CSR ROOFING
ARCHITECTURAL MANUAL

MONIER™ Living in style.

WUNDERLICH™ *The lasting beauty of terracotta*

BE SURE WITH CSR

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SECTION 1
INTRODUCTION

FOREWORD

This manual has been prepared by CSR Roofing to assist the architect, builder and installer to specify, prepare and install roof tiles. While it is not possible to detail every condition that may be encountered, CSR Roofing will assist to advise on any special situations that may occur.

This manual has been written as a working guide for industry, however it is not intended to replace good trade practice and experience essential to obtaining a quality roof installation. Nor does this manual override specific advice received from CSR Roofing fixing services.

Architects and specifiers should ensure that the details provided in this manual are followed, and determine to their own satisfaction that the job is complete to an acceptable standard of trade practice.

INTRODUCTION

IMPORTANT

All care has been taken in the compilation of this manual. However, CSR Roofing accepts no responsibility or liability for the contents of the manual (including any printing or typographical errors) and recommends that all standards and recommendations are independently checked.

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

SPECIFICATIONS

While information contained in this manual is correct at the time of creation, specifications are subject to change without notice.

LOCAL AUTHORITIES

Installation standards and product specifications contained in this manual are minimum recommendations based on both Australian and New Zealand Standards and good trade practice. As environmental conditions vary by region, the appropriate fixing standard for specific regions will also vary. Therefore, where applicable, the local CSR Roofing fixing office should be consulted.

It is also recommended that other local authorities be consulted.

PERFORMANCE

CSR roof tiles will perform as specified if installed in accordance with good trade practice and the recommendations set down in this and other relevant literature.

Tile installation specifications should be applied in conjunction with, state regulations and Australian and New Zealand 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.

This manual covers the range of CSR roof tiles and accessories available in Australia and New Zealand and the preferred methods and standards for fixing tiles.

The following points should be considered:

- 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 installation methods are given, but as there are some variations in procedure from state to state. Advice should be obtained locally
- Special installation standards apply to designated high wind areas.

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GLOSSARY

Abutment
Where the roof tiles meet a structure rising above the roof.

Accessory
A concrete or terracotta product used to finish the roof; includes 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 ridge.

Anti-ponding board
A sarking or underlay-support of various materials, (galvanised iron, fibrous cement etc), installed along the eaves lines from the top of the fascia back to the rafter with a clearance of 10 mm below the first batten. This prevents water "ponding" behind the fascia. Anti-ponding boards should be installed on all low pitched roofs or roofs with no overhang.

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 that penetrates a sloping roof.

Barge board/verge board/gable board
A sloping board installed to the pitched edges of a gable, covering the ends of roof timbers.

Barge course/Verge course
The tiles next to the gable.

Bastard valley
A valley or hip formed by the intersection of two roof planes at different pitches.

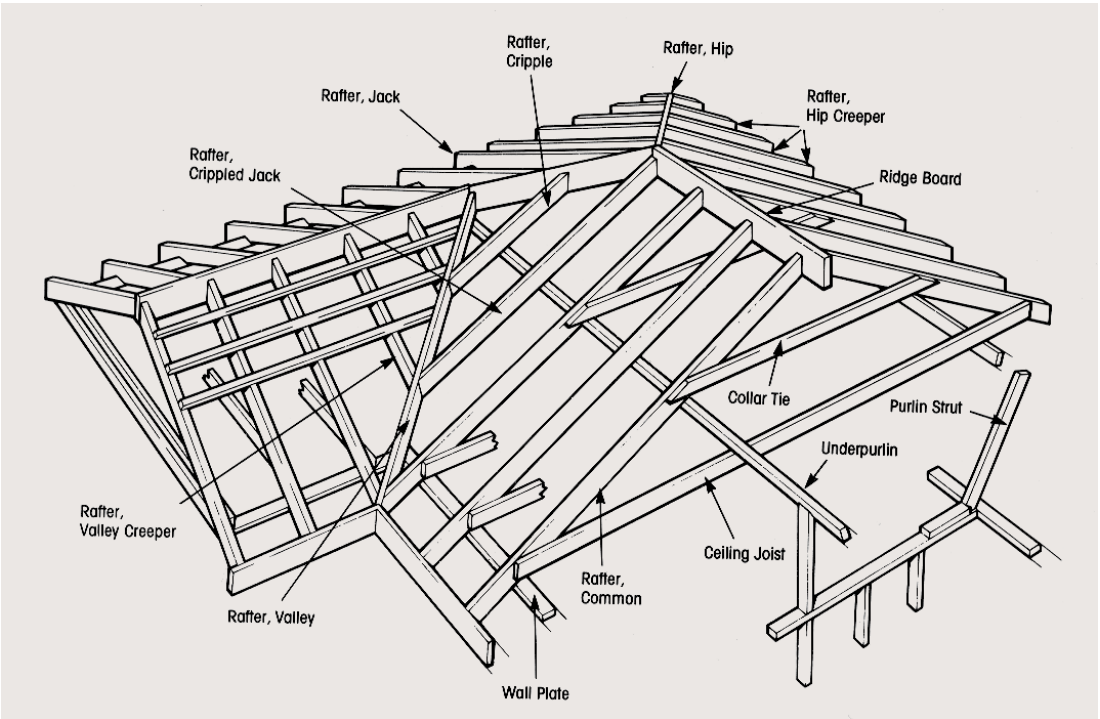
Battens
A specifically sized timber or steel section installed parallel to the eave line on which tiles are fixed.

Bedding
A composition of brick layers' sand and cement for fixing ridge capping on hips and ridges. The edges are finished off with a pointing material.

Bellcast batten: (Tilting batten)
A batten installed 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 usually serves this purpose).

Bond
The system of aligning tiles on the roof in relationship to each other. With a straight bond, the sides of tiles form straight lines from bottom to top course. With a staggered, broken or cross bond, tiles in each alternate course overlap, by half, the tiles above and below them.

ROOF STRUCTURAL MEMBERS



Box gutter
An internal roof gutter, into which, two adjoining roof planes discharge water in opposing directions, or a single roof plane discharging water against a wall, parapet or chimney. Usually but not always discharges into a sump.

Capillary break
A groove or space left between two surfaces, large enough to prevent capillary movement of water into a building.

Ceiling joists
The joists that carry the ceiling and also form a tie between the feet of the common rafters.

Cleat
A small piece of wood that reinforces another, or is used to locate positively another timber.

Clipping batten
A batten installed to the rafters directly behind the fascia. The clipping batten is used for installing the bottom course of tiles when sarking is not specified. Generally it is only used on homes with metal fascias, and only in high wind areas.

Collar tie
The timber used to connect two rafters at or near their centres.

Concealed gable flashing
Is a flashing made from galvanised steel or similar product.

Counter battens
A batten normally installed on top of 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 installed to the counter battens, creating an air space that allows sarking to dish between the rafters.

Dormer or dormer window
A vertical window or opening, coming through a sloping roof, usually provided with its own-pitched roof.

Dormer cheek
The upright side to a dormer.

Dutch Gable
A gable where the ridge terminates before the edge of the roof connected by a hip running to the corner of the roof.

Eaves
The lowest overhanging part of a sloping roof that projects beyond the external wall.

Eaves fascia
A board on edge installed along the feet of the rafters. It often carries the eaves gutter along the eaves.

Eaves overhang
The inclined distance (line of rafter) from the outside of the external wall to the inner face of the fascia.

Eaves width
The horizontal distance from the inner face of the fascia board to the outside of the external wall.

Edge of roof
The area of a roof bounded by the eaves, ridge and barge, extending towards the centre of the roof for a distance equal to 0.1 multiplied by the minimum plan dimension of the building, measured from eaves to eaves, or barge to barge.

Façade
The face or front of a building.

Fall
The slope or pitch of a roof or gutter.

Fascia board
A wide board set vertically on edge and fixed to the rafter ends or wall, which caries the gutter.

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.

Flexible pointing
A highly pliable yet durable compound which, once cured, forms an incredibly strong bond between the tile and ridge capping.

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

Gutter
Any form of roof water channel, eg:
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. In NZ this is defined as an area where wind speed exceeds 44m/sec in accordance with NZS 3604:1992 Section 5.

Hip end Tile
A sloping triangular roof fitting designed to cover the end of a hipped roof.

Hipped roof (End)
A gable roof which has two additional sloping planes at either end of the roof.

Lap
Head or End lap: the distance by which one course of tiles overlaps the course below.
Side lap: the distance by which one tile interlocks with the tile beside it.

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

Loading
he installing requirements and materials for sarking, battens, tiles and accessories etc, specified by the tiling manufacturer as sufficient to withstand the loading requirements of AS 1170.0 and AS 1170.0 Suppl 1:2000.

Mansard Roof
A roof structure with two pitches. The steep pitch commences at the eaves, and intersects with the lower pitch, which finishes 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 that form a true and straight line where the cut tiles join on each slope.

Mortar
See "Bedding".

Mottle
Used to describe the laying of various coloured tiles at a consistent percentage throughout the roof.

Nogging
Short pieces of timber nailed between studs in a wall to brace the structure.

Parapet wall
Usually a brick or timber structure that rises 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 angle or slope of the roof surface to the horizontal expressed either in degrees or as a ratio, eg 15° or 1:3.75.

Profile
The shape and design of the tile.

Rafter
A sloping member that extends from the eaves to the ridge of a roof to support roofing material.
Common rafter: the main support rafter of the slope between eaves, wall plate and ridge.
Cripple Creeper rafter: the rafter connecting a hip and valley.
Crippled jack or Broken Hip rafter: a rafter connecting the end of a ridge to a valley.
Hip rafter: a rafter following the line of the intersection of two roof planes.
Hip creeper rafter: a rafter connecting a wall top plate and hip.
Jack or Crown End rafter: a rafter installed at the end of a ridge and the meeting point of two hips.
Principal rafter: an upper member in a truss that has the same inclination as the common rafters.
Valley rafter: a rafter following the line of the internal intersection of two roof surfaces.
Valley creeper rafter: a rafter connecting ridge and valley.

Rake
The roofs angle of inclination from the horizontal.

Ridge
The horizontal line where two planes of a roof meet together.

Ridge board
The horizontal board, set on edge, at which the rafters meet.

Ridge capping
A roof fitting used to cover the ridge-line that can be either 'V' shaped or arched (rounded). This generally consists of a specifically made tile used for both the ridge and hips of a roof.

Rigid pointing
A mixture of clean sand, cement and oxide colouring or pre-mixed flexible material, used for the completion of joints between ridge or hips and with roof tiles or tiles at gable ends.

Roof
A covering to protect a building from the elements.

Roof tile
A concrete or terracotta product used to cover the field of the roof.

Sarking/Underlay and Underlay/Sarking
A reflective, pliable membrane that is installed under the tile battens and conforms to AS/NZS 4200.1. (Underlay is not reflective in New Zealand and has an absorbency rating of 100g/m2)

Sawtooth roof
A roof structure that is vertical on one side with a slope down 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 bargeboard shaped to match the overhanging profile formed by the under surface of roof tiles that overhang a gable end. The tiles are pointed up on the interlocking joints.

Skillion
The term for a pitched roof with one plane.

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 a wall or roof. Sometimes referred to as sheeting.

Soaker
A concealed flashing under tiles, mitred hips and parapet walls shaped and installed to allow water to discharge on the tiles of the course below.

Soffit
The lining installed under the eaves between the fascia board and external wall.

Soffit bearer
Timber or metal used to support the soffit.

Stormseal
A bitumen impregnated foam strip used to weatherproof areas of roof to prevent water penetration during storms, can be flexible pointed.

Staggered bond
The method of laying tiles where the vertical joint of every tile 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 that the vertical joints form one straight line up the slope of the roof.

Steel battens
Steel battens must be designed in accordance with, AS 2050.2002, 2.2 and manufactured from metallic coated steel with a minimum coating class of Z275 or in accordance with AS 1397. In corrosive areas, advice should be sought from the manufacturer.

Stud
A vertical wall support.

Tile clip
A specially formed metal fastening used to secure tiles to supporting members.

Tilting batten
Serves the same purpose as a bellcast batten.

Top plate
The horizontal member above a wall on which the truss or rafter sits.

Truss roofs
A roof supported by self-supporting, triangulated structural framework which is, usually prefabricated and delivered to the job site. This type of construction is commonly used for all types of roofs.

Under purlin
A horizontal member in a roof at right angles to the principal rafters or trusses. It carries the common rafters.

Underlay/Sarking and Sarking/Underlay
A reflective, pliable membrane that is installed under the tile battens and conforms to AS/NZS 4200.1. (Underlay is not reflective in New Zealand and has an absorbency rating of 100g/m2)

Upright work
Tiling carried out on a roof pitched close to vertical, normally on a façade or a mansard roof.

Valley
The internal angle formed by the meeting of two sloping surfaces of a roof; the opposite of a hip. A valley tray is installed in this area to direct water to the gutter.

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.

Valley iron/Valley tray
A "V" shaped sheet lipped on each outside edge and formed to fit into the angle of a valley.

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 creating a water channel for draining purposes.

Z Flashing
Normally a galvanised strip with an internal lip fixed under the fibre cement verge strip to allow water to run into the gutter.

CSR ROOFING HISTORY

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THE MONIER STORY

In the middle of the 19th century Joseph Monier, a commercial gardener, experimented with wire reinforcement for his concrete flower pots. He perfected his invention, patented it and in 1867 exhibited the result at the Paris Exposition.

His invention was acquired by a German company in 1885 and subsequently developed into an entire system for reinforced concrete in the construction industry known as "Das System Monier", or "Monierbuilt". Although Joseph Monier did not die a rich man, his name became well known throughout Europe.

The name Monier came to Australia in 1901 by way of another German, who established a concrete pipe manufacturing business at Darling Harbour in Sydney using the Monier patent.

The business went though many changes until, in 1936, Cement Linings Ltd was formed and became the foundation of the Monier Company. The company name changed to Monier Limited in 1979, by which time the company had many businesses associated with the building and construction industry, including many concrete tile factories.

The name Monier was first used for concrete tiles in 1948 when factories were established at Villawood in Sydney and Canberra, but over the years its use extended across Australia and New Zealand.

THE WUNDERLICH STORY

Ernest Wunderlich migrated to Australia in 1855 followed shortly after by his two brothers, Alfred and Otto. In those days, the Wunderlich's were importers of pressed metal ceilings. However, in 1892, when a consignment of terracotta roof tiles arrived in Sydney from the south of France and the consignee could not be found, the Wunderlich brothers purchased the consignment. These tiles were called Marseille, after the port from which they were exported.

World War I disrupted the supply of tiles from France, but by this time the Marseille tiles were in great demand. The Wunderlich brothers recognised this as a timely opportunity. They began manufacturing their own version of the tile leading them to build a tile factory in Sydney in 1916, and a tile accessory plant in Melbourne.

By 1957, the Wunderlich Company had clay tile factories throughout Australia and New Zealand, while continuing to manufacture other building products such as their pressed metal ceilings.

In 1969, CSR acquired the Wunderlich clay roof tile manufacturing business. Monier purchased Wunderlich in 1983. Monier in turn was 100% acquired by CSR Ltd in 1994.

Presently, CSR Roofing produces Monier concrete tiles from six plants and Wunderlich terracotta tiles from one plant, servicing the whole of Australia and New Zealand.

SECTION 2
ROOFING INFORMATION

CONTENTS

BENEFITS OF ROOF TILES

STYLE + COLOUR CHOICE

Different styles and colours can create a mood or make a statement, help you stand out in the crowd or blend in with the streetscape. It's an entirely individual choice.

In many cases, the design determines your roofing material selection.

With our wide range of traditional and contemporary tiles and extensive choice of colours, you can combine different finishes and shades to create a roof that is as subtle or dramatic as your design.

Because choosing the right tile can be a time consuming process, expert product consultants are on hand at our display centres to assist in finding the style and colour that will best create that individual look.

ENDURANCE + STRENGTH

Concrete and terracotta tiles are made to strict strength specifications that meet Australian and New Zealand Standards.

Terracotta has been used for thousands of years both for its incredible durability and its beauty.

The high density and strength of concrete ensure your tiles will be both waterproof and highly enduring. Concrete tiles do not become brittle or porous with old age. In fact, independent testing indicates that concrete tiles actually strengthen and become less porous over time.

FIRE PROTECTION

Non-combustible materials such as concrete and terracotta provide the very best protection against radiant heat from bushfires. As further protection, CSR Roofing provides relevant advice for houses being built in fire prone areas later in the manual.

MINIMUM ABSORPTION

Even during severe downpours, tiles absorb negligible amounts of water. This absorption does not affect the tile's weatherproofing performance. In fact, independent research indicates that tiles absorb less water with age.

EASY CLEAN SURFACE

In some climates, moss and lichen can grow on your tiles. They will not affect your tiles in any way, and can add character to your roof. However, if you prefer the clean lines of your tiles, both moss and lichen can be easily removed.

THERMAL INSULATION

The density of concrete and terracotta roof tiles provides highly effective thermal insulation relative to other roofing materials.

TANK WATER SAFE

If you collect or are planning on using tank water, the water from a tiled roof is as drinkable as water from any other type of roof.

OCEAN SALT SAFE

Unlike some roofing materials, modern tiles are not affected in any way by exposure to salt air, making them ideal for coastal locations.

IMPERVIOUS TO FROST

If building in a frost-prone area, tiles will not be affected or damaged by frost or ice due to modern design and manufacturing methods.

PREVENTS CONDENSATION

A tiled roof can “breathe”, minimising the need for insulation against the corrosive effects of condensation that can affect other roofing materials.

CORROSION + WARP FREE

Unlike other roofing materials, tiles will not corrode in any environment.

ACOUSTIC INSULATION

The density of roof tiles ensures that your roof tiles make no noise, ensuring quiet enjoyment of your home. The creaking and tapping sounds associated with other roofing materials often have to be masked with insulation. The density of tiles acts as a nature sound barrier to any external noise.

AFFORDABLE CHOICE

Considering the critical role they play, roof tiles are a surprisingly affordable choice.

Installing a roof constitutes as little as 5% of the cost of your home, slightly less for concrete, slightly more for terracotta. It's worth getting a quote just to make the comparison yourself.

The value of terracotta is not just in its beauty and longevity, but in the appreciable amount it can add to the real estate value of your home.

COLOUR FACTS

Concrete tiles

The colour coating on concrete tiles is purely decorative, and plays no role in any protective or waterproofing function.

Over several years, the colour coating of your concrete tiles may take on a more subdued, matt appearance because of the effects of air pollution and powerful UV rays from the sun.

Terracotta tiles

Because they are fired, the colours of both glazed and natural terracotta tiles will never, ever fade, which means you'll undoubtedly never need Wunderlich's 50 year colourfast guarantee.

No other roofing material can offer such a guarantee.

RE-ROOFING OPTIONS

It's worth noting that there may be little or no difference between the cost of installing a new tiled roof or having an existing roof repainted, so consider getting a quote before you proceed.

EASY TO CLEAN

Like any roofing material, tiles can become dirty or mossy. Whether you choose to clean them yourself or hire a tradesman, moss, lichen and grime can be easily removed using a high pressure water spray and suitable cleaning agent.

NATURAL SALTS

Occasionally, the natural salts within a concrete tile can migrate to the surface as a whitish grey discolouration called efflorescence or 'bloom'.

This may also occur in the bedding material on both terracotta and concrete roofs.

This has no effect on the performance of the tile. Although common to many concrete products, efflorescence does not always occur and disappears naturally over time.

SERVICES

PRODUCT AND TECHNICAL LITERATURE

Full product and technical literature is available on all concrete and terracotta tile products manufactured by CSR Roofing at www.csr.com.au or from any of our regional offices around Australia and New Zealand.

QUALITY CONTROLS

CSR Roofing products are tested for weight, dimensional stability, transverse strength, water absorption, and colour consistency under strict quality controls in accordance with Australian, New Zealand and International Standards. Additionally, the quality of all raw materials is continuously monitored during the manufacturing process while research is carried out on an ongoing basis in an effort to continually improve our products and services.

FULLY TRAINED REPRESENTATIVES

Whether you're building a new house or re-roofing, CSR Roofing sales staff are fully trained to respond to all enquiries regarding pricing, product and technical information, installation, product selection.

SAMPLES

Samples are available from any of our fully maintained regional selection centres. Simply phone 1800 MONIER (666 437) in Australia and 0800 MONIER (666 437) in New Zealand.

INSTALLATION SERVICE

CSR Roofing offers a roof tile installation service in most regions and can provide customers with supply and fix quotations for all products, direct from the manufacturer.

Our team of highly experienced and fully equipped roofing contractors ensure you get a truly efficient, professional job. In some regions, CSR Roofing recommends the roofing services of qualified tiling contractors and distributors.

SITE DELIVERY

CSR Roofing tiles are packaged and handled in a manner that allows tiles to be delivered ready for roof loading.

Off road forklifts can be used where terrain permits to position roof tiles around the site to allow for easy access onto the roof.

SAFETY, HEALTH AND ENVIRONMENT

CSR Roofing recognises that Safety, Health and Environmental responsibility is a vital part of our business. We are all responsible for:

- Preventing injuries
- Preventing occupational illnesses
- Minimising the adverse impact of our activities on the environment
- Complying with all legal requirements
- Our Safety, Health and Environment Policy sets out clear responsibilities.

CONTACT INFORMATION

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1800 666 437

REGIONAL OFFICES

Refer to www.csrroofing.com.au for a list of all Australian and New Zealand regional offices.

TILE SAMPLES

Tile samples can be ordered through the Tile Express area on our website. (only in Australia)
Visit www.csrroofing.com.au
Home > Professional > Tile Express

WWW.MONIER.CO.NZ

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SECTION 3
DESIGN

THE DESIGN OF A TILED ROOF AND ITS SUPPORTING STRUCTURE REQUIRES CAREFUL CONSIDERATION, INVOLVING UNDERSTANDING OF A NUMBER OF BUILDING STANDARDS. ONE OF THE KEY RESPONSIBILITIES OF THE SPECIFIER IS TO DETERMINE THE DESIGN GUST WIND SPEED AFFECTING A PARTICULAR SITE.

CONTENTS

DESIGN CONSIDERATIONS

To facilitate this, the Australian Standards AS 1170.2, AS 4055 and NZS 4203 are to be considered, regarding:

- **The regional design wind speeds**
- **The terrain category of a building site**
- **The Technical Record 440 (TR440) extension of this code, which is deemed to be the standard for design of products for most cyclonic areas This is particularly applicable in Australia to areas north of the latitude 250 south, and within 50kms of the coast (including off shore islands).**
- **Local requirements and covenants determined by State and/or local statutory authorities. Special conditions may apply to the site in relation to items a), b) and c)**

The installation specifications given in this manual are based on a basic wind speed for ultimate strength of 74m/s at a height of 6m from ground level. This is suitable for sites in Regions A, B and New Zealand. For installation specifications for designated cyclonic areas i.e. Regions C and D it is also advisable to consult both your building engineer and your local CSR Roofing office.

This section will cover CSR Roofing's recommended installing specifications based on the design gust wind speed, as well as:

- Minimum roof pitch requirements
- Maximum rafter length requirements
- Rafter and truss spacings and batten requirements
- Batten installing requirements
- Sarking/underlay installation requirements

Please note that relevant local authorities may apply special specification to the final structure. Specifiers are advised to determine local requirements before proceeding.

Furthermore, regional CSR Roofing offices may recommend additional installing specifications based on experience of a particular region, so it is also advisable to consult your local CSR Roofing office prior to commencement of work.

WIND CATEGORIES

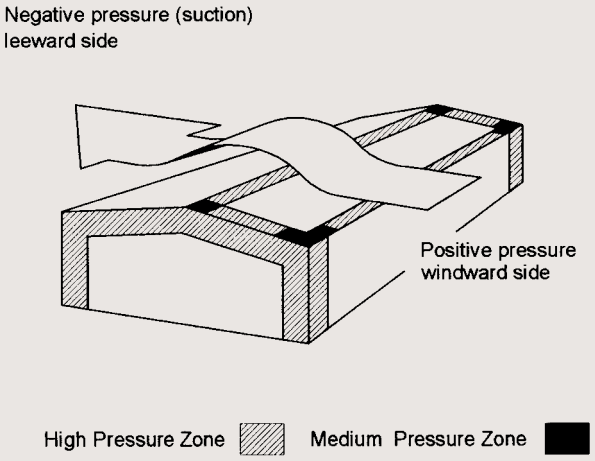
Winds and the pressure they create, must be considered when specifying roof structures and roofing materials.
The negative pressure exerted to the leeward side of a pitched roof at 35m/s can be greater than the weight of the tiles, therefore determining the wind force affecting a site at height is essential to identify the appropriate level of security installation.

The magnitude of these wind forces is affected by the following factors:
Basic wind speed, Direction, Terrain and Building height.

BASIC WIND SPEED CATEGORIES

AS 1170.2/Amdt 3 and AS 4055 provides information on wind speeds generally affecting different regions of Australia.

NEGATIVE PRESSURE (SUCTION) LEEWARD SIDE

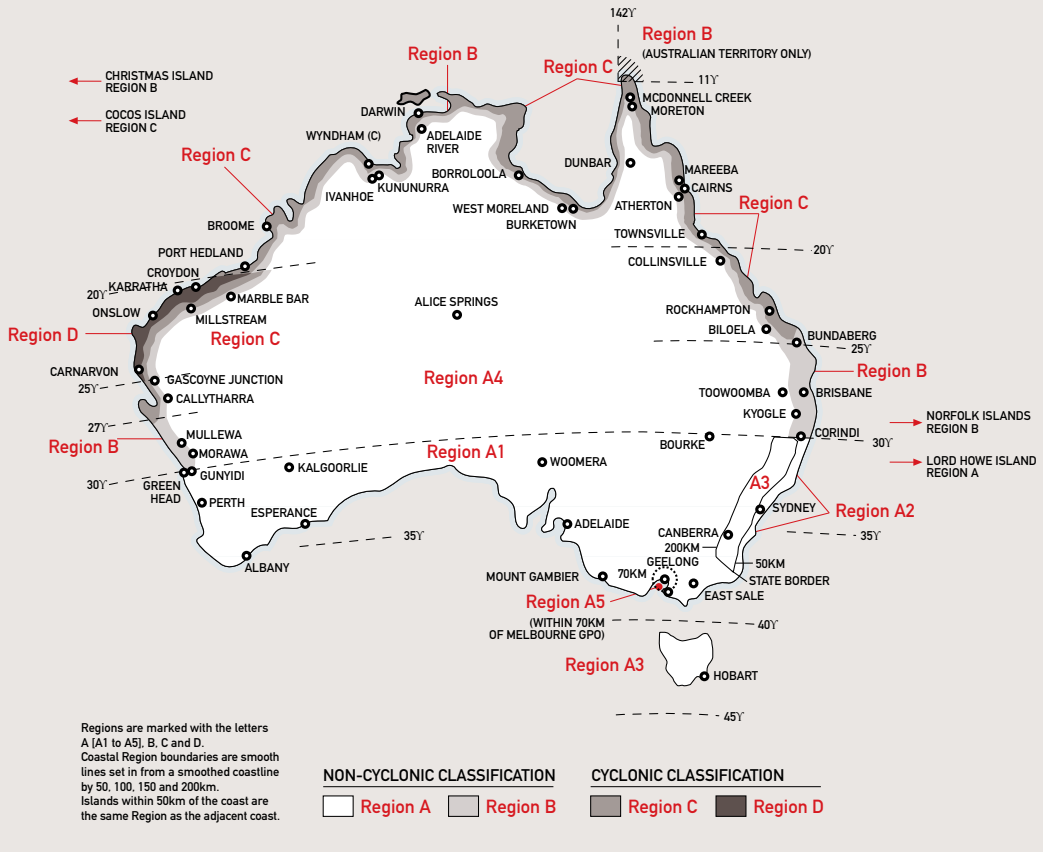


REGIONS	V_s (M/S)
A	38
B	38
C	45
D	50

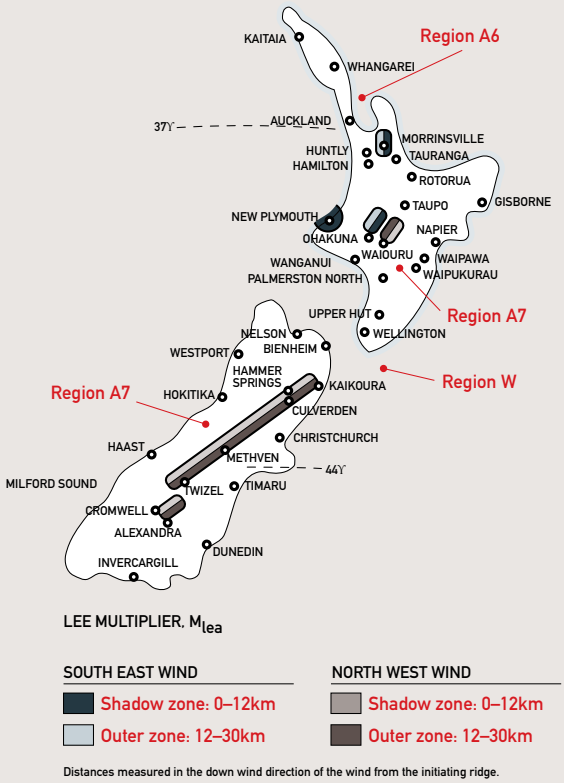
REGIONS	V_p (M/S)
A	41
B	49
C	57
D	69

REGIONS	V_u (M/S)
A	50
B	60
C	70
D	85

AUSTRALIA



NEW ZEALAND



LEE MULTIPLIER, M_{lee}

SOUTH EAST WIND	NORTH WEST WIND
Shadow zone: 0–12km	Shadow zone: 0–12km
Outer zone: 12–30km	Outer zone: 12–30km

Distances measured in the down wind direction of the wind from the initiating ridge.

* NZS 4203 General Structual Design and Design Loading for Buildings provides information on wind speeds generally affecting different regions of New Zealand.

For further information on Wind Loads in New Zealand refer to NZS 4203 General Structual Design and Design Loading for Buildings.

Based on the Wind Class specification provided, CSR Roofing is able to assess the appropriate level of security installation required for the roof in accordance with AS 2050 Installation of Roof Tiles.

It is the specifiers responsibility to determine the wind speed affecting a site and a house design. In other words to determine the Wind Class of a regional area combined with the Wind Speeds affecting a site. Cyclone affected regions will have a Wind Class from C1 to C4. For non-cyclonic regions, a Wind Class from N1 to usually N4 is required to be specified on your roofing structure plan.

The table below summarises the relationship between the Wind Speeds and the Wind Class.

TABLE 1: DESIGN WIND SPEED — EQUIVALENT VALUES/AS 4055

WIND CATEGORY	KM/H	FOR NON-CYCLONIC REGIONS A AND B	FOR CYCLONIC REGIONS C AND D	DESIGN GUST WIND SPEED (M/SEC) — PERMISSIBLE STRESS METHOD ONLY
W28	101	N1	•	28
W33	119	N2	•	33
W41	148	N3	C1	41
W50	180	N4	C2	50
W60	216	N5	C3	60
W70	252	N6	C4	70

Wind Classification system N1, N2, N3, N4, N5, N6 for non-cyclonic Regions A and B, and C1, C2, C3 and C4 for cyclonic Regions C and D shall be considered. The system includes the combinations of regions, terrain categories, shielding of housing and topographic effects given in Table 2.

TABLE 2: WIND CLASSIFICATION SYSTEM (REFER AS 4055)

REGION	TERRAIN CATEGORY	TOPOGRAPHIC CLASSIFICATION														
		T1			T2			T3			T4			T5		
		FS	PS	NS	FS	PS	NS	FS	PS	NS	FS	PS	NS	FS	PS	NS
A	TC 3	N1	N1	N1	N2	N2	N2	N2	N3	N3	N2	N3	N3	N3	N3	N4
	TC 2.5	N1	N1	N2	N2	N3	N3	N2	N3	N3	N3	N3	N4	N3	N4	N4
	TC 2	N1	N2	N2	N2	N3	N3	N3	N3	N3	N3	N4	N4	N4	N4	N4
	TC 1	N2	N3	N3	N3	N3	N4	N3	N4	N4	N4	N4	N4	N4	N5	N5
B	TC 3	N2	N2	N3	N3	N3	N4	N3	N4	N4	N4	N4	N4	N4	N5	N5
	TC 2.5	N2	N3	N3	N3	N4	N4	N3	N4	N4	N4	N4	N5	N4	N5	N5
	TC 2	N2	N3	N3	N3	N4	N4	N4	N4	N5	N4	N5	N5	N5	N5	N6
	TC 1	N3	N4	N4	N4	N5	N5	N4	N5	N5	N5	N5	N6	N5	N6	N6
C	TC 3	C1	C1	C2	C2	C2	C3	C2	C3	C3	C3	C3	C3	C3	C4	C4
	TC 2.5	C1	C2	C2	C2	C3	C3	C3	C3	C3	C3	C4	C4	C4	C4	NA
	TC 1, TC 2	C2	C2	C2	C2	C3	C3	C3	C4	C4	C3	C4	C4	C4	NA	NA
D	TC 3	C2	C3	C3	C3	C4	C4	C3	C4	C4	C4	NA	NA	NA	NA	NA
	TC 2.5	C2	C3	C3	C3	C4	C4	C4	NA	NA	C4	NA	NA	NA	NA	NA
	TC 1, TC 2	C3	C3	C4	C4	NA	NA	C4	NA	NA	NA	NA	NA	NA	NA	NA

FS full shielding
NS no shielding
C cyclonic
PS partial shielding
N non-cyclonic
N/A not applicable

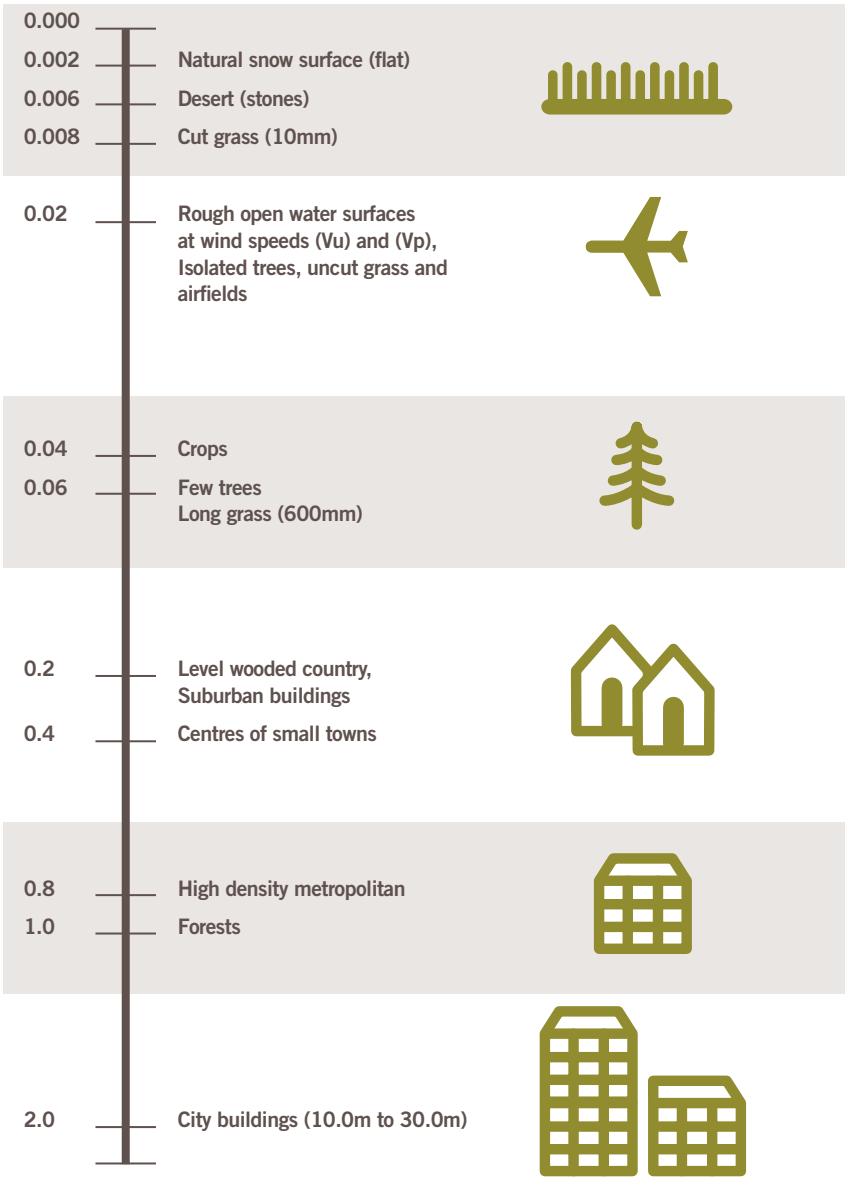
TERRAIN CATEGORIES

TERRAIN

The shielding provided by permanent structures, hills and vegetation has the effect of modifying wind speeds.

Terrain categories are used for determining a site's exposure to wind. In Australia, terrain is defined in accordance with AS 1170.2 and AS 4055 into four categories. In NZ, the relevant standard is NZS 4203. For the effective use of this tool, the direction and speed of wind flows towards a site must be assessed.

ROUGHNESS LENGTH (2°)M



THE FOUR TERRAIN CATEGORIES ARE:

Terrain Category 1
Z° = 0.002M

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 snowfields.

Terrain Category 2
Z° = 0.02M

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° = 0.2M

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

Terrain Category 4
Z° = 2.0M

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

FIXING REQUIREMENTS FOR TILES AND ACCESSORIES

TABLE 3: AS2050 MINIMUM MECHANICAL INSTALLING REQUIREMENTS FOR TILES AND ANCILLARIES

WIND CLASSIFICATION	TILE INSTALLING		ANCILLARY INSTALLING
	EDGE OF ROOF	FIELD OF ROOF	RIDGE, HIP AND BARGE TILES
Up to and including N2 N1 and N2	Mechanically fasten each full tile in second course and then every second tiles in every course or every tile in each alternate course		Mechanically fasten each tile
Up to and including N3 and C1	Mechanically fasten each full tile in second course	Mechanically fasten each second full tile	Mechanically fasten each tile
N4 and C1/C3	Mechanically fasten every full tile	Mechanically fasten every full tile	Mechanically fasten each tile

TABLE 4: AS 2050 WIND CLASSIFICATION AND MAXIMUM DESIGN GUST WIND SPEED

WIND CLASSIFICATION	MAXIMUM DESIGN GUST WIND SPEED (M/S)		
	PERMISSABLE STRESS METHOD (VP)	SERVICEABILITY LIMIT STATE (VS)	ULTIMATE LIMIT STATE (VU)
N1	28 (W28N)	26	34
N2	33 (W33N)	26	40
N3C1	41 (W41N/C)	32	50
N4C2	50 (W50N/C)	39	61
C3	60 (W60C)	47	74

Note: Wind classifications are as defined in AS 4055

TABLE 5: AUSTRALIAN MECHANICAL REQUIREMENTS FOR TILES AND ACCESSORIES

DESIGN WIND VELOCITY (M/S)	TILE FIXING		RIDGE FIXING		BARGE FIXING
	EDGE OF ROOF	FIELD OF ROOF	RIDGE TILES	HIP RIDGE TILES	
Up to but not including ≤ 33	Mechanically fix all full tiles in the 2nd course and then either every 2nd tile in every course, or every tile in every 2nd course		Mechanically fix every ridge tile.	Mechanically fix every ridge tile.	Mechanically fix each barge tile.
≥ 34 < 41	Mechanically fix each full tile in 2nd course	Mechanically fix each 2nd full tile	Mechanically fix every ridge tile	Mechanically fix the end four hip ridge tiles.	Mechanically fix each barge tile.
≥ 41 < 60	Mechanically fix every full tile	Mechanically fix every full tile	Mechanically fix every ridge tile	Mechanically fix every hip ridge tiles.	Mechanically fix each barge tile.

TABLE 6: NEW ZEALAND MINIMUM FIXING REQUIREMENTS FOR TILES AND ACCESSORIES

DESIGN WIND VELOCITY (M/S)	TILE FIXING EDGE OF ROOF/BODY OF ROOF	RIDGE & HIP FIXING	BARGE FIXING
LOW WIND SPEED Up to 32 m/s	Mechanically fix all full tiles in 2nd course and then either every 2nd tile in every course, or every tile in every 2nd course	Approved adhesive or mechanical fastening of ridge and hip capping	Mechanically fix each barge tile
MEDIUM WIND SPEED Up to 37 m/s	Mechanically fix all full tiles in 2nd course and then either every 2nd tile in every course, or every tile in every 2nd course	Approved adhesive or mechanical fastening of ridge and hip capping	Mechanically fix each barge tile
HIGH WIND SPEED UP TO 44 M/S	Mechanically fix all full tiles in 2nd course and then either every 2nd tile in every course, or every tile in every 2nd course	Approved adhesive or mechanical fastening of ridge and hip capping	Mechanically fix each barge tile
VERY HIGH WIND SPEED Up to 50 m/s	Mechanically fix every full tile	Approved adhesive or mechanical fastening of ridge and hip capping	Mechanically fix each barge tile
SPECIFIC ENGINEERING DESIGN Over 50 m/s	Please consult your Regional CSR Roofing Office	Please consult your Regional CSR Roofing Office	Please consult your Regional CSR Roofing Office

Note:
- Accepted methods of mechanical fixing are specified later in this manual.
- CSR Roofing recommends the use of Flexible Pointing as standard for all roofs, removing the need for other forms of mechanical fixing. Flexible Pointing also provides other significant benefits referred to later in this manual.
- Please consult your regional CSR Roofing office for their specific recommendations.

TABLE 7: AUSTRALIAN FIXING RECOMMENDATIONS

WIND CLASS	SARKING/ UNDERLAY	SECURITY PADS	MECHANICALLY FIX TILES	MECHANICALLY FIX EAVE TILES	ANTI-PONDING BOARD	FIXING BODY AND EDGE OF ROOF
N1	Optional depending on pitch	Optional	Optional	Optional	Required for pitches under 20° subject to state specifications	See table 3
N2		Recommended				
N3	Mandatory as specified by AS 4200.2					
N4			Mandatory	Recommended		
C1						
C2						
C3						

TABLE 8: NEW ZEALAND FIXING RECOMMENDATIONS

WIND CLASS	UNDERLAY	MECHANICALLY FIX TILES	MECHANICALLY FIX EAVE TILES	ANTI-PONDING BOARD	FIXING BODY & EDGE OF ROOF
Low	Optional depending on pitch			Required for pitches under 20^0	See Table 6
Medium	•			Required for pitches under 20^0	See Table 6
High	•			Required for pitches under 20^0	See Table 6
Very High	Mandatory	•	•	Required for pitches under 20^0	See Table 6

• Denotes recommendation

MINIMUM ROOF PITCH

CSR Roofing tiles are designed and tested to cope with the diverse range of wind and weather conditions across Australia and New Zealand.

The following factors affect the design of your roof:

THE ROOF TILE SELECTION

With a profiled roof tile, the depressions in the body of the tile act as a natural watercourse, enabling water to be channelled down the roof quickly.

For flatter profiled tiles, these depressions are either less prominent or do not feature. As a result, water is freer to be pushed across the roof surface by wind. The effect is that water migrates to the watercourse of the tile.

THE PITCH OF THE ROOF

The greater the pitch, the greater the force of gravity combined with wind force to pull water from the roof.

Conversely, the lesser the pitch, the lesser the force of gravity combined with wind force to pull water from the roof.

For this reason, tiling is not recommended below 15 degrees without special precautions being taken in direct consultation with your regional CSR Roofing office. Indeed, AS 2050 states where it is intended to fix tiles to roofs with a pitch of less than 15 degrees, the tile manufacturer's advice should be sought.

Sarking/underlay is a pliable foil installed prior to fixing the roof battens.
In New Zealand underlay is a self supporting building paper. Not only does sarking/underlay act as a secondary water catchment, sarking/underlay also aids with keeping your home cooler and dust free.

There are several differing grades of sarking/underlay, it is recommended that you consult with your local CSR Roofing representative who can assist you with the correct application to suit your particular design.

Table 9 indicates the minimum roof pitch at which CSR Roofing tiles are to be installed, with and without the need for sarking/underlay, for each region.

TABLE 9: MINIMUM ROOF PITCH — DEGREES

MINIMUM PITCH	NSW		VIC		QLD		SA		WA (SURROUNDING PERTH)		NZ		CYCLONE AREA	
MONIER CONCRETE	Without Sark	With Sark	Without Sark	With Sark	Without Sark	With Sark	Without Sark	With Sark	Without Sark	With Sark	Without Sark	With Sark	Without Sark	With Sark
Elabana	20	15	20	15	20	15	20	15	20	15	20	15	#	17.5
Centurion	20	15	20	15	20	15	20	15	20	15	20	15	#	17.5
Tudor	20	15	20	15	20	15	20	15	20	15	na	na	na	17.5
Waverley	20	15	20	15	20	15	20	15	20	15	na	na	na	17.5
Homestead	20	15^	20	15^	20	15^	20	15^	20	15	na	na	na	17.5
Traditional	20	15^	20	15^	20	15^	20	15^	20	15	na	na	#	17.5
Georgian	20	15^	20	15^	20	15^	20	15^	25	22.5	na	na	#	25
Cambridge	20	15^	20	15^	20	15^	20	15^	25	22.5	na	na	#	25
Horizon	20	15^	20	15^	20	15^	20	15^	25	22.5	#	25	#	25
Madison	20	15^	20	15^	20	15^	20	15^	25	22.5	na	na	#	25
WUNDERLICH – TERRACOTTA														
Modern French	20	15	20	15	20	15	20	15	20	15	25	20	#	17.5
Nouveau	20	15	20	15	20	15	20	15	20	15	25	20	#	18.5
Marseille	20	15	20	15	20	15	20	15	a	a	25	20	#	17.5
Nullarbour	#	25	#	25	#	22.5	#	25	#	22.5	#	25	#	25
Heritage Shingle*	#	25	#	25	#	25	#	25	#	25	#	25	#	25

Sarking/underlay required regardless of pitch
Anti ponding boards are required for pitches less than 20 deg and in cyclone areas
Consideration must be given to rafter length, site exposure and terrain category when determining roof pitch

^ Refer to EDGE technology fixing specification

* Longer lead times and minimum order quantities apply

• Not all profiles available in all states, check availability with your local sales office

• Maximum rafter lengths apply, refer to Table 10, page 11 in Section 4.

na not available

MONIER™
Living in style.

EDGE TECHNOLOGY FIXING SPECIFICATION

MONIER™ ROOF TILES TREATED WITH 'EDGE' TECHNOLOGY*

'EDGE' TECHNOLOGY

Monier's breakthrough 'EDGE' Technology is a patented process that now offers architects and designers greater flexibility when it comes to contemporary roof design. 'EDGE' technology has been comprehensively field tested, and has also undergone rigorous wind tunnel testing to endure product performance exceeds AS 2050-2002. Additionally, successful testing has also been conducted at Lafarge's world class facility in London England.

PRODUCT SPECIFICATION

This fixing specification is to be used when installing Monier™ roof tiles that have been treated with Monier's Patented 'EDGE' technology. Available in selected states.

PRODUCT RANGE

Horizon, Georgian, Cambridge, Madison

SARKING/UNDERLAY

Mandatory for all pitches below 20 degrees. Additional consideration must be given to locations that are elevated, or in coastal regions with our exposed to high wind speeds.

MINIMUM ROOF PITCH

15 degrees with sarking/underlay.
At the minimum roof pitch of 15 degrees, the maximum rafter length is 4.5metres.
For longer rafters lengths add 2 degrees to the pitch for every addional metre.

HEAD LAP

100mm for all pitches below 20 degrees.
If sarking/underlay is used at 20 degrees , a head lap of 80mm is permissible providing the terrain category is not less than T2.5.

FIXING

Nailing is required for wind speeds up to N2.
Cyclone clips are required for wind speeds of N3 or more.

GENERAL

Special Consideration should be given to regions prone to cyclonic activity. Alternate fixing methods may need to be adopted. Refer these enquiries to the technical support team.

*Not available in all states

RAFTER LENGTH AND SPACINGS

RAFTER LENGTH

With heavy rainfall, a considerable volume of water can accumulate at the bottom of a roof. The longer the roof run (rafter length), the more water accumulates.

AS 2050 states long rafter lengths may require sarking/underlay to prevent inundation of water into the roof. These lengths may vary according to the tile, the pitch of the roof and the exposure.

CSR Roofing advises against the use of minimum pitch for long rafter lengths without sarking/underlay. As a general guide for contoured tiles, rafter length should not exceed 4.5m at a minimum pitch of 15 degrees. For every 0.5m increase in rafter length above 4.5 metres, the pitch should increase by 1 degree until the acceptable pitch of 22.5 degrees is reached for long rafters.

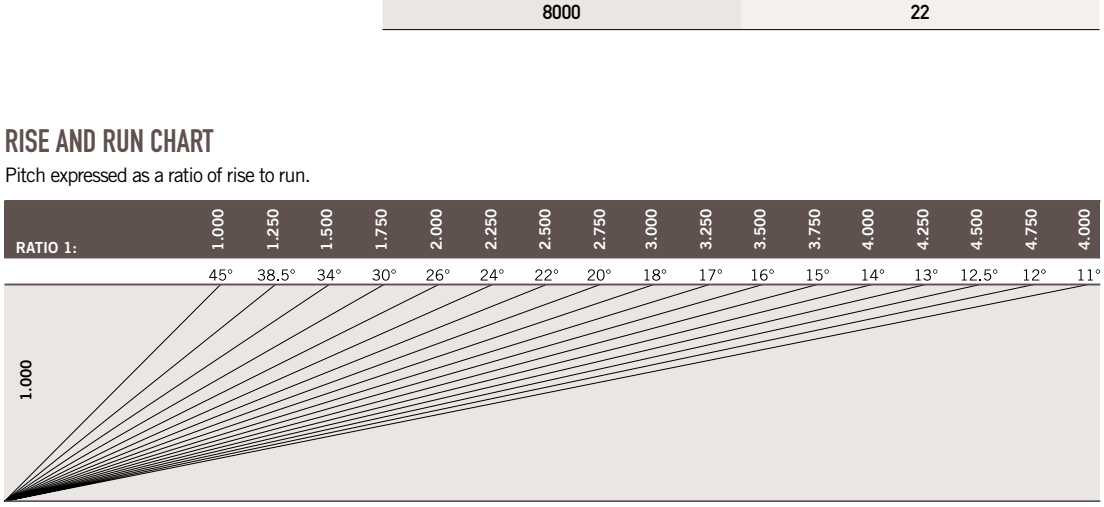
Table 10 indicates the rafter length dimensions at which sarking/underlay should be installed over the affected roof area. Advice should be sought from your local CSR Roofing office with regard to regional sarking/underlay installation requirements.

TABLE 10: PITCH LEVELS IN RELATION TO RAFTER LENGTH

MAXIMUM RAFTER LENGTH (MM)	ROOF — DEGREES OF PITCH
4500	15
5000	16
5500	17
6000	18
6500	19
7000	20
7500	21
8000	22

RISE AND RUN CHART

Pitch expressed as a ratio of rise to run.



Equivalent pitch in degrees is a close approximation only

RAFTER (TRUSS) SPACINGS

The wider the rafter spacing, the greater the stresses upon them, and the batten specified.

Battens made of timber should be sound, and in sufficient length and size to meet regional fixing requirements. Batten sizes and types vary by region, however must be fixed in accordance with the AS 1684 or AS 1720.1 and NZS 3604 in New Zealand.

RAFTER LENGTH CONSIDERATIONS

CSR Roofing tiles are designed to be dimensionally consistent, allowing some tolerance to assist the roof tiler during set out. However, it is advisable to consider the rafter length at the design stage, to avoid the need to cut a short tile course.

BATTEN SIZES AND RAFTER SPACINGS

The following table summarises suitable batten types at varying rafter spacings, with the current CSR Roofing practice in each region.

TABLE 11: BATTEN SIZES AND RAFTER SPACINGS (MM)

BATTEN MATERIAL SPECIFICATION				
RAFTER SPACING	UP TO 450	451–600	601–900	901–1200
New South Wales	Hardwood 38 x 25	Hardwood 25 x 50	Hardwood 38 x 50	Metal Topspan 40
	Softwood 38 x 28	Softwood 38 x 38	Softwood 50 x 50	
			Softwood 63 x 38	
			Metal Topspan 40	
Victoria	Hardwood 38 x 25	Hardwood 25 x 50	Hardwood 38 x 50/38 x 38	Hardwood 38 x 75
	Softwood 38 x 28	Softwood 38 x 38	Softwood 50 x 50	Metal Topspan 40
		Metal Topspan 40	Metal Topspan 40	
Queensland	Hardwood 38 x 25	Hardwood 25 x 50	Hardwood 38 x 50	Hardwood 50 x 50
		Softwood 38 x 38	Softwood 40 x 50	Metal Topspan 40
			Metal Topspan 40	
South Australia	Hardwood 38 x 25	Hardwood 25 x 38	Hardwood 38 x 50	Hardwood 50 x 75
		Metal Topspan 40	Softwood 50 x 50	Metal Topspan 40
			Metal Topspan 40	
Western Australia	Hardwood 38 x 25	Hardwood 38 x 25	Hardwood 38 x 38	Hardwood 50 x 50
		Softwood 38 x 38	Softwood 63 x 38	
		Metal Topspan 40	Metal Topspan 40	Metal Topspan40
Tasmania	Hardwood 38 x 25	Hardwood 25 x 50	Hardwood 38 x 50	Hardwood 50 x 75
		Softwood 38 x 38	Softwood 50 x 50	Metal Topspan 40
		Metal Topspan 40	Metal Topspan 40	
Australian Capital Territory	Hardwood 38 x 25	Hardwood 25 x 50	Hardwood 38 x 50	Hardwood 50 x 50
		Softwood 38 x 38	Softwood 63 x 38	Metal Topspan 40
			Metal Topspan 40	
New Zealand	Softwood 25 x 50	Softwood 40 x 50	Softwood 50 x 50	Softwood 50 x 75*
		Metal Topspan 40	Metal Topspan 40	Metal Topspan 40*

Green font denotes the recommended and commonly used batten specification in each region.
* With engineer approval
Where metal battens are used refer to the batten supplier's fixing specification.

SECTION 4
PREPARATION

AS PER AS 2050 THE CORRECTNESS AND SAFETY OF THE BUILDING IS THE RESPONSIBILITY OF THE BUILDER.

CONTENTS

KEY RESPONSIBILITIES

Before roof tiles can be loaded onto the roof frame, the following must be completed, unless otherwise specified in the roof contract.

1. The roof structure and rafters secured, square and properly braced
2. Fascia boards installed at the correct height with counter (tilt) batten (where applicable)
3. Valley boards and valley irons installed in place
4. Barge boards installed with counter (tilt) battens fitted (where applicable)
5. In the case of exposed rafters, all above rafter boarding and ceiling materials are to be installed
6. Gutters, spouting, down pipes and dry soakers (where applicable) installed
7. Anti-ponding facilities installed (within NZ, Vic and WA)
8. Chimneys, abutments, vent pipes and roof ventilation installed, complete with their flashings and supports
9. Installation of full scaffold, guardrail or safety mesh in accordance with Occupational Health and Safety guidelines. If there is uncertainty about the builder's safety requirements, contact your CSR Roofing office.

This section deals with specifications associated with the construction of the roof frame and installation of associated materials leading up to the installation of roof tiles.

WORKING AT HEIGHTS

The Falls from Heights Advisory Standard 2000 or equivalent Codes of Practice in each state gives practical advice about ways to identify and manage the risk of people falling while carrying out:

- Housing construction; and
- Any other type of construction work

The specific recommendations for fall protection varies by region, therefore it is highly recommended that local guidelines are referred to. A system of fall protection is required where there is:

- Potential for a person to fall working at heights'*
- Where persons at or near a workplace may be exposed to the risk of injury from falls from heights.

A workplace health and safety plan must be completed detailing the control measures to be used to prevent the risk of injury.

Several control measures are available to protect persons from the risk of falling when carrying out work at a height.

The five levels of control measures, in order of preference are:

- Elimination – If you eliminate a hazard you completely eliminate the associated risk.
- Substitution – You can substitute something else (a substance or a process) that has less potential to cause injury.
- Isolation/engineering – You can make a structural change to the work environment or work process to interrupt the path between the worker and the risk.
- Administrative – You may be able to reduce risk by upgrading training, changing rosters or other administrative actions.
- Personal protective equipment – When you can't reduce the risk of injury in any other way, use personal protective equipment (gloves, goggles, etc.) as a last resort.

Edge protection should be used on the edge of a working platform, walkway, stairway, ramp or landing and be able to withstand the impact of a person falling against it.

* Confer with your local safety authority for height regulations.

ROOF FRAME

Wall frames and all load-bearing internal partitions must be properly framed and braced.

The roof structure, must be square and straight and of dimensions true to specification. Braces should be fixed diagonally on the underside of the rafter or truss top chord.

Creeper rafters must be installed at hip corners to ensure that normal rafter spacing along the eave is maintained. Hip and ridge boards should have their top edges level with the top of the rafters.

Please note that even a slight deviation in a roof plane will be noticeable on a finished roof, and cannot be corrected by the tiler.

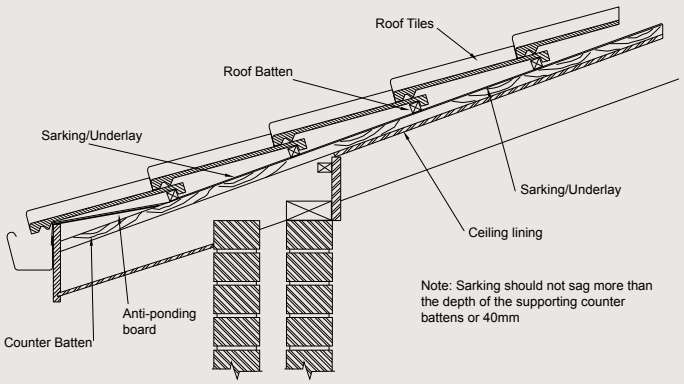
METAL ROOF FRAMES

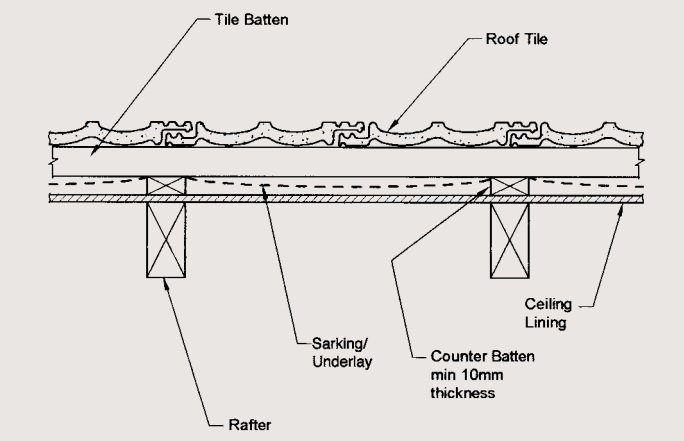
When installing to metal roof frames the nails/screws used must be non-ferrous, stainless steel or steel with an appropriate corrosion resistant coating. Corrosion may result from an unfavourable galvanic relationship in metallic substrate, particularly in corrosive areas.

EXPOSED RAFTER

In the case of raked ceilings or exposed rafters, ceiling linings, counter battens and sarking/underlay installed on top of the rafters. Counter battens must be fastened over the rafter centre lines to ensure the sarking/underlay sag complies with AS/NZS 4200.2

Clearance between the sarking/underlay, any insulation material and the ceiling linings.





VALLEY BOARDS

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

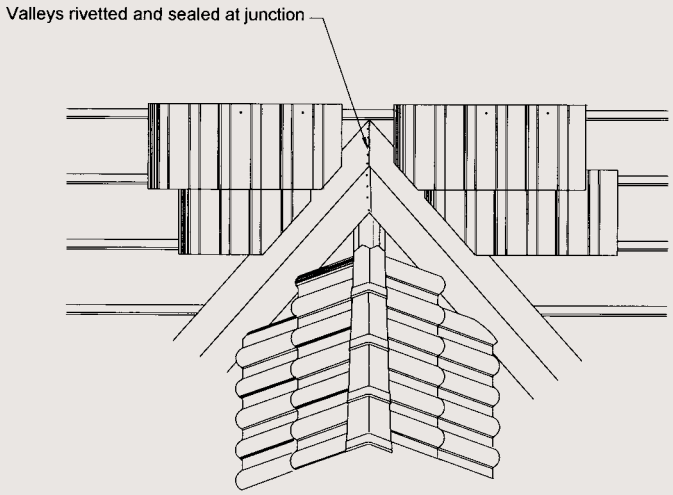
Valley boards and irons should be installed to finish level with the top of the tile batten, and must extend the full width of the valley.

Tapered valley boards having a section of 175 x 19 and 6mm can be used. The 6mm edge should be placed to the outside of the valley. Where 38mm thick tile battens are used, a valley board with an outside thickness of 25mm should be used.

1 Valley boards must comply with Standards. Valley Boards should not extend less than 220mm up each slope of the roof. Tiles should overlap each side of the valley guttering no less than 100mm.

2 Where there is a change in direction of a valley, a nonflammable polyurethane water based bitumen impregnated foam is recommended. Great care should be taken to ensure that valley boards and valley irons form a continuous water path to the eaves. The lip of the valley should, at all points, reach the height of the roofing battens.

1



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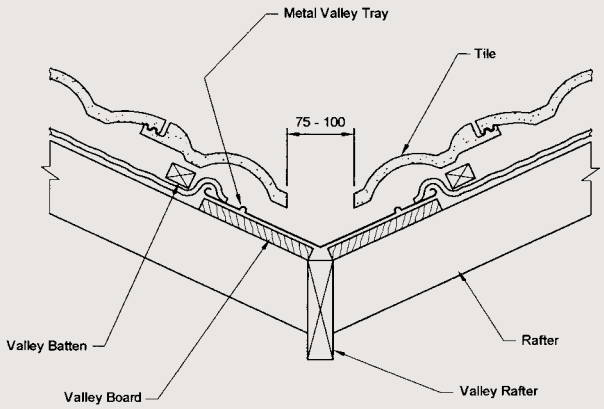


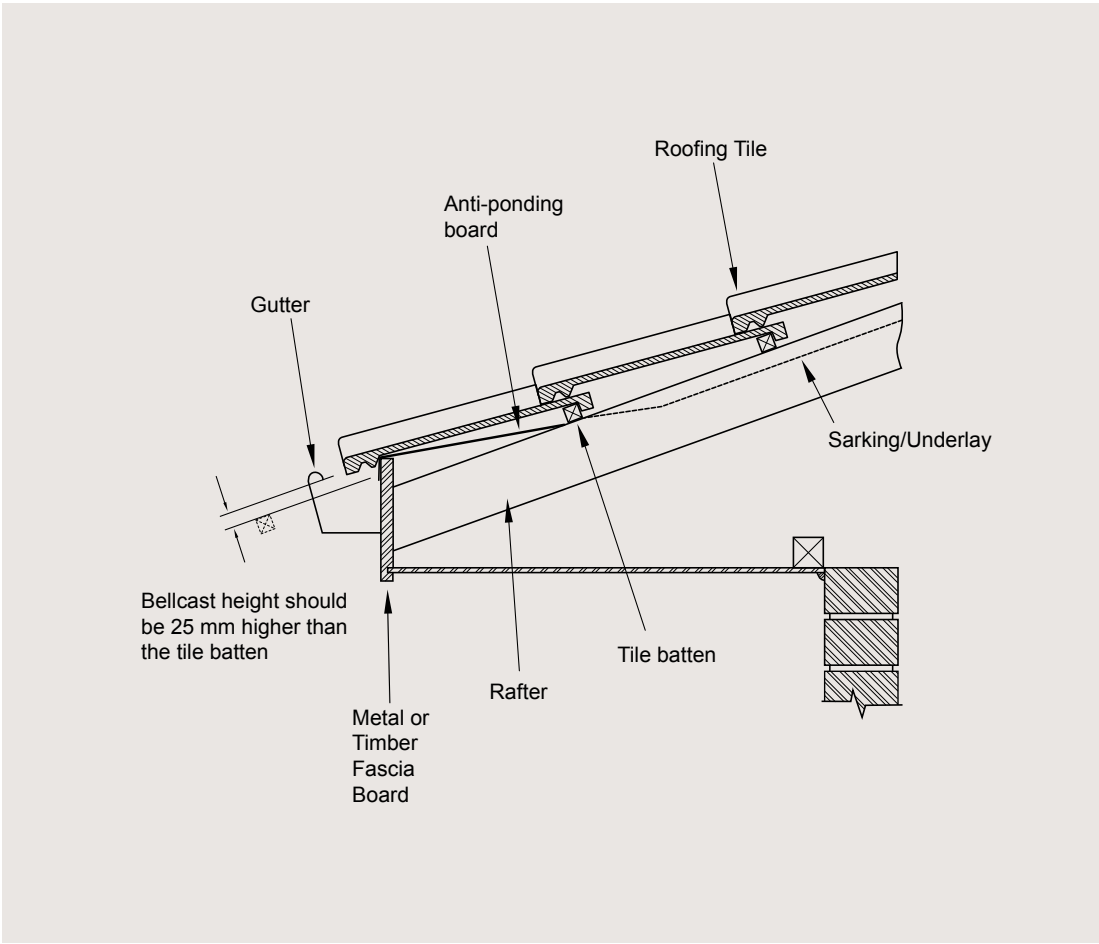
FASCIA

Fascia board height is extremely important to ensure the last course of tiles on a roof does not dip. If the fascia height is deficient or if a fascia batten is not employed, the last course of tiles will not appear in the same plane as the remainder of the roof.

The top edge of the fascia boards should be secured to the rafters, 25mm higher than the tile batten thickness. For example, a batten of 25mm thickness requires a 50mm distance between the top of the rafter and the top of the fascia board. This distance is known as the fascia, tilt or bellcast height.

The measurement of the fascia distance should be reduced by 10mm if the roof pitch is less than 20 degrees. Conversely, as the pitch increases to 45 degrees, the fascia distance must also increase.

Where a fascia board is not used, or fascia height is not adequate, a batten referred to as a "fascia", "bellcast" or "tilt" batten must be installed. The fascia batten height can be calculated using the same method, as above, and should be installed on the top edge of the bottom rafter.



Note: weather checks should be position fully into the gutter.

FLASHINGS

Flashing should be installed by a qualified tradesperson prior to tiling, where possible.

Flashing should be pliable enough to be dressed down well into the tile profile with sufficient mass to retain its position under wind pressure (at least 20kg per m^2 AS/NZ 17kg).

Cover flashing should be carried a minimum of 115mm over the tile, and dressed closely into the wall, watercourse and against the tile profile. The top edge should be firmly secured into raked joints or machine cut grooves in masonry. Flashing against vertical framework must be suitably supported.

The lower edge of wall sheeting over a tiled roof must finish 90mm above the top of the tile batten to allow clearance over the tiles. The distance must be maintained for all batten sizes. Minimum clearance between top of rafter and the bottom edge of raking, stepped or cover flashings should be 100mm therefore the following table applies for different battern thicknesses.

Clearance	Batten Thickness
125 mm	25 mm
138 mm	38 mm
150 mm	50 mm

1 Secret Gutter Flashing

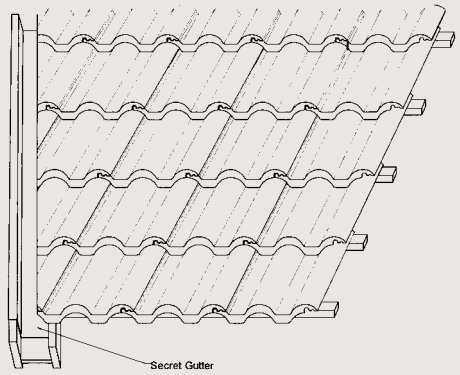
There are a number of different flashings that can be employed in the roof, depending on the junction type. The following are typical details of roof flashings.

2 Saddle Flashing

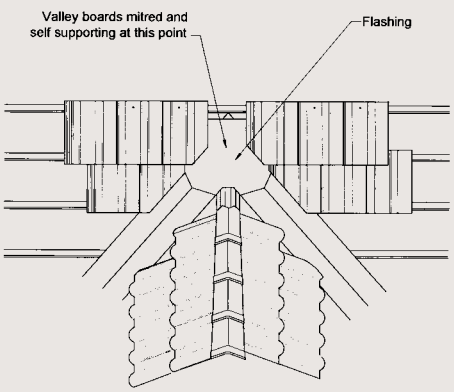
3 Dutch Gable Flashing

Flashing should extend past the hip line by a minimum of 300mm.

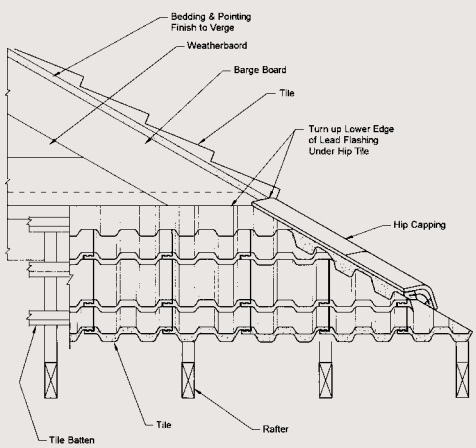
1 SECRET GUTTER FLASHING



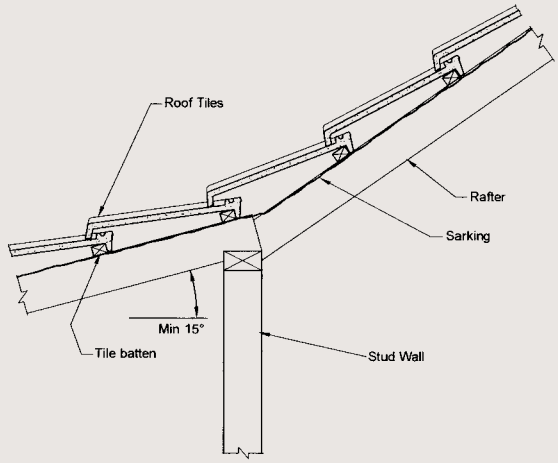
2 SADDLE FLASHING

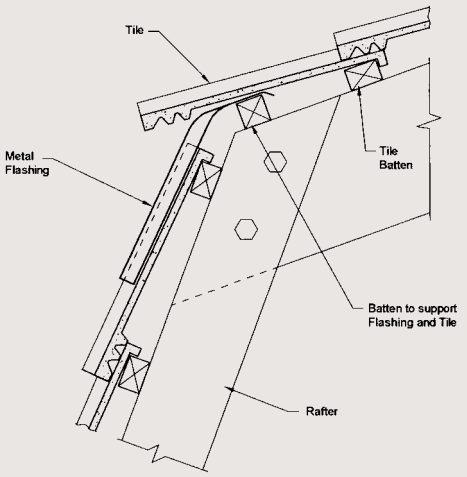


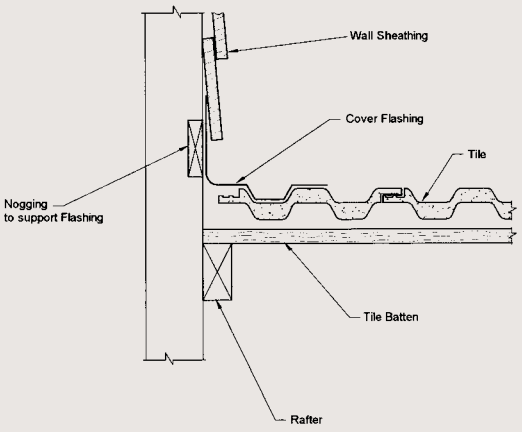
3 DUTCH GABLE FLASHING

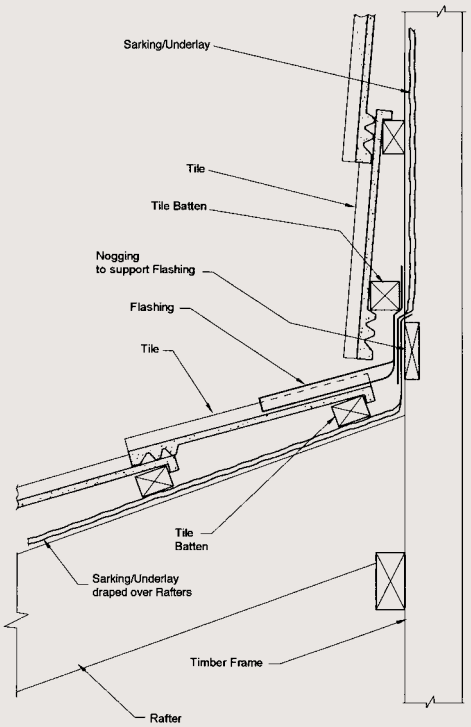


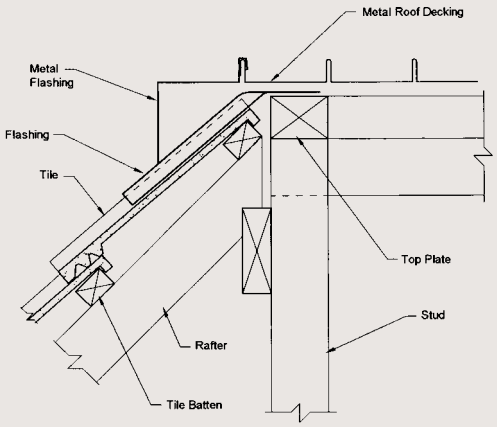
4 CHANGE OF PITCH FLASHING



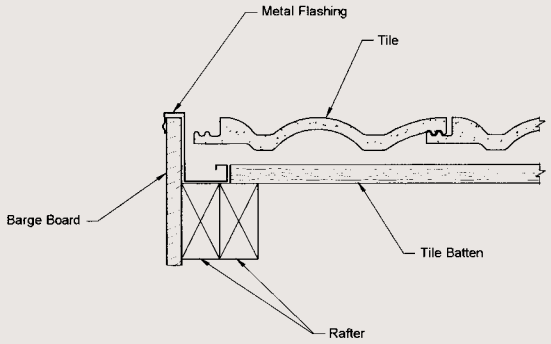




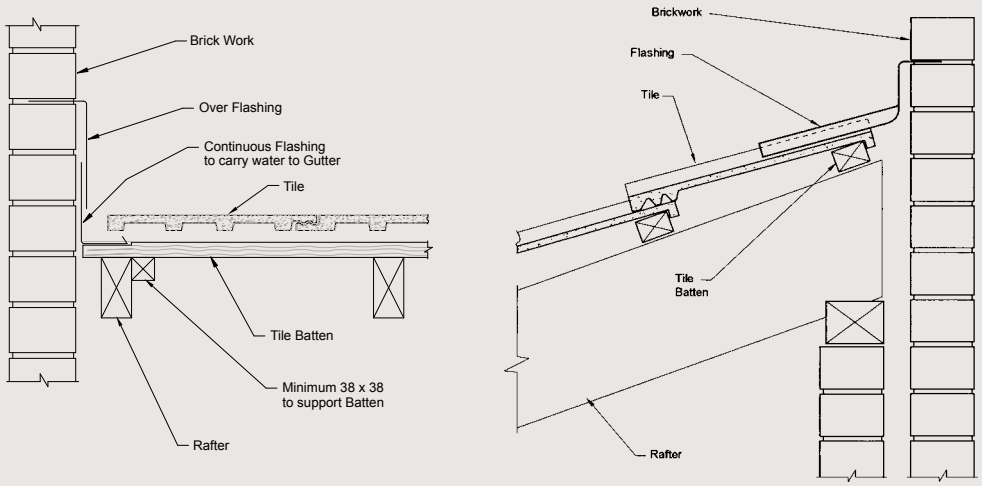




5 BARGE BOARD FLASHING



6 BRICKWORK FLASHING



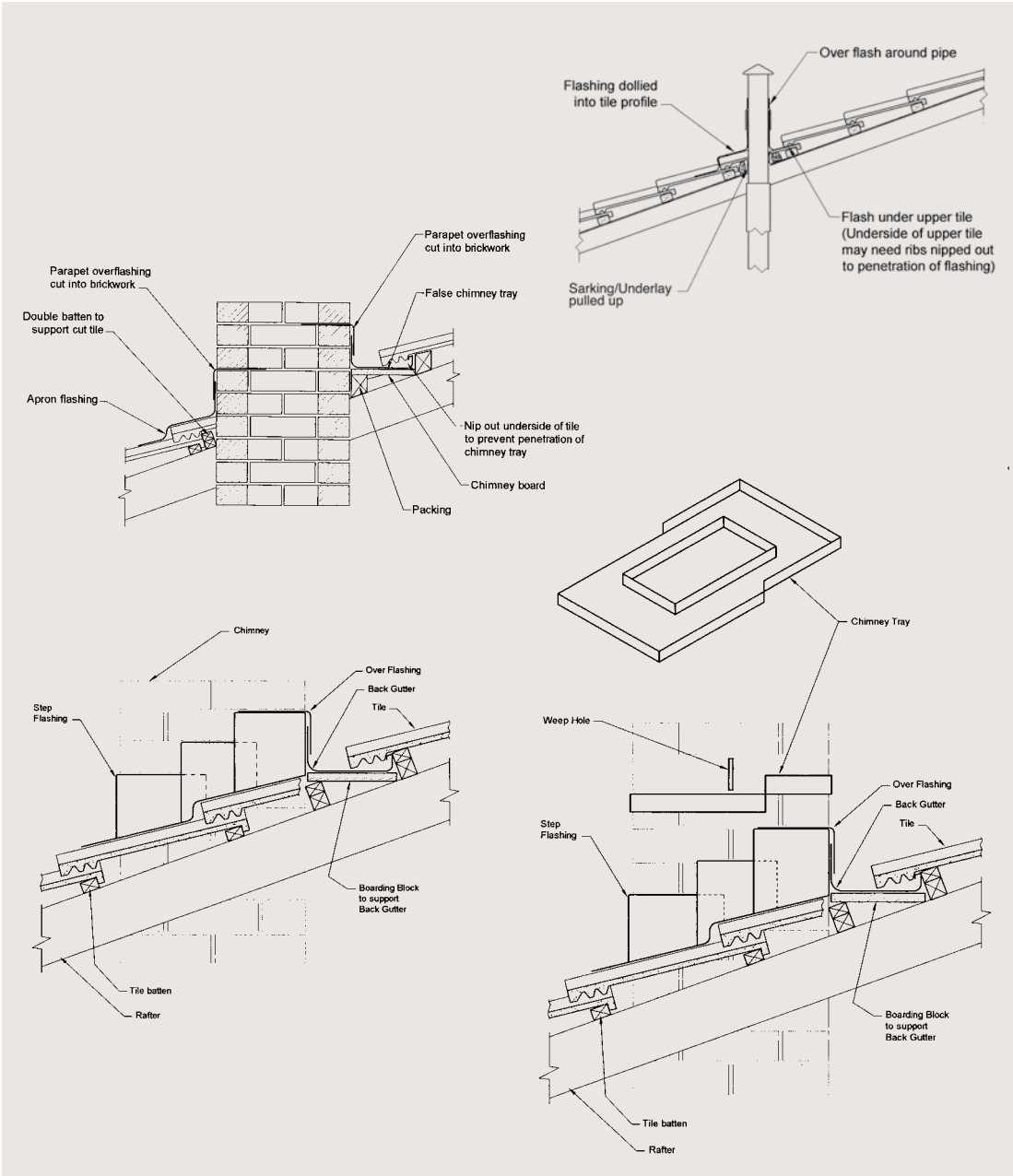
7 Chimney Flashing

Sarking/underlay around penetrations in the roof, such as chimneys, shafts, vents and skylights, abutments, should be trimmed and the edges turned up to divert water around the projections and from under flashings. The issue of ponding should be considered.

GENERAL

All edges and junctions of finished works should be clean and properly sealed against water penetration.

7 CHIMNEY FLASHING



BARGE

1 Height

Where fitted, barge boards should be aligned to the top of the roof battens.

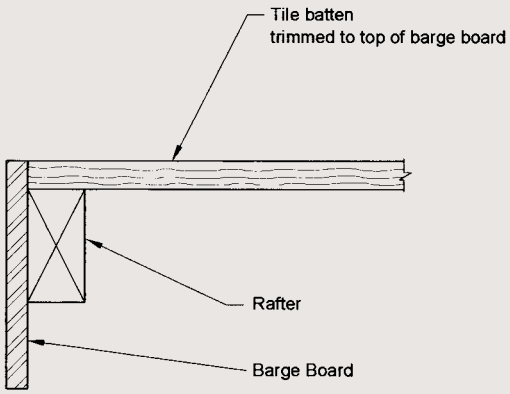
For bed and point finish which utilise a fibre cement strip barge boards should be finished 6mm below the surface of the tile batten.

2 Installation

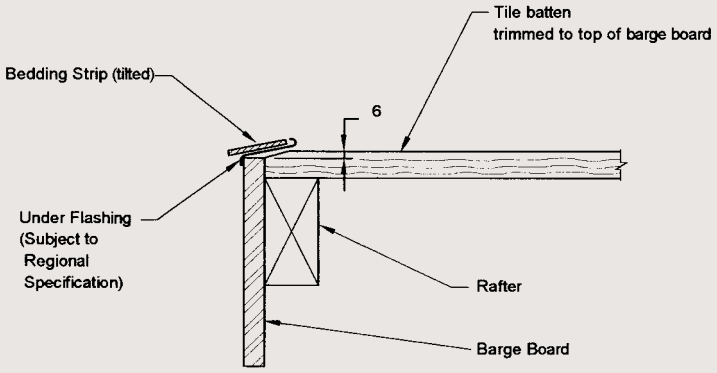
Where tiles are installed next to a barge board, the barge board should be fitted 5mm above the highest point of the tile.

The gutter should project approximately 18mm past the outside face of the barge board for square barge tiles, and 65mm for half round barge tiles.

1 HEIGHT



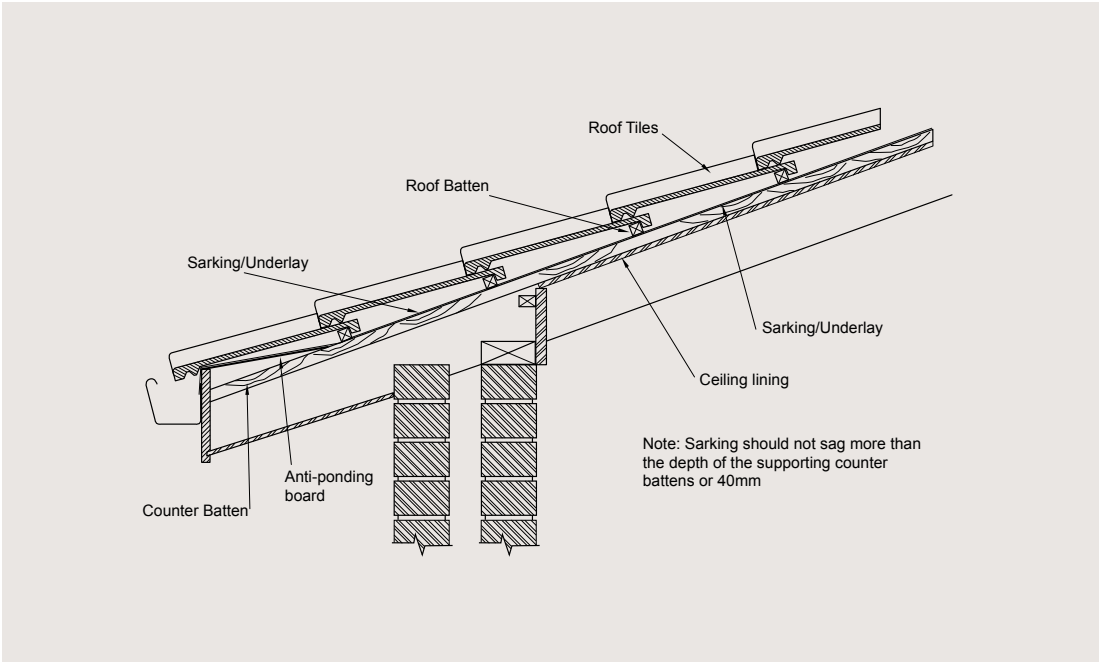
2 INSTALLATION



ANTI-PONDING BOARDS

Anti-ponding boards should be installed at the eaves line to prevent sarking/ underlay from sagging, and to ensure that water collected will discharge into the gutter. In accordance with AS 4200.2 and NZS 4206, anti-ponding boards are recommended on pitchs less than 20˚ as stipulated in AS 2050.

Anti-ponding boards are strongly recommended where no eaves overhang exist.



DOWNPIPES

As per AS 2050, where a downpipe discharges (via a spreader) onto a tiled roof, a distance of 1.8m eitherside of the point of discharge to the eaves gutter should be protected from inundation with either sarking/underlay, flashing or soakers. Ideally, water from the top roof should be directly to the storm water system.

The spreader employed should also have both ends sealed to prevent water discharging into the side lap of tiles. The discharge holes on the spreader should be aligned with the valleys within the tile.

SECTION 5
INSTALLATION

THIS MANUAL HAS BEEN PREPARED BY CSR 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 THAT MAY BE ENCOUNTERED, CSR ROOFING WILL ASSIST AND ADVISE ON ANY SPECIAL SITUATIONS THAT MAY OCCUR.

CONTENTS

LAYING TILES

Tiles should be laid and secured in accordance with AS 2050 and NZS 4206 "Installation of Roof Tiles."

This section details CSR Roofing's security installation specifications. These specifications have been developed from regional experience, research and practical application, in context of the following relevant Building Codes and Standards:

a) AS 2050 "Installation of Roof Tiles"

b) AS/NZ4200.2 "Installation of materials suitable for use as Pliable Building Membrane"

While regional variations exist, your roof tiling contractors will:

1. Install an appropriate fall protection system to meet Occupational Health and Safety guidelines (subject to regional practice)
2. Install tile battens
3. Install sarking or underlay (as required)
4. Install tiles and accessories using a recommended security method
5. Bed and point ridge and hip joins
6. Install fire-resistant batts over party walls (as required)
7. Fix anti-ponding boards (subject to regional practice)
8. Clean the roof of footmarks and loose debris

BATTENS

The installation of battens to rafters must comply with the loading requirements of Clause 1.4.1 of AS 2050.

SECURITY FIXING TO RAFTER

- Fixing for tiles to battens and for battens to steel frame should be non-ferrous stainless steel or steel with an appropriate corrosion-resistant coating
- Clout nails must comply with AS 2334 and NZS 4206, have a minimum diameter of 2.8mm, and have a minimum penetration of 15mm into the rafter (or 18mm in New Zealand)
- Self-drilling screws used to fix battens must comply with AS 3566 and NZS 4206

JOINTS IN BATTENS

Batten joints should be staggered over the roof so that three consecutive battens (NZ – 2 consecutive battens) are not jointed on the same rafter. All joints in battens must meet in the centre of trusses or rafters, and not be joined over girder trusses. Battens should be nailed.

HIP AND VALLEY JOINTS

Where battens intersect with hip board and valleys provide firm support.

STEEL BATTENS

Refer to the steel batten suppliers for the technical fixing specification. Particular consideration should be paid to batten spacings as battens may be installed by trades other than the roof tiler.

BEDDING AND POINTING

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.

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.

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.)

SARKING/UNDERLAY

SARKING/UNDERLAY HAS TWO KEY PURPOSES:

a) the reflective foil finish acts as a radiant heat barrier, reflecting up to 95% of radiant heat

b) where tiles are broken or become dislodged, Sarking/Underlay acts as a secondary barrier to water entry, particularly at lower roof pitches. As such, Sarking/Underlay is mandatory on roofs with long run rafters or low pitch.

Sarking/Underlay is a reflective, water resistant foil laminate material (or self supporting building paper in NZ) that sits snugly beneath the batten of a tiled roof. Underlay is a pliable building membrane that sits snugly beneath the batten of a tiled roof.

RECOMMENDATIONS

There are a number of circumstances where the use of Sarking/Underlay is recommended, or mandatory:

- Where local regulatory authorities suggest extreme weather conditions are probable i.e. cliff tops, open exposed sites or bushfire prone areas
- In bushfire prone areas, to prevent embers entering the roof space
- Where design wind velocity exceeds 41m/s (ie. greater than C1 or N3) and 44m/s in NZ.
- Immediately underneath and extending to the gutter around solar hot water collectors
- Where condensation may be an issue
- To minimise the build up of dust in the ceiling cavity
- At the change of roof pitch joint from that joint to the eaves gutter
- Where rafter length exceeds 4.5m at minimum pitch
- Under raked ceiling or exposed rafters

For Australian conditions, CSR Roofing recommends the use of a medium duty polymer based material known as Enviroseal, manufactured by CSR Bradford. CSR Bradford Enviroseal is designed specifically for Australian conditions and exceeds the requirements of AS/NZS 4200.1 Pliable Building Membranes

The advantages of Enviroseal are:

- resistance to tearing
- acts as a vapour barrier
- significantly increased strength over paper-based Sarking/Underlay
- significantly increase life of the Sarking/Underlay
- one side is treated with anti-glare surfacing reducing reflection
- maximum flammability index rating of 5

CSR Roofing recommends the use of Sarking/Underlay in all roofs.

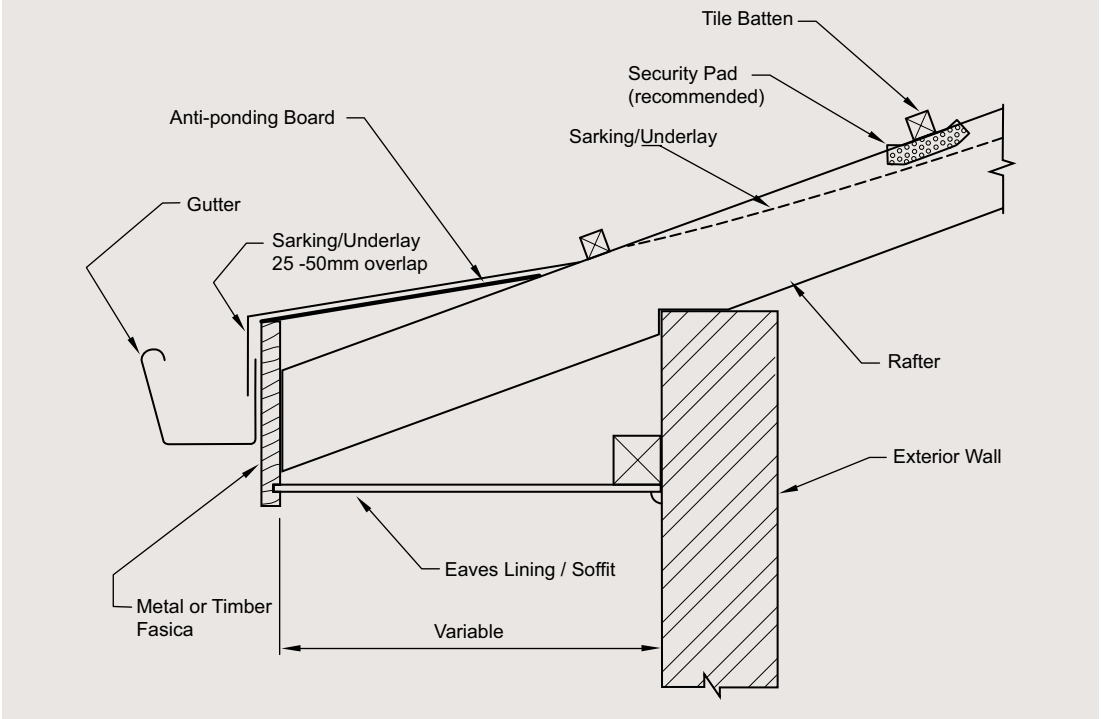
Laying

The reflective side of Sarking/Underlay should be laid face down.

Over-lapping Sarking/Underlay

Sarking/Underlay should overlap not less than 150mm, ensuring the upper layer rests over the top of the lower layer of Sarking/Underlay. At the end of a roll of Sarking/Underlay, the layers of Sarking/Underlay should overlap by a minimum of one rafter spacing. Sarking/Underlay should sag no more than 40mm between the rafters.

SARKING/UNDERLAY



Obstacles in the Roof

Hot Flue: The Sarking/Underlay should be cut back, allowing a clear space of 50mm
Penetrations: The Sarking/Underlay should be turned up and sealed to divert water from any projection in the roof. Where a fascia batten is used in place of a fascia board and there is no gutter, the Sarking/Underlay material should be neatly cut back to the outside edge of the fascia batten.

Use of Security Pads

To avoid constant flexing and to increase the life of the Sarking/Underlay material the use of security pads or anti-flap pads is recommended. Security pads should be installed in a staggered pattern under each second row of battens between each pair of rafters.

Sarking/Underlay at Eaves

To allow effective run off into gutter, Sarking/Underlay should extend over the fascia board by a minimum of 25mm and a maximum of 50mm.

Sarking/Underlay Support

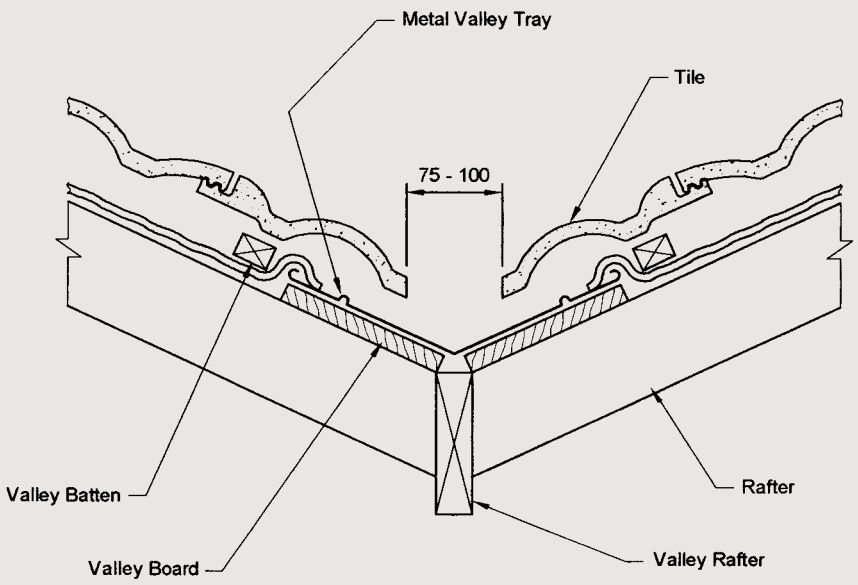
Subject to regional specifications, an approved anti-ponding board is recommended on roofs with a low pitch. (Refer to the prior section on Anti-Ponding Boards.)

Where rafter centres exceed 600mm, the Sarking/Underlay should be adequately reinforced. Where the rafter centres exceed 900mm, supporting the Sarking/Underlay or using an approved heavy grade Sarking/Underlay becomes mandatory. Installation of Sarking/Underlay support or safety mesh is performed by other trades as referred to in AS 2050 Appendix B.

Sarking/Underlay at Valleys

Sarking/Underlay is held in place by fixing a valley batten parallel to the valley gutter. The Sarking/Underlay should overlap the valley by no more than 25mm or be rolled over or cut at the valley batten. If Sarking/Underlay projects too far into valley the roof is likely to leak.

VALLEY



INSTALLATION

Sarking/Underlay must be installed to CSR Roofing fixing specifications, in accordance with AS/NZ 4200.2.

Sarking/Underlay is mandatory where wind exceeds 41m/s or N3 as per AS2050

LAYING OF TILES

Tiles should be laid and secured in accordance with AS 2050 and NZS 4206.

LOADING

The entire roof must be battened and sarked before tiles can be loaded onto the roof.

In buildings with exposed rafters, or a rafter length greater than 6m, tiles should be loaded onto the structure from each side to ensure their weight is evenly distributed.

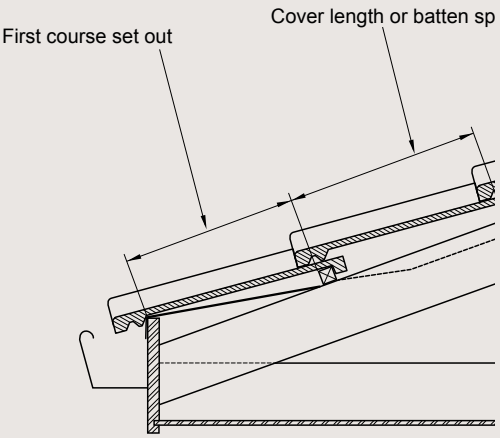
FIRST COURSE

The first course of tiles should project approximately 50mm over the fascia and into the gutter.

LAYING

All tile courses should be aligned horizontally, vertically and diagonally, to ensure a straight finish at the roof edge and to achieve the best look for the roof.

TILE SET OUT



STRAIGHT BONDED

CROSS BONDED

SECURING OF TILES

TILE CLIPS

CSR Roofing security fixing system includes a variety of clip fittings.

1 Standard Tile Clip

The Standard and Heavy Duty clip, available in either galvanised or plastic.

2 Eave tile Clips

Eaves clips reduce the possibility of tiles lifting at the eaves in high wind areas.

3 Steep and Vertical pitch

All tiles should be mechanically fixed between pitches of 40–70 degrees. "Mechanical fixing" may be achieved through nailing every tile, screwing every tile or clipping every tile. The specific method used varies by region. It is recommended that local advice is sought.

In extreme conditions, clips is the preferred method of mechanical fixing in Australia.

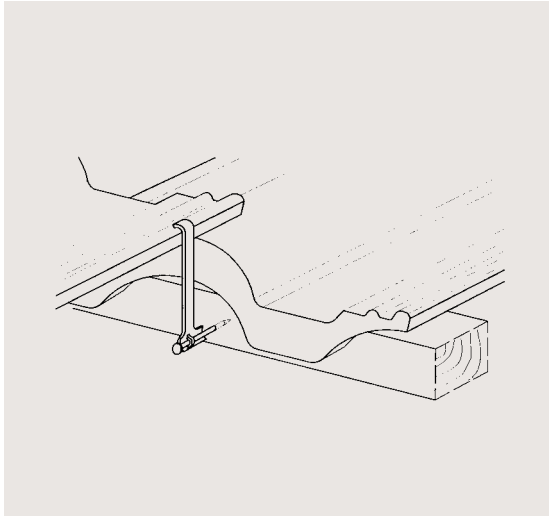
Tiles at pitch greater than 70 degrees must be double mechanical fixed and sarked.

NAILS

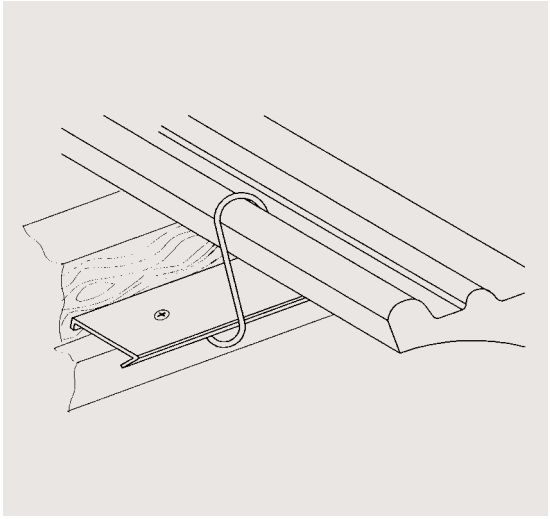
Nails should be non-ferrous or galvanised, of 2.8mm diameter, with length to penetrate the rafter at least 15mm (18mm in New Zealand). The nail requirements relevant to the timber used and wind loadings are specified in AS 2050.2.4. and NZ 4206.

CSR Roofing's Security Fixing system also offers the use of standard and heavy duty clips, eaves tile clips, screws and adhesives. The additional requirements relating to their application in Sections 1.34, 1.43 and 2.4 of AS 2050.

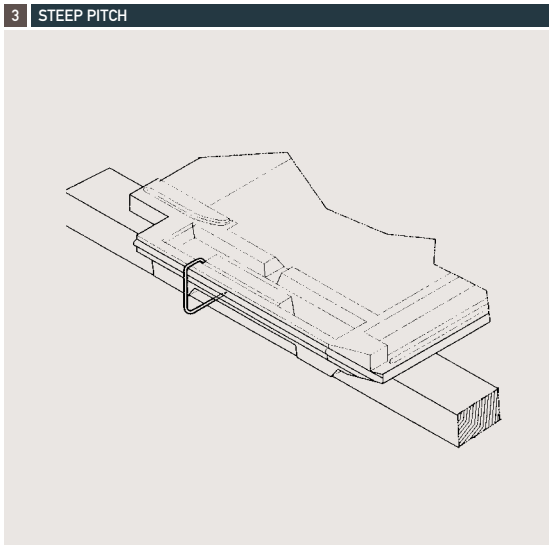
1 STANDARD TILE CLIP



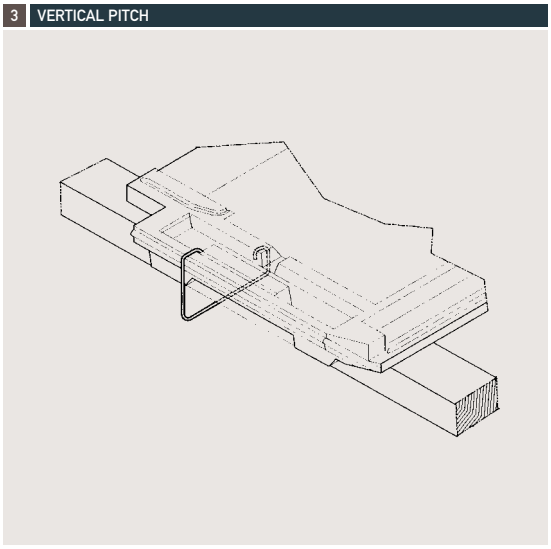
2 EAVE TILE CLIPS



3 STEEP PITCH



3 VERTICAL PITCH



SECURING ACCESSORIES

ACCESSORY TILES

After the main roof tiles have been laid, the installation of accessory tiles can commence. CSR Roofing manufactures various types of accessories, as detailed in the Product Sections of this manual. All junctions of hip and ridges must be made weatherproof. Accessories available for installation are dependent on the profile, the pitch and the position of the join in the roof.

LAYING

All ridge and hip tiles must be laid in a straight line, allowing for the natural contour of ridge tiles. The over-lapping of ridge tiles should be directed away from the prevailing winds.

Ridge

The ridge tiles are initially laid onto a bed of mortar and finished with flexible pointing material.

Hip

A hip begins with a Hip Starter or Shell End, positioned on a bed of mortar at the lower end of the hip.

The roof tiles at the join of a hip must be cut and laid with a maximum of 20mm between the planes.

A Hip Starter must be laid to project into the gutter, in line with the nose of the first course of tiles. Alternatively a ridge tile can be shaped to replace a hip starter.

SECURITY FIXING

1 Ridge and hip

As specified in Table 3 (Minimum Fixing Requirements for Tiles and Accessories/ Fixing Recommendations), at design wind speeds above 41m/s or 44m/s (in NZ), every ridge tile must be mechanically fixed.

Cut tiles should be supported by galvanised nails spiked to the hip board.

2 Steep Pitch

Steep Pitch Ridge tiles are used on roofs pitched in excess of 40 degrees.
A galvanised wire or bitumen-impregnated foam may be used to reinforce the bed and pointing of the ridge, hip or gable.

RIDGE AND HIP FINISHES

Ridge and hip tiles may be laid using different methods to create varying looks for the ridge/hip line. The following are suggested details suitable for hips.

3 Standard detail

4 Mitred Hip Detail

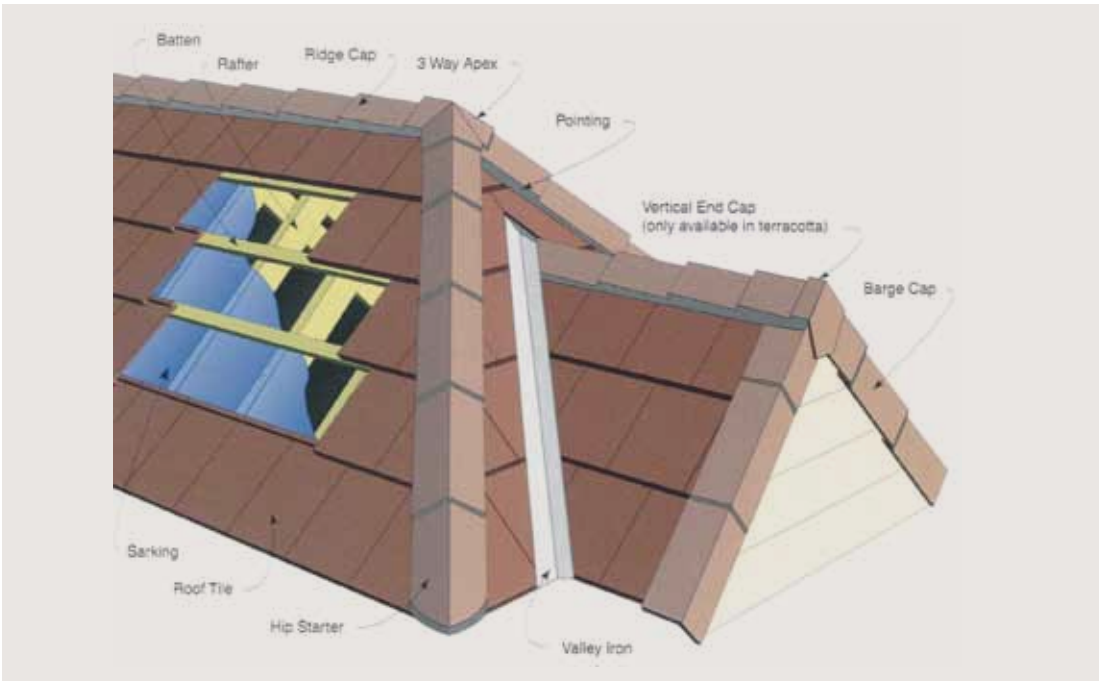
Consult your local CSR Roofing office for profiles suitable for Mitred hips.

A continuous metal underflashing is installed under the hip tiles.
The underflashing can be in the form of a concealed gutter. All mitred tiles must be machine cut and mitred joints filled with a suitable sealant.

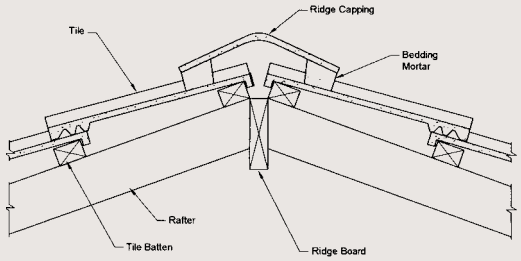
5 Butt Joining/A Line

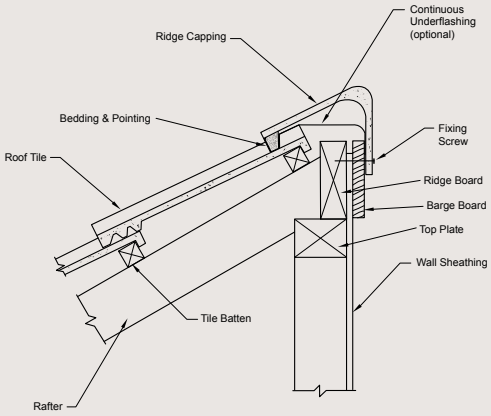
An alternative to conventional, overlapping ridge and hip tiles, butt-joining provides a smooth yet defined roofline. A continuous underflashing is required with this treatment.

ROOF DETAIL

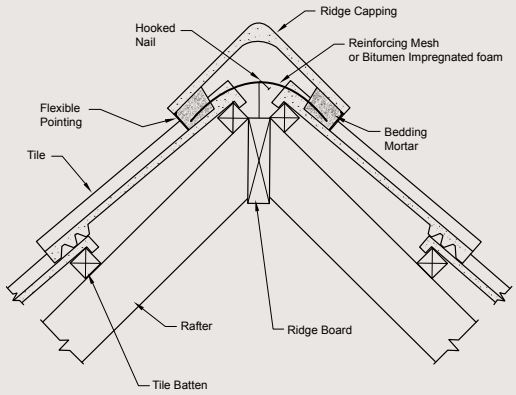


1 RIDGE AND HIP

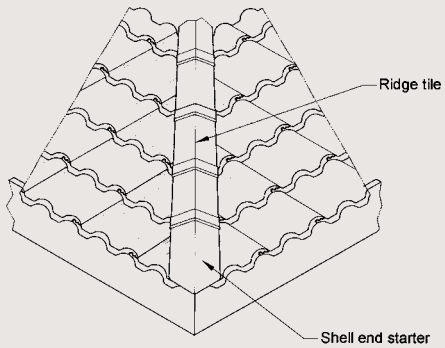




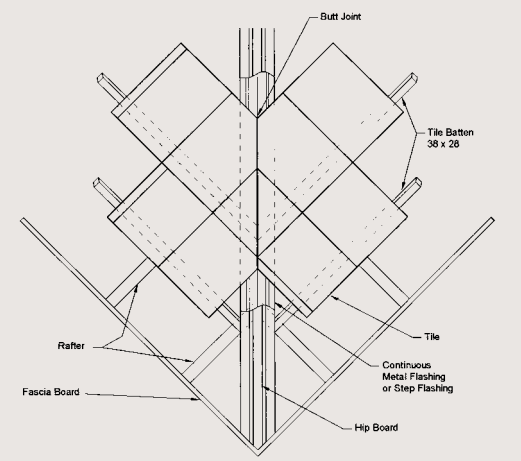
2 STEEP PITCH



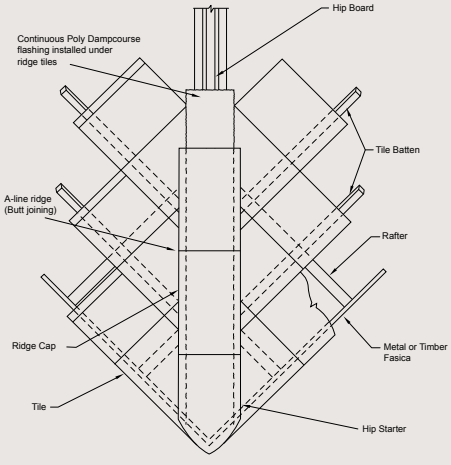
3 STANDARD DETAIL



4 MITRED HIP DETAIL



5 BUTT JOINING/A LINE



6 Valley Tile Installation

The valley width is dependent on regional weather conditions.

Under normal conditions, a gap of 75 to 100mm between tiles is acceptable. In high rainfall areas, valley tiles should be sealed with a bitumen impregnated foam. The valley gap may be increased to 100mm.

In high rainfall areas, valley design and downpipe position should be designed to suit the roof as per AS3500.

7 Fire Walls/Internal Seperating Walls

A fire retardant material should fill the cavity above the fire wall up to the underside of the tiles. In NZ, the fire retardant material and batten is replaced with a fired rated mortar or bedding. Except for 75mm x 50mm roof batten or less, timber or other combustible building element, should not pass through the fire-wall.

8 Counter Battening

Whenever a lining material is installed over rafters – commonly rerferred to as 'Close Boarding' counter battens wil need to be installed. This will then ensure sarking/underlay can be laid in accordance with the relevant Australian Standard AS4200.2 and also provide a base for the tile battens to be fixed.

BUSH FIRE PROTECTION

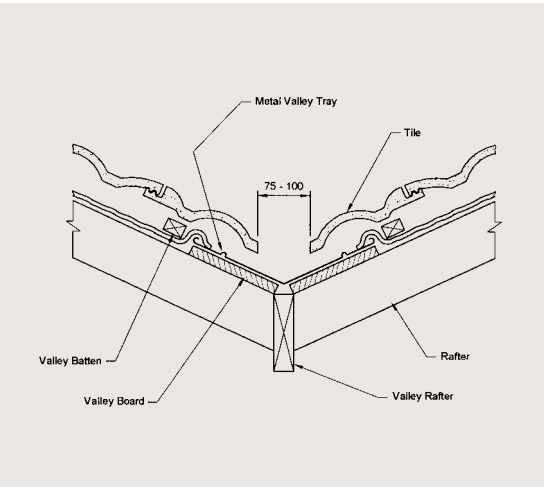
As per AS 3959, additional fixing requirements apply to designated bush fire hazard areas. State authorities, insurers, country fire authorities or related bodies, can identify these high fire hazard areas:

For roofs in these areas,

- Sarking/Underlay must be used
- Flexible pointing must be used
- Every tile must be secured

In Australian locations where high winds are in excess of 41m/s i.e. above N3 or C1, sarking with security pads is recommended irrespective of roof pitch.

6 VALLEY TILE INSTALLATION



Where winds exceed 41m/s, sarking is mandatory. In New Zealand, these wind speeds are 41m/s and 44m/s respectively. If further clarification is required, it is advisable to contact your local CSR Roofing office for advice.

BARGE/GABLE

For gable roofs, it is good practice for roof tiles to finish with equal length of tile at both ends.

A gable end (verge) can be set according to local requirements and exposure conditions, and include:

9 Bed and Point Finish

- Place a fibre cement bedding strip 100mm wide and 5mm thick over the barge board. The bedding strip should project a minimum of 19mm but a maximum of 25mm beyond the face of the barge board. It is recommended that the bedding strip is secured into place with a timber fillet
- The degree of projection of the bedding strip should be left to the tiler's discretion to ensure finish off with a full tile at all left hand gables (where practical). The underlap of the tile to all left hand gables should be removed.
- The barge board must be kept flush with the top of the batten. This allows the fibre cement strip to sit level with the top of the batten and barge board.
- A bedding of cement mortar is placed onto the strip. Tiles with a clean edge are positioned along this bed and pointed with an appropriately coloured flexible pointing. Pointing should be finished with a slight incline toward the outer edge and devoid of trowel marks.

10 A+B Barge/Gable Finish

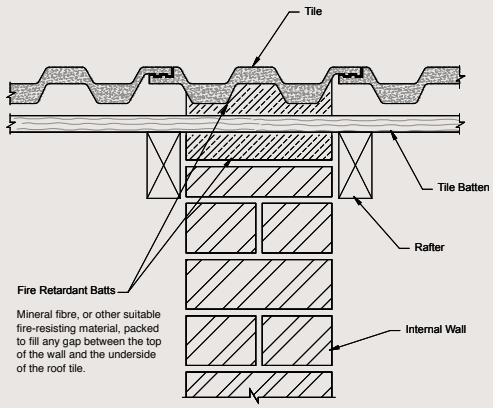
The top of the barge board should be flush with the top of the tilt batten.

Either standard or rounded barge tiles are laid over the gable end (with or without a bedding between the tiles and the barge tile). The lower end of the barge tiles are mechanically fixed (screwed or nailed) according to local specification into the barge board or brickwork.

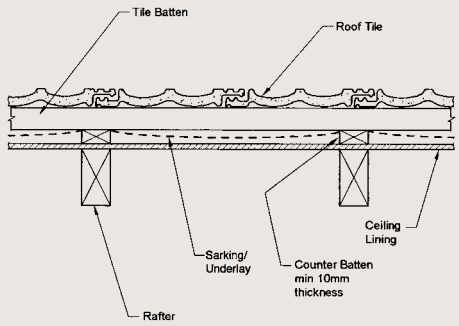
11 Concealed/Secret Gutter Finish

The top of the barge must be 75mm above the top of the battens. A suitable metal soaker should be installed as illustrated.

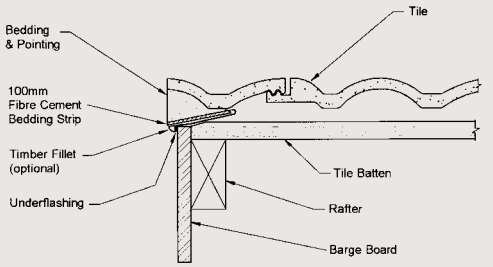
7 FIRE WALLS



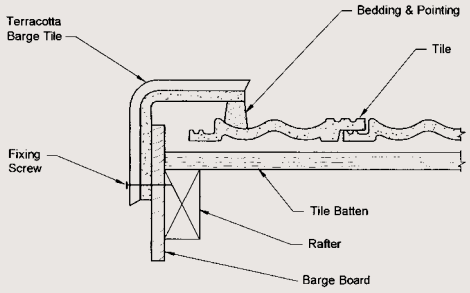
8 COUNTER BATTENING



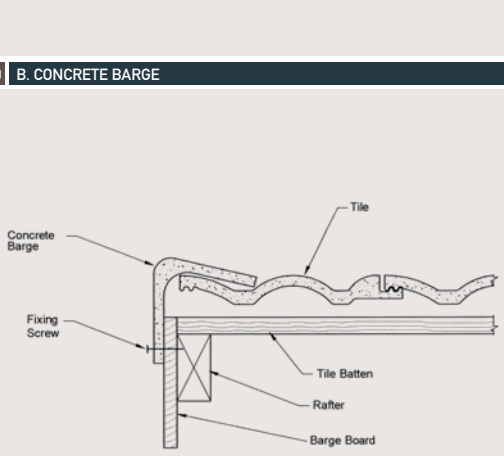
9 BED AND POINT FINISH



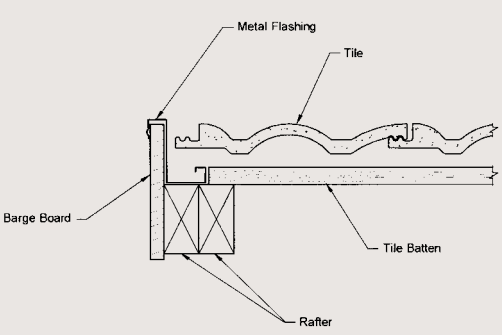
10 A. TERRACOTTA GABLE END



10 B. CONCRETE BARGE



11 CONCEALED/SECRET GUTTER FINISH



BED AND POINT MATERIALS

Mortar Mix

The bedding mortar mix should be a sand-cement mix of four parts bricklayer's sand to one part cement. Refer to 2.3 of AS 2050 or NZS 4206.

Application

The bedding should be trowelled through the whole joint with an even finish. All tiles adjacent to the ridge and hip should be lightly cleaned and brushed free of loose particles.

Flexible Pointing

Flexible Pointing is a highly pliable yet durable compound which, once cured, forms an incredibly strong bond between the tile and ridge capping. The use of Flexible Pointing yields the following benefits:

- Unlike traditional mortar based pointing, it will bend rather than crack with the movement of the house
- No need to wait for the roof to settle before pointing can begin, allowing the roof to be completed earlier
- Flexible Pointing saves time and money through a reduction in long term roof maintenance
- Bond between tile and ridge is so strong that it removes the need for mechanical fasteners
- Will flex and move to allow for the removal and replacement of tiles
- Available in a range of contemporary colours

As per AS 2050.2, Clause 2.4 above 33m/s, cement mortar should not be used as the sole fixing method.

Application

Pointing should be coloured to match the roof tiles. Trowel the flexible pointing material to a thickness of 3–5mm, ensuring that the pointing is in full contact with the edge of the capping and has a neat, clean finish. Weepholes may be required to allow drainage. All tiles adjacent to the ridge and hip tiles are to be cleaned and brushed free of loose mortar and pointing particles.

ROOF COMPLETION

Tilers should take care to remove all debris from the roof and gutters on completion of the job. In particular, care should be taken to remove any steel debris, such as nails, which may cause staining of the tiles or premature corrosion of gutters.

A final detail check of the roof on completion is conducted to ensure that any broken or cracked tiles are replaced ensuring the roof is fully waterproof.

CARING FOR YOUR ROOF

Your roof is required to remain waterproof for a long time after it is installed. In fact, your roof tiles are structurally guaranteed to perform their function for 50 years* (Please refer to the guarantee for each product)

Understandably, this guarantee does not cover matters beyond our control, such as:

- Damage caused to the roof by other parties, including plumbers,
- TV antenna and airconditioning installers etc.
- Falling objects
- Air pollution
- Acts of nature
- Tiles being treated with the wrong chemical or coatings
- Acts of war or terrorism

To ensure your roof remains watertight, roof traffic should be kept to a minimum. Below are some handy hints to minimise damage to your roof.

- Only access your roof when absolutely necessary and observe safety requirements
- Wear soft sole, non-slip footwear
- Always be aware of weather and conditions, as tiles can be slippery
- Extend your ladder at least 1 metre past the gutter and secure
- Only step on the lower centre of roof tiles
- Secure a walkway of plywood, ladders, planks etc. if heavy traffic is necessary
- To remove objects from the roof. Use a long stick or rake where possible
- Remove roof tiles by kicking the lower centre of the tile towards the ridge
- When performing any maintenance to your roof, it is recommended that you consult a roofing specialist.

Also enclosed are some simple hints should you need to repair your roof. When in doubt about your roof, always consult a roofing specialist.

SOME FACTS ABOUT TILED ROOFS

Leaks are most often confined to small areas and usually occur as a result of one or more of the following problems:

- Cracked or broken cement mortar bedding to the ridge or hip capping
  Capping should be rebedded or repointed
- Cracked or broken roof tiles
  Individual roof tiles should be replaced
- Roof tiles displaced
  Displaced tiles should be put back into their proper position
- Blocked drainage channels under the ‘sidelaps’ of individual tiles
  Any build-up of dirt or debris should be removed
- Flashings blocked, damaged or displaced
  These problems should be corrected
- Blocked gutters (including valley gutters) and downpipes
  These should be cleaned out

CAUTION

If your roof needs checking or if you have a roof leak, it is always best to employ an expert tradesperson to undertake the work for you, as walking around on roofs can be dangerous.

SECTION 6
MONIER RANGE

CONTENTS

MONIER™
Living in style.

MONIER CONCRETE TILES

Our concrete range elegantly covers every style of home

The first concrete tiles were produced in Germany in 1844 in a single colour. Technology has advanced quite a bit since then, and Monier has led the way since the 1940's to produce concrete tiles that are stylish, strong, exact in size, have high quality colour coatings, and are extremely long lasting.

Because Monier concrete tiles are made to last, you'll have a virtually maintenance-free roof that will save you money on repairs over the years, while being beautifully affordable from the outset.

Following the recommendations detailed in this manual, and installation by reputable tiling contractors, Monier concrete tiles are impervious to the worst weather elements, from howling winds to fierce heat, from snow and ice to salt spray.

In addition, Monier concrete tile offer considerable sound proofing qualities, making them extremely suitable for high traffic locations, for example, on major roads or near airports.

They are also truly versatile, being able to meet the design demands of almost any shape or contoured roof. In fact, since the 1960's more people have selected Monier concrete roof tiles than any other tile.

PERFORMANCE 50 YEAR GUARANTEE

MANUFACTURE

Tiles are manufactured to AS 2049 and NZS 4206.

APPLICATION

Tiles can be fixed as either roof or wall coverings, within a range of pitches to vertical.

FIRE RESISTANCE

All tiles are incombustible and fully fire resistant according to ASTM (USA) E108–88 tests. (No comparable Standard available in Australia and NZ).

MASS OF ROOFING

To calculate timber sizes, allow 60kg/m² for concrete tiles, terracotta tiles and battens for a pitched or truss roof with a flat ceiling. Based on a roof having a mass of 60kg/m² plus a 10mm plaster ceiling, counter battens and light weight insulation, allow 90kg/m² for a cathedral style ceiling.

PERFORMANCE

All roof tiles manufactured by CSR Roofing confirm to AS 2049.

PRODUCT DETAIL

For specific information relating to the use of each profile, refer to both the specific product details covered in this section and the recommendation for a specific profile detailed in the Design Consideration section.

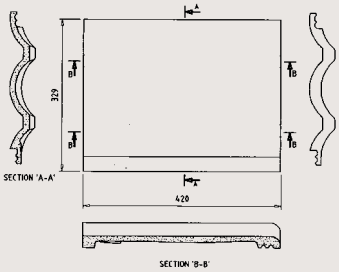
MONIER™
Living in style.

ELABANA

To view colour swatches for each state refer to www.csrroofing.com.au

An ideal tile for enhancing both modern and Mediterranean designs, the prominent roll of Elabana's profile adds eye-catching style to your roof.

PERFORMANCE 50 YEAR GUARANTEE



COVERAGE
Approximately 10.6 tiles per m^2.

DIMENSIONS (NOMINAL)

Length:	420mm
Width:	329mm

MASS (WEIGHT)

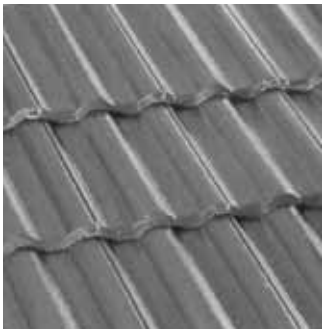
Per tile:	4.5kg
Per m^2:	47.0kg

HEAD LAP
Minimum head lap should be 75mm. This may increase according to set out, however head lap should not exceed 110mm.

RECOMMENDED BOND
Straight & Cross Bond

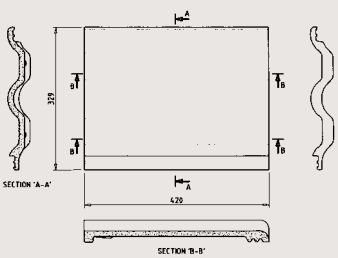
MONIER™
Living in style.

CENTURION



To view colour swatches for each state refer to www.csrroofing.com.au

As the name suggests, a slim, continuing Roman-style roll gives Centurion its attractive, classical profile, a look suited to all forms of roof design.



COVERAGE
Approximately 10.6 tiles per m^2.

DIMENSIONS (NOMINAL)

Length:	420mm
Width:	329mm

MASS (WEIGHT)

Per tile:	4.5kg
Per m^2:	47.0kg

HEAD LAP
Minimum head lap should be 75mm. This may increase according to set out, however head lap should not exceed 110mm.

RECOMMENDED BOND
Straight & Cross Bond

PERFORMANCE 50 YEAR GUARANTEE

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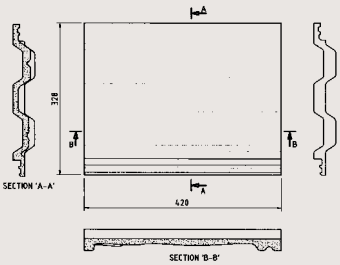
Living in style.

TUDOR

To view colour swatches for each state refer to www.csrroofing.com.au

A look suited to both traditional steep pitches and contemporary architecture, Tudor gives classic style a fresh look with its clean, defined lines and geometric design.

PERFORMANCE 50 YEAR GUARANTEE



COVERAGE
Approximately 10.6 tiles per m^2.

DIMENSIONS (NOMINAL)

Length:	420mm
Width:	328mm

MASS (WEIGHT)

Per tile:	4.5kg
Per m^2:	47.0kg

HEAD LAP
Minimum head lap should be 75mm. This may increase according to set out, however head lap should not exceed 110mm.

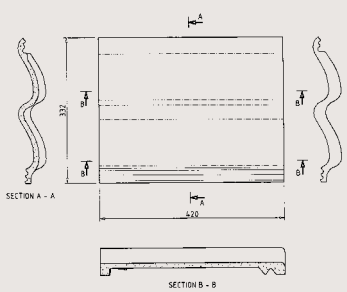
RECOMMENDED BOND
Straight & Cross Bond

MONIER™
Living in style.

WAVERLEY

To view colour swatches for each state refer to www.csrroofing.com.au

Unique and modern, the gentle and continuous wave pattern of the Waverley is truly unique to Australia. Its exclusive styling is perfect for Mediterranian inspired designs through to contemporary architecture.



COVERAGE
Approximately 10.6 tiles per m^2.

DIMENSIONS (NOMINAL)

Length:	420mm
Width:	332mm

MASS (WEIGHT)

Per tile:	4.8kg
Per m^2:	48.0kg

HEAD LAP
Minimum head lap should be 75mm. This may increase according to set out, however head lap should not exceed 110mm.

RECOMMENDED BOND
Straight Bond or Cross Bond

PERFORMANCE 50 YEAR GUARANTEE

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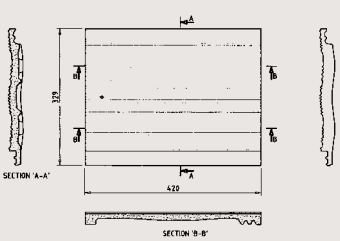
Living in style.

HOMESTEAD

To view colour swatches for each state refer to www.csrroofing.com.au

With its gently curved shape and grooved surface, Homestead recreates the appearance of early hand-split timber shakes to create a style and endurance of which our pioneers would be proud.

PERFORMANCE 50 YEAR GUARANTEE



COVERAGE
Approximately 10.6 tiles per m^2.

DIMENSIONS (NOMINAL)

Length:	420mm
Width:	329mm

MASS (WEIGHT)

Per tile:	5.0kg
Per m^2:	50.0kg

HEAD LAP
Minimum head lap should be 75mm. This may increase according to set out, however head lap should not exceed 110mm.

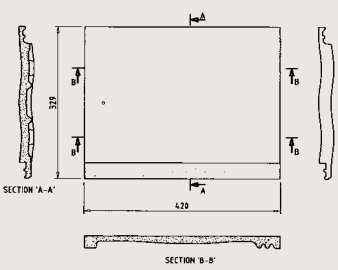
RECOMMENDED BOND
Straight Bond or Cross Bond

MONIER™
Living in style.

TRADITIONAL

To view colour swatches for each state refer to www.csrroofing.com.au

Traditional in strength but modern in appearance, this classic profile creates a smooth surface and subtle wave that gives a flowing, undulating texture to the roof.



COVERAGE
Approximately 10.6 tiles per m^2.

DIMENSIONS (NOMINAL)

Length:	420mm
Width:	329mm

MASS (WEIGHT)

Per tile:	4.9kg
Per m^2:	50.0kg

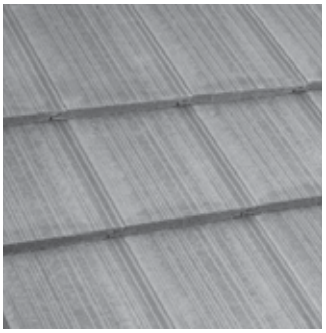
HEAD LAP
Minimum head lap should be 75mm. This may increase according to set out, however head lap should not exceed 110mm.

RECOMMENDED BOND
Straight Bond or Cross Bond

PERFORMANCE 50 YEAR GUARANTEE

MONIER™
Living in style.

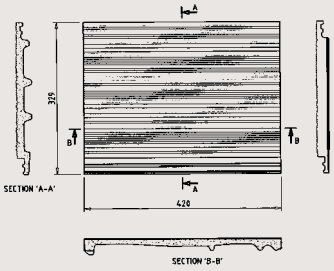
GEORGIAN



To view colour swatches for each state refer to www.csrroofing.com.au

With its fine textured surface and flat profile, Georgian roof tiles recall the precise edges of colonial sawn timber shingles.

PERFORMANCE 50 YEAR GUARANTEE



COVERAGE
Approximately 11.0 tiles per m^2.

DIMENSIONS (NOMINAL)

Length	420mm
Width	329mm

MASS (WEIGHT)

Per tile:	5.2kg
Per m^2:	52.0kg (80mm lap) 56.0kg (100mm lap)

HEAD LAP
Minimum head lap should be 80mm. This may increase according to set out, however head lap should not exceed 110mm.

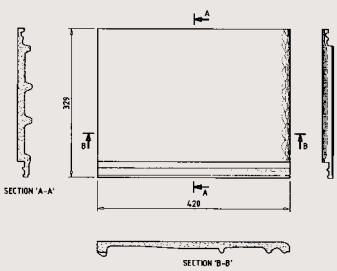
RECOMMENDED BOND
Cross Bond

MONIER™
Living in style.

CAMBRIDGE

To view colour swatches for each state refer to www.csrroofing.com.au

With rough-hewn front edges and depth of colour, Cambridge roof tiles recreate the formal elegance and clean, neat appearance of a true slate roof.



COVERAGE
Approximately 11.0 tiles per m^2.

DIMENSIONS (NOMINAL)

Length:	420mm
Width:	329mm

MASS (WEIGHT)

Per tile:	5.3kg
Per m^2:	53.0kg (80mm lap) 57.0kg (100mm lap)

HEAD LAP
Minimum head lap should be 80mm. This may increase according to set out, however head lap should not exceed 110mm.

RECOMMENDED BOND
Cross Bond

PERFORMANCE 50 YEAR GUARANTEE

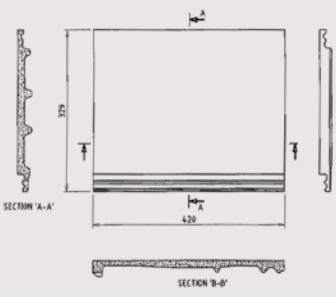
MONIER™
Living in style.

HORIZON

To view colour swatches for each state refer to www.csrroofing.com.au

A sleek, flat profile is finished with a clean nose delivering streamlined roof lines in a palette of earthy, natural tones.

PERFORMANCE 50 YEAR GUARANTEE



COVERAGE
Approximately 11.0 tiles per m^2.

DIMENSIONS (NOMINAL)

Length	420mm
Width	329mm

MASS (WEIGHT)

Per tile:	5.2kg
Per m^2:	52.0kg (80mm lap)
	56.0kg (100mm lap)

HEAD LAP
Minimum head lap should be 80mm. This may increase according to set out, however head lap should not exceed 110mm.

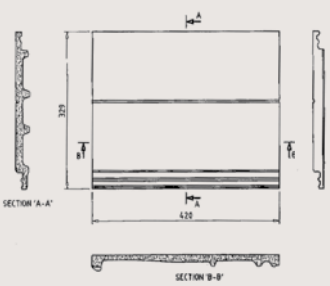
RECOMMENDED BOND
Cross Bond

MONIER™
Living in style.

MADISON

To view colour swatches for each state refer to www.csrroofing.com.au

A clean, flat profile with a minimalist edge. The face of the tile is accentuated with a singular groove down the centre



COVERAGE
Approximately 11.0 tiles per m^2.

DIMENSIONS (NOMINAL)

Length	420mm
Width	329mm

MASS (WEIGHT)

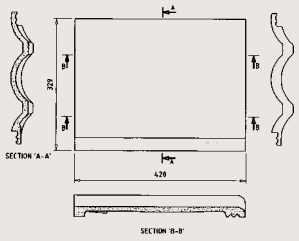
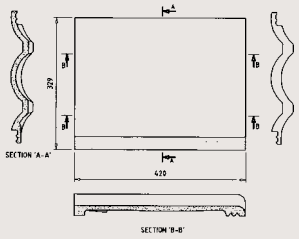
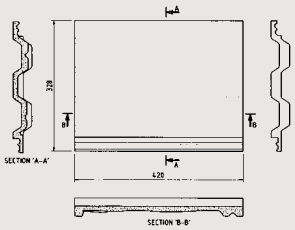
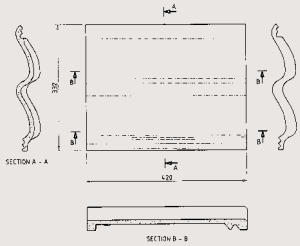
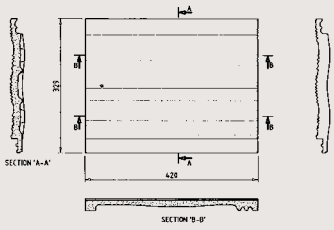
Per tile:	5.2kg
Per m^2:	52.0kg (80mm lap) 56.0kg (100mm lap)

HEAD LAP
Minimum head lap should be 80mm. This may increase according to set out, however head lap should not exceed 110mm.

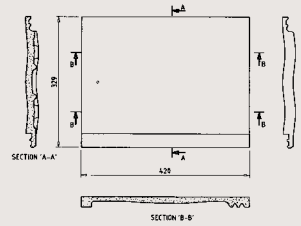
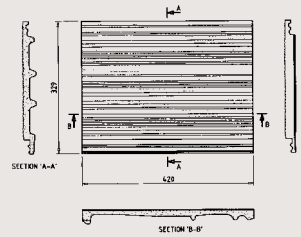
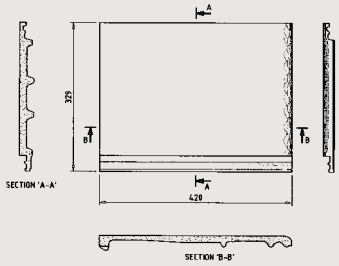
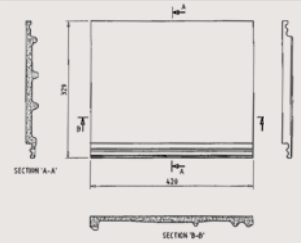
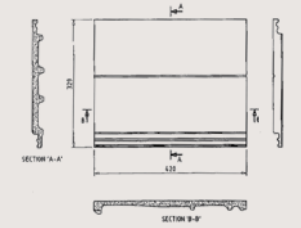
RECOMMENDED BOND
Cross Bond & 1/4 Bond

PERFORMANCE 50 YEAR GUARANTEE

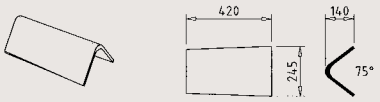
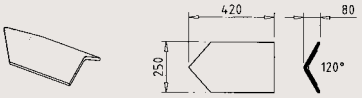
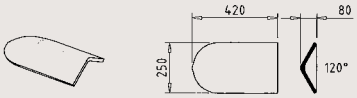
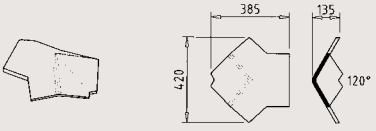
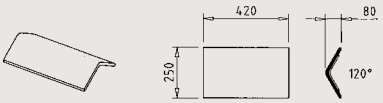
MONIER RANGE PROFILES

PROFILE	LENGTH (MM)	WIDTH (MM)	WEIGHT (KG)	MIN HEAD LAP (MM)	MAX HEAD LAP (MM)	BONDING METHOD	COVERAGE (TILE PER M²)
Elabana							
	420	329	4.5	75	110	Straight & Cross Bond	10.6
Centurion							
	420	329	4.5	75	110	Straight & Cross Bond	10.6
Tudor							
	420	328	4.5	75	110	Straight & Cross Bond	10.6
Waverley							
	420	332	4.8	75	110	Straight or Cross	10.6
Homestead							
	420	329	5.0	75	110	Straight or Cross	10.6

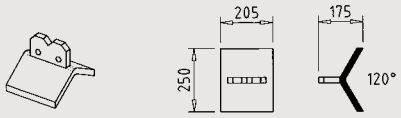
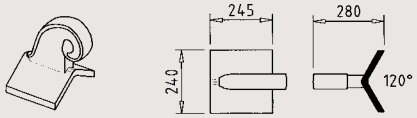
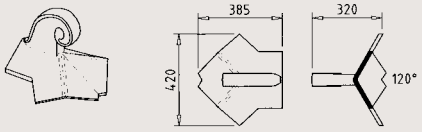
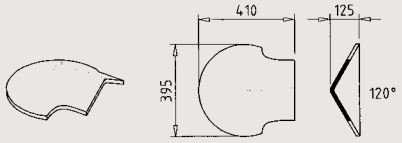
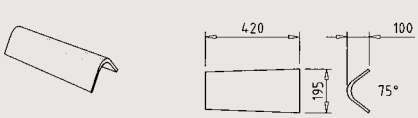
MONIER RANGE PROFILES

PROFILE	LENGTH (MM)	WIDTH (MM)	WEIGHT (KG)	MIN HEAD LAP (MM)	MAX HEAD LAP (MM)	BONDING METHOD	COVERAGE (TILE PER M^2)
Traditional							
	420	329	4.9	75	110	Straight or Cross	10.6
Georgian							
	420	329	5.2	80	110	Cross	11
Cambridge							
	420	329	5.3	80	110	Cross	11
Horizon							
	420	329	5.2	80	110	Cross	11
Madison							
	420	329	5.2	80	110	Cross & 1/4 Bond	11

MONIER RANGE ACCESSORIES

PROFILE	LENGTH (MM)	WIDTH (MM)	HEIGHT (MM)	ANGLE (DEGREE)	WEIGHT (KG)
Unibarge					
	420	245	140	75	5.1
Starter					
	420	250	80	120	2.8
Shell End Starter					
	420	250	80	120	–
3-Way Apex (butt & overlapping)					
	391.7	413.3	135	135	3.8
Ridge					
	420	250	80	120	3.4

MONIER RANGE ACCESSORIES

PROFILE	LENGTH (MM)	WIDTH (MM)	HEIGHT (MM)	ANGLE (DEGREE)	WEIGHT (KG)
Ridge Saddle					
	205	250	175	120	3.3
Gable Finial — ScrolL					
	245	240	280	120	5.1
Apex Finial — Scroll					
	385	420	320	120	6
Spoon-Starter					
	410	395	125	120	6
Barge — NZ					
	420	195	100	75	–

SECTION 7
WUNDERLICH RANGE

CONTENTS

WUNDERLICH™
The lasting beauty of terracotta

WUNDERLICH TERRACOTTA TILES

Perfectly timeless. Perfectly natural. Perfectly beautiful.

More than 30 years ago in China, over six thousand beautifully formed terracotta soldiers and horses — the famous "Entombed Warriors" – were unearthed by archaeologists. Almost all were completely intact, despite having been buried for more than two thousand years.

PERFORMANCE AND COLOUR 50 YEAR GUARANTEE

It's because terracotta possesses a lasting strength and durability, as well as great versatility and a natural beauty that comes from the earth itself (terracotta is Italian for baked earth). In fact, the terracotta products we use today are made from virtually the same 'ingredients' that were used to produce these ancient and enduring relics.

The earliest known use of terracotta dates back almost six thousand years to the Bronze Age, while it is thought that the first glazed roofing tiles were made in China from 2700 BC. So when Ernest, Alfred and Otto Wunderlich began to manufacture terracotta tiles in Australia back in 1916 after importing them for 30 years, they were simply renewing and reinventing a timeless tradition that goes back six millennia.

Our terracotta tiles add more than just heritage value.

Before the Wunderlich brothers began producing quality, affordable terracotta roof tiles, only a select few were able to benefit from the many advantages of a tiled roof.

With the extremes of climate experienced in our corner of the world, roofs need to be durable. In the fierce heat of summer, Wunderlich tiles are slow to absorb heat, and allow the roof to breathe, which helps keep your house cooler for longer. Our terracotta tiles need little or no maintenance, and will not fade.

Of course, the heritage value of a tiled roof cannot be overlooked. In suburban streets and country towns, the traditional pitched roof with its distinctive terracotta tiles has helped form the character and atmosphere of the places we call home. In fact, many heritage homes are still adorned and protected by the original Wunderlich roof tiles installed almost one hundred years ago.

Naturally, the value of a terracotta roof is not limited to its enduring beauty and heritage qualities. As the real estate market continued to prove, the prestige, durability and practicality of a terracotta tiled roof can increase the resale value of your home.

The range that puts our terracotta roof tiles on top.

You put much of yourself into the house you build, so your choice of roof tile is literally the cap on your personal style. Practical but beautiful, classic yet contemporary, fashionable but enduring, Wunderlich's extensive range offers a selection of shapes, or profiles, whose designs have been adapted from and influenced by a variety of modern and cultural sources. We also offer an impressive range of natural colours and finishes to complement any design.

MANUFACTURE

Tiles are manufactured to AS 2049 and NZS 4206

APPLICATION

Tiles can be fixed as either roof or wall coverings, within a range of pitches to vertical.

FIRE RESISTANCE

All tiles are incombustible and fully fire resistant according to ASTM (USA) E108–88 tests. (No comparable Standard available in Australia and NZ).

PERFORMANCE

All roof tiles manufactured by CSR Roofing confirm to AS 2049.

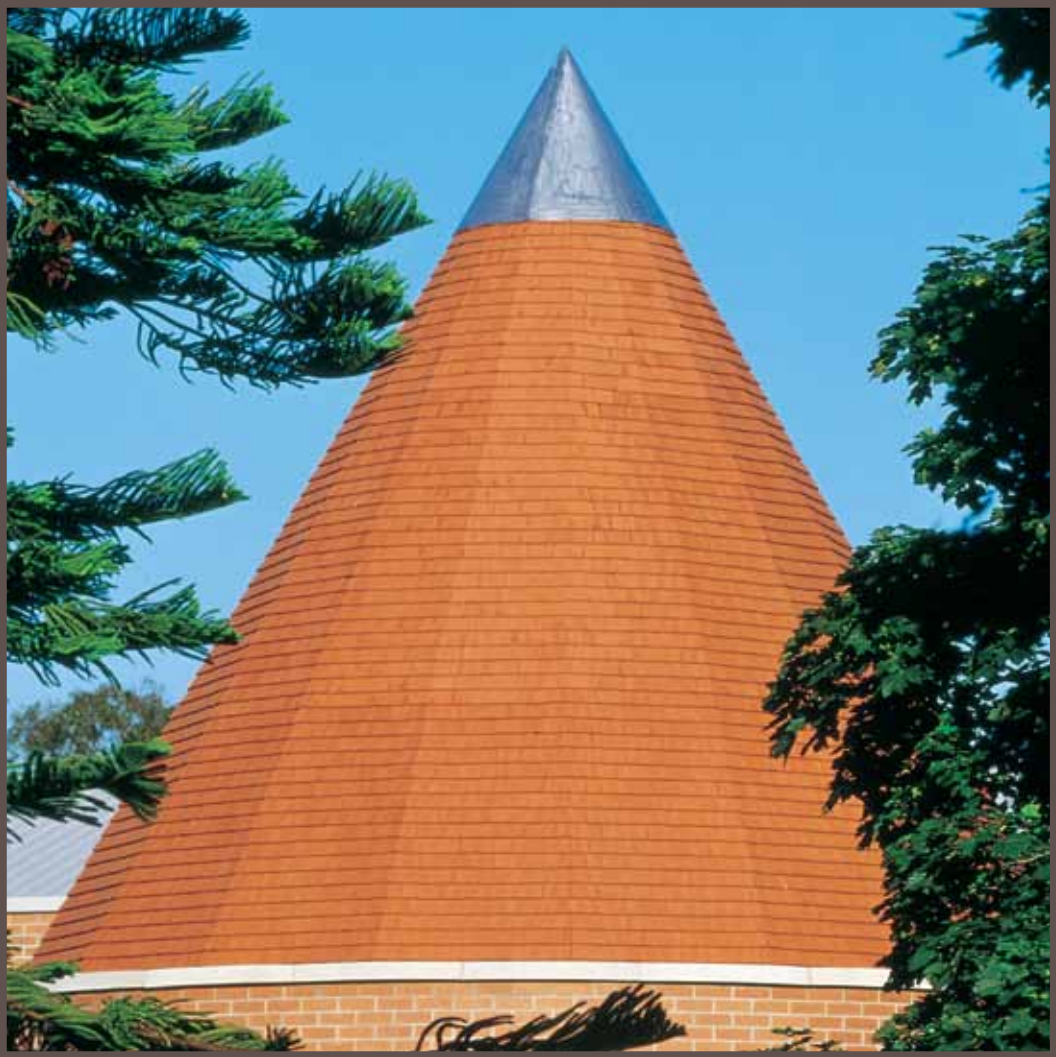
PRODUCT DETAIL

For specific information relating to the use of each profile, refer to both the specific product details covered in this section and the recommendation for a specific profile detailed in the Design Consideration section.

WUNDERLICH™
The lasting beauty of terracotta

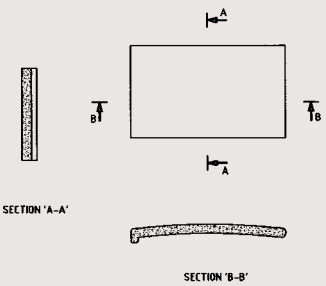
HERITAGE SHINGLE*

To view colour swatches for each state refer to www.csrroofing.com.au



Heritage shingles can add an authentic, ageless elegance to a home. The classic small shingle shape is suitable for an entire roof, or simply to point out design features such as a turret or bay window.

PERFORMANCE AND COLOUR 50 YEAR GUARANTEE



COVERAGE
Approximately 60.0 shingles per m^2.

DIMENSIONS (NOMINAL)

Length:	266mm
Width:	165mm

SHINGLE AND HALF

Length:	266mm
Width:	248mm

MASS (WEIGHT)

Per tile:	1.3kg
Per m^2:	90.0kg

UNDERCOVER TOP COURSE SHINGLE

Length:	165mm
Width:	165mm

HEAD LAP
Recommended to be in excess of 50mm.

RECOMMENDED BOND
Cross Bond

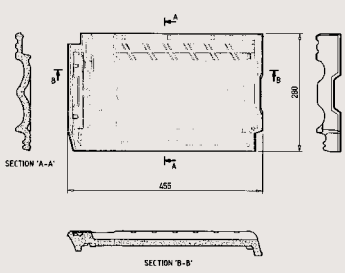
*Available on request. Minimum order required.

WUNDERLICH™
The lasting beauty of terracotta

MARSEILLE

To view colour swatches for each state refer to www.csrroofing.com.au

Create heritage style or a timeless look for your home with the classic French-inspired roof tile that has become a tradition.



COVERAGE
12.6 tiles per m^2

DIMENSIONS (NOMINAL)

Length:	455mm
Width:	280mm

MASS (WEIGHT)

Per tile:	3.75kg
Per m^2:	46.0kg

LAP ADJUSTMENT
The head or end lap adjustment is up to 25mm and the side lap adjustment is up to 5mm.

RECOMMENDED BOND
Cross Bond

PERFORMANCE AND COLOUR 50 YEAR GUARANTEE

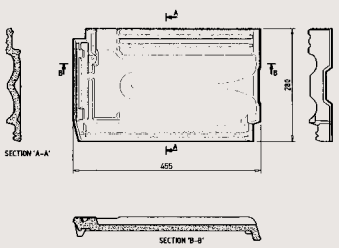
WUNDERLICH™
The lasting beauty of terracotta

MODERN FRENCH

To view colour swatches for each state refer to www.csrroofing.com.au

A striking way to enhance any design, our Modern French profile is influenced by classic French Provincial style and is ideal for both traditional and contemporary homes.

PERFORMANCE AND COLOUR 50 YEAR GUARANTEE



COVERAGE
12.6 tiles per m^2.

DIMENSIONS (NOMINAL)

Length:	455mm
Width:	280mm

MASS (WEIGHT)

Per tile:	3.75kg
Per m^2:	46.0kg

HEAD LAP
The head or end lap adjustment is up to 25mm and the side lap adjustment is up to 5mm.

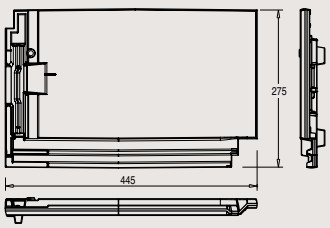
RECOMMENDED BOND
Cross Bond

WUNDERLICH™
The lasting beauty of terracotta

NULLARBOR

To view colour swatches for each state refer to www.csrroofing.com.au

The ultimate, flat terracotta tile for modern and classic architecture. The Nullarbor delivers streamlined, sophisticated rooflines.



COVERAGE
12.9 tiles per m^2.

DIMENSIONS (NOMINAL)

Length:	445mm
Width:	275mm

MASS (WEIGHT)

Per tile:	3.85kg
Per m^2:	48.0kg

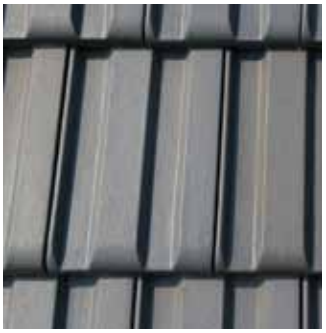
LAP ADJUSTMENT
The head or end lap adjustment is up to 11mm and the side lap adjustment is up to 5mm.

RECOMMENDED BOND
Cross Bond

PERFORMANCE AND COLOUR 50 YEAR GUARANTEE

WUNDERLICH™
The lasting beauty of terracotta

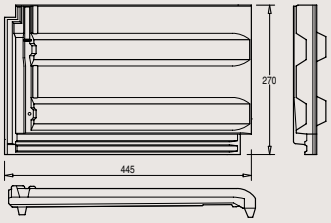
NOUVEAU



To view colour swatches for each state refer to www.csrroofing.com.au

Integrating beautifully with the design features of your home, Nouveau offers a streamlined, ultr-modern appearance with a unique satin finish that provides durability with excellent depth and intensity of colour.

PERFORMANCE AND COLOUR 50 YEAR GUARANTEE



COVERAGE
Average 12.6 tiles m^2

DIMENSIONS (NOMINAL)

Length:	445mm
Width:	270mm

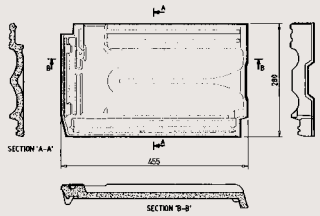
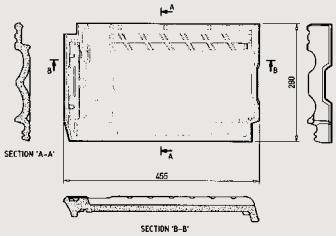
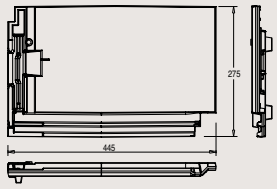
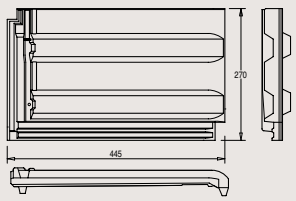
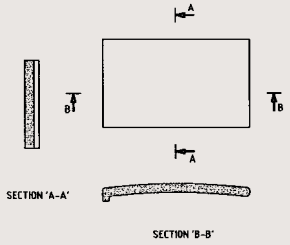
MASS (WEIGHT)

Per tile:	3.75kg
Per m^2:	44.0kg

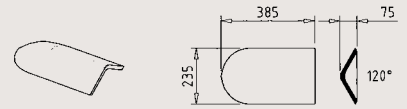
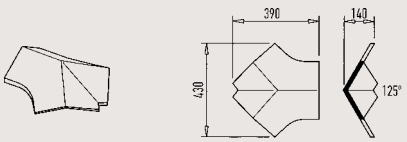
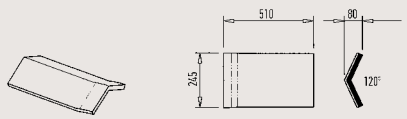
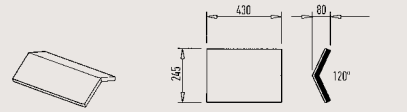
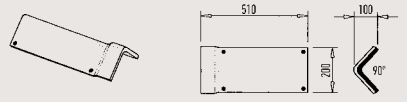
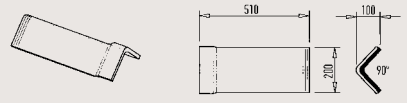
LAP ADJUSTMENT
The head or end lap adjustment is not limited and the side lap adjustment is up to 2mm.

RECOMMENDED BOND
Cross Bond

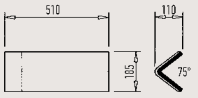
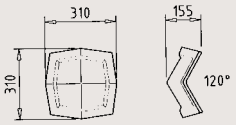
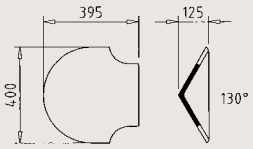
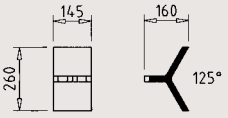
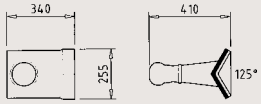
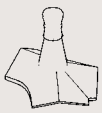
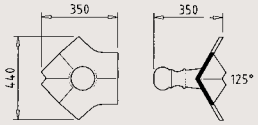
WUNDERLICH RANGE PROFILES

PROFILE	LENGTH (MM)	WIDTH (MM)	WEIGHT (KG)	HEAD LAP (MM)	SIDE LAP (MM)	BONDING METHOD	COVERAGE (TILE PER M^2)
Modern French							
	455	280	3.75	25	5	Cross	12.6
Marseille							
	455	280	3.75	25	5	Cross	12.6
Nullarbor							
	445	275	3.85	11	2	Cross	12.9
Nouveau							
	445	270	3.75	–	2	Cross	12.6
Heritage Shingle							
	266	165	1.3	50	–	Cross	60

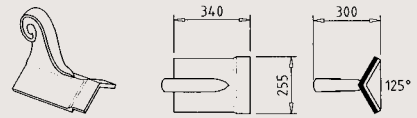
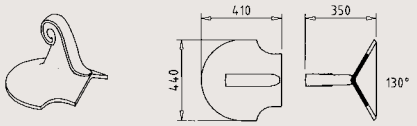
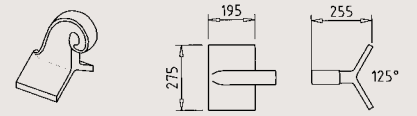
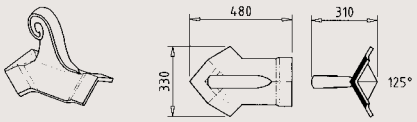
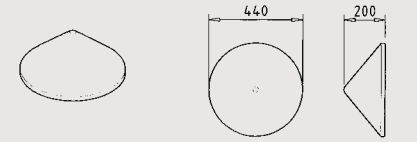
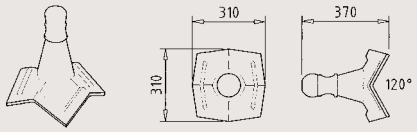
WUNDERLICH RANGE ACCESSORIES

PROFILE	LENGTH (MM)	WIDTH (MM)	HEIGHT (MM)	ANGLE (DEGREE)
Starter				
	385	235	75	120
3-Way Apex				
	390	430	140	125
Ridge				
	510	245	80	120
A-line Ridge (butt ridge)				
	430	245	80	120
Barge				
	510	200	100	90
Steep Pitch Ridge				
	510	200	100	90

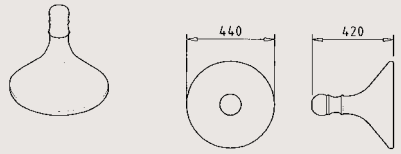
WUNDERLICH RANGE ACCESSORIES

PROFILE		LENGTH (MM)	WIDTH (MM)	HEIGHT (MM)	ANGLE (DEGREE)
Saw Tooth Ridge					
		510	185	110	75
4-Way Apex					
		310	310	155	120
Spoon					
		395	400	125	130
Ridge Saddle					
		145	260	160	125
Gable Finial Ball Type					
		340	255	410	125
Apex Finial Ball Type					
		350	440	350	125

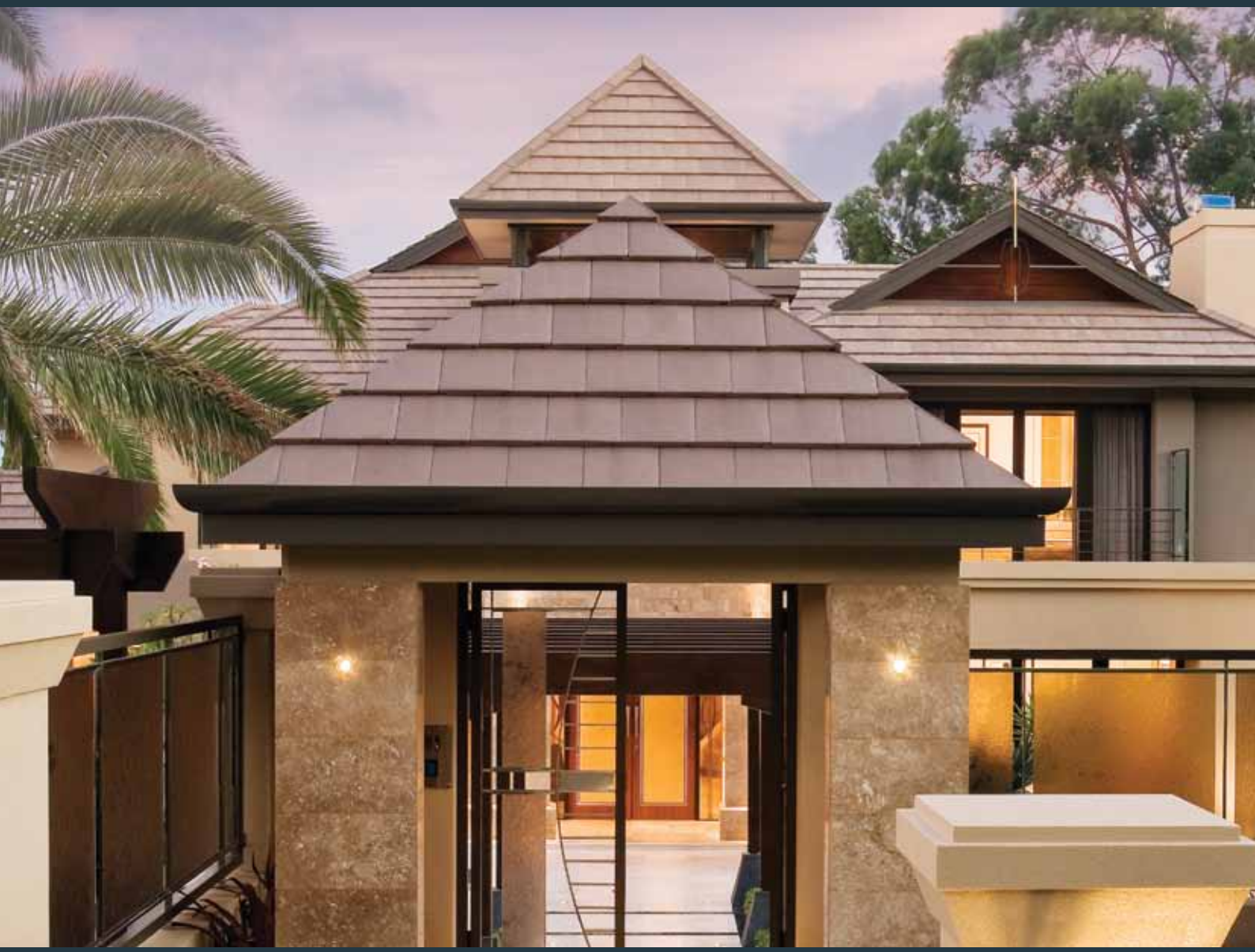
WUNDERLICH RANGE ACCESSORIES

PROFILE	LENGTH (MM)	WIDTH (MM)	HEIGHT (MM)	ANGLE (DEGREE)
Gable Finial Scroll Type				
	340	255	300	125
Finial Spoon with Scroll				
	410	440	350	130
Finial Saddle with Scroll				
	195	275	255	125
Apex Finial Scroll Type				
	480	330	310	125
China Hat				
	440	440	200	–
4 Way Apex with Ball				
	310	310	370	120

WUNDERLICH RANGE ACCESSORIES

PROFILE	LENGTH (MM)	WIDTH (MM)	HEIGHT (MM)	ANGLE (DEGREE)
China Hat with Ball				
	440	440	420	–
Gargoyles & Dragons				
	Availability and other variations available on request.			

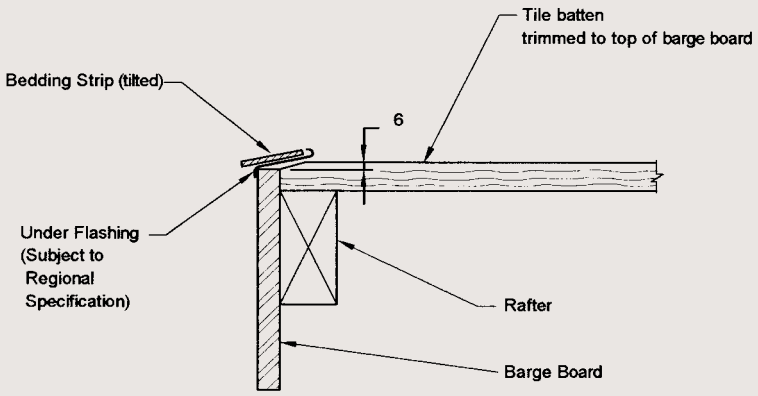
SECTION 8
ARCHITECTURAL DRAWINGS



CONTENTS

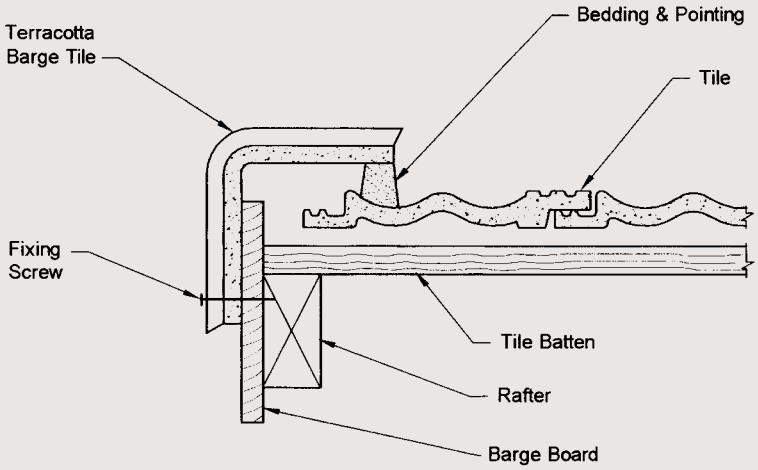
BARGE BOARD HEIGHT

BARGE BOARD HEIGHT	
DRG NO.:	MN003.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING

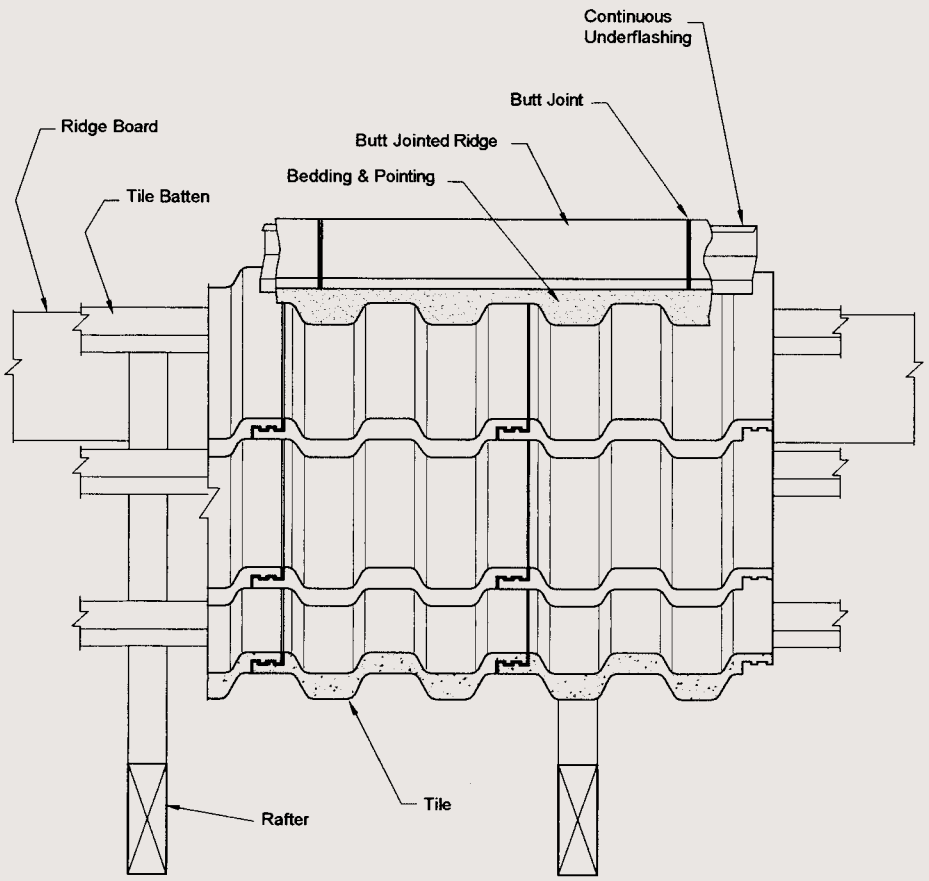


BARGE TILE

TERRACOTTA BARGE TILE	
DRG NO.:	MN014.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING



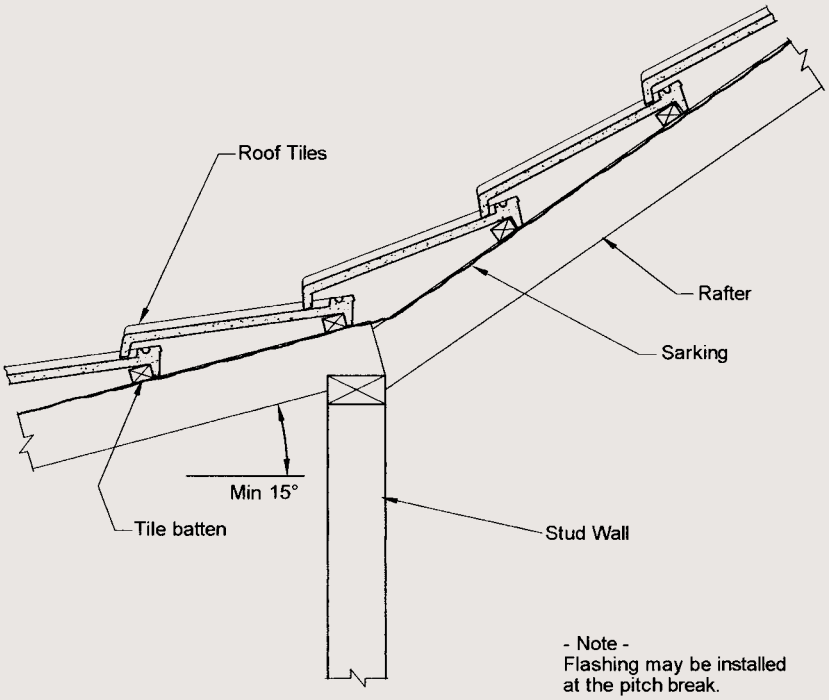
BUTT JOINTING OF RIDGE (A–LINE)



BUTT JOINTING OF RIDGE	
DRG NO.:	MN009.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING

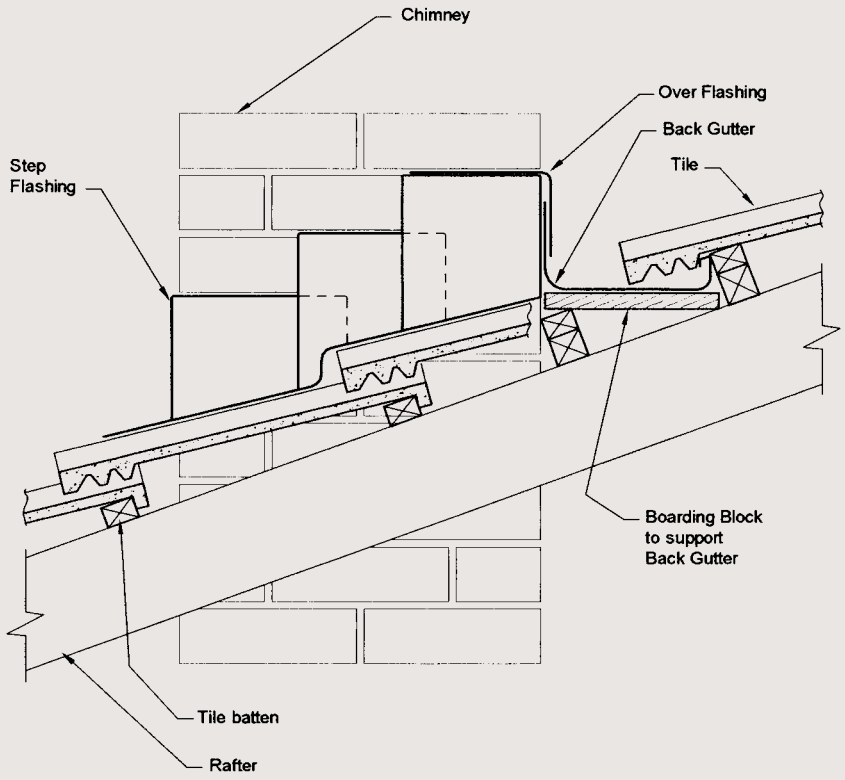
CHANGE IN PITCH

CHANGE IN PITCH	
DRG NO.:	MN029.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING



CHIMNEY FLASHING

CHIMNEY FLASHING	
DRG NO.:	MN026.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING



CHIMNEY TRAY

CHIMNEY TRAY	
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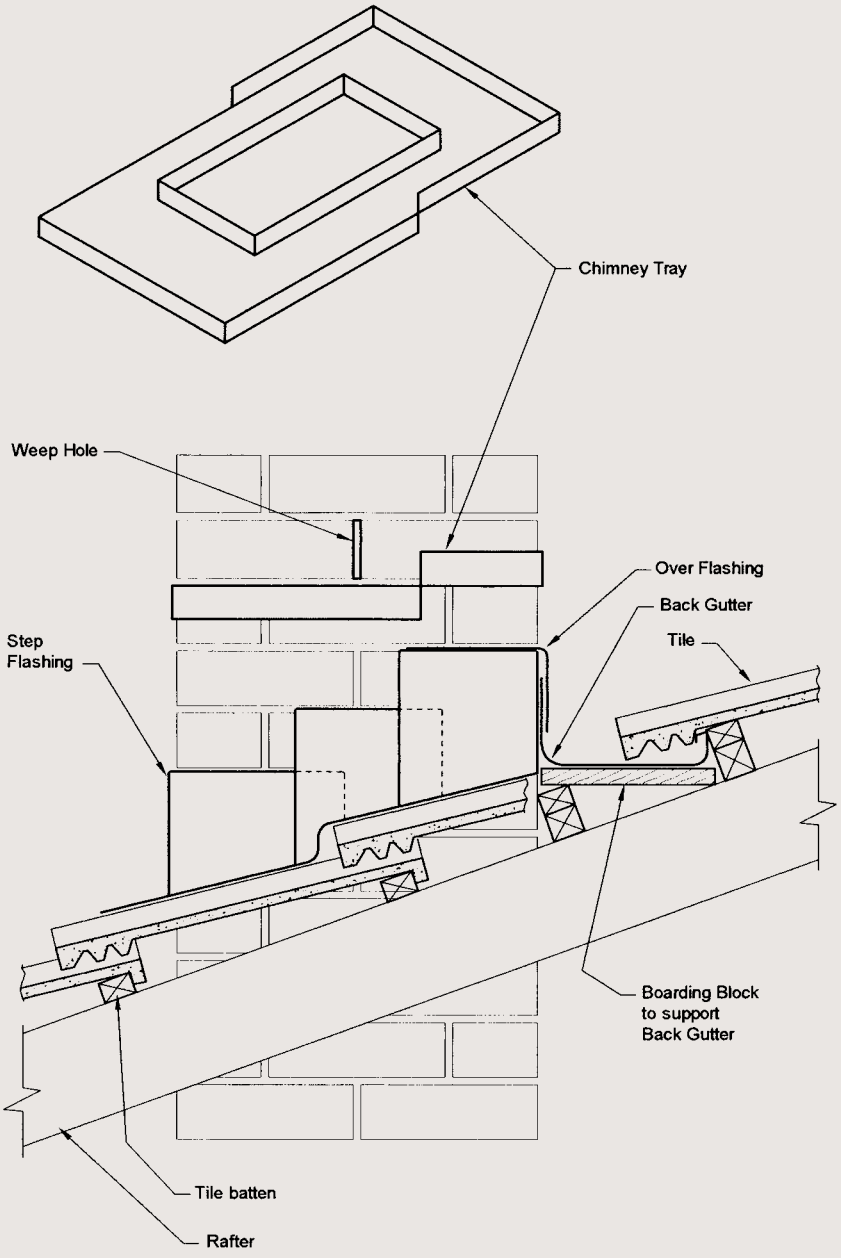
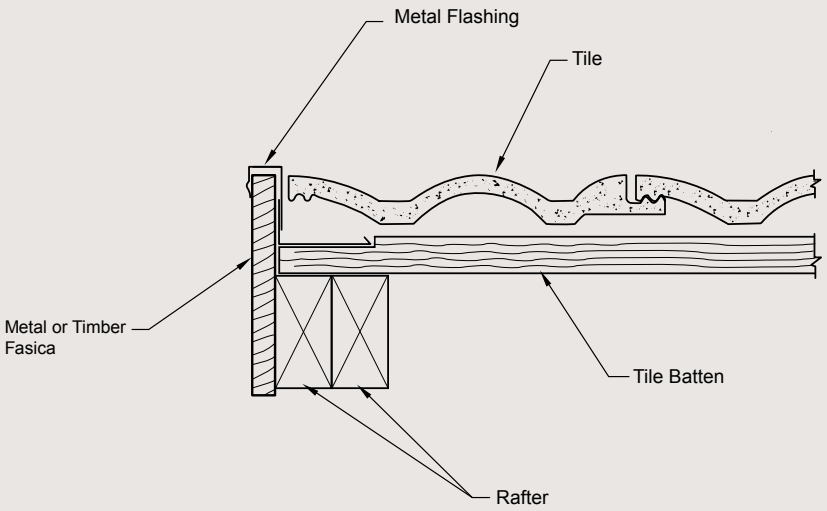
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING



CONCEALED FLASHING TO GABLE FINISH



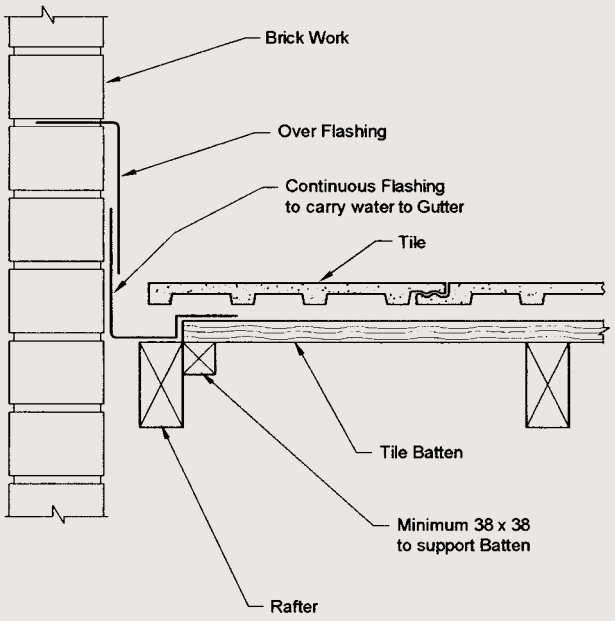
CONCEALED FLASHING TO GABLE FINISH

DRG NO.: MN016.DWG
SCALE: NOT TO SCALE
AUTHOR: CSR ROOFING

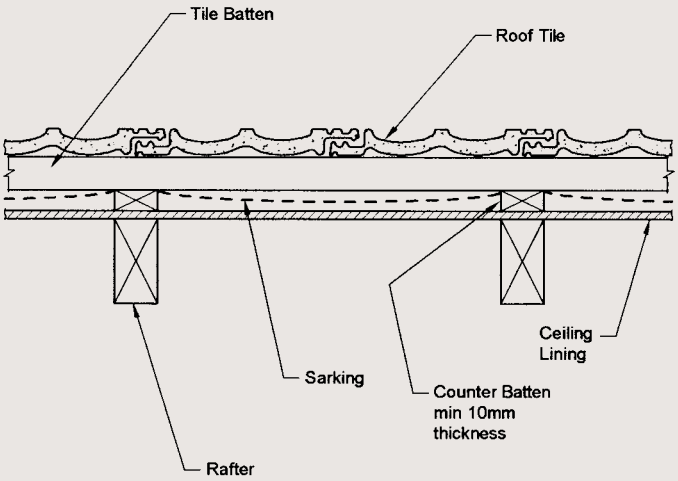
CONCEALED GUTTER FLASHING TO ABUTMENT

CONCEALED GUTTER FLASHING TO ABUTMENT

DRG NO.: MN017.DWG
SCALE: NOT TO SCALE
AUTHOR: CSR ROOFING



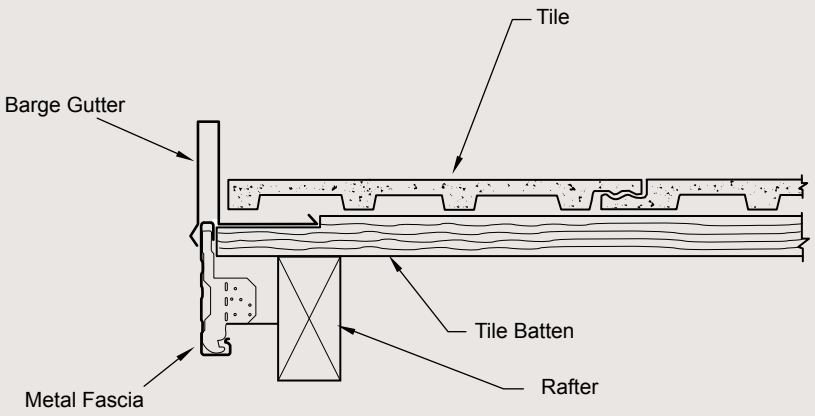
COUNTER BATTEN



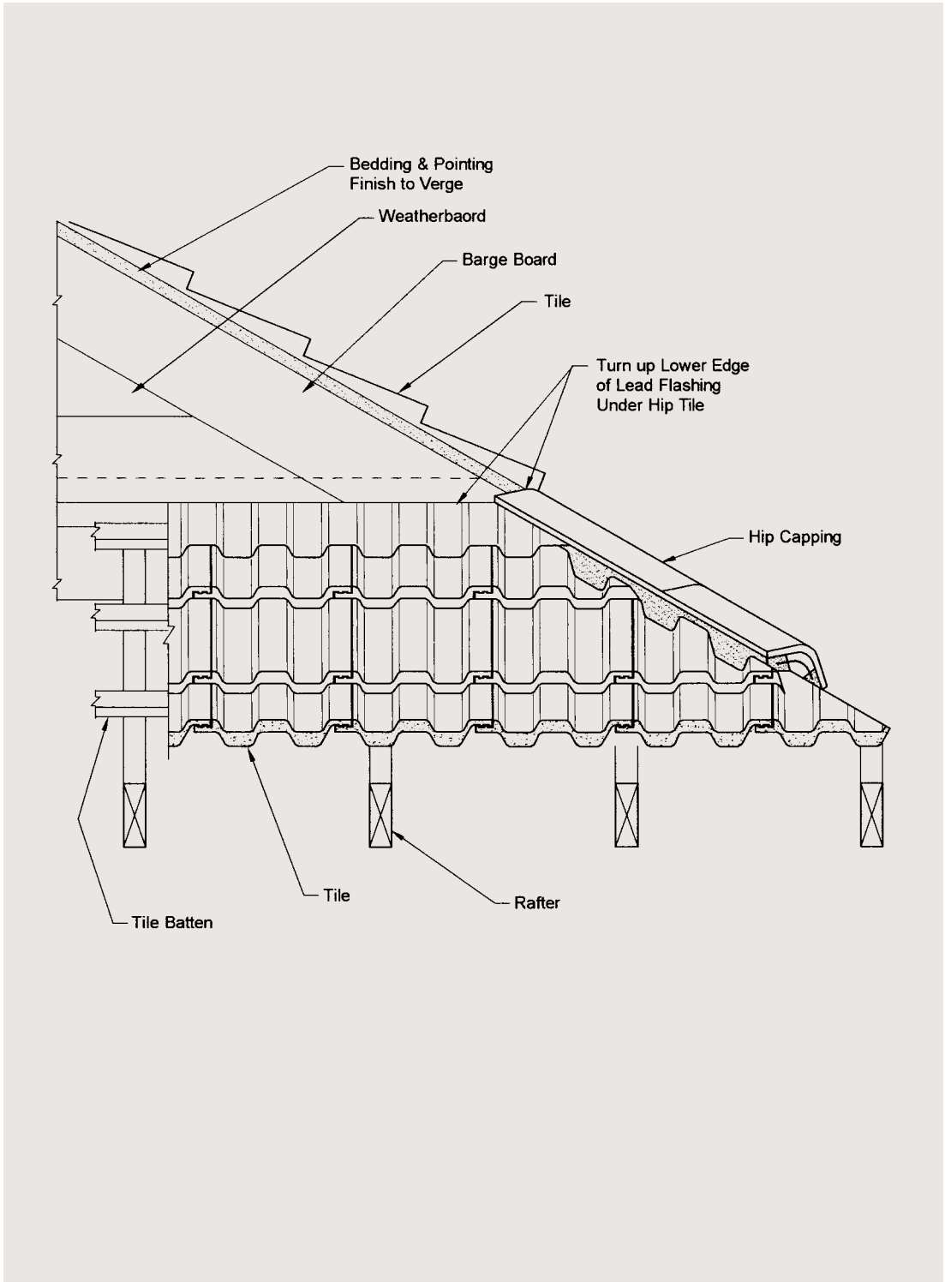
COUNTER BATTEN	
DRG NO.:	MN028.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING

DRY VERGE

DRY VERGE	
DRG NO.:	GS100.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING



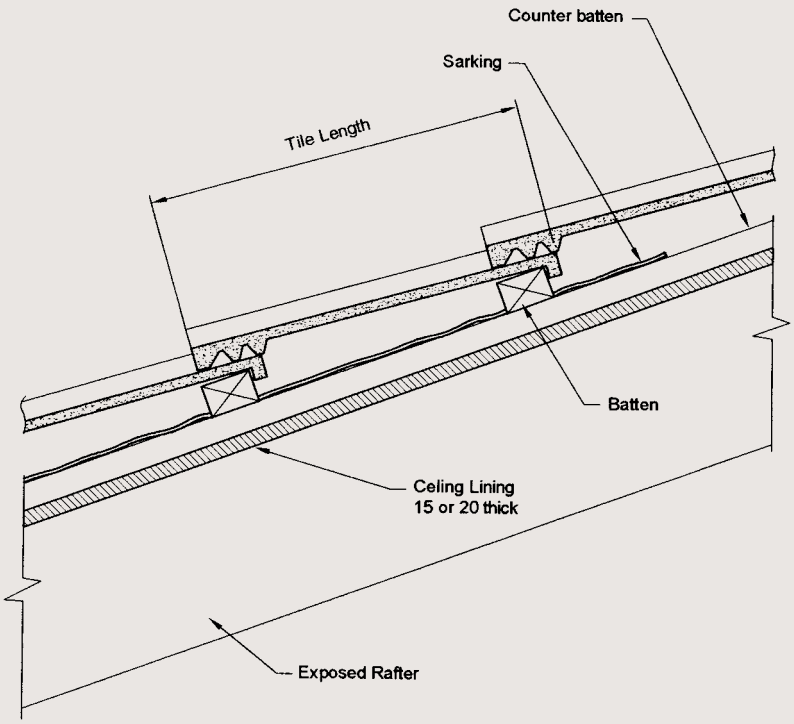
DUTCH GABLE DETAIL



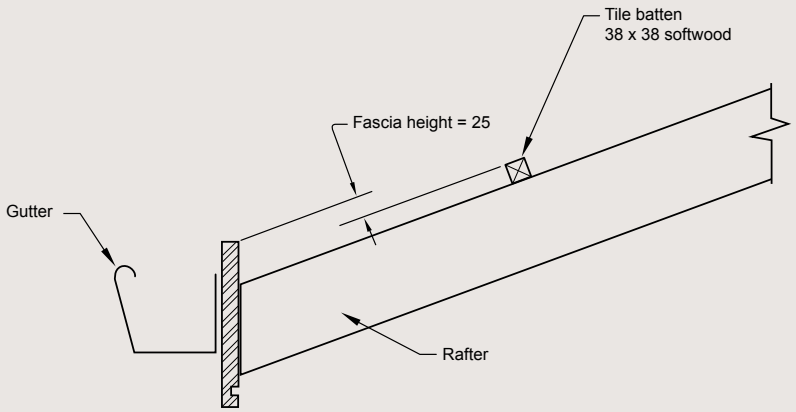
DUTCH GABLE DETAIL	
DRG NO.:	MN023.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING

EXPOSED RAFTER

EXPOSED RAFTER	
DRG NO.:	MN001.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING



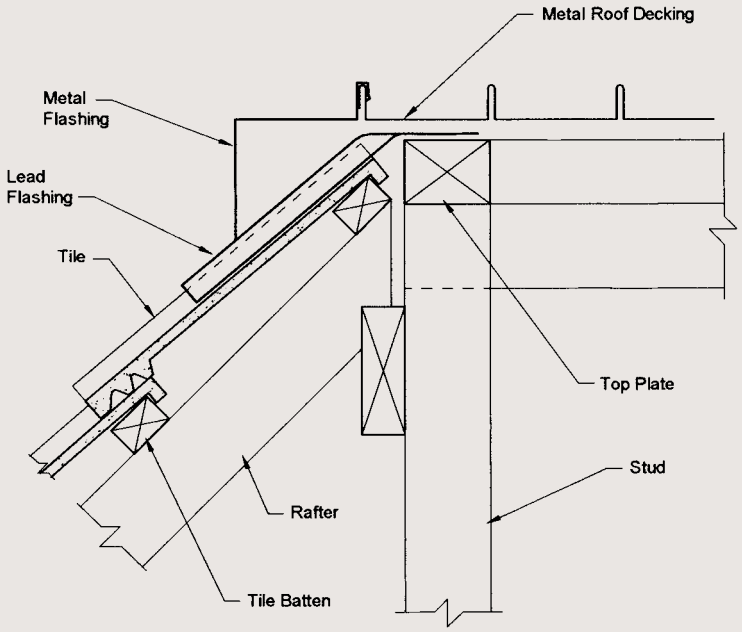
FASCIA HEIGHT



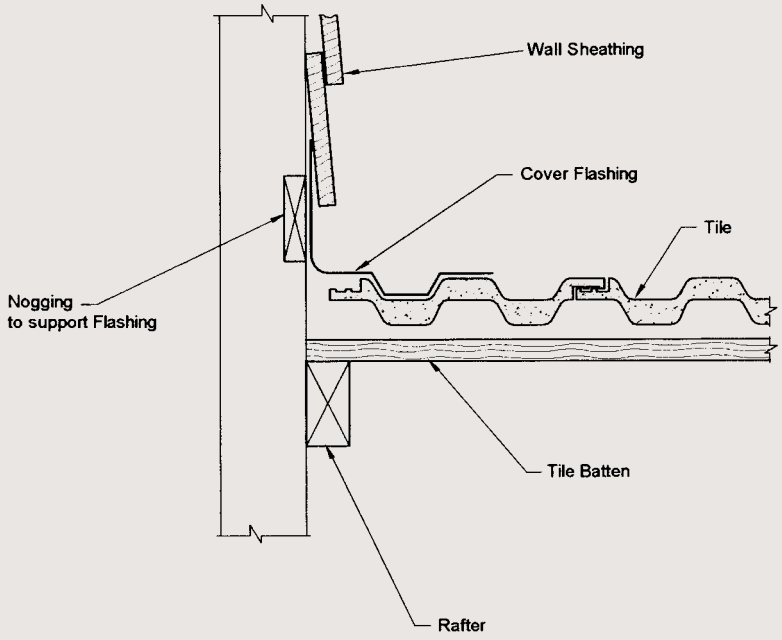
FASCIA HEIGHT	
DRG NO.:	MN002.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING

FLASHING AT JUNCTION OF METAL ROOF & TILE

FLASHING AT JUNCTION OF METAL ROOF & TILE	
DRG NO.:	MN024.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING



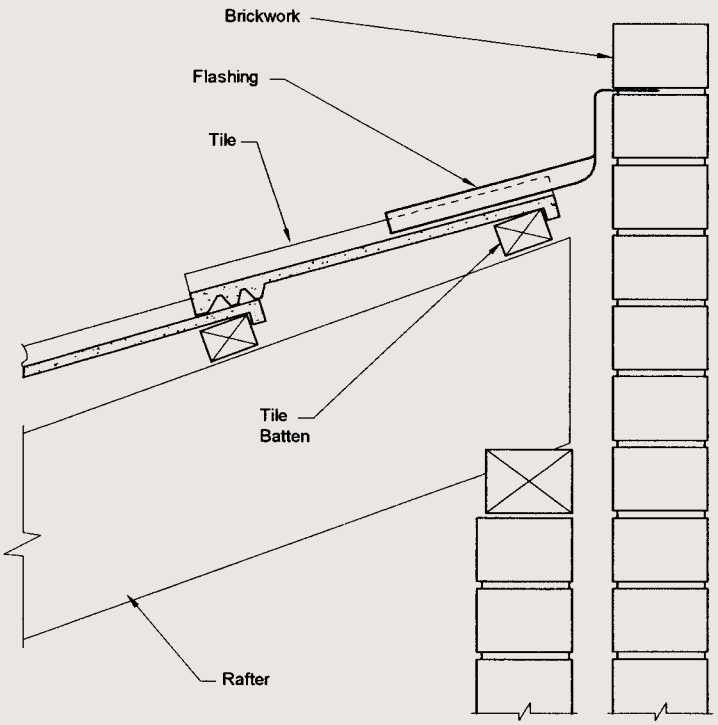
FLASHING AT SIDE ABUTMENT



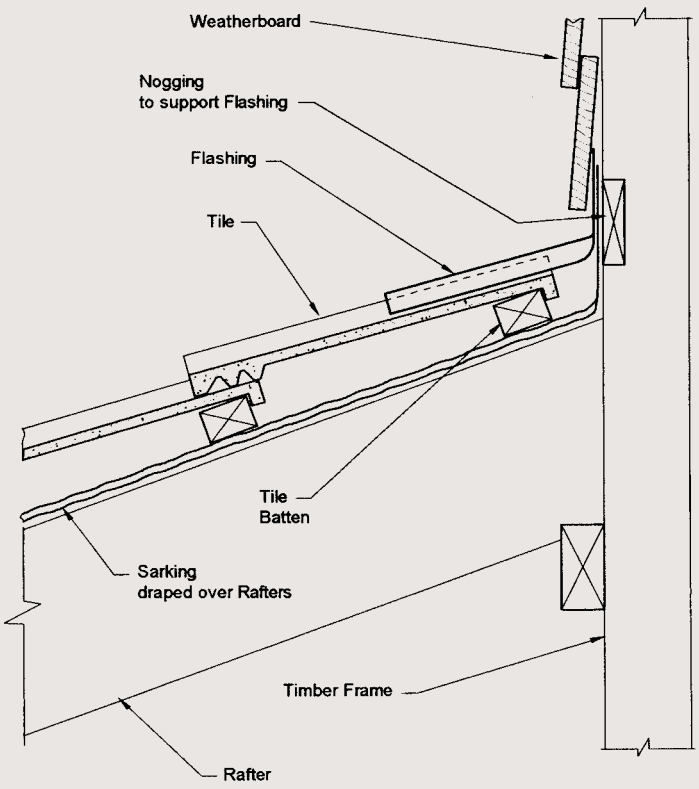
FLASHING AT SIDE ABUTMENT	
DRG NO.:	MN018.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING

FLASHING TO BRICK ABUTMENT

FLASHING TO BRICK ABUTMENT	
DRG NO.:	MN021.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING



FLASHING TO TIMBER FROM ABUTMENT

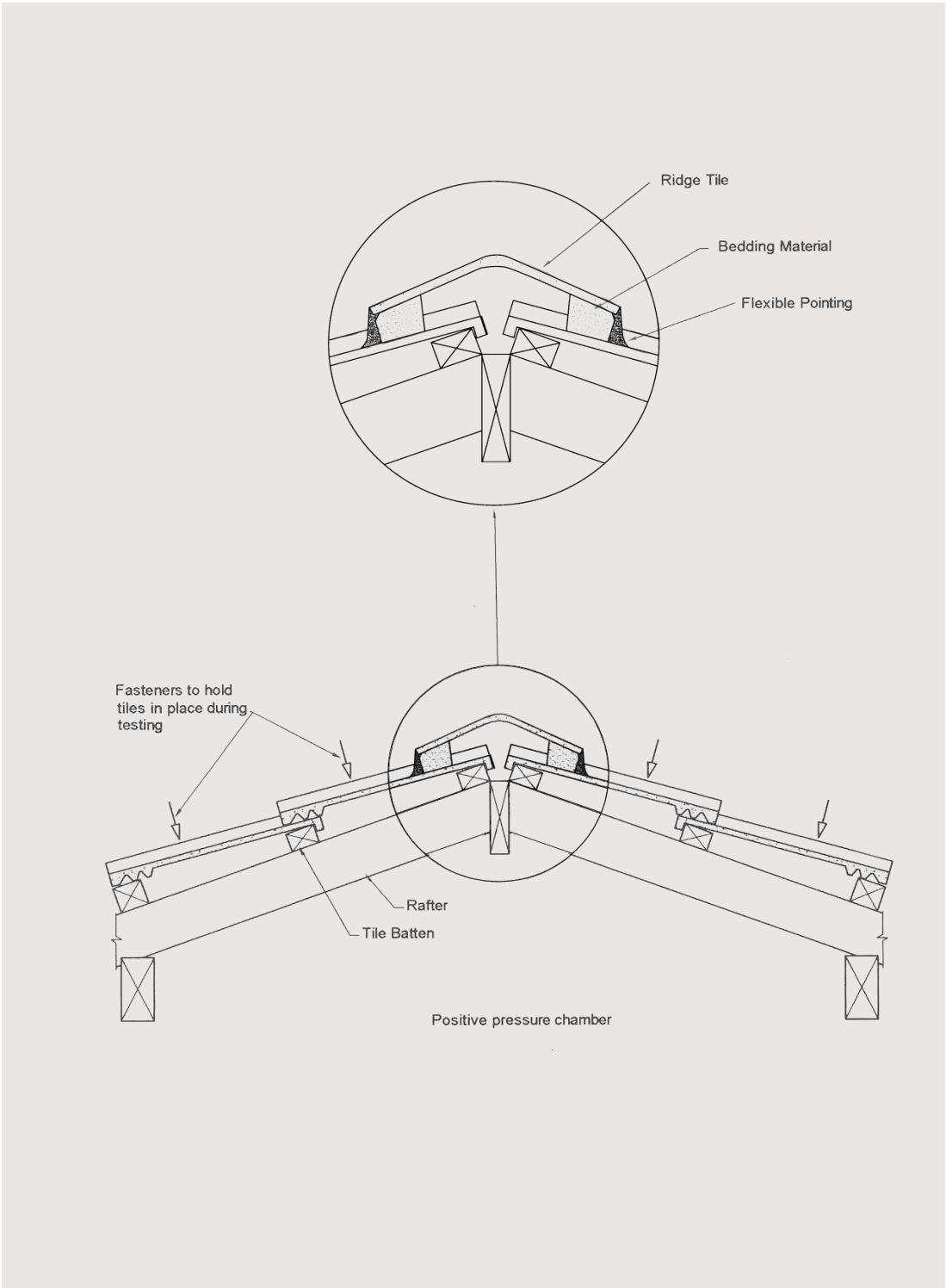


FLASHING TO TIMBER FROM ABUTMENT

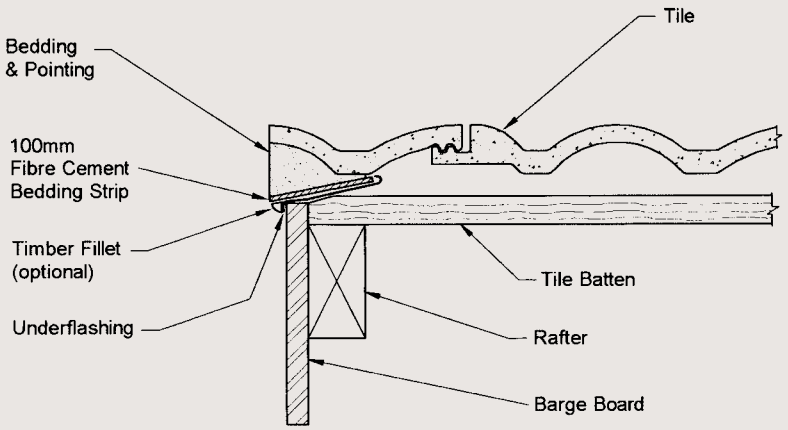
DRG NO.: MN020.DWG
SCALE: NOT TO SCALE
AUTHOR: CSR ROOFING

FLEXIBLE POINTING

FLEXIBLE POINTING	
DRG NO.:	MN030.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING



GABLE END BED AND POINT FINISH

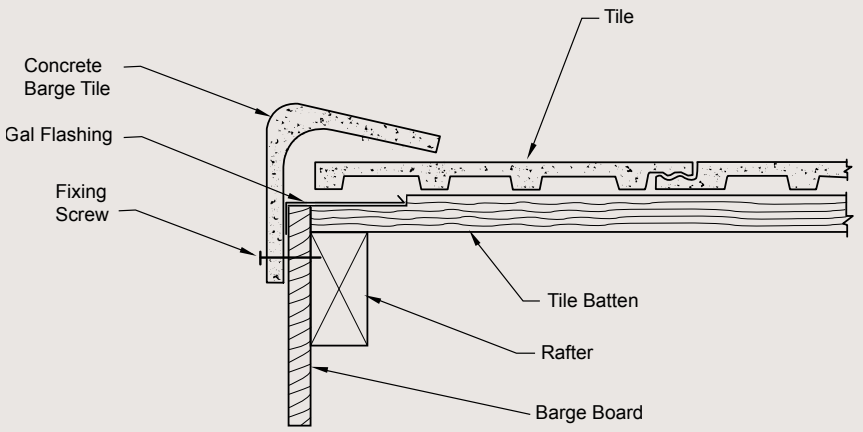


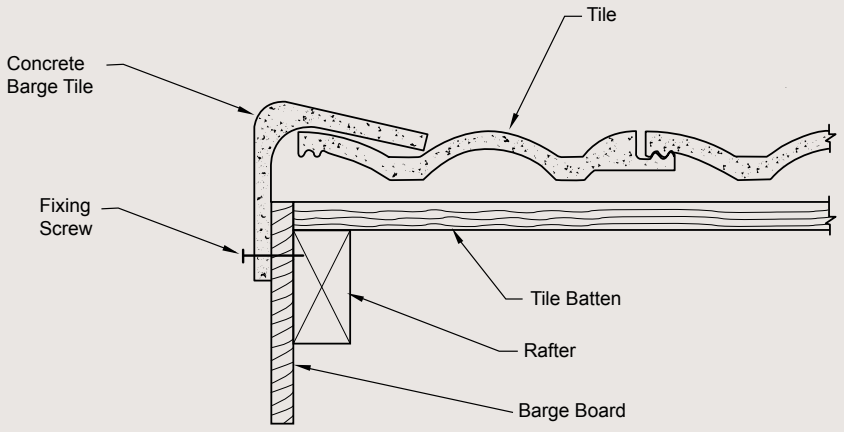
GABLE END BED AND POINT FINISH

DRG NO.: MN012.DWG
SCALE: NOT TO SCALE
AUTHOR: CSR ROOFING

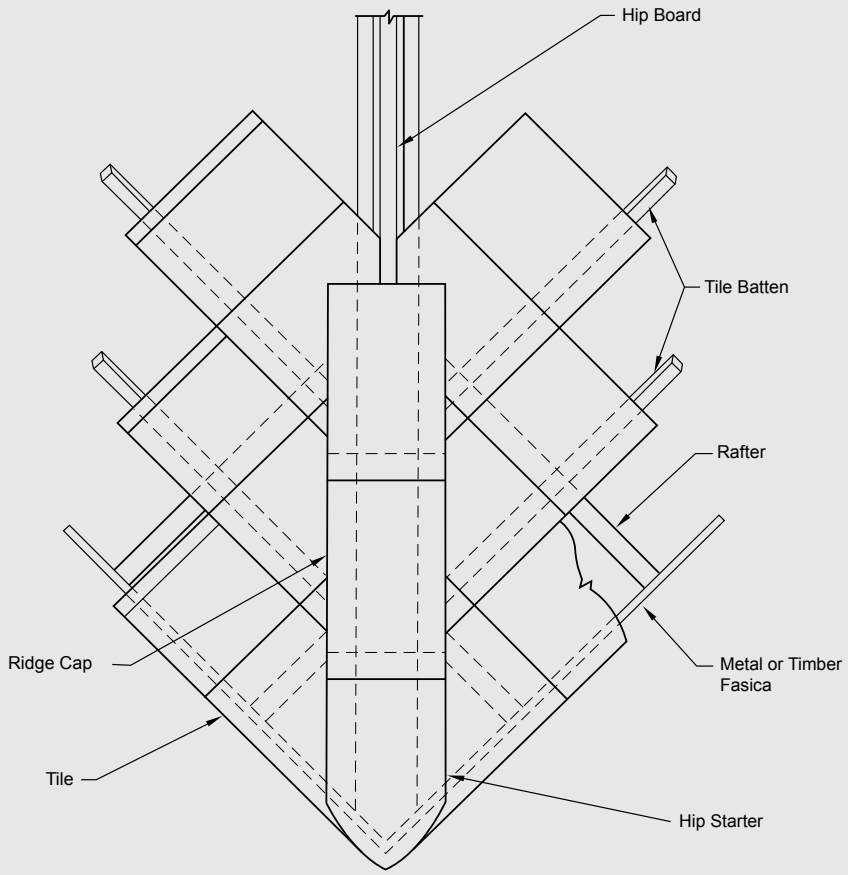
GABLE END COVER TILE

GABLE END COVER TILE	
DRG NO.:	MN013.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING





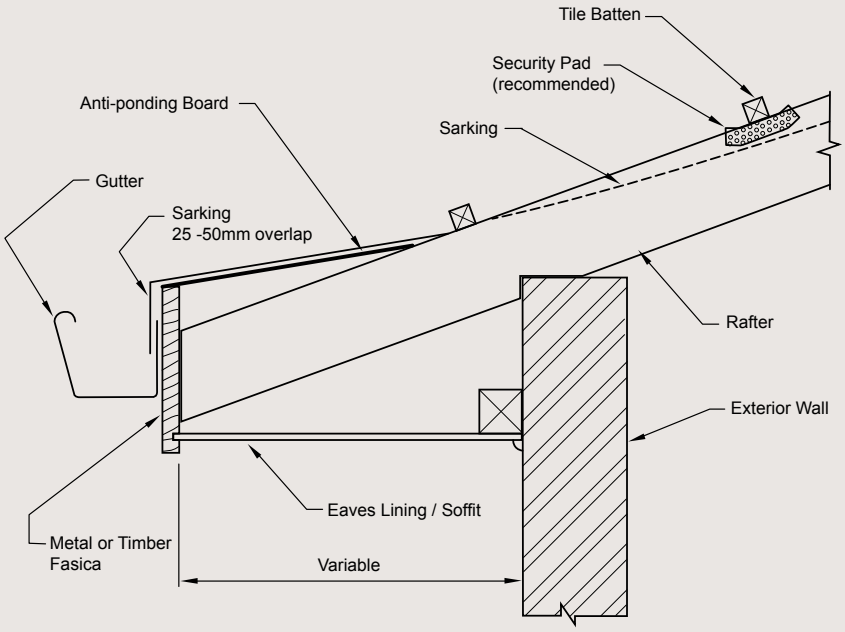
HIP END



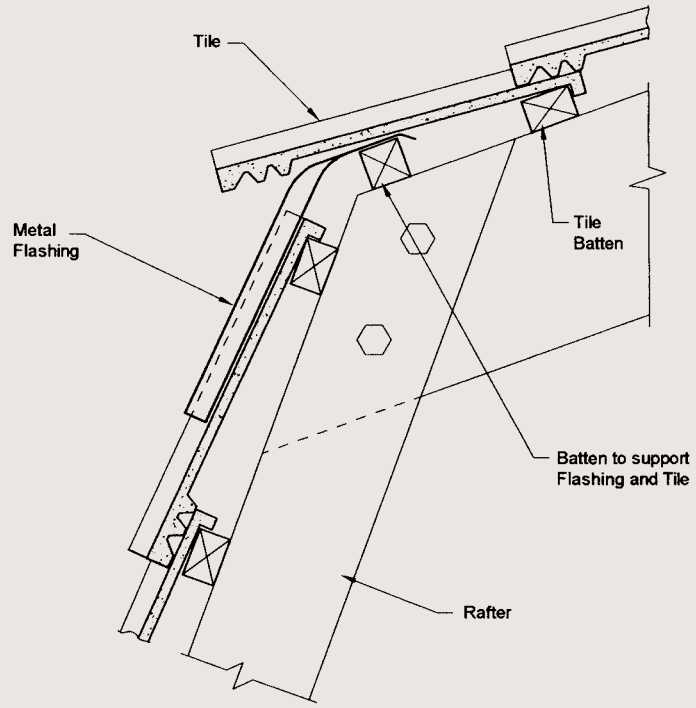
HIP END	
DRG NO.:	MN011.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING

INSTALLED SARKING

INSTALLED SARKING	
DRG NO.:	MN005.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING



MANSARD DETAIL

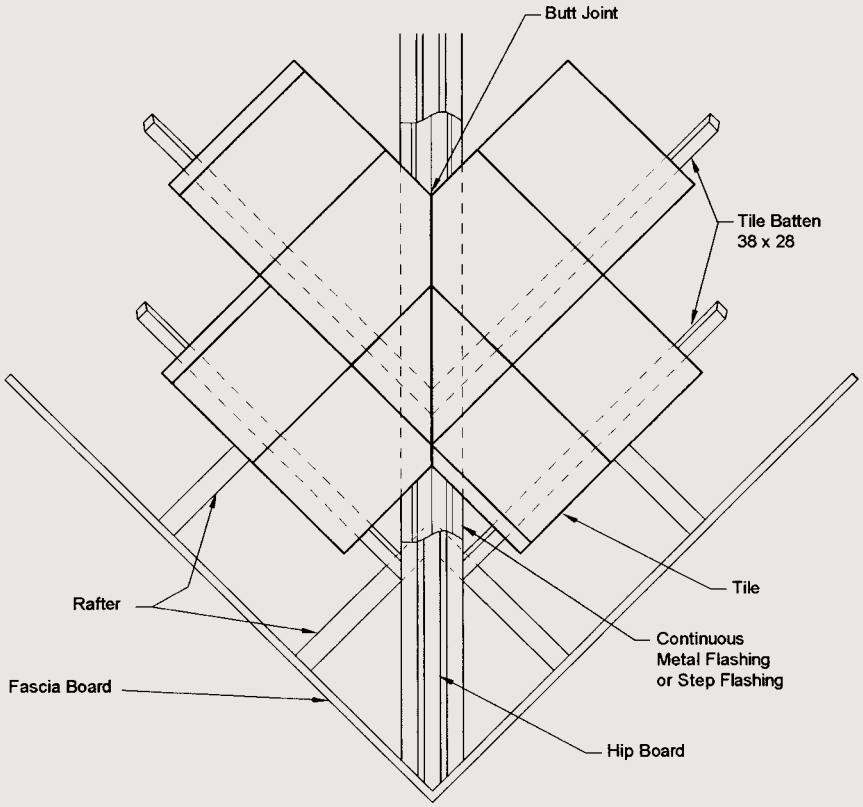


MANSARD DETAIL	
DRG NO.:	MN025.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING

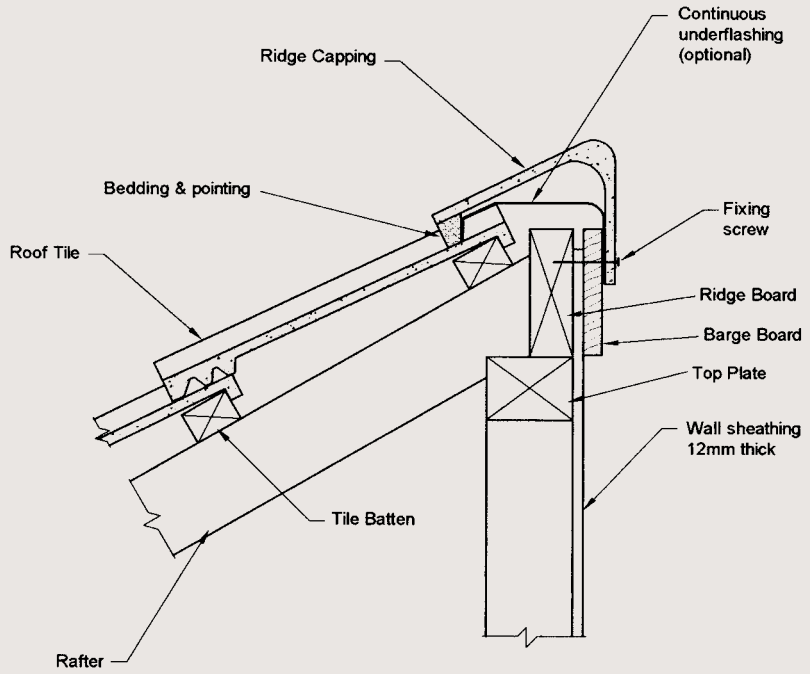
MITRED HIP WITH CONCEALED FLASHING

MITRED HIP WITH CONCEALED FLASHING	
DRG NO.:	MN010.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING

NOTE:
This hip treatment can only be applied to selected profile.
Please enquire to your regional Monier Wunderlich office.



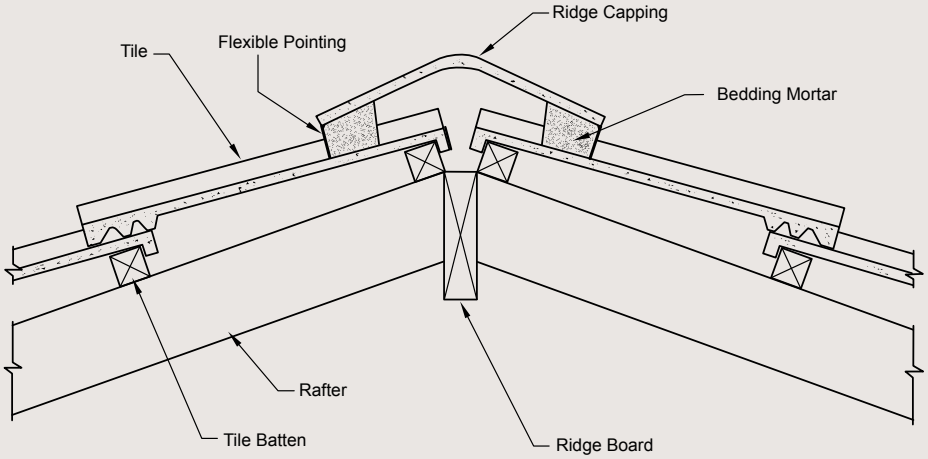
SAWTOOTH RIDGE CAP



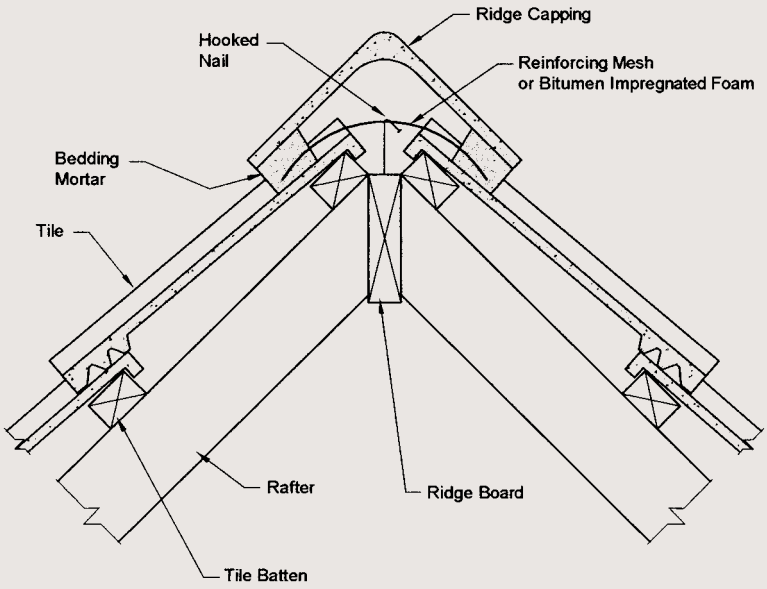
SAWTOOTH RIDGE CAP	
DRG NO.:	MN008.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING

STANDARD RIDGE CAP

STANDARD RIDGE CAP	
DRG NO.:	MN006.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING



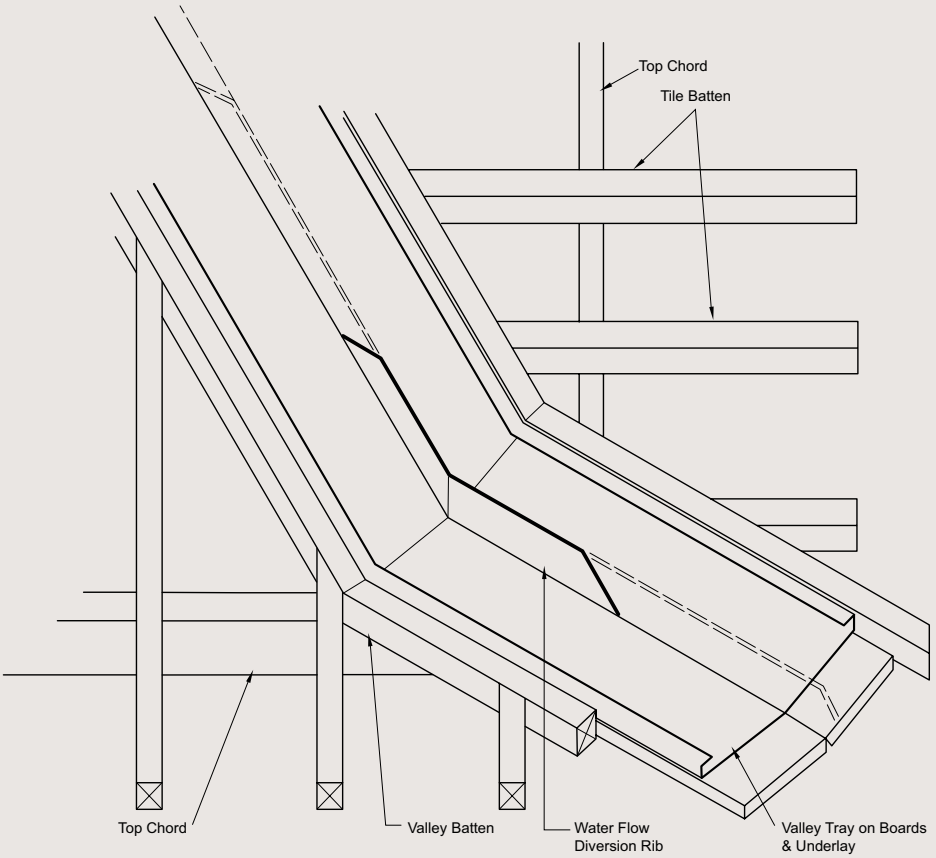
STEEP PITCHED RIDGE CAP



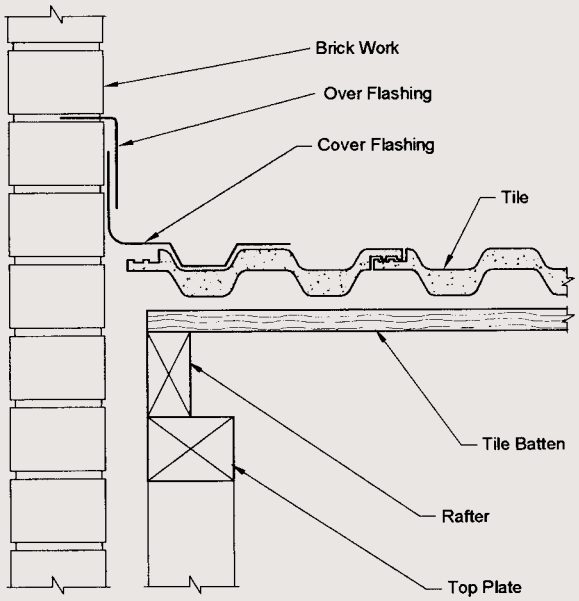
STEEP PITCHED RIDGE CAP	
DRG NO.:	MN007.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING

STEEP PITCH ROOF VALLEY

STEEP PITCH ROOF VALLEY
DRG NO.: GS101.DWG
SCALE: NOT TO SCALE
AUTHOR: CSR ROOFING



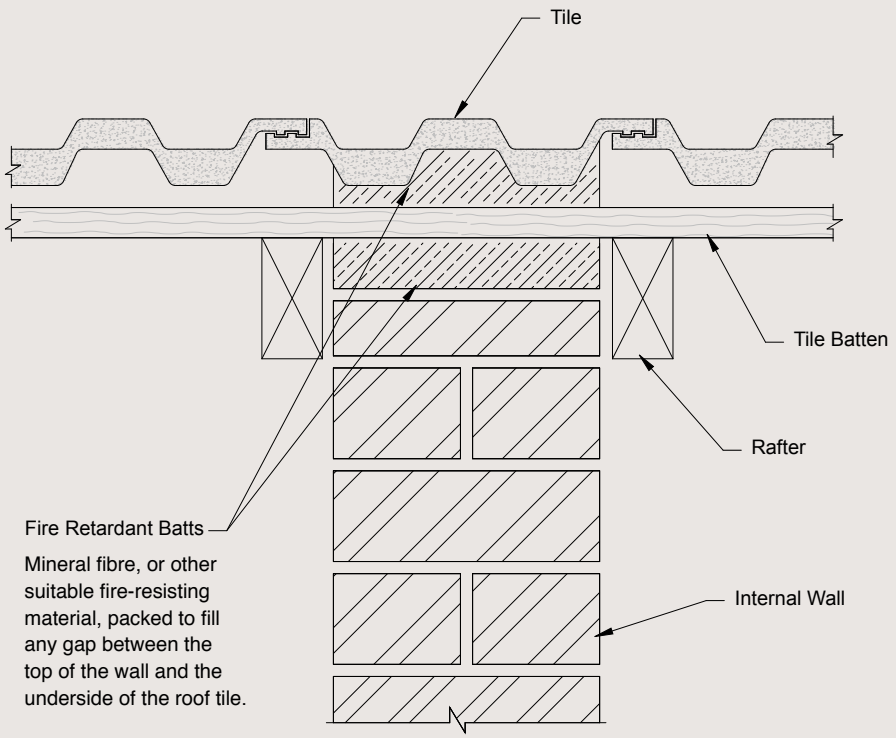
STEPPED COVER FLASHING



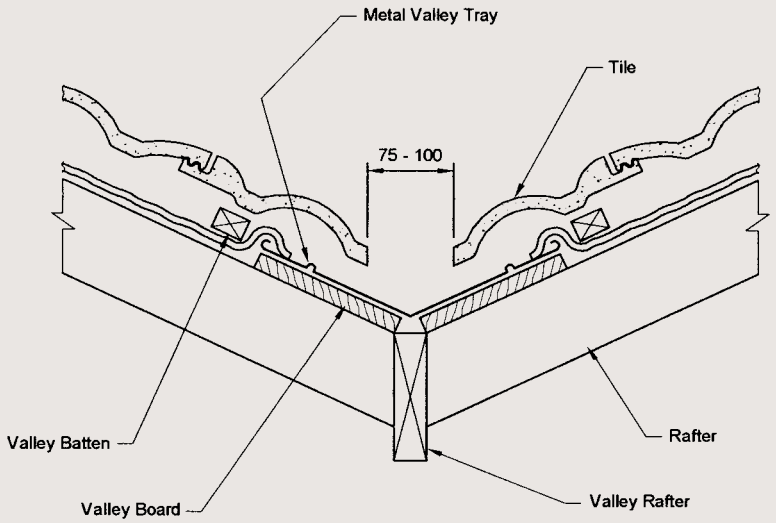
STEPPED COVER FLASHING	
DRG NO.:	MN019.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING

TILING OVER INTERNAL FIRE WALL

TILING OVER INTERNAL FIRE WALL
DRG NO.: MN004.DWG
SCALE: NOT TO SCALE
AUTHOR: CSR ROOFING



VALLEY FINISH



VALLEY FINISH	
DRG NO.:	MN015.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING

VERTICAL TILING

VERTICAL TILING	
DRG NO.:	MN022.DWG
SCALE:	NOT TO SCALE
AUTHOR:	CSR ROOFING