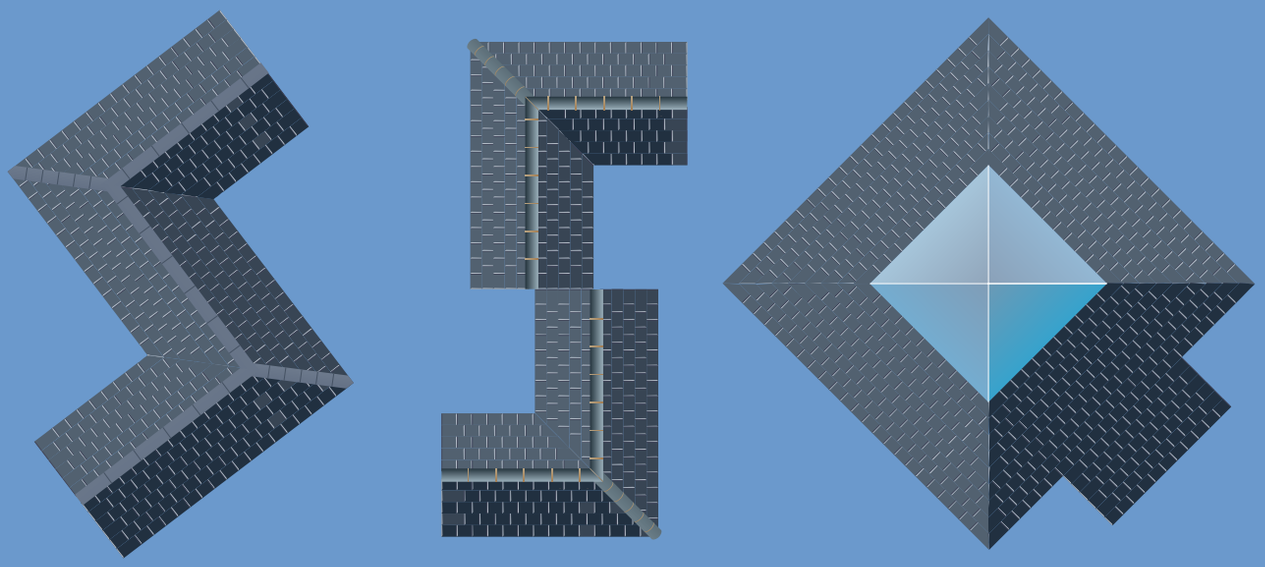

Natural roofing slate design and fixing guide

SSQ

EXCLUSIVELY **NATURAL SLATE**

Contents

This Guide has been prepared by the SSQ Group in collaboration with practising UK architects, familiar with both traditional (nail) and hook fixing practices.

It is intended to provide comprehensive information on the design and fixing of SSQ natural slate roofing and cladding products. Product literature on these products, including Del Carmen, Riverstone and Matacouta slates are available on request from SSQ.

For advice and assistance on the design, application, installation and specification of SSQ slates, please contact the SSQ Technical Services Department on:

tel 0208 961 7725
fax 0208 965 7013
www.ssqgroup.com
email info@ssq.co.uk

References

Publications and organisations referred to in this guide:

BS 1202: Parts 2 and 3: 1974

BS 5250: 2011, Code of practice for control of condensation in buildings

BS 5534: 2014, Code of practice for slating and tiling, Part 1: Design

BS 6399: Part 2: 1997, Code of practice for wind loads

BS 8000: 2013, Workmanship on building sites, Part 6: Code of practice for slating and tiling of roofs and cladding.

BS 8104: 1992, Code of practice for assessing exposure of walls to wind-driven rain

BRE Report, Thermal insulation: avoiding risks

BRE Digest 346: Parts 1 to 7

Building Regulations F2: 2013

Lead Development Association
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London W1G 6NP
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Quality standards

Quality standards

BS EN 12326 ensures that all roofing slates sold in the UK are tested in the same way, using the same methodology, regardless of their origin. The CE mark carried on the packaging or accompanying commercial documentation, confirms that the slates have been tested and thus conform to UK Building Regulations.

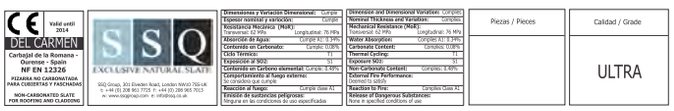
Roofing slates, which have **not** been tested to BS EN 12326 and not carry CE marking or documentation, do not conform to UK Building Regulations, and should not be incorporated into the building.

The standard itself is not an indication of the quality of the slate, there is no pass/fail criteria. It is merely a harmonised way of carrying out a number of mandatory tests. The results of these tests are given as values or statements. Thus the user is presented with the problem of how to determine a good slate from a not so good one.

SSQ in consultation with independent geologists have come up with a simple way of judging the performance of roofing slates. The test results, normally printed on the crate label are the key to judging the quality of a roofing slate. SSQ use the following criteria when carrying out initial source selection and during the quality control procedure.

Firstly look for the CE mark on the crates and accompanying commercial documentation. Identify the test results, on the label or from within the documents.

Secondly look for the following criteria:



Strength (CMoR)

Slates that perform well in the UK environment typically achieve flexural strengths in excess of 65 Mpa.

Water absorption

Low water absorption is a characteristic of high quality slate. With lower water absorption there is a reduced risk of swelling minerals, delamination and damage during the freeze thaw cycle. The old British Standard for water absorption was <0.3% and the new standard BS EN 12326 looks for <0.6% for an A1 classification. SSQ base their criteria on the old standard and look for <0.3%.

Oxidation/thermal cycling

This will occur due to the presence of reactive iron-sulphur minerals, and is usually evidenced by the thermal cycling tests, but not always. The results are classified into 3 categories:

T1
Inert, may be some discolouration around the inclusion, but will not form runs of discolouration.

T2
Inclusions present within the slate that will leach and form runs of discolouration, but are unlikely to cause structural changes.

T3
Holes, structural changes and runs of discolouration will occur due to oxidation of the inclusions.

SSQ only look at roofing slates within the T1 classification.

Carbonate content

The higher the carbonate content the higher the potential for rapid material loss under acidic conditions. It is generally safe to assume slates with a lower carbonate content will weather more slowly unless reactive iron-sulphurs are present. Proven quality roofing slates typically have a carbonate content <3%.

Proven performance

Empirical testing in controlled conditions gives an indication of quality. However the best method of all to indicate the long term behaviour of roofing slate, is to look at installations, thus establishing proven history of performance in the UK environment.

Quick quality checklist

☐ Flexural strength	CMoR > 65 Mpa
☐ Water absorption	<0.3%, generally the lower the better
☐ Free of oxidation	Select slates with low potential for oxidation (T1)
☐ Carbonate content	< 3%, generally the lower the better
☐ Proof	Look for a proven history of UK performance

Nail fixing

Design work

Design considerations

Effective design of a slate roof must take into account a number of inter-related factors including site exposure, the pitch of the roof, the type of slate selected and the slate lap.

General guidance on the most important points to be considered is given below. Full application and sitework details are given on pages 8 to 22. Further information can be obtained from BS 5534: 2014, Code of practice for slating and tiling, Part 1: Design.

Reference should be made also to BS 8000: 2013, Workmanship on building sites, Part 6: Code of practice for slating and tiling of roofs and claddings.

Environmental conditions

a Rain exposure

The degree of exposure of a building to driving rain determines the minimum lap which should be specified.

The anticipated degree of exposure is given in Figure 1 (taken from BS 5534: Part 1: 2014).

Localised factors such as high buildings, buildings on the slopes or tops of hills and coastal sites, can increase the exposure grading which should be applied in a specific project. Table 1 on page 5 shows the recommended minimum lap for moderate and severe exposure sites.

For more detailed information on exposure to rain refer to BS 8104: 1992.

b Wind uplift

Adequate resistance to wind load and wind lift can be provided by following the application details shown on pages 8 to 21, taking into account minimum lap recommendations given in Table 1.

Design calculations for wind load and wind uplift are given in BS 5534: Part 1, BRE Digest 346: Parts 1 to 7 and BS 6399: Part 2: 1990, Code of practice for wind loads, which replaces BS CP3: Chapter 5: Part 2: 1972.

Pitch of roof

In general, the lower the pitch of the roof, the greater should be the lap. This longer lap will help to resist both capillary action and wind uplift.

On steeper pitches with free-flowing drainage, smaller slates may be used.

For exposed sites, wide slates with a greater lap should be used (see BS : 5534 : 2014).

Lap

The lap is calculated by taking account of wind uplift, exposure to driving rain and the roof pitch. Table 1 gives the recommended minimum laps for various roof pitches and building exposures.

Figure 1 Categories of exposure to driving rain

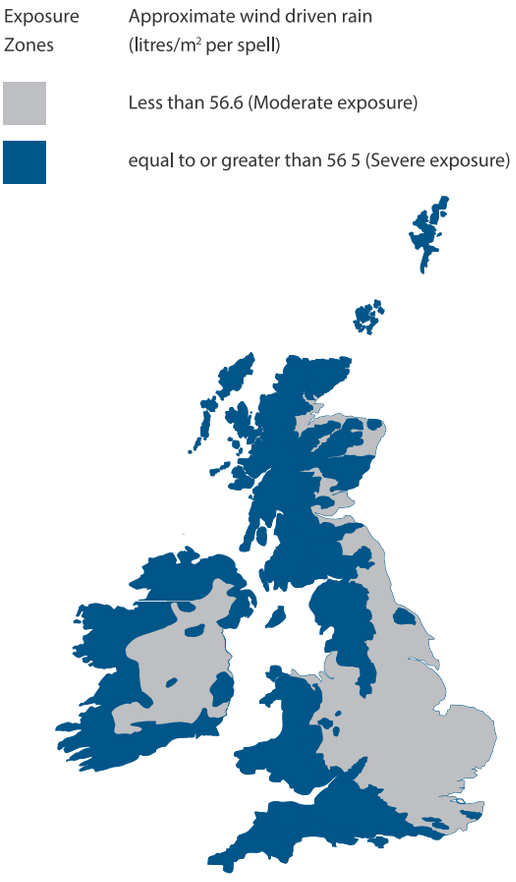


Table 1 Minimum head lap for fixing slates with nails or hooks according to BS 5534: 2003

Moderate exposure (less than 56.5 l/m)

Slate size (mm) length · width	Rafter pitch 20°	22.5°	25°	27.5°	30°	35°	40°	45°	80°
600 · 300	115	105	90	85	80	70	60	55	
500 · 300	115	105	90	85	80	70	60	55	
500 · 250	125	110	90	85	80	70	60	55	50
450 · 300					80	70	60	55	50
450 · 220					80	70	60	55	50
400 · 300					80	70	60	55	50
400 · 250					80	70	60	55	50
400 · 200					80	70	60	55	50
350 · 250					80	70	60	55	50
350 · 200					80	70	60	55	50
320 · 220					80	70	60	55	50
300 · 200					80	70	60	55	50
270 · 180					80	70	60	55	50
250 · 150						70	60	55	50

Severe exposure (56.5 l/m or over)

Slate size (mm) length · width	Rafter pitch 20°	22.5°	25°	27.5°	30°	35°	40°	45°	80°
600 · 300	150	135	120	110	100	90	80	70	
500 · 300		130	100	110	100	90	80	70	
500 · 250		130	120	110	100	90	80	70	65
450 · 300					100	90	80	70	65
450 · 220					100	90	80	70	65
400 · 300					100	90	80	70	65
400 · 250					100	90	80	70	65
400 · 200					100	90	80	70	65
350 · 250					100	90	80	70	65
350 · 200					100	90	80	70	65
320 · 220					100	90	80	70	65
300 · 200					100	90	80	70	65
270 · 180						90	80	70	65
250 · 150								70	65

Battens

Recommended timber batten sizes for natural slate roofs are 50 · 25 mm, up to 600 mm rafter spans, according to BS 5534: Part 1: 1997.

Battens should be set out horizontally across the roof at a gauge calculated from the formula:

$$\text{gauge} = \frac{(\text{length of slate} - \text{lap})}{2}$$

Battens should be nailed at maximum 600 mm centres, with the end of each length fully supported and be not less than 50 mm wide by 25 mm thick.

Note If used, counterbattens should be a minimum 38 – 25 mm.

Underlay

Underlay should be selected to meet the requirements of BS 5534.

Ventilation

To comply with the Building Regulations F2: 1995 and BS 5250: 1989 (1995), Code of practice for control of condensation in buildings, ventilation equivalent to a 10 mm continuous vent must be provided at the eaves on both sides of the roof when the roof is of 'cold roof' construction and 25 mm if of 'warm roof' construction.

Additional ventilation at or near the ridge equivalent to a 5 mm continuous vent is required in the case of 'warm roofs' and is also recommended if the case of 'cold roofs' if pitch of the roof is greater than 35°, or if the span is greater than 10 metres.

'Cold roofs' are defined as being those where the insulation is at ceiling level, and 'warm roofs' where the insulation is in the plane of the roof (rafter level).

Fixing methods

All SSQ natural slates can be fixed by using either traditional holing and nailing (see pages 10 to 24) or the hook fixing system (see pages 30 to 44).

Nails

Nails should be copper to Part 2: 1974.

The gauge of the nail shall be 3.3mm minimum and shall have a head of noless than 10 mm diameter.

They should be 20 to 25 mm longer than two thicknesses of slate, but longer nails should be used at the eaves course especially if a sprocket is used.

Coverage of slates

See table 2 for coverage of all slate sizes at different laps.

Total weight of slate roof

The total weight of slates on a roof can be calculated as follows:

Example

Slate type	Del Carmen
Slate size (mm · mm)	400 · 250
Weight of slates (kg/1000)	1235
Exposure	Moderate
Roof pitch	40°
Roof area m²	150
Length of roof slope (m)	9.5

The **headlap** can be found from Table 1 by reference to slate size, roof pitch, and exposure = **65 mm**.

The slate **coverage** per m² can be found from Table 2 = **23.9**.

The **total weight** of slates on roof can be found from the formula:

$$\frac{\text{weight of slates (kg)} \cdot \text{area of roof (m}^2\text{)} \cdot \text{slate coverage}}{1000}$$

Therefore, the total weight=

1235/1000 · 150 · 23.9

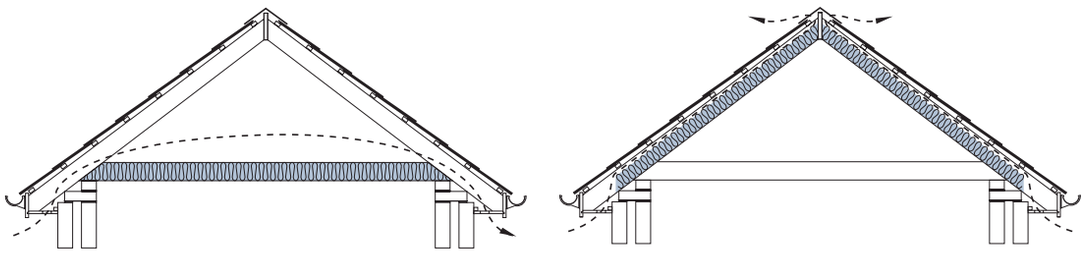
= **4427 kg**

Holing

The position of the hole is measured up from the tail of the slate At a position calculated from this formula.

Holing = batten gauge + lap + 10mm

Figure 2 Cold and warm roof ventilation



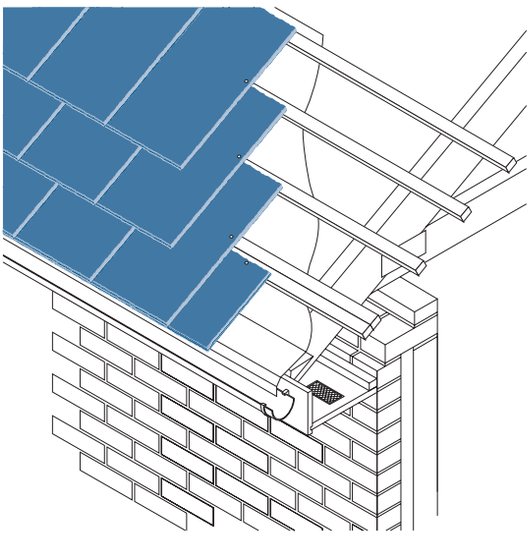
Cold roof insulation at ceiling joist level

Warm roof insulation at rafter level

Table 2 Coverage of SSQ slates with nail fixing method

Slate size (mm) length · width	Lap (mm) 50	65	75	80	90	100	110	115	120	130	140	150
	Number of slates/m²											
600 · 300	12.1	12.5	12.7	12.8	13.1	13.3	13.6	13.7	13.9	14.2	14.5	14.8
500 · 300	14.8	15.3	15.7	15.9	16.3	16.7	17.1	17.3	17.5	18.0	18.5	19.0
500 · 250	17.8	18.4	18.8	19.0	19.5	20.0	20.5	20.8	21.0	21.6	22.2	
450 · 300	16.7	17.3	17.8	18.0	18.5	19.0	19.6	19.9	20.2	20.8	21.5	
450 · 250	20.0	20.8	21.3	21.6	22.2	22.9	23.5	23.9	24.2	25.0	25.8	
450 · 230	21.7	22.6	23.2	23.5	24.2	24.8	25.6	26.0	26.3	27.2	28.1	
400 · 300	19.0	19.9	20.5	20.8	21.5	22.2	23.0	23.4	23.8			
400 · 250	22.9	23.9	24.6	25.0	25.8	26.7	27.6	28.1	28.6			
400 · 200	28.6	29.9	30.8	31.3	32.3	33.3	34.5	35.1	35.7			
350 · 300	22.2	23.4	24.2	24.7	25.6	26.7	27.8					
350 · 250	26.7	28.1	29.1	29.6	30.8	32.0	33.3					
350 · 200	33.3	35.1	36.4	37.0	38.5	40.0	41.7					
320 · 220	33.7	35.7	37.1	37.9	39.5	41.3	43.3					
320 · 180	41.2	43.6	45.4	46.3	48.3	50.5	53.0					
300 · 200	40.0	42.6	44.4	45.5	47.6	50.0						
300 · 150	53.3	56.7	59.3	60.6	63.5	66.7						

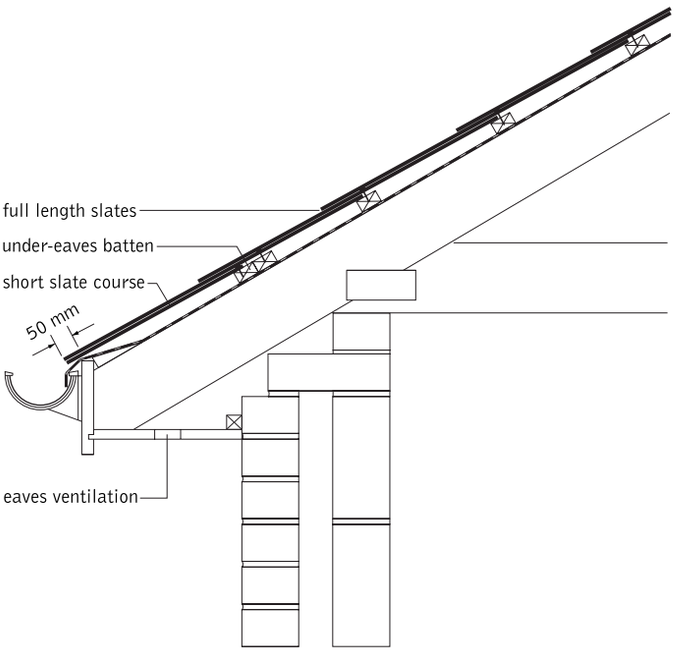
N.B No allowance has been made for wastage



Eaves

At all eaves, a double course of slates is required, comprising a course of short slates over which the first course of full length slates is fixed.

The length of the eaves slates should be gauge + lap.

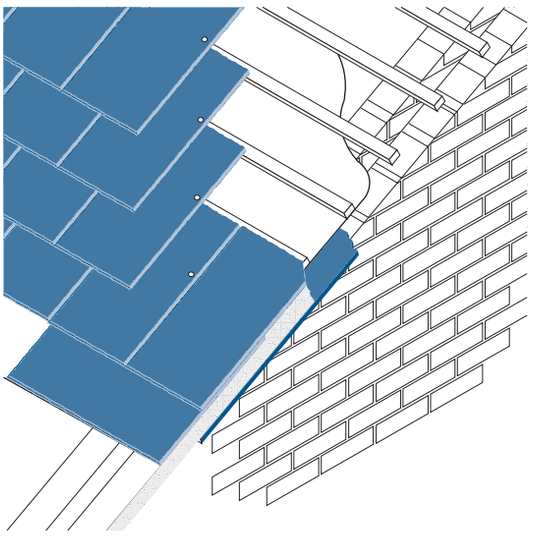


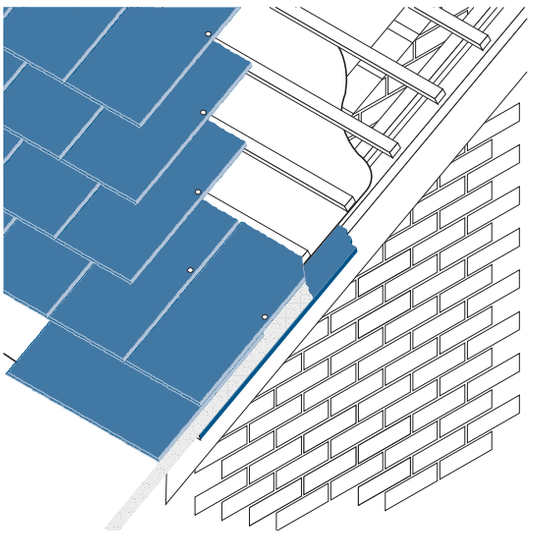
Fixing sequence at eaves

1 Fix the underlay to extend over the tilting fillet and fascia board into the gutter. The underlay should overhang the fascia board by 50 mm.
2 Fix the first full course batten (the eaves batten) so that the tails of the slates in the eaves and the undereaves courses align, ensuring that they will overhang 40 to 50 mm into the gutter. Fix the undereaves batten immediately below the eaves batten (see page 6 for minimum batten dimensions).
3 Lay the slates forming the undercourse on their backs and head-nail them to the undereaves batten.
4 Fix the eaves course with the tails of the slates aligning with the tails of slates in the undereaves course.

Evas Ventilation

When an over facia vent is installed the facia depth needs to be reduced by the depth of the ventilator. This will accommodate the vent and will not change the lay of the roof and will avoid a change of pitch detail at the eaves.





Verges

Where an undercloak is fixed it should consist of one or more courses of slates not less than 4.5 mm thick, laid riven side up and closely butted.

If more than one course is used, joints should be staggered.

Verges should be finished with slate and slate-and-a-half in alternate courses. Provision may be made for a slight inward tilt from the verge.

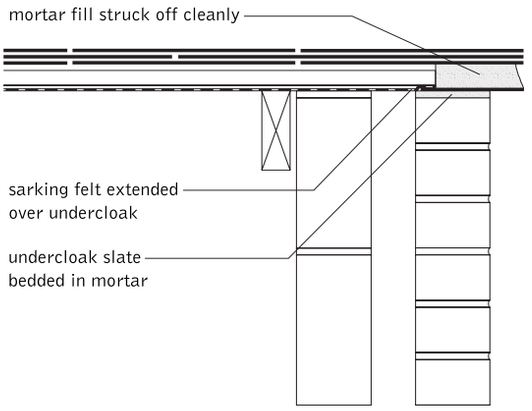
Mortar for bedding and pointing; 1:3 cement/sand pigmented to match colour of slates.

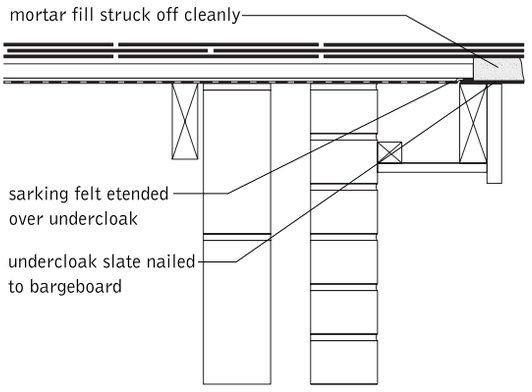
Fixing sequence at verge on brickwork

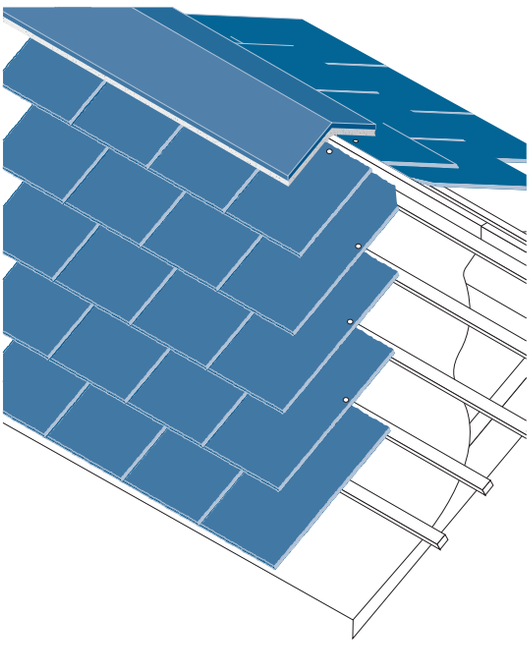
1 Bed the undercloak in mortar so that it extends 40 to 50 mm from the face of the wall.
2 Fix verge slates flush with the undercloak.
3 Fill the gap between the undercloak and the slates with mortar and strike off smoothly to provide a flush joint.

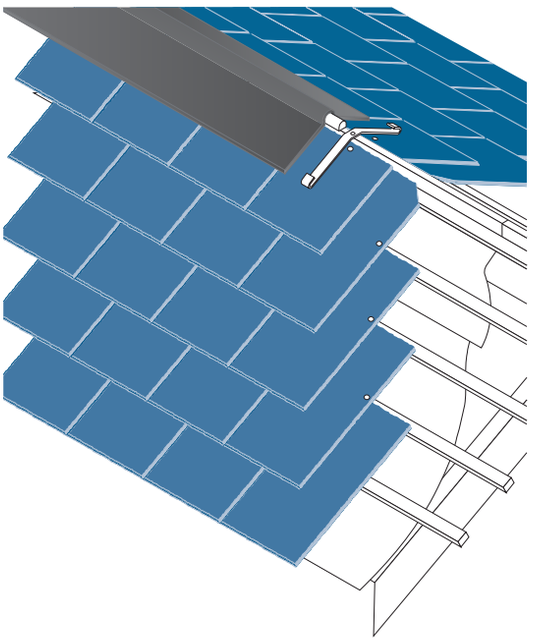
Fixing sequence at verge on bargeboard

1 Fix the undercloak with nails so that it overhangs the face of the bargeboard by 40 to 50 mm.
2 Fill the gap between the undercloak and slates with mortar and strike off smoothly to provide a flush joint.









Ridges

The length and gauge of slate in the top courses at the ridge must be sufficient to ensure that the appropriate lap is maintained.

Shouldered slates should be used in the course below the top course to enable the short top course slates to be nailed directly to the batten.

Fixing sequence with tiled ridge

1 Fix underlay over the ridge so that it overlaps the main underlay by at least 150 mm. When using ventilated ridges, a gap of 50 mm should be allowed between the top of the underlay of each pitch.
2 Fix the top course of slates to maintain gauge.
3 Lay ridge tiles true. Joint ridge tiles in mortar and firmly bed the edges along the roof slope in mortar. Where ridge tiles meet, squeeze up the bedding to fill the joint and strike it off smoothly; no separate pointing is necessary.
4 Fill the ends of the ridges at the gables with mortar and slips of slate finished flush with the tile.

Fixing sequence with sheet metal ridge (not illustrated)

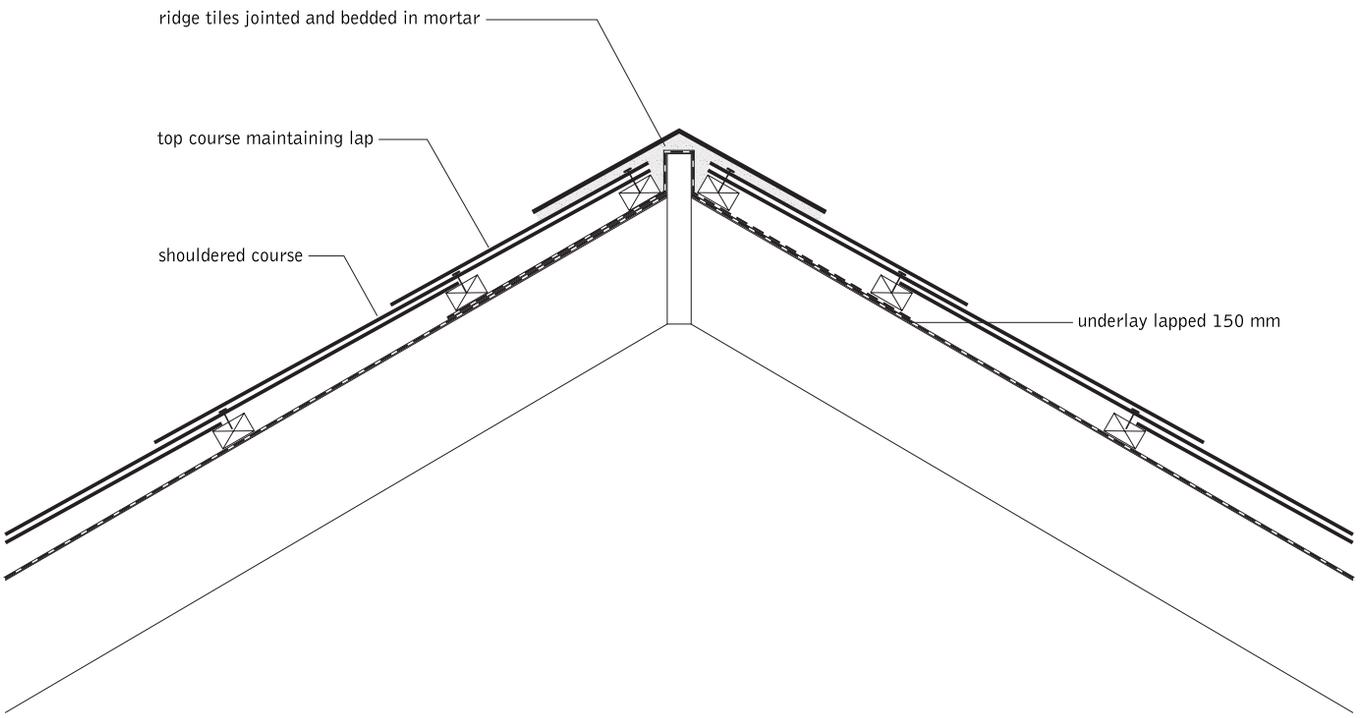
If required, stainless steel, copper or zinc ridges can be made by the roofer on site.

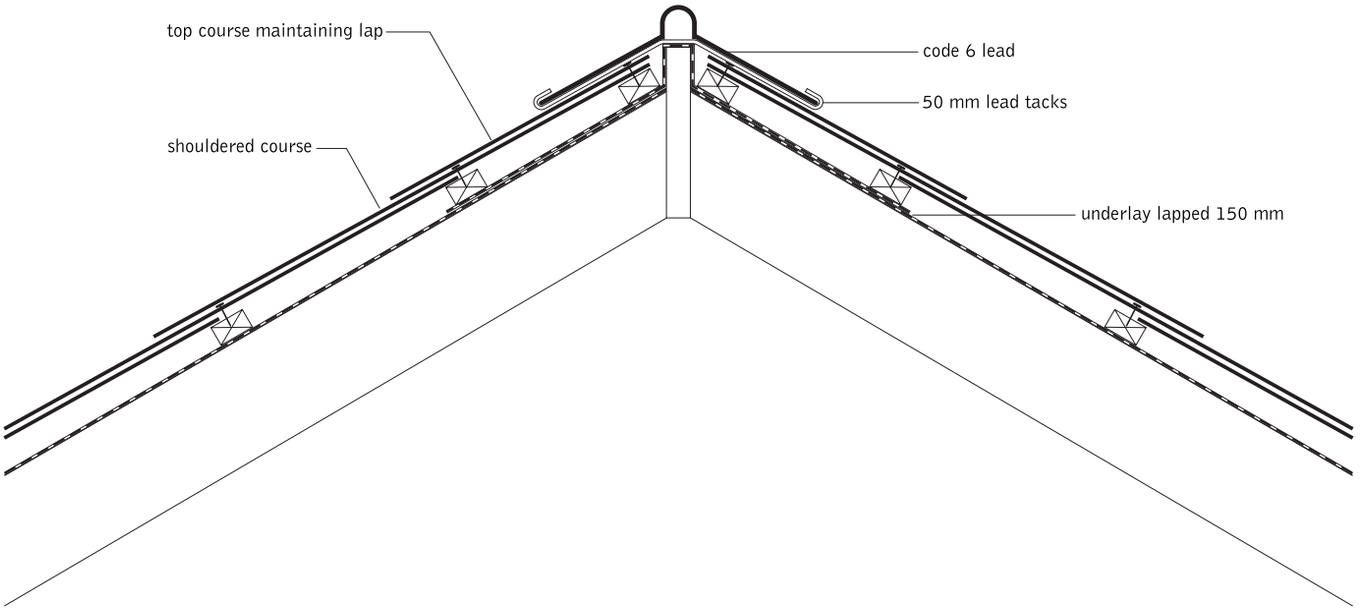
1 Fix 150 mm wide board in lieu of battens at the ridge.
2 Fix underlay over the ridge so that it overlaps the main underlay by at least 150 mm. When using ventilated ridges, a gap of 50 mm should be allowed between the top of the underlay of each pitch.
3 Fix the top course of slates to maintain gauge.
4 Fix 50 mm zinc tack at 500 mm intervals.
5 Fix the sheet metal ridges on the board, overlapping each ridge piece by 100 mm and nailing it to the board with two clout nails on each pitch wherever an overlapping end of the ridge with pre-bonded clips. At verges, hips etc., cut and shape the ridge accordingly.

Note To ensure resistance to wind pull-out, the length of the ridge pieces should not exceed 1 m.

Fixing sequence with lead roll ridge

1 Fix underlay over the ridge so that it overlaps the main underlay by at least 150 mm. When using ventilated ridges, a gap of 50 mm should be allowed between the top of the underlay of each pitch.
2 Fix the top course of slates to maintain gauge.
3 Cover the timber roll with Code 6 lead strips 450 to 500 mm wide and 1.5 to 1.8 m long. Lap the strips 75 mm at the joints; secure the lead with screws; top sealed with a lead dot under the overlap. Fix 50 mm lead tacks at 750 mm.


ridge tiles jointed and bedded in mortar
top course maintaining lap
shouldered course
underlay lapped 150 mm


top course maintaining lap
code 6 lead
50 mm lead tacks
shouldered course
underlay lapped 150 mm

Hips

In cutting slates for hips, care must be taken to preserve an adequate bond, using slate and a half slates.

Where pitches at hips are almost vertical, the hips can be treated in the same way as verges.

Fixing sequence at mitred hip

1 Fix 600 mm wide underlay, overlapping the main underlay.
2 Cut slates carefully, ensuring that adequate width is maintained at the head. SSQ do not recommend the fixing of mitred hips on roofs where the angle of the hip is 30° or less.
3 Hip slates must have an even size and shape at every course.
4 Fix hip slates interleaved with lead soakers – nailed to battens at the top edge – to provide a weathertight close-mitred joint.
5 Cut slates of adequate width to connect with main roof slates and hip slates. The slate nearest the hip slate must remain a full slate.

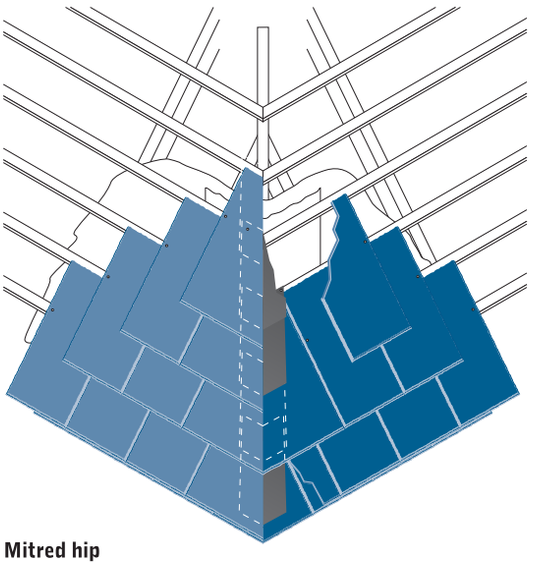
Fixing sequence with lead roll hip

1 Fix 600 mm wide underlay, overlapping the main underlay.
2 Finish slating as close to timber roll as possible.
3 Cover the timber roll with Code 6 lead strips 450 to 500 mm wide and 1.5 to 1.8 m long. Lap the strips 75 mm at the joints equal to the lap of the slates. Fix the 50 mm lead tack at 500 mm centres, under the timber roll.

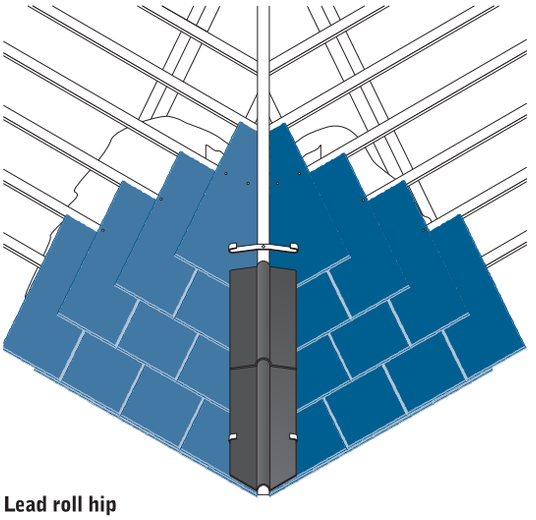
Fixing sequence with ridge tiled hip

Mortar 1:3 cement/sand pigmented to approved colour.

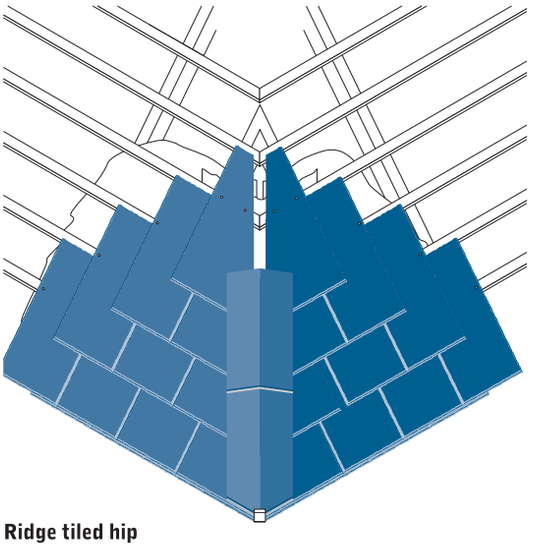
1 Fix 600 mm wide underlay, overlapping the main underlay.
2 Fix hip to iron (to BS 5534: Part 1) to hip rafter.
3 Cut slates to fit closely at junction.
4 Lay hip ridge tiles true and bed edges and joints firmly in mortar, struck off smoothly to provide a flush finish.
5 Cut first tile to align with corner of eaves.
6 Fill end of hip with mortar and slips of slate finished flush.



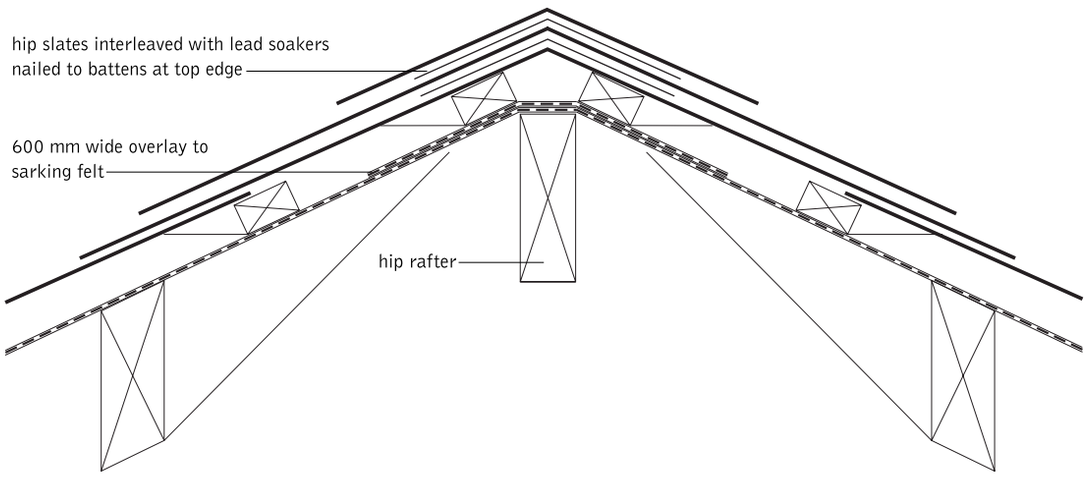
Mitred hip



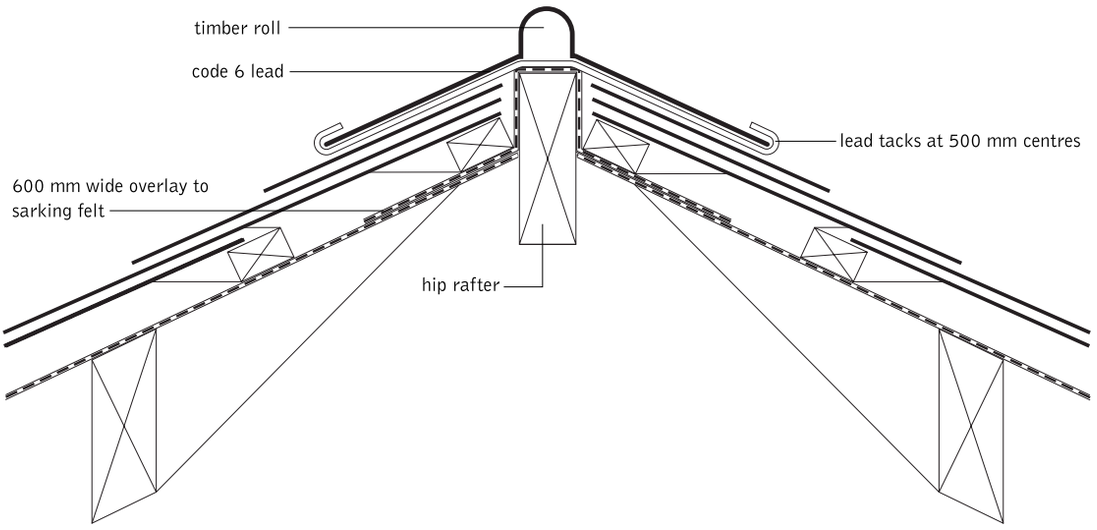
Lead roll hip



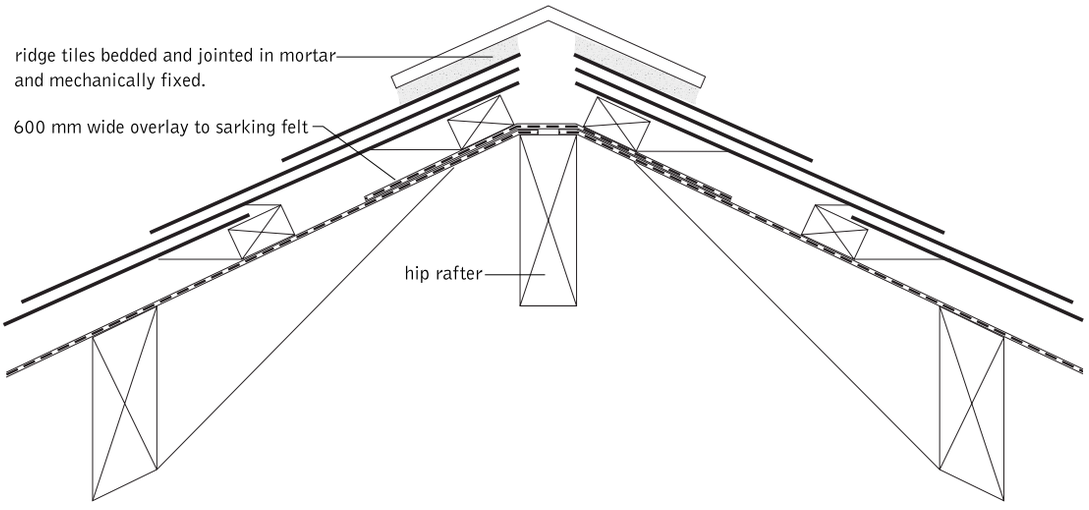
Ridge tiled hip



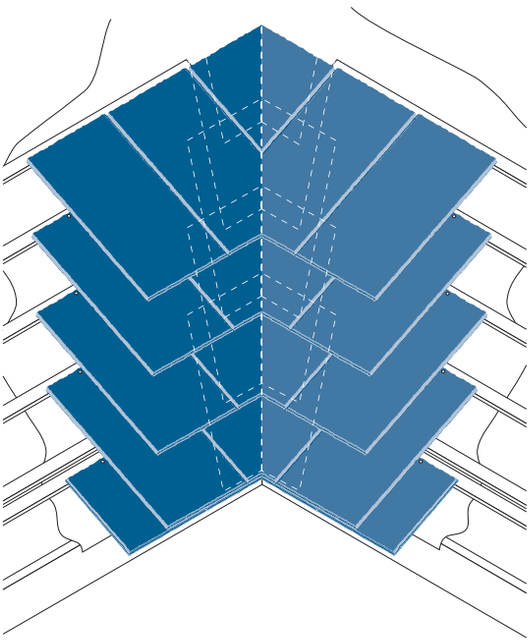
Mitred hip



Lead roll hip



Ridge tiled hip



Valleys

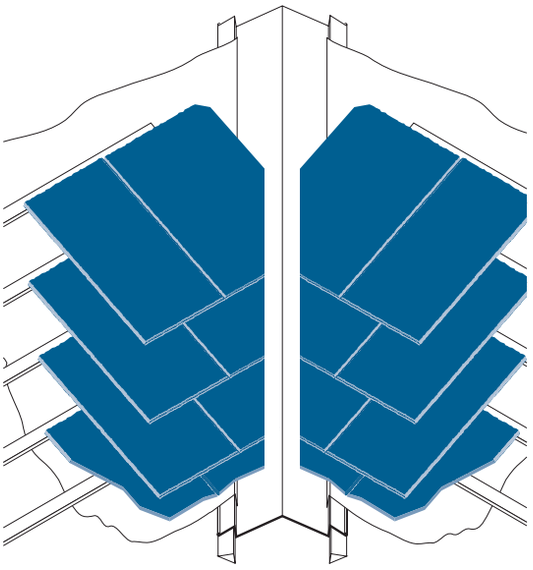
Special care should be taken to ensure that valleys feature a clear unobstructed channel, at least 100 mm wide. Increased kerbing may be required to accommodate mass flow where the pitches on either side of a valley are unequal.

For more information on open lead valleys, please contact the Lead Development Association at:

42-46 Weymouth Street
London W1G 6NP
Telephone 0207 499 8422
or contact the SSQ Technical Department.

Fixing sequence at mitred valley

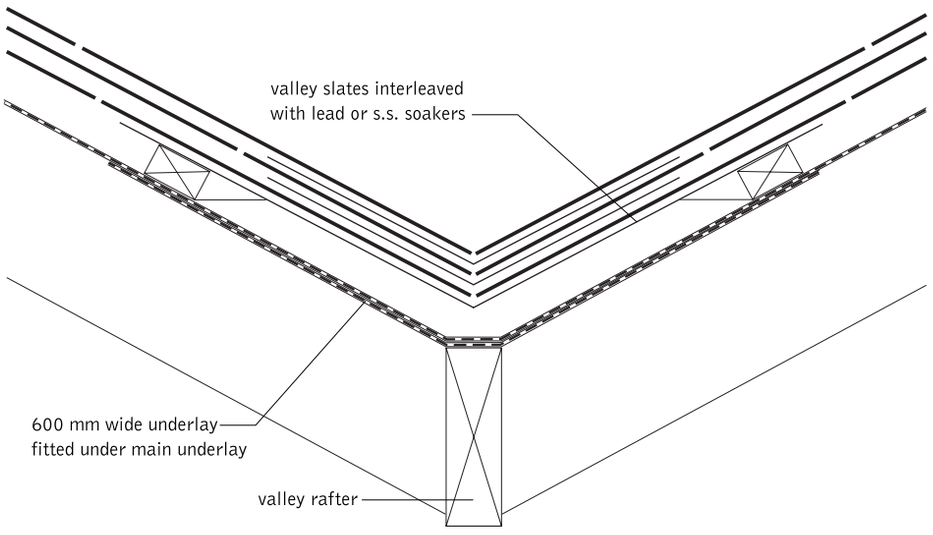
1 Lay a strip of underlay 600 mm wide over the valley, underlapping the main underlay.
2 Cut slate-and-a-half carefully, ensuring that adequate width is maintained at the tail.
3 Fix slates to interleave with Code 3 lead or stainless steel soakers – nailed to battens at the top edge – to provide a straight, weathertight, close-mitred joint. The size of the soaker must be not less than one slate in length; in width, it should be at least a slate on both sides at the head and at least half a slate on both sides at the tail.

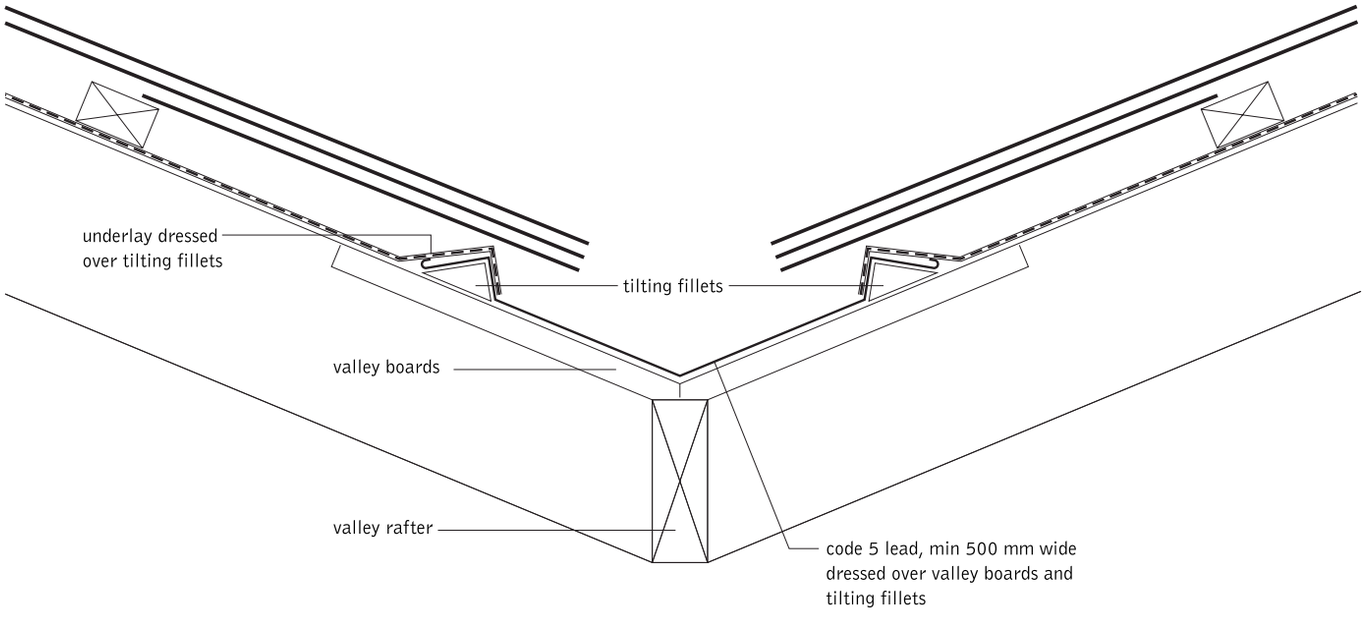


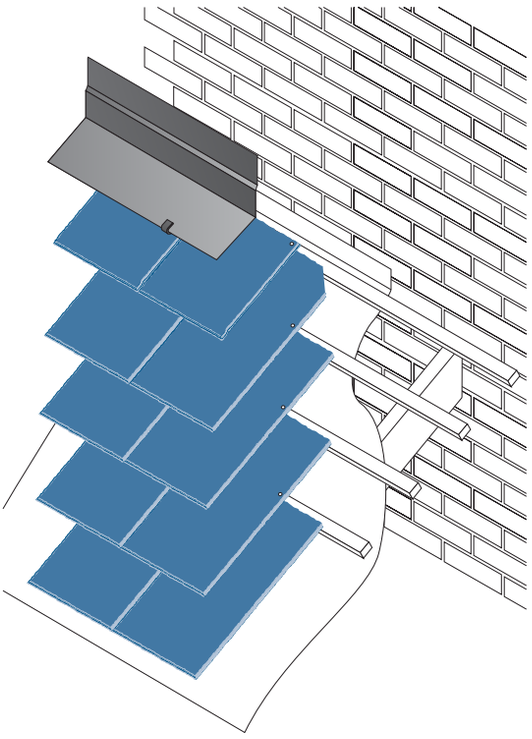
Fixing sequence at valley gutter and open valley

1 Fix valley boards down length of gutter.
2 Fix tilting fillets on either side of the valley board and dress underlay over these tilting fillets.
3 Dress Code 5 lead strip at least 500 mm wide, into the gutter and over the tilting fillets, extending at least 40 mm beyond each tilting fillets.
4 Cut slates accurately, ensuring sufficient width is retained at the tail, to overhang the tilting fillet but leave a minimum of 100 mm clear width of valley.

Note The edges of the slating should not be tilted up over open valleys.


valley slates interleaved
with lead or s.s. soakers
600 mm wide underlay
fitted under main underlay
valley rafter

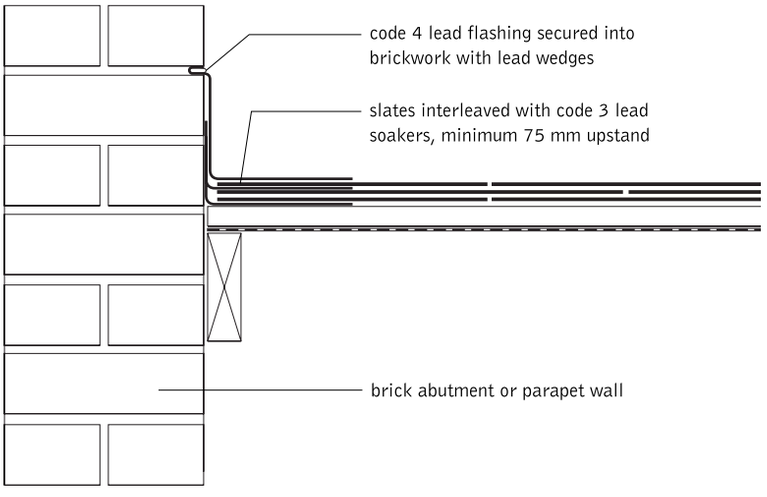

underlay dressed
over tilting fillets
tilting fillets
valley boards
valley rafter
code 5 lead, min 500 mm wide
dressed over valley boards and
tilting fillets

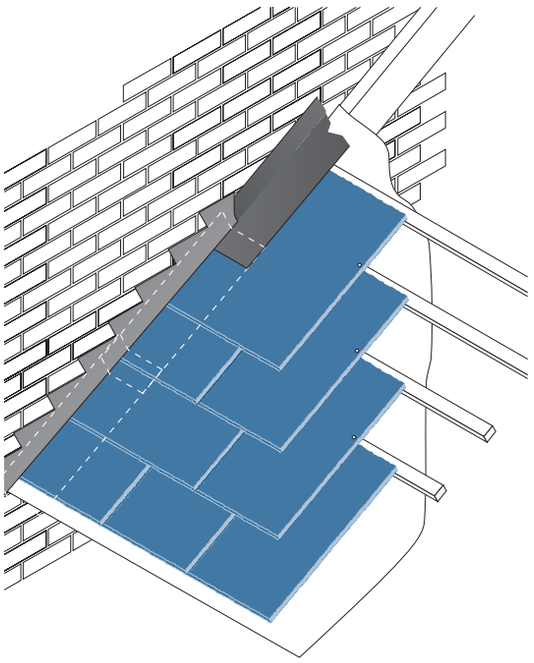


Abutments and parapets

a At top of roof slope

1 Turn underlay 100 mm up abutments.
2 Fix short slates as the top course to maintain gauge.
3 Fix Code 6 lead tack, 50 mm wide, at 300 to 500 mm centres and laps.
4 Fix Code 4 lead apron flashing in 1.5 to 2.0 m lengths, wedge at the laps and at 450 mm centres and secure into the brickwork joints to a depth of at least 25 mm, dressed down 150 mm over the slates.





Abutments and parapets

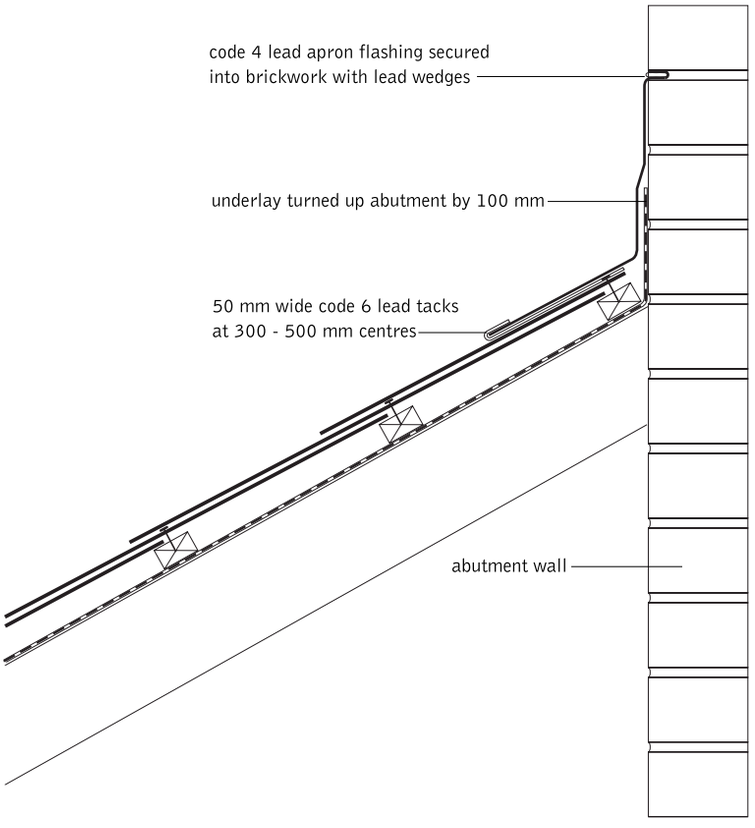
b At end of roofs slope

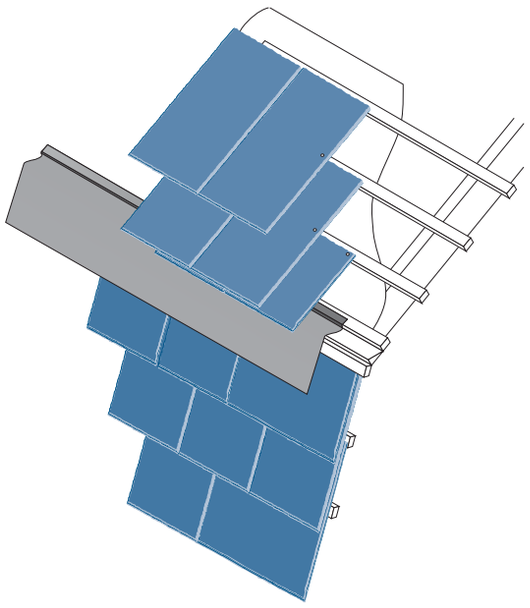
As nearly as possible, the abutment slates should be slate and slate-and-a-half in alternate courses. Soakers should be equal to slate length plus 15 mm. The width should be equal to half the standard slate width.

Note To avoid staining when lead is used, a smear coat of patination oil should be applied to the surface of the lead before fixing.

Fixing sequence

1 Cut slates as required and interleave with Code 3 lead soakers, dressed to provide at least 75 mm upstand to form a close, weathertight abutment, fix soakers by turning down over the head of each slate.
2 Fix Code 4 lead flashing over soaker. Welt top edge, secure into the brickwork joints, to a depth of at least 25 mm, with lead wedges and point in mortar.

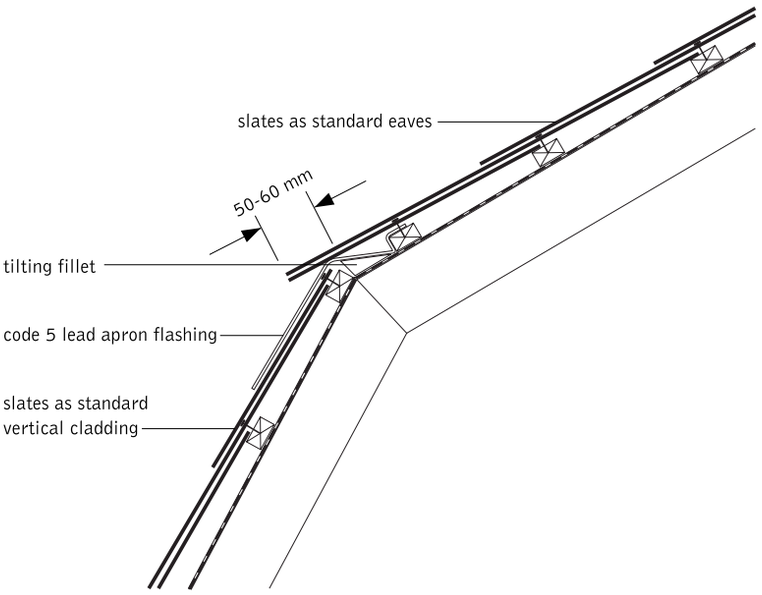


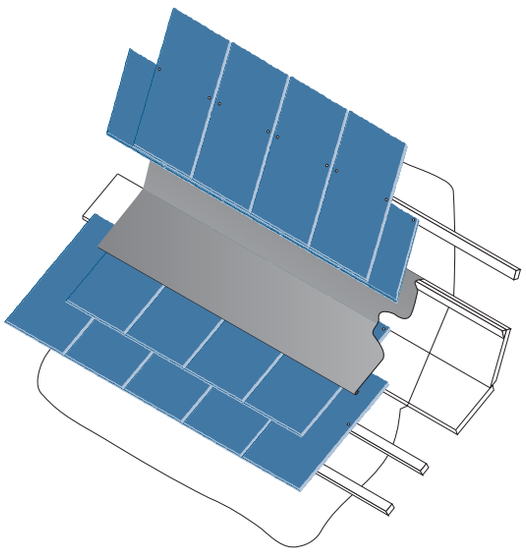


Change of roof pitch

Fixing sequence at Mansard

1 Slate lower slope as for standard vertical cladding (see pages 22-23).
2 Fix a tilting fillet to the upper slope to form an upstand equal to the batten thickness.
3 Fix first batten to the upper edge.
4 Fix Code 5 lead apron flashing over the first batten and tilting fillet and dress down over the heads of the slates below at least 150 mm.
5 Slate the upper slope as standard eaves with the bottom edge of the upper slates overhanging the flashing by 50 to 60 mm.

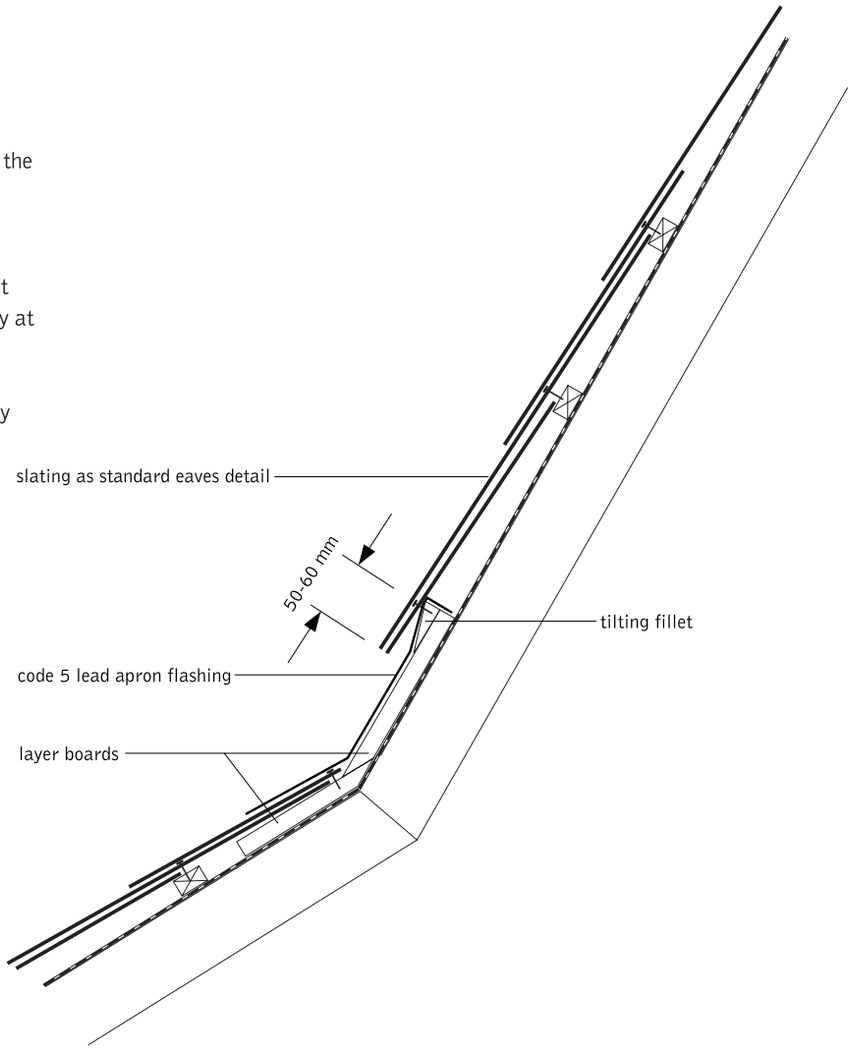




Change of roof pitch

Fixing sequence at reduced change of pitch

1 Complete slating lower slope as for standard roof upper edge.
2 Fix layer boards to the rafters at the intersection of the two roof slopes, equal in thickness to the battens.
3 Fix tilting fillet to the top edge of the upper layer board, equal in thickness to the battens.
4 Fix Code 5 lead apron flashing over the tilting fillet and dress down over the heads of the slate below by at least 150 mm.
5 Slate and batten upper slope as standard eaves, with bottom course projecting below tilting fillet by 50 to 60 mm.



Vertical cladding

SSQ slates used for external wall cladding provide a highly aesthetic appearance as well being extremely functional.

A wide range of cladding patterns can be achieved, which can offer particular benefits of economy and weather resistance as well as allowing versatility in design.

Fixing sequence for vertical cladding

1 General

Vertical slating or cladding may be fixed either directly to batten or to battens and counter batten soundly fixed on the wall face (see BS 5534: Part 1: 2014). The minimum recommended head lap is 50 mm.

If vertical slating or cladding is used as a facing for timber framed construction, a suitable underlay is required to act as a breather membrane.

2 At lower edge

Fix slates at the lower edge of vertical work in the same way as roof slating.

At external corners, or next to openings, full slate and half width slate should be used on alternate courses and soakers should be fixed at every course.

3 At top edge

Cut slates for the top course to maintain gauge.

4 At abutments

Form abutments with full slate and half slate on alternate courses.

5 At angles

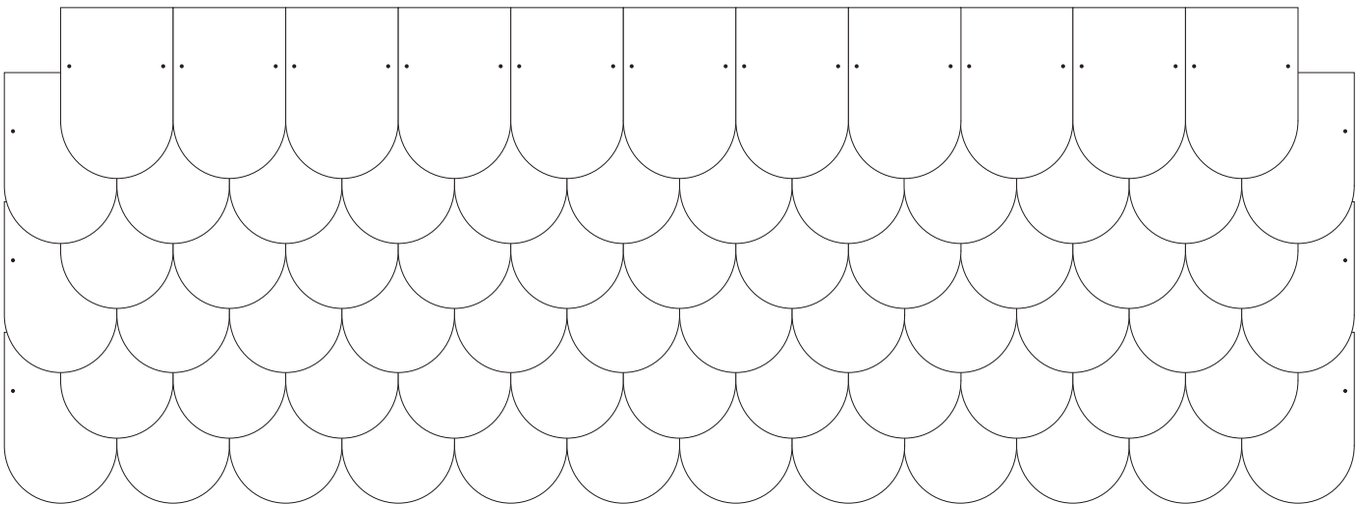
Cut the slates as appropriate and interleave with lead soakers fixed by nailing to battens at the top edge, which is formed with full slate and half slate in alternate course.

6 At abutments adjacent to openings

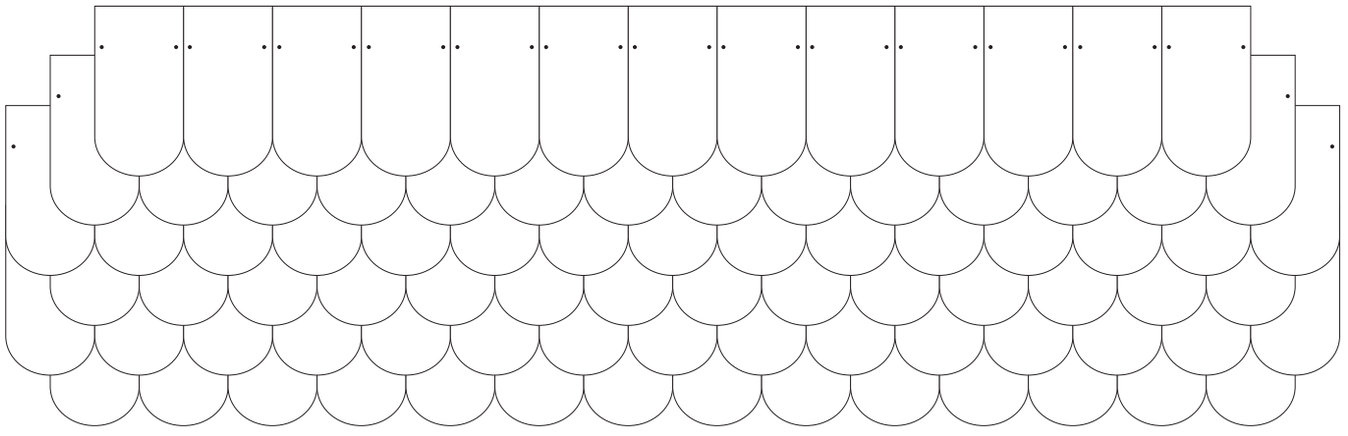
Fix full slate and half slate on alternate courses, interleaving with lead soakers. Fix flashings, suitable for the particular window installations, around all openings.

7 At gable ends

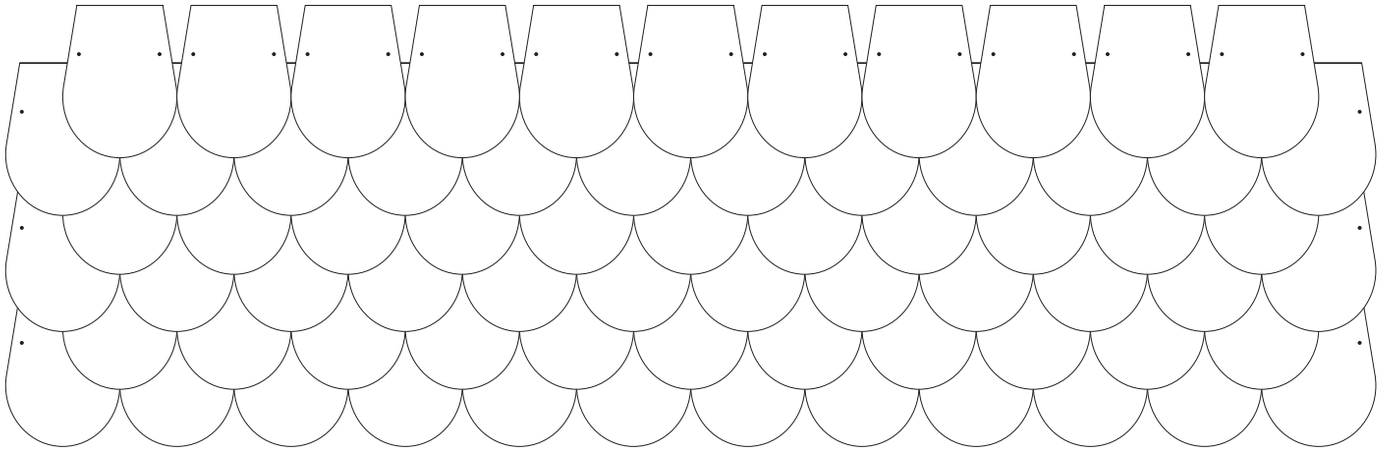
Splay cut slates at the ends of courses to fit closely under the verge, either by cutting wide slates to leave a 5 mm gap adjacent to the abutment or cutting the last two slates at the end of every course so that the tail of the end slate is almost at right angles to the verge.



Half round



Fish scale



Bullnose

Sitework

Storage on site

Slates should be stored in pallets whenever possible. Slates should be stacked on their long edge on dry, level ground. Two battens should be placed under each row of slates.

Preparatory work

Sorting and stacking slates

Each slate should be inspected and the thicker end selected for the tail. After being holed, they should be stacked into three separate stacks.

Thick slates should be used on the lower roof (eaves), medium slates on the middle roof and thin slates on the upper roof (ridge) section.

Dressing and holing slates

Slates up to 4 mm thick can be dressed and holed by hand using a spike hammer. Thicker slates can be holed by hand or machine.

When holing by hand, the slate must be laid flat over a narrow iron and holed from the reverse side (bed) towards the face, thus leaving a small countersunk hole which allows for the head of the fixing nail.

Each slate should be holed twice at a distance from the tail equal to the holing gauge (gauge + head lap + 8 to 15 mm) and between 20 and 25 mm from the long edge of the slate.

When holing by machine, a boring method is recommended. If a machine with a punching method is used, care must be taken to ensure proper maintenance and adjustment of the holing machine to prevent excessive breakage. If slates are drilled, do not drill more than one at a time.

Cutting slates

When using a slate cutting machine for cuts to hips and valleys etc., proper adjustment and maintenance is required.

To maintain adequate laps and allow proper fixing, slates must not be cut too narrow. As a general rule no slate should be less than one half the width of the slate.

At verges and abutments, the alternate courses must be started with a slate-and-a-half or a slate if this is not less than 145 mm.

At valleys, hips and other angled surfaces, the slates must be cut on the rake using wider slates to maintain an adequate width of head or tail of no less than 95 mm.

Traditional holing and nailing method

When holing and nailing it is imperative that slates are fixed in accordance with BS 5534, Code of practice for slating and tiling.

Reference should also be made to BS 8000, Workmanship on building sites: Part 6. SSQ will not entertain claims for loss or damage where this has not been strictly adhered to. The main stages are outlined below:

1 Hole slates to the correct gauge, measuring from the tail of the slates. The position of the holes can be calculated using the formula:
holing gauge = gauge + lap + 8 to 15 mm
Holes should be between 20 and 25 mm from the long edges of the slate. At the same time, sort the slates into three or four groups of equal thickness. See BS 8000: Part 6: Section 4. 3. 1.
2 Fix underlay as specified.
3 Mark out the roof to the correct batten gauge. The gauge may be adjusted to provide equal numbers of courses up the slope length, provided that the specified lap is not reduced.
4 Fix battens.
5 Check width of slates and mark out the slate joints (perpends) on battens. It is generally necessary to mark out only every second perpend.
6 Load slates on roof so that the thickest slates are used in the lowest courses and the thinnest slates near the ridge.
7 Fix slates to perpend lines, laying to give an overall appearance, with the tails of the slates aligned.

Use slates of consistent thickness in any one course, laid with the thicker end as the tail. Form verges by using slate-and-a-half slates and full slates in alternate courses to maintain bond. Fix each slate with two nails through prepared holes.