MarleyRoofing

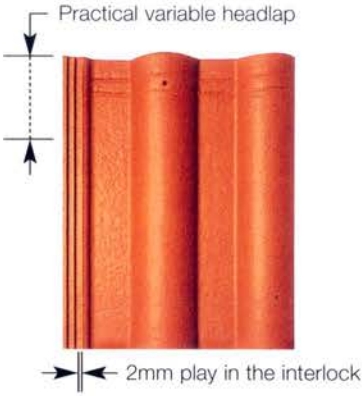
Roof planning and tile estimating guide for Marley concrete roof tiles in Southern Africa

Introduction

This guide has been compiled to enable the specifier of Marley concrete roof tiles to optimise roof planning. It is a practical working tool for calculating all roof dimensions and for the correct estimating of roof tile quantities. It must always be used in conjunction with **Marley's Minimum Fixing Specifications for Concrete Roof Tiles** and **Marley's Good Roof Tiling Practice in Southern Africa**.

In order to achieve the above objectives, it is necessary for the user of this guide to become acquainted with a number of facts, definitions and methods related to the concrete roof tile industry in general and to Marley roof tiles in particular. These items are dealt with in detail in the following pages.

Marley concrete roof tiles



Marley **Monarch, Modern, Double Roman, Mendip, Ludlow, Homestead and Double Roman "Plus"** are state-of-the-art, high-quality concrete roof tiles of standardised size, designed for a variable headlap and incorporating the most advanced technical features to ensure maximum performance on the roof.

These Marley tiles perform efficiently on pitched roofs from **17,5º** to **25º** at a minimum headlap of **100 mm** and on pitches of **26º** upward at a minimum headlap of **75 mm.**

The **Modern** slate tile performs efficiently at a minimum headlap of **100 mm** on pitched roofs from **26° upward**. The Modern slate tile is not designed for low pitch roofs.

The tile headlap must under no circumstance be reduced below the minimum recommended, but can always be increased to suit the rafter length in order to cover the roof with full courses.

Estimating roof tile quantities

Basic estimating tables are supplied on pages 10 – 12. These tables are used for general estimating at nominal tile coverage.

The **Eaves tables (Tables 2, 3, 4, 5)** indicate the average linear coverage of the tiles and the number of tiles along the eaves length. Calculations are given at lock mid-shuffle position, subject to standard manufacturing tolerances.

A practical 2 mm side play is provided in the side interlock (1 mm either way of the nominal linear cover) which gives flexibility when setting out the roof and helps to achieve the correct perpendicular alignment of the courses.

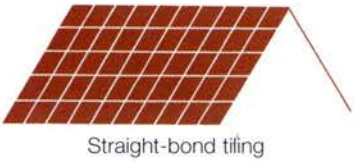
Note: Eaves tables vary between profiles. It is essential to use the correct one.

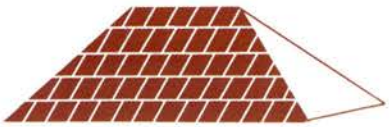
The **Rafter tables (Table 6 and 7)** on page 12 indicate the number of tiles to be used on the rafter length to ensure that the minimum tile headlap of **100 mm or 75 mm is obtained**, taking into account a 60 mm overhang of the tile into the gutter.

When the rafter length is not an exact multiple of the batten centres as shown in the tables, the full course of tiles indicated must be used and the tile headlap must be increased evenly on the rafter length in order to complete the roof with full courses (see pages 12, 22, 23 and 24).

Fittings and Roof Details (see page 13).

Tiling


Straight-bond tiling

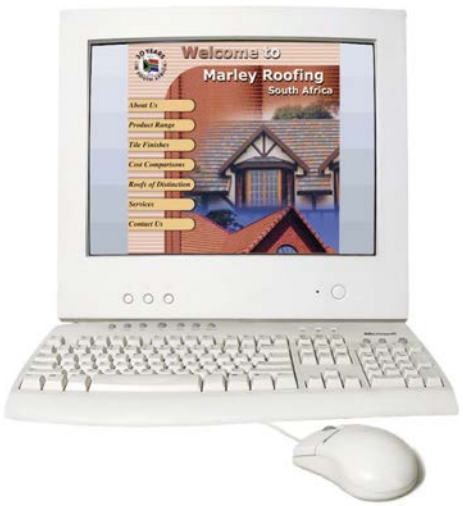

Broken-bond tiling

Marley **Monarch, Double Roman, Mendip, Ludlow, Homestead** and **Double Roman "Plus"** tiles can be laid either straight-bond or broken-bond. Tile quanties are indentical for both practices.
Straight-bond tiling is the recommended practice for gable roofs, eliminating the need to cut half-tiles at gable ends. Half-tiles are not manufactured.

Marley **Modern** slate tiles should always be laid broken-bond.
(Refer to Modern brochure)

Contents

Estimating tables



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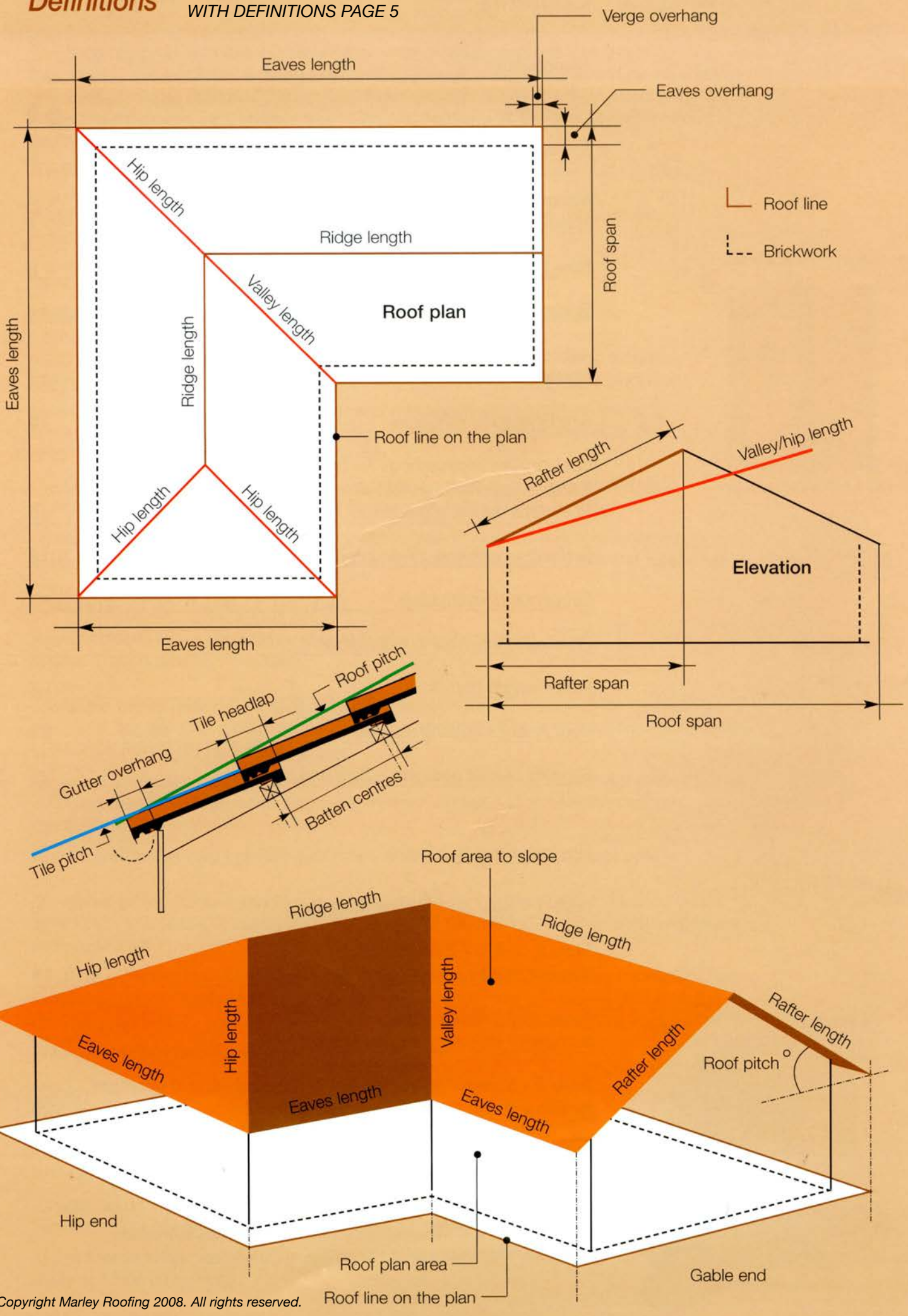
Definitions

TO BE READ IN CONJUNCTION WITH DEFINITIONS PAGE 5



Definitions

Eaves length:
The total length of the roof at eaves, including verge overhangs.

Roof span:
The projected span of the roof on the plan, including eaves overhangs and the gutter overhang.

Rafter span:
The projected span of a rafter length, equal to half the roof span for a symmetrical double pitched roof.

Rafter length:
The distance measured on top of the rafter, between the rafter apex and the edge of the rafter at eaves, or the outside edge of the fascia board.

Roof line on the plan:
The projected line of the roof perimeter on the plan, including verge and eaves overhangs, and the gutter overhang.

Gutter overhang:
The distance by which the tiles overhang the fascia board over the gutter. For estimating purposes, with a standard 100 mm gutter this distance is assumed at: 50 mm on the plan, 60 mm on the slope. This can vary with the size of the gutter.

Roof plan area:
The flat surface area on the plan calculated from the roof line.

Roof area to slope:
The actual area to be tiled.

Roof pitch: — Green line on diagram page 4
The angle between the rafter and the horizontal.

Rafter pitch = Roof pitch.

Minimum roof pitch – Minimum tile headlap:
See page 7.

Roof constant multiplicators:
Constant factors used in roof calculations (Table 1, page 8).

Tile headlap:
The distance by which the tiles overlap one another.

Tile pitch: — Blue line on diagram page 4
The angle between the tile when laid on the roof and the horizontal. The tile pitch on the roof is always lower than the roof pitch (± 5°).

Batten centres:
The distance by which the battens are spaced, measured from top of batten to top of batten or from centre to centre.

Ridge length:
The horizontal length of the roof apex.

Hip and valley length: — Red line on diagram page 4
The length of a hip or valley measured from eaves to apex. Note: The length of the hip or valley cannot be measured off the plan and must always be calculated (see page 9).

Estimating quantities:
The purpose of estimating is to find out the actual quantity of tiles which will be used in practice to complete the roof. Irrespective of the estimating method used, estimating must always be done with full tiles on both the eaves and the rafter lengths (see estimating methods pages 15 and 23).

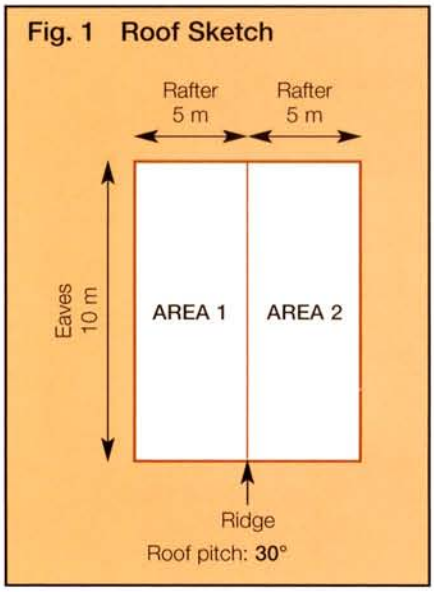
If tiles are to be cut at a roof end to accommodate a fixed eaves length (between parapet walls or at split gables), the perpendicular row of tiles to be cut must be estimated as full tiles.

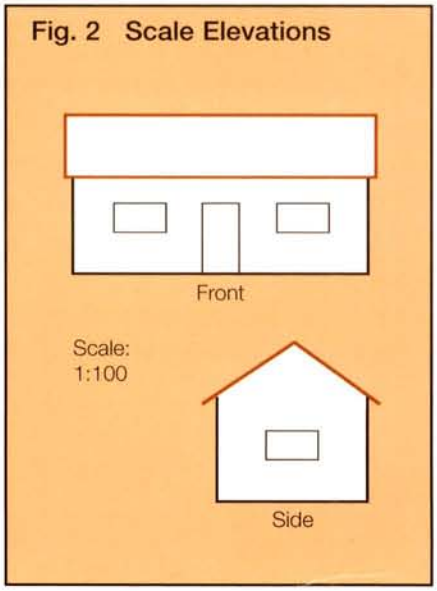
For estimating purposes, a tile to be cut must be counted as a full tile; the portion that is cut away becomes waste.

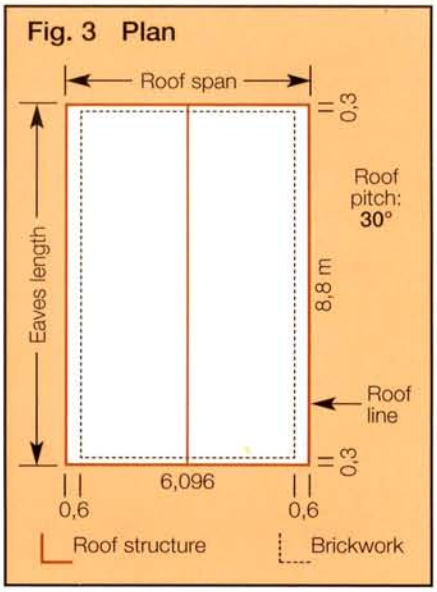
Before calculating quantities, ascertain that all areas to be tiled, including overhangs and possible overlaps of roof areas, are clearly identified.

Information required for estimating

What information has the customer provided?







1. **A sketch drawing of the roof showing accurate eaves and rafter lengths and the roof pitch (fig 1).**
Note these dimensions for each roof area and proceed to page 15.

or 2. **Scale drawings showing front and side elevations (fig 2).**

Without dimensions these are not sufficient to arrive at an accurate estimate, and should be referred back to the specifier or client for more information.

Measurements scaled off drawings are likely to be inaccurate and should not be used for estimating.

If sufficient dimensions are included proceed to page 15.

or 3. **Plans showing projected dimensions of the roof or brickwork and the roof pitch (fig 3).**
Read off the given dimensions for the length and width of the roof or brickwork.
Then:

If the plan is of the brickwork – proceed to (i).

If the plan is of the roof structure – proceed to (ii).

(i) Add any distances by which the roof structure overhangs the brickwork. These details must be obtained from the customer and can be relevant at:

(a) The verge, namely the distance between the brickwork and the outside edge of the verge counterbatten.

(b) The eaves, namely the distance between the brickwork and the outside edge of the rafter plus the thickness of the fascia board if any.

Where applicable, these dimensions must be added to all eaves and verge dimensions. Proceed to (ii).

(ii) Add the distance by which the tiling overhangs the roof structure at eaves – i.e. 50 mm for a standard 100 mm gutter – to allow the tiles to overhang into the centre of the gutter. Proceed to (iii).

(iii) Total eaves length and total roof span are now established. In order to calculate the relevant rafter length for each roof area, multiply the rafter span of each roof area by the rafter constant (Table 1, page 8).

If the roof has valleys and hips, calculate their relevant lengths also using Table 1, as shown on page 9.

Proceed to page 15.

The pitch of the roof must always be obtained from the drawing or from the customer.

Minimum roof pitch – Minimum tile headlap

These minimums have been determined arbitrarily to ensure optimum performance of the roof and must be strictly adhered to. Where a particular design dictates in some areas pitches below the minimum recommended special precautions must be taken. See Below Minimum Pitch Specification in File 18 Minimum Fixing Specifications.

The minimum headlap must not be reduced under any circumstances. It is always better to raise the safety factor of the roof by increasing the tile headlap.

Tile profile	Minimum roof pitch		Minimum headlap	
	with underlay	without underlay	17,5° to 25°	26° and above
Monarch *Mendip* *Double Roman* *Double Roman "Plus"* *Ludlow* *Homestead*	17,5°	26°	100 mm	75 mm
Modern slate tile	26°	26°	–	100 mm

Tile headlap:

1. Where exceptionally long rafter lengths are encountered the tile headlap must be increased, 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 roofs.
2. In very exposed areas (Category C) the tile headlap may also be increased. However, greater headlap is not as effective as a steeper pitch.
3. When designing low-pitched roofs one must bear in mind that at 17,5° roof pitch and 100 mm tile headlap the tile itself lies on the roof at only 12,5° pitch.

Measuring up existing roofs

On existing buildings roof measurements must be taken on site as follows:

Eaves length:

on gable roofs: The distance from the left gable overhang to the right gable overhang.

on hip/valley roofs: The distance measured at eaves from hip to hip or from hip to valley, or from valley to valley.

Roof slope:
The distance from the centre of the ridge tile to the end of the first tile overhanging into the gutter.

Rafter length:
The distance measured on top of the rafter, between the rafter apex and the outside edge of the rafter at eaves or the outside edge of the fascia board.

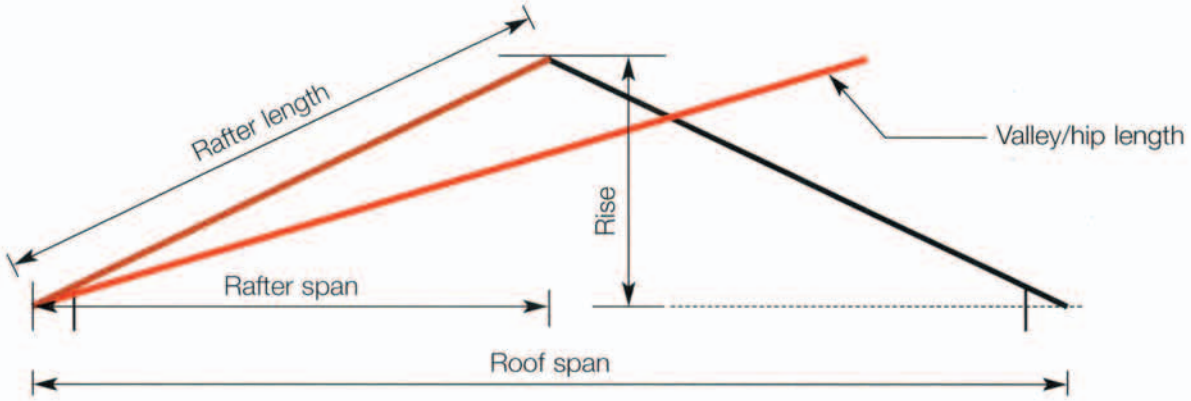
Valley/hip length:
The distance measured on top of the hip or valley rafter, between the rafter apex and the outside edge of the rafter at eaves, or the outside edge of the fascia board if any.

Roof pitch:
Use a roof pitch indicator. Alternatively, divide the rafter length by the rafter span. The result is the rafter constant shown in Table 1, page 8. Read off the corresponding roof pitch in the left hand column.

Table 1 – Roof constant multiplicators

Roof pitch	Rafter	Valley/Hip *For calculations in-between use the preceding higher constant.*			Rise
		90° Standard	120°	150°	
17,5°	**1,049**	**1,450**	**1,197**	**1,082**	**0,315**
18°	1,051	1,451	1,200	1,085	0,325
19°	1,058	1,456	1,205	1,091	0,344
20°	**1,064**	**1,460**	**1,211**	**1,097**	**0,364**
21°	1,071	1,465	1,217	1,104	0,384
22°	1,079	1,471	1,224	1,111	0,404
22,5°	**1,082**	**1,473**	**1,227**	**1,115**	**0,414**
23°	1,086	1,476	1,230	1,118	0,424
24°	1,095	1,482	1,238	1,127	0,445
25°	**1,103**	**1,488**	**1,246**	**1,135**	**0,466**
26°	1,113	1,496	1,254	1,144	0,488
27°	1,122	1,503	1,263	1,154	0,510
27,5°	**1,127**	**1,506**	**1,267**	**1,159**	**0,521**
28°	1,133	1,511	1,272	1,164	0,532
29°	1,143	1,519	1,281	1,174	0,554
30°	**1,155**	**1,528**	**1,291**	**1,185**	**0,577**
31°	1,167	1,537	1,302	1,197	0,601
32°	1,179	1,546	1,313	1,209	0,625
32,5°	**1,186**	**1,551**	**1,319**	**1,215**	**0,637**
33°	1,192	1,556	1,325	1,220	0,649
34°	1,206	1,567	1,338	1,236	0,675
35°	**1,221**	**1,578**	**1,351**	**1,249**	**0,700**
36°	1,236	1,590	1,365	1,265	0.727
37°	1,252	1,602	1,379	1,281	0,754
37,5°	**1,260**	**1,609**	**1,387**	**1,288**	**0,767**
38°	1,269	1,616	1,394	1,297	0,781
39°	1,287	1,630	1,411	1,314	0,810
40°	**1,305**	**1,644**	**1,428**	**1,332**	**0,829**
41°	1,325	1,660	1,445	1,351	0,869
42°	1,346	1,677	1,464	1,372	0,900
42,5°	**1,356**	**1,685**	**1,474**	**1,382**	**0,916**
43°	1,367	1,695	1,484	1,393	0,933
44°	1,390	1,712	1,506	1,416	0,966
45°	**1,414**	**1,732**	**1,528**	**1,439**	**1,000**
46°	1,440	1,753	1,552	1,464	1,036
47°	1,466	1,775	1,576	1,490	1,072
47,5°	**1,480**	**1,786**	**1,589**	**1,504**	**1,091**
48°	1,494	1,798	1,603	1,518	1,111
49°	1,524	1,823	1,630	1,547	1,150
50°	**1,556**	**1,850**	**1,660**	**1,579**	**1,192**
51°	1,589	1,877	1,691	1,611	1,235
52°	1,624	1,907	1,724	1,646	1,280
52,5°	**1,643**	**1,923**	**1,741**	**1,664**	**1,303**
53°	1,662	1,940	1,759	1,683	1,327
54°	1,701	1,973	1,797	1,722	1,376
55°	**1,743**	**2,009**	**1,837**	**1,764**	**1,428**
56°	1,788	2,049	1,880	1,808	1,483
57°	1,836	2,091	1,925	1,855	1,540
57,5°	**1,861**	**2,113**	**1,949**	**1,880**	**1,570**
58°	1,887	2,136	1,973	1,906	1,600
59°	1,942	2,184	2,026	1,960	1,664
60°	**2,000**	**2,236**	**2,082**	**2,018**	**1,732**

Calculating the length of the rafter, valley or hip



1. Rafter length

To calculate the length of the rafter at a given pitch, multiply the rafter span by the appropriate rafter constant (Table 1).

Example: Given a rafter span of **6,00 m**

Roof pitch: **30°**

Multiply: Rafter span x Rafter constant for 30° pitch (1,155)

Thus: **Rafter length = 6,00 m x 1,155 = 6,930 m**

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2. Valley or hip length

The length of a valley or hip cannot be read off a plan and must always be calculated. Multiply the rafter span by the appropriate valley/hip constant (Table 1).

Example: Given a rafter span of **6,00 m**

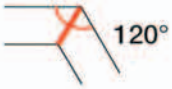
Roof pitch: **30°**

Standard valley or hip: 

(bisecting 90° on the roof plan)

Multiply: Rafter span x 90° Valley/hip constant for 30° pitch (1,528)

Thus: **Valley/hip rafter length = 6,00 m x 1,528 = 9,168 m**

Non-standard valley or hip: 

(Ex: bisecting 120° on the roof plan)

Multiply: Rafter span x 120° Valley/hip constant for 30° pitch (1,291)

Thus: **Valley/hip rafter length = 6,00 m x 1,291 = 7,746 m**

Valley design

Open valleys can be used at all pitches and are particularly useful where a valley forms the junction between two roof slopes of different pitches (bastard valleys).
It is recommended that on pitches below 22,5° only open valleys be used.

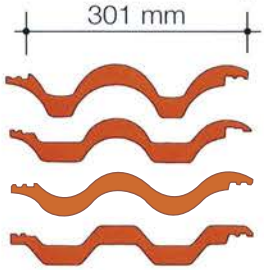
At roof pitches below 25° (low-pitch roofs) the width of the valley liner should not be less than 450 mm. Refer to the Marley Good Roof Tiling Practice brochure.

Eaves tables – Number of tiles on the eaves length

Eaves tables **2**, **3**, **4** and **5** below show the average linear coverage of Marley concrete roof tiles along the eaves length. Calculations are given at lock mid-shuffle position, subject to standard manufacturing tolerances. These tables also help to establish the desired verge overhang.

Table 2

Monarch
Double Roman
Double Roman "Plus"
Homestead



Continued on page 11 ▶

Linear coverage at lock mid-shuffle position:

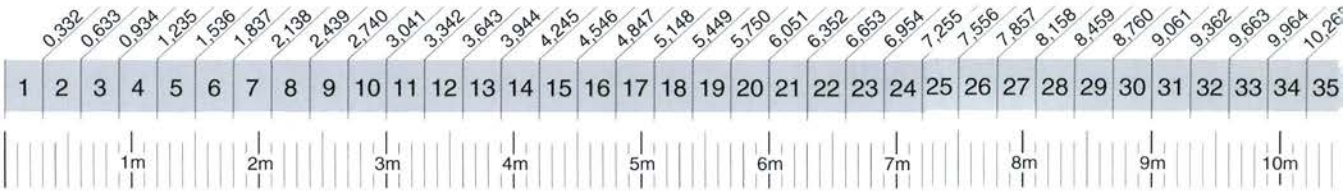


Table 3

Modern

Linear coverage at lock mid-shuffle position:

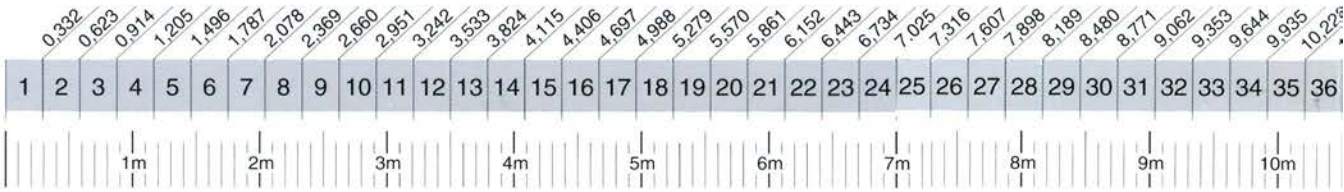
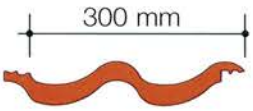


Table 4

Mendip



Linear coverage at lock mid-shuffle position:

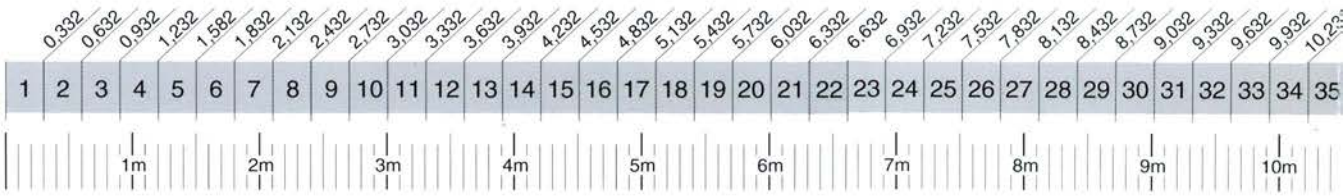
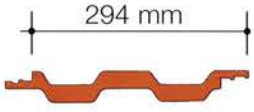
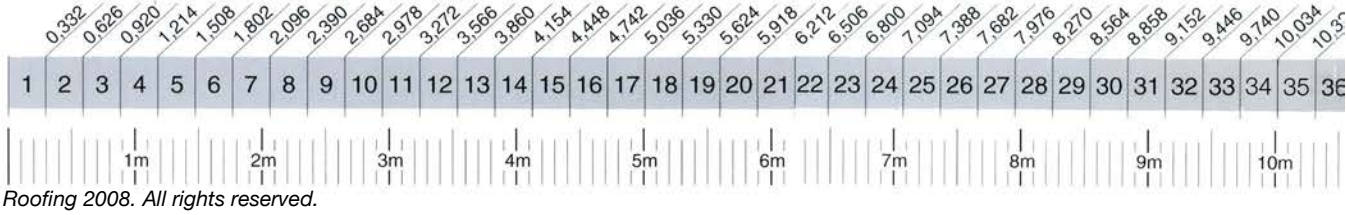


Table 5

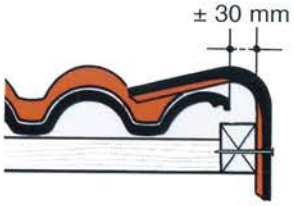
Ludlow



Linear coverage at lock mid-shuffle position:



Eaves length with Rake Verge Tiles



Where the roof is finished off with Marley Rake Verge Tiles 30 mm must be deducted from the eaves length for each verge.

Example: Given a roof length of **7,00 m with two gable ends**
7,00 m – (0,03 m x 2) = 6,94 m

∴ 23 Monarch tiles will cover the eaves length, using the play in the side lock

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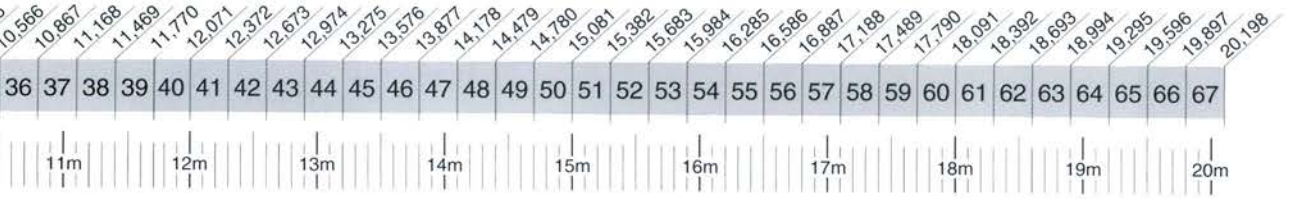
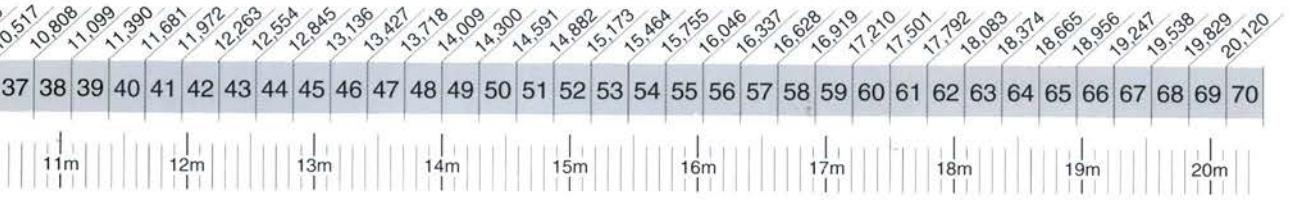
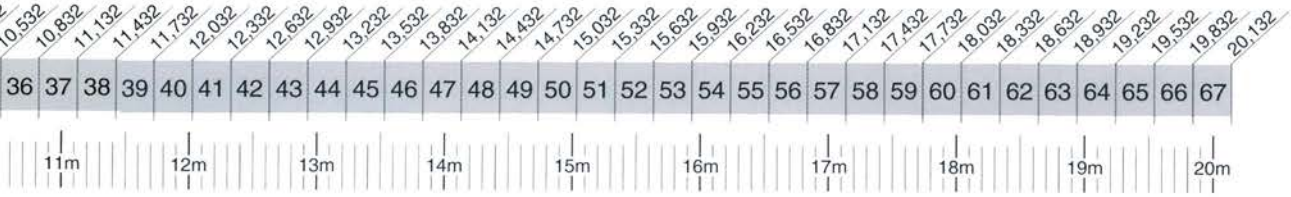
Example: Given a roof length of **10 m** with two gable ends
34 Monarch tiles are required to cover the eaves length



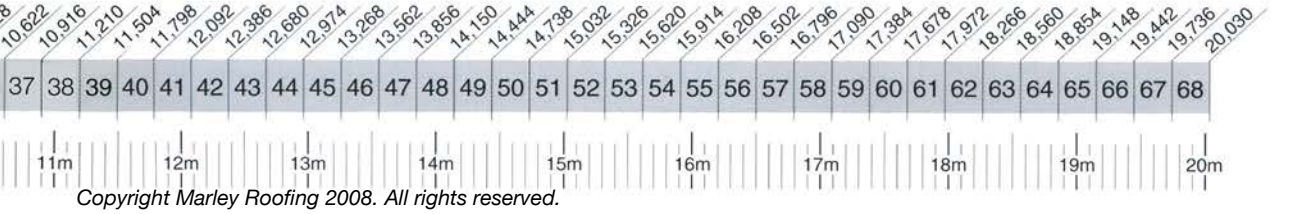
Example: Given a roof length of **10 m** with two gable ends
35 Modern tiles are required to cover the eaves length



Example: Given a roof length of **10 m** with two gable ends
34 Mendip tiles are required to cover the eaves length



Example: Given a roof length of **10 m** with two gable ends
34 Ludlow tiles are required to cover the eaves length



Rafter tables

NOTE: USE ONLY TABLE 6 FOR MODERN TILES

Table **6** and **7** indicate the number of courses which must be allowed on the rafter length to ensure that the relevant minimum headlap of **100 mm** or **75 mm** is obtained.

The tile headlap must not be reduced below the minimum indicated. Doing so would adversely affect the performance of the roof. The headlap can always be increased to suit the rafter length and to complete the roof with full courses.

The rafter tables show the corresponding rafter length for each course, providing for a standard 60 mm tile overhang into the gutter. The top batten at the ridge is normally placed at 25 mm from the rafter apex (see rafter length details, page 22).

General estimating

This should always be done at 320 mm batten centres (Table 6) to ensure sufficient quantities of tiles, irrespective of the roof pitch.

Generally, in South African practice*, the carpenter will batten the roof at 320 mm centres, but this dimension always requires adjustments, especially on hip/valley roofs. Please note that at estimating stage, one has no possible knowledge or control of the exact batten centres which will be determined by the carpenter on the roof to suit the rafter length.

Example: ***Monarch tile***

Given a rafter length of **7 m**

22 courses are required on the rafter length

The headlap shall be increased evenly on the rafter length

**Refer to Marley Good Roof Tiling Practice brochure.*

Estimating for community housing

When estimating is done at minimum tile headlap for maximum cost-saving (Table 7), care must be taken in the calculations to avoid shortages in quantities. Specifications at minimum headlap must always be accompanied by the correct corresponding rafter length.

Read carefully how to apply the estimating methods correctly, pages 15, 23 and 24.

Table 6 – Standard table for estimating

at 320 mm batten centres

—

100 mm headlap

All Marley roof tiles

—

All roof pitches from 17,5° upward

Number of courses	Rafter length
1	0,360
2	0,680
3	1,000
4	1,320
5	1,640
6	1,960
7	2,280
8	2,600
9	2,920
10	3,240
11	3,560
12	3,880
13	4,200
14	4,520
15	4,840
16	5,160
17	5,480
18	5,800
19	6,120
20	6,440
21	6,760
22	7,080
23	7,400
24	7,720
25	8,040
26	8,360
27	8,680
28	9,000
29	9,320
30	9,640
31	9,960
32	10,280
33	10,600
34	10,920
35	11,240
36	11,560
37	11,880
38	12,200

Table 7

Cost saving table from 26° upward

Absolute maximum batten centres

345 mm

Absolute minimum headlap

75 mm

NOT APPLICABLE FOR MODERN TILES

Number of courses	Rafter length	
1	0,360	
2	0,705	
3	1,050	1m
4	1,395	
5	1,740	
6	2,085	2m
7	2,430	
8	2,775	
9	3,120	3m
10	3,465	
11	3,810	
12	4,155	4m
13	4,500	
14	4,845	
15	5,190	5m
16	5,535	
17	5,880	
18	6,225	6m
19	6,570	
20	6,915	
21	7,260	7m
22	7,605	
23	7,950	
24	8,295	8m
25	8,640	
26	8,985	
27	9,330	9m
28	9,675	
29	10,020	
30	10,365	10m
31	10,710	
32	11,055	
33	11,400	11m
34	11,745	
35	12,090	12m

Roof details estimating

Ridges and hips

*** Inland 2,7 per linear metre — Coastal 2,5 per linear metre**

Taper ridge* Marley taper ridge tiles have a variable overlap (min 50 mm) and require no cutting. **Allow ..... ridge tiles per linear metre of ridge or hip length + one extra ridge tile per length of ridge or hip to enable the overlap to be increased as required.**

Hip/ridge junction **Allow 1 extra ridge tile for each hip for mitring.**

Monoridge Marley monoridge tiles have a fixed overlap. They are designed with an overlapping collar to ensure maintenance-free protection to this roof detail. **Allow 2,7 monoridge tiles per linear metre of ridge length + one extra ridge tile per length of ridge for cutting as required.**

Gables

Rake verges **For each verge, allow one rake verge tile for each course of tiling + one extra verge tile for mitring at the apex.**

Cutting work at hips and valleys

Hips **Allow 3 extra tiles per linear metre of hip.**

Valleys **Cutting tiles at valleys needs to be more accurate than at hips. Allow 4 extra tiles per linear metre of valley.**

Roof windows and dormers – Assess carefully these roof details and their requirements: hips, valleys, gutters etc. and whether dormer cheeks are tile hung or not. Add the quantity of tiles and wastage required.

Wastage and breakage

The Roofing Contractor has the best knowledge of site conditions and of his operatives. Therefore, he is the best person to decide what percentage to add on. The following can, however, be taken as a guide when estimating and ordering:

Main tile quantity: Allow 2% extra tiles.
Ridge tiles and verge tiles: Allow 5% extra tiles.

It is good practice to allow an extra 20 tiles minimum per roof, to keep under the roof for possible after-trade damages.

Other materials

Battens (net) At 100 mm tile headlap: **3,13 m of batten per m² of tiling area.**
At 75 mm tile headlap: **2,90 m of batten per m² of tiling area.**

Underlay As per manufacturer specifications. Minimum overlaps of underlay: **150 mm.**

Nails and clips: Minimum nail ordering quantity: **1 kg**

Tile nails	Length	Nails per kg	Clips
Monarch	**90 mm**	**225** ±	Large clip
Mendip, Double Roman Double Roman "Plus"	**75 mm**	**250** ±	Large clip
Ludlow, Homestead	**63 mm**	**320** ±	Small clip
Modern	**50 mm**	**385** ±	Small clip
Serrated nails for Rake verge tiles:	**75 mm**	**235** ±	
Nails for clips	**75 mm**	**250** ±	

Iron oxide pigment for bedding mortar: Minimum ordering quantity: **1 kg**
Recommended proportion: Not more than 5% of the cement used in the mortar.

M22 touch-up coating for bedding and flashings: Minimum ordering quantity: **1 litre**

Simplifying the roof plan

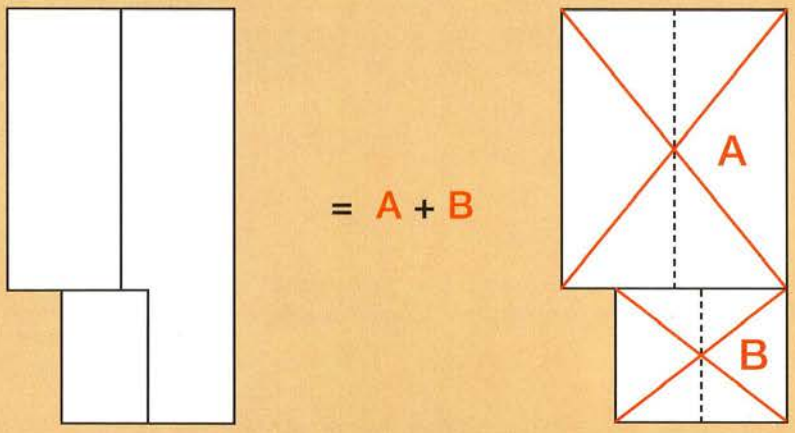
Two roofs having the same eaves and rafter lengths – and the same pitch – will have the same areas regardless of whether the roof has hip or gable ends, as can be seen from the sketches below.

Roof configurations having the same pitch can therefore be simplified for the purpose of estimating the main roof tile quantities.

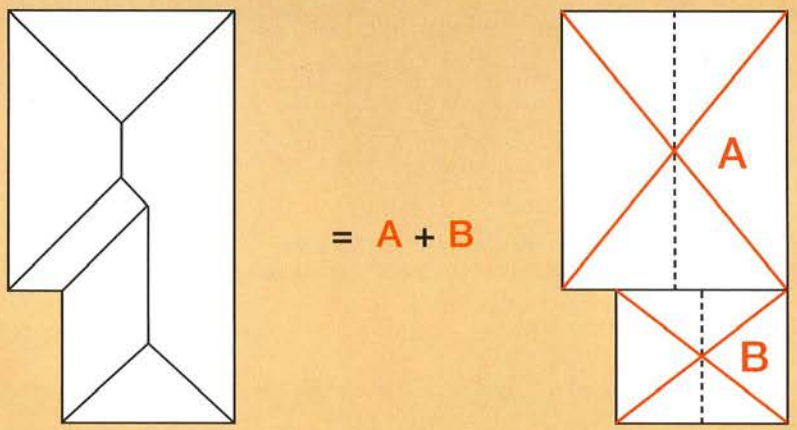
Additional tiles for overlapping areas, if any, and for cutting work at valleys and hips, plus a percentage for wastage and breakage, are then added to the main quantity.

Roof areas having different pitches and asymmetrical or irregular shapes must be calculated separately.

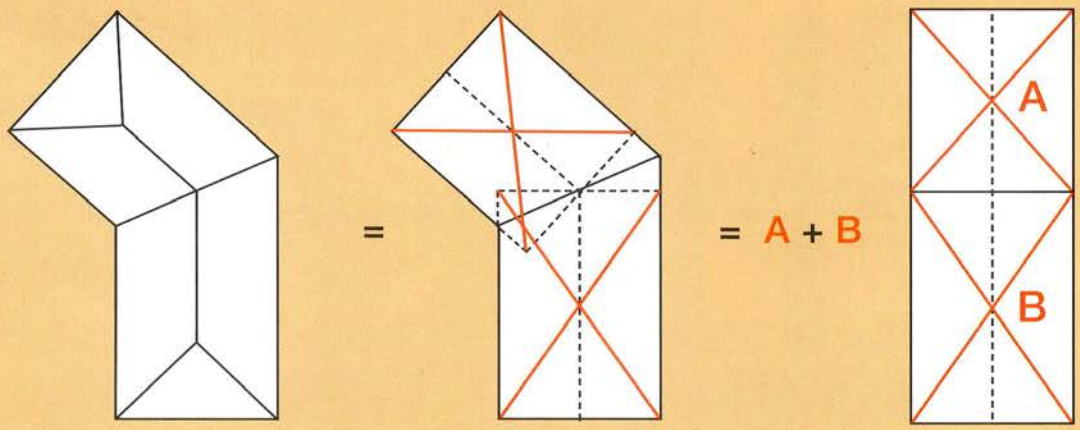
Roof area at the same pitch:



Roof area at the same pitch:



Roof area at the same pitch:



Basic estimating methods for main roof tile quantities

Eaves length/Rafter length method (linear method)

This is the only accurate method for estimating the correct number of full tiles required for any given roof design where full details are available. Marley recommends this method in all instances.

To calculate the number of tiles required for a roof area it is necessary to multiply the number of tiles required along the eaves length by the number of courses required on the rafter length.

The number of courses on the rafter length varies with the headlap required for the roof pitch. The minimum headlaps for Marley concrete roof tiles are indicated on page 7 and in the tile brochures. Ascertain the minimum headlap according to the pitch of the roof, the exposure category and the roof design.

It is now possible to determine the quantity of tiles required for each roof area:

Using Table **2**, **3**, **4** or **5**, pages 10–11, read off the number of tiles required along the eaves length. Use the correct eaves table for the relevant profile. Round up to the nearest full tile.

Using Table **6** or **7**, page 12, read off the number of courses required on the rafter length at the relevant tile headlap. Round up to the nearest full tile.

Multiply the number of tiles along the eaves by the number of courses on the rafter for each roof area, then add together the totals.

Roof Area method

Having found all the relevant eaves and rafter lengths it is also possible to calculate the total roof area to be tiled, as follows

1. If the roof consists of a number of roof areas with the same eaves and rafter lengths:

   Total Roof Area = No. of equal Areas x Eaves length x Rafter length.

2. If the roof consists of a number of roof areas with different eaves and rafter lengths, or different pitches:

   Total Roof Area = Eaves length of Area 1 x Rafter length of Area 1
   + Eaves length of Area 2 x Rafter length of Area 2
   + Eaves length of Area 3 x ... etc. continuing this way for all areas.

3. If the roof consists of a number of roof areas **at the same pitch** the total roof area can also be found from the roof plan area, using the rafter constant from Table 1, as follows

   Total Roof Area = Roof plan Area 1 + Roof plan Area 2 + Roof plan Area 3 ... etc.
   x by rafter constant for the relevant pitch (Table 1).

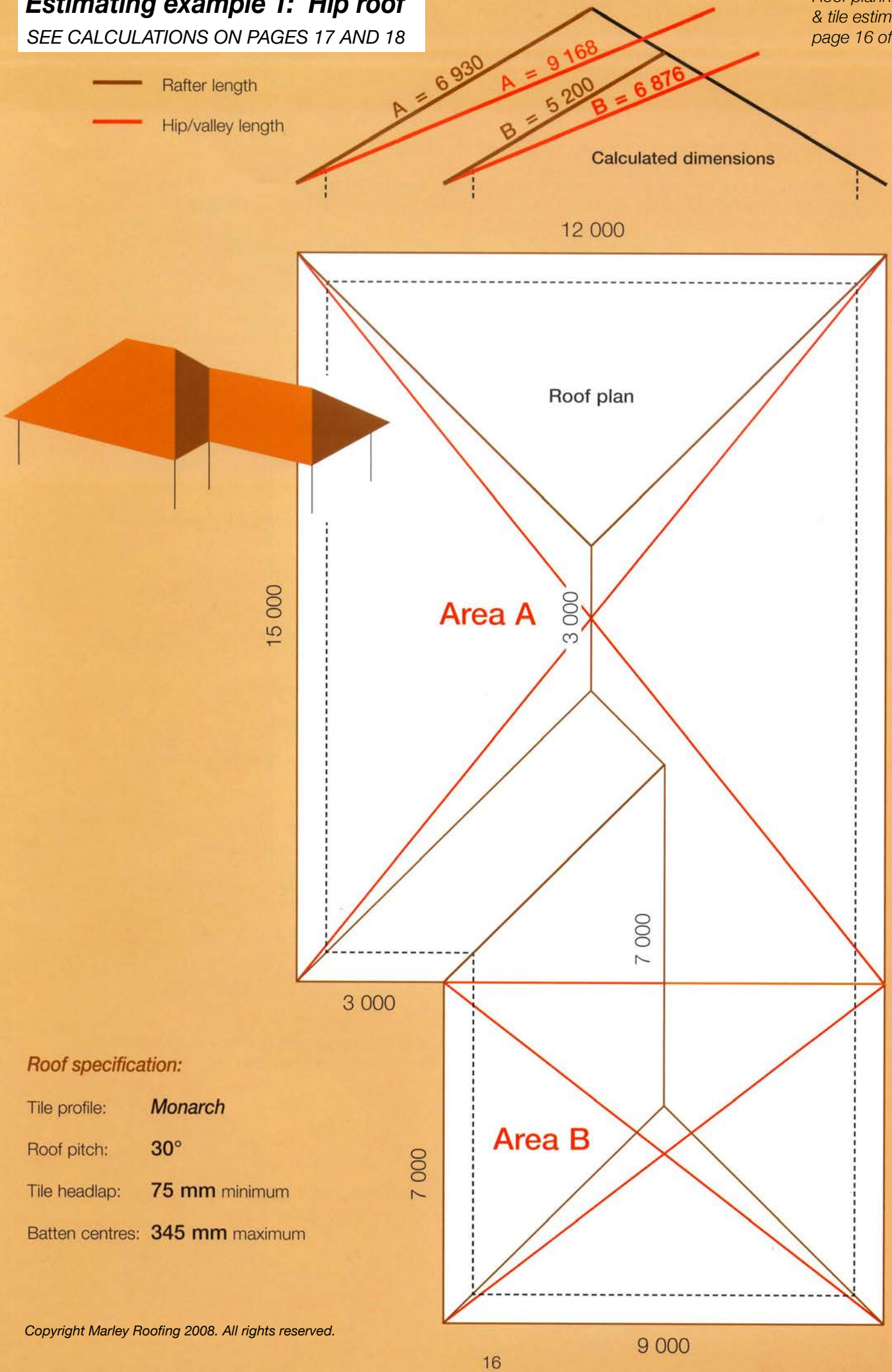
   This method can be used to calculate any number of roof areas together, provided that they are at a same pitch.

   Having found the total roof area to be tiled from 1, 2 or 3 above, multiply it by the appropriate number of tiles per m^2 shown for the relevant profile at the relevant headlap (See page 22, 23 and 24).

NOTE: The Roof Area method can lead to wrong estimates if applied incorrectly. See examples of calculations and how to use this method accurately, pages 23 and 24.

Estimating example 1: Hip roof

SEE CALCULATIONS ON PAGES 17 AND 18



Roof specification:

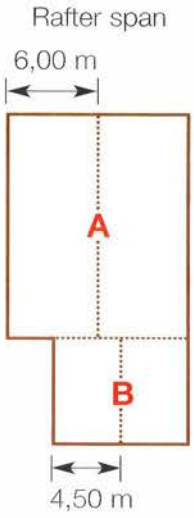
Tile profile: ***Monarch***

Roof pitch: **30°**

Tile headlap: **75 mm** minimum

Batten centres: **345 mm** maximum

Estimating example 1: Hip roof



Given the roof specification shown on page 16:
Reduce the roof plan to basic areas for estimating (A and B).
Change your dimensions to metres, followed by two decimals (see note page 19).

Main tile quantity:

(Eaves length/rafter length method)

Determine: Number of tiles on the eaves length (Monarch – Table 2)

for	**Area A:**	15,00 m	=	50 tiles
for	**Area B:**	7,00 m	=	23* tiles

Calculate: Rafter length = Rafter span x Rafter constant for 30° (Table 1)

for	**Area A:**	6,00 m	x 1,155	=	6,93 m
for	**Area B:**	4,50 m		=	5,20 m

Determine: Number of courses on the rafter length at 75 mm headlap (Table 5)

for	**Area A:**	6,93 m	=	21 courses
for	**Area B:**	5,20 m	=	16 courses

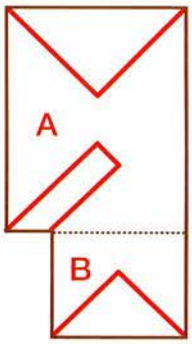
Calculate: Number of tiles required:

for	**Area A:**	50 tiles x 21 courses	x 2	=	2 100
for	**Area B:**	23 tiles x 15 courses		=	736
					2 836

**23 tiles will cover the eaves length as the hip tile will cover the corner.*

Extra tiles for cutting work at valley and hips: (see page 13)

Calculate: Length of hips and valley
= Number of hips/valleys x rafter span x Hip/valley constant for 30° pitch (Table 1)



Area A:	Full hips	3 x 6,00 m x 1,528	=	27,51 m
	Short hip*	(9,17 m – 6,88 m)	=	2,29 m
Area B:	Full hips	2 x 4,50 m x 1,528	=	13,75 m
Total length of hips		(27,51 m + 2,29 m + 13,75 m)	=	43,55 m
Length of valley		1 x 4,50 m x 1,528	=	6,88 m

		Number of tiles (carried over from page 17)		**2 836**

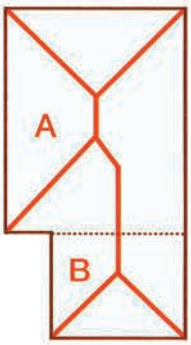
Cutting and wastage: *(continued)*

**The length of the short hip is the difference between the full hip and the valley lengths.*

Calculate: Number of tiles required for cutting at hips and valley

Hip:	3 tiles per metre of hip	**3 tiles x 43,55 m**	=	**131**
Valley:	4 tiles per metre of valley	**4 tiles x 6,88 m**	=	**28**
	Number of tiles for the roof before wastage			**2 995**
	Add 2% for wastage	**2 995 x 0,02**	=	**60**
				3 055
Total number of Monarch tiles required: (Round up to nearest 10)				**3 060**

Ridge tile quantity for ridges and hips (see page 13)



Total length of hips			**43,55 m**
Add length of ridge	Short ridge	=	**3,00 m**
	Long ridge	=	**7,00 m**
Total length			**53,55 m**

Calculate: Number of ridge tiles*	**2,5 per m x 53,55 m**	=	**134**
Add one ridge tile per length of ridge		=	**2**
Add one ridge tile per hip for mitring at hip/ridge junction		=	**6**
			142
Add 5% for wastage	**142 x 0,05**	=	**8**
Number of ridge tiles required			**150**

Include one hip starter per hip

*** Inland 2,7 per linear metre — Coastal 2,5 per linear metre**

Sequence of estimating

The estimating examples given in this brochure provide a guide for most roof calculations. Irrespective of the estimating method used, the sequence of calculations must always be observed as follows:

1. Roof area (Main tiles)

- Calculate the number of tiles for each roof area.
- Add the number of tiles required for cutting work at valleys, hips, abutments, etc as required.
- Total up the above results.
- Add 2% for wastage.
- Round up to nearest 10.

2. Ridges and hips (Ridge tiles)

- Total up the lengths of ridges and hips and calculate the number of ridge tiles required.
- Add one ridge tile for each length of ridge.
- Add one ridge tile for each hip for mitring.
- Total up ridge tiles.
- Add 5% for wastage.
- Round up to nearest 5.

3. Verges (Rake Verge Tiles)

- Identify the number of verges.
- Determine the number of courses of tiles at each verge.
- Add up the total number of courses and allow one verge tile for each course.
- Add one verge tile for each verge for mitring at the apex.
- Total up verge tiles.
- Add 5% for wastage.
- Round up to nearest 5.

4. Dormers, roof windows and roof details

- Identify these details and calculate the quantities and wastage required.
- Do not subtract tiles from the main tile quantity for roof windows and details of less than 1 m^2 coverage.

5. Accessories and other materials

- Calculate these items last, adding wastage as required.

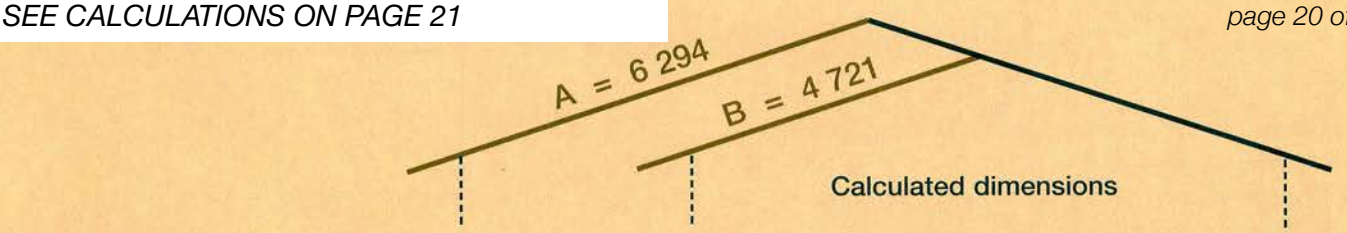
Note: Dimensions on plans are usually given in millimetres – Estimating is most conveniently done in metres, followed by two decimals – Always cross check your calculations.

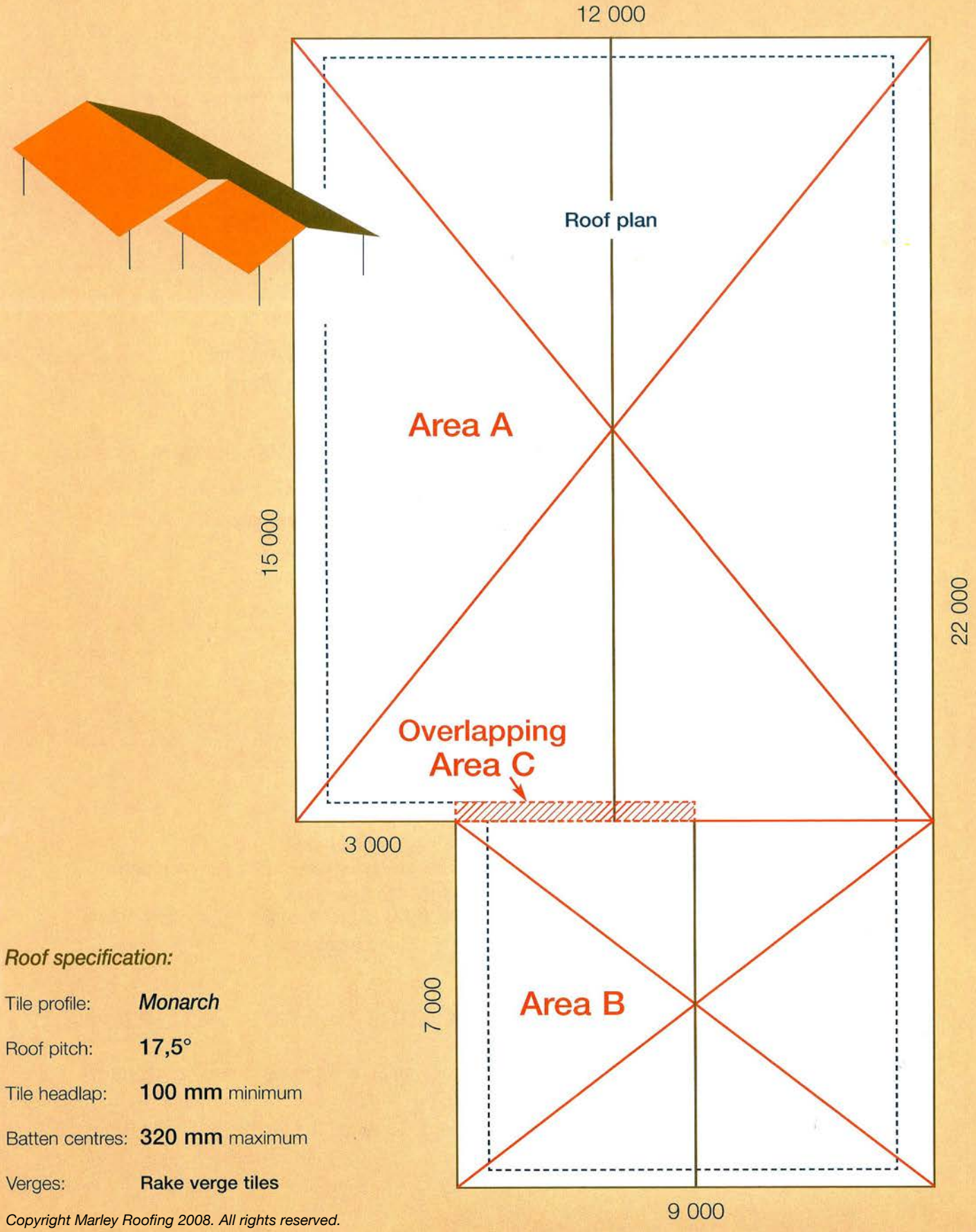
Standard trade practice:

Estimates of quantities and price quotations are always subject to re-measurement on completion of work.

Estimating example 1: Gable roof

SEE CALCULATIONS ON PAGE 21

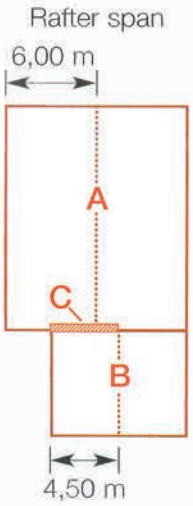




Roof specification:

Tile profile:	***Monarch***
Roof pitch:	**17,5°**
Tile headlap:	**100 mm** minimum
Batten centres:	**320 mm** maximum
Verges:	**Rake verge tiles**

Estimating example 2: Gable roof



Given the roof specification shown on page 20:
Reduce the roof plan to basic areas for estimating (A, B and C).
Change your dimensions to metres, followed by two decimals
(see note page 19).

Main tile quantity: (Eaves length/rafter length method)

Determine: Number of tiles on the eaves length (Monarch – Table 2)

for **Area A:**	15,00 mm	=	50 tiles
for **Area B:**	7,00 mm	=	23* tiles

**23 tiles will cover the eaves length with Rake Verge Tiles (see page 11)*

Calculate: Rafter length = Rafter span x Rafter constant for 17,5° roof pitch: 1,049 (Table 1)

for **Area A:**	6,00 m x 1,049	=	6,30 m
for **Area B:**	4,50 m x 1,049	=	4,72 m

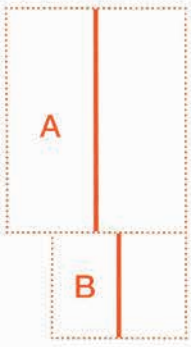
Determine: Number of courses on the rafter length at 100 mm headlap (Table 6)

for **Area A:**	6,30 m	=	20 courses
for **Area B:**	4,72 m	=	15 courses

Calculate: Number of tiles required:

for **Area A:**	50 tiles x 20 courses x 2	2 000
for **Area B:**	23 tiles x 15 courses x 2	690
for **Area C** (overlapping area)	1 tile x 15 courses	15
Number of tiles for the roof before wastage		2 705
Add 2% for wastage	2 750 x 0,02	55
Total number of Monarch tiles required		2 760

Ridge tile quantity: (see page 13)



Determine: Ridge length

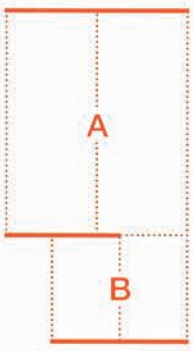
for **Area A:**	15,00 m
Area B:	7,00 m
	22,00 m

Number of ridge tiles required:
22,00 m x 2,5* tiles per m = 55

Add 1 extra tile for each ridge length	2
	57
Add 5% for wastage 57 x 0,05	3
Total number of ridge tiles required Include ventilated ridges and terminal ridges if applicable	60

* 2,5 per m coastal - 2,7 per m inland

Rake verge tile quantity: (see page 13)

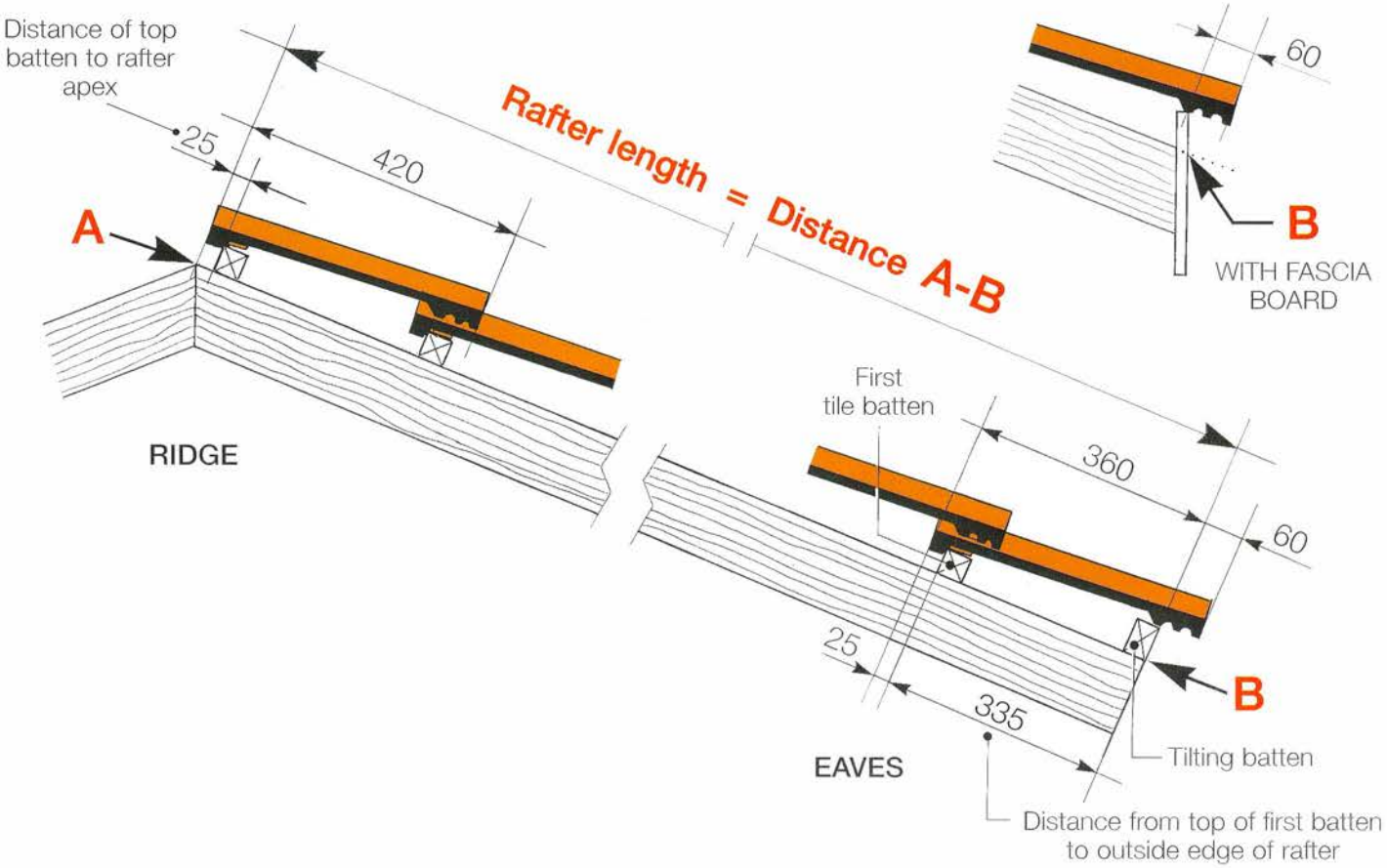


Determine: Number of verges: 6

Number of verge tiles required:

Area A:	
3 verges x 20 courses	60
1 short verge x 5 courses	5
Area B:	
2 verges x 15 courses	30
	95
Add one verge tile to each verge for mitring	6
	101
Add 5% for wastage 101 x 0,05	5
	106
Total number of rake verge tiles required (Round up to nearest 5)	110

Rafter length details



The basic rafter tables (Table 6 and 7, page 12) indicate the number of courses which must be allowed on the rafter length to ensure that the relevant minimum tile headlap for the roof pitch is obtained.

The Marley rafter tables are calculated as shown here, with a constant tile position at the ridge and at the eaves:

1. Position of the first tile at the ridge

The top batten is normally placed at 25 mm from the rafter apex **A**, except for steep roof pitches where this dimension must be reduced to bring the two top courses of tiles closer together.

2. Position of the first tile batten at the eaves

The first tile batten at the eaves is normally placed at 335 mm from the outside edge of the rafter **B** (or the projected rafter line on the outside face of the fascia board) to allow for a 60 mm overhang of the first tile into the gutter.

For example, should a roof have only one course of tiles its rafter length would be 360 mm and the tile overhang beyond the rafter length (gutter overhang) would be 60 mm.

Please note: These distances remain constant for estimating

- irrespective of the tile headlap and batten centres used
- and irrespective of the final design of the rafter end (with or without fascia board)

How to determine the appropriate batten centres and tile headlap for estimating with the roof area method:

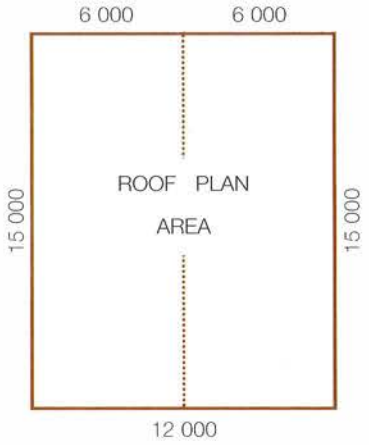
Example: Given a rafter length of		6,762 m
Deduct **25 mm** (distance of first batten from rafter apex)	=	6,737 m
Divide by **20 courses** (see page 23)		
Batten centres (rounded up)	=	337 mm
Appropriate tile headlap:		
(Tile length 420 mm less 337 mm batten centres)	=	83 mm

Roof area estimating method

Tile profile:
Monarch

Roof pitch:
27,5°

Tile headlap:
75 mm minimum



This method, also known as trigonometrical method, makes use of the rafter constant (Table 1) in order to calculate the roof area to slope from the roof plan area.

As already stated on page 15, this method can lead to wrong estimates if applied incorrectly at minimum headlap. It should only be used for rough calculations in the absence of detailed information, with a good understanding of its application to overlapping roof tiles in order to avoid shortages of quantities in the estimating.

Given the roof specification shown here:

Example 1 – Rough estimate:

The roof area method lends itself to wrong calculations if used at minimum headlap without checking whether the tiling is practically possible on the rafter length, as follows

Calculate:	Roof plan area	**15,00 m x 12,00 m**	=	**180,00 m²**
Calculate:	Roof area to slope (multiply by rafter constant for 27,5°, Table 1)			
		180,00 m² x 1,127	=	**202,86 m²**
Determine:	Number of Monarch tiles per m² at 75 mm headlap	**9,63 tiles per m²**		
Calculate:	Basic number of tiles before wastage	**202,86 m² x 9,63**	=	**1954 tiles**

This calculation does not allow for the roof to be completed with a full course of tiles if the tiling is done at 75 mm headlap, on both the rafter length and the eaves length.

Comparison – Eaves length/rafter length method:

Determine:	Number of tiles on the eaves length (Monarch, Table 2)	**15 m**	=	**50 tiles**
Determine:	Number of courses on the rafter length 6,762 m at 75 mm headlap (Table 7)	**20 courses x 2**	=	**40 tiles**
Calculate:	Basic number of tiles for the roof before wastage	**50 x 40**	=	**2000 tiles**

In this simple example, there is a difference of 46 tiles between the two results obtained above, which would correspond to a shortage of ±4,5 m² of tiling on the roof.

This calculation at minimum headlap demonstrates that shortages in quantity can easily occur if the roof area method is applied incorrectly.

How to apply the roof area method accurately:

In practice, the roof must always be covered with full horizontal courses. In order to arrive at the correct estimate of tiles required, the appropriate batten centres and tile headlap must first be established (see page 22). Then find in Table 8, page 24, the corresponding number of Monarch tiles per m² (9,86 in this case) which must also be used in the calculation for a correct result.

Thus:	Roof area to slope as above	**202,86 m²**		
	Tile headlap to suit 20 courses on the rafter length	**83 mm**		
	Number of Monarch tiles per m² at 83 mm headlap	**9,86 tiles per m²**		
	Basic number of tiles for the roof before wastage	**202,86 m² x 9,86**	=	**2000 tiles**

Table 8 — Number of tiles per m² at various practical headlaps

MARLEY CONTOURED TILES

Tile headlap mm	Batten centres mm	Double Roman Double Roman "Plus" Monarch Homestead per m²	Mendip per m²	Ludlow per m²
75	**345**	**9,63**	**9,66**	**9,86**
76	344	9,66	9,69	9,89
77	343	0,69	9,72	9,92
78	342	9,72	9,75	9,95
79	341	9,75	9,78	9,98
80	**340**	**9,78**	**9,81**	**10,01**
81	339	9,81	9,84	10,04
82	338	9,84	9,87	10,07
83	337	9,86	9,90	10,10
84	336	9,90	9,93	10,13
85	**335**	**9,93**	**9,96**	**10,16**
86	334	9,96	9,99	10,19
87	333	9,99	10,02	10,22
88	332	10,02	10,05	10,25
89	331	10,05	10,08	10,28
90	**330**	**10,08**	**10,11**	**10,31**
91	329	10,11	10,14	10,34
92	328	10,14	10,17	10,37
93	327	10,17	10,20	10,40
94	326	10,20	10,23	10,43
95	**325**	**10,23**	**10,26**	**10,47**
96	324	10,26	10,29	10,50
97	323	10,29	10,32	10,53
98	322	10,32	10,35	10,56
99	321	10,35	10,38	10,60
100	**320**	**10,38**	**10,42**	**10,63**
101	319	10,41	10,45	10,66
102	318	10,45	10,48	10,70
103	317	10,48	10,51	10,73
104	316	10,51	10,55	10,76
105	**315**	**10,55**	**10,58**	**10,80**
106	314	10,58	10,61	10,83
107	313	10,61	10,65	10,87
108	312	10,65	10,68	10,90
109	311	10,68	10,72	10,94
110	**310**	**10,72**	**10,75**	**10,97**

MARLEY MODERN SLATETILE

Tile headlap mm	Batten centres mm	Modern per m²
100	**320**	**10,80**
101	319	10,83
102	318	10,87
103	317	10,90
104	316	10,94
105	**315**	**10,97**
106	314	11,00
107	313	11,04
108	312	11,07
109	311	11,11
110	**310**	**11,14**
111	309	11,17
112	308	11,21
113	307	11,24
114	306	11,28
115	**305**	**11,31**
116	304	11,34
117	303	11,38
118	302	11,41
119	301	11,45
120	**300**	**11,48**
121	299	11,51
122	295	11,55
123	297	11,58
124	296	11,62
125	**295**	**11,65**

Figures per m² are at lock mid-shuffle position, rounded up.

All figures are net. Wastage must be added.

NOTE: When rough estimates are made with the roof area method at nominal tile coverage (minimum headlap) as in example 1 (page 23), a full horizontal course must be added for each roof area where the rafter length is not an exact multiple of the batten centres to ensure sufficient tile quantities.

If the exact rafter length for each roof area is not available, add 5% generally to your estimate of the roof tile quantity to cover any eventuality.

Benefits of roof planning – Do's and don'ts

Good understanding of the features of Marley concrete roof tiles and proper roof planning at design stage can result in substantial savings, especially on large projects.

1. Do select the most suitable rafter length:

Roof specification:	Rafter span		6,00 m
	Roof pitch		30°
	Minimum headlap		75 mm
	Maximum batten centres		345 mm
Calculate rafter length:	Rafter span 6,00 x rafter constant 1,155	=	6,93 m

The Rafter table 7, page 12, shows that 21 courses must be used to ensure that the minimum headlap of 75 mm is obtained.

By reducing the rafter length by 15 mm to 6,915 m, the minimum headlap of 75 mm will be obtained with 20 courses.

Note: In economic housing – where savings are essential – specifications at minimum headlap must always be accompanied by the correct corresponding rafter length.

2. Do select the most suitable batten centres when the rafter length is fixed:

Roof specification:	Rafter length	6,672 m
	Roof pitch	27,5°
	Minimum headlap	75 mm
	Maximum batten centres	345 mm

The Rafter table 7, page 12, shows that 20 courses of tiles are required to ensure that the minimum headlap of 75 mm is obtained.

The headlap shall be increased evenly to 83 mm tile headlap – 337 mm batten centres in order to cover the roof with full courses

Note: When rafter lengths are fixed and cannot be adjusted (as on hip/valley roofs) it is always necessary to adjust the batten centres.

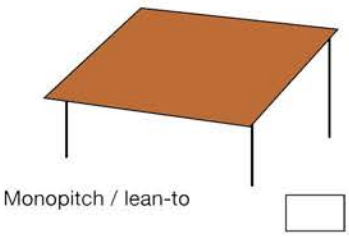
3. Do select Rake Verge Tiles and other overlapping fittings for the most efficient, maintenance-free finish to the roof details and long-term performance.

Don'ts

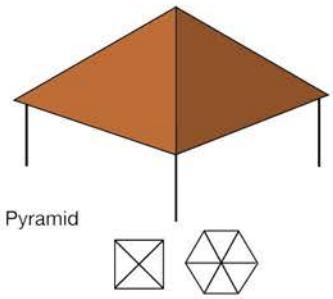
- Do not – under any circumstance – stretch the tiling over the rafter length by reducing the minimum tile headlap allowed.
- Do not install Marley concrete roof tiles below the minimum roof pitch recommended.
- Do not lay Modern tiles 'straight-bond'.

Doing so would automatically invalidate Marley's guarantee.

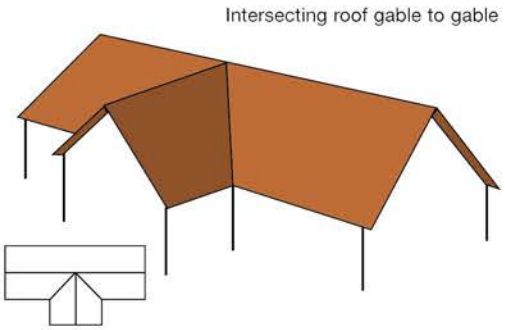
Roof forms



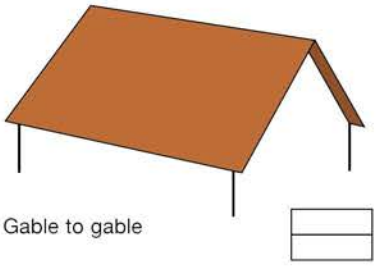
Monopitch / lean-to



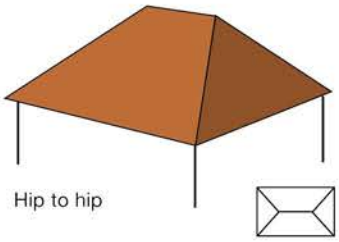
Pyramid



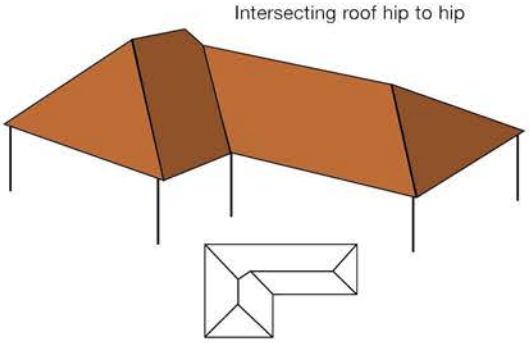
Intersecting roof gable to gable



Gable to gable

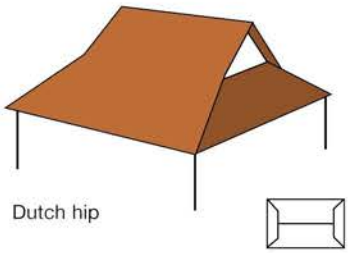


Hip to hip



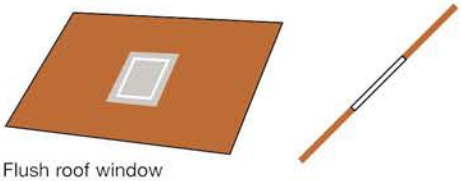
Intersecting roof hip to hip

Double pitch asymmetric

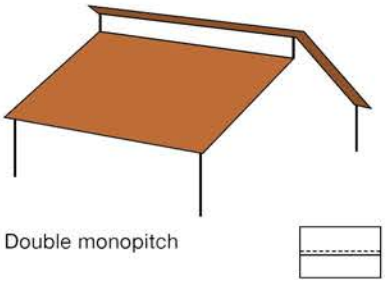


Dutch hip

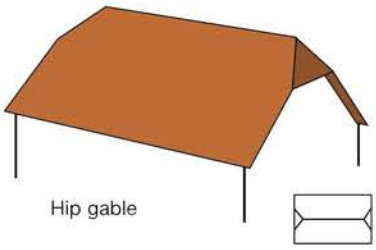
Roof windows / Dormers



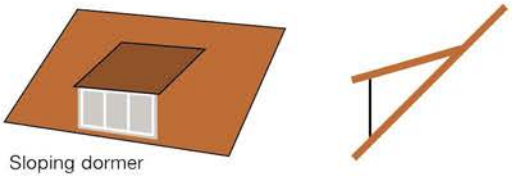
Flush roof window



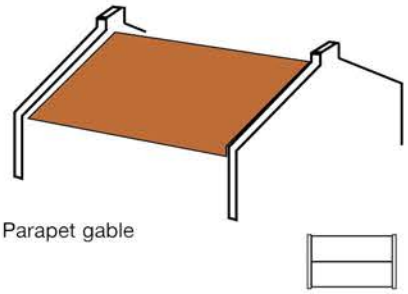
Double monopitch



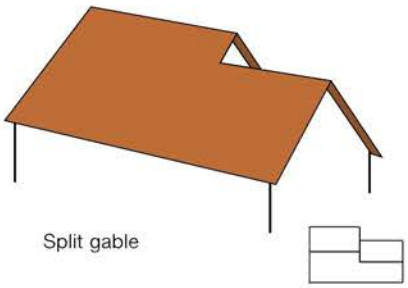
Hip gable



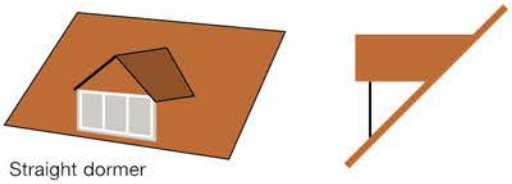
Sloping dormer



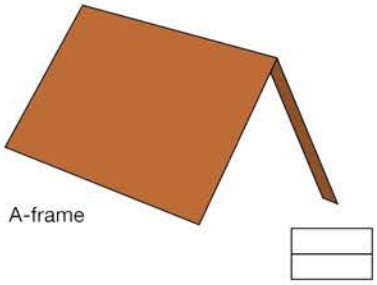
Parapet gable



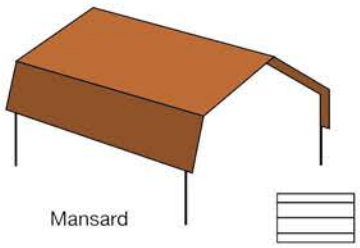
Split gable



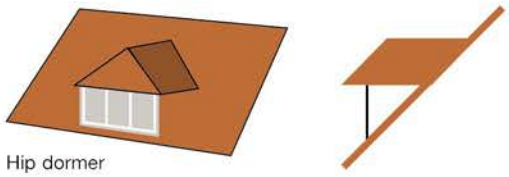
Straight dormer



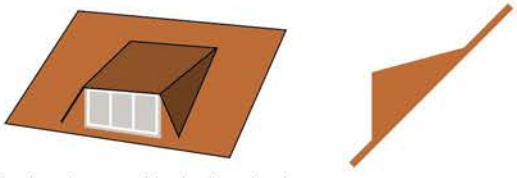
A-frame



Mansard



Hip dormer



Sloping dormer with sloping cheeks

Marley Roofing

Gauteng: Tel: (011) 316-2121 – e-mail: olifants@marley.co.za
KwaZulu-Natal: Tel: (032) 944-4155 – e-mail: tongaat@marley.co.za
Website: **www.marleyroofing.co.za**

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