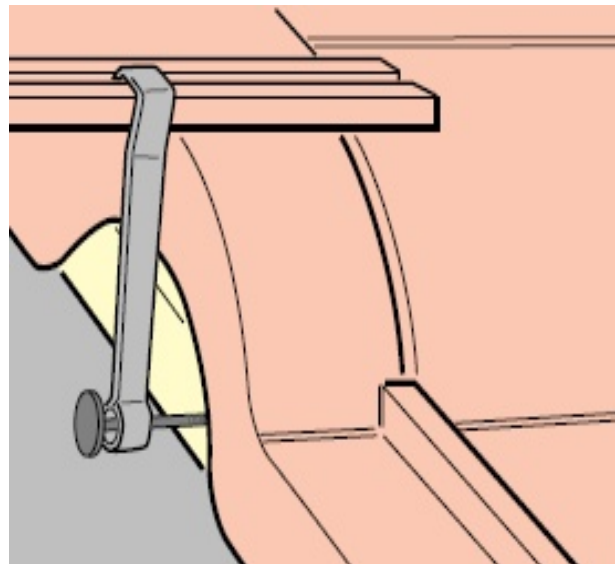
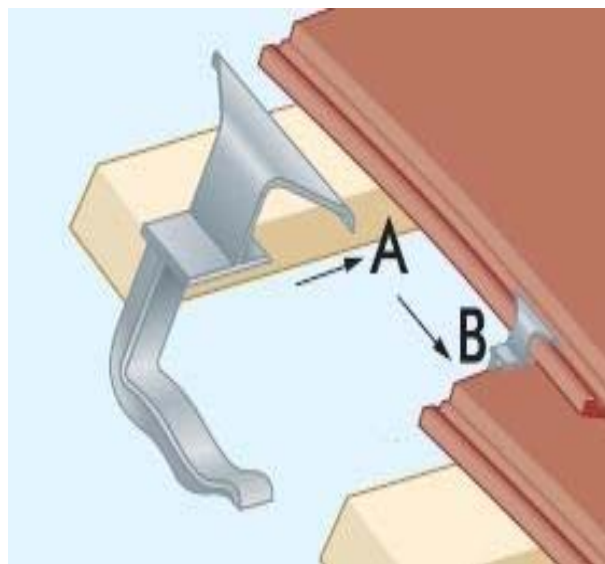


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ZONAL FIXING METHOD

USER GUIDE AND FIXING TABLES

FOR

FORTICRETE ROOF TILES

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FORTICRETE  ROOFING PRODUCTS

October 2006

October 2006

Roof Tile Fixing Specifications

The Zonal Method

User's Guide



This Users Guide is a joint publication prepared by the technical committees of the Concrete Tile Manufacturers' Association, Clay Roof Tile Council, and the National Federation of Roofing Contractors.

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Introduction

The Zonal Method is a method for obtaining a fixing specification for roof tiles and is a simplification of the calculations defined in BS 5534¹, 'Code of practice for slating and tiling (including shingles)'. The assumptions made in the simplification process may produce a specification with more or stronger fixings than that required if the full BS 5534¹ calculation is undertaken.

Manufacturers of roof tiles will provide fixing tables for their products in accordance with the Zonal Method. With some basic information about the design of roof tile to be used, the building and the site topography, the manufacturers' fixing tables will provide a fixing specification without the need for complex calculations. All manufacturers' fixing tables follow the same layout, a sample copy of which is given in Appendix B.

Scope

Included in the scope of this guide are roofs covered with single-lap and double-lap clay and concrete roof tiles including ridges, hips, verges and valley junctions (for exclusions see Appendix C).

Designers, specifiers and users are advised to check that the manufacturers' fixing tables refer to tiles, fittings and accessories that are manufactured to the appropriate British or European Standard or supported by recognized UKAS-accredited third-party assessment.

Where reference is made to the fixing specifications of proprietary products and to manufacturers' recommendations, the specifier should obtain evidence that these fixing specifications and recommendations have been proven by relevant experience or relevant test method data based on the conditions and methods of use in the UK climate to be fit for purpose.

In cases where the fixing specifications concerning the use of proprietary products varies from those contained in BS 5534¹, it is essential that the manufacturer's recommendations give the designer and user adequate assurance of performance. It is advisable that the designer, specifier, or, user seeks assurances at the design stage of a project that such recommendations are appropriate for the intended application.

How to use the Zonal Method

1. Information required

To use the Zonal Method the following information is required:

1. The manufacturer's name and model of roof tile to be used.
2. The altitude of the site (less than 100m, 100 to 200 m, over 200 m but less than 300m).
3. The wind speed zone in which the building lies (1, 2, or, 3). This can be obtained from the map given in Appendix A.
4. The height of the building (less than or equal to 5m, 10m, or, 15m).
5. The pitch of the roof (e.g. for single lap tiles less than 35° ; 35° - 44° ; or, 45° - 54° ; for double lap 35° - 59°).
Note: The tile manufacturer should be consulted to determine the minimum pitch for the tile selected. Roofs with long rafters may be subject to additional pitch restrictions.
6. The headlap requirement for single lap tiles (75mm or 100mm)
7. If counter-battens are to be used.

2 Manufacturers' Fixing Tables

For each tile type two sets of Tile Fixing Specification tables will be available from the manufacturer:

Tiles fixed to battens only; and
 Tiles fixed to battens over counter-battens.

Both will require that all perimeter tiles are fixed, including tiles adjacent to valleys and, where appropriate, verge specifications will be provided. The tile fixing specification will be in accordance with the following format:

Zonal Fixing specification	Single lap tiles	Double lap tiles
A	No fixings required (except perimeters)	Not Applicable
B	Each tile once nailed (right hand nail hole – flat tiles)	Each tile twice nailed every fifth course
C	Each tile twice nailed (flat tiles only)	Each tile twice nailed every fourth course
D	Each tile clipped	Each tile twice nailed every third course
E	Each tile once nailed and clipped	Each tile twice nailed every second course
F	Each tile twice nailed and clipped	Each tile twice nailed
<p>Note 1 The manufacturers shall base their zonal fixing specifications on the Zonal Method Technical Reference² developed by the CTMA and the CTRC. The manufacturers shall ensure that the specifications are appropriate for their products.</p>		
<p>Note 2 The manufacturer may also specify the use of improved nails (e.g. ring shank nails) for fixing tiles. Where these are required the Zonal Method fixing specification letter will be marked with an asterisk, e.g. C*.</p>		
<p>Note 3 The Zonal Method calculations are based on the use of substructures that provide a shielding factor of 1, e.g. flexible underlays and rigid underlays, including, board sarking, liner trays and sandwich panels.</p>		
<p>Note 4 The manufacturers may define additional fixing specifications to those in the table and assign fixing specification letters from G onwards. In some cases the manufacturer may specify a 'proprietary system' and this will be marked PS and the manufacturer should be contacted for the details of the fixing method.</p>		

3 How to use the Manufacturers' Tile Fixing Tables

Check that the table to be used is the current version from the manufacturer of the roof tile that is to be fitted.

The following sequence should be used:

- (1) Within the appropriate manufacturer's table, identify the sub-table relevant to the site's altitude. e.g. less than 100 m; 101 to 200 m; or, 201 to 300m.
- (2) Within the altitude sub-table identify the wind speed zone appropriate for the site location (Zone 1, 2, or 3). This can be obtained from the map given in Appendix A.
- (3) Identify the building height to ridge (5m, 10m, 15m).
- (4) For single lap tiles identify the headlap column (75 or 100mm). Where the headlap falls between 75 mm and 100 mm use the 75 mm fixing specification for the designated lap.
- (5) For single lap tiles identify the roof pitch column (less than 35°; 35°- 44°; or, 45° - 54°).
- (6) For plain tiles identify the roof pitch column (e.g. 35° - 59°).
- (7) The fixing specification can then be obtained, e.g. A to F.

Hips, Hip-Ridges, Ridges, Verges, Valley Junctions, Penetrations and Openings

Hips (bonnets, arris and purpose-made fittings for plain tiles)

Hips should be installed in accordance with BS 5534¹, BS 8000-6³ and the manufacturer's instructions.

Individual bonnet, arris and purpose made hip tiles to be used in each course with double-lap plain tiles should be mechanically fixed with nails, and head bedded to prevent uplift.

Hip-Ridges, Ridges, Verges and Valley junctions

Ridges should be installed in accordance with BS 5534¹, BS 8000-6³ and the manufacturer's instructions.

The mechanical fixing of all hip ridges and ridges is recommended. But in all cases, to comply with BS 5534¹ and BS 8000-6³, hip-ridge or ridges should be mechanically fixed for a distance of not less than two consecutive units or a distance of 900 mm, whichever is the greater, from the face of rigid masonry supports such as gables, dormers, valley junctions, abutments and separating walls where there is a risk that differential movement may take place.

All verge tiles or verge components, should be clipped (single lap tiles), or twice nailed (double lap plain tiles), or secured by using a proprietary dry verge system.

All methods used for the mechanical fixing of hip ridges, ridges and verges should meet the requirements of BS 5534¹ and BS 8000-6³, including proprietary 'dry fix' systems, which should be fixed strictly in accordance with the selected manufacturer's instructions.

Roof penetrations and openings (i.e. roof windows, chimneys)

Consideration should be given to the location of any penetrations and openings in the roof to facilitate the optimum tile module so as to avoid small cut tiles. All tiles adjacent to roof penetrations or openings should be mechanically fixed.

References

1. BS 5534, Code of practice for slating and tiling (including shingles), British Standards Institution, 2003
2. Zonal Method Technical Reference CRTC / CTMA 2006
3. BS 8000–6, Workmanship on building sites – Code of practice for slating and tiling of roofs and claddings, British Standards Institution, 1990
4. BS 6399–2, Loading for buildings – Code of practice for wind loads, British Standards Institution, 1997

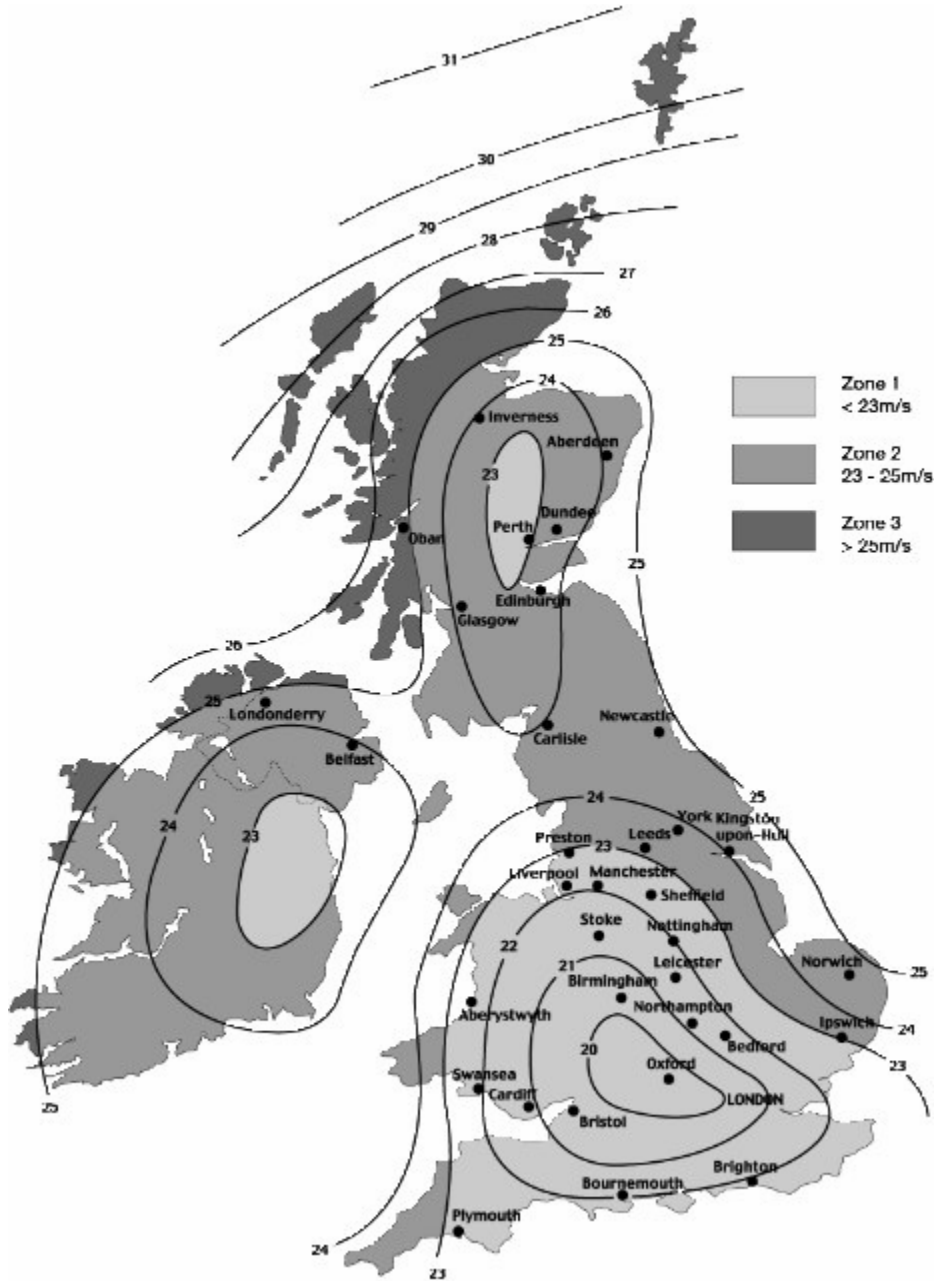
Further Guidance

Practical guidance on the application of single-lap and double-lap tiling can also be obtained from CITB/CS Trainer Resource Package for Operatives in the Construction Industry Manuals', Construction Industry Training Board, 2002:

- CTP 036/1 – Roof Slating and Tiling – Common Materials and Methods;
- CTP 036/2 – Roof Slating and Tiling – Single-lap, Variable Gauge, Interlocking Tiles;
- CTP 036/3 – Roof Slating and Tiling – Double-lap, Variable Gauge, Plain Tiles;
- CTP 036/5 – Roof Slating and Tiling – Single-lap, Fixed Gauge, Interlocking and mitred tiles.

UK Map of Three Wind Speed Zones

Appendix A



For the Channel Islands assume a wind speed of 24 m/s i.e. Zone 2

If the building lies on the junction of two wind speed zones use the higher wind speed zone when determining the fixing specification in accordance with the Zonal Method.

Map reproduced by kind permission of BRE Ltd.

Manufacturers' tile fixing specification template

Appendix B

Note: All perimeter tiles must be fixed including tiles adjacent to valleys and the tile fixing specifications given in the following tables apply to all roof areas.

Site altitude: 0 - 100m		Tile type and name				
Headlap	75 mm			100 mm		
Pitch	Below 35°	35 - 44°	45 - 54°	Below 35°	35 - 44°	45 - 54°
Zone 1	?	?	?	?	?	?
5 m	?	?	?	?	?	?
10 m	?	?	?	?	?	?
15 m	?	?	?	?	?	?
Zone 2	?	?	?	?	?	?
5 m	?	?	?	?	?	?
10 m	?	?	?	?	?	?
15 m	?	?	?	?	?	?
Zone 3	For Zone 3 a full calculation to BS 6399-2 ³ and BS 5534 ¹ is required.					

Site altitude: 101 – 200 m		Tile type and name				
Headlap	75 mm			100 mm		
Pitch	Below 35°	35 - 44°	45 - 54°	Below 35°	35 - 44°	45 - 54°
Zone 1	?	?	?	?	?	?
5 m	?	?	?	?	?	?
10 m	?	?	?	?	?	?
15 m	?	?	?	?	?	?
Zone 2	?	?	?	?	?	?
5 m	?	?	?	?	?	?
10 m	?	?	?	?	?	?
15 m	?	?	?	?	?	?
Zone 3	For Zone 3 a full calculation to BS 6399-2 ³ and BS 5534 ¹ is required.					

Site Altitude: 201 – 300 m		Tile type and name				
Headlap	75 mm			100 mm		
Pitch	Below 35°	35 - 44°	45 - 54°	Below 35°	35 - 44°	45 - 54°
Zone 1	?	?	?	?	?	?
5 m	?	?	?	?	?	?
10 m	?	?	?	?	?	?
15 m	?	?	?	?	?	?
Zone 2	?	?	?	?	?	?
5 m	?	?	?	?	?	?
10 m	?	?	?	?	?	?
15 m	?	?	?	?	?	?
Zone 3	For Zone 3 a full calculation to BS 6399-2 ³ and BS 5534 ¹ is required.					

Site altitude: greater than 300 m		Tile type and name				
For altitudes above 300 m a full calculation to BS 6399-2 and BS 5534 ¹ is required						

Zonal fixing specification method

- Single lap tiles
- A No fixings required
 - B Each tile once nailed (right hand hole on flat tiles)
 - C Each tile twice nailed (flat tiles only)
 - D Each tile clipped
 - E Each tile once nailed and clipped
 - F Each tile twice nailed and clipped

- Double lap tiles
- Not applicable
 - Each tile twice nailed every fifth course
 - Each tile twice nailed every fourth course
 - Each tile twice nailed every third course
 - Each tile twice nailed every second course
 - Each tile twice nailed

* requires the use of improved nails.

List of Exclusions

Appendix C

The Zonal Method is not applicable in the following circumstances:

- For buildings where the site altitude is greater than 300m.
- For buildings on sites where the maximum gradient of the land within 200 m of the building is greater than 10%.
- Where the building is within 6 kilometres of an airport and is plus or minus 10 degrees each side of the runway centre line measured from the touchdown point.
- Where the ridge height of the building is greater than 15 m.
- Where the roof pitch is greater than 54° for single lap tiles and 59° for double lap tiles.
- For buildings where the roof substructure does not provide a shielding factor of 1 as defined in BS 5534¹ e.g. the roof does not have an underlay or sub-roof system such as liner trays or sandwich panels.
- For tiles or slates not made of concrete or clay.
- Heritage, listed or historic buildings requiring restoration using traditional skills.
- For buildings on sites located in wind zones where the wind speed is greater than 25 m/s i.e. Zone 3.

The fixing specification for the roof covering of any excluded site or building must be determined by calculation in accordance with the methods described in BS 5534¹ and BS 6399-2⁴. For example, in some extreme cases, special nails or clips may be required.

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ROOFTILE

FIXING TABLES

**WITHOUT
COUNTERBATTENS**

Note: All perimeter tiles must be fixed including tiles adjacent to valleys and the tile fixing specifications given in the following tables apply to all roof areas.

Zonal Fixing Specification Method (Single Lap Tiles)	
A	No fixings required
B	Each tile once nailed (right hand hole on flat tiles)
C	Each tile twice nailed (flat tiles only)
D	Each tile clipped
E	Each tile once nailed and clipped
F	Each tile twice nailed and clipped
*	requires the use of improved nails (eg C*)

Site Altitude	0-100m			Tile Type:	Centurion			Without Counterbattens		
Headlap	100mm									
Gauge	285mm									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	D	D	N/A							
10m	D	D	N/A							
15m	D	D	N/A							
Zone 2										
5m	D	D	N/A							
10m	D	D	N/A							
15m	D	D	N/A							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required									

Site Altitude	101-200m			Tile Type:	Centurion			Without Counterbattens		
Headlap	100mm									
Gauge	285mm									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	D	D	N/A							
10m	D	D	N/A							
15m	D	D	N/A							
Zone 2										
5m	D	D	N/A							
10m	D	D	N/A							
15m	D	D	N/A							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required									

Site Altitude	201-300m			Tile Type:	Centurion			Without Counterbattens		
Headlap	100mm									
Gauge	285mm									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	D	D	N/A							
10m	D	D	N/A							
15m	D	D	N/A							
Zone 2										
5m	D	D	N/A							
10m	D	D	N/A							
15m	D	D	N/A							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required									

Site Altitude	Greater than 300m			Tile Type:	Centurion			Without Counterbattens		
For altitudes above 300m, a full calculation to BS 6399-2 and BS 5534 is required										

Note: All perimeter tiles must be fixed including tiles adjacent to valleys and the tile fixing specifications given in the following tables apply to all roof areas.

Zonal Fixing Specification Method (Single Lap Tiles)	
A	No fixings required
B	Each tile once nailed (right hand hole on flat tiles)
C	Each tile twice nailed (flat tiles only)
D	Each tile clipped
E	Each tile once nailed and clipped
F	Each tile twice nailed and clipped
*	requires the use of improved nails (eg C*)

Site Altitude	0-100m						Tile Type: Gemini			Without Counterbattens		
Headlap	75mm			80mm			95mm					
Gauge	195mm			190mm			175mm					
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°			
Zone 1												
5m	E	B	B	E	B	B	E	B	B			
10m	E	B*	B*	E	B*	B*	E	B*	B*			
15m	E	B*	B*	E	B*	B*	E	B*	B*			
Zone 2												
5m	E	B*	B*	E	B*	B*	E	B*	B*			
10m	E	B*	E	E	B*	E	E	B*	E			
15m	E	E	E	E	E	E	E	E	E			
Zone 3												
For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required												

Site Altitude	101-200m						Tile Type: Gemini			Without Counterbattens		
Headlap	75mm			80mm			95mm					
Gauge	195mm			190mm			175mm					
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°			
Zone 1												
5m	E	B*	B*	E	B*	B*	E	B*	B*			
10m	E	B*	E	E	B*	E	E	B*	B*			
15m	E	E	E	E	E	E	E	E	E			
Zone 2												
5m	E	B*	E	E	B*	E	E	B*	E			
10m	E	E	E	E	E	E	E	E	E			
15m	E	E	E	E	E	E	E	E	E			
Zone 3												
For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required												

Site Altitude	201-300m						Tile Type: Gemini			Without Counterbattens		
Headlap	75mm			80mm			95mm					
Gauge	195mm			190mm			175mm					
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°			
Zone 1												
5m	E	B*	E	E	B*	E	E	B*	B*			
10m	E	E	E	E	E	E	E	E	E			
15m	E	E	E	E	E	E	E	E	E			
Zone 2												
5m	E	E	E	E	E	E	E	E	E			
10m	E	E	E	E	E	E	E	E	E			
15m	E	E	E	E	E	E	E	E	E			
Zone 3												
For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required												

Site Altitude	Greater than 300m						Tile Type: Gemini			Without Counterbattens		
For altitudes above 300m, a full calculation to BS 6399-2 and BS 5534 is required												

Note: All perimeter tiles must be fixed including tiles adjacent to valleys and the tile fixing specifications given in the following tables apply to all roof areas.

Zonal Fixing Specification Method (Single Lap Tiles)	
A	No fixings required
B	Each tile once nailed (right hand hole on flat tiles)
C	Each tile twice nailed (flat tiles only)
D	Each tile clipped
E	Each tile once nailed and clipped
F	Each tile twice nailed and clipped
*	requires the use of improved nails (eg C*)

Site Altitude 0-100m		Tile Type: Minislate						Without Counterbattens		
Headlap	75mm			80mm						
Gauge	195mm			190mm						
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	C	B	B	C	B	B				
10m	C*	B*	B*	C*	B*	B*				
15m	C*	B*	B*	C*	B*	B*				
Zone 2										
5m	C*	B*	B*	C*	B*	B*				
10m	C*	B*	C	C*	B*	C				
15m	E*	C	C	E*	C	C				
Zone 3 For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required										

Site Altitude 101-200m		Tile Type: Minislate						Without Counterbattens		
Headlap	75mm			80mm						
Gauge	195mm			190mm						
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	C*	B*	B*	C*	B*	B*				
10m	C*	B*	C	C*	B*	C				
15m	E*	C	C	E*	C	C				
Zone 2										
5m	C*	B*	C	C*	B*	C				
10m	E*	C	C	E*	C	C				
15m	E*	C*	C*	E*	C*	C*				
Zone 3 For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required										

Site Altitude 201-300m		Tile Type: Minislate						Without Counterbattens		
Headlap	75mm			80mm						
Gauge	195mm			190mm						
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	C*	B*	C	C*	B*	C				
10m	E*	C	C	E*	C	C				
15m	E*	C*	C*	E*	C	C*				
Zone 2										
5m	E*	C	C	E*	C	C				
10m	E*	C*	C*	E*	C*	C*				
15m	E*	C*	C*	E*	C*	C*				
Zone 3 For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required										

Site Altitude Greater than 300m		Tile Type: Minislate						Without Counterbattens		
For altitudes above 300m, a full calculation to BS 6399-2 and BS 5534 is required										

Note: All perimeter tiles must be fixed including tiles adjacent to valleys and the tile fixing specifications given in the following tables apply to all roof areas.

Zonal Fixing Specification Method (Single Lap Tiles)	
A	No fixings required
B	Each tile once nailed (right hand hole on flat tiles)
C	Each tile twice nailed (flat tiles only)
D	Each tile clipped
E	Each tile once nailed and clipped
F	Each tile twice nailed and clipped
*	requires the use of improved nails (eg C*)

Site Altitude	0-100m			Tile Type:	Senator			Without Counterbattens		
Headlap	75mm									
Gauge	310mm									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 2										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required									

Site Altitude	101-200m			Tile Type:	Senator			Without Counterbattens		
Headlap	75mm									
Gauge	310mm									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 2										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required									

Site Altitude	201-300m			Tile Type:	Senator			Without Counterbattens		
Headlap	75mm									
Gauge	310mm									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 2										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required									

Site Altitude	Greater than 300m			Tile Type:	Senator			Without Counterbattens		
For altitudes above 300m, a full calculation to BS 6399-2 and BS 5534 is required										

Note: All perimeter tiles must be fixed including tiles adjacent to valleys and the tile fixing specifications given in the following tables apply to all roof areas.

Zonal Fixing Specification Method (Single Lap Tiles)	
A	No fixings required
B	Each tile once nailed (right hand hole on flat tiles)
C	Each tile twice nailed (flat tiles only)
D	Each tile clipped
E	Each tile once nailed and clipped
F	Each tile twice nailed and clipped
*	requires the use of improved nails (eg C*)

Site Altitude	0-100m			Tile Type:	V2			Without Counterbattens		
Headlap	75mm									
Gauge	310mm									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 2										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required									

Site Altitude	101-200m			Tile Type:	V2			Without Counterbattens		
Headlap	75mm									
Gauge	310mm									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 2										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 3	For Zone 3, a full calculation to BS 639-2 and BS 5534 is required									

Site Altitude	201-300m			Tile Type:	V2			Without Counterbattens		
Headlap	75mm									
Gauge	310mm									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 2										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 3	For Zone 3, a full calculation to BS 639-2 and BS 5534 is required									

Site Altitude	Greater than 300m	Tile Type:	V2			Without Counterbattens		
For altitudes above 300m, a full calculation to BS 639-2 and BS 5534 is required								

Note: All perimeter tiles must be fixed including tiles adjacent to valleys and the tile fixing specifications given in the following tables apply to all roof areas.

Zonal Fixing Specification Method (Single Lap Tiles)	
A	No fixings required
B	Each tile once nailed (right hand hole on flat tiles)
C	Each tile twice nailed (flat tiles only)
D	Each tile clipped
E	Each tile once nailed and clipped
F	Each tile twice nailed and clipped
	* requires the use of improved nails (eg C*)

Site Altitude	0-100m			Tile Type:			Without Counterbattens		
Headlap									
Gauge									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°
Zone 1									
5m									
10m									
15m									
Zone 2									
5m									
10m									
15m									
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required								

Site Altitude	101-200m			Tile Type:			Without Counterbattens		
Headlap									
Gauge									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°
Zone 1									
5m									
10m									
15m									
Zone 2									
5m									
10m									
15m									
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required								

Site Altitude	201-300m			Tile Type:			Without Counterbattens		
Headlap									
Gauge									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°
Zone 1									
5m									
10m									
15m									
Zone 2									
5m									
10m									
15m									
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required								

Site Altitude	Greater than 300m	Tile Type:	Without Counterbattens
For altitudes above 300m, a full calculation to BS 6399-2 and BS 5534 is required			

ROOFTILE

FIXING TABLES

**WITH
COUNTERBATTENS**

Note: All perimeter tiles must be fixed including tiles adjacent to valleys and the tile fixing specifications given in the following tables apply to all roof areas.

Zonal Fixing Specification Method (Single Lap Tiles)	
A	No fixings required
B	Each tile once nailed (right hand hole on flat tiles)
C	Each tile twice nailed (flat tiles only)
D	Each tile clipped
E	Each tile once nailed and clipped
F	Each tile twice nailed and clipped
*	requires the use of improved nails (eg C*)

Site Altitude	0-100m			Tile Type:	Centurion			With Counterbattens		
Headlap	100mm									
Gauge	285mm									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	D	D	N/A							
10m	D	D	N/A							
15m	D	D	N/A							
Zone 2										
5m	D	D	N/A							
10m	D	D	N/A							
15m	D	D	N/A							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required									

Site Altitude	101-200m			Tile Type:	Centurion			With Counterbattens		
Headlap	100mm									
Gauge	285mm									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	D	D	N/A							
10m	D	D	N/A							
15m	D	D	N/A							
Zone 2										
5m	D	D	N/A							
10m	D	D	N/A							
15m	D	D	N/A							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required									

Site Altitude	201-300m			Tile Type:	Centurion			With Counterbattens		
Headlap	100mm									
Gauge	285mm									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	D	D	N/A							
10m	D	D	N/A							
15m	D	D	N/A							
Zone 2										
5m	D	D	N/A							
10m	D	D	N/A							
15m	D	D	N/A							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required									

Site Altitude	Greater than 300m			Tile Type:	Centurion			With Counterbattens		
For altitudes above 300m, a full calculation to BS 6399-2 and BS 5534 is required										

Note: All perimeter tiles must be fixed including tiles adjacent to valleys and the tile fixing specifications given in the following tables apply to all roof areas.

Zonal Fixing Specification Method (Single Lap Tiles)	
A	No fixings required
B	Each tile once nailed (right hand hole on flat tiles)
C	Each tile twice nailed (flat tiles only)
D	Each tile clipped
E	Each tile once nailed and clipped
F	Each tile twice nailed and clipped
*	requires the use of improved nails (eg C*)

Site Altitude	Tile Type: Gemini						With Counterbattens		
0-100m									
Headlap	75mm			80mm			95mm		
Gauge	195mm			190mm			175mm		
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°
Zone 1									
5m	E	B*	B*	E	B*	B*	E	B*	B*
10m	E	E	E	E	E	E	E	B*	E
15m	E	E	E	E	E	E	E	E	E
Zone 2									
5m	E	E	E	E	E	E	E	E	E
10m	E	E	E	E	E	E	E	E	E
15m	E	E	E	E	E	E	E	E	E
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required								

Site Altitude	Tile Type: Gemini						With Counterbattens		
101-200m									
Headlap	75mm			80mm			95mm		
Gauge	195mm			190mm			175mm		
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°
Zone 1									
5m	E	E	E	E	E	E	E	E	E
10m	E	E	E	E	E	E	E	E	E
15m	E	E	E	E	E	E	E	E	E
Zone 2									
5m	E	E	E	E	E	E	E	E	E
10m	E	E	E	E	E	E	E	E	E
15m	E	E	E	E	E	E	E	E	E
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required								

Site Altitude	Tile Type: Gemini						With Counterbattens		
201-300m									
Headlap	75mm			80mm			95mm		
Gauge	195mm			190mm			175mm		
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°
Zone 1									
5m	E	E	E	E	E	E	E	E	E
10m	E	E	E	E	E	E	E	E	E
15m	E	E	E	E	E	E	E	E	E
Zone 2									
5m	E	E	E	E	E	E	E	E	E
10m	E	E	E	E	E	E	E	E	E
15m	E	E	E	E	E	E	E	E	E
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required								

Site Altitude	Tile Type: Gemini						With Counterbattens		
Greater than 300m									
For altitudes above 300m, a full calculation to BS 6399-2 and BS 5534 is required									

Note: All perimeter tiles must be fixed including tiles adjacent to valleys and the tile fixing specifications given in the following tables apply to all roof areas.

Zonal Fixing Specification Method (Single Lap Tiles)	
A	No fixings required
B	Each tile once nailed (right hand hole on flat tiles)
C	Each tile twice nailed (flat tiles only)
D	Each tile clipped
E	Each tile once nailed and clipped
F	Each tile twice nailed and clipped
*	requires the use of improved nails (eg C*)

Site Altitude	0-100m			Tile Type: Minislate			With Counterbattens		
Headlap	75mm			80mm					
Gauge	195mm			190mm					
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°
Zone 1									
5m	C*	B*	B*	C*	B*	B*			
10m	C*	C	C	C*	C	C			
15m	E*	C	C	E*	C	C			
Zone 2									
5m	E*	C	C	E*	C	C			
10m	E*	C*	C*	E*	C*	C*			
15m	E*	C*	C*	E*	C*	C*			
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required								

Site Altitude	101-200m			Tile Type: Minislate			With Counterbattens		
Headlap	75mm			80mm					
Gauge	195mm			190mm					
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°
Zone 1									
5m	E*	C	C	C*	C	C			
10m	E*	C*	C*	E*	C	C*			
15m	E*	C*	C*	E*	C*	C*			
Zone 2									
5m	E*	C*	C*	E*	C*	C*			
10m	E*	C*	C*	E*	C*	C*			
15m	E*	C*	C*	E*	C*	C*			
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required								

Site Altitude	201-300m			Tile Type: Minislate			With Counterbattens		
Headlap	75mm			80mm					
Gauge	195mm			190mm					
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°
Zone 1									
5m	E*	C	C*	E*	C	C*			
10m	E*	C*	C*	E*	C*	C*			
15m	E*	C*	C*	E*	C*	C*			
Zone 2									
5m	E*	C*	C*	E*	C*	C*			
10m	E*	E*	E*	E*	E*	E*			
15m	E*	E*	E*	E*	E*	E*			
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required								

Site Altitude	Greater than 300m			Tile Type: Minislate			With Counterbattens		
For altitudes above 300m, a full calculation to BS 6399-2 and BS 5534 is required									

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C	Each tile twice nailed (flat tiles only)
D	Each tile clipped
E	Each tile once nailed and clipped
F	Each tile twice nailed and clipped
*	requires the use of improved nails (eg C*)

Site Altitude	0-100m			Tile Type: Senator			With Counterbattens		
Headlap	75mm								
Gauge	310mm								
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°
Zone 1									
5m	D	D	E						
10m	D	D	E						
15m	D	D	E						
Zone 2									
5m	D	D	E						
10m	D	D	E						
15m	D	D	E						
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required								

Site Altitude	101-200m			Tile Type: Senator			With Counterbattens		
Headlap	75mm								
Gauge	310mm								
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°
Zone 1									
5m	D	D	E						
10m	D	D	E						
15m	D	D	E						
Zone 2									
5m	D	D	E						
10m	D	D	E						
15m	D	D	E						
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required								

Site Altitude	201-300m			Tile Type: Senator			With Counterbattens		
Headlap	75mm								
Gauge	310mm								
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°
Zone 1									
5m	D	D	E						
10m	D	D	E						
15m	D	D	E						
Zone 2									
5m	D	D	E						
10m	D	D	E						
15m	D	D	E						
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required								

Site Altitude	Greater than 300m	Tile Type: Senator	With counterbattens
For altitudes above 300m, a full calculation to BS 6399-2 and BS 5534 is required			

Note: All perimeter tiles must be fixed including tiles adjacent to valleys and the tile fixing specifications given in the following tables apply to all roof areas.

Zonal Fixing Specification Method (Single Lap Tiles)	
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C	Each tile twice nailed (flat tiles only)
D	Each tile clipped
E	Each tile once nailed and clipped
F	Each tile twice nailed and clipped
*	requires the use of improved nails (eg C*)

Site Altitude	0-100m			Tile Type:	V2			With Counterbattens		
Headlap	75mm									
Gauge	310mm									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 2										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required									

Site Altitude	101-200m			Tile Type:	V2			With Counterbattens		
Headlap	75mm									
Gauge	310mm									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 2										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required									

Site Altitude	201-300m			Tile Type:	V2			With Counterbattens		
Headlap	75mm									
Gauge	310mm									
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	
Zone 1										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 2										
5m	D	D	E							
10m	D	D	E							
15m	D	D	E							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required									

Site Altitude	Greater than 300m			Tile Type:	V2			With Counterbattens		
For altitudes above 300m, a full calculation to BS 6399-2 and BS 5534 is required										

Note: All perimeter tiles must be fixed including tiles adjacent to valleys and the tile fixing specifications given in the following tables apply to all roof areas.

Zonal Fixing Specification Method (Single Lap Tiles)	
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E	Each tile once nailed and clipped
F	Each tile twice nailed and clipped
*	requires the use of improved nails (eg C*)

Site Altitude	0-100m			Tile Type:	With Counterbattens		
Headlap							
Gauge							
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35° 35° - 44° 45° - 54°
Zone 1							
5m							
10m							
15m							
Zone 2							
5m							
10m							
15m							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required						

Site Altitude	101-200m			Tile Type:	With Counterbattens		
Headlap							
Gauge							
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35° 35° - 44° 45° - 54°
Zone 1							
5m							
10m							
15m							
Zone 2							
5m							
10m							
15m							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required						

Site Altitude	201-300m			Tile Type:	With Counterbattens		
Headlap							
Gauge							
Rafter Pitch	Below 35°	35° - 44°	45° - 54°	Below 35°	35° - 44°	45° - 54°	Below 35° 35° - 44° 45° - 54°
Zone 1							
5m							
10m							
15m							
Zone 2							
5m							
10m							
15m							
Zone 3	For Zone 3, a full calculation to BS 6399-2 and BS 5534 is required						

Site Altitude	Greater than 300m			Tile Type:	With Counterbattens		
For altitudes above 300m, a full calculation to BS 6399-2 and BS 5534 is required							