments to be secured by nailing or wiring as required.

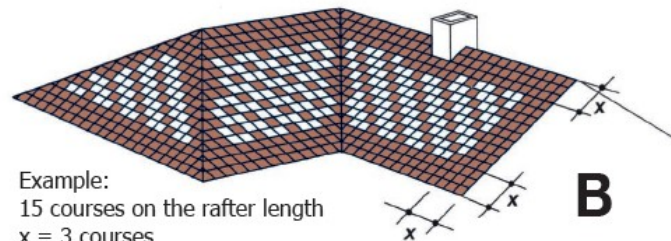


<b>17,5° to &lt; 26°</b>	Undertile membrane mandatory
<b>26° to &lt; 45°</b>	Undertile membrane recommended
<b>45° to &lt; 55°</b>	Undertile membrane recommended Each tile to be nailed
<b>Above 55°</b>	Undertile membrane mandatory Each tile to be nailed and clipped

### B

#### Semi-exposed roof situations Perimeters and local areas

Mechanically fix a band of tiles (x) to a fifth of the number of courses on the rafter length at eaves and verges (or the full overhang whichever is greater), and at ridges and abutments, and one adjacent full tile at hips and valleys, and every third tile diagonally on the rest of the roof. Cut tiles at hips, valleys and abutments to be secured by nailing or wiring as required.



Example:  
15 courses on the rafter length  
x = 3 courses

<b>17,5° to &lt; 26°</b>	Undertile membrane mandatory
<b>26° to &lt; 45°</b>	Undertile membrane recommended
<b>Above 45°</b>	Undertile membrane mandatory Each tile to be nailed and clipped

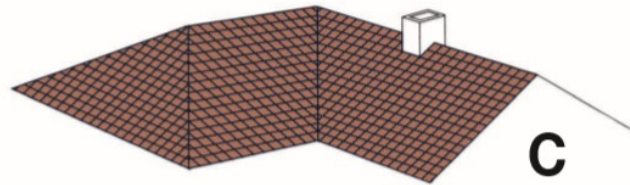
Soffits should be closed at eaves and verge overhangs.

# C

## Exposed roof situations and coastal areas

Soffits should be closed at eaves and verge overhangs.

Generally, they are within 5km from the coast line, unless otherwise defined locally.



- 17,5° to < 26°** Each tile to be clipped  
Undertile membrane mandatory
- 26° to < 45°** Each tile to be nailed or clipped  
Undertile membrane mandatory
- Above 45°** Each tile to be nailed and clipped  
Undertile membrane mandatory

## MINIMUM FIXING SPECIFICATION – SINGLE STOREY DOUBLE PITCH

### Minimum fixing specification

- A: Perimeters only
  - B: Perimeters and local areas
  - C: Each tile fixed
- Fixing specs page 5 of 9*



#### 17,5° to < 22,5°

Terrain category	h	Basic wind speed on terrain m/s									
		38	40	42	44	46	48	50	52	54	56
1	3m	B	B	B	B	C	C	C	C	C	C
	5m	B	B	B	C	C	C	C	C	C	C
	10m	B	C	C	C	C	C	C	C	C	C
2	3m	A	A	A	A	B	B	B	C	C	C
	5m	A	A	B	B	B	C	C	C	C	C
	10m	B	C	C	C	C	C	C	C	C	C
3	3m	A	A	A	A	A	A	B	B	B	B
	5m	A	A	A	A	B	B	B	C	C	C
	10m	A	B	B	B	B	C	C	C	C	C
4	3m	A	A	A	A	A	A	A	A	A	B
	5m	A	A	A	A	A	A	A	B	B	B
	10m	A	A	A	A	A	B	B	B	B	C

#### 22,5° to < 26°

Terrain category	h	Basic wind speed on terrain m/s									
		38	40	42	44	46	48	50	52	54	56
1	3m	B	B	B	B	B	C	C	C	C	C
	5m	B	B	B	B	C	C	C	C	C	C
	10m	B	B	C	C	C	C	C	C	C	C
2	3m	A	A	A	A	B	B	B	B	C	C
	5m	A	A	B	B	B	B	C	C	C	C
	10m	B	B	C	C	C	C	C	C	C	C
3	3m	A	A	A	A	A	B	B	B	B	B
	5m	A	A	A	B	B	B	B	B	B	C
	10m	A	B	B	B	B	B	C	C	C	C
4	3m	A	A	A	A	A	A	A	A	A	B
	5m	A	A	A	A	A	A	A	A	B	B
	10m	A	A	A	A	B	B	B	B	B	B

**26° to < 30°**

		Basic wind speed on terrain m/s										
		h	38	40	42	44	46	48	50	52	54	56
Terrain category	3m	B	B	B	B	B	C	C	C	C	C	C
	5m	B	B	B	C	C	C	C	C	C	C	C
10m	B	C	C	C	C	C	C	C	C	C	C	C
1	3m	A	A	A	A	B	B	B	B	C	C	C
	5m	A	A	B	B	B	B	C	C	C	C	C
	10m	B	B	C	C	C	C	C	C	C	C	C
2	3m	A	A	A	A	A	B	B	B	B	B	B
	5m	A	A	A	B	B	B	B	B	B	C	C
	10m	A	B	B	B	B	B	C	C	C	C	C
3	3m	A	A	A	A	A	A	A	A	A	A	B
	5m	A	A	A	A	A	A	A	A	B	B	B
	10m	A	A	A	A	B	B	B	B	B	C	C
4	3m	A	A	A	A	A	A	A	A	A	A	B
	5m	A	A	A	A	A	A	A	A	B	B	B
	10m	A	A	A	A	B	B	B	B	B	B	B

**30° to < 35°**

		Basic wind speed on terrain m/s										
		h	38	40	42	44	46	48	50	52	54	56
Terrain category	3m	B	B	B	B	C	C	C	C	C	C	C
	5m	B	B	B	B	C	C	C	C	C	C	C
10m	C	C	C	C	C	C	C	C	C	C	C	C
1	3m	A	A	B	B	B	B	B	B	B	C	C
	5m	B	B	B	B	B	C	C	C	C	C	C
	10m	B	B	C	C	C	C	C	C	C	C	C
2	3m	A	A	A	A	A	A	B	B	B	B	B
	5m	A	A	A	B	B	B	B	B	C	C	C
	10m	A	B	B	B	B	B	C	C	C	C	C
3	3m	A	A	A	A	A	A	A	A	A	B	B
	5m	A	A	A	B	B	B	B	B	B	C	C
	10m	A	B	B	B	B	B	C	C	C	C	C
4	3m	A	A	A	A	A	A	A	A	A	B	B
	5m	A	A	A	A	A	A	A	B	B	B	B
	10m	A	A	A	A	B	B	B	B	B	B	B

**35° to < 40°**

		Basic wind speed on terrain m/s										
		h	38	40	42	44	46	48	50	52	54	56
Terrain category	3m	B	B	B	B	C	C	C	C	C	C	C
	5m	B	B	C	C	C	C	C	C	C	C	C
10m	C	C	C	C	C	C	C	C	C	C	C	C
1	3m	A	A	B	B	B	B	B	C	C	C	C
	5m	B	B	B	B	B	C	C	C	C	C	C
	10m	B	C	C	C	C	C	C	C	C	C	C
2	3m	A	A	A	A	B	B	B	B	B	C	C
	5m	A	A	B	B	B	B	B	B	C	C	C
	10m	B	B	B	B	B	C	C	C	C	C	C
3	3m	A	A	A	A	A	A	A	A	A	B	B
	5m	A	A	A	A	A	A	A	B	B	B	B
	10m	A	A	A	B	B	B	B	B	B	C	C
4	3m	A	A	A	A	A	A	A	A	A	B	B
	5m	A	A	A	A	A	A	B	B	B	B	B
	10m	A	A	A	B	B	B	B	B	B	C	C

**40° to < 45°**

		Basic wind speed on terrain m/s										
		h	38	40	42	44	46	48	50	52	54	56
Terrain category	3m	B	B	C	C	C	C	C	C	C	C	C
	5m	B	C	C	C	C	C	C	C	C	C	C
10m	C	C	C	C	C	C	C	C	C	C	C	C
1	3m	A	B	B	B	B	C	C	C	C	C	C
	5m	B	B	B	C	C	C	C	C	C	C	C
	10m	C	C	C	C	C	C	C	C	C	C	C
2	3m	A	A	A	A	B	B	B	B	C	C	C
	5m	A	A	B	B	B	B	C	C	C	C	C
	10m	B	B	B	B	C	C	C	C	C	C	C
3	3m	A	A	A	A	A	A	A	A	A	B	B
	5m	A	A	A	A	A	A	B	B	B	B	B
	10m	A	A	A	B	B	B	B	B	C	C	C
4	3m	A	A	A	A	A	A	A	A	A	B	B
	5m	A	A	A	A	A	B	B	B	B	B	B
	10m	A	A	A	B	B	B	B	B	C	C	C

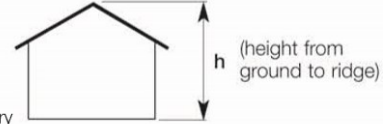
## MINIMUM FIXING SPECIFICATION – DOUBLE STOREY DOUBLE PITCH

### Minimum fixing specification

A: Perimeters only  
 B: Perimeters and local areas  
 C: Each tile fixed

*Fixing specs  
 page 6 of 9*

### Double storey Double pitch



Tinted areas:  
 Undertile membrane mandatory

#### 17,5° to < 22,5°

		h	Basic wind speed on terrain m/s									
		▽	38	40	42	44	46	48	50	52	54	56
Terrain category <b>1</b>	5m		B	C	C	C	C	C	C	C	C	C
	10m		C	C	C	C	C	C	C	C	C	C
	15m		C	C	C	C	C	C	C	C	C	C
Terrain category <b>2</b>	5m		B	B	B	C	C	C	C	C	C	C
	10m		C	C	C	C	C	C	C	C	C	C
	15m		C	C	C	C	C	C	C	C	C	C
Terrain category <b>3</b>	5m		A	A	B	B	B	B	B	C	C	C
	10m		B	B	B	C	C	C	C	C	C	C
	15m		B	C	C	C	C	C	C	C	C	C
Terrain category <b>4</b>	5m		A	A	A	A	A	B	B	B	B	B
	10m		A	A	B	B	B	B	B	C	C	C
	15m		B	B	B	B	B	C	C	C	C	C

#### 22,5° to < 26°

		h	Basic wind speed on terrain m/s									
		▽	38	40	42	44	46	48	50	52	54	56
Terrain category <b>1</b>	5m		B	B	C	C	C	C	C	C	C	C
	10m		C	C	C	C	C	C	C	C	C	C
	15m		C	C	C	C	C	C	C	C	C	C
Terrain category <b>2</b>	5m		B	B	B	B	C	C	C	C	C	C
	10m		B	C	C	C	C	C	C	C	C	C
	15m		C	C	C	C	C	C	C	C	C	C
Terrain category <b>3</b>	5m		A	A	B	B	B	B	B	C	C	C
	10m		B	B	B	B	B	C	C	C	C	C
	15m		B	B	C	C	C	C	C	C	C	C
Terrain category <b>4</b>	5m		A	A	A	A	A	A	B	B	B	B
	10m		A	A	A	B	B	B	B	B	C	C
	15m		A	B	B	B	B	B	C	C	C	C

#### 26° to < 30°

		h	Basic wind speed on terrain m/s									
		▽	38	40	42	44	46	48	50	52	54	56
Terrain category <b>1</b>	5m		B	B	C	C	C	C	C	C	C	C
	10m		C	C	C	C	C	C	C	C	C	C
	15m		C	C	C	C	C	C	C	C	C	C
Terrain category <b>2</b>	5m		B	B	B	B	B	C	C	C	C	C
	10m		B	C	C	C	C	C	C	C	C	C
	15m		C	C	C	C	C	C	C	C	C	C
Terrain category <b>3</b>	5m		A	A	A	B	B	B	B	C	C	C
	10m		A	B	B	B	B	C	C	C	C	C
	15m		B	B	C	C	C	C	C	C	C	C
Terrain category <b>4</b>	5m		A	A	A	A	A	A	B	B	B	B
	10m		A	A	A	A	B	B	B	B	C	C
	15m		A	A	B	B	B	B	C	C	C	C

#### 30° to < 35°

		h	Basic wind speed on terrain m/s									
		▽	38	40	42	44	46	48	50	52	54	56
Terrain category <b>1</b>	5m		B	B	C	C	C	C	C	C	C	C
	10m		C	C	C	C	C	C	C	C	C	C
	15m		C	C	C	C	C	C	C	C	C	C
Terrain category <b>2</b>	5m		B	B	B	B	C	C	C	C	C	C
	10m		B	C	C	C	C	C	C	C	C	C
	15m		C	C	C	C	C	C	C	C	C	C
Terrain category <b>3</b>	5m		A	A	A	B	B	B	B	C	C	C
	10m		A	B	B	B	B	C	C	C	C	C
	15m		B	B	C	C	C	C	C	C	C	C
Terrain category <b>4</b>	5m		A	A	A	A	A	A	B	B	B	B
	10m		A	A	A	A	B	B	B	B	C	C
	15m		A	A	B	B	B	B	C	C	C	C

**35° to < 40°**

		Basic wind speed on terrain m/s										
		h	38	40	42	44	46	48	50	52	54	56
<b>1</b>	Terrain category 5m	B	B	C	C	C	C	C	C	C	C	C
	10m	C	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C	C
<b>2</b>	Terrain category 5m	B	B	B	B	C	C	C	C	C	C	C
	10m	B	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C	C
<b>3</b>	Terrain category 5m	A	A	B	B	B	B	B	C	C	C	C
	10m	B	B	B	B	C	C	C	C	C	C	C
	15m	B	B	C	C	C	C	C	C	C	C	C
<b>4</b>	Terrain category 5m	A	A	A	A	A	A	B	B	B	B	B
	10m	A	A	A	B	B	B	B	C	C	C	C
	15m	A	B	B	B	B	C	C	C	C	C	C

**40° to < 45°**

		Basic wind speed on terrain m/s										
		h	38	40	42	44	46	48	50	52	54	56
<b>1</b>	Terrain category 5m	B	C	C	C	C	C	C	C	C	C	C
	10m	C	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C	C
<b>2</b>	Terrain category 5m	B	B	B	C	C	C	C	C	C	C	C
	10m	C	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C	C
<b>3</b>	Terrain category 5m	A	A	B	B	B	B	C	C	C	C	C
	10m	B	B	B	B	C	C	C	C	C	C	C
	15m	B	C	C	C	C	C	C	C	C	C	C
<b>4</b>	Terrain category 5m	A	A	A	A	A	B	B	B	B	B	B
	10m	A	A	A	B	B	B	B	C	C	C	C
	15m	A	B	B	B	B	C	C	C	C	C	C



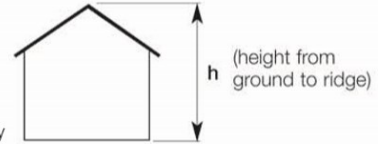
## MINIMUM FIXING SPECIFICATION – THREE STOREYS DOUBLE PITCH

### Minimum fixing specification

- A:** Perimeters only  
**B:** Perimeters and local areas  
**C:** Each tile fixed
- Fixing specs  
page 7 of 9*

### Three storeys Double pitch

Tinted areas:  
 Undertile membrane mandatory



#### 17,5° to < 22,5°

Terrain category	h	Basic wind speed on terrain m/s									
		38	40	42	44	46	48	50	52	54	56
<b>1</b>	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>2</b>	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>3</b>	10m	B	B	B	B	C	C	C	C	C	C
	15m	B	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>4</b>	10m	A	A	B	B	B	B	C	C	C	C
	15m	B	B	B	B	B	C	C	C	C	C
	20m	B	B	B	C	C	C	C	C	C	C

#### 22,5° to < 26°

Terrain category	h	Basic wind speed on terrain m/s									
		38	40	42	44	46	48	50	52	54	56
<b>1</b>	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>2</b>	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>3</b>	10m	B	B	B	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>4</b>	10m	A	A	A	B	B	B	C	C	C	C
	15m	A	B	B	B	C	C	C	C	C	C
	20m	B	B	C	C	C	C	C	C	C	C

#### 26° to < 30°

Terrain category	h	Basic wind speed on terrain m/s									
		38	40	42	44	46	48	50	52	54	56
<b>1</b>	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>2</b>	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>3</b>	10m	B	B	B	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>4</b>	10m	A	A	A	B	B	B	C	C	C	C
	15m	A	B	B	B	C	C	C	C	C	C
	20m	B	B	C	C	C	C	C	C	C	C

#### 30° to < 35°

Terrain category	h	Basic wind speed on terrain m/s									
		38	40	42	44	46	48	50	52	54	56
<b>1</b>	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>2</b>	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>3</b>	10m	B	B	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>4</b>	10m	A	A	B	B	B	C	C	C	C	C
	15m	B	B	B	C	C	C	C	C	C	C
	20m	B	C	C	C	C	C	C	C	C	C

**35° to < 40°**

h		Basic wind speed on terrain m/s									
		38	40	42	44	46	48	50	52	54	56
<b>1</b>	Terrain category 10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>2</b>	Terrain category 10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>3</b>	Terrain category 10m	B	B	B	B	C	C	C	C	C	C
	15m	B	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>4</b>	Terrain category 10m	A	A	A	B	B	B	B	C	C	C
	15m	A	B	B	B	B	B	C	C	C	C
	20m	B	B	B	C	C	C	C	C	C	C

**40° to < 45°**


h		Basic wind speed on terrain m/s									
		38	40	42	44	46	48	50	52	54	56
<b>1</b>	Terrain category 10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>2</b>	Terrain category 10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>3</b>	Terrain category 10m	B	B	B	B	C	C	C	C	C	C
	15m	B	C	C	C	C	C	C	C	C	C
	20m	C	C	C	C	C	C	C	C	C	C
<b>4</b>	Terrain category 10m	A	A	A	B	B	B	B	C	C	C
	15m	A	B	B	B	B	C	C	C	C	C
	20m	B	B	B	C	C	C	C	C	C	C

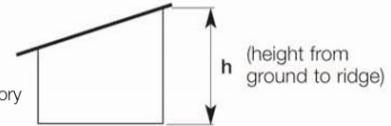
## MINIMUM FIXING SPECIFICATION – MONOPITCH

### Minimum fixing specification

- A: Perimeters only  
 B: Perimeters and local areas  
 C: Each tile fixed
- Fixing specs page 8 of 9*

### Monopitch

 Tinted areas:  
Undertile membrane mandatory



#### 17,5° to < 22,5°

Terrain category	h ▽	Basic wind speed on terrain m/s									
		38	40	42	44	46	48	50	52	54	56
1	5m	C	C	C	C	C	C	C	C	C	C
	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
2	5m	B	B	C	C	C	C	C	C	C	C
	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
3	5m	B	B	B	B	B	C	C	C	C	C
	10m	B	B	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
4	5m	A	A	A	A	B	B	B	B	B	C
	10m	A	B	B	B	B	B	C	C	C	C
	15m	B	B	B	C	C	C	C	C	C	C

#### 22,5° to < 26°

Terrain category	h ▽	Basic wind speed on terrain m/s									
		38	40	42	44	46	48	50	52	54	56
1	5m	C	C	C	C	C	C	C	C	C	C
	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
2	5m	B	B	C	C	C	C	C	C	C	C
	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
3	5m	B	B	B	B	C	C	C	C	C	C
	10m	B	B	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
4	5m	A	A	A	B	B	B	B	B	C	C
	10m	A	B	B	B	B	B	C	C	C	C
	15m	B	B	B	C	C	C	C	C	C	C

#### 26° to < 30°

Terrain category	h ▽	Basic wind speed on terrain m/s									
		38	40	42	44	46	48	50	52	54	56
1	5m	C	C	C	C	C	C	C	C	C	C
	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
2	5m	B	B	C	C	C	C	C	C	C	C
	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
3	5m	B	B	B	B	C	C	C	C	C	C
	10m	B	B	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
4	5m	A	A	A	B	B	B	B	B	C	C
	10m	A	B	B	B	B	C	C	C	C	C
	15m	B	B	B	C	C	C	C	C	C	C

#### 30° to < 35°

Terrain category	h ▽	Basic wind speed on terrain m/s									
		38	40	42	44	46	48	50	52	54	56
1	5m	C	C	C	C	C	C	C	C	C	C
	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
2	5m	B	C	C	C	C	C	C	C	C	C
	10m	C	C	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
3	5m	B	B	B	B	C	C	C	C	C	C
	10m	B	B	C	C	C	C	C	C	C	C
	15m	C	C	C	C	C	C	C	C	C	C
4	5m	A	A	A	B	B	B	B	B	C	C
	10m	A	B	B	B	B	C	C	C	C	C
	15m	B	B	B	C	C	C	C	C	C	C

Monopitch > 35° : Use 3-Storey chart on previous page.

These Marley Fixing Specifications have been established in accordance with SANS 10062 - 2003 (Code of Practice for the Fixing of Concrete Roof Tiles), SANS 10160 - 1989 (Code of Practice for the General Procedures and Loadings to be adopted for the Design of Buildings) and Marley's worldwide recommendations.

If local knowledge and experience of adverse climatic conditions and/or topographical features indicate a more stringent fixing specification it should override the general requirements given here.

*The manufacturer reserves the right to change or discontinue any of the specifications or products without notification. All goods are subject to availability and the company's conditions of sale which are available on request.*

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