Roof Systems

A guide to Boral's roof tiles & accessories

Roof Systems

A guide to Boral's roof tiles & accessories

Terracotta Profiles

shaped roof tiles

Shaped Terracotta Range

French

Product Specifications

Quality and beauty is best expressed in the French Terracotta roof tiles. Clay has long been the traditional roof tile material, as terracotta provides both strength and insulation against temperature and weather. The French Terracotta roof tiles unique two valley shape gives the roof line a look of texture and flow. It will give your home a look of refinement and classical style and is ideal for both rural and city living.

French Terracotta roof tiles interlock at the head and side lap and are laid in a cross bond pattern. To ensure maximum weather proofing the nail hole for tile fixing has been designed in the batten lug on the underside of the tile and is unique to Boral Roofing.

For further fixing details refer to Roof Installation Section.

Coverage

No. of tiles per m (squared): 11.9

Dimensions (Nominal)

Actual length:	423 mm
Actual width:	265 mm
Exposed length:	355 mm
Exposed width:	236 mm

Mass (Nominal)

Mass per tile:	3.1 kg
Mass per m (squared):	37.2 kg

Set Out (Nominal)

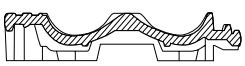
Batten spacing: 337 mm min. – 362 mm max.

It is good tiling practice to check the gauge of all kiln fired clay roof tiles at the site.

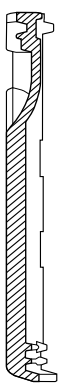
Recommended Bond

Cross Bond

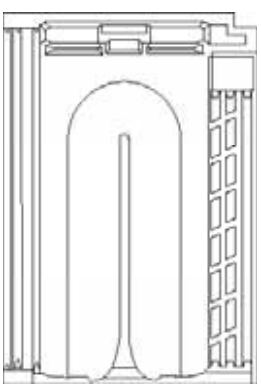
Cross section



Longitudinal section



Plan view



Availability: NSW, QLD and VIC

shaped roof tiles

Flat Concrete Range

French

Minimum Roof Pitch

Minimum recommended pitch under normal conditions, is 15° with sarking and 20° without sarking. Sarking may be required at pitches greater than 20° in areas requiring special consideration, such as coastal areas and exposed or elevated sites.

Maximum rafter length

At the minimum roof pitch the maximum rafter length allowed is 4.5 metres. For rafter lengths over 4.5 metres, Boral Roofing recommends you add 2° to the pitch for every metre of additional rafter length.

(The maximum un-sarked rafter length is 6 metres. This conforms with the requirements of AS 2050.)

Quality

All tiles are designed to conform to the Australian Standards AS 2049 Roof Tiles, and AS 2050 Installation of roof tiles.

General

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Victoria
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66-67 Tootal Road Dingley Village
VIC 3172
PO Box 1060 Clayton
VIC 3169

South Australia
Boral Hollostone Masonry SA Pty Ltd
Main North Road
Pooraka SA 5095

BORAL

shaped roof tiles

Shaped Terracotta Range

Swiss

Product Specifications

Based on a bold European design, Swiss Terracotta roof tile's clean lines makes it ideal for modern and Mediterranean style homes. And it's as durable as it is stylish. Made from the finest clay in the world and designed by the world's leading tile craftsmen, Swiss roof tiles is suitable for a variety of modern roof applications, from homes to commercial buildings.

Swiss terracotta roof tiles interlock at the head and side lap and are laid in a straight bond pattern. To ensure maximum weather proofing the nail hole for tile fixing has been designed in the batten lug on the underside of the tile and is unique to Boral Roofing.

For further fixing details refer to Roof Installation Section.

Coverage

No. of tiles per m (squared): 13.2

Dimensions (Nominal)

Actual length:	418 mm
Actual width:	260 mm
Exposed length:	355 mm
Exposed width:	214 mm

Mass (Nominal)

Mass per tile:	3.2 kg
Mass per m (squared):	43.5 kg

Set Out (Nominal)

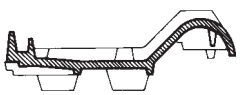
Batten spacing: 355 mm

It is good tiling practice to check the gauge of all kiln fired clay roof tiles at the site.

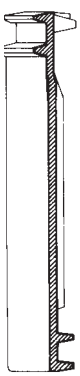
Recommended Bond

Straight Bond

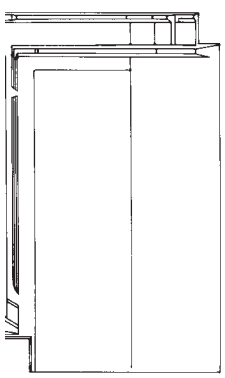
Cross section



Longitudinal section



Plan view



Availability: NSW, QLD and VIC

shaped roof tiles

Flat Concrete Range

Swiss

Minimum Roof Pitch

Minimum recommended pitch under normal conditions, is 15° with sarking and 20° without sarking. Sarking may be required at pitches greater than 20° in areas requiring special consideration, such as coastal areas and exposed or elevated sites.

Maximum Rafter Length

At the minimum roof pitch the maximum rafter length allowed is 4.5 metres. For rafter lengths over 4.5 metres, Boral Roofing recommends you add 2° to the pitch for every metre of additional rafter length.

(The maximum un-sarked rafter length is 6 metres. This conforms with the requirements of AS 2050.)

Quality

All tiles are designed to conform to the Australian Standards AS 2049 Roof Tiles, and AS 2050 Installation of Roof Tiles.

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Concrete Profiles

flat roof tiles

Flat Concrete Range

Linea

Product Specifications

The Linea shingle is a cost effective alternative to the traditional slate shingle which gives a distinct, clean sweeping look to any house design. The Linea shingle can be used to gain the rustic feel of a country house or create a vision of grandeur for a home in the city.

The smooth, flat design of the tile enables the natural curb of the roof to be accentuated. Made of durable concrete, each tile is a rugged performer against heat, wind and rain. Linea roof tiles are colour-through, which means they retain their colour presentation.

Coverage

No. of tiles per m (squared): 9.40

Dimensions (Nominal)

Actual length:	432 mm
Actual width:	345 mm
Exposed length:	357 mm
Exposed width:	300 mm

Mass (Nominal)

Mass per tile:	5.55 kg
Mass per m (squared):	52.20 kg

Set Out (Nominal)

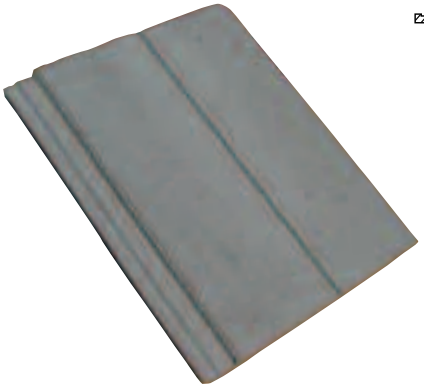
Batten spacing: 357 mm max.

Head Lap

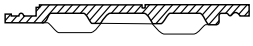
Minimum head lap shall be 75 mm. This may increase according to set out. However, head lap should not exceed 120 mm.

Recommended Bond

Quarter Bond

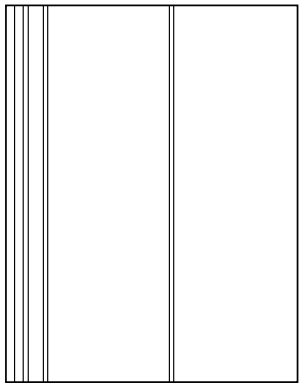


Cross section



Longitudinal section

Plan view



Availability: NSW, ACT, Queensland and Victoria

flat roof tiles

Linea

Minimum Roof Pitch

Minimum recommended pitch under normal conditions, is 20° with sarking. Some areas may require special consideration, such as coastal areas and exposed or elevated sites.

Maximum rafter length

At the minimum roof pitch the maximum rafter length allowed is 4.5 metres. For rafter lengths over 4.5 metres, Boral Roofing recommends you add 2° to the pitch for every metre of additional rafter length.

Quality

All tiles are designed to conform to the Australian Standards and good trade practice, AS 2049 roof tiles, and AS 2050 installation of roof tiles. All Boral roof tiles are tested by both Boral Roofing and the CSIRO Division of Building, Construction and Engineering to ensure the highest standards of quality, durability and performance.

Colours and Finishes

Please refer to the Boral Roofing brochures to determine the colours and finishes available in your state.

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Dingley Village
VIC 3172

Queensland
Boral Roofing
110-118 Cobalt Street
Carole Park QLD 4300

flat roof tiles

Flat Concrete Range

Striata

Product Specifications

The Striata shingle roof tile with its flat profile has been a preferred choice of discerning Australian home owners for decades. It offers a crisp, clean appearance that perfectly complements both traditional and modern homes.

They are an alternative to the very expensive slate tiles and timber shingles. The Striata is available with colour-through and with colour-on. Their low profile design and unique textured surface blend perfectly with country-style homes, colonial cottages and federation style homes and can also be used to great effect on some contemporary designs.

Coverage

No. of tiles per m (squared): 9.4

Dimensions (Nominal)

Actual length:	432 mm
Actual width:	345 mm
Exposed length:	357 mm
Exposed width:	300 mm

Mass (Nominal)

Mass per tile:	5.5 kg
Mass per m (squared):	51.7 kg

Set Out (Nominal)

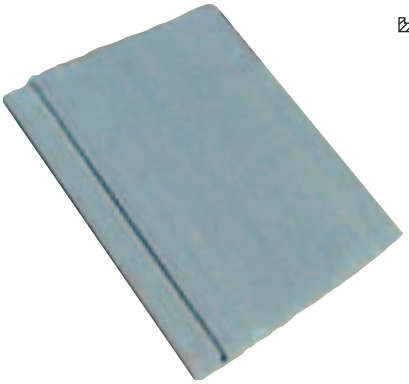
Batten spacing: 357 mm max.

Head Lap

Minimum head lap shall be 75 mm. This may increase according to set out. However, head lap should not exceed 120 mm.

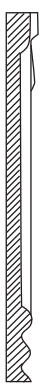
Recommended Bond

Cross Bond/Straight Bond

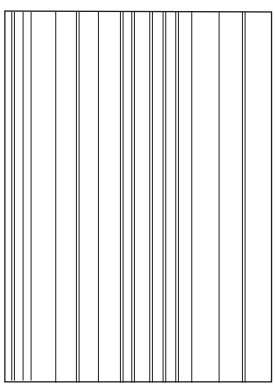


Cross section

Longitudinal section



Plan view



Availability: Striata is available in NSW and ACT

flat
roof tiles

Striata

Minimum Roof Pitch

Minimum recommended pitch under normal conditions,is 20° without sarking. Sarking may be required at pitches greater than 20° in areas requiring special consideration, such as coastal areas and exposed or elevated sites.

Maximum rafter length

At the minimum roof pitch the maximum rafter length allowed is 4.5 metres. For rafter lengths over 4.5 metres, Boral Roofing recommends you add 2° to the pitch for every metre of additional rafter length.

Quality

All tiles are designed to conform to the Australian Standards and good trade practice, AS 2049 roof tiles, and AS 2050 installation of roof tiles. All Boral roof tiles are tested by both Boral Roofing and the CSIRO Division of Building, Construction and Engineering to ensure the highest standards of quality, durability and performance.

Colours and Finishes

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Dingley Village
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Australian Capital Territory
Brick and Tile Display
16 Whyalla Street
Fyshwick ACT 2609

Queensland
Boral Roofing
110-118 Cobalt Street
Carole Park QLD 4300

flat roof tiles

Flat Concrete Range

Striata

Product Specifications

The Striata shingle roof tile with its flat profile has been a preferred choice of discerning Australian home owners for decades. It offers a crisp, clean appearance that perfectly complements both traditional and modern homes.

They are an alternative to the very expensive slate tiles and timber shingles. The Striata is available in a colour-on finish. Their low profile design and unique textured surface blend perfectly with country-style homes, colonial cottages and federation style homes and can also be used to great effect on some contemporary designs.

Coverage

No. of tiles per m (squared): 9.4

Dimensions (Nominal)

Actual length:	432 mm
Actual width:	345 mm
Exposed length:	357 mm
Exposed width:	300 mm

Mass (Nominal)

Mass per tile:	5.5 kg
Mass per m (squared):	51.7 kg

Set Out (Nominal)

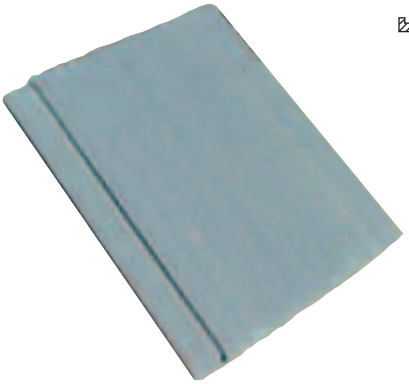
Batten spacing: 357 mm max.

Head Lap

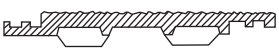
Minimum head lap shall be 75 mm. This may increase according to set out. However, head lap should not exceed 120 mm.

Recommended Bond

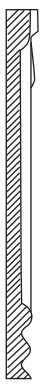
Cross Bond



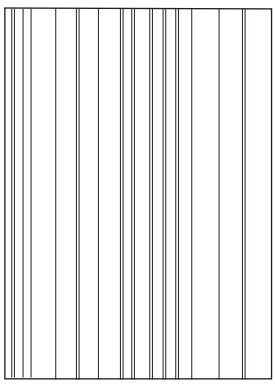
Cross section



Longitudinal section



Plan view



Availability: Queensland

flat
roof tiles

Striata

Minimum Roof Pitch

Minimum recommended pitch under normal conditions,is 20° without sarking. Sarking may be required at pitches greater than 20° in areas requiring special consideration, such as coastal areas and exposed or elevated sites.

Maximum rafter length

At the minimum roof pitch the maximum rafter length allowed is 4.5 metres. For rafter lengths over 4.5 metres, Boral Roofing recommends you add 2° to the pitch for every metre of additional rafter length.

Quality

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Colours and Finishes

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flat roof tiles

Flat Concrete Range

Striata

Product Specifications

The Striata shingle roof tile with its flat profile has been a preferred choice of discerning Australian home owners for decades. It offers a crisp, clean appearance that perfectly complements both traditional and modern homes.

They are an alternative to the very expensive slate tiles and timber shingles. The Striata is available with colour-through and with colour-on. Their low profile design and unique textured surface blend perfectly with country-style homes, colonial cottages and federation style homes and can also be used to great effect on some contemporary designs.

Coverage

No. of tiles per m (squared): 9.4

Dimensions (Nominal)

Actual length:	432 mm
Actual width:	345 mm
Exposed length:	357 mm
Exposed width:	300 mm

Mass (Nominal)

Mass per tile:	5.5 kg
Mass per m (squared):	51.7 kg

Set Out (Nominal)

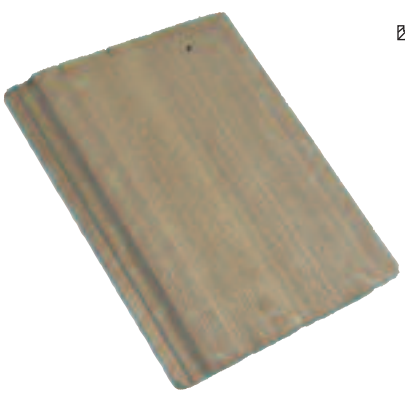
Batten spacing: 357 mm max.

Head Lap

Minimum head lap shall be 75 mm. This may increase according to set out. However, head lap should not exceed 120 mm.

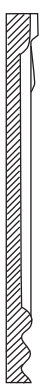
Recommended Bond

Cross Bond

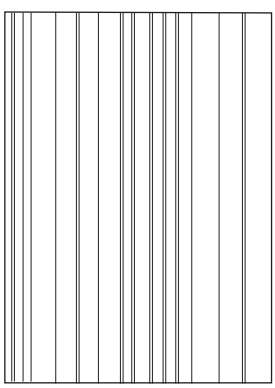


Cross section

Longitudinal section



Plan view



Availability: Striata is available in Victoria

flat
roof tiles

Striata

Minimum Roof Pitch

Minimum recommended pitch under normal conditions,is 20° without sarking. Sarking may be required at pitches greater than 20° in areas requiring special consideration, such as coastal areas and exposed or elevated sites.

Maximum rafter length

At the minimum roof pitch the maximum rafter length allowed is 4.5 metres. For rafter lengths over 4.5 metres, Boral Roofing recommends you add 2° to the pitch for every metre of additional rafter length.

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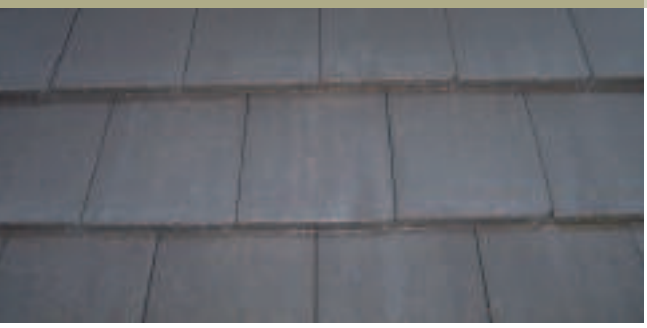


flat roof tiles

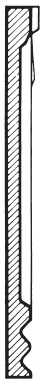
Flat Concrete Range

Uno

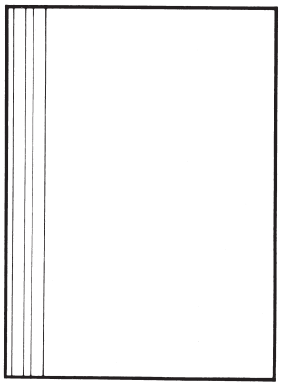
Product Specifications	The Uno shingle roof tile with its flat profile provides the continuous lines demanded by contemporary architecture while retaining the age old appearance of slate.	
Coverage	No. of tiles per m (squared):	9.4
Dimensions (Nominal)	Actual length:	432 mm
	Actual width:	345 mm
	Exposed length:	357 mm
	Exposed width:	300 mm
Mass (Nominal)	Mass per tile:	5.5 kg
	Mass per m (squared):	51.7 kg
Set Out (Nominal)	Batten spacing:	357 mm max.
Head Lap	Minimum head lap shall be 75 mm. This may increase according to set out, however; head lap should not exceed 120 mm.	
Recommended Bond	Cross Bond	

Cross section

Longitudinal section



Plan view



Availability: Victoria

flat
roof tiles

Uno

Minimum Roof Pitch

Minimum recommended pitch under normal conditions, is 20°. Some areas require special consideration, such as coastal areas and exposed or elevated sites. Sarking is mandatory.

Maximum rafter length

At the minimum roof pitch the maximum rafter length allowed is 4.5 metres. For rafter lengths over 4.5 metres, Boral Roofing recommends you add 2° to the pitch for every metre of additional rafter length.

Quality

All tiles are designed to conform to the Australian Standards and good trade practice, AS 2049 roof tiles, and AS 2050 installation of roof tiles. All Boral roof tiles are tested by both Boral Roofing and the CSIRO Division of Building, Construction and Engineering to ensure the highest standards of quality, durability and performance.

Colours and Finishes

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General

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call us on 1300 363 072, or

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Sales offices

New South Wales
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South Penrith Business Centre
South Penrith NSW 2750

Victoria
Boral Roofing
Tootal Road
Dingley Village
VIC 3172

Australian Capital Territory
Brick and Tile Display
16 Whyalla Street
Fyshwick ACT 2609

Queensland
Boral Roofing
110-118 Cobalt Street
Carole Park QLD 4300

flat roof tiles

Flat Concrete Range

Shingle

Product Specifications

First there was the wooden shake. Then the slate shingle. And now Boral Roofing presents the Shingle, a flat profile concrete roof tile that is a long-lasting successor to the roof tile of our pioneers. Its clean, simple design, together with a unique striated surface, make it a popular choice for all kinds of roofs.

Coverage

No. of tiles per m (squared): 10.8

Dimensions (Nominal)

Actual length:	432 mm
Actual width:	315 mm
Exposed length:	332 mm
Exposed width:	280 mm

Mass (Nominal)

Mass per tile:	5.3 kg
Mass per m (squared):	57.3 kg

Set Out (Nominal)

Batten spacing: 332 mm max.

Head Lap

Minimum head lap shall be 100 mm. This may increase according to set out. However, head lap should not exceed 110 mm.

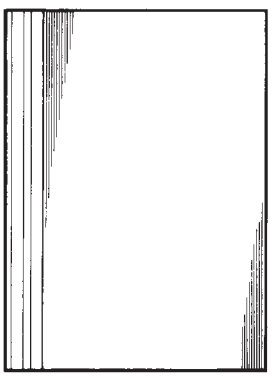
Recommended Bond

Cross Bond

Cross section

Longitudinal section

Plan view



Availability: South Australia

flat roof tiles

Flat Concrete Range

Shingle

Minimum Roof Pitch

Minimum recommended pitch under normal conditions, is 18° with sarking and 20° without sarking. Sarking may be required at pitches greater than 20° in areas requiring special consideration, such as coastal areas and exposed or elevated sites.

Maximum Rafter Length

At the minimum roof pitch the maximum rafter length allowed is 4.5 metres. For rafters over 4.5 metres, Boral Roofing recommends an increase of 2° to the pitch for every metre of additional rafter length.

Quality

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Colours and Finishes

Please refer to the Flat Concrete roof tile brochures to determine the colours and finishes available in your state.

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VIC 3172
PO Box 1060 Clayton
VIC 3169

South Australia
Boral Hollostone Masonry SA Pty Ltd
Main North Road
Pooraka SA 5095

BORAL

flat
roof tiles
Flat Concrete Range

Seamless Ridge Capping System™

Product Specifications

Seamless Ridge is exclusively available to suit Boral's, Flat Concrete roof tiles: Linea,Striata and Uno.

Hip and top ridge battens must be installed.

Coverage

Hips:	1 piece per tile course or 2.1 pieces per lineal metre
Top Ridge:	1.6 pieces per lineal metre

Dimensions (Nominal)

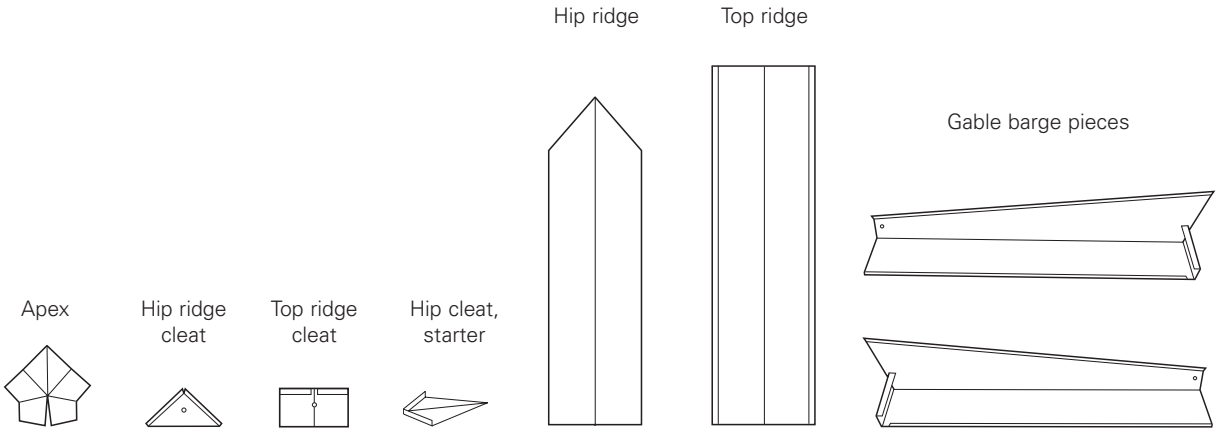
Hip Cap:	Actual length:	640 mm
	Actual width:	184 mm
	Exposed length:	490 mm
	Exposed width:	184 mm
Top Ridge Cap:	Actual length:	680 mm
	Actual width:	184 mm
	Exposed length:	600 mm
	Exposed width:	184 mm

Pitch Range

Minimum recommended pitch is 18° under normal conditions.
Pitch range is 18 - 35 degrees. (Greater pitches can be achieved with the use of purpose made top ridge sections. 3 - 4 weeks delay to process order).

Fixing Requirements

All seamless ridge pieces need to be positively fixed.
Please contact your state Boral Roofing Sales Office for technical details.
Note: Installers of the seamless ridge system require training and accreditation from Boral Roofing.



Availability: NSW, QLD and VIC

flat roof tiles

Flat Concrete Range

Seamless Ridge Capping System™

Quantities

Top Ridge Piece:	1 length, effective cover 600 mm
Top Ridge Cleat:	1 per length of ridge
Hip Ridge Piece:	1 length per tile course (Maximum tile course 356 mm)
Hip Ridge Cleat:	1 per length of ridge
Gable Barge Pieces:	1 length per tile course. (Maximum tile course 356 mm) To be ordered in pairs, left (finishes) or right (starters)
Apex pieces:	1 per apex intersection
Starter Cleat:	1 per hip

Performance

Wind Categories; N 1, N 2, N 3 and C 1

Atmospheric Environments; suitable for benign, mild and moderate categories.

General

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66-67 Tootal Road Dingley Village
VIC 3172
PO Box 1060 Clayton
VIC 3169

South Australia
Boral Hollostone Masonry SA Pty Ltd
Main North Road
Pooraka SA 5095

BORAL

shaped roof tiles

Shaped Concrete Range

Slimline

Product Specifications

Innovative. Bold. Modern. The Slimline's unique design is right at home on Australia's most progressive structures. Its low profile and clean, angular lines result in a roof that is as eye-catching as the home it's a part of.

Coverage

No. of tiles per m (squared): 9.2

Dimensions (Nominal)

Actual length:	432 mm
Actual width:	336 mm
Exposed length:	357 mm
Exposed width:	308 mm

Mass (Nominal)

Mass per tile:	4.80 kg
Mass per m (squared):	44.16 kg

Set Out (Nominal)

Batten spacing: 357 mm max.

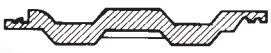
Head Lap

Minimum head lap shall be 75 mm. This may increase according to set out. However, head lap should not exceed 120 mm.

Recommended Bond

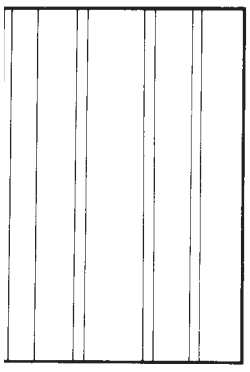
Straight Bond / Cross Bond

Cross section



Longitudinal section

Plan view



Availability: NSW and ACT

shaped roof tiles

Shaped Concrete Range

Slimline

Minimum Roof Pitch

Minimum recommended pitch under normal conditions, is 15° with sarking and 20° without sarking. Sarking may be required at pitches greater than 20° in areas requiring special consideration, such as coastal areas and exposed or elevated sites.

Maximum rafter length

At the minimum roof pitch the maximum rafter length allowed is 4.5 metres. For rafter lengths over 4.5 metres, Boral Roofing recommends you add 2° to the pitch for every metre of additional rafter length.

Quality

All tiles are designed to conform to the Australian Standards and good trade practice, AS 2049 Roof Tiles, and AS 2050 installation of Roof Tiles. All Boral roof tiles are tested by both Boral Roofing and the CSIRO Division of Building, Construction and Engineering to ensure the highest standards of quality, durability and performance.

Colours and Finishes

Please refer to the Shaped Concrete roof tile brochures to determine the colours and finishes available in your state.

General

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Victoria
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66-67 Tootal Road Dingley Village
VIC 3172
PO Box 1060 Clayton
VIC 3169

South Australia
Boral Hollostone Masonry SA Pty Ltd
Main North Road
Pooraka SA 5095

BORAL

shaped roof tiles

Shaped Concrete Range

Macquarie

Product Specifications

The Macquarie features a low, double curve profile designed to match the character and style of Australia's most fashionable homes. Beautiful, strong and durable, the Macquarie's superior performance is another reason why it's one of our most popular tiles.

Coverage

No. of tiles per m (squared): 9.2

Dimensions (Nominal)

Actual length:	432 mm
Actual width:	343 mm
Exposed length:	357 mm
Exposed width:	308 mm

Mass (Nominal)

Mass per tile:	4.65 kg
Mass per m (squared):	42.80 kg

Set Out (Nominal)

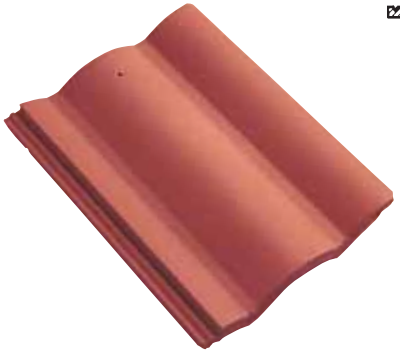
Batten spacing: 357 mm max.

Head Lap

Minimum head lap shall be 75 mm. This may increase according to set out. However, head lap should not exceed 120 mm.

Recommended Bond

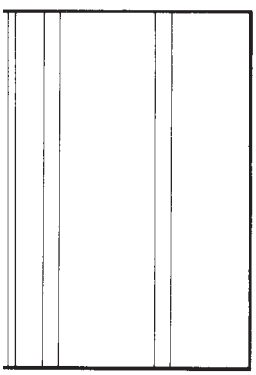
Straight Bond / Cross Bond



Cross section

Longitudinal section

Plan view



Availability: NSW, ACT, QLD and VIC

shaped roof tiles

Shaped Concrete Range

Macquarie

Minimum Roof Pitch

Minimum recommended pitch under normal conditions, is 15° with sarking and 20° without sarking. Sarking may be required at pitches greater than 20° in areas requiring special consideration, such as coastal areas and exposed or elevated sites.

Maximum rafter length

At the minimum roof pitch the maximum rafter length allowed is 4.5 metres. For rafter lengths over 4.5 metres, Boral Roofing recommends you add 2° to the pitch for every metre of additional rafter length.

Quality

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Colours and Finishes

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PO Box 1060 Clayton
VIC 3169

South Australia
Boral Hollostone Masonry SA Pty Ltd
Main North Road
Pooraka SA 5095

BORAL

shaped roof tiles

Shaped Concrete Range

Windsor

Product Specifications

The Windsor combines both traditional and modern design features. It is a practical tile with a striking appearance. A low, rounded mid-section contrasted with flat water channels makes the Windsor an ideal 'all rounder' – matching the character of many different home and building types.

Coverage

No. of tiles per m (squared): 9.2

Dimensions (Nominal)

Actual length:	432 mm
Actual width:	343 mm
Exposed length:	357 mm
Exposed width:	308 mm

Mass (Nominal)

Mass per tile:	4.75 kg
Mass per m (squared):	43.70 kg

Set Out (Nominal)

Batten spacing: 357 mm max. (NSW, Qld & Vic)

Head Lap

Minimum head lap shall be 75 mm. This may increase according to set out. However, head lap should not exceed 120 mm.

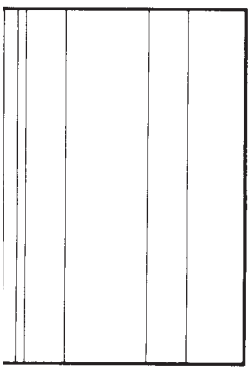
Recommended Bond

Straight Bond / Cross Bond

Cross section

Longitudinal section

Plan view



Availability: NSW, ACT, QLD and VIC

shaped roof tiles

Shaped Concrete Range

Windsor

Minimum Roof Pitch

Minimum recommended pitch under normal conditions, is 15° with sarking and 20° without sarking. Sarking may be required at pitches greater than 20° in areas requiring special consideration, such as coastal areas and exposed or elevated sites.

Maximum Rafter Length

At the minimum roof pitch the maximum rafter length allowed is 4.5 metres. For rafter lengths over 4.5 metres, Boral Roofing recommends you add 2° to the pitch for every metre of additional rafter length.

Quality

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Colours and Finishes

Please refer to the Shaped Concrete roof tile brochures to determine the colours and finishes available in your state.

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South Australia
Boral Hollostone Masonry SA Pty Ltd
Main North Road
Pooraka SA 5095

BORAL

shaped
roof tiles

Shaped Concrete Range

Capri

Product Specifications

One of our most popular profiles, the Capri roof tile's low, round shape make it an ideal choice for a wide range of classic, colonial and conventional home designs.

Coverage

No. of tiles per m (squared): 10.5

Dimensions (Nominal)

Actual length:	432 mm
Actual width:	315 mm
Exposed length:	343 mm
Exposed width:	280 mm

Mass (Nominal)

Mass per tile:	5.2 kg
Mass per m (squared):	54.6 kg

Set Out (Nominal)

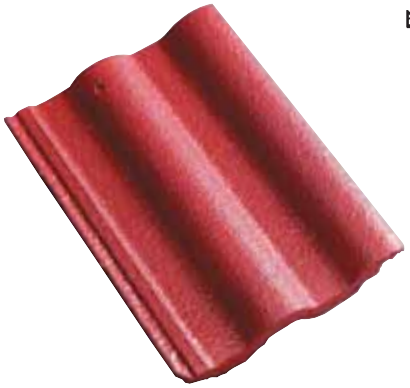
Batten spacing: 343 mm max.

Head Lap

Minimum head lap shall be 89 mm. This may increase according to set out. However, head lap should not exceed 100 mm.

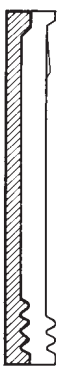
Recommended Bond

Cross Bond

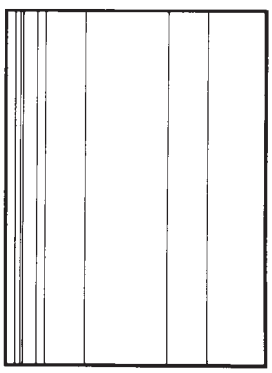


Cross section

Longitudinal section



Plan view



Availability: South Australia

shaped
roof tiles

Shaped Concrete Range

Capri

Minimum Roof Pitch

Minimum roof pitch with sarking is 15° and 18° without sarking. Sarking may be required at pitches greater than 18° in areas requiring special consideration, such as coastal areas and exposed or elevated sites.

Maximum Rafter Length

At the minimum roof pitch the maximum rafter length allowed is 4.5 metres. For rafters over 4.5 metres, Boral Roofing recommends an increase of 2° to the pitch for every metre of additional rafter length.

Quality

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Colours and Finishes

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VIC 3169

South Australia
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Main North Road
Pooraka SA 5095

BORAL

shaped
roof tiles

Shaped Concrete Range

Madrid/Provincial

Product Specifications

With its origins firmly in the Old Country, the Madrid captures the traditional charm and appearance of classic European roof tiles. And thanks to its high, rounded profile, lap moulding and special verandah effect, the Madrid boasts maximum protection against weathering.

The Madrid is available with colour-on and the Provincial with colour-through.

Coverage

No. of tiles per m (squared) 10.3

Dimensions (Nominal)

Actual length:	432 mm
Actual width:	315 mm
Exposed length:	332 mm
Exposed width:	295 mm

Mass (Nominal)

Mass per tile:	4.7 kg
Mass per m (squared)	48.4 kg

Set Out (Nominal)

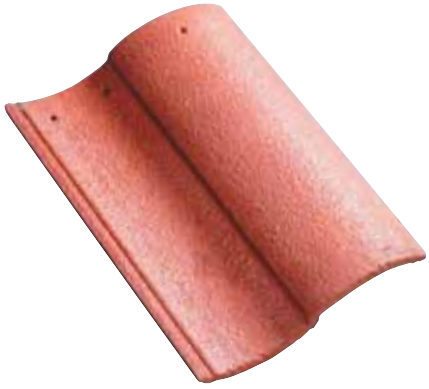
Batten spacing: 332 mm max.

Head Lap

Minimum head lap shall be 100 mm. This may increase according to set out. However, head lap should not exceed 110 mm.

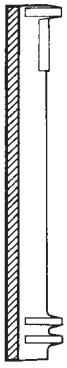
Recommended Bond

Straight Bond

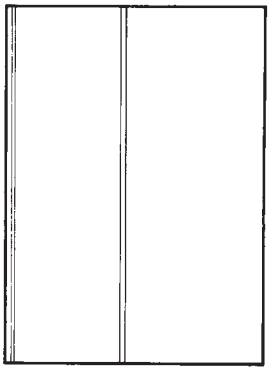


Cross section

Longitudinal section



Plan view



Availability: Madrid: South Australia. Provincial: South Australia and Victoria.

shaped roof tiles

Shaped Concrete Range

Madrid/Provincial

Minimum Roof Pitch

Minimum roof pitch with or without sarking is 20°. Sarking may be required at pitches greater than 20° in areas requiring special consideration, such as coastal areas and exposed or elevated sites.

Maximum rafter length

At the minimum roof pitch the maximum rafter length allowed is 4.5 metres. For rafter lengths over 4.5 metres, Boral Roofing recommends you add 2° to the pitch for every metre of additional rafter length.

Quality

All tiles are designed to conform to the Australian Standards and good trade practice, AS 2049 Roof Tiles, and AS 2050 installation of Roof Tiles. All Boral roof tiles are tested by both Boral Roofing and the CSIRO Division of Building, Construction and Engineering to ensure the highest standards of quality, durability and performance.

Colours and Finishes

Please refer to the Boral Roofing brochures to determine the colours and finishes available in your state.

General

Product information contained in this leaflet is correct at time of printing. However, due to Boral's commitment for continued improvement, specifications are subject to change without notice.

Boral Roofing's liability is limited to the replacement of product should it fail to perform as specified in literature current at the date of manufacture.

Fixing standards and product specifications contained in this leaflet are minimum recommendations based on Australian Standards and good trade practice. However, we recommend that local authorities are consulted as they may require different standards to be met.

For more information about Boral Shaped Concrete roof tiles and other Boral Roofing products including Terracotta Shingle™, Shaped Terracotta and Flat Concrete roof tile ranges:
call us on 1300 363 072, or
visit our website at www.boral.com.au/imagine

Sales offices

New South Wales
Mackellar Street
Emu Plains
Private Bag 9001
South Penrith Business Centre
South Penrith NSW 2750

Australian Capital Territory
Brick and Tile Display
16 Whyalla Street
Fyshwick ACT 2609

Queensland
Boral Roofing
110-118 Cobalt Street
Carole Park QLD 4300

Victoria
Boral Roofing
66-67 Tootal Road Dingley Village
VIC 3172
PO Box 1060 Clayton
VIC 3169

South Australia
Boral Hollostone Masonry SA Pty Ltd
Main North Road
Pooraka SA 5095

BORAL

shaped
roof tiles

Shaped Concrete Range

Regent

Product Specifications

Although the same shape as the Capri tile, the Regent is different in one very important way – the colour goes through the body of the tile and it has an unique ribbed surface that not only increases water dispersion and reduces wind turbulence, but is ideal for adding a striking design touch to a wide range of homes.

Coverage

No. of tiles per m (squared): 10.5

Dimensions (Nominal)

Actual length:	432 mm
Actual width:	315 mm
Exposed length:	343 mm
Exposed width:	280 mm

Mass (Nominal)

Mass per tile:	5.2 kg
Mass per m (squared):	54.6 kg

Set Out (Nominal)

Batten spacing: 343 mm av.

Head Lap

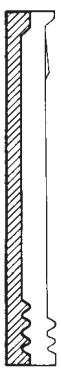
Minimum head lap shall be 89 mm. This may increase according to set out. However, head lap should not exceed 100 mm.

Recommended Bond

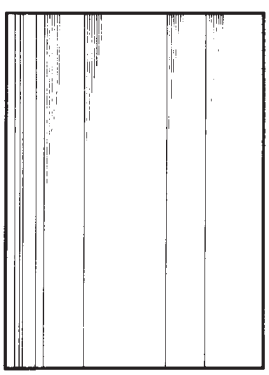
Cross Bond

Cross section

Longitudinal section



Plan view



Availability: South Australia

shaped roof tiles

Shaped Concrete Range

Regent

Minimum Roof Pitch

Minimum roof pitch with sarking is 15° and 18° without sarking. Sarking may be required at pitches greater than 18° in areas requiring special consideration, such as coastal areas and exposed or elevated sites.

Maximum Rafter Length

At the minimum roof pitch the maximum rafter length allowed is 4.5 metres. For rafters over 4.5 metres, Boral Roofing recommends an increase of 2° to the pitch for every metre of additional rafter length.

Quality

All tiles are designed to conform to the Australian Standards and good trade practice, AS 2049 Roof Tiles, and AS 2050 installation of Roof Tiles. All Boral roof tiles are tested by both Boral Roofing and the CSIRO Division of Building, Construction and Engineering to ensure the highest standards of quality, durability and performance.

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Sales offices

New South Wales
Mackellar Street
Emu Plains
Private Bag 9001
South Penrith Business Centre
South Penrith NSW 2750

Australian Capital Territory
Brick and Tile Display
16 Whyalla Street
Fyshwick ACT 2609

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110-118 Cobalt Street
Carole Park QLD 4300

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Boral Roofing
66-67 Tootal Road Dingley Village
VIC 3172
PO Box 1060 Clayton
VIC 3169

South Australia
Boral Hollostone Masonry SA Pty Ltd
Main North Road
Pooraka SA 5095

BORAL

Accessories

Terracotta Accessories

Ridge and Hip Tiles

Vee Ridge (130°)
Dimensions: 430L x 265W x 88D
Cover length: 400

Steep Pitch Vee Ridge (81°)
For roofs over 45° in pitch
Dimensions: 430L x 265W x 185D
Cover length: 400

Arched Ridge
(Special order)
Dimensions: 385L x 265W x 100D
Cover length: 300

Ridge and Hip Accessories

Vee Ridge Shell End (130°)
Dimensions: 430L x 265L x 70D

Arched Ridge Shell End
(Special order)
Dimensions: 385L x 265W x 100D

Apex Tiles

Vee Ridge

Vee Ridge Three Way Apex (130°)
Dimensions: 265W x 85D

Vee Ridge Four Way Apex (130°)
Dimensions: 365W x 85D

Please note that all dimensions are in millimetres

Terracotta Accessories

Apex Tiles

Arched Ridge

Arched Ridge Three Way Apex
(special order)

Arched Ridge Four Way Apex
(special order)

Spoon Apex

Spoon Apex
For closing multiple junctions

Barge Tiles

Universal Tapered Barge Capping
Dimensions: 430L x 140D
Cover length: 1 length per tile

Steep Pitch Vee Ridge (81°)
For roofs over 45° in pitch
Dimensions: 430L x 265W x 185D
Cover length: 400

Crests and Finials

Ridge Crest (130°)

Gable Finial (130°)

Three Way Apex Finial (130°)

Please note that all dimensions are in millimetres

Concrete Accessories

Ridge and Hip Tiles

Standard Ridge (130°)
Dimensions: 430L x 250W x 85D
Cover length: 400

Saw Tooth Ridge (90°)
Dimensions: 480L x 250W x 170D
Cover length: 450

Barge Tiles

Barge Capping (76°)
Gable end cover tile
Dimensions: 430L x 220W x 140D
Cover length: 1 length per tile

Apex Tiles

Ridge Apex

Three Way Apex (130°)
Dimensions:
430L x 440W x 85D

Four Way Apex (130°)
Dimensions:
370W x 140D

Spoon Apex

Spoon Apex
For closing multiple
hip junctions
Dimensions:
515L x 435W x 110D

Chinaman's Hat Apex (30°)
Dimensions:
690L x 180D

Crests and Finials

Ridge Crest (130°)
Dimensions: 150L x 245W x 130D

Gable Finial (130%)
Dimensions: 430L x 250W x 265D
Cover length: 400

Three Way Apex Finial (130°)
Dimensions: 430L x 440W x 300D

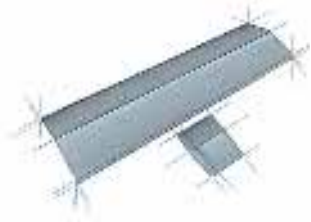
Please note that all dimensions are in millimetres

General Accessories

Seamless Ridge Capping System[PAT]

Hip Ridge and Cleat
Dimensions: 640L x 184W x 52D

Hip Starter Cleat
Dimensions: 300L x 120W x 20D



Top Ridge and Cleat
Dimensions: 680L x 184W x 27D

Barge Cover (Left)
Dimensions: 530L x 105W x 96D

Barge Cover (Right)
Dimensions: 530L x 105W x 96D

Apex

Acrylic Tiles

French Single/Double

Swiss Single/Double

Acrylic tiles are designed to be used in areas not exceeding1m^2.

Acrylic tiles, manufactured from transparent Plexiglas, are available to suit most Boral Roofing tile profiles in single or double tile sets.

Please note that all dimensions are in millimetres

General Accessories

Roof Tile Clips

Nail in Side Lap Clip (FCTNSCS)

Suit Swiss Terracotta roof tiles

Nail in Side Lap Clip (FCCNSCP)

Suit Macquarie, Windsor and Slimline roof tiles

Nail in Side Lap Clip (FCTCNSCFL)

Suit French, Linea and Striata roof tiles

Spring Wire Side Lap Clip

Clip-on head clip, for hardwood and softwood battens. Available to suit various profiles and batten sizes.

Boral Roofing clips are available for Boral concrete and terracotta roof tiles. Manufactured from corrosion resistant galvanised steel. Boral Roofing roof tile clips are suitable for both timber and metal battens.

General Accessories

Galvanised hip end tray – adjustable to any pitch supports the Shell End and cut tiles at hip ends.

Boral Roofing also maintains stocks of: Battens, Sarking, Anti-ponding board and accessories.

Please note that all dimensions are in millimetres

Design Solutions

Technical Information

Contents

Introduction

Foreword

This manual has been prepared by Boral Montoro Pty Ltd trading as Boral Roofing to assist the builder, the architect and the installer, to specify, detail, prepare and install roof tiles. While it is not possible to list and detail every condition which may be encountered, Boral Roofing will assist and advise on any special situations which may occur.

It should be noted that the manual has been written as a working guide for industry, however it is not intended to replace good trade practice and the long trade experience essential to obtain a quality roof installation.

Architects and specifiers should not only ensure that the details provided in this manual are followed, but should determine to their own satisfaction that the job is completed to an acceptable standard of trade practice.

Important

All care has been taken in the compilation of this manual. However Boral Roofing accepts no responsibility nor liability for the contents of the manual (including any printing or typographical errors) and recommends that all standards, specifications and recommendations be independently checked.

Note: The Instructions and details in this manual refer to both concrete and terracotta tiles (except where specifically noted).

Quality Control

Boral Roofing maintains a fully staffed Quality Control Laboratory. The product is meticulously tested for weight and dimensional stability, transverse strength, water absorption, permeability and colour consistency.

Specifications

Production information contained in this leaflet is correct at time of printing, however specifications are subject to change without notice.

Boral Roofing liability is limited to the replacement of product should it fail to perform as specified in literature current at the date of manufacture.

Local Authorities

Fixing standards and product specifications contained in this leaflet are minimum recommendations based on Australian Standards and good trade practice. It is however recommended that local authorities are consulted as they may require different standards to be met.

Performance

Boral Roof tiles will perform as specified if fixed in accordance with good trade practice and recommendations set down in this and other relevant literature.

These roof tile fixing specifications should be applied in the following context:

- in conjunction with, but subordinate to, state codes and regulations and Australian Standards.

The objective of these specifications is to provide up-to-date information for architects, building contractors and all persons responsible for purchasing and installing roof tiles. The material covers the range of Boral Roof tiles and accessories available in Australia, and the preferred methods and standards for fixing tiles, including special treatments.

The following points should be noted:

- The need to encourage the highest standards of trade practice to ensure long lasting and attractive roof finishes.
- The need to encourage compatibility between overlapping trades on building sites.
- The full range of products may not be available or applicable to all states at this time.
- Uniform fixing methods are given but there are some variations in procedure from state to state. Advice should be obtained locally.
- Special fixing standards apply to designated high wind areas.

Roofing Terminology

Abutment: Where the roof tiles meet a brick or timber structure rising above the roof.

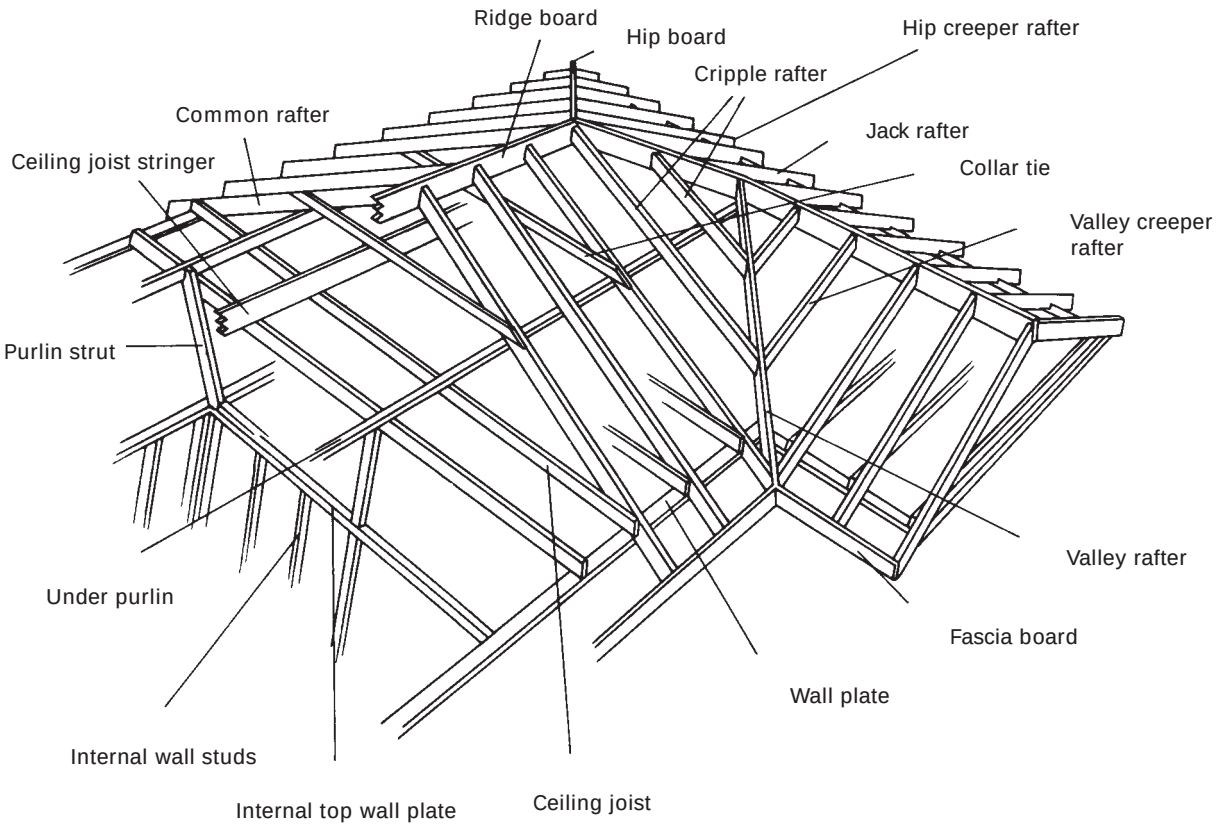
Accessory: A concrete or terracotta product used to finish the roof; included apex, ridge and barge tiles.

"A" Frame Roof: A steep pitched gable roof, each slope extending from close to the ground line to meet at the top ridge.

Apex: The intersection of all ascending hips where they meet either a ridge or another ascending hip. Note: Also the name of a three-or-four-way fitting used to cover this point.

Apron Flashing: A one piece flashing, such as is used at the lower side of a chimney, penetrating a sloping roof.

Roof Structural Members



Barge Board/Verge Board/ Gable Board:	A sloping board parallel with the pitch of the roof along a gable, covering the ends of roof timbers.
Anti-Ponding Board:	A lining of various materials, (galvanised iron, fibrous cement etc.), fixed along the eaves lines from the top of the fascia, back to the rafter with a clearance of 10 mm below the first batten.
Barge Course/Verge Course:	The tiles next to the gable, which overhang it slightly.
Bastard Valley or Hip:	A valley or hip formed in an abnormal or non-parallel line on which tiles are fixed.
Battens:	Selected sized timber fixed parallel to the eave line on which tiles are fixed.
Bedding:	Composition of sand and cement for fixing ridge capping on hips and ridges.
Bellcast Batten: (Tilting batten)	A batten fixed on the toe of the rafters in a vertical line with the plum cut, to keep the eaves course of tiles on the same rake as the other courses. (The fascia board generally serves this purpose.)
Bond:	The system of aligning tiles on the roof in relationship to each other. With straight bond the sides of tiles form straight lines from bottom to top course. With staggered, broken or cross bond, tiles in each alternate course overlap, by half, the tiles above and below them. For installation as a quarter bond, (Linea) tiles in each alternate course overlap by a quarter of the tile width.
Box Gutter:	An internal roof gutter between the slopes of a roof or a roof and a wall that discharges water internally through a sump.
Capillary Break:	A groove or space left between two surfaces, large enough to prevent capillary movement of water into a building.
Ceiling Joist:	The joists that carry the ceiling and also form a tie between the feet of the common rafters.
Cleat:	A small piece of wood reinforcing another or used to locate positively another timber.
Collar Tie:	The timber used to connect two rafters near their approximate centres.
Concealed Gable Flashing:	Normally a galvanised strip with an internal lip fixed under the fibre cement verge strip and running to the gutter line.
Counter Battens:	A batten normally fixed on top and parallel to the rafters over the ceiling lining where the ceiling lining is fixed on top of the rafters (exposed beams). Tiling battens are then fixed to the counter battens, creating an air space, allowing sarking to dish between the rafters.
Creeper Rafters:	Short rafters spanning between ridge and valley, reducing in length at the end which joins the valley rafter.

Cripple Creepers:	Joins the valley rafter to the hip rafter.
Dormer or Dormer Window:	A vertical window or opening, coming through a sloping roof and usually provided with its own pitched roof.
Dormer Cheek:	The upright side to a dormer.
Dutch Gable:	A roof having a gable near the ridge and the lower part hipped.
Eave or Eaves:	The lowest overhanging part of a sloping roof which projects beyond the external wall.
Eaves Fascia:	A board on edge fixed along the feet of the rafters. It often carries the eaves gutter along the eaves.
Facade:	The face or front of a building normally of steep elevation.
Fascia Board:	A wide board set vertically on edge, fixed to the rafter ends or wall plate or wall. It carries the gutter.
Fall:	The slope or pitch of a roof or gutter.
Finial:	Usually a pointed ornament at the top of a gable, hip junctions and dutch gables.
Fire Wall:	A wall which divides a building to resist the spread of fire. A fire resistant sealer is required between the top of the fire wall and the roofing materials, unlike a parapet wall which rises through the roof.
Flapping:	A noise caused by wind passing over a tile roof making sarking flap against the underside of the batten and tile. Anti-flap pads can be used to overcome this problem.
Flashing:	A strip of impervious flexible metal, which excludes water from the junction between a roof covering and another surface usually vertical.
Gable or Gable End:	The triangular part of the end wall of a building with a sloping roof.
Gable Roof:	A roof where two sloping planes join creating a gable end at one or both ends.
Gable Splayed:	The gable that does not run parallel with the roof slope and runs at an angle from an extended ridge.
Gauge:	The distance between the roof tile battens.
Gauge Stick:	A stick made from straight batten approximately 1800 mm long, marked by saw cuts at the correct gauge or set out for the tiles being used.

Glaze: A "frit" (glaze) fired onto the surface of terracotta roof tiles to provide various colours.

Gutter: Any form of roof water channel, viz:

Back Gutter – a gutter at the back of a chimney or other penetration in a pitched roof.
Box Gutter – a gutter with parallel sides, usually between two opposing roof slopes.
Concealed Gutter (Secret Gutter) – a gutter formed at a valley or against an abutment and concealed by the tiles and flashing.
Eaves Gutter – a gutter fixed at the eaves.
Valley Gutter – a gutter at the internal junction of two roof slopes.

High-Wind Area: Areas in which the basic design and wind velocity, modified for terrain and height in accordance with AS 1170.2, has a wind classification N3/C1 or greater.

Hip: The edge formed by the meeting of two pitched roof surfaces.

Hip Board: The board, set on edge, at which the hip rafters meet.

Hip Capping: (Ridging) A shaped capping on hips to prevent water penetration.

Hip End: The sloping triangular end of a hipped roof.

Hipped Roof: A roof which has four slopes instead of the two slopes of the ordinary gabled roof. The shorter sides are roofed with small sloping triangles, called the hipped (hip) ends, which are bounded by two hips above (meeting at the ridge) and eave below. Normally the eaves area at the same level all round.

Jack Rafter: The rafters are shorter than the common rafters and cut against the hip or valley rafters.

Lap: The distance by which one course of tiles overlaps the course below.

Lifts: Roofing trade term for stacks of tiles around the roofs.

Loading: The fixing, as specified by the tiling manufacturer, of sarking, battens, tiles and accessories shall be sufficient for the completed roof to withstand the loading requirements of AS 1170.1, AS 1170.2 and AS 4055.

Mansard Roof: A roof structure with two pitches, one a steep pitch and one a low pitch on each side of the ridge line. The steep pitch commences at the eaves, and intersects with the lower pitch which finished at the ridge. Tiles on the lower pitch overhang the steeper pitch by a slight margin.

Mitred Hips/Valleys:	Cut tiles on hips or valleys forming a true and straight line where the cut tiles join on each slope.
Mortar:	See "Bedding".
Mottle:	The phrase used to lay various coloured tiles at a consistent percentage throughout the roof.
Nogging:	Short pieces of timber nailed between studs in a wall to stiffen the structure.
Parapet Wall:	Usually a brick or timber structure rising above the roof line.
Picking Up:	The term used when the tiler is trowelling off any excess mortar that may overhang the ridge capping after bedding.
Pitch:	The ratio of the height to the span of a roof, or its angle of inclination to the horizontal.
Pointing:	A mixture of clean sand, cement and oxide colouring or a pre-mixed flexible material used for the completion of joints between ridge or hips and with roof tiles or tiles at gable ends.
Profile:	The end elevation or cross section of the tile to indicate shape and design of the tile.
Purlin:	A horizontal beam in a roof, at right angles to the principal rafters or trusses. It carries the common rafters if there are any.
Rafter:	A sloping timber extending from the eave to the ridge of a roof.
Rake:	The roofs angle of inclination from the horizontal.
Ridge:	The apex of a roof, usually a horizontal line.
Ridge Board:	The horizontal board set on edge, at which the rafters meet.
Ridge Capping:	A covering over a ridge line either "V" shaped or arched (rounded). This is generally a specifically made tile used for both the ridge and hips of a roof.
Roof:	A covering to protect a building from the elements.
Roof Tile:	A concrete or terracotta product used to form the field of the roof.
Sarking:	Reflective foil fixed under the tile battens and conforming to AS/NZS 4200-1-2.

Saw Tooth:	The roof structure which is vertical on one side with a slope from the ridge line on the other.
Secret Gutter:	A gutter usually fixed against a wall adjoining the roof slopes, concealed by the roof covering and vertical wall flashing, then spilling into an eaves gutter.
Scribe Board:	A type of barge board shaped to the same profile formed by the under surface of roof tiles, overhanging a gable end. The tiles which overhang are pointed up on the interlocking joints.
Skillon:	Term for low pitched roof continuing from the main slope or running off a wall.
Skylight:	A glazed window or translucent roof section fitted parallel to the roof slope to admit light.
Sheathing:	A close boarding or other material, nailed to the framework of wall or roof. Sometimes referred to as sheeting.
Soaker:	A concealed flashing under tiles, slates etc, or mitred hips and parapet walls, shaped and fixed to discharge water on the tile or slate of the course below.
Soffit:	The lining fixed under the eaves between the fascia board and external wall.
Soffit Bearer:	Timbers used to support the soffit.
Staggered Bond:	The method of laying tiles whereby the vertical joint of every tiles is laid to overlap with a half bond of the tiles in the course below.
Starter/Shell End:	The first hip cap at the lowest point of the hip line.
Straight Bond:	Where tiles are not staggered, but are laid directly on top of the tile in the course below, so the vertical joints form one straight line up the slope of the roof.
Steel Battens:	Steel battens shall be designed in accordance with AS 1538. They shall be manufactured of galvanised steel, of at least commercial grade, with a corrosion-resistant coating of a minimum of 300 g/m of zinc.
Stud:	A vertical wall support.
Tap Plate:	The horizontal timber above a wall on which the truss or rafter sits.

Tilting Batten:	Serves the same purpose as bellcast batten.
Tile Clip:	Specially formed metal fastening used to secure tiles to supporting members.
Truss Roofs:	A self supporting structural timber frame work of triangular shaped members. Usually prefabricated and delivered to job site. This type of construction is commonly used in all types of roofs.
Upright Work:	Tiling carried out on a roof pitched close to vertical, normally on a facade front, or a mansard roof.
Valley:	The intersection between two sloping surfaces of a roof, towards which water flows, the opposite of a hip.
Valley Iron/Tray:	A"V" shaped sheet lipped on each outside edge and formed to fit into the angle of the valley structure.
Valley Batten:	A tiling batten fixed parallel to each side of the valley board. It must be fixed on all valleys when the roof is sarked.
Vent:	Any pipe or tube protruding through the roof covering, normally circular in shape.
Verge:	The edge of a sloping roof which overhangs a gable.
Weephole:	A small hole inserted in the ridge bedding and pointing mortar at the water channel of the tile for draining purposes.
Z Flashing:	Normally a galvanised strip with an internal lip fixed under the fibre cement verge strip and run into the gutter line.

Design Considerations

2.1 Code Considerations

The design of a roof requires the consideration of many building codes and standards.

The following sections and tables summarise the major design requirements applicable to roof tiles. These requirements are by no means exclusive, as there may be any number of local regulative requirements of covenants. Specifiers are advised to ensure they have fully determined the local requirements.

2.2 Standards

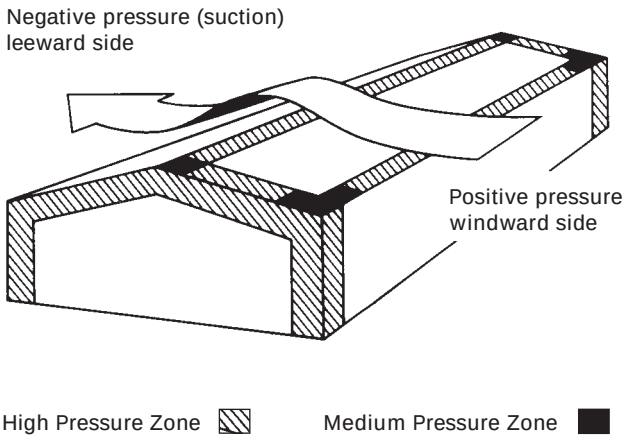
Boral Roofing tiles comply with the following standard: AS 2049 Roof Tiles.

Boral Roof fixing complies with the following standards: AS 2050 installation of Roof Tiles; Installation of Foil AS/NZ 4200.2, and Boral Roof Tiling Standards Manual.

2.3 Wind Forces

Wind Forces must be considered when designing or specifying roof structures and roofing materials. The forces involved may take the form of positive or negative pressure (suction).

Figure 2.3 Wind Forces on Roofs



The magnitude of these forces is affected by regional wind velocities, exposure and building configuration.

The methods for determining these are set out in the Standards Association of Australia Loading Code for Wind Forces (AS 1170 Part 2).

As an extension to this code, following Cyclone Tracy devastating Darwin in 1974 criteria were developed for the design of structures including roofing. The resultant set of guidelines is called Technical Record 440 (TR440) and is now deemed to be the standard for design of products for most cyclonic areas.

In the design of any roofing structure, consideration must be paid to the wind forces applicable to various portions of the roof and structure. This is particularly applicable in Australia to the areas north of latitude 27° South, and within 50 kms of the coast (including off shore islands) where cyclonic design criteria must be taken into account.

The design of the roof is determined by:

a) The regional basic design wind velocity (as determined by Australian Standard AS 1170, Part 2 "SAA Loading Code Wind Forces").

b) The terrain category of the buildings site (the local exposure of the roof as determined by Australian Standard AS 1170, Part 2 "SAA Loading Code Wind Forces").

c) Cyclonic extensions of these codes (special design considerations and load increases as determined by Technical Record 440 "Guidelines for the testing and evaluation of products for cyclone-prone areas").

d) Local requirements and covenants determined by State and or local statutory authorities. These may include statements of the conditions which are deemed to apply to the site in relation to items a), b) and c) above.

The specifications in this manual are designed to cover the requirements of a), b) and c), however local and special requirements must be determined through the relevant local authorities prior to specification of the final structure.

2.4 Wind Load Categories

The effect of local buildings, hills and vegetation is taken into account by the code as local structures and terrain features will dissipate the force of the wind. The wind load categories in Australia are defined by AS 1170.2 are as follows:

The four defined terrain categories are assessed by the direction and speed the wind flows towards a structure. Those quoted are in accordance with AS 1170.2.

Terrain Category
1, Z° = 0.002 m

Exposed open terrain with few or no obstructions, in which the average height of objects surrounding the structure is less than 1.5 metres. This category includes water surfaces (open sea coast and lakes), flat and treeless plains, and open snow fields.

Terrain Category
2, Z° = 0.02 m

Open terrain, grassland with few well-scattered obstructions having heights generally from 1.5 to 10.0 metres. This category includes open parkland and sparsely built up outskirts of towns and suburbs.

Terrain Category
3, Z° = 0.2 m

Terrain with numerous closely spaced obstructions having the size of domestic houses. This includes most suburban areas.

Terrain Category
4, Z° = 2.0 m

Terrain with numerous large, high (10.0 to 30.0 metres) and close obstructions, such as large city centres and well-developed industrial complexes.

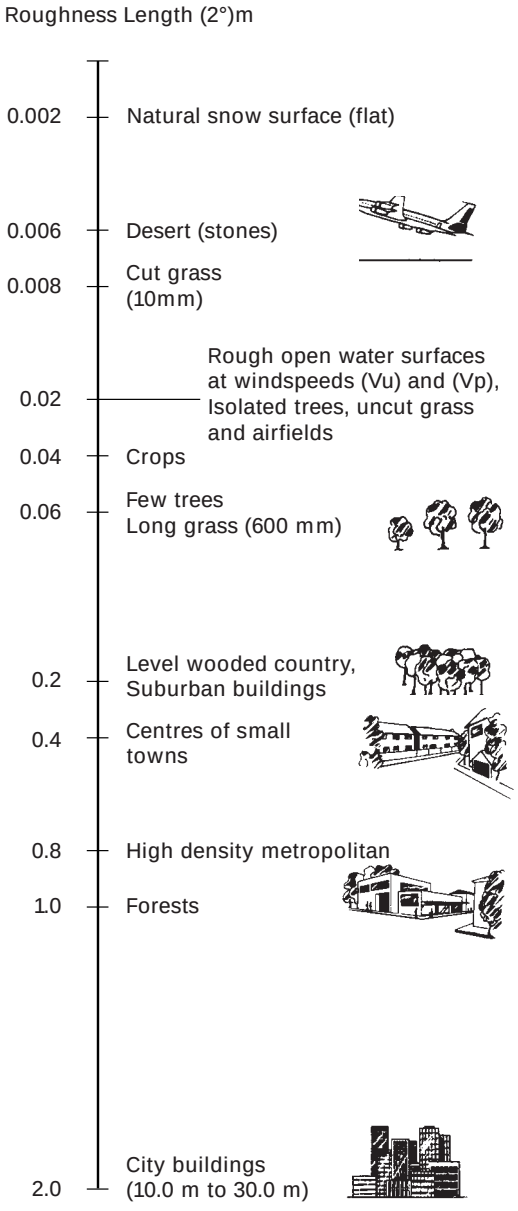
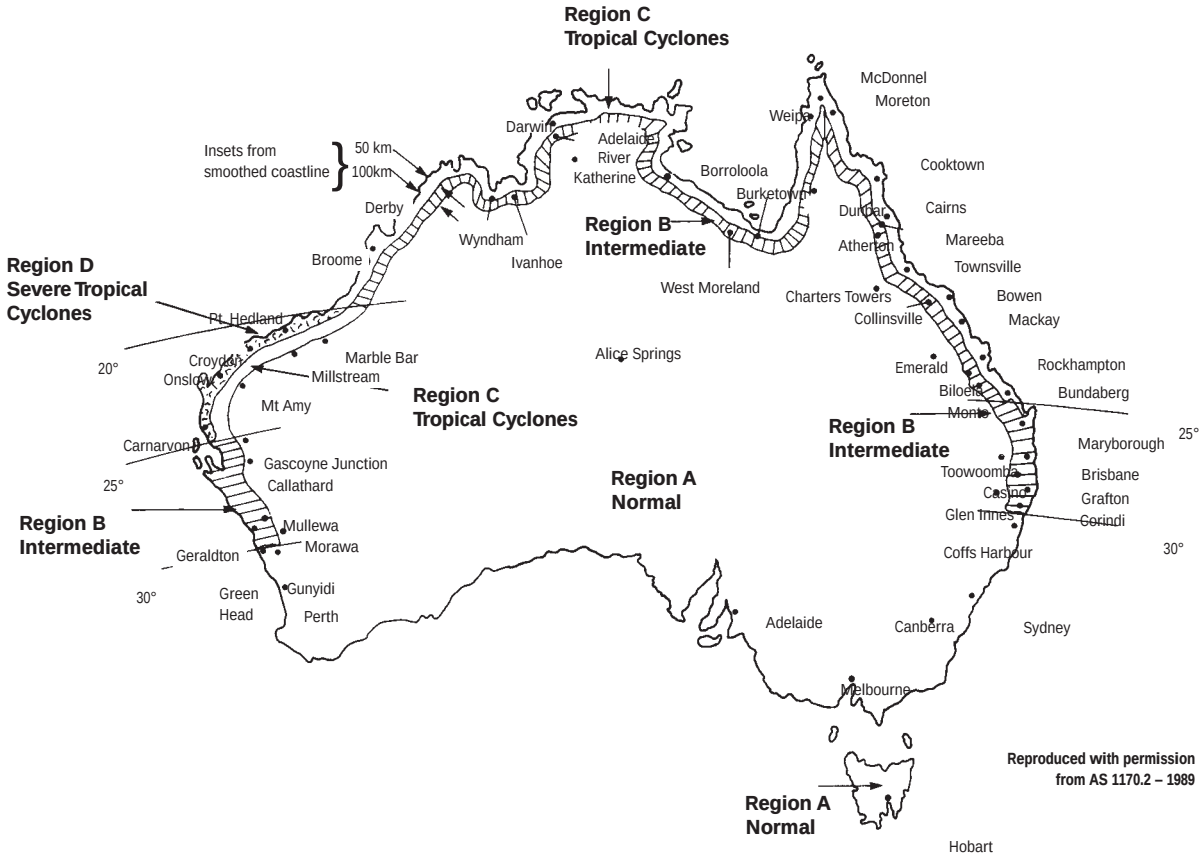


Figure 2.4 (a) Basic Wind Load Categories

Figure 2.4 (b) Basic Wind Speed Regions



Basic Wind Speed for Ultimate Strength in Different Regions

Region	Wind Speed (m/sec)
A	50
B	60
C	70
D	85

2.5 Minimum Roof Pitch

Boral Roofing tiles are designed and tested to suit all normal weather conditions. Table 2.5 indicates minimum roof pitches for Boral Roofing tiles. If there is any doubt regarding roof pitches please refer to Boral Roofing Sales Office.

Table 2.5 Minimum Roof Pitch – Degrees

Profile	Minimum Pitch Without Sarking	Minimum Pitch With Sarking
Concrete		
Macquarie	20	15
Windsor	20	15
Slimline	20	15
Striata	20	20
Linea	n/a	20
Uno	n/a	20
Madrid/Provincial	20	20
Capri	18	15
Regent	18	15
Shingle	20 (SA only)	18 (SA only)
Terracotta		
Monarch	20	15
Valente	20	15

2.6 Maximum Rafter Lengths

The minimum pitch recommended for a roof can be influenced by the water run off depth. Extremely long roof runs accumulate water to a considerable depth at the bottom of the run, particularly at low pitches, and under heavy rainfall conditions. Boral Roofing recommend that any roof with rafter lengths in excess of 4.5 metres should be installed at a pitch greater than the minimum stated in Table 2.5. As a general guide the specified pitch should increase by 2° for every additional metre of rafter length.

2.7 Maximum Rafter Lengths Without Sarking

AS 2050 Installation of roof tiles, item 3.1.5 provides the following information: "Long rafter lengths may require sarking to prevent inundation of the roof. These lengths may vary according to the tile type, the pitch of the roof and the exposure. The manufacturer's specifications should be consulted." Table 2.7 indicates maximum rafter lengths, measured from the topmost point of the rafter downwards, below which sarking shall be installed over the remainder of the rafter length.

Table 2.7 Sarking Requirements in Relation to Pitch/Rafter Length

Roof – Degrees of Pitch	Maximum Rafter Length Without Sarking (mm)
18 <20	4,500
20 <22	5,500
22	6,000

Preparation for Installation

3.1 General

The specifier should ensure that the roof structure complies with all relevant local and state statutory requirements and standards where applicable. Particular attention must be paid to the structure to ensure that it is square and straight and properly braced.

This stage of the construction is critically important where roof tiles are used as the slightest deviation from a plain surface will be noticeable on a finished roof and cannot be corrected by the tiler.

Inspection of product for transportation damage should be done upon receipt. If there is any visible damage, a claim should be filed promptly against the carrier.

Examine each pallet for colour, profile and damage. Check accessory items for proper colour, profile and damage. If there is damage to the tile or quantities delivered are not correct, please notify Boral Roofing or your local distributor immediately.

Suitable areas of the building sites should be made available and access should preferably be provided to all sides of the roof from these stacking locations in order to ensure the most efficient roof loading procedures.

3.2 Tile Set Out

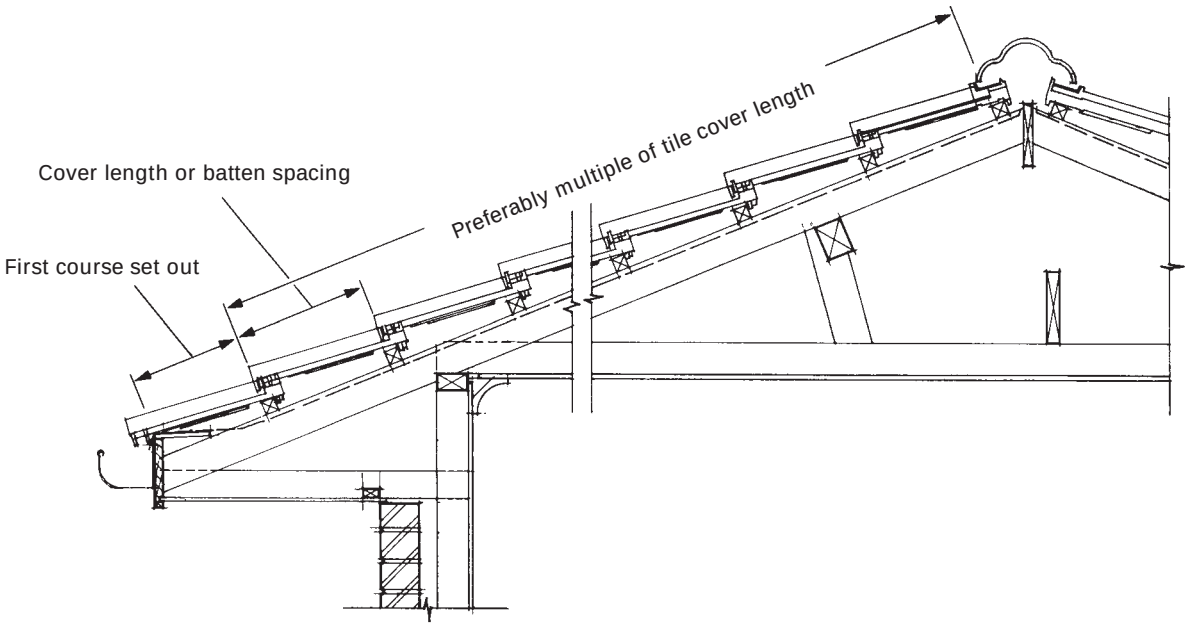
Boral Roofing tiles are designed to be consistent in dimension and set out, the design allowing some tolerance in set out to assist the roof tiler. It is recommended however, that designers should ensure that the rafter lengths be designed in order to avoid the cutting of roof tiles at the ridge line, eaves and gables. See Figure 3.2.1.

3.2.1 **Tile Set Out** (Terracotta & Concrete)

Tile set out should be to specifications provided by Boral Roofing for each tile profile. Please contact your state Boral Roofing Sales Office for details.

See Figure 3.2.1 for set out measurement points
3.2.1 (a) Concrete Tile Batten Gauge
3.2.1 (b) Terracotta Tile Batten Gauge.

Figure 3.2.1 Tile Set Out



How to apply the Boral Roofing Batten Gauge Ready Reckoner
(a) Concrete tiles

1. First set out nail to be fixed from front edge of fascia.
(i) when using 38 x 38mm battens = 315mm
(ii) when using 38 x 50mm battens = 303mm
(iii) when using Top Span 20 battens = 328mm

2. Top set out nail to be fixed down from centre of ridge board or truss.
(i) when using 38 x 25mm battens = 50mm
(ii) when using 50 x 25mm battens = 62mm
(iii) when using Top Span 20 battens = 35mm

3. Measure distance between bottom and top setout nails.

4. Look up this measurement on Ready Reckoner or find batten gauge.
For e.g. Rafter length of 4.550 then batten gauge is 0.350
and number of adjustable courses is 13.

Table 3.2.1 (a) Concrete Tile Batten Gauge

Batten Gauge	330 mm	335 mm	340 mm	345 mm	350 mm	355 mm	357 mm
Tile Courses	100 mm lap	←				→	75 mm lap
First Course	315 mm	315 mm	315 mm	315 mm	315 mm	315 mm	315 mm
2	645 mm	650 mm	655 mm	660 mm	665 mm	670 mm	672 mm
3	975 mm	985 mm	995 mm	1005 mm	1015 mm	1025 mm	1029 mm
4	1305 mm	1320 mm	1335 mm	1350 mm	1365 mm	1380 mm	1386 mm
5	1635 mm	1655 mm	1675 mm	1695 mm	1715 mm	1735 mm	1743 mm
6	1965 mm	1990 mm	2015 mm	2040 mm	2065 mm	2090 mm	2100 mm
7	2295 mm	2325 mm	2355 mm	2385 mm	2415 mm	2445 mm	2457 mm
8	2625 mm	2660 mm	2695 mm	2730 mm	2765 mm	2800 mm	2814 mm
9	2955 mm	2995 mm	3035 mm	3075 mm	3115 mm	3155 mm	3171 mm
10	3285 mm	3330 mm	3375 mm	3420 mm	3465 mm	3510 mm	3528 mm
11	3615 mm	3665 mm	3715 mm	3765 mm	3815 mm	3865 mm	3885 mm
12	3945 mm	4000 mm	4055 mm	4110 mm	4165 mm	4220 mm	4242 mm
13	4275 mm	4335 mm	4395 mm	4455 mm	4515 mm	4575 mm	4599 mm
14	4605 mm	4670 mm	4735 mm	4800 mm	4865 mm	4930 mm	4956 mm
15	4935 mm	5005 mm	5075 mm	5145 mm	5215 mm	5285 mm	5313 mm
16	5265 mm	5340 mm	5415 mm	5490 mm	5565 mm	5640 mm	5670 mm
17	5595 mm	5675 mm	5755 mm	5835 mm	5915 mm	5995 mm	6027 mm
18	5925 mm	6010 mm	6095 mm	6180 mm	6265 mm	6350 mm	6384 mm
19	6255 mm	6345 mm	6435 mm	6525 mm	6615 mm	6705 mm	6741 mm
20	6585 mm	6680 mm	6775 mm	6870 mm	6965 mm	7060 mm	7098 mm
21	6915 mm	7015 mm	7115 mm	7215 mm	7315 mm	7415 mm	7455 mm
22	7245 mm	7350 mm	7455 mm	7560 mm	7665 mm	7750 mm	7812 mm
23	7575 mm	7685 mm	7795 mm	7905 mm	8015 mm	8085 mm	8169 mm
24	7905 mm	8020 mm	8135 mm	8250 mm	8365 mm	8420 mm	8526 mm
25	8235 mm	8355 mm	8475 mm	8595 mm	8715 mm	8775 mm	8883 mm

☐ Sarking as required AS 2050 Installation of Roof Tiles.

Boral Roofing, Batten Gauge Ready Reckoner (b) Terracotta tiles

Table 3.2.1 (b) Terracotta Tile Batten Gauge

Courses	Valente Profile	Monarch Profile					
Batten Gauge	355 mm	Min. 337 mm	342 mm	347 mm	352 mm	357 mm	Max. 362 mm
First course	295 mm	310 mm	310 mm	310 mm	310 mm	310 mm	310 mm
2	650 mm	647 mm	652 mm	657 mm	662 mm	667 mm	672 mm
3	1005 mm	984 mm	994 mm	1004 mm	1014 mm	1024 mm	1034 mm
4	1360 mm	1321 mm	1336 mm	1351 mm	1366 mm	1381 mm	1396 mm
5	1715 mm	1658 mm	1678 mm	1698 mm	1718 mm	1738 mm	1758 mm
6	2070 mm	1995 mm	2020 mm	2045 mm	2070 mm	2095 mm	2120 mm
7	2425 mm	2332 mm	2362 mm	2392 mm	2422 mm	2452 mm	2482 mm
8	2780 mm	2669 mm	2704 mm	2739 mm	2774 mm	2809 mm	2844 mm
9	3135 mm	3006 mm	3046 mm	3086 mm	3126 mm	3166 mm	3206 mm
10	3490 mm	3343 mm	3388 mm	3433 mm	3478 mm	3523 mm	3568 mm
11	3845 mm	3680 mm	3730 mm	3780 mm	3830 mm	3880 mm	3930 mm
12	4200 mm	4017 mm	4072 mm	4127 mm	4182 mm	4237 mm	4292 mm
13	4555 mm	4354 mm	4414 mm	4474 mm	4534 mm	4594 mm	4654 mm
14	4910 mm	4691 mm	4756 mm	4821 mm	4886 mm	4951 mm	5016 mm
15	5265 mm	5028 mm	5098 mm	5168 mm	5238 mm	5308 mm	5378 mm
16	5620 mm	5365 mm	5440 mm	5515 mm	5590 mm	5665 mm	5740 mm
17	5975 mm	5702 mm	5782 mm	5862 mm	5942 mm	6022 mm	6102 mm
18	6330 mm	6039 mm	6124 mm	6209 mm	6294 mm	6379 mm	6464 mm
19	6685 mm	6376 mm	6466 mm	6556 mm	6646 mm	6736 mm	6826 mm
20	7040 mm	6713 mm	6808 mm	6903 mm	6998 mm	7093 mm	7188 mm
21	7395 mm	7050 mm	7150 mm	7250 mm	7350 mm	7450 mm	7550 mm
22	7750 mm	7387 mm	7492 mm	7597 mm	7702 mm	7807 mm	7912 mm
23	8105 mm	7724 mm	7834 mm	7944 mm	8054 mm	8164 mm	8274 mm
24	8460 mm	8061 mm	8176 mm	8291 mm	8406 mm	8521 mm	8636 mm
25	8815 mm	8398 mm	8518 mm	8638 mm	8758 mm	8878 mm	8998 mm

☐ Sarking as required AS 2050 Installation of Roof Tiles.

3.2.2 Counter Battens

Counter Battens are needed when the design calls for lining on top of the rafters such as raked ceilings or exposed rafters. In these circumstances a counter batten is fastened to the rafter through the ceiling lining. (Sarking must be used with raked or close boarded ceilings.) AS NZS 4200-2.

Figure 3.2.2 (a) Counter Batten Detail

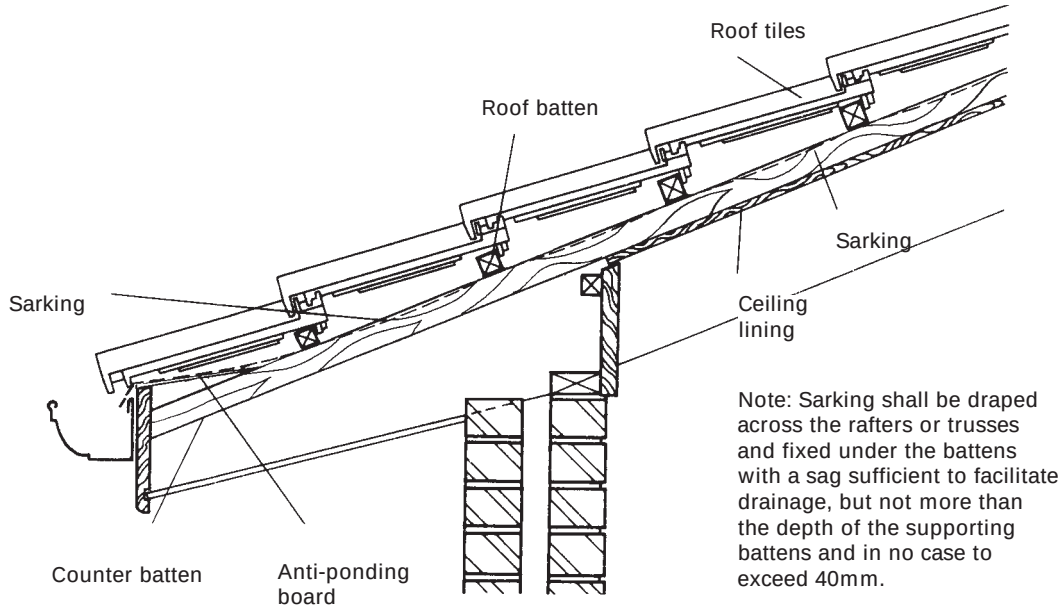
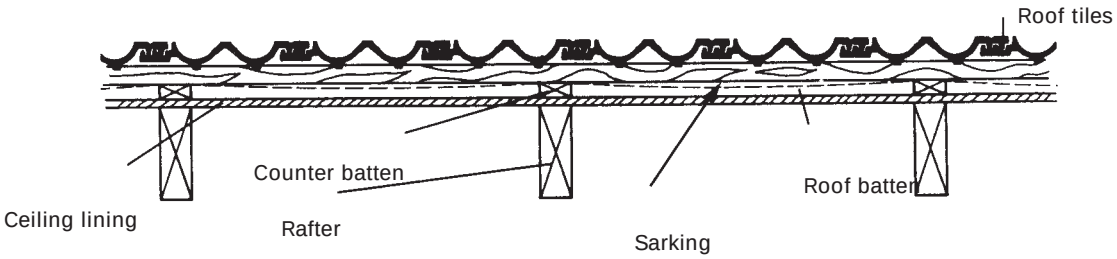


Figure 3.2.2 (b) Counter Batten Detail



3.2.3 Recommended Batten Sizes and Types

Batten sizes and types vary by region throughout Australia, depending on local practice, rafter spacing, timber availability etc. The following table summarises suitable batten types and current practices. It is recommended that local authorities be consulted before final specification of battens and requirements may vary. Battens that are warped, twisted, of uneven dimension, or excessively knotty, should not be used. Where steel battens are to be used, refer to the batten suppliers technical information.

Table 3.2.3 Batten Sizes and Rafter Spacings (mm)

Rafter Spacing	450 mm Softwood	450 mm Hardwood	600 mm Softwood	600 mm Hardwood	900 mm Softwood	900 mm Hardwood
New South Wales	38 x 28	38 x 25	38 x 38	38 x 25	63 x 38	50 x 38
Australian Capital Territory	38 x 28	38 x 25 50 x 25	38 x 38	38 x 25 50 x 25	63 x 38	50 x 38
Victoria		50 x 25	38 x 38	50 x 25		50 x 38
Queensland		50 x 25		50 x 25		50 x 38
South Australia		38 x 25		50 x 25		50 x 38
Tasmania		50 x 25		50 x 25		50 x 38
Western Australia		38 x 25		38 x 25		50 x 38

3.2.4 Batten Installation

Battens should be aligned within a tolerance of ± 2 mm in 4 m.

Joints in battens must be cut over the centre of the rafter or top chord and nailed.

Batten joints should be staggered over the roof so that no two consecutive battens are joined on the same rafter.

Battens are to be nailed at each rafter intersection. The nails are to penetrate the rafter to a depth of at least 10 times the diameter of the specified nail. (See appendix C Australian Standard 2050 for Acceptable nail sizes.)

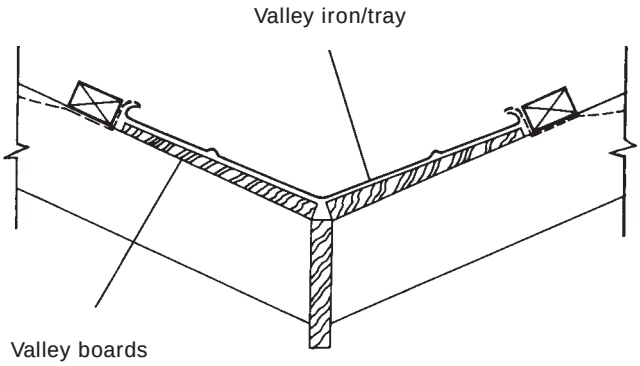
At valleys or hips, battens should be cut and nailed into the valley or hip boards in a manner which provides a firm support for the weight of the laid tiles.

3.3 Valleys

Valley boards and irons should be installed with enough depth in the valley iron so that it finishes level with the top of the roof batten when this is later installed.

Valley boards should be at least 19 mm thick and should be laid over the ends of the rafters where they join to valley rafters.

Figure 3.3 Standard Valley Detail

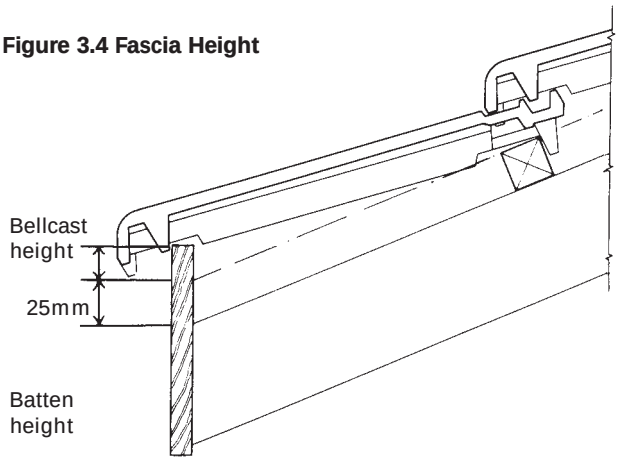


Where there is a change in direction of a valley, great care should be taken to ensure that valley boards and valley irons form a continuous water path to the eaves and that the lip of the valley should at all points, reach the height of the roofing battens.

3.4 Fascia Height

The "bellcast" or "tilt" is the additional height required on the fascia or bellcast/tilt batten (fascia batten) in order to bring the nose of the gutter course of tiles up to the correct height to enable the first tile course to sit on the same plane as the remainder of the roof.

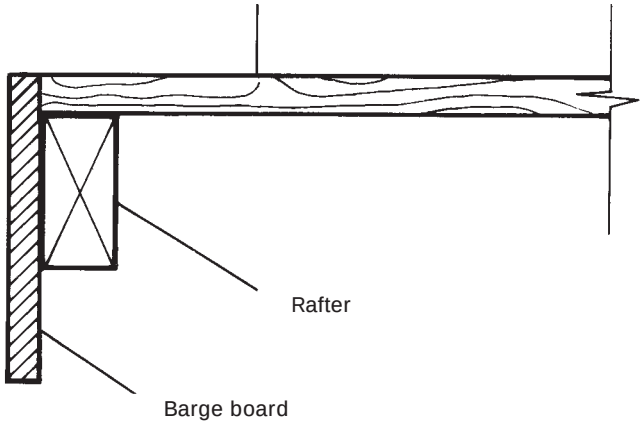
Figure 3.4 Fascia Height



3.5 Barge Height

The barge boards, where fitted, should be aligned to the level of the top of the roof battens.

Figure 3.5 Barge Height



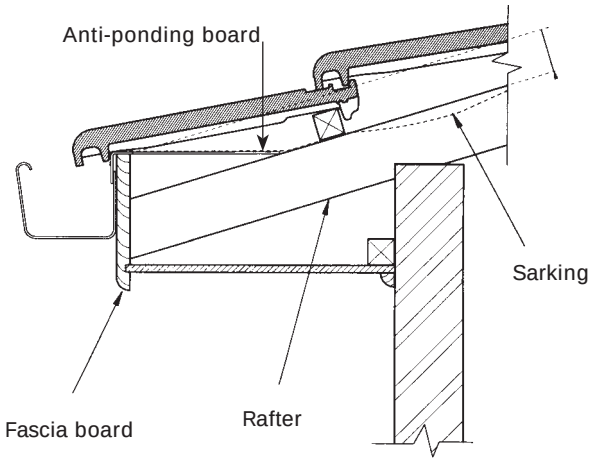
3.6 Anti-Ponding Boards

Where sarking is used anti-ponding boards should be installed at any point where the sarking might dish to a negative pitch. Anti-ponding boards are mandatory in the following situations:

a) On sarked roofs with pitches less than 20°.

b) On all roof pitches where sarking is used and there is no eaves overhang.

Figure 3.6 Anti-Ponding Boards at Eaves



3.7 Laying the Roof

3.7.1 Laying and Securing

Tiles should be laid and secured in accordance with AS 2050 Installation of roof tiles. All courses should be aligned horizontally and vertically. Secure tiles and ancillaries as per Table 3.7.1 (a).

Table 3.7.1 (a) Minimum Mechanical Installing Requirements for Tile and Ancillaries

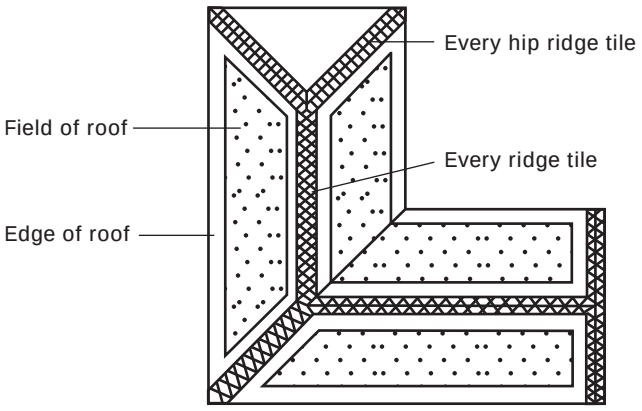
	Tile installing		Ancillary installing
Wind Classification	**Edge of roof**	**Field of roof**	**Ridge, hip & barge tiles**
N1 and N2	Mechanically fasten each full tile in second course and then every second tile in every course or every tile in each alternate course.		Mechanically fasten each tile.
N3 and C1	Mechanically fasten each full tile in second course	Mechanically fasten each second full tile in every course	Mechanically fasten each tile.
N4 and C3	Mechanically fasten every full tile	Mechanically fasten every full tile	Mechanically fasten each tile.

Notes:

1 For pitches over 35° extra precautions need to be taken. Contact Boral Roofing for technical recommendations.

2 For values greater than C3, contact Boral Roofing for technical recommendations.

Figure 3.7.1 Plan of a Typical L-shaped Hip and Gable Roof



3.7.2 First Course

The first course of tiles should be positioned to provide an adequate projection over the fascia and into the gutter. This projection is normally 50 mm for the terracotta and concrete tile range.

3.7.3 Tile Fastenings

Fastenings used to fix tiles to battens / purlins should be non-ferrous or galvanised clouts with a minimum 2.8 mm diameter. The fastening will be of such a length that the fastening will penetrate the batten / purlin not less than 15 mm. Galvanised fastenings to comply with AS 2334.

Roofing clips can be used for fixing both concrete and terracotta tiles where specified in place of clouts.

3.8 Roof Tile Fixing Systems

The design of the Boral Roofing tile allows various fixing methods to be used. Common practice is to nail fix or clip tiles.

Boral Roofing recommends that where clip fixing is required, the clips will be fixed at the SIDE LAP.

Clips and nails are suitable for fixing tiles in areas where the wind category is N4 or less.

In known high wind areas or where the wind classification is C (Cyclonic) Boral Roofing recommends the use of side lap clips for the tile installation.

Nails and clips are galvanised to conform to AS 2050 Installation of roof tiles, however, in extreme environmental conditions such as:

- Wind categories greater than N4, C3.
- Extreme marine environment or industrial environment.
- Marine environment.

Extra precautions may be required to combat wind loads or corrosion of the fastenings.

Contact Boral Roofing for technical recommendations.

Figure 3.8 (a) Nail Hole Position Monarch and Valente Tiles

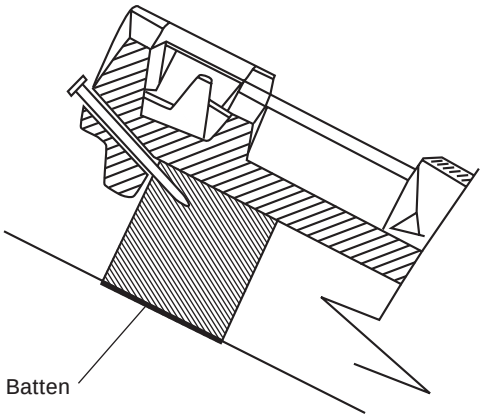


Figure 3.8 (b) Nail in Side Lap Clip (FCTCNSCFL)
Suits Linea, Striata, Uno and French tiles

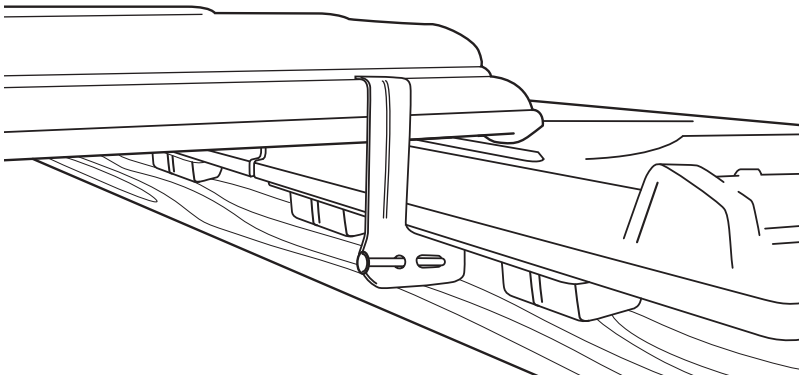


Figure 3.8 (c) Nail in Side Lap Clip (FCCNSCP)
Suit Macquarie, Windsor and Slimline tiles

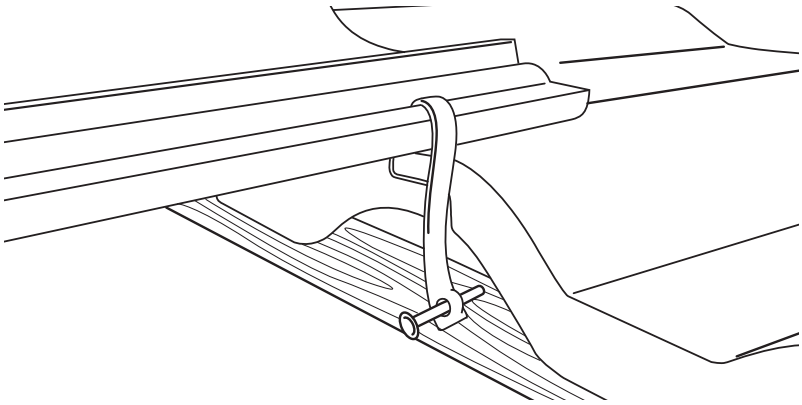
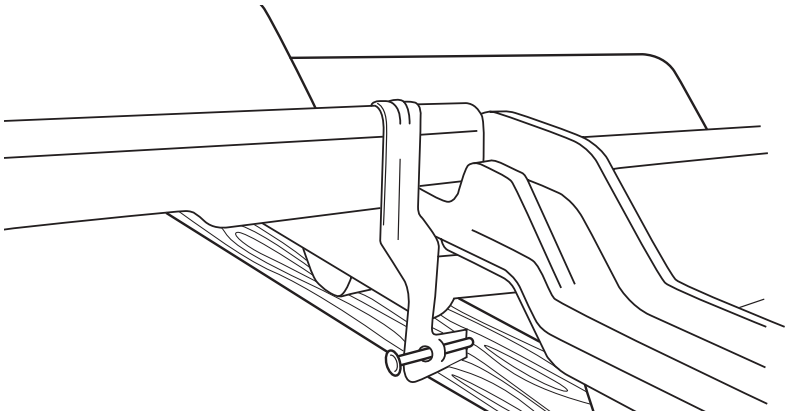


Figure 3.8 (d) Nail in Side Lap Clip (FCTNSCS)
Suit Swiss tile



3.9 Sarking

Sarking has two primary purposes, the provision of a reflective foil finish minimises heat transmission into the roof space and as a water resistant membrane sarking provides a secondary barrier to water entry, particularly at lower roof pitches and where high wind can cause a drift or spray of moisture to pass into the roof space. Sarking is mandatory where the wind classification is greater than N3.
There are also a number of circumstances which dictate the use of sarking as a protective measure against damage irrespective of roof pitch.

a) Where local regulatory authorities require the use of sarking or where extreme weather conditions are probable i.e. cliff tops, open exposed site or bushfire prone areas.

b) Where overhanging trees leave the possibility of the occasional branch breaking, resulting in broken tiles.

c) Immediately underneath and extending to the gutter around solar hot water collectors.

d) Where water run off from a high level valley discharges onto tiled roofs, sarking can be used to conduct any penetrated water away. When sarking is used in this manner it shall be a minimum width of 1800mm either side from the point of discharge and extend down to the eaves gutter.

e) Where sarking is used as a condensation barrier.

f) At any change of roof pitch and extending from there to the eaves gutter.

g) Where radiant heat is a problem and sarking is used to control it.

h) Where rafter length exceeds 4.5 metres. (See table 2.7)

i) Where the roof pitch exceeds 45° the whole roof should be sarked.

j) To avoid constant flexing and increase the life of the sarking, anti-flap pads are recommended.

The typical roofing details indicating the acceptable methods of use for sarking:

Where roof pitch exceeds 45° the whole roof shall be sarked. (Not required in Victoria). Where a valley discharges water onto a lower roof, such roof will require sarking from lower end of the valley to the fascia, with a minimum of 1.8 metre width from the side of the valley. Not withstanding the above provisions, where local site conditions are believed to involve greater than average normal exposure to wind driven rains, it may be necessary to increase roof pitch and/or tile lap and/or fixing requirements and/or sarking which may exceed the normal tabulated requirements.

Locations which may require special consideration include all coastal areas, installations on high ground and high rise buildings where design criteria for wind classification is greater than N 2. Sarking is mandatory when the wind classification is greater than N 3.

Table 3.9 (a) Duty Classification and Allowable Use in Australia

Use	Extra Heavy	Heavy	Medium
Tiled Roofing: 600 mm spans	Allowable	Allowable	Allowable Must be supported below if the wind classification exceeds N3.
>600 mm 900 mm spans	Allowable	Allowable, if supported below.	Allowable, if supported below.
>900 mm spans	Allowable, if supported below.	Allowable, if supported below.	Allowable, if supported below.

Note: Manufacturers of Sarking membranes provide "Safety Sarking" for use as fall prevention between rafters. This can be used unsupported to 900 mm centres.

3.9 (b) Eaves

Sarking material should be carried over fascia board a minimum of 25 mm to give drip into gutter. At this point, material should be supported to prevent ponding. An approved anti-ponding board is mandatory at pitches less than 20° or where roof are sarked with no eaves overhang regardless of pitch.

3.9 (c) Valleys

At valley gutters the sarking membrane should finish at the valley iron and be fixed by a valley batten, if carried into valley iron then material should project a maximum of 20 mm. If sarking projects too far into valley, the roof will almost certainly leak.

3.9 (d) Laps and Joins

The sarking membrane should be lapped 150 mm at horizontal joints and across both rafters at vertical joints.

Figure 3.9 (a) Standard Sarking Detail

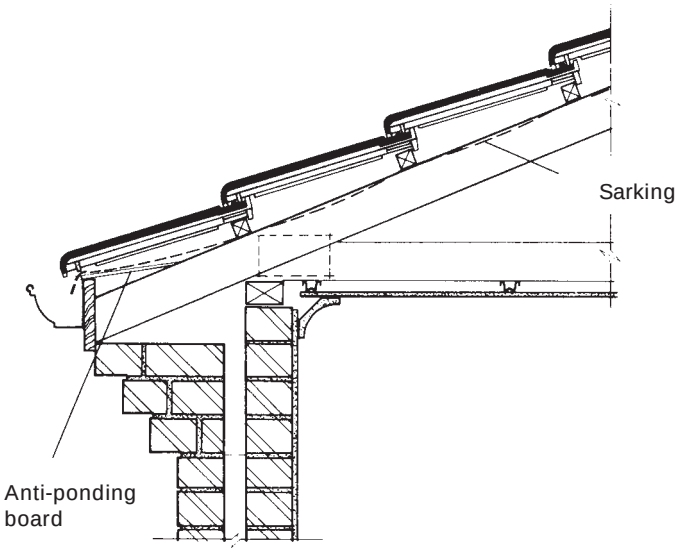
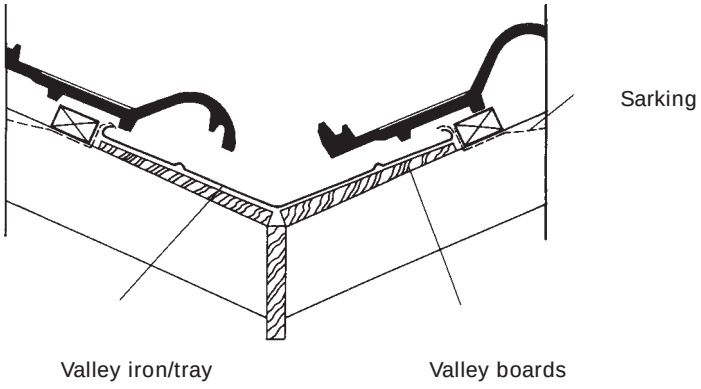


Figure 3.9 (b) Valley Sarking Detail



Ridge Systems

4.1 Ridge Systems

Boral Roofing manufactures and supplies various types of ridge capping. Concrete and terracotta vee ridge is available as standard (130°) or steep angle (81°) inclined angle.

A metal ridge cap is also available. All Boral Roofing ridge caps may be positively fixed (mechanically fastened) if required.

4.2 Ridge Installation

(General) after the roof tiles have been laid and the hip tiles cut in, install the ridge capping. Requirements of Australian Standard 2050 Installation of roof tiles provides the following information:

1. All ridge, hip and barge tiles are to be mechanically fastened.
2. The cutting of tiles at ridges and hips shall extend under the capping by a sufficient distance to be weatherproof.
3. All cut tiles will be supported to ensure they are in the same plane as adjacent tiling.
4. All capping will be laid / set to achieve a straight and regular line of ridge capping.

Boral Roofing specifications:

- All junctions of hips and ridges should be made weatherproof, either by a purpose made fitting or by close joining with an under soaker or over flashing. Three way, four way and spoon apexes are available for joining hip and ridge sections.
- Lapping of ridge tiles should be directed away from the prevailing winds.
- The front tip of the hip starter is to be set 50 mm into the gutter in line with the eaves course of tiles.
- Cut tiles at hips should be supported by galvanised nails spiked to the hip boards where necessary.
- Weep holes are to be pushed through the mortar bed at top ridges on all concrete tiles or cut terracotta tiles. Weep holes to be placed one per tile pan.
- Cut tiles at hips are to be aligned with adjacent tiling.

Figure 4.2 (a) Vee Ridge (130°) Typical Detail

(Concrete and Terracotta)

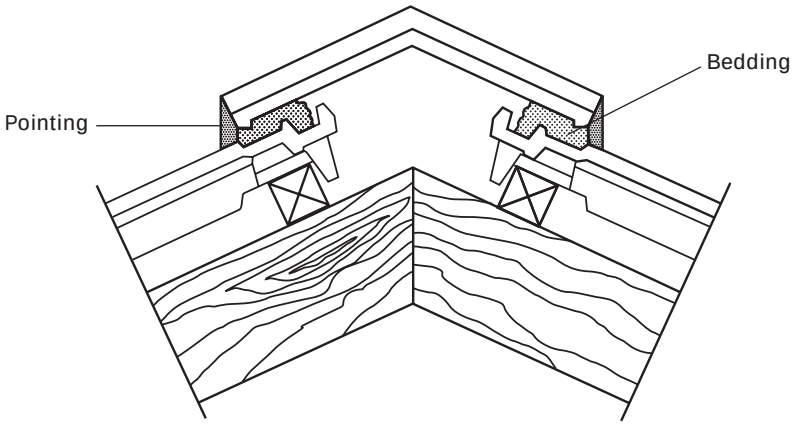


Figure 4.2 (b) Vee Ridge (81°) Typical Detail

(Concrete and Terracotta)

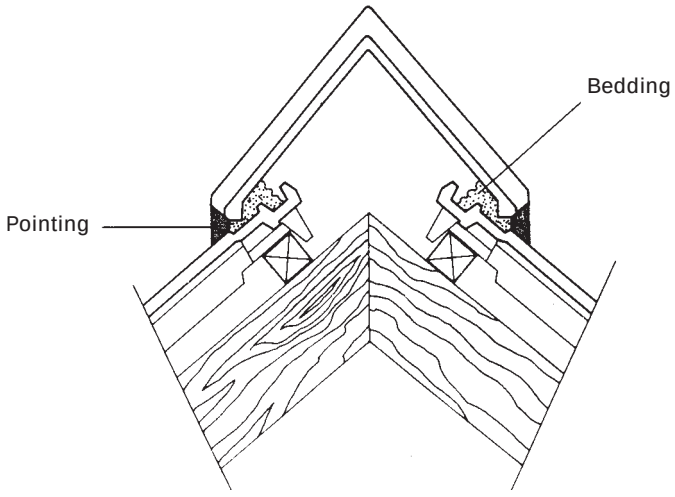


Figure 4.2 (c) Arched Ridge Typical Detail (Terracotta only)

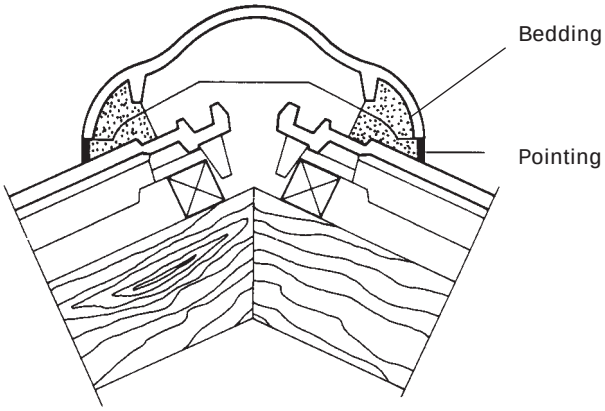


Figure 4.2 (d) Butt Ridge System (Cross Section)

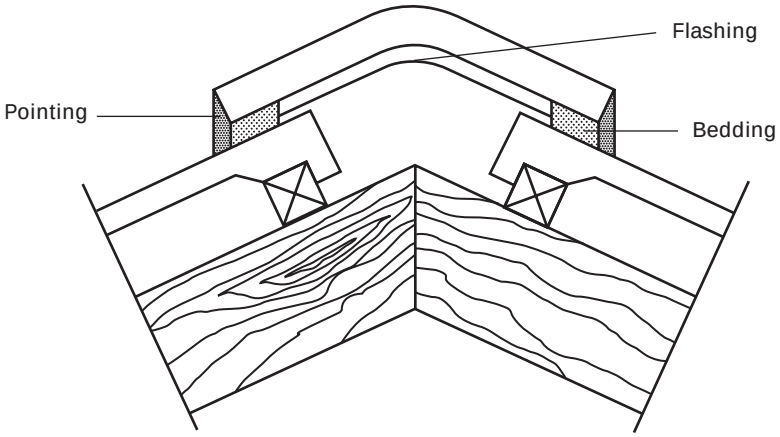
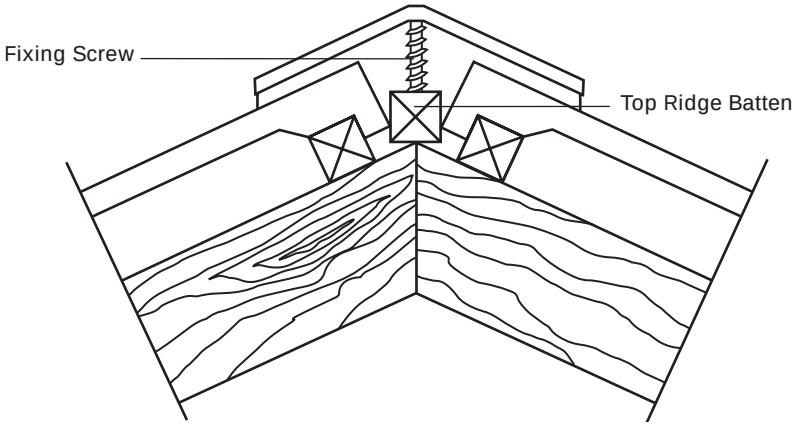


Figure 4.2 (e) Seamless Ridge (Cross Section)



4.3 Seamless Ridge System

Seamless Ridge is available to suit Boral Roofing's, Grange range of concrete roof tiles: Linea,Striata and Uno.

Hip and top ridge battens must be installed.

Minimum recommended pitch is 18° under normal conditions.
Pitch range is 18-35 degrees. (Greater pitches can be achieved with the use of purpose made top ridge sections. 3-4 weeks delay to process order).

All seamless ridge pieces need to be positively fixed.

Please contact your state Boral Roofing Sales Office for technical details.
Note: Installers of the seamless ridge system require training and accreditation from Boral Roofing.

4.4 Seamless Ridge Installation

Preparation:

- The hip board and top ridge batten are essential for this application and the finished height is also important.
  The finished height can be achieved by a number of methods.

Hips:

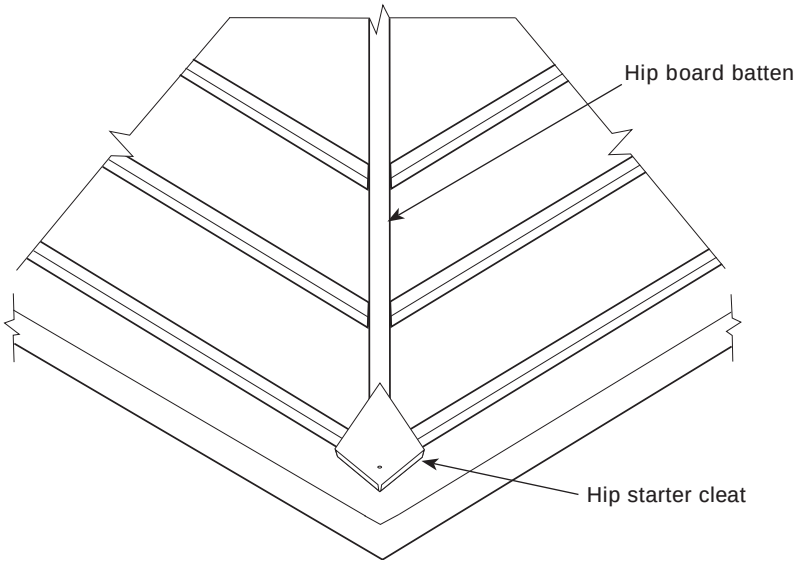
1. Install a raised hip board, finished height = the tile batten thickness + 20 mm above rafters. (Generally possible only with a cut roof frame.)
   Mitre cut and secure tile battens to the hip board.
2. Install a hip batten, finished height = the tile batten thickness + 20 mm, in a straight line from apex to fascia board, fixed to existing hip board.

Top Ridge:

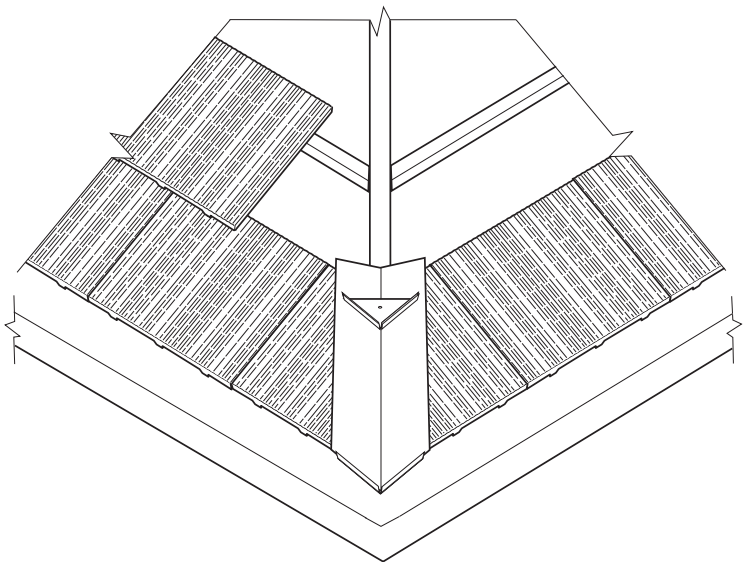
1. Install a top ridge batten to truss apex or along existing top ridge board. (Batten required 20 – 25 mm thicker than the roof tile batten.)
   Ensure the last course or ridge battens have a maximum gap of 50 mm.

- Batten out or batten and Sark the roof as normal.
- Ensure an even tile set out through out the roof and hips.
- Lay out and secure tiles to the requirements of the Australian Standard 2050.

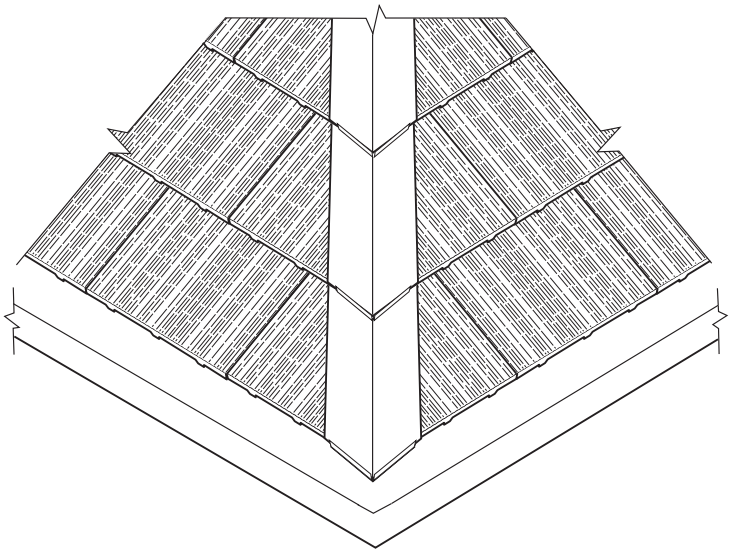
Step 1. Fasten a hip board batten from the apex to the fascia board and install the hip starter cleat.



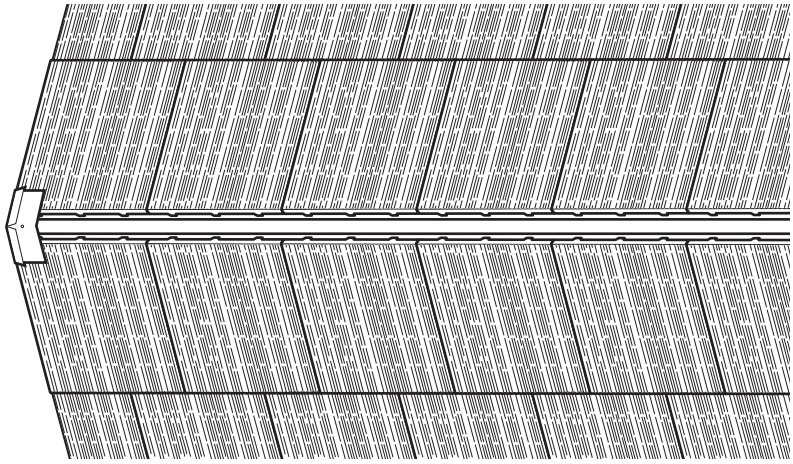
Step 2. Cut in hip tiles then clip the first hip piece over the hip starter cleat and fasten in place. Install the next hip cleat in line with the following course of tiles and screw fix to the hip batten.



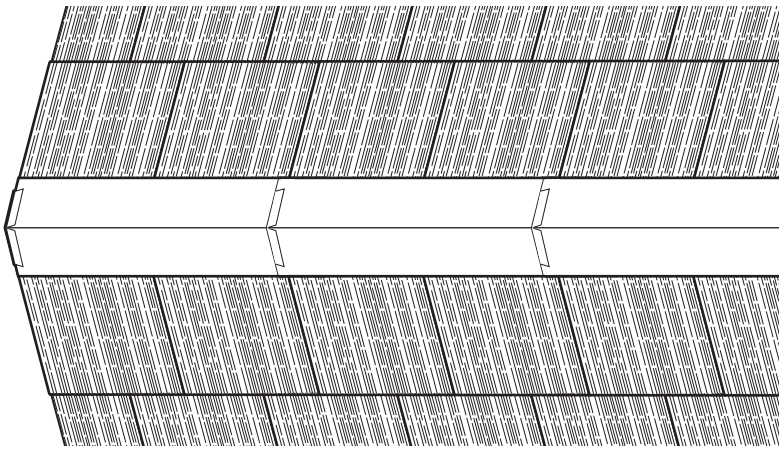
Step 3. Continue laying and cutting tiles and installing hip pieces until the hip is completed.



Step 4. Provide a top ridge batten at the truss apex or atop the existing top ridge board and finish the tiles as close as practical to the top ridge. Install a top ridge cleat.

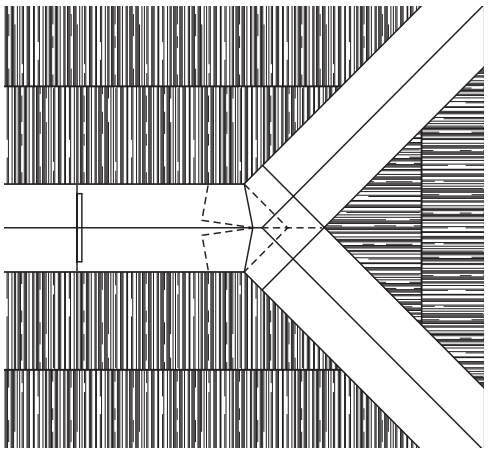


Step 5. Clip the first top ridge piece in place then screw fix the next top ridge cleat in position. (Allow minimum 80 mm overlap for top ridge.) Continue the installation the length of the top ridge.



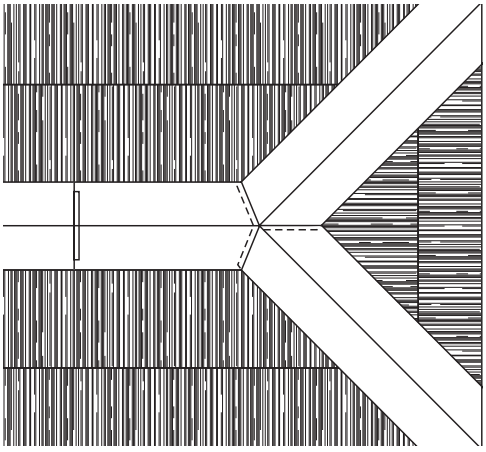
Step 6. Finish apex by installing a purpose made apex section (fig. a) or overlapping dominant ridges (fig. b), cutting, sealing and pop riveting joints.

Figure (a) Install Apex Section, Seal and Pop Rivet



Step 6.

Figure (b) Overlap Dominant Ridges, Seal and Pop Rivet



Hip Details

5.1 Hip Details

The following are suggested details suitable for hips. These details are by no means exhaustive. Recommendations of experienced tilers may offer a further source of details. Shape starter tile to foot of all hips. Cut Boral Roofing tiles closely to the rake of the hip to leave a maximum gap of 20 mm between hip cuts. Fix apex tiles to all junctions of hips and ridges.

5.1.1 Starter tiles on hips must project into gutter in line with the eaves course tiles.

Figure 5.1 (a) Standard Hip Detail

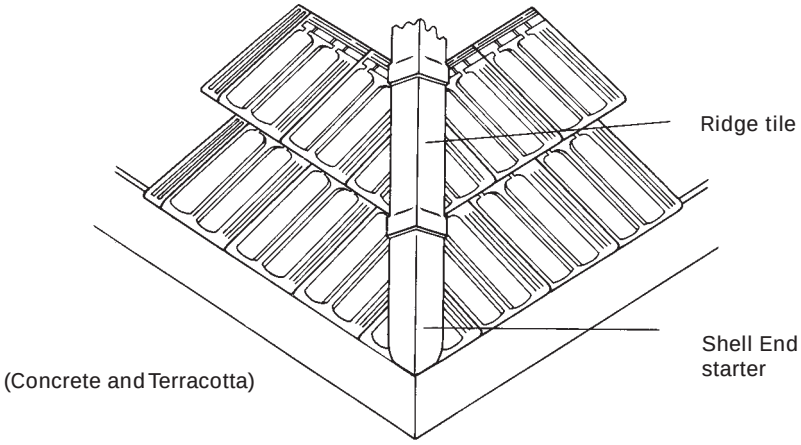
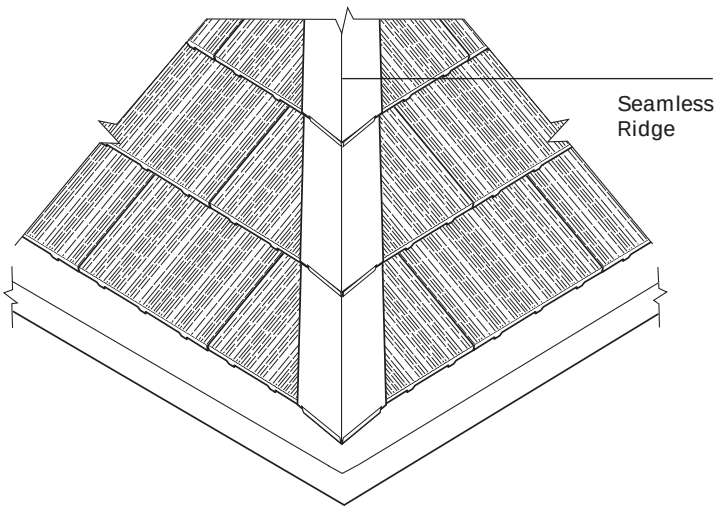


Figure 5.1 (b) Seamless Ridge Detail

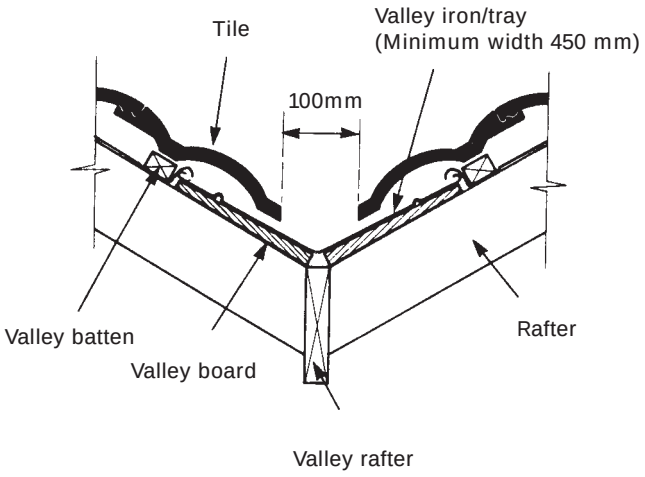


Valleys

6.1 Valley Boards

Valley boards should be a minimum of 18 mm thick, be below the top of the tile batten and extend the full width of the valley. An outside thickness of 25 mm applies where tile battens are 38 mm in thickness.

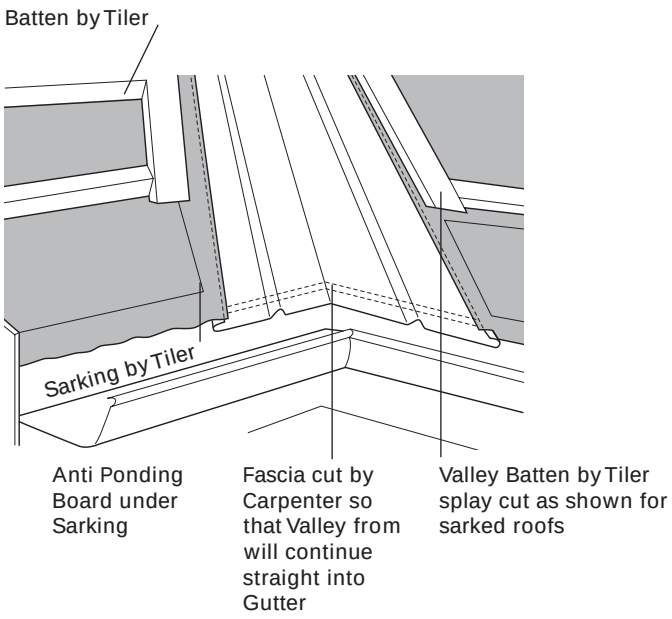
Figure 6.1 Valley Junction Detail



6.2 Sarking at Valleys

Where sarking is used, it should overlap the valley by no more than 20 mm and be held in place by a valley batten fixed parallel to the valley board.

Figure 6.2 Sarking at Valleys



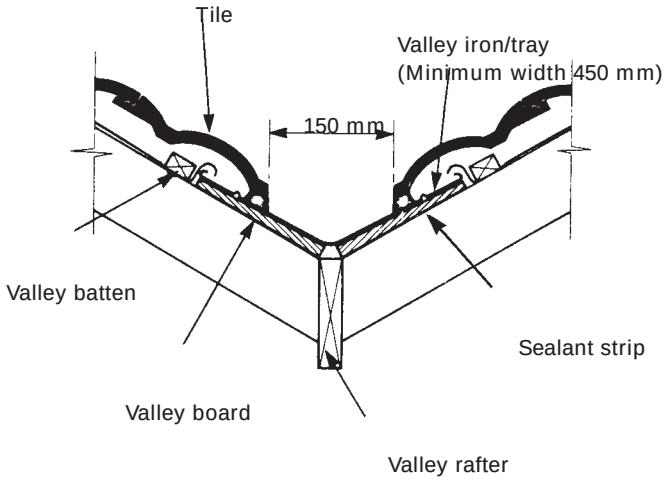
6.3 Valley General

6.3.1 Under normal conditions a gap of 100 mm between tiles is acceptable.

6.3.2 In high rainfall areas the valley tiles can be bedded and pointed or sealed with a sealant strip and the gap between the cut tiles may be increased up to 150 mm.

6.3.3 Valley irons/trays should be treated with corrosion inhibiting materials prior to bedding and pointing.

Figure 6.3.3 Valley for High Rainfall Areas



Barge/Gables

7.1 Barge/Gable Systems

There are a number of ways of setting a barge/gable end. These include a) bed and point, b) barge tiles and c) secret gutter, and can be applied according to local requirements and exposure conditions.

Good tiling practice in States and Territories has over time developed various methods of installation of these systems. The information provided in the following text may not be common practice in your State or Territory. Please contact your state Boral Roofing Sales Office for technical details.

7.1.1 Bed and Point

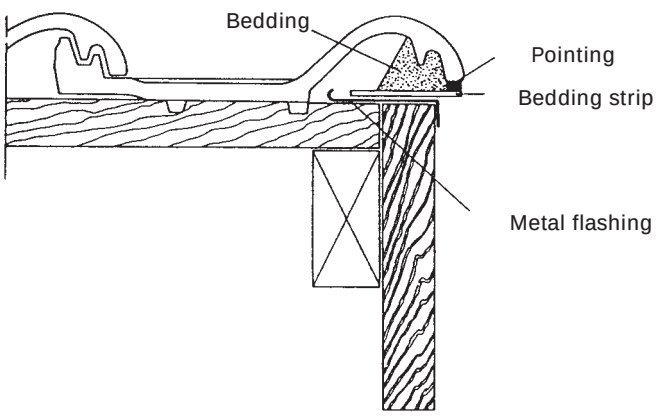
a) Place bedding strip of 5 mm fibre cement 100 mm wide over the metal Z flashing, which sits on top of the barge board and bed roof tile to it. The projection over the barge board shall be a minimum of 10 mm and a maximum of 25 mm. Point neatly without visible trowel marks.

b) With a bed and point finish the projections at gable ends should be left to the tilers discretion, thus ensuring the finishing off with a full tile at all left hand gables whenever practicable. The exposed side water channel to all left hand gables should be removed. Where the overhang is of sufficient width it is advisable for the carpenter to fix a quad moulding under the fibrous cement undercloak prior to bedding and pointing.

All verge tiles shall be mechanically fixed.

c) The barge board must be kept flush with the top of the batten. This is to allow the fibro strip to be let into the batten to sit level with the top of the batten and barge board.

Figure 7.1.1 Bed and Point Barge Detail



7.1.2 Barge Roll/Cap

Universal barge roll/caps are laid over the gable end and screw fixed to the barge boards. The top of the barge board should be flush with the top of the tiling batten. The barge roll/caps are to be screw fixed according to local specifications. In some cases Boral Roofing Concrete Barge Roll/Caps may be fixed without bedding and pointing.

Figure 7.1.2 (a) Tapered Barge Roll/Cap Detail (Fixed to Timber Barge Board)

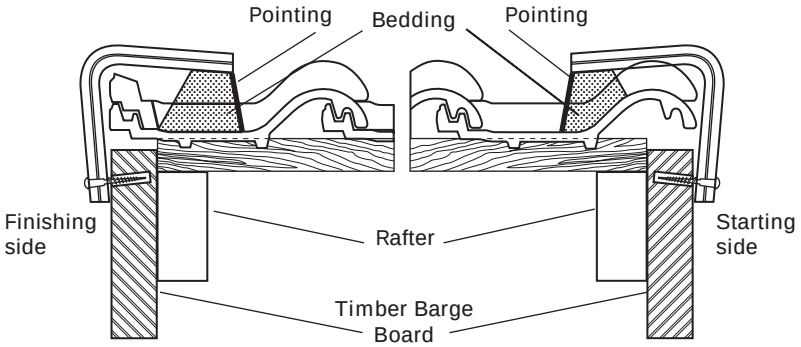
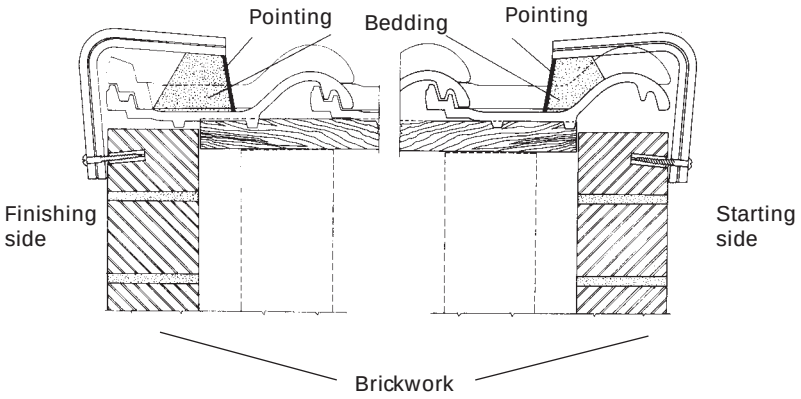


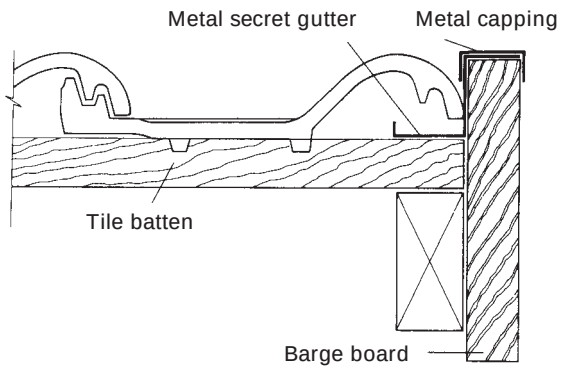
Figure 7.1.2 (b) Tapered Barge Roll/Cap Detail (Fixed to brickwork)



7.1.3 Secret Gutter Finish

The top of the barge must be 75 mm above the top of the battens.

Figure 7.1.3 Barge/Gable Details



Roof and Flashing Details

8.1 Roof Flashings General

Roof details should take into consideration special flashings required at parapet walls, chimneys and other details. As a general rule flashings should overlap the upstand of at least one tile or provide alternative water run-off details such as secret or soaker gutters. Generally lead flashings are used and these should be at least 20 kg per m^2. Where roofs are sarked, consideration should be taken of the ponding of water in the sarking, particularly at eaves and around large penetrations such as chimneys and skylights etc. Anti-ponding boards should be installed at these points either by the builder or a carpenter or tiler. The following are typical details of roof flashings which have proved successful over time. However good trade practice and the expertise of most tilers in unusual details should be take into consideration.

Figure 8.1 (a) Head Wall Flashings

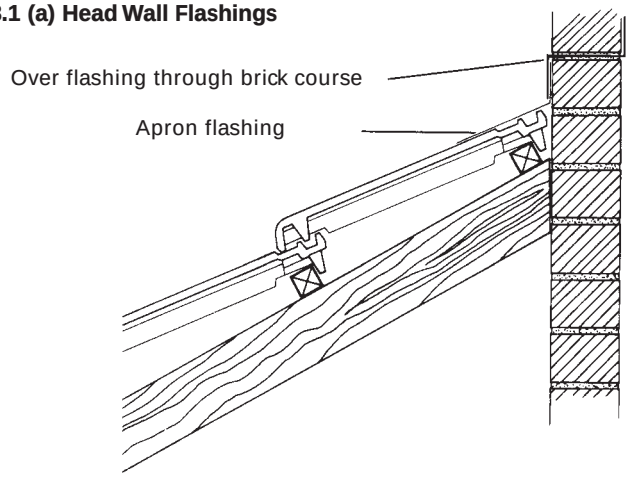


Figure 8.1 (b) Step Flashing Chased to Brick Course

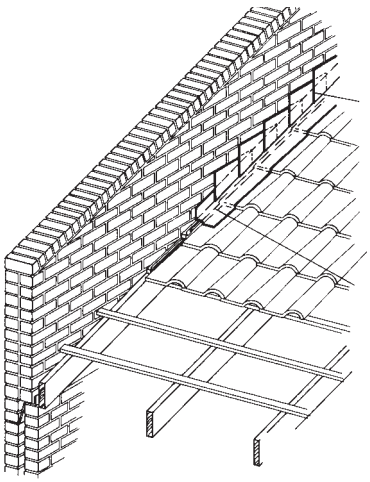


Figure 8.1 (c) Dutch Gable Flashings

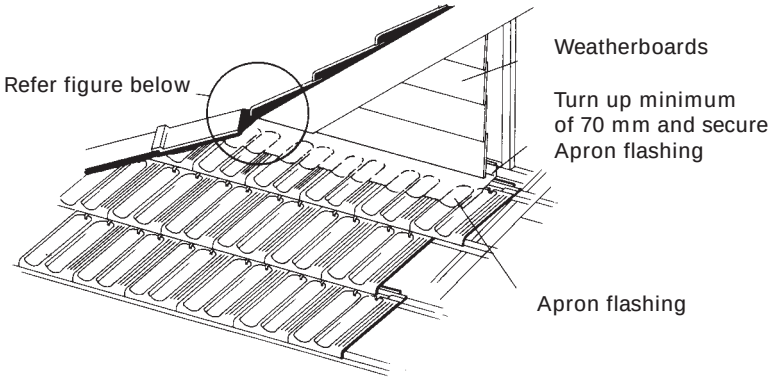


Figure 8.1 (d) Dutch Gable at Hip and Barge Junction

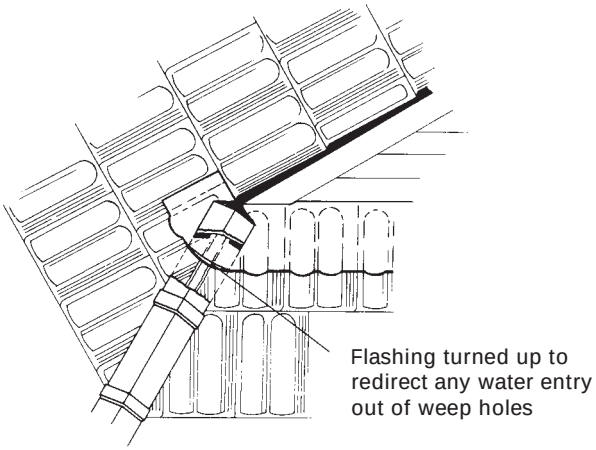


Figure 8.1 (e) Saddle Flashings

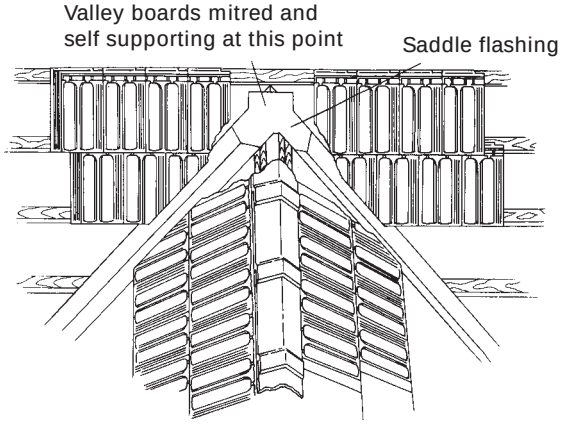


Figure 8.1 (f) Mansard Roof

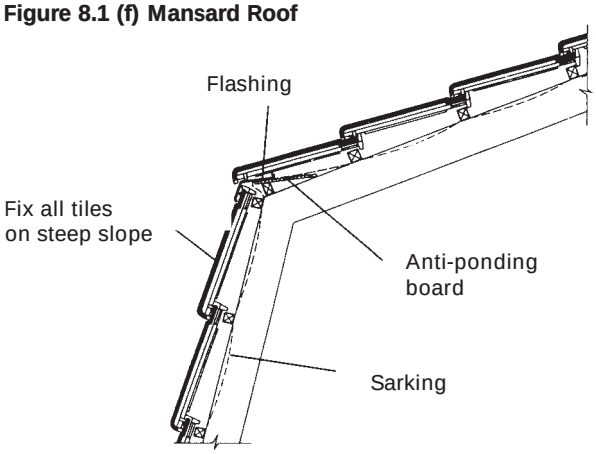


Figure 8.1 (g) Change of Pitch

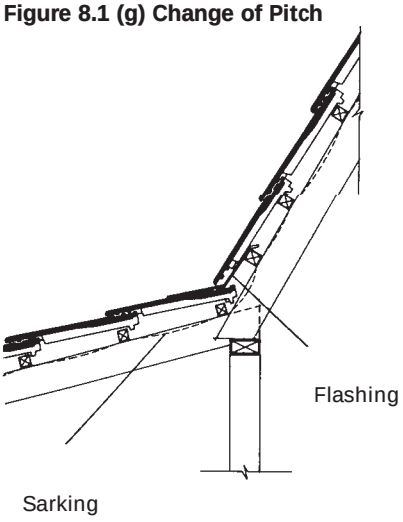


Figure 8.1 (h) Splayed Gable

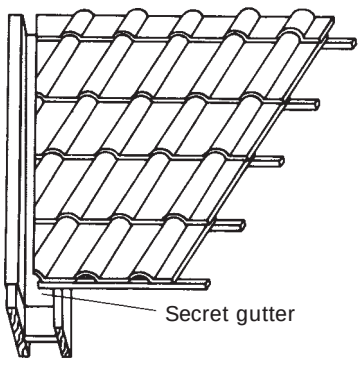


Figure 8.1 (i) Pipe Penetration

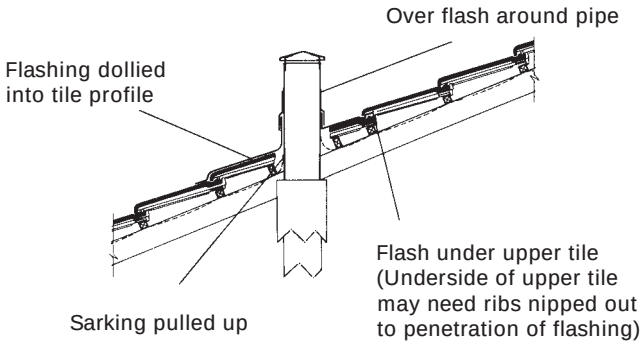
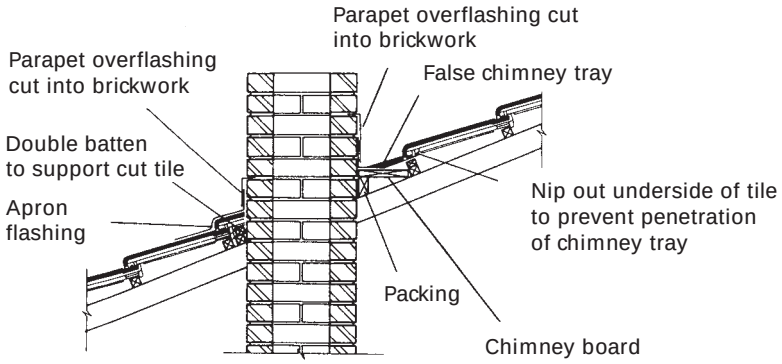
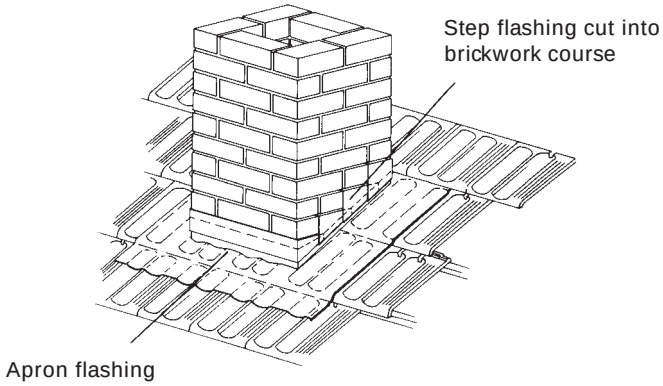


Figure 8.1 (j) Chimney Penetration





Bedding and Pointing

9.1 Bedding Mortar Mix

Australian Standard 2050 Installation of roof tiles requires as a minimum, "Cement mortar for bedding (1:4) 1 cement, 4 ± 0.4 sand."

The use of other additives such as "Lime, Fire clay" is permitted at the following ratios:

- Lime composition bedding mortar (1:1:6)….1 cement, 1± 0.25 lime, 6± 0.6 sand.
- Fire clay when used, replaces an equal amount of sand therefore, if 1/2 a measure of fire clay is used the ratio would be (1: 0.5: 3.5) …1 cement, 0.5± 0.005 fire clay, 3.5± 0.3.5 sand.
  Fire clay is not a replacement for cement.

The use of plasticizer's and products that aerate mortar is **not permitted** as these products weaken the mortar.

9.2 Pointing Mortar

Cement mortar bonding shall not be used as the mechanical fixing method. It can be used however in conjunction with some other form of mechanical fixing.

- Pointing mortar when used shall be 3-1 mix, 3 clean sharp sand, 1 cement, with oxides or pigments to suit.
- Flexible, premixed pointing is available and in most cases is rated as a mechanical fixing. Check with the manufacturer for confirmation of status.

9.3 Bedding and Pointing

The pointing should be neatly trowelled, with an even finish throughout. Collar/cuffs should be pointed (if Flexible pointing is the mechanical fixing then it is mandatory to point collars/cuffs.)

Roof Completion

10.1 Roof Completion

Tilers should take care to remove all debris from the roof and gutters on completion of the job and in particular, care should be taken to remove any steel debris – nails etc, which might cause staining of tiles or premature corrosion of gutters should they remain on the roof.

A final detail check should be made on the roof before completion to ensure that any broken or cracked tiles are replaced and the roof is fully weatherproof.

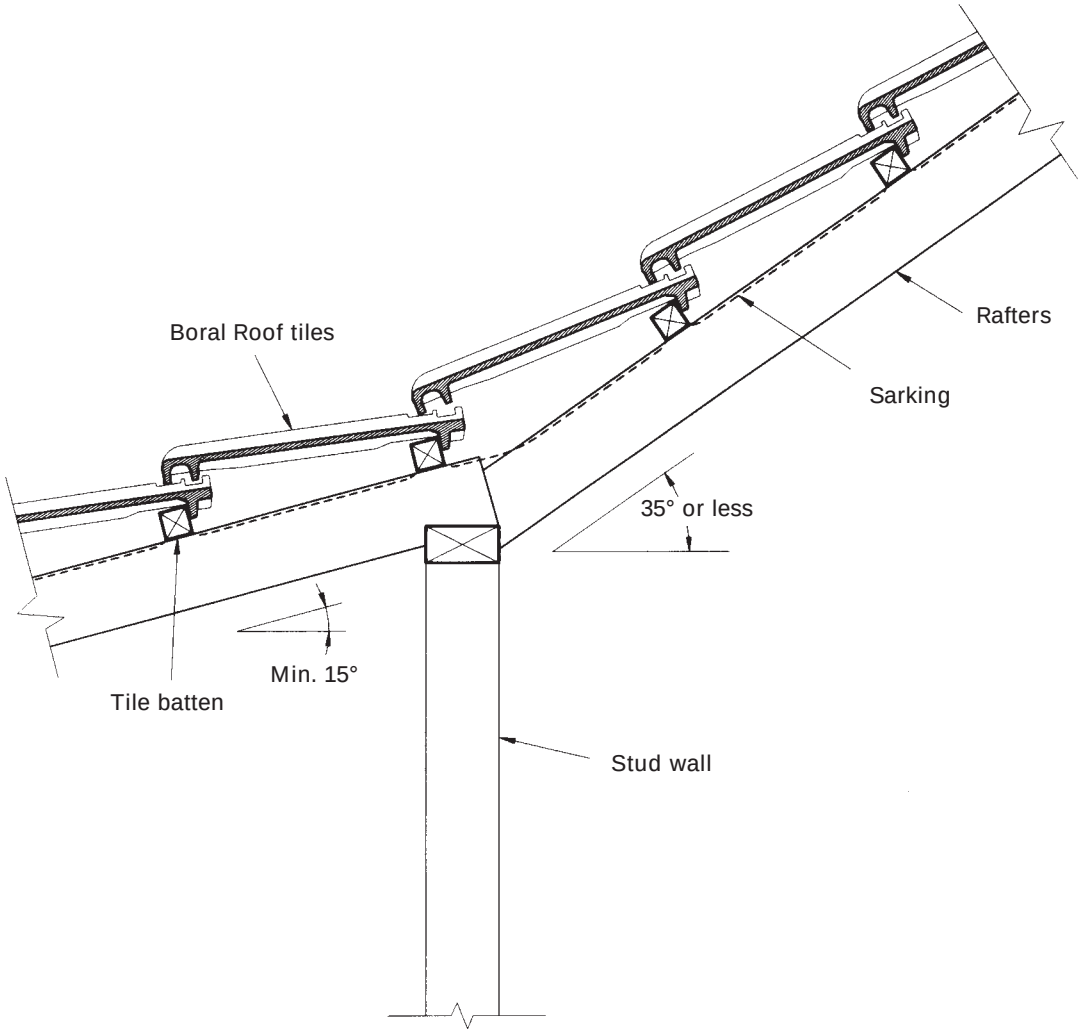
Architectural Details

Contents

All Architectural Details are a guideline in relation to tiling only.

BORAL

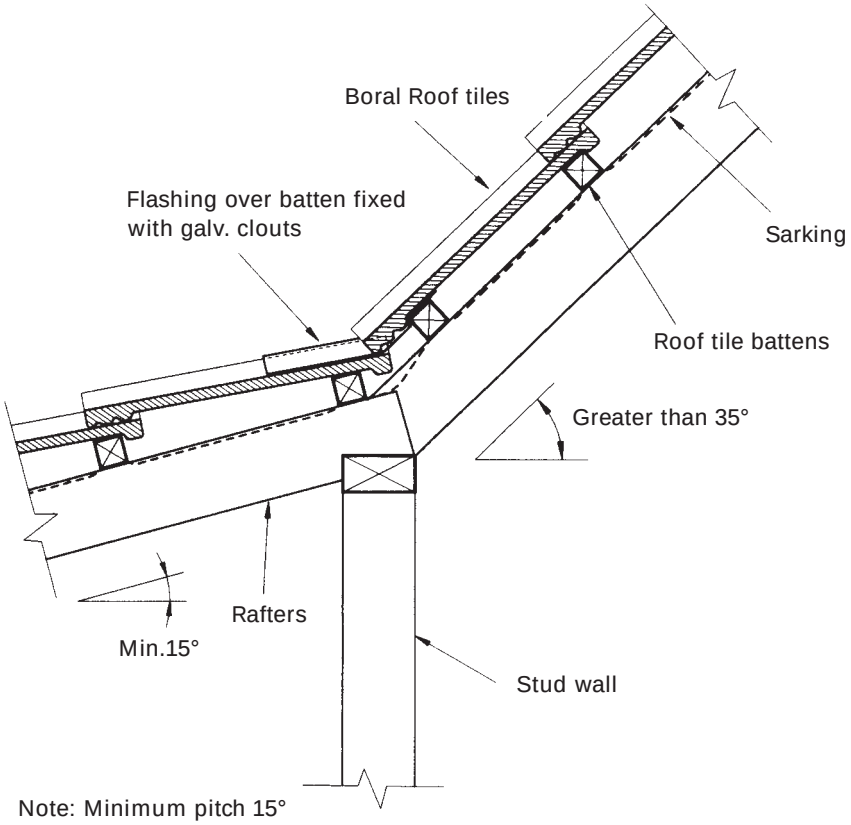
Change in Pitch



Unless otherwise stated all dimensions are in millimetres

Issued: July 2004	Scale: 1:10

Change in Pitch Flashing



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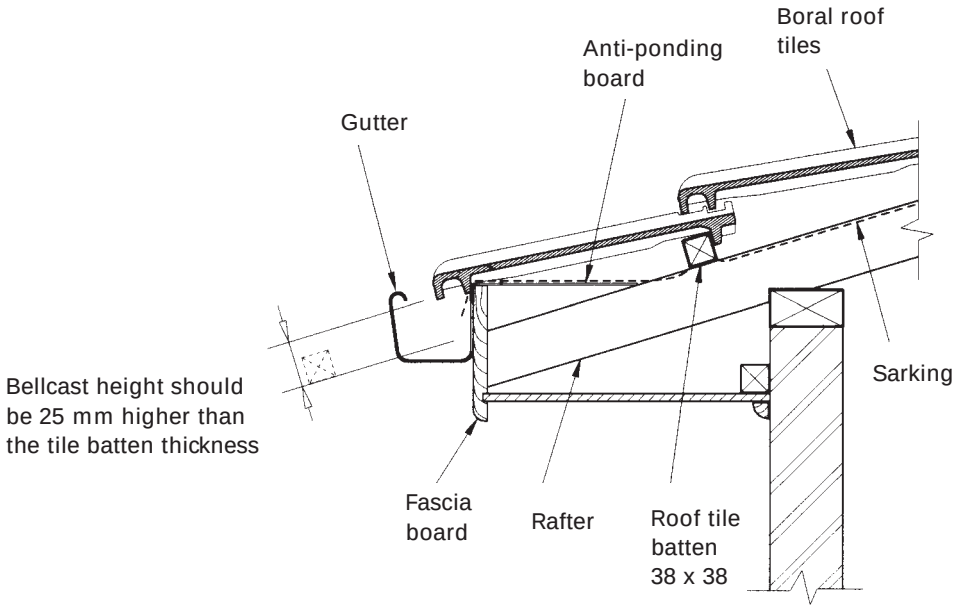
Fascia Board/Bellcast Height



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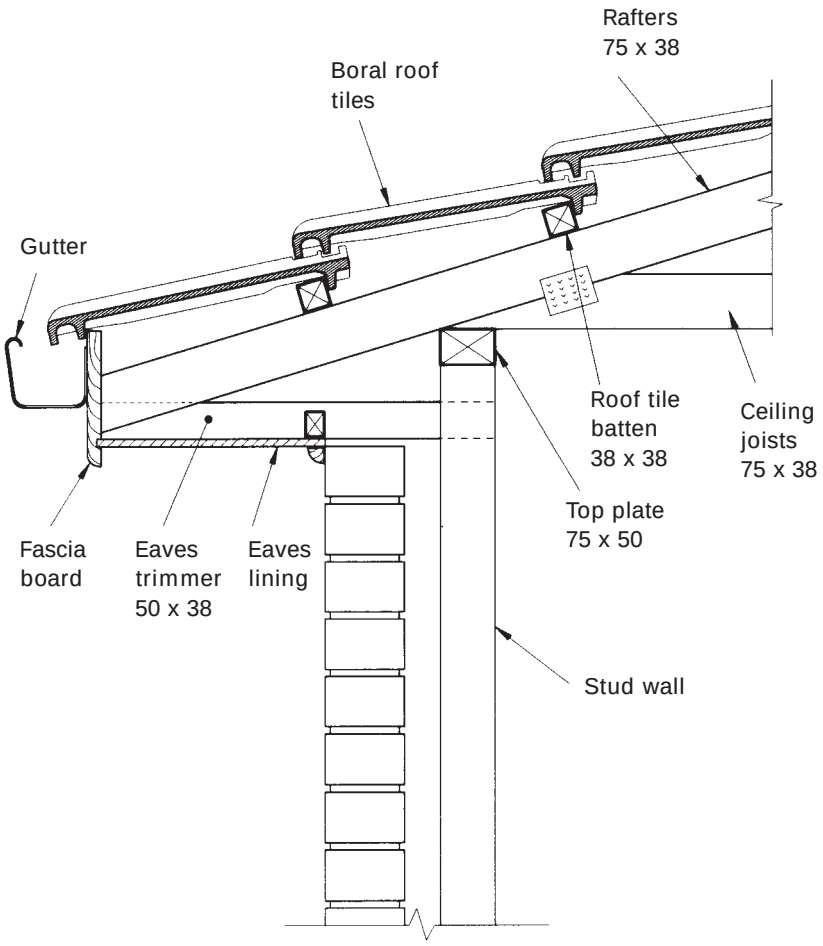
Eaves Detail



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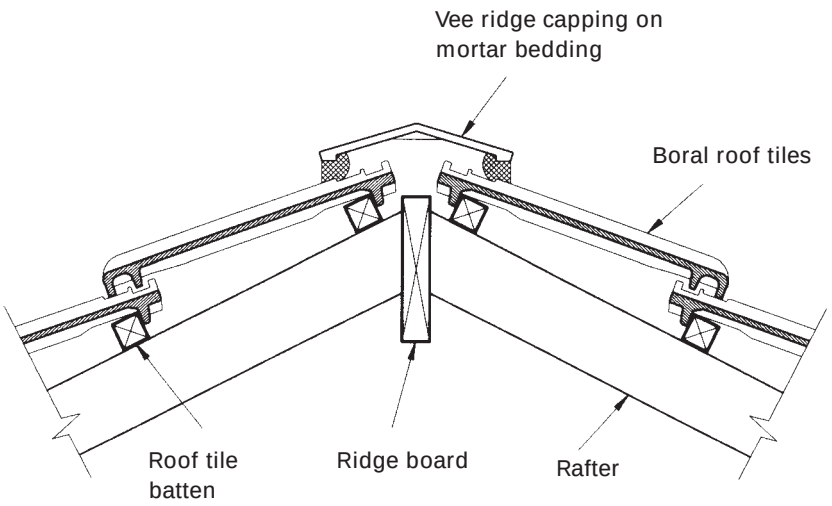
Ridge Detail



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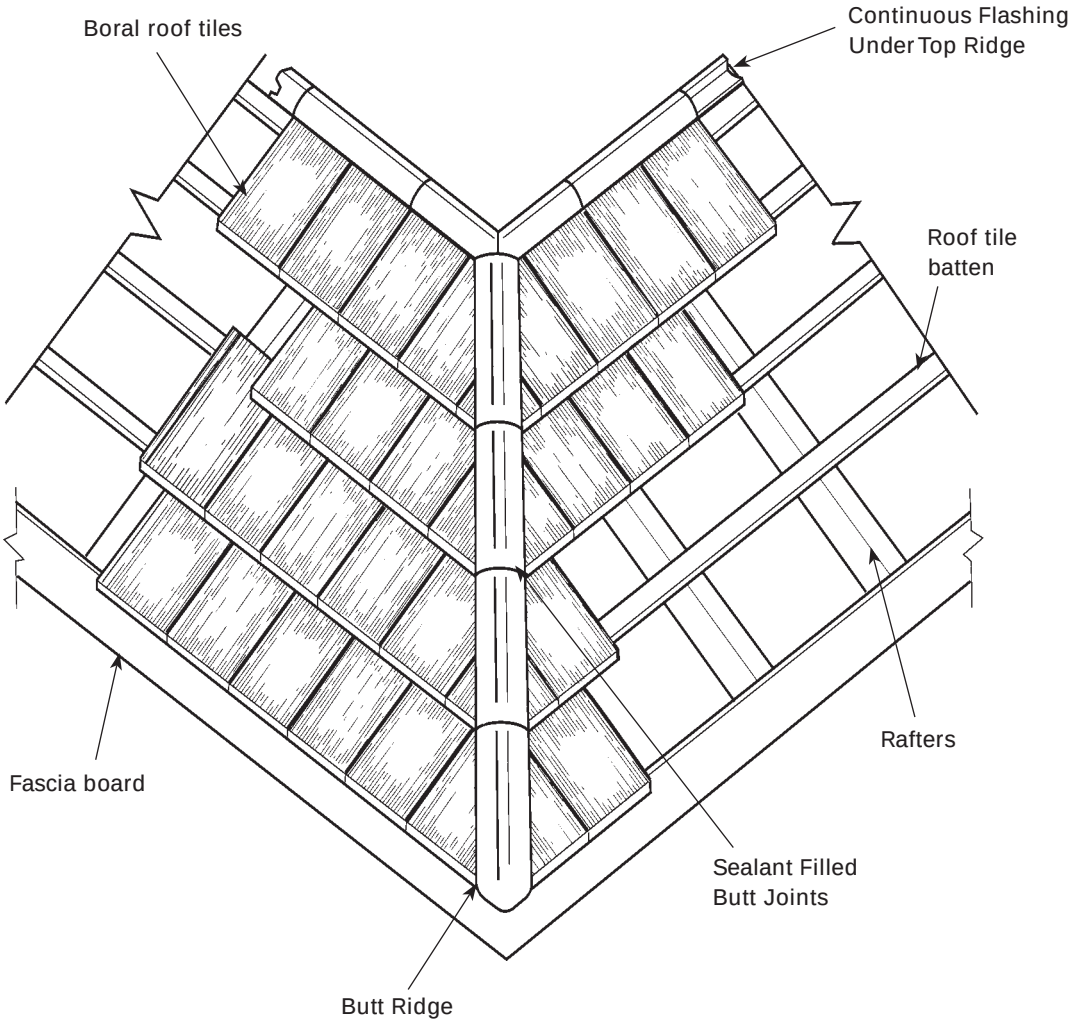
Butt Ridge System



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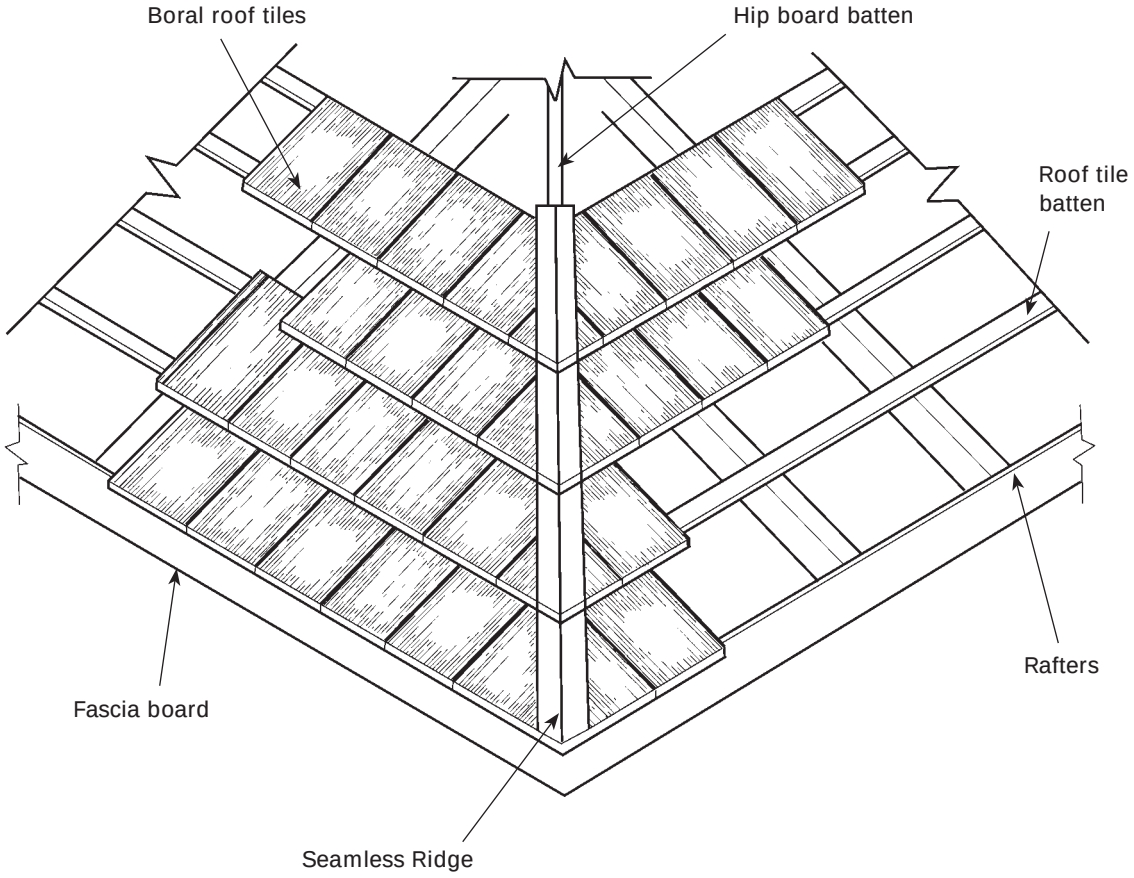
Seamless Ridge System



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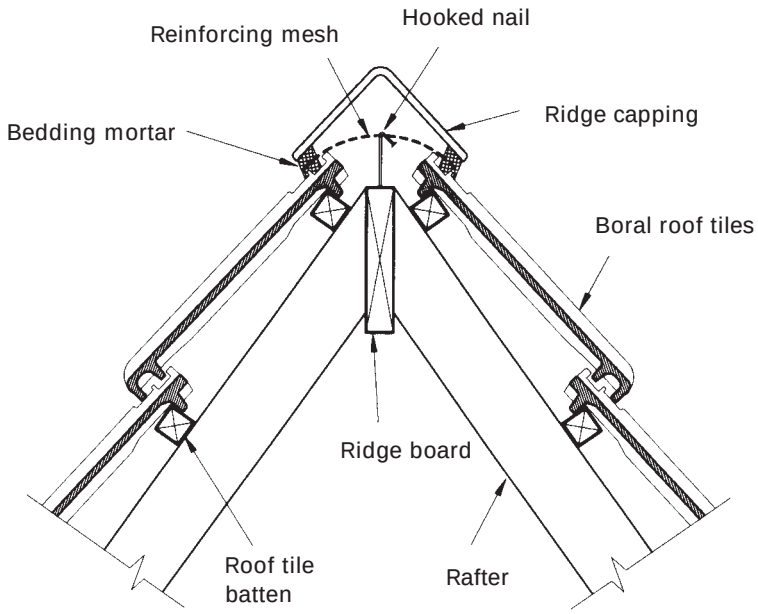
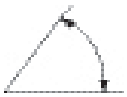
Steep Pitched Ridge Cap





Unless otherwise stated all dimensions are in millimetres

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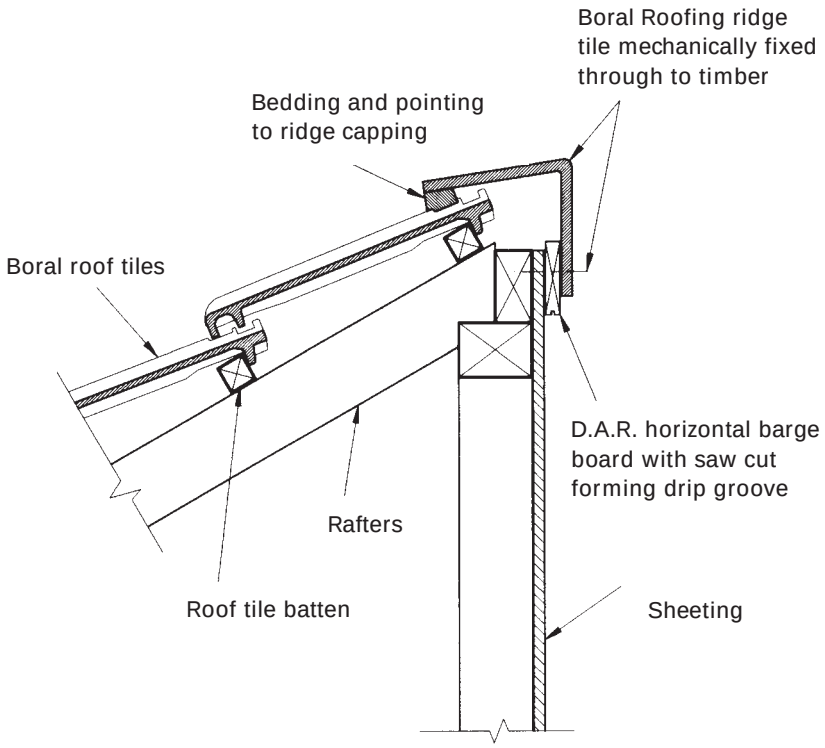
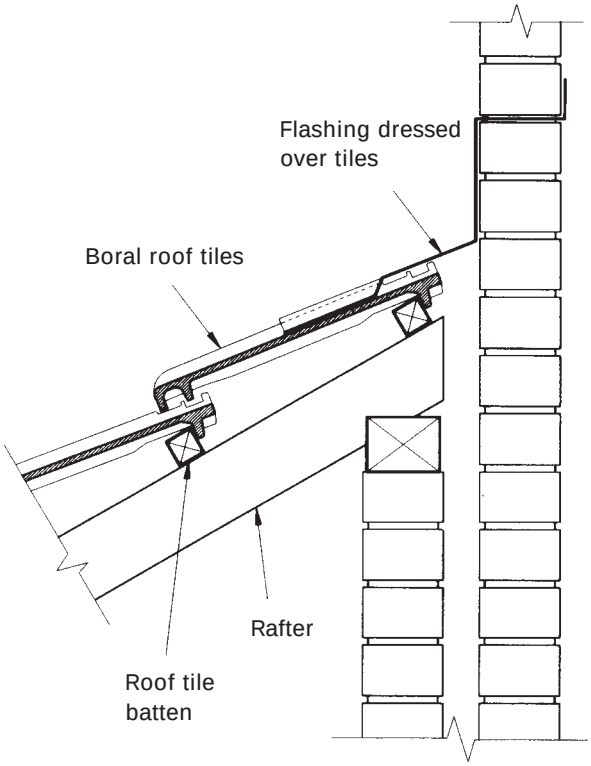
Saw Tooth Ridge
(Steep Pitch Vee Ridge)



Unless otherwise stated all dimensions are in millimetres

Issued: July 2004	Scale: 1:10

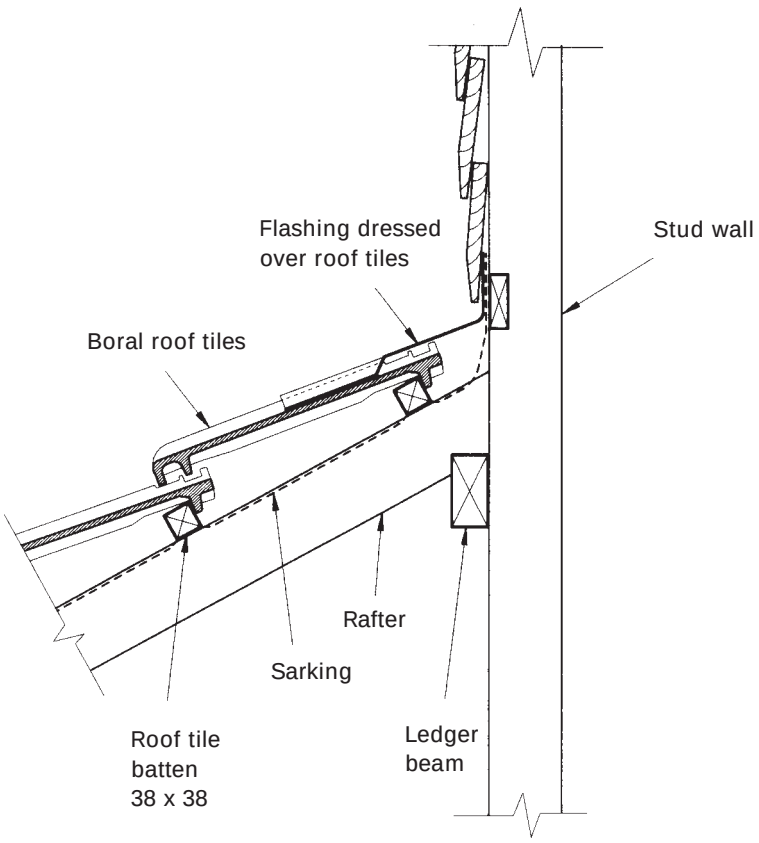
Flashing to Brick Abutment



Unless otherwise stated all dimensions are in millimetres

Issued: July 2004	Scale: 1:10

Flashing to Timber Abutment



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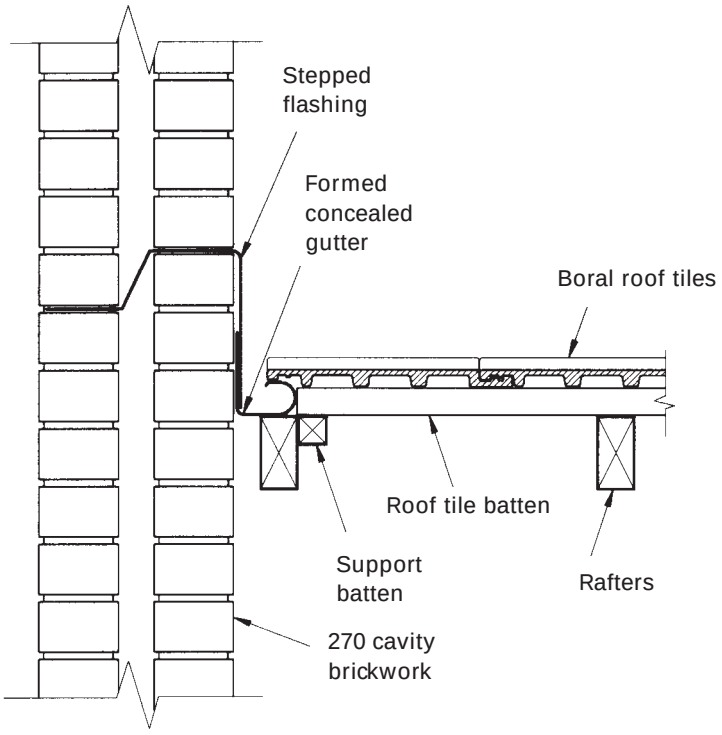
Issued: July 2004	Scale: 1:10

Parapet Concealed Gutter



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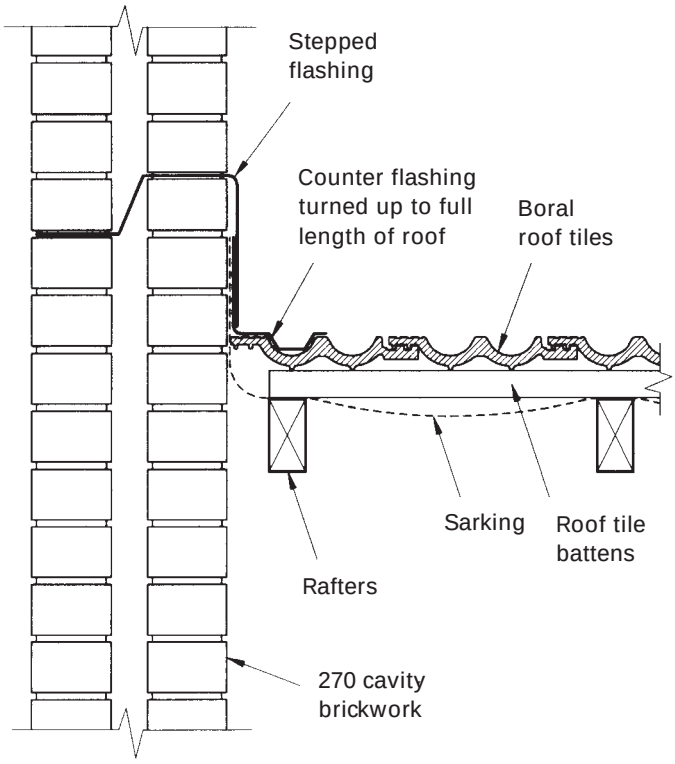
Parapet – Detail Brick Wall



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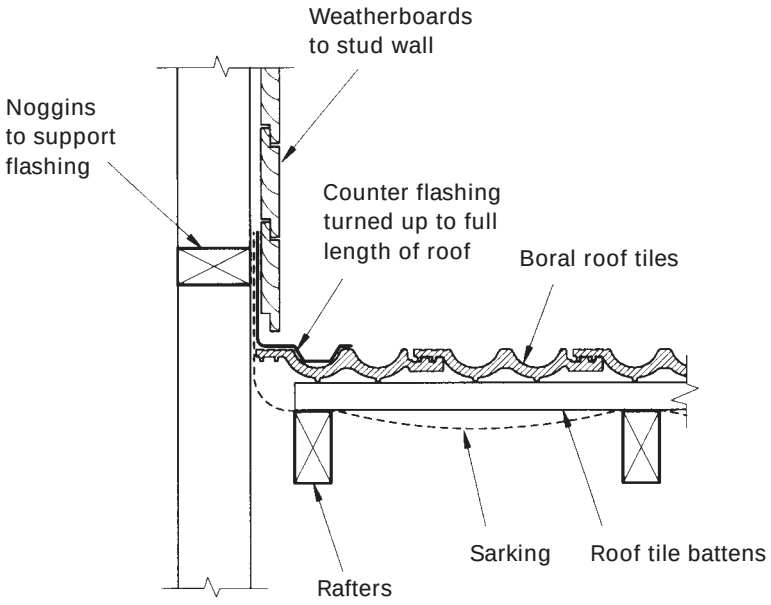
Flashing at Side Abutment



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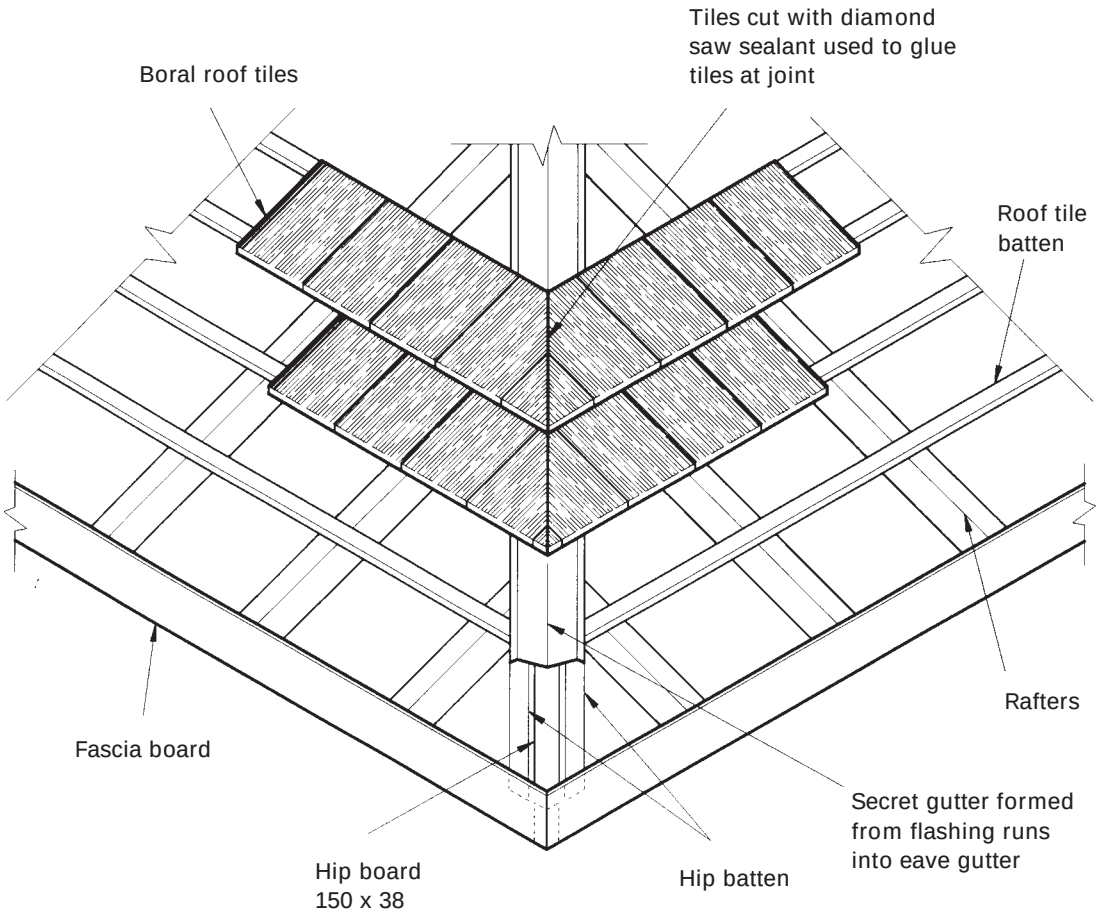
Mitred Hip



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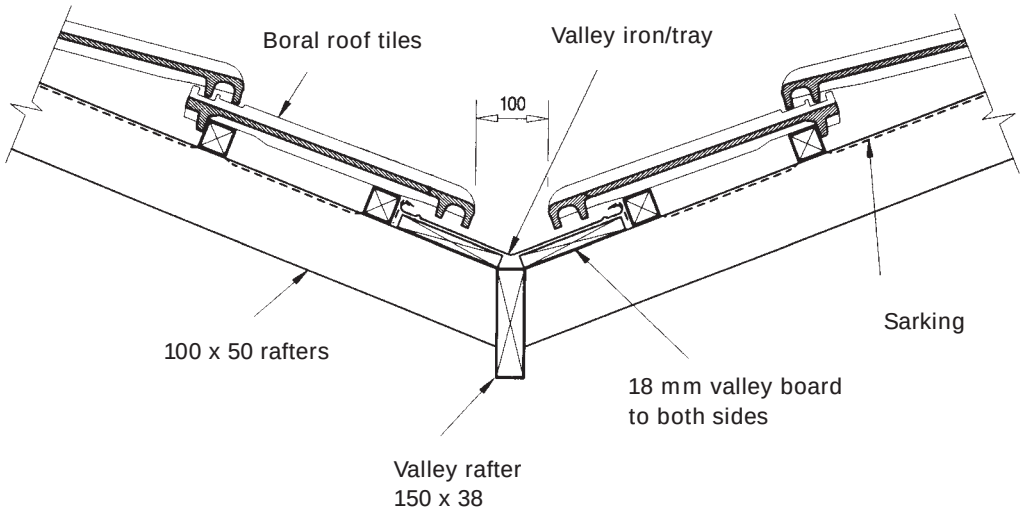
Valley Detail



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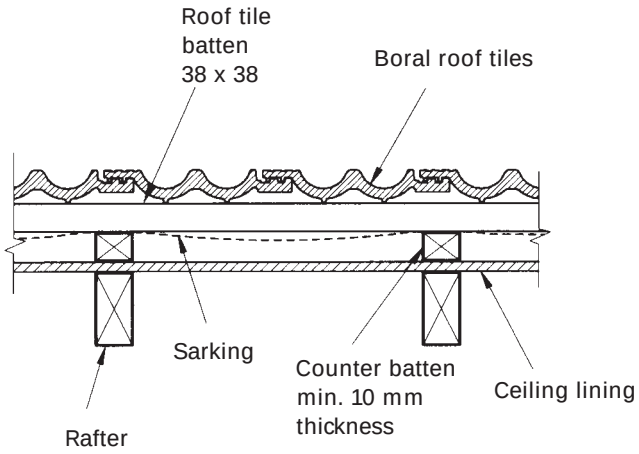
Counter Batten



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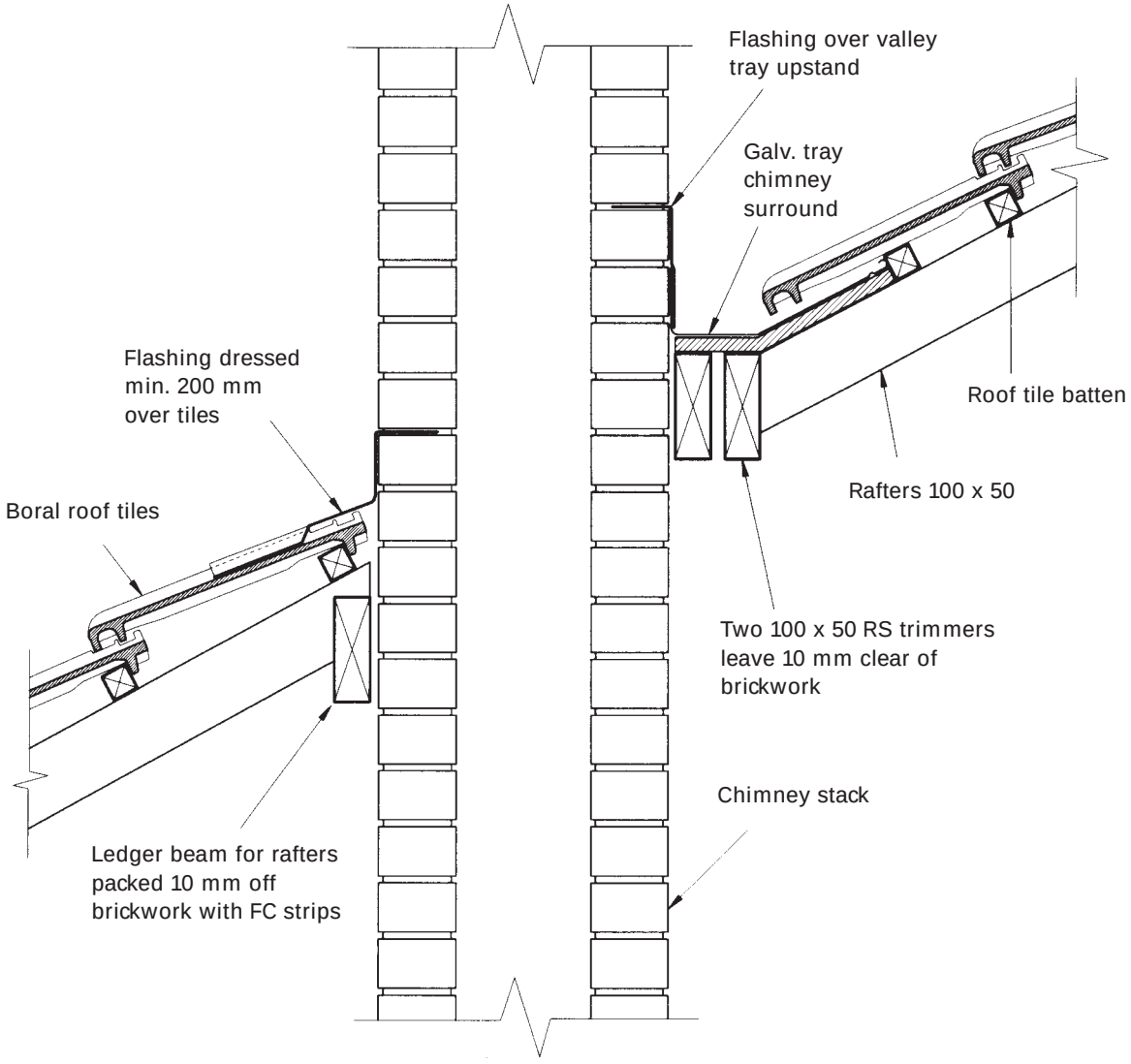
Chimney Junctions



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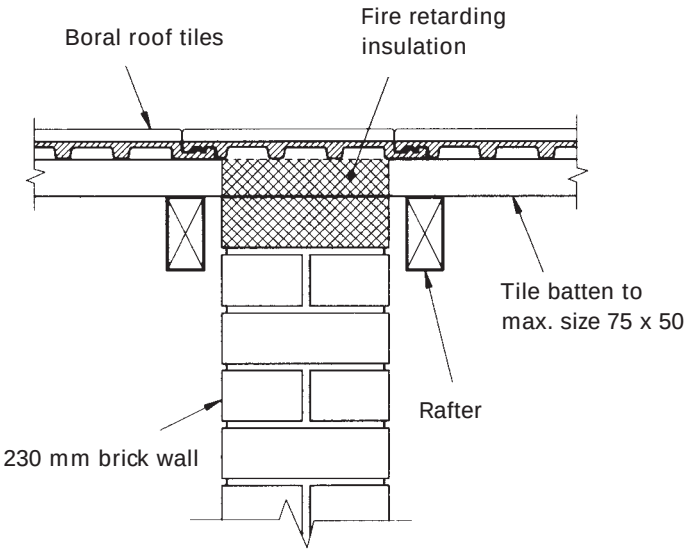
Tile Over Internal Fire Wall



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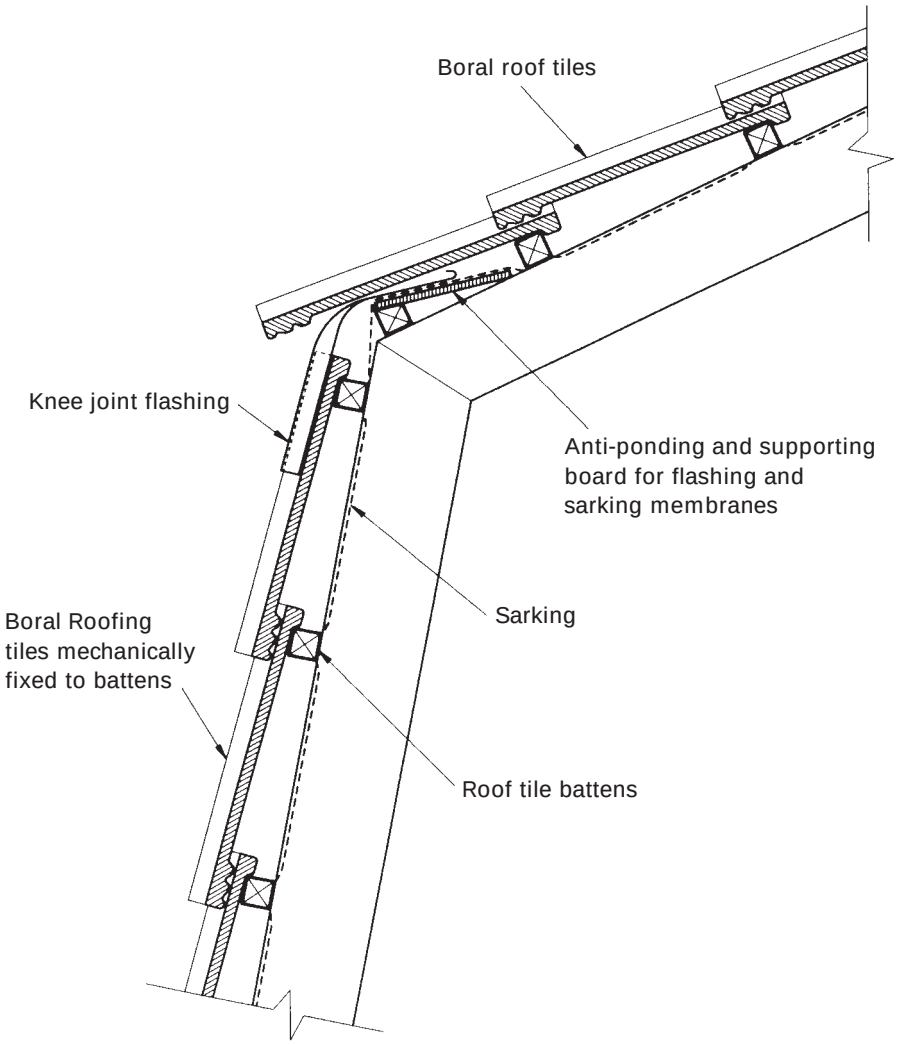
Mansard Roof



Unless otherwise stated all dimensions are in millimetres

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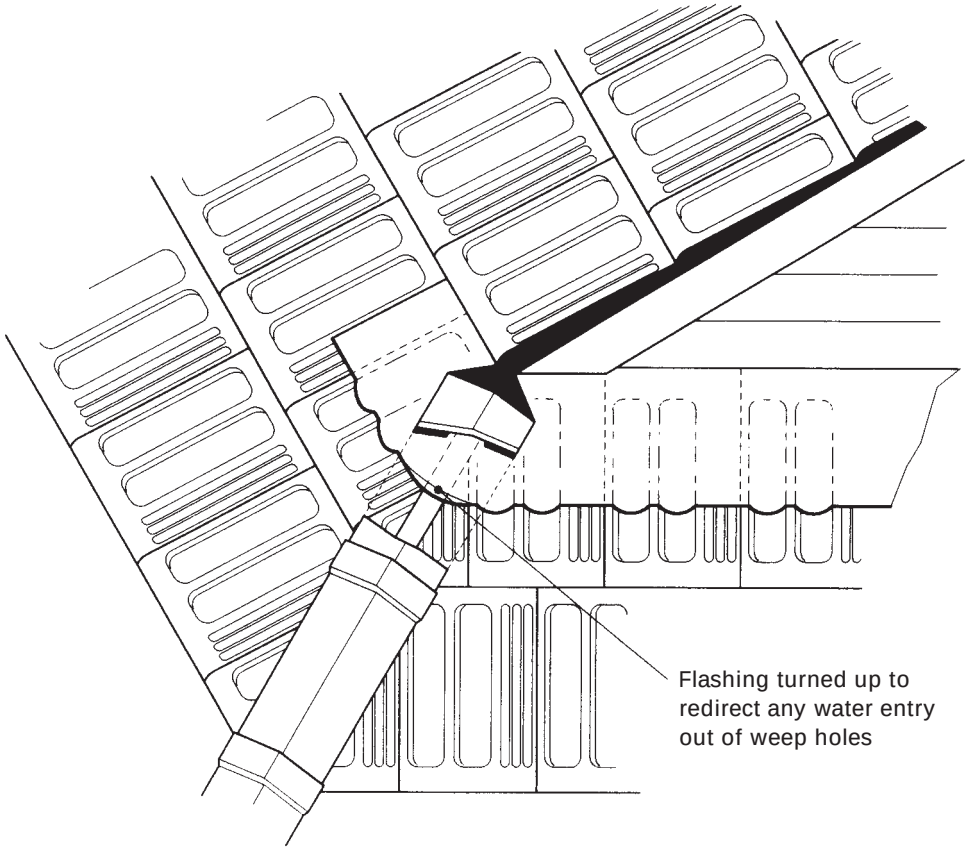
Elevation of Dutch Gable



Unless otherwise stated all dimensions are in millimetres

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Sustainability

Boral Montoro Pty Ltd trading as Boral Roofing is an Australian owned company with manufacturing plants in: New South Wales, Queensland, South Australia and Victoria producing quality concrete and terracotta roof tiles and accessories.

All Boral Roofing sites maintain a Quality Management System, AS/NZS – ISO 9001.

Boral Roofing maintains fully staffed Quality Control Laboratories at these locations where product from each shift is meticulously tested for weight and dimensional stability, transverse strength, water absorption and permeability to the requirements of AS 2049 Roof tiles.

Outside agencies are available to Boral Roofing and they provide verification of the in-house testing and the testing regimes i.e. Dynamic Weather Resistance, Wind loads that Boral Roofing will undertake at various times.

This Sustainability section covers:

Testing: AS 2049 – Roof Tiles

Boral Roofing conducts regular sampling and testing of both concrete and terracotta tiles during production and prior to dispatch from our various plants.

The test criterions are set out below:

1 Dimensional Tolerances

A sample of 12 tiles shall be tested. The dimensional tolerances for roof tiles shall be determined in accordance with AS 4046.2. The mean of the individual results shall be as follows:

a) Exposed width: manufacturer's nominated width ± 2%.

b) Length: manufacturer's nominated length ±2%.

2 Transverse Breaking Load

When tested in accordance with AS 4046.3, the average transverse breaking load for the six test specimens shall be not less than 4 N per millimetre of exposed width for all tiles. Additionally, the transverse breaking load for each of the individual test specimens shall be not less than 3.325 N per millimetre of exposed width for all tiles.

Retests are permitted.

3 Water Absorption

Water absorption; when roof tiles or accessories are tested in accordance with AS 4046.4, the percentage of water absorption of any test pieces shall be not more than 10% for tiles graded as "general purpose".

4 Permeability

When tiles are tested in accordance with AS 4046.5, the permeability of each of the three test specimens shall be such that, at the end of 2 hours, no drop of water shall have formed on the underside of any of the test specimens.

Retests are permitted.

5 Resistance to Salt Attack

The ability of roof tile units to resist salt attack shall be categorized (see table 1) by testing in accordance with AS 4046.7.

Table 1 Salt Attack Resistance Categories

Category	Requirement/description
Exposure Grade	<0.4 g loss in 40 cycles in AS 4046.7 for roof tiles (non-metallic)
General Purpose	Supplier's experience, according to which it is possible to demonstrate that the product has a history of surviving under environmental conditions similar to those existing at the site considered. Products that fit this category are not expected to meet the mass loss criterion for "exposure" grade when tested in accordance with AS 4046.7.

Roof tiles manufactured in accordance with this Standard, categorized as "exposure" grade shall be deemed suitable in all exposure environments, including severe marine environment.

Note: Severe marine environment; up to 100m from a non-surf coast and up to 1km from a surf coast are both regarded as severe marine environment. The distances specified are from the mean high water mark.

All Boral Roofing's tiles are exposure grade.

AS 2050 – Installation of Roof Tiles

All Boral Roofing tiles have been subjected to the "Dynamic weather resistance test".

Fire Resistance

All Boral Roofing tiles are incombustible during fires.

Boral Roof tiles when used in conjunction with sarking (sarking to be rated Low and cover the entire roof) form an acceptable method of roof covering where construction to level 3 in accordance with AS 3959 Construction of buildings in bushfire-prone areas is required.

Note: Extreme winds can be generated during bushfires. Fixing requirements should be increased as a precaution against the higher wind classification.

Thermal Performance

The colour of roofing should be considered in relation to thermal performance. Most of Australia has a climate, which requires the roof to limit heat gain rather than be concerned with heat loss. The colour of an exposed surface determines the amount of solar radiation, which will be absorbed. Experiments have shown light coloured tiles lower the air temperature in the roof space by up to 9° compared to dark tiles.

The use of reflective foil sarking and ventilators should also be considered.

Acoustic Performance

Typically, external noise penetrates a building through windows, doors, walls and to a lesser extent the roof. Generally the roof would be the least important path of noise transmission though in locations where there are busy roads, railways or aircraft noise the roof becomes an element to be considered.

Noises in the frequencies of 100Hz to 300Hz (normal for road, rail and aircraft noise) roof tiles have the potential to reduce sound by 30 decibels.

Water Collection

The surface of a concrete or terracotta tile is non-toxic and therefore suitable for use in collecting water.

AS 2049 Roof tiles, requires the surface treatment of all roof tiles to be free of any elements or chemicals in concentrations known to be hazardous to health.

Concrete roof tiles; claims have been made that concrete tiles can double their weight from water absorption. This is patently incorrect. All concrete tiles that conform with AS 2049 have a maximum water absorption limit of 10% and practical tests show water uptake after 24 hours immersion to be less than half the specified limit.

Terracotta roof tiles; once fired are inert bodies and no lead, cadmium or other heavy metals are used in the ceramic glazes.

Notes

1. Consideration is required in regards to the types of material used for flashings especially in the collection of potable water from the roof.
2. Guidelines are provided in "Guidelines on the collection, care and control of rainwater in tanks".

3. A method of assessing compliance is provided by BS 6920.

Durability

Roof tiles can be expected to perform satisfactorily for a period of 50 years; refer to the Boral Roofing's product guarantee.

Roof tiles are manufactured to strict specifications to with stand the normal stresses found in roofing applications. (See testing)

Concrete tiles; are fixed to the roof in a "semi-green" state for ease of cutting and securing the roof tiles. Over time as the concrete tile cures the strength increases dramatically.

Terracotta tiles; have a high early strength and maintain that strength over the life of the tile.

Questions

Maintenance

Both concrete and terracotta tiles are easy to repair.

If a roof suffers damage due to storm and tempest the repair is simple, as only the tiles actually damaged need to be replaced.

With the use of "Flexible" pointing material, it makes a tiled roof almost maintenance free.

Use of Sarking

The need to Sark roofs is becoming less a choice, and more a requirement. In NSW's, BASIX's requires sarking under roof cladding rated medium or dark by solar absorption testing. Energy efficient roof systems will also bring about similar changes nationally.

Sarking is a thermal barrier, water resistant, dust resistant and fire retardant membrane; its use is recommended under all roofing materials.

Safety Rail

A risk assessment of the individual job site should be conducted and an appropriate safety system installed to prevent injuries by falls through or off the roof, regardless of height or the roof surface.

Security Fixing

Is dependant on the nominated wind classification of the job site. This information should be provided on plans or specifications from the designer or builder.

Coastal Regions

AS 2049 requires all tiles to be "exposure" grade unless otherwise nominated. Both Terracotta and Concrete tiles are available for use in coastal regions.

Display and Selection Centres

Display and Selection Centres

Customer Services

Fully Trained Technical Representatives

Boral Roofing sales staff are fully trained to respond to all enquiries regarding pricing, product technical information, roof tile fixing, colour selection and directions for information on other Boral Products.

Full Technical Literature

Full technical literature is available on all concrete and terracotta roof tile products manufactured by Boral Roofing.

Colours and Samples

Boral Roofing maintains many brick and tile display centres in Australia. At these centres, customers can choose the brick and tile combinations for their project in comfort and with fully trained consultants.

The addresses of the Boral Display and Selection Centres are shown overleaf.

Site Delivery

Boral roof tiles are delivered to site in excellent condition and ready for roof loading.

In some cases off road fork lifts can be arranged to position the roof tiles at the most convenient location on site.

Contracting Service

In all states, Boral Roofing offers a roof tile contracting service, providing the customer with supply and fix quotations for all products direct from the manufacturer. In some states quotations can also be arranged from qualified independent tiling contractors.

Quality Controls

Boral Roofing products undergo strict quality controls in accordance with Australian and International standards.

Research is carried out on an on-going basis in an effort to continually improve our products and services.

Safety Rail

Boral Roofing can organise Safety Rails for your project so as to satisfy the requirements of the Safety Authority in your State. (Offer not available for Queensland customers).

Flexible Pointing

Flexible pre-mixed pointing material stops the incidence of settlement cracking in ridging thus reducing maintenance costs. Another benefit is the consistent colour. Flexible pointing is classified as a mechanical fixing.

Display and Selection Centres
The actual roof tile colours can be viewed at any of the locations below. Most of these locations also have Boral bricks on display, enabling you to do one-stop shopping for bricks and roof tiles.

ACT

Fyshwick
16 Whyalla Street
Fyshwick ACT 2609

NEW SOUTH WALES

Badgerys Creek
Martin Road
Badgerys Creek NSW 2170

Castle Hill
Boral Select
5 Hoyle Avenue
Castle Hill NSW 2154

Newcastle
21 Pendlebury Road
Cardiff NSW 2285

Revesby
Hiland Building Centre
7 The River Road
Revesby NSW 2212

Shell Cove
Boral Ideas Centre
Cnr Southern Cross Boulevard
and Hinchinbrook Drive
Shell Cove NSW 2529

Sydney
Sydney Building Information Centre
525 Elizabeth Street
Surry Hills NSW 2010

Wagga Wagga
385 Edward Street
Wagga Wagga NSW 2650

Wyong
Boral Select
154 Pacific Highway
Wyong NSW 2259

QUEENSLAND

Darra
Harcourt Road
Darra QLD 4076

Gold Coast
Cnr Nerang Southport
and Ashmore Roads
Ashmore QLD 4214

Lawnton
Lawnton Pocket Road
Lawnton QLD 4501

Springwood
Home & Building Display Centre
Cnr Old Chatswood Road
and Pacific Highway
Springwood QLD 4127

Sunshine Coast
Lot 2, Maroochydore Road
(turn at Conara Road)
Kunda Park QLD 4556

VICTORIA

Ballarat
Highland Brick & Roofing
Lot 10 Wiltshire Lane
Ballarat VIC 3350

Bendigo
Hume & Iser Building Centre
35-37 Charleston Place
Bendigo VIC 3550

Caroline Springs
1037 Western Highway
Caroline Springs VIC 3023

Dingley Village
66-78 Tootal Road
Dingley Village VIC 3172

Echuca
Rich River Brick & Tile
31 Murray Valley Highway
Echuca VIC 3564

Scoresby
2 Cathies Lane
Scoresby VIC 3152

Shepparton
O'Sullivan Bricks & Windows
8 Mercury Drive
Shepparton VIC 3630

South Geelong
West Coast Roofing
Unit 2/12 Crown Street
South Geelong VIC 3220

Thomastown
2 Trawalla Avenue
Thomastown VIC 3074

Warrnambool
South West Roofing
41B McMeekin Road
Warrnambool VIC 3280