Roofing Design Requirements

BUILDER VERSION

Monier™ ROOFING | CSR

INTRODUCTION

Understanding roofing design requirements

Monier has developed this guide to provide the builder or main contractor with the following information:

(i) Product overview offered by Monier;
(ii) Roofing essentials & NCC 2022 Requirements;
(iii) Roof design considerations;
(iv) Job site requirements; and
(v) Warranty and maintenance.

At the time of estimation, the following information is to be supplied by either the building designer or the main contractor, so that the appropriate roof installation system can be specified:

(i) Wind classification.
(ii) Rafter or truss spacing and material.
(iii) Roof pitch.
(iv) Roof bracing.
(v) Corrosion potential of the site.
(vi) The need for sarking.
(vii) Specific statutory or regulatory requirements.
(viii) Bushfire Classification
(ix) Exposed rafter, zero eave and boundary wall requirements.

The design recommendations in this document only relate to Monier tiled roofs of buildings that are intended for domestic, commercial or light industrial purposes for wind classifications N1 to N6 and C1 to C4 inclusive, with a roof pitch of 12 degrees or greater (depending on profile).

For projects outside the scope of these guidelines, your Monier representative should be contacted for specific advice.

PRODUCT OVERVIEW

7 reasons why you should choose Monier roof tiles

1. Tiles can create the right look for all styles of homes and provides flexible design options.
2. Tiles are best suited for Australian conditions.
3. Colour lasts longer on tiles.
4. Tiles offer a sustainable roofing option.
5. The Monier Collections comes with a 50 year performance guarantee; while the Luxe Collection offers a 50 year performance and colour guarantee.
6. Tiles can be used on low-pitched roofs. Monier offers roofing solutions for roof pitches with 12 degree or more.
7. Tiles are highly resistant to high winds^. Their density reduces the risk of wind uplift.

^Broughton, G, Shoalwater and Roleystone WA tornadoes - wind damage to buildings (2008).

TILE MATERIAL & PROFILE

All Monier tiles are tested to and in compliance with Australian Standards and *National Construction Code (NCC) 2022* requirements. Monier offers three Collections to choose from when selecting roof tiles – Luxe, Premium and Classic.

For more information on product specifications refer to the Monier product data sheets from **monier.com.au.**

LUXE COLLECTION

The Monier terracotta range, Luxe Collection„ includes timeless designs and the confidence knowing that the colour will last a lifetime. A terracotta roof will embrace all the elements and will not fade.

Urban Shingle
Peak

Nouveau
Ravine

Marseille
Peak

COLOUR LOCK C-LOC™ TECHNOLOGY

PREMIUM COLLECTION

The concrete Premium Collection comes with C-LOC™ Colour Lock Technology providing better UV protection to improve gloss retention of the tile. Locking in the premium look for your home for longer.

Cambridge
Soho Night

Madison
Soho Night

Horizon
Barramundi

CLASSIC COLLECTION

Competitive on price, the concrete Classic Collection is made with concrete tiles that are tested to withstand the harsh Australian weather.

Atura
Wild Rice

Tudor^
Aniseed

Elabana
Salt Spray

^Tudor is a standard product in VIC, SA and TAS only.

TILE LAYOUT

What is bonding?

Bonding refers to the way the tiles are laid on a roof. There are 3 types of bonding used with the Monier range of profiles – Straight, cross & 1/4 bond. Each bonding method is suited to the shape of the roof tile.

Table 1 provides information on the recommended bonding layout.

STRAIGHT

CROSS

1/4 BOND

Table 1 – Bonding Recommendations

PROFILE	RECOMMENDED BONDING
Urban Shingle	Cross
Nouveau	Cross or Straight
Marseille	Cross
Cambridge	Cross
Madison	1/4 Bond
Horizon	Cross
Atura	Straight
Elabana	Straight
Tudor	Straight
Centurion	Straight

ROOF FINISH

The final decision when completing the roof is deciding on whether to install A-line or Lapped ridge. The modern A-line ridge provides a sleek minimalist finish and complements flatter profile tiles. A Lapped ridge is the more traditional choice, creating a classic look and is ideal for curved tiles.

Monier recommends A-line ridge for any flat profile. The ridge finish recommended by profile is indicated in table 2. Please note A-line ridge is not available in C2-C4 wind classifications.

At the time of estimation, please confirm the selected ridge finish to be quoted with your plan.

Table 2: Ridge selection

PROFILE	A-LINE RIDGE FINISH	LAPPED RIDGE FINISH
Urban Shingle	●	●
Nouveau	●	●
Marseille		●
Cambridge	●	●
Madison	●	●
Horizon	●	●
Atura	●	●
Elabana		●
Tudor		●
Centurion		●

A-line ridge

Lapped ridge

TERRACOTTA TILE COLOURS

Luxe Collection

Titan

SA: 88.20%
SRI: 4.44%
LRV: 5.12%
N & U

Titan Gloss

SA: 88.30%
SRI: 3.53%
LRV: 4.79%
M

Bedrock

SA: 86.60%
SRI: 9.01%
LRV: 5.81%
M, N & U

Peak

SA: 83.40%
SRI: 13.48%
LRV: 7.59%
M, N & U

Mystic Grey

SA: 83.20%
SRI: 11.80%
LRV: 10.03%
M

Ravine

SA: 73.40%
SRI: 24.49%
LRV: 10.58%
N **&** U

Pottery Brown

SA: 84.30%
SRI: 10.42%
LRV: 5.86%
M

Comet

SA: 78.70%
SRI: 20.50%
LRV: 14.60%
M & N

Delta Sands

SA: 73.50%
SRI: 27.57%
LRV: 10.75%
M

Riverstone

SA: 67.10%
SRI: 32.41%
LRV: 19.12%
M & N

Florence Red

SA: 77.90%
SRI: 21.28%
LRV: 9.22%
M

Cottage Red

SA: 82.30%
SRI: 25.56%
LRV: 9.97%
M

Mars

SA: 56.90%
SRI: 47.09%
LRV: 21.16%
M & N

Sunset

SA: 64.60%
SRI: 45.17%
LRV: 14.69%
M

Earth

SA: 56.90%
SRI: 45.58%
LRV: 17.77%
M, N & U

Aurora

SA: 85.10%
SRI: 21.56%
LRV: 11.59%
M

Tanbark

SA: 84.70%
SRI: 12.62%
LRV: 5.69%
M

Burgundy

SA: n/a
SRI: 16.51%
LRV: 5.73%
M

Bungalow

SA: n/a
SRI: 5.74%
LRV: 12.50%
M

Not all colours are available for Marseille, Nouveau & Urban Shingle. Please refer to key **M** Marseille, **N** Nouveau & **U** Urban Shingle.
SA = (Solar Absorptance) is a measure of how much of the sun's radiation is absorbed by a material. Monier tiles were assessed through Solar Absorptance test to *ASTM E903-20 Standard Test Method for Solar Absorptance, reflectance and Transmittance of materials using integrating spheres.*
SRI = (Solar Reflective Index) is an indicator of the ability of a roof surface to return solar energy to the atmosphere. The lower the SRI, the hotter a material surface is likely to become under the sun. Monier tiles were assessed through SRI test to *ASTM E1980-01.*
LRV = (Light Reflective Value) refers to the percentage of light a colour reflects. *BS 8493:2008 Light Reflective Value (LRV) of a Surface - Method of Test.*

CONCRETE TILE COLOURS
PREMIUM & CLASSIC COLLECTION

Sambuca

SA: 95.70%
SRI: -0.80%
LRV: 4.70%
A, CT, E, H & T

Barramundi

SA: 92.70%
SRI: 3.95%
LRV: 9.55%
A, CT, E, H & T

Soho Night

SA: 93.40%
SRI: 2.07%
LRV: 6.82%
C & M

Chocolate

SA: n/a
SRI: 7.84%
LRV: 9.97%
CT & T

Wollemi

SA: 90.20%
SRI: 4.70%
LRV: 13.01%
A & H

Camelot

SA: 91.70%
SRI: 4.70%
LRV:: 7.81%
A & H

Babylon

SA: 87.80%
SRI: 8.68%
LRV: 13.24%
A, E & H

Aniseed

SA: 84.80%
SRI: 11.68%
LRV: 14.73%
A, E, H & T

Caraway

SA: 89.00%
SRI: 6.34%
LRV: 10.75%
A & H

Silver Perch

SA: 78.80%
SRI: 16.84%
LRV: 23.32%
A & H

Wild Rice

SA: 68.00%
SRI: 35.80%
LRV: 34.35%
A, E & H

Mist Grey

SA: 46.70%
SRI: 60.18%
LRV: 40.25%
H

Seashell

SA: 42.50%
SRI: 61.66%
LRV: 60.56%
H

Salt Spray

SA: 41.70%
SRI: 63.67%
LRV: 63.04%
A, CT, E & H

Chilli

SA: 88.40%
SRI: 7.72%
LRV: 7.42%
A, E & H

Saffron

SA: 69.00%
SRI: 33.81%
LRV: 14.94%
CT, E & T

Not all colours are available for Madison, Cambridge, Horizon, Atura, Tudor, Elabana & Centurion. Please refer to key **M** Madison, **C** Cambridge, **H** Horizon, **A** Atura, **T** Tudor, **E** Elabana & **CT** Centurion.
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OTHER DESIGN CONSIDERATIONS

Thermal benefit of roof tiles

The colour of roofing, thermal mass, thermal conductivity, corrugated surface and roof pitch all affect the energy efficiency of a dwelling.

The roof makes up to 30% of the entire facade of the home and is exposed to high levels of UV. The colour of a roof affects the level of solar absorbed by the roof. The higher the solar absorption (SA) value indicates the surface absorbs a larger amount of solar radiation. For example, a black hat will absorb more heat compared to a white hat. A study conducted by The University of Newcastle has shown that light coloured tiles yield energy savings between 25-36% compared to dark coloured tiles[1].

To select the most suitable tile colour for the dwelling, it's important to consider the location of the property. In warmer climate zones, it's advisable to opt for a lighter colour roof with a lower SA value. Conversely, in cooler climate zones, darker tiles may be more appropriate.

Roof tiles are effective temperature regulators, allowing for cooler temperatures in summer and maintaining the warmth of a home during winter, which assists with reducing energy costs. Tiles generate less surface temperatures because the material creates a thermal lag effect to store energy within the material[2], not releasing it until the temperature drops, which enhances the thermal comfort of houses.

Tiles are a sustainable roofing material

Roof tiles have impressive thermal performance, have a longer product life cycle than other roofing materials, and can be recycled or reused after they have lived out their life on the home.

1. The Properties of roof tiles. ARTA. https://artastorage.blob.core.windows.net/media/1116/arta-properties-of-roof-tiles.pdf.

2. Solar Absorptance Factsheet. ARTA. https://artastorage.blob.core.windows.net/media/1219/solar-absorptance-fact-sheet-4june-r2.pdf.

ROOFING ESSENTIALS & NCC REQUIREMENTS

Ventilation

Effective ventilation is an important way to create a more comfortable, healthy and energy efficient home. The Bradford Ventilation range of vent solutions include natural, wind driven products and smart, powered ventilation.

The benefits of ventilation

- Expels hot air from your roof space in warmer weather
- Exhausts moisture and condensation in cooler weather
- Reduces the load on your air conditioning system
- Helps reduce energy costs

For more information visit: **bradfordventilation.com.au**

NCC 2022 Requirements

The NCC2022 Housing Provisions Standard, 10.8 Condensation Management states that homes in climate zones 6, 7 & 8 must ventilate their roof space to outdoor air. It also states that the wet areas of the home must also be ducted out directly to outdoor air. Both clauses can be met with a Bradford Ventilation solution.

Roof Sarking

You only get one chance to install sarking and that is when you install a new roof. The benefits of sarking far outweigh the incremental cost of the product.
Sarking is a flexible membrane that is laid under the roof battens during the installation of a new roof. We recommend the use of sarking for all new roofs irrespective of roof pitch, terrain category or location.

The benefits of roof sarking

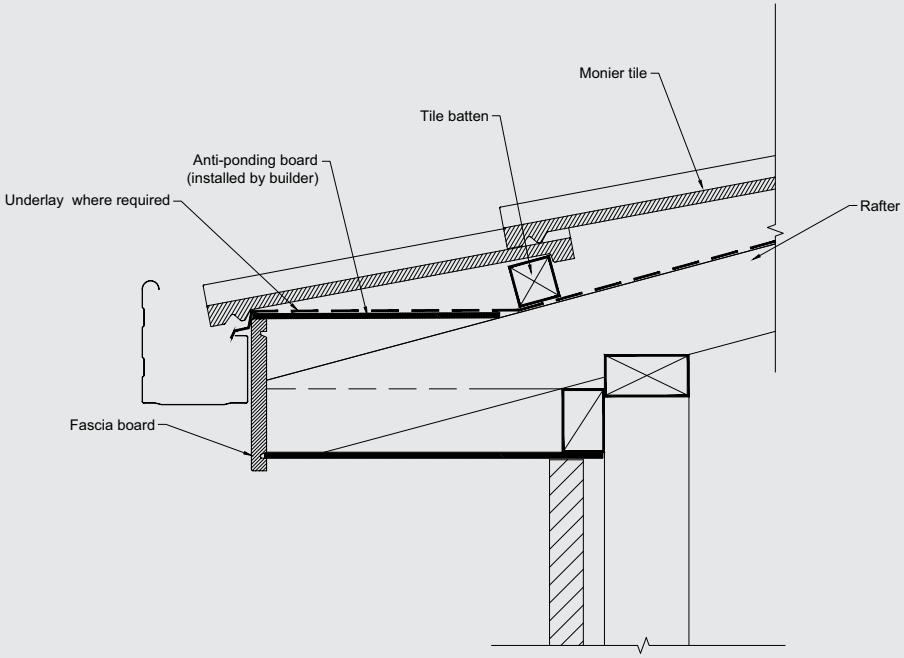
- Acts as a **secondary protective layer underneath your tiles that minimises wind-driven rain entering the roof space** which can lead to mould growth, ceiling staining or rot
- **Reduces draughts entering the roof space**, allowing insulation to work more effectively which ultimately improves the energy efficiency of your home
- **Provides compliance to BAL bush fire ember attack requirement**s in accordance AS3959 by providing a **secondary form of ember protection** for the roof space
- **Improves thermal performance by reflecting up to 97% of radiant heat**, helping provide a more energy efficient and comfortable home (Bradford Thermoseal range)
- **Helps manage the risk of condensation** by allowing moisture to escape whilst preventing the entry of water (Bradford Enviroseal range)

For more information visit: **bradfordinsulation.com.au**

NCC 2022 Requirements & Australian Standards

Sarking is mandatory by the NCC and Australian Standards under a number of circumstances. To summarise, sarking is essential if the construction meets one or more of the below criteria, as the minimum standard, Monier recommends:

- wind class is equal to or greater than N3/ C1;
- locate in a bushfire prone area;
- valleys spreading onto lower roofs;
- under spreaders (at the builders request);
- change of pitch in mid roof;
- exposed rafters;
- flat profiled tiles or raked ceilings; and
- in relation to pitch/ rafter lengths.



Anti-ponding board

Anti-ponding board ensures water drains away correctly and does not pool under the roof edge tiles. Anti-ponding boards sit underneath the sarking between the fascia boards and the rafters.

NCC requirements

(a) An anti-ponding device/board must be provided where sarking is installed on –
(i) Roofs with a pitch less than 20, and
(ii) Roofs with no eaves overhang, regardless of the roof pitch.

(b) An anti-ponding device/board required by (a) must be water resistant and fixed along the eaves line from the top of the fascia back up the rafter with a clearance of approximately 50mm below the first batten.

Monier also recommends anti-ponding boards and sarking be installed where the house is three storeys or greater.

Roof Design Considerations

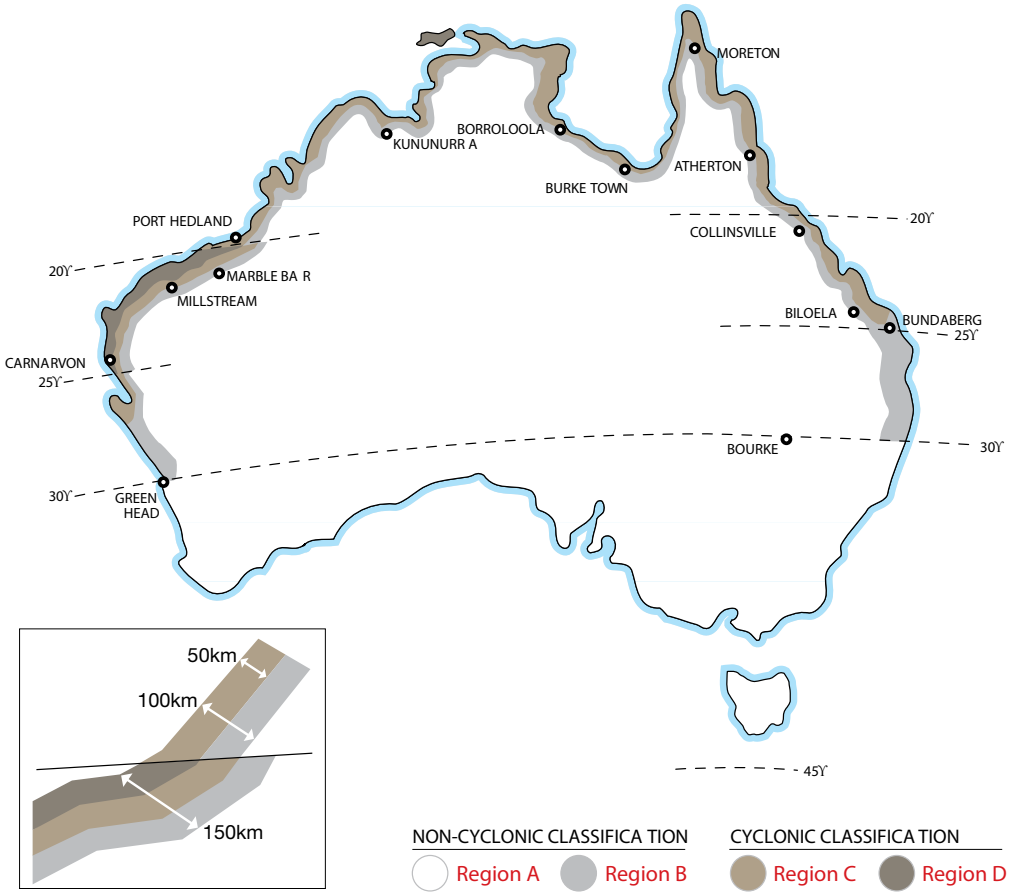
Wind classification

The wind classification shall be determined in accordance with *AS 4055 - Wind loads for housing* by qualified building engineer.
There are 5 factors that affect a domestic building site`s wind class:

1) Geographic wind speed;
2) Terrain Categories, TC (e.g. the height of houses/ river/ obstructions near the site);
3) The Topographic class (e.g. whether the project is on a hill);
4) The shielding condition (e.g. trees around the project); and
5) The distance from the smoothed boundary (coastline or higher wind region).

For more information about wind classification contact your Monier representative.

Figure 1 - Wind speed region



The wind region by Australian Building Codes Board (ABCB), the authority who develop *NCC/BCA*, is summarised by the map, Figure 1.

Securing roof tiles

The method of fixing specified to secure the roof tiles to the underlying frame is dependent on the wind classification. The builder must provide the wind classification when placing an order to ensure the appropriate fixing method is installed per the table 3 below.

Table 3 – Tile fixing requirements

WIND CLASSIFICATION	MINIMUM MECHANICAL INSTALLATION REQUIREMENTS FOR TILES AND ANCILLARIES		
	TILE FIXING		RIDGE, HIP AND BARGE TILES
	EDGE OF ROOF*	FIELD OF ROOF	
N1 & N2	Mechanically fasten each full tile in second course and then every second tile in every course or every tile in each alternative course		Mechanically fasten each tile
N3	Mechanically fasten each full tile in second course	Mechanically fasten each second full tile in every course	Mechanically fasten each tile
N4 to N6	Mechanically fasten every full tile	Mechanically fasten every full tile	Mechanically fasten every tile
C1	Mechanically fasten every full tile	Mechanically fasten each second full tile in every course	Mechanically fasten every tile
C2 & C3	Mechanically fasten every tile	Mechanically fasten every tile	Mechanically fasten every tile

*Based on regional experience & tile selection, either a nailing or clipping fixing method will be recommended.

Source: National Construction Code 2022 Volume 2 Table 3.5.2.1.

Installation in bush fire prone area

According to the NCC 2022, concrete and terracotta roof tiles are non-combustible materials.

When constructing a new home determining whether the dwelling is located in Bushfire Prone Area (BPA) will affect the construction of the roof. If the home is located in a designated BPA, the home must be constructed to a minimum Bushfire Attack Level (BAL) of 12.5. The BAL classifications is based on the exposure of a site to ember attack and radiant-heat thresholds, expressed as kW/m2. For example BAL-29 is primarily concerned with protection from ember attack and from radiant heat up to and including 29 kW/m2.

When building a home in a BAL 12.5 or greater the following requirements for sarking must be actioned:

- Sarking is mandatory and installed directly below the roof tile battens;
- Sarking needs to cover the entire roof area including the top ridge; and
- Sarking installed without any gaps that would allow entry of embers e.g. the sarking meets fascias, gutters, valleys and the like.

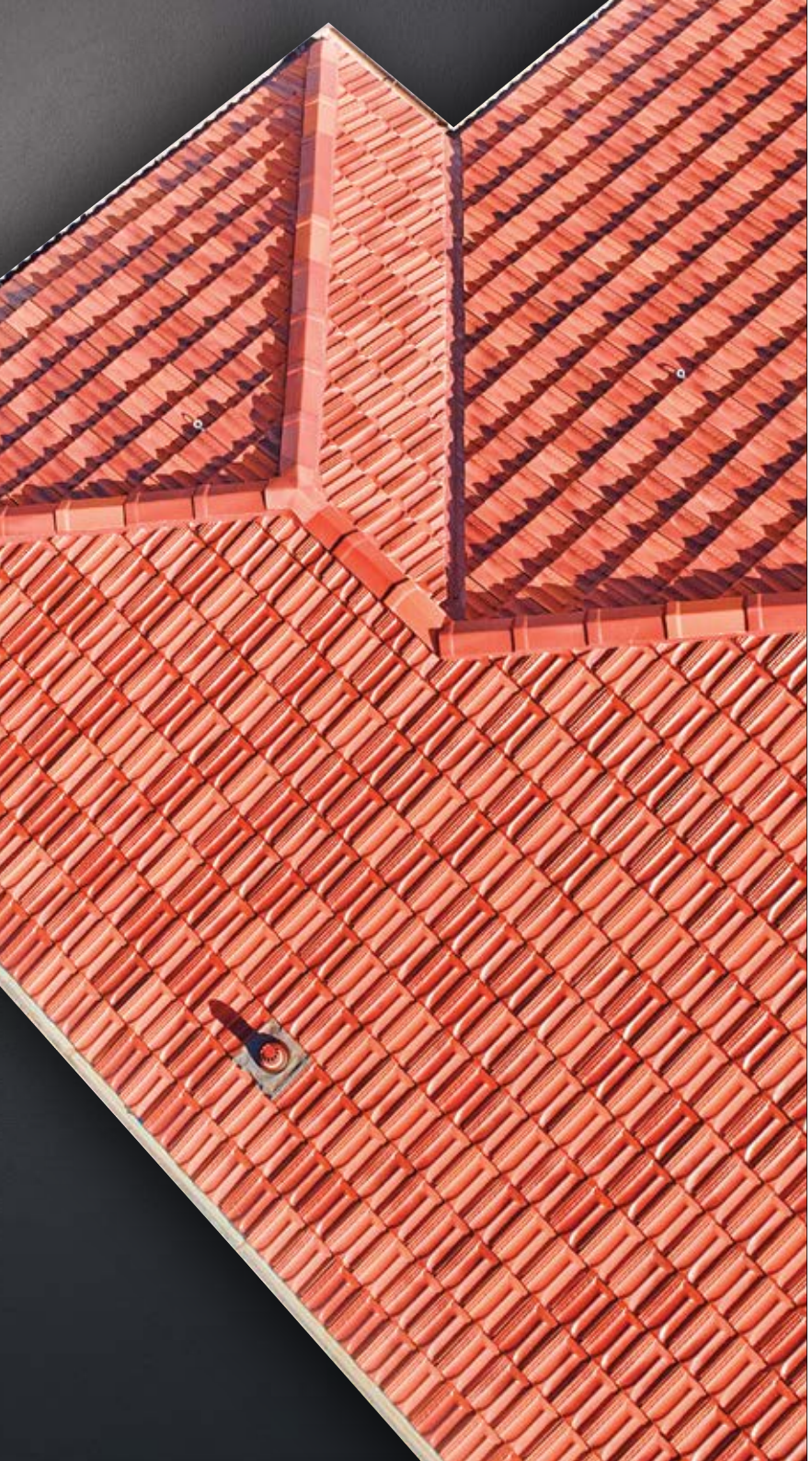
When fire wall is required to separate the spread of fire in construction, roof battens above fire walls is required by NCC to be sized 75 x 50mm or less.

Please refer to Table 4 for more details in BAL requirements:

Table 4 – BAL Requirements

	SARKING APPLICABLE	OTHER ROOFING MATERIALS RECOMMENDED
BAL EXEMPT	N/A	N/A
BAL Low	Confirm if the BAL is BAL12.5 or BAL-EXEMPT	
BAL 12.5	Roof or Roof Plus Grade of Sarking	Anti-ponding board
BAL 19	Roof or Roof Plus Grade of Sarking	Anti-ponding board
BAL 29	Roof or Roof Plus Grade of Sarking	Anti-ponding board, valley seal and mechanically fix every tile
BAL 40	Roof or Roof Plus Grade of Sarking	Anti-ponding board, valley seal and mechanically fix every tile, sealed roof/ wall and roof/roof junction
BAL FZ (Fire Zone)	Roof or Roof Plus Grade of Sarking	Refer to your regional Monier office for specific details

Please refer to *Building with tile roofs in bushfire prone areas* by Australian Roofing Tile Association for more installation guidance.



Determining rafter spacing

The rafter spacing has a direct relationship with batten size. The preferred rafter spacing for roof tiles is 600mm to minimise fall through risk. However, batten spans up to 900mm are allowed in non-cyclonic areas with larger-sized battens, as *AS 1684.2** states.

Roof pitch

The shallower the roof pitch, the weaker the force of gravity pulling water from the roof. If tiles are desired in circumstances with a roof pitch < 12 degrees (refer to Table 5 & 6 for the relationship between regions, profile selection, pitch and rafter length in determining the construction specification for your roof), Monier recommends that the pitch of the roof be raised to a pitch appropriate for the rafter length of the roof. If tiles are desired in circumstances with a roof pitch > 35 degrees, consult with your Monier representative.

*AS 1684.2 - Residential timber-framed construction: Non-cyclonic areas.

Table 5 - Determining rafter length for concrete tiles

Bumpy Tiles					Semi-Flat Tiles				Flat Tiles			
Elabana, Tudor & Centurion					Atura				Horizon, Cambridge & Madison			
Pitch	Sarking Mandatory	Max rafter w/ out sark	Recommended Head Lap (mm)	Max rafter w. sark	Sarking Mandatory	Max rafter w/ out sark	Recommended Head Lap (mm)	Max rafter w. sark	Sarking Mandatory	Max rafter w/ out sark	Recommended Head Lap (mm)	Max rafter w. sark
12°	Minimum pitch 15°				Minimum pitch 15°				Minimum pitch 15°			
15°	Yes	n/a	80	4.5	Yes	n/a	80	4.5	Yes	n/a	100	4.5
16°	Yes	n/a	80	5	Yes	n/a	80	5	Yes	n/a	100	5
17°	Yes	n/a	80	5.5	Yes	n/a	80	5.5	Yes	n/a	100	5.5
18°	Yes	n/a	80	6	Yes	n/a	80	6	Yes	n/a	100	6
19°	Yes	n/a	80	6.5	Yes	n/a	80	6.5	Yes	n/a	100	6.5
20°	No	5.5	80	8	No	5.5	80	7	Yes	n/a	80	7
21°	No	5.5	◇75	8.5	No	5.5	80	7.5	Yes	n/a	80	7.5
22°	No	6	◇75	9	No	6	80	8	Yes	n/a	80	8
23°	No	6	◇75	9.5	No	6	80	8.5	Yes	n/a	80	8.5
24°	No	6	◇75	10	No	6	80	9	Yes	n/a	80	9
25° & above	No	6	◇75	10	No	6	80	9.5	Yes	n/a	80	9.5

NOTES:
In consultation with your Monier representative, tiles may be installed at rafter lengths longer than those indicated in this table.
* Note 1 Monier highly recommends the use of sarking for additional protection. Check your terrain category, as this may have implications on whether or not sarking is required.
* Note 2 Monier recommends that safety system used in construction DOES NOT penetrate or damage sarking material.
* Note 3 Monier recommends the use of extra heavy duty sarking below 15°
* Note 4 AS 2050:2018 3.1.5 Maximum rafter lengths, measured from the topmost point of the rafter downwards.
* Note 5 AS 2050:2018 3.1.2 states Anti-ponding board shall be provided on roofs < 20° and where there is zero eaves.
* Note 6 All flat concrete tiles must be installed with sarking.

Table 6 - Determining rafter length for terracotta tiles

	Marseille			Nouveau			Urban Shingle		
Pitch	Sarking Mandatory	Max rafter w/ out sark	Max rafter w. sark	Sarking Mandatory	Max rafter w/ out sark	Max rafter w. sark	Sarking Mandatory	Max rafter w/ out sark	Max rafter w. sark
12°		Minimum pitch 15°		Yes	n/a	4.5	Minimum pitch 18°		
15°	Yes	n/a	4.5	Yes	n/a	4.5			
16°	Yes	n/a	5	Yes	n/a	5			
17°	Yes	n/a	5.5	Yes	n/a	5.5			
18°	Yes	n/a	6	Yes	n/a	6	Yes	n/a	6
19°	Yes	n/a	6.5	Yes	n/a	6.5	Yes	n/a	6.5
20°	No	5.5	8	No	5.5	8	Yes	n/a	8
21°	No	5.5	8.5	No	5.5	8.5	Yes	n/a	8.5
22°	No	6	9	No	6	9	Yes	n/a	9
23°	No	6	9.5	No	6	9.5	Yes	n/a	9.5
24°	No	6	10	No	6	10	Yes	n/a	10
25° & above	No	6	10	No	6	10	Yes	n/a	10

NOTES:
In consultation with your Monier representative, tiles may be installed at rafter lengths longer than those indicated in this table.
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JOB SITE REQUIREMENTS

Builder Checklist

The below must be installed prior to Monier contractors installing a roof:

- Valley boards/ valley tray and creepers;
- Secured facial board 25mm higher than the tile batten thickness (except for low-pitched);
- Barge board (if used timber barge board, make sure the top is flushed with the tile batten);
- Pre-primed metal capping;
- Flashing to adjacent wall;
- Gutters and plumbing; and
- Leaf guard (for bushfire zone).

Safety recommendations

When installed by Monier, we keep trades up to date on safe practices and procedures. Monier reviews SWMS, and conduct regular Toolbox Talks and random audits on supervisors and contractors. We attend and represent Monier on any builders Safety Committee where required.

Requirements from the builder

Where pitch is greater than 30 degrees, Monier requires builders to provide and ensure that the below items are in place:

• Full scaffold;

• Roofing structure to be secured other than batten and roof tiles;

• Safe propping (check industry practice from ARTA here);

• Scaffold/ edge protection; and

• Void protection on stairways.

PRODUCT WARRANTY & MAINTENANCE

Warranty

The Monier Terracotta Collection comes with a 50-year colour and performance guarantee. The Monier Concrete Collection comes with a 50-year performance guarantee. Monier roof tiles are compliant with the relevant sections of *AS 2049: 2022 - Roof tiles*, verified through continuous testing in accordance with *AS 4046 - Methods of testing roof tiles*, as required by National Construction Code.

For more information on the Monier roof tile warranty, and how to register the warranty visit monier.com.au.

Maintenance

After installation and prior to their release, tiles undergo a quality assurance assessment, but roofs require regular maintenance to ensure performance.

- Gutters, downpipes and valleys of a roof require cleaning. These areas can become built up with debris, such as leaves and twigs. When gutters, downpipes and valleys become blocked, a build up of water can overflow back into the roof leading to water damage. This kind of build up can present a potential fire hazard, as dry leaves and twigs are combustible.
- Depending on the homes surroundings, gutters, downpipes and valleys should be checked at least once a year. If the home is located near tree lined area more frequent checks are recommended.
- Roofs should be inspected by qualified roofing specialist every five to seven years.

CSR | Monier™ ROOFING