Introduction

This section provides guidance on meeting the performance requirements for pitched roof coverings. Types of pitched roof coverings covered within this section include:

- Concrete interlocking tiles
- Plain concrete tiles
- Natural slates
- Fibre cement slates

11.3.1 Compliance

The specification and installation of pitched roof coverings and their ancillary components shall meet the performance requirements of this section.

11.3.2 Information to be provided

The Designer shall provide sufficient design details to demonstrate it meets the requirements of this section.

A full set of design drawings and specifications shall be made available to the Warranty provider and all other interested parties prior to the associated works starting on site. This may include:

1. Evidence that all roof tiles and/or slates satisfy the relevant British Standards as outlined within this section. Evidence of CE/UKCA marking should be provided upon request.
2. A site specific fixing specification for the roof tiles and/or slates.

The Warranty surveyor, at their discretion, may also request supporting information that demonstrates suitability for use of any materials or systems contained within the above.

11.3.3 Specification and installation of underlays

Pitched roof underlays shall be suitable for the intended purpose and:

- Be of a suitable material specification.
- Be suitable for the geographical location and wind zone.
- Be fixed in accordance with the underlay manufacturer's recommendation's.
- Be designed, specified and installed to prevent water ingress.

Underlays for use beneath tiles and slates are either fully supported over boarding, sheathing or sarking, or unsupported and draped over rafters/counter battens. Underlays may be of the following specification:

- BS 8747 Class 1F reinforced bitumen or Class 5U polyester reinforced bitumen.
- 2HR[1] underlay to BS EN 13859-1 Class W1 water penetration classification with a third party product conformity certificate for the use intended.
- 3LR[2] underlay to BS EN 13859-1 Class W1 water penetration classification with a third party product conformity certificate for the use intended.

[1] HR (high water vapour resistance) underlay - >0.25MNs/g.
[2] LR (low water vapour resistance) underlay - <0.25MNs/g.
(LR underlays are sometimes referred to as 'vapour permeable' or 'vapour open').

There are two categories of underlay: HR, non-vapour permeable and LR, vapour permeable. These types of underlay should comply with BS EN 13859-1 and have a third party product conformity certificate. They should also have sufficient tensile and nail-tear strength, and low extensibility, to produce the required resistance to wind uplift.

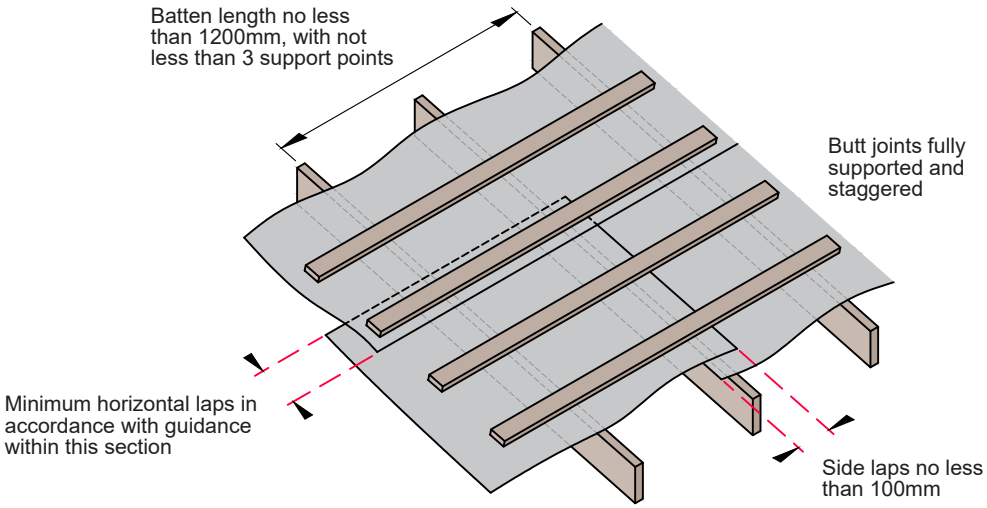
Classification of underlays

Underlays should be classified in accordance with their geographic location and wind zone. Underlays should only be used in those wind zones for which the design wind pressure is not greater than the declared wind uplift resistance. Refer to BS 5534 A8. Figure A.4 for design wind pressures for geographical wind zones location map. It is important to ensure the underlay is suitable for the geographical wind zone and that laps in the underlay are secured in accordance with the manufacturer's third party product conformity certificate for the geographical wind zone and batten spacing. This lap can be secured either with a batten or a suitable product with third party product conformity certificate in accordance with the manufacturer's recommendations.

Underlay nails

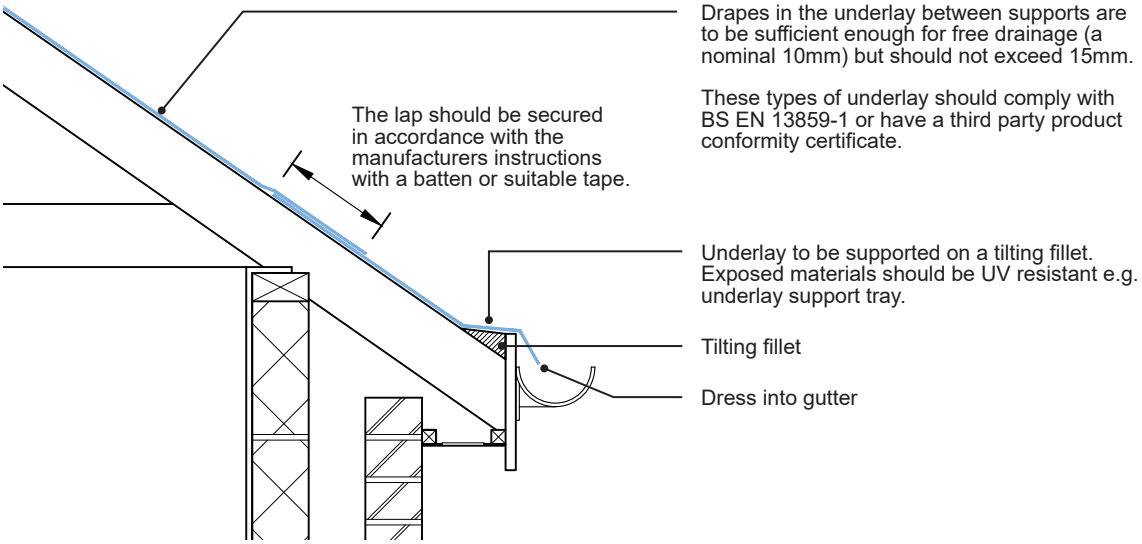
Nails for use with roofing underlays should be clout head nails of no less than 3mm shank diameter and 20mm length made of copper, aluminium alloy or steel coated by any of the zinc or zinc alloy coating methods specified in BS EN 10230-1.

Roof underlay laps



The lap of the underlay should be secured in accordance with the manufacturers third party product conformity certificate.

Roof underlay detailing at eaves level



Installation of underlays

Lay the specified roofing underlay parallel to eaves or ridge with horizontal overlaps, as specified in the table below. Vertical side laps should be a minimum of 100mm. Minimise the gap at laps resulting from different tautness between underlay courses. Drape in underlay between supports is to be sufficient for free drainage (a nominal 10mm) but should not exceed 15mm in accordance with BS 5534. Fix underlay with the fixings specified, keeping the number of perforations to a minimum. Handle and fix underlay with care to ensure there are no tears or punctures, and repair any tears or punctures prior to tiling. Ensure that the underlay does not obstruct the flow of air through ventilators located at eaves, ridge or in the main roof, and appropriately weather all holes formed in underlays for soil vent pipes, etc. Avoid contact between the underlay and the underside of tiles. To prevent wind uplift, fix additional battens or timber strips where laps occur between tiling battens (refer to BS 5534 6.2 Underlays).

Minimum horizontal laps for underlays

Rafter pitch	Not fully supported	Fully supported
12.5º to 15º	225mm	150mm
15º to 35º	150mm	100mm
35º and above	100mm	75mm

11.3.4 Timber tiling battens

Timber tiling battens shall be of an adequate durability and be securely fixed in accordance with the design.

Timber species

Tiling battens and counter battens should be selected from the timber species set out in BS 5534, and their characteristics and defects should not exceed the permissible limits given in Annex D to G of BS 5534.

Grading

Battens should be suitably graded to meet the requirements in BS 5534. Only battens that have been graded and bear the BS 5534 marking will be acceptable for use.

Sizing

Timber batten sizes should be not less than the minimum values recommended in BS 5534 and as per the 'Recommended batten sizes for pitched roofs and vertical work' table.

Battens for large spans or special loading conditions should be designed by structural calculation for strength and stiffness, in accordance with Annex F of BS 5534.

Batten marking

Each batten should be permanently marked with the following information:

- Supplier.
- Origin (imported or British grown and/or species code).
- Graded BS5534.
- Size.

Preservatives

BS 8417 provides recommendations for preservatives for timber. Indicative preservative treatment schedules are given in Annex E of BS 5534. Battens treated with preservatives can contain toxic substances that could introduce an environmental hazard, and should be disposed of safely.

Fixing timber battens

Battens should be at least 1200mm in length and supported at each end and intermediately by at least three rafters or walls. Stagger butt joints over intermediate supports, splay nail each batten end and nail battens to each rafter.

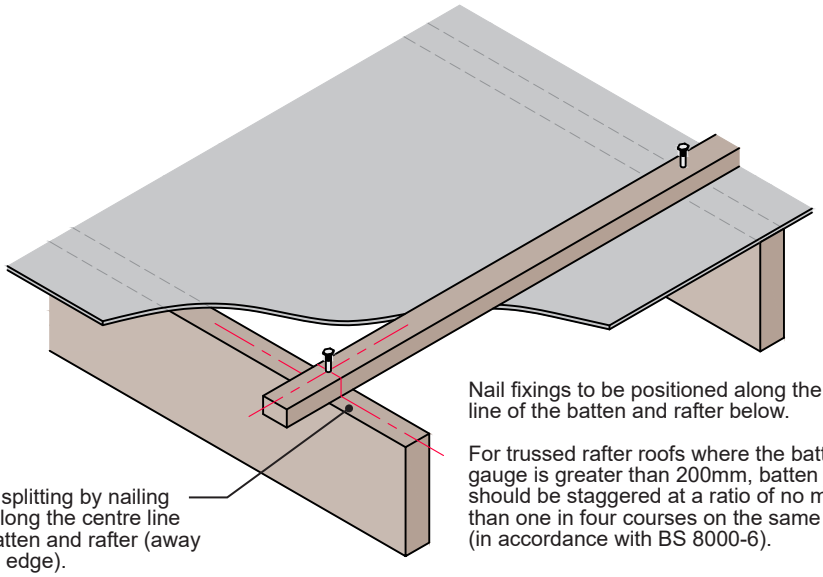
For trussed rafter roofs where the batten gauge is greater than 200mm, do not have more than one joint in any four consecutive battens on the same support.

For trussed rafter roofs where the batten gauge is less than 200mm do not have more than three joints together in any 12 consecutive battens on the same support.

The batten sizes given in the table should be taken as minimum dimensional requirements. Take care that nails used to secure tiles do not penetrate the underside of battens or the underlay.

Fixing battens to rafters

Fix the specified battens up the roof slope on top of the rafters, ensuring a minimum 40mm nail penetration into rafters (smooth shank). Nail counter battens at maximum 300mm centres vertically up the roof slope. Where boarding is used the fixing should coincide with the line of rafters.



Recommended batten sizes for pitched roofs and vertical work (BS 5534 in accordance with clause 4.11.4.1 Table 3)

Tile type	Basic minimum sizes[1]			
Rafter/supports	450mm span		600mm span	
	width	depth	width	depth
Plain pitched/vertical	38mm	25mm	38mm	25mm
Single lap interlocking tiles/slate	38mm	25mm	50mm	25mm
Fibre cement slates	38mm	25mm	50mm	25mm
Natural slates	50mm	25mm	50mm	25mm

[1] All dimensions subject to re-sawing allowance: width +3mm, depth 0 or +3mm based on measurement reference moisture content of 20%

11.3.5 Specification of tiles and slates

Tiles and slates shall be of an adequate durability, material specification and be suitable for the site specific weather exposure.

Roof coverings shall satisfy the Building Regulations in relation fire spread.

Tiled and pitched roof coverings should be in accordance with the relevant Building Regulations.

The principal British Standards relevant to the specification of tiles and slates are:

- BS 5534 Code of Practice for slating and tiling (including shingles). This gives recommendations for the design, materials, application, installation and performance of slates and tiles (BS 5534 should be read in conjunction with BS 8000-6).
- BS 8000-6 Workmanship on building sites. Code of Practice for slating and tiling of roofs and claddings. This applies to the laying and fixing of clay and concrete tiles, natural and fibre cement slates and their associated fixings and accessories.
- BS 5250 Management of moisture in Buildings: Code of Practice. This describes the causes and effects of surface and interstitial condensation in buildings, and gives recommendations for control of condensation in roofs.

Material specification

Tiles and slates should meet the requirements of the following standards:

- BS EN 1304 – Clay roofing tiles and fittings
- BS EN 490 and BS EN 491 – Concrete tiles and fittings
- BS EN 12326 – Natural slates
- BS EN 492 - Fibre cement slates and fittings

Where roof integrated photovoltaic (PV) solar panels are specified, they must satisfy the requirements set out in our ‘Electrical Services – Photovoltaic Solar Panels’ section.

Natural slates

Natural slates must meet the following level of performance and durability as detailed in BS EN 12326:

- Achieve a A1 code rating for water absorption less than 0.6%
- Achieve a T1 code rating for ‘Thermal cycle’ test.
- Achieve a S1 code rating for ‘Sulphur dioxide exposure’ test.
- A copy of the consignment documentation or “accompanying commercial document” (ACD) from the supplier/producer should be provided to confirm these test performances.

It is important that slates are graded on site to ensure an even finish.

Weather exposure

Rain penetration of the roof covering is dependent on a combination of the rainfall rate, wind speed and the ability of the roof tile to resist the ingress of snow and rain water. The Designer should therefore be aware of the various means by which rain and snow can, under certain conditions, penetrate the roof covering.

These include:

- Capillary action and rain water creep.
- Raindrop bounce and negative pressure rain suction.
- Driving rain, deluge rain and flooding.
- Surcharging of rain water over laps on long-rafter roofs.
- Wind-driven snow.

Rain and snow

The roof of the building shall adequately protect the building and people who use the building from harmful effects caused by precipitation and wind-driven spray. Roofs are required to resist the penetration of precipitation (rainfall) to the inside of the building, thereby preventing damage to any part of the building where it might be carried.

Most pitched roofs keep the rain and snow out of the building and give a satisfactory performance. However, it is acknowledged that similar roofs built to the same design and using identical roof materials, but in different locations, may not necessarily provide the same level of assurance since they will be subject to different weather conditions and exposure.

Exposure to driving rain

The UK has a high risk of severe driving rain, and even in some sheltered locations may be subject to high levels of deluge rainfall. BS 5534 defines four categories of exposure, based on the driving rain data given in BS 8104 and BR 262, and should be used for buildings up to 12m in height. For buildings over 12m in height, the influence of increased wind speeds should be taken into account using BS EN 1991-1-4.

Design for wind loading

When considering the wind loading on the roof covering, designers should consult BS 5534. This provides calculation methods to assess the wind load on each tile as a uniformly distributed load, and also takes into account the porosity of the tiles and the effectiveness of the substrate (boarding or sarking), and/or underlay shielding, when calculating wind uplift loads. The standard method in BS EN 1991-1-4 Eurocode 1. Actions on structures. General actions. Wind actions should be used to determine the basic wind speed of the site, which is then used to calculate the effective wind speed and dynamic wind pressure on the roof by applying a series of factors to account for terrain, topography, building height and length etc.

Control of internal pressure

The total wind force on a roof is dependent on the pressure differential between the inner and outer faces of the roof covering. Such pressures are significantly reduced by the use of underlay or boarding beneath tiling or slating. Its contribution towards shielding the underside of the tiles or slates from the full transmission of internal pressures means the underlay is required to have an adequate tensile strength for the specific application. The tensile strength of the underlay, its air permeability factor and the withdrawal resistance of batten nail fixings are therefore important when determining the overall resistance to wind uplift of the roof system.

Aircraft vortices

Roofs near airports can experience high local wind load forces due to air vortices created by certain aircraft when taking off and landing, which may be greater than the wind loads calculated to BS 5534. Designers should seek advice from the Airport Authority Planning Department when designing roof fixings in these locations, and refer to the guidance contained in BRE Digest 467 Slate and tile roofs: avoiding damage from aircraft wake vortices.

11.3.6 Fixing requirements for tiles and slates

Tiles and slates shall be fixed in accordance with a site specific fixing specification and site exposure conditions.

The procedures for calculating the wind loads and determining the fixing specification for tiles and slates in accordance with BS EN 1991-1-4 and BS 5534 are complex to undertake. Designers are advised to obtain a full roofing fixing specification from the slate or tile manufacturer.

Alternative proprietary mortar mixes may be accepted if they are shown to have similar durability and workability.

Tile fixing should be in accordance with BS 8000-6 and the manufacturer's recommendations.

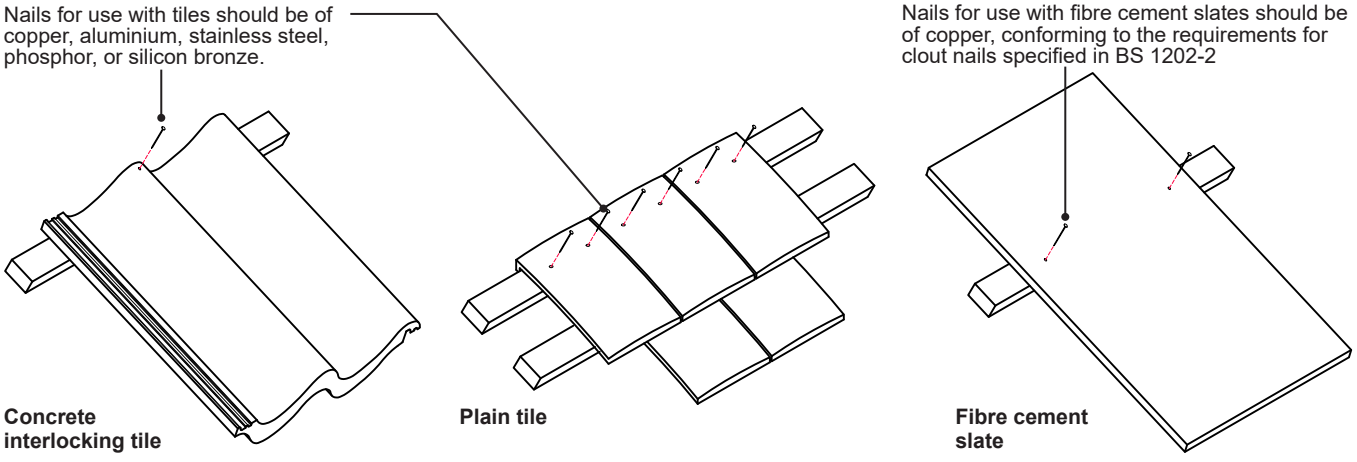
Nailing tiles and slates to battens

Concrete interlocking, plain tiles and natural slate

Nails for use with tiles should be of copper, aluminium, stainless steel, phosphor or silicon bronze. Aluminium nails intended for use with tiles should conform to BS 1202-3 and should be clout head nails of 3.35mm or 2.65mm diameter. The length of nail will be determined by the required wind uplift and the design of the tile. Stainless steel nails for use with tiles should conform to BS EN 10088-3 and BS 5534 grade 304, 316, 321 or 347, and should be specified for coastal areas, areas of high exposure or where there is a risk from chemical reaction.

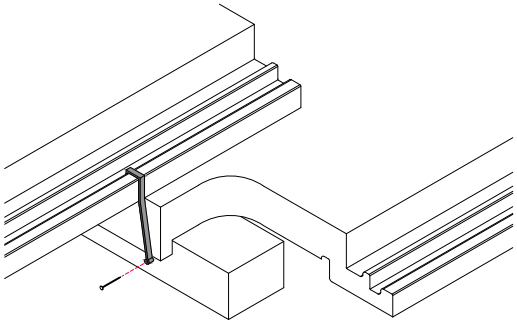
Fibre cement slates

Nails intended for use with fibre cement slates should be of copper, conforming to the requirements for clout nails specified in BS 1202-2. The shank diameter and length should be determined by the exposure of the site and the nail's withdrawal resistance. Normally, 30mm x 2.65mm copper nails are adequate for most applications. For exposed sites, or where aggressive environments are encountered, contact the slate manufacturer. Copper disc 'tail' rivets are used to further secure the tail of fibre cement slates against wind chatter.



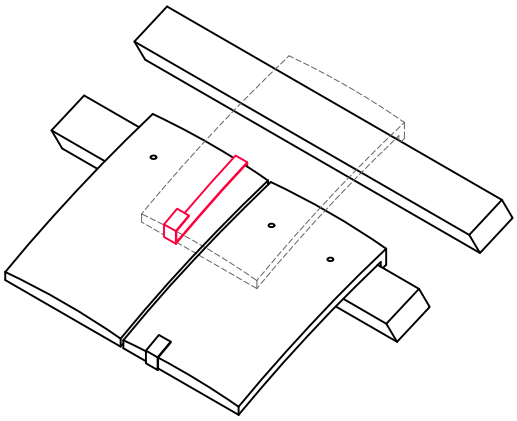
Tile clips

Interlocking tiles



Tile clips should be located over the side interlock of the tile immediately behind the overlapped tile, and nailed to the tiling batten. Tile clips provide resistance to the applied overturning moment more successfully than a nail fixing. The latter is closer to the pivot line, where the nib touches the batten and cannot resist the uplift force at the tail. The phenomenon is also related to roof pitch and the step height of the roof covering, and BS 5534 acknowledges that, at roof pitches of 45°-55°, all tiles should be at least nailed to battens to prevent displacement. At pitches exceeding 55° all tiles must be both head nailed and tile clipped to reduce 'chatter' in high winds.

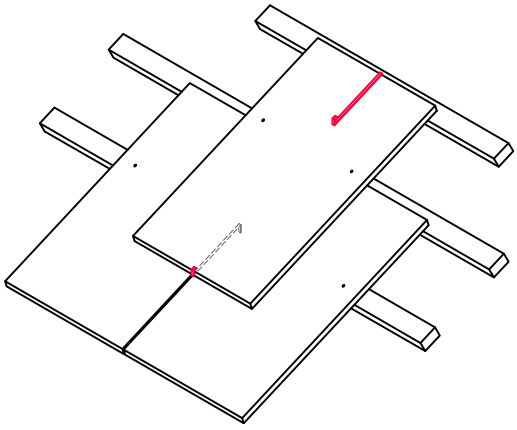
Plain tiles



Tile clips may need to be utilized to achieve a subtitle number of fixings to comply with BS 5534 especially on hips or valleys. Tile clips provide resistance to the applied overturning moment more successfully than a nail fixing. The latter is closer to the pivot line, where the nib touches the batten and cannot resist the uplift force at the tail.

BS 5534 acknowledges that for nibbed tiles, where the rafter pitch is below 60°, two nails should be used in each tile in at least every fifth course. For rafter pitches of 60° and above, including vertical, two nails should be used in every tile.

Slate hooks



Hooks are formed from stainless steel wire conforming to BS 1554 grade 316 S11 or 316 S19. For further advice on the use of slate hooks, refer to BS 5534 section 4.12.3 and 5.3.6.4 Hooks and rivets for slates. Slates should not be nailed to accommodate hooks.

Hooks with crimped shanks reduce the capillary rise of water at the perpendicular joints between slates and are suitable for all roof pitches between 25° and 90°. Straight shank hooks should not be used at roof pitches below 30°. Hooks should not be used at roof pitches below 25°.

11.3.7 Installation and detailing for tiles and slates

Tiles and slates shall be specified and installed to prevent water ingress and be suitable for the site exposure conditions.

Roof pitch and lap requirements

When determining the pitch, head-lap and/or side-lap of a tile, the roof pitch is taken to be equal to the rafter pitch. Hence, all references to pitch refer to the rafter pitch, with the laid angle of the roof tile or slate always being less than roof pitch.

The actual pitch of a tile should be determined in accordance with the following guidelines:

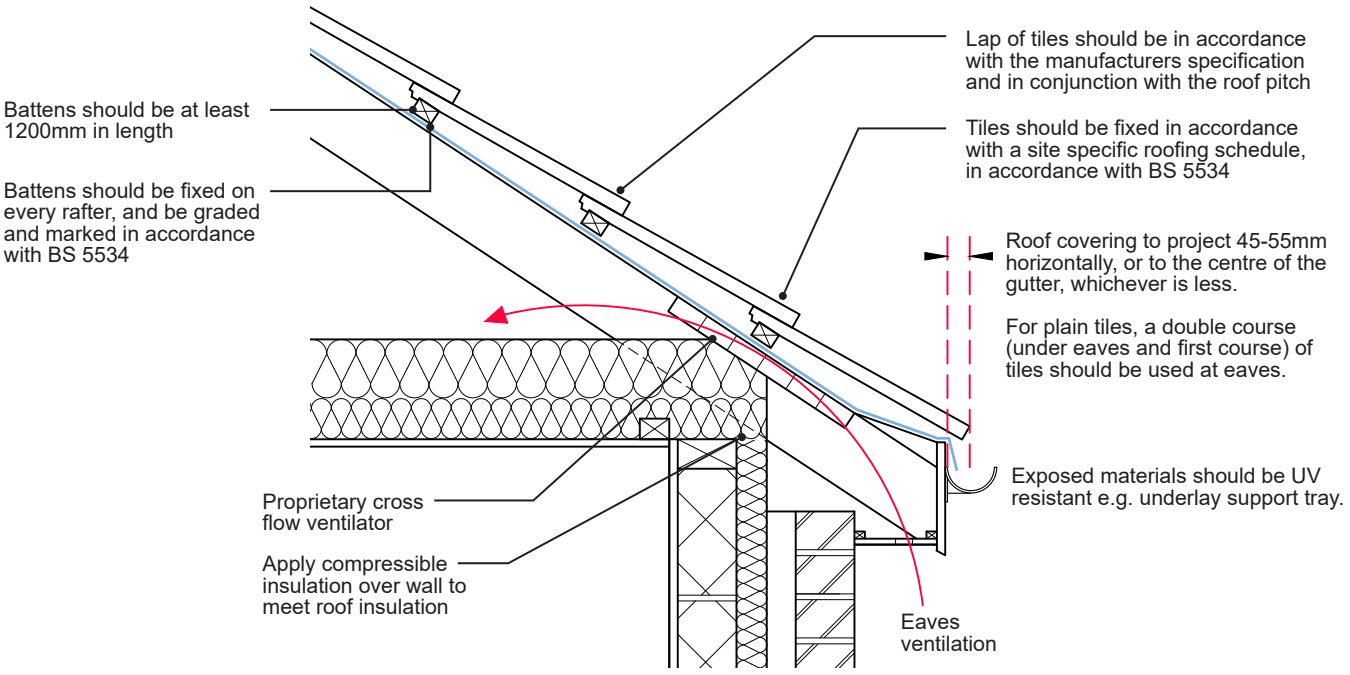
- Tile to rafter pitch angles.
- Interlocking single-lap tiles: 5° less than rafter pitch.
- Plain tiles: 7° less than rafter pitch.
- Double-lap fibre cement slates: 1.25° less than rafter pitch.

If the design rafter pitch is less than the minimum recommended rafter pitch for the particular tile, then they can be considered as having an aesthetic function only. In such cases, the true weatherproofing of the roof system must rely on a fully supported waterproof membrane with an uninterrupted drainage path between counter battens to the eaves gutter.

Type of tile or slate	Gauge	Minimum headlap	Minimum permissible pitch
Concrete interlocking (single lap)	As per manufacturers recommendations	75mm or to the manufacturer's recommendations	30° [2]
Plain (double lap)	Maximum 1/3 length lap	65mm generally for clay tiles 75mm in severe exposure conditions	35°
Slates (double lap)	Maximum 1/3 length lap	54mm[1] minimum, increased with lower pitch and severe exposure conditions	20° subject to headlap
Notes: [1] For pitches greater than 45° in sheltered and moderate exposure zones only. [2] For pitches below 30°, evidence shall be provided as to suitable performance.			

The roof pitch should not be less than 20°.

General eaves detailing



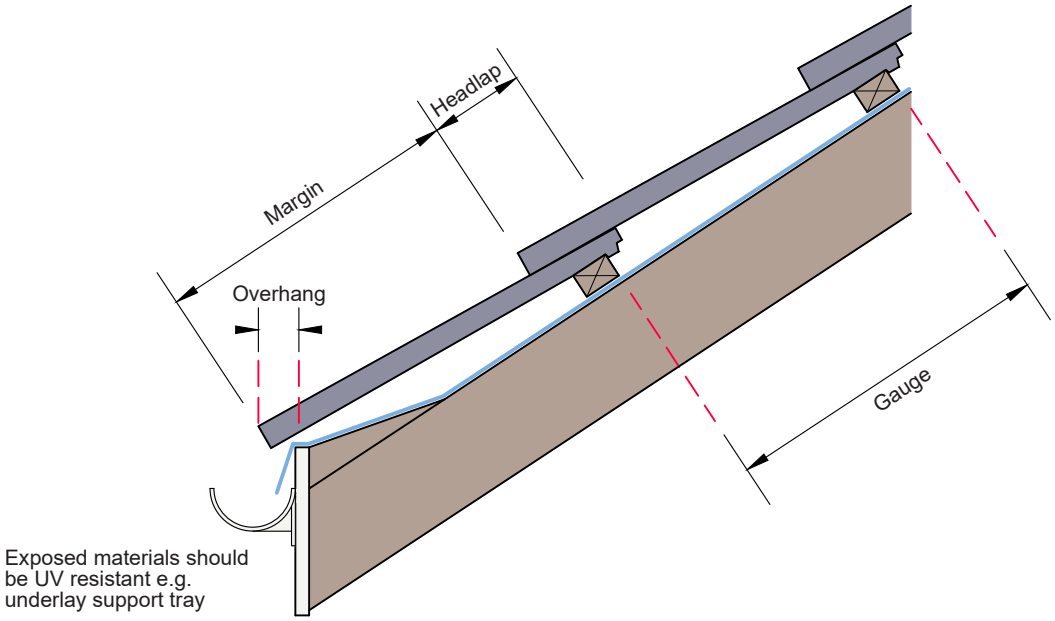
BS 5534 recommends the use of aluminium or stainless steel nails under normal conditions of exposure. Plain or galvanised nails may be used for fixing battens to rafters, but care must be exercised when there is high humidity as certain timber preservative treatments may corrode steel, zinc or aluminium. For all roof areas and rafter pitches, every tile should be mechanically fixed.

Key check points at the eaves

At the eaves (bottom edge), the batten should be set to provide the required overhang of the tiles into the gutters. The recommended overhang is 45mm-55mm horizontally or to the centre of the gutter, whichever is less.

- Ensure fascia board is to correct height so as to prevent tiles kicking up or drooping.
- Fit duct trays to retain insulation.
- Fix underlay protector trays, fascia vents and comb fillers (profiled tiles).
- Clip eaves course where required.
- Ensure vent path to roof space is achieved.
- Ensure exposed materials are UV resistant.

Eaves and bottom edge detail



Relevant British Standards

- BS EN 490
- BS 5250
- BS EN 1990
- BS 5534
- BS EN 1991-1-4
- BS 8000-6
- EN 13859-1
- BS 6399

Ridges, hips, verges and valleys

The use of mortar for the bedding of ridge tiles, hip tiles, or lay tiles does not provide sufficient tensile bond strength to resist wind uplift, as it can be affected by a number of factors, such as wind loadings, mix of mortar, design and movement of the roof structure. The tensile strength of mortar should not be taken into account as the mechanical fixings should provide the resistance. Tiles only bedded on mortar are not acceptable.

Note: Dry fix ridge and hip systems are available to provide full mechanical fixing of all ridge and hip tiles to meet BS 5534 recommendations.

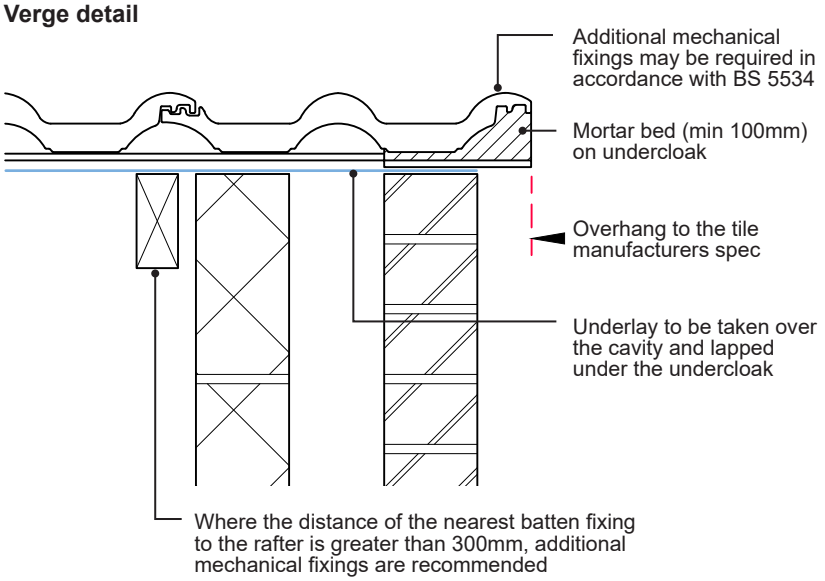
Verge (in accordance with BS 5534, BS 8612 and BS 8000-6)

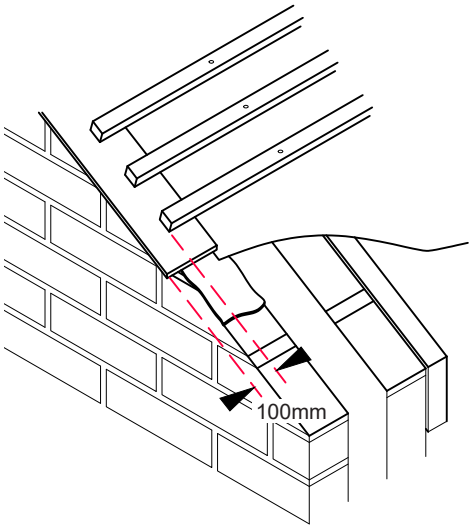
Battens should overlap onto the outer skin of the brickwork or the undercloak material; the projection for plain tiles and slates should be 38-50mm beyond the gable wall. For concrete interlocking tiles, the projection should be 30-60mm beyond the gable wall. Where the distance of the nearest batten fixing to the rafter is greater than 300mm, an additional mechanical fixing is recommended.

Note: Where proprietary verge tiles or systems are specified, the detailing should be in accordance with manufacturers' recommendations that are relevant to UK conditions of use.

- Use recommended undercloak for mortar.
- Level off irregularities in brickwork.
- Carry underlay over gable wall or bargeboard, and fit undercloak.
- Use the correct mortar mix.
- Bed and point tiles in one operation.
- Keep mortar clear from the ends of tiling battens.
- Fix all perimeter tiles (clip and/or nail).
- Cut plain tiles are not acceptable, and purpose-made plain tile-and-a-half tiles should be used.
- Natural slate verges should be formed with full slates and either slate-and-a-half or half slates that are a minimum of 150mm wide.

Verge detail





Where proprietary verge tiles or systems are specified the detailing should be in accordance with the manufacturer's recommendations that are relevant to UK conditions of use.

Mortar must not be the sole means of fixing and should only be used for decorative purposes. Suitable mechanical fixings are required. Mortar should be to the recommendations in BS 5534 and typically consist of a cement and sand mix based on sharp sand, with soft sand added to achieve workability. The proportion of sharp sand should not be less than a third of the total sand content to ensure the durability of the feature. The mortar should be 1:3 cement: sand with plasticiser.

Undercloak

Where an undercloak is used it should comprise plain tiles, slates or fibre cement sheet strip. It is usually fixed at verges beneath the battens and on top of the underlay to support the mortar onto which the verge tiles are bedded. If batten ends are cut, treat with a suitable preservative. A 100mm wide bed of mortar should be neatly laid on the undercloak, this should be bedded solidly and finished neatly.

Ridge (in accordance with BS 5534, BS 8612: Dry-fixed ridge, hip and verge systems for slating and tiling and BS 8000-6)

Dry fix systems

Proprietary dry roofing products and systems should be used as an alternative to just mortar bedding at verges, ridges, hips and valleys to provide weathering and mechanical resistance properties. Dry roofing products as fitted should not adversely affect the performance of the roof as laid.

Dry ridge systems should be manufactured and tested to meet BS 8612. The dry ridge system should be specified in accordance with BS8612 and be suitable for the location and the wind loading (see 'Note 1' below).

Specifiers should seek evidence that this will not be the case, and should use dry roofing products only if such evidence is available.

Note 1: Users should pay particular attention to the resistance to wind load and durability performance of dry roofing products.

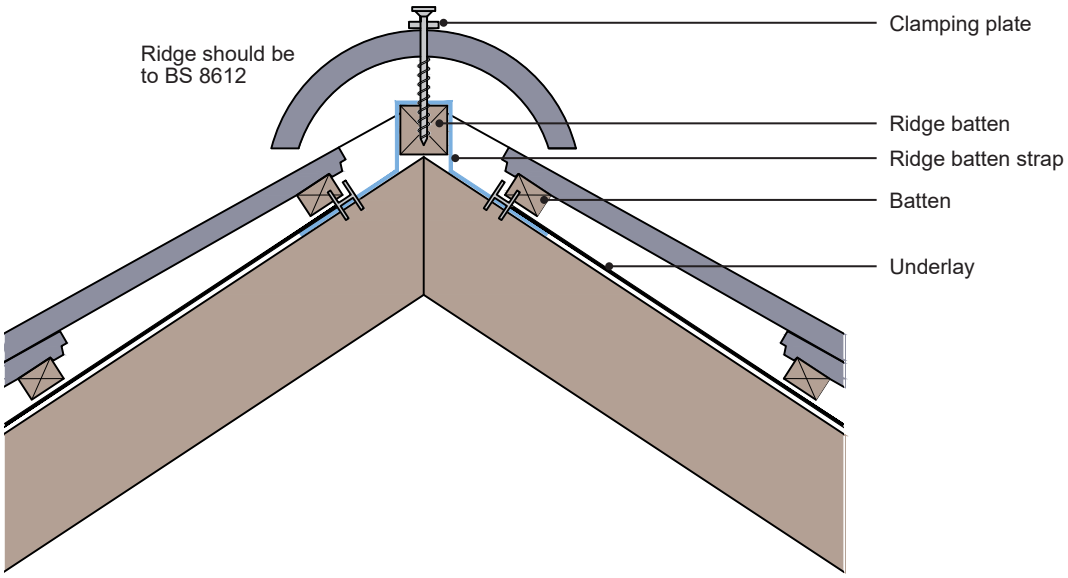
The ridge or top course batten should be set to allow the ridge tiles, ridge units or metal ridge to overlap the top course of tiles by the overlap necessary for the main tiles. For interlocking tiles, this should be not less than 75mm. For double-lap products, the top batten should be set to allow the ridge to overlap the penultimate course by the required head-lap.

For ridge tiles:

- Check ridge tile is suitable for pitch of roof.
- Edge bed components onto tiles.
- Ensure top course tiles or slates are mechanically fixed.
- Mitre tiles neatly at hip ridge junctions, and use a lead saddle underneath for protection.
- Use the correct mortar mix.
- Use dentil slips in deep profiled tiles in all joints more than 25mm thick to reduce mortar and risk of shrinkage.
- **All** mortar bedded ridge tiles must also be mechanically fixed by proprietary fixings in accordance with the roof covering manufacturer's recommendations.

Note: Dry fix ridge systems are available to provide full mechanical fixing of all ridge and hip tiles to meet BS 5534 recommendations.

Typical dry ridge detail

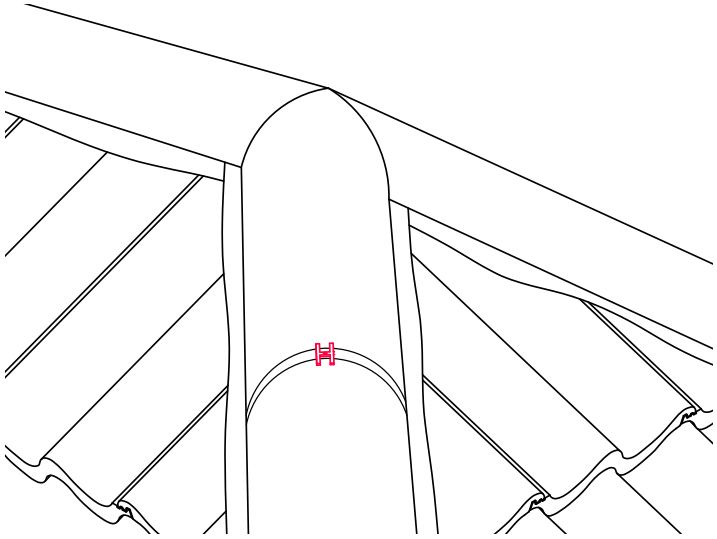


Hip (in accordance with BS 5534, BS 8512 and BS 8000-6)

For hip roof construction:

- Check hip tile is suitable for pitch of roof.
- Mitre tiles neatly at hip ridge junctions and use a lead saddle underneath for protection.
- Use the correct hip iron at base of hip.
- Use the correct mortar mix.
- For concrete interlocking tiles, use dentil slips in deep profiled tiles in all joints more than 25mm thick to reduce mortar and risk of shrinkage.
- All mortar bedded hip tiles must also be mechanically fixed (screws, nails, clips, etc.).

Note: Dry fix ridge systems are available to provide full mechanical fixing of all ridge and hip tiles to meet BS 5534 and BS 8512 recommendations.



Valley (in accordance with BS 5534 and BS 8000-6)

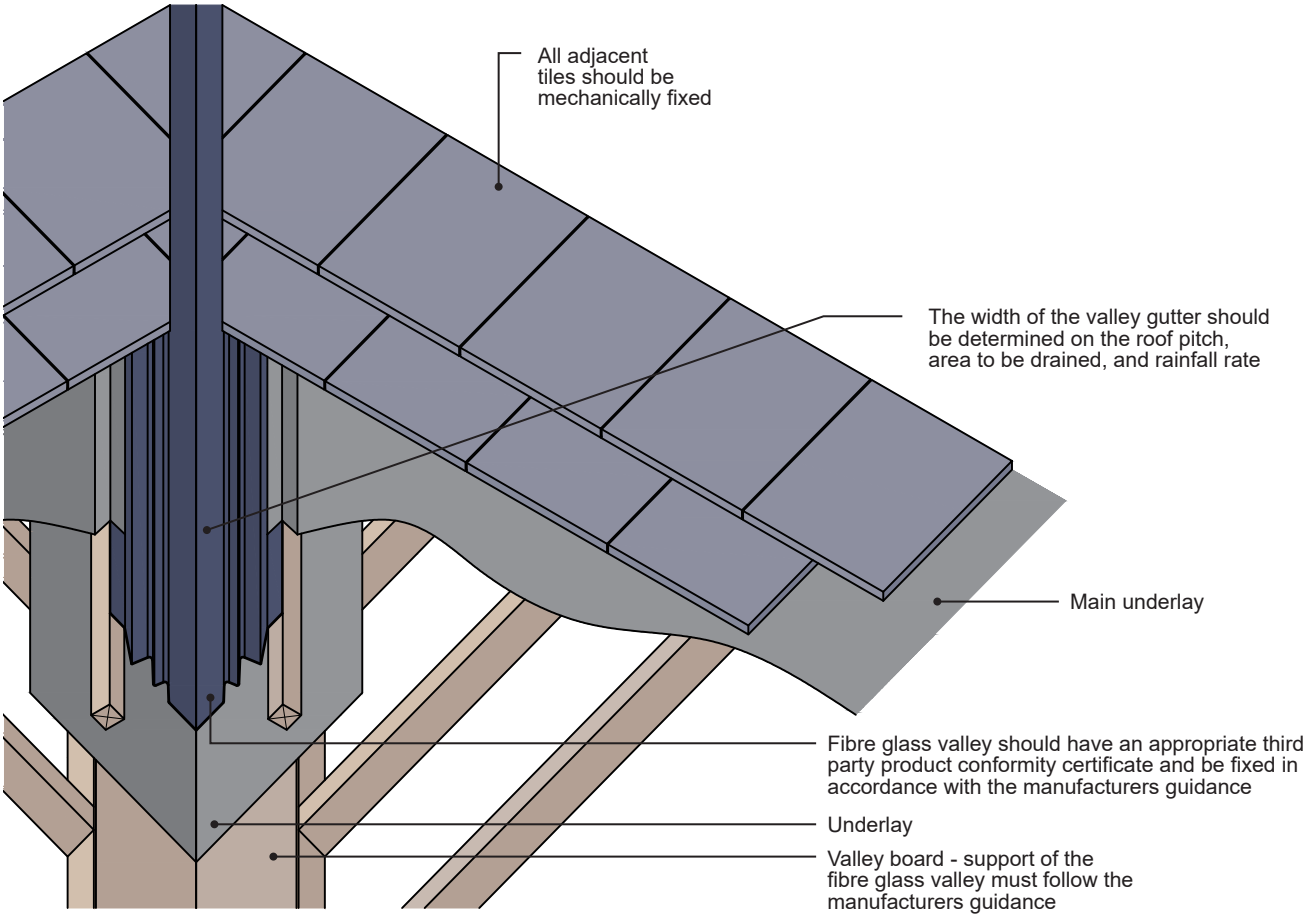
The design of pitched valley gutters is just one roof detail where the latest guidance is much improved over previous Codes of Practice. The valley is the most vulnerable area of a pitched roof in respect to potential water ingress, as it drains all of the water from adjacent roof slopes.

Consequently, the design data is related to the pitch of the roof, the rainfall rate, the length of the valley and the catchment area or area of the roof to be drained. Designers are able to determine the width of the valley trough so that it is appropriate for discharging the rain water from the adjacent roof covering to the eaves gutter.

For valley gutters:

- Check roof pitch, area to be drained and rainfall rate to determine width of valley gutter.
- Consider length of valley when choosing proprietary valley troughs (over 8m).
- Ensure roof structure provides adequate support for valley lining; make flush with top of rafter.
- Do not place bitumen underlay beneath a lead sheet valley.
- Keep open gutter width 100mm-250mm (correct width to be determined by reference to Table 11 and 12 in BS 5534).
- Keep roof design as simple as possible.
- Avoid discharge of valleys onto roofing wherever possible, but where inevitable use a lead saddle.
- Avoid direct contact with lead when using mortar; provide a fibre cement undercloak or tile slips.
- Do not block tile laps with mortar to avoid water damming.
- Where fibre glass valleys are used only products supported by a third party product conformity certificate will be acceptable and the installation and support of the fibre glass valley unit must follow the manufacturer's guidance.
- Mechanically fix all tiles adjacent to valleys.

GRP dry valley detail



11.3.8 Weathering details

Durable weathering details shall be provided at all abutments, intersections and junctions to prevent moisture ingress to the inside of the home.

Materials for flashings and weatherings

Lead is generally ideal for roofing purposes; it is easily dressed over complicated shapes using simple hand tools, and can be joined by soldering or lead burning. For most roofing purposes, Codes 3, 4 and 5 will be adequate, but for extreme conditions of exposure, thicker codes may be necessary.

Lead sheet used for roofs, flashings and weatherings should, in terms of suitability to meet the Warranty requirements, be in accordance with BS EN 12588 or hold a valid UKAS (or European equivalent) third party product conformity certificate (e.g. British Board of Agrément, BRE, etc.) that demonstrates adequacy and durability for use.

Lead should be specified, detailed and installed in accordance with guidance provided by the Lead Sheet Training Academy.

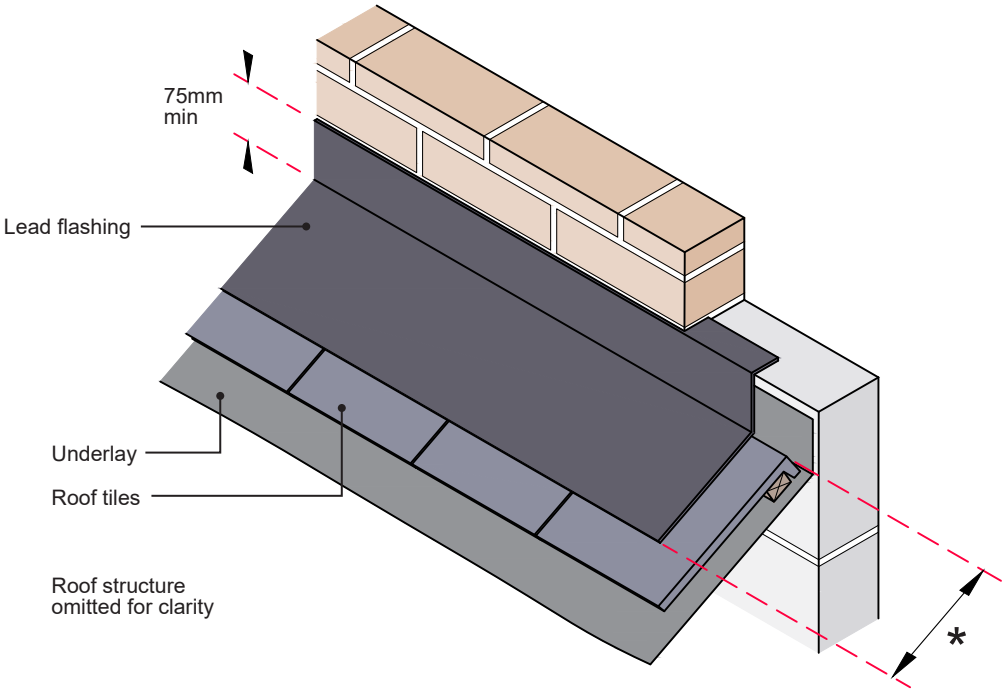
Lead flashing, patination and compatibility with other metals

A coat of patination oil should be applied to lead flashings after fixing. Lead can be used in contact with other metals, such as copper and stainless steel, without risk of bimetallic corrosion, but should not be used with aluminium in a marine or coastal environment.

Top edge abutment

- Turn roofing underlay a minimum of 50mm up at the abutment.
- Fix the top tiling batten as close as possible to the abutment.
- Complete tiling in the usual way.
- Chase abutment and insert lengths of code 4 lead, no more than 1.5m long; wedge in with small pieces of lead or stainless steel lead flashing clips, no less than 450mm apart.
- Lead should be wide enough to give at least 150mm cover to top course of tiles, below 30°. Increase cover to 290mm at 15° rafter pitch.
- Vertical upstand should be 75mm-100mm.
- Lap each length of lead by no less than 100mm.
- Dress lead to the profile of the tiles.
- Secure lead flashings with copper or stainless steel clips, with frequency dependent on exposure.

*The lap should be measured from the lowest fixing of underlying material and be no less than 150mm or the 'Minimum lap of the flashing with the roof covering' table, whichever is the greater.

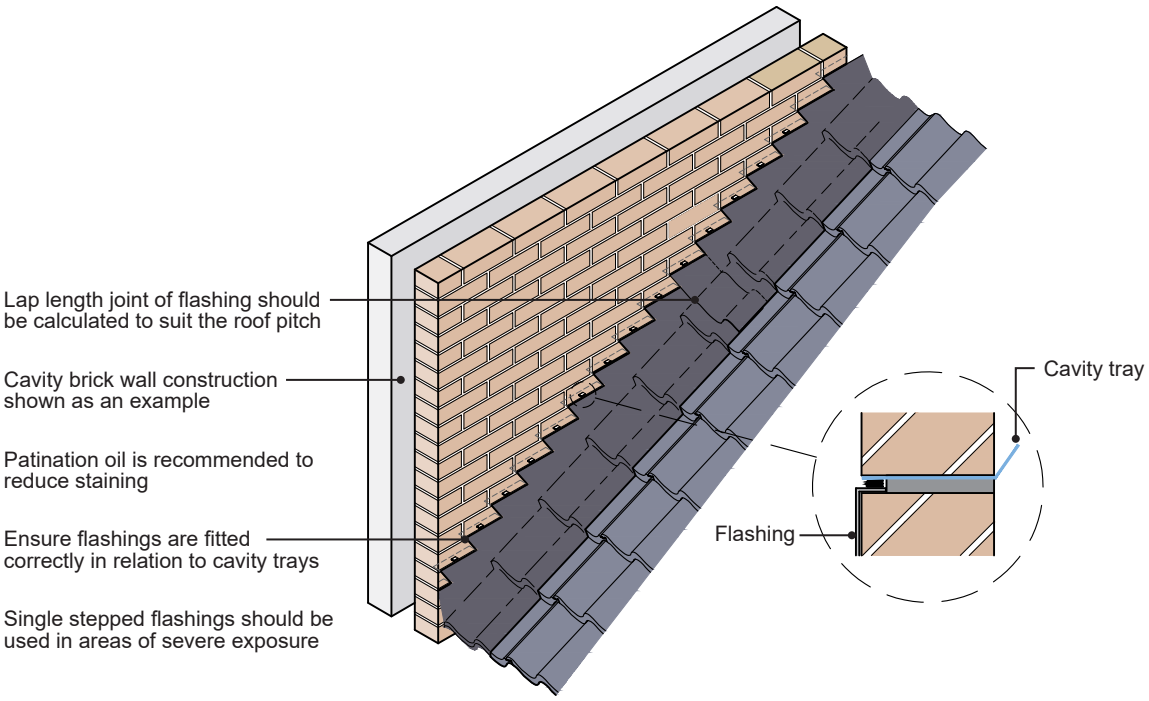


Minimum lap of the flashing with the roof covering

Pitch of roof	Cover of lead flashing on roof (mm)
30º	150mm
20º	220mm
15º	290mm
Note: 1. For pitches over 30°, a minimum lap of 150mm should be provided 2. In areas of severe/very severe exposure the vertical upstand should increase to 100mm	

Side abutment (stepped cover flashing) with concrete interlocking tiles

- Turn roofing underlay a minimum of 50mm up at the abutment.
- Finish the tiling battens as close to the abutment as possible.
- Lay the tiles to butt as close as possible to the wall.
- Cut a piece of Code 4 lead to form a combined step and cover flashing.
- Flashing should not exceed 1.5m in length, and should be 150mm-200mm in width or wide enough to cover the first roll, whichever gives the greater cover.
- Chase out brickwork mortar joints and push folds of flashing into chases; wedge in with small pieces of lead.
- Dress cover flashing as tightly as possible to tile profile.
- Re-point brickwork.
- In areas of high exposure, or when dressing lead over flat tiles, use clips to hold cover flashing in place.
- When using this type of flashing with flat tiles below 25°, increase cover of flashing over tile to 200mm.
- All free edges of flashings should be clipped to suit the exposure. Lead clips are only for use in very sheltered locations whereas all other clips should be of copper or stainless steel.



Side abutment (soakers and step flashings) with plain tiles

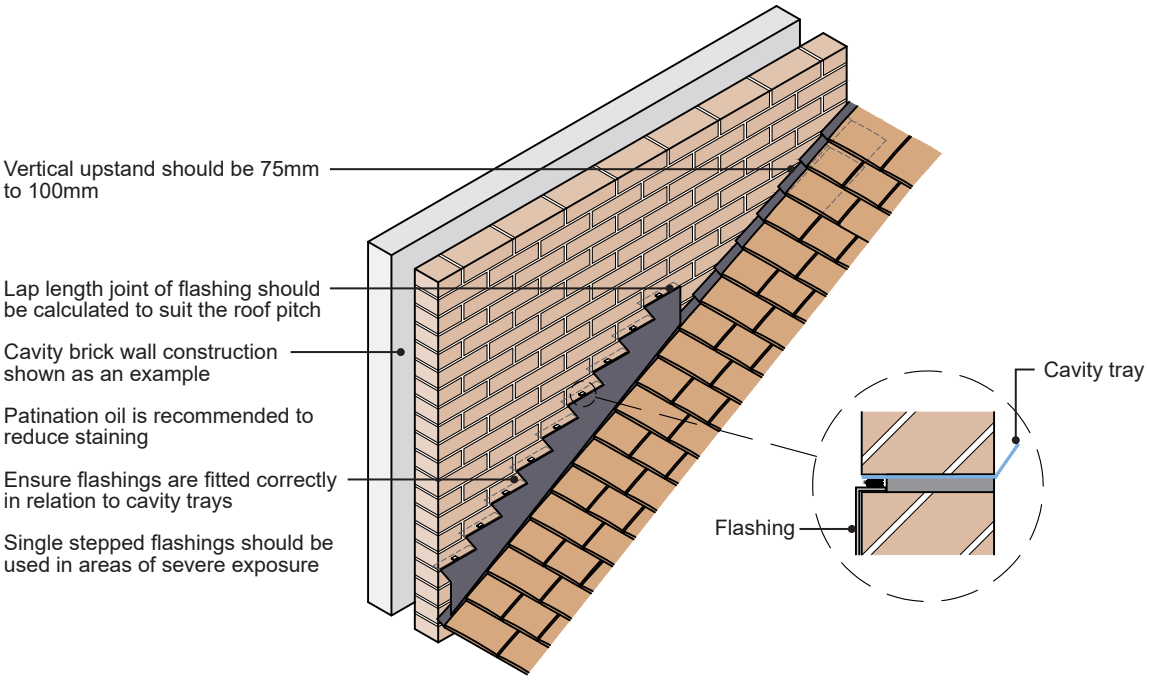
Soakers are used where double-lap plain tiles abut a wall.

- Turn underlay 50mm up the abutment and cut tiling battens 10mm-25mm short of the wall and fix securely.
- Lay tiles close to the abutment with a soaker fitted between each tile.
- Form Code 3 lead soakers with an upstand of 75mm to place against the abutment. They should be 175mm wide and 190mm long, allowing a 25mm downturn over the back of the tile. After all tiles and soakers have been fixed, insert a stepped flashing into the abutment wall and dress down over the upturned edges of the soakers.

Side abutment (step and cover flashing with soakers) with fibre cement/natural slates

- Continue the underlay across the roof and turn up the wall by a minimum of 50mm. Cut the battens 10mm-25mm short of the wall, and fix securely.
- Finish the slating with alternate courses of slates and slate-and-a-half slates, cut as necessary to maintain the bond.
- Code 3 lead soakers, with a minimum width of 175mm and length equal to gauge + lap +20mm, are to be interleaved with the slates and turned 75mm up the wall.
- The Code 4 stepped lead flashing should be secured in the brickwork bed joints with lead wedges and dressed neatly over the soakers.

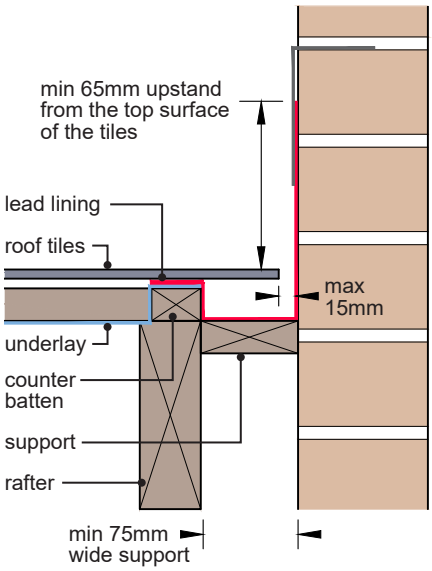
Side abutment detail with plain tiles or fibre cement/natural slates



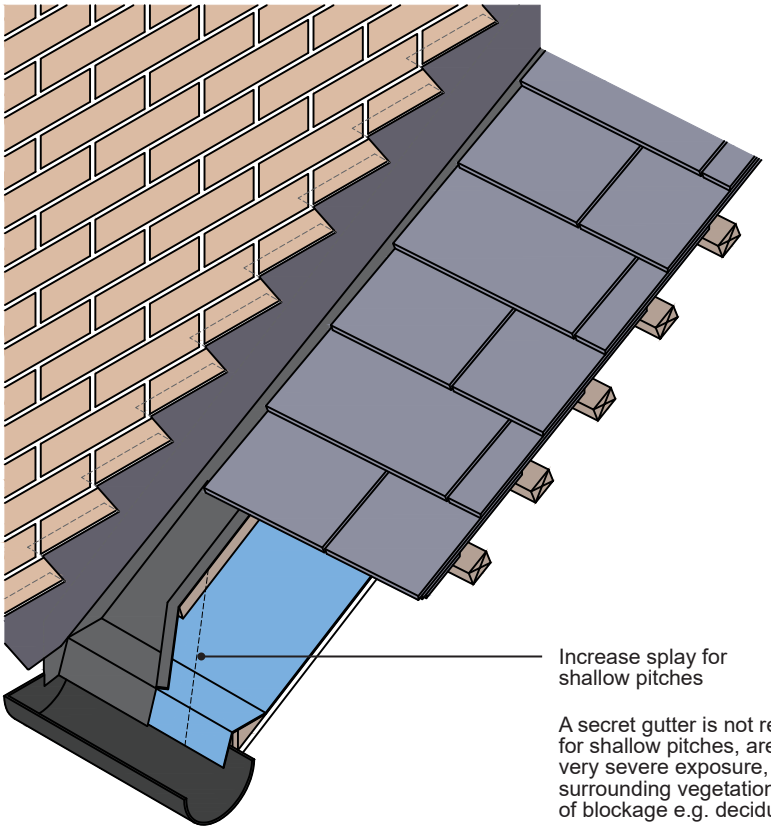
Side abutment secret gutter arrangement

A secret gutter may be formed as an alternative to a step and cover flashing when using single-lap flat interlocking tiles. Profiled tiles are not suitable for use in conjunction with a secret gutter.

- Form secret gutters before starting tiling.
- Fix a support between the last rafter and the abutment; this should be a minimum of 75mm wide and run the full length of the abutment.
- Fix a splayed timber fillet at the discharge point to raise lead lining to the right height; avoid backward falls.
- Fix a counter batten along the outer edge of rafter.
- Line gutter with Code 4 or 5 lead, in lengths of no more than 1.5m.
- Lap each strip offered over the lower one by a minimum of 150mm, and fix with copper nails at head.
- Turn up lead welts to provide a weather check and exclude birds and vermin from entering tile batten space.
- Gutter should be a minimum of 25mm deep and have a vertical upstand of no less than 65mm above the top surface of the tiles.
- Fit a stepped flashing, chased into brickwork and dressed over vertical upstand.
- Turn the roofing underlay up the side of the counter battens and butt the tiling battens up to the counter batten.
- Lay tiles to leave a gap of 15mm by the side of the abutment.
- All free edges of flashings should be clipped to suit the exposure. Lead clips are only for use in very sheltered locations whereas all other clips should be of copper or stainless steel.



Secret gutter construction for concrete interlocking tiles and slates



A secret gutter is not recommended for shallow pitches, areas of severe or very severe exposure, or areas where surrounding vegetation may cause risk of blockage e.g. deciduous trees.

Box/back gutters

Back gutters may be lead welded off-site and positioned when tiling is undertaken. A gutter should be formed where the bottom edge of tiling meets an abutment. Form the gutter before tiling, but after felting and battening is complete.

- Fix a lay board to support lead lining, with a tilting fillet, close to the abutment to flatten the pitch of the lead.
- Dress a sheet of Code 5 lead (width of abutment plus 450mm) into position with a vertical upstand of at least 100mm up the abutment.
- Dress the extra width of lead around the corner of the abutment after any side abutment weathering has been fitted.
- Dress the upper edge of lead over the tilting fillet and turn it back to form a welt.
- Chase abutment, insert a cover flashing of Code 4 lead and dress it over the vertical upstand of the gutter.

Roof protrusions

The flashings against chimney stacks, skylights and other similar projections through the roof surface should be similar to that described for abutments where appropriate.

- Make perforations for pipes, chimney stays, supports for ladders etc. weather tight by dressing over and under tiling with a lead or copper slate to which a sleeve is burned or soldered.
- Boss sleeve around pipe or stay, and seal at top with a collar.

Saddles

The following details can apply to any type of valley or hip /ridge intersection:

- Use Code 4 lead no less than 450mm square and large enough to give a lap of at least 150mm over the gutter lining on each side.
- Saddles should be capable of being readily dressed down when in position.

Clips

Clips for flashings are important in all roofing applications and where used should be fixed at 300mm-500mm centres, depending on the exposure of the building.

Clips may be formed from the following materials:

- Lead: Only suitable for sheltered locations with a thickness the same as that of the flashing it is fixing.
- Copper: Should be a minimum of 0.6mm thick, and may be thicker for very exposed locations.
- Stainless steel: Should be 22swg or 28swg thick, and is used for very exposed locations or where the fixing point is more than 75mm from the free edge of the flashing.
- Nails and screws: Copper wire nails (with jagged shanks) should be a minimum 25mm long x 10 gauge. Stainless steel annular ring shank wire nails should be a minimum 25mm long x 12 gauge. Screws should be brass or stainless steel, minimum 25mm long x 10 gauge.

11.3.9 Roof lights

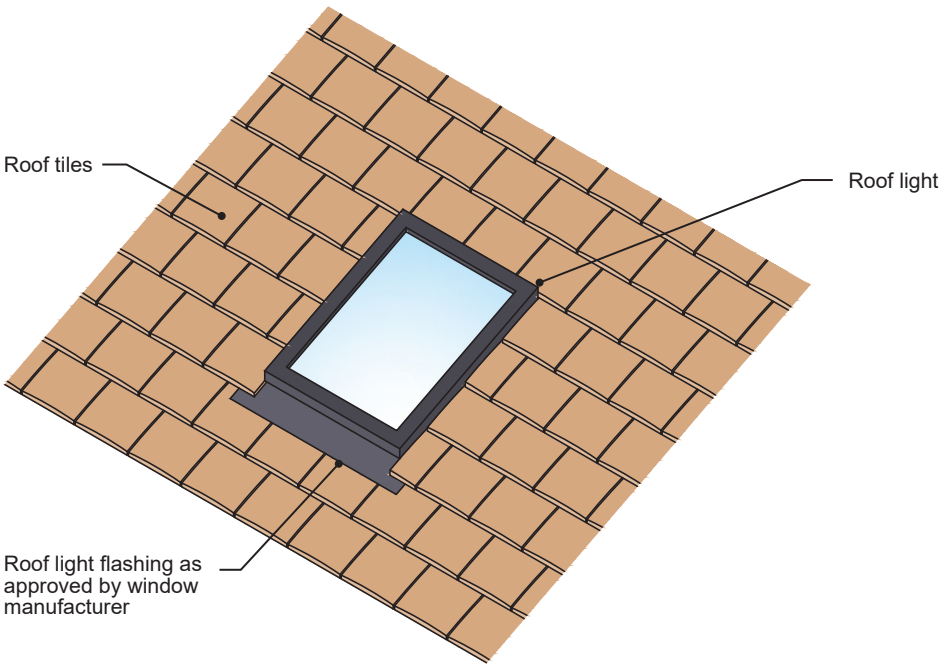
Roof lights shall:

- Be suitable for the intended purpose.
- Have an accompanying flashing kit.
- Be installed in accordance with the manufacturer's recommendations.

Most roof lights are of the 'factory manufactured' variety which should be proven to be suitable for the intended purpose. Most of these come with 'flashing kits' which should be installed in accordance with the manufacturer's instructions. If a flashing kit is not provided, the flashing should be installed following the Lead Sheet Association good practice guide.

Rainwater outlets should not be cited directly above rooflights to avoid a concentration of water discharge directly above the roof light.

Lead flashing to roof lights



11.3.10 Fire stopping and maintaining compartmentation

Where fire stopping is provided to maintain compartmentation, it shall:

- Be specified and installed to satisfy the Building Regulations.
- Be of a material which is suitable for the intended purpose with a relevant third party product conformity certificate and testing.
- Be installed in accordance with the manufacturer's recommendations.
- Have no holes or gaps for smoke to pass through once the fire stopping has been fitted.
- Be specified to take account of any movement in the building.

Compartmentation

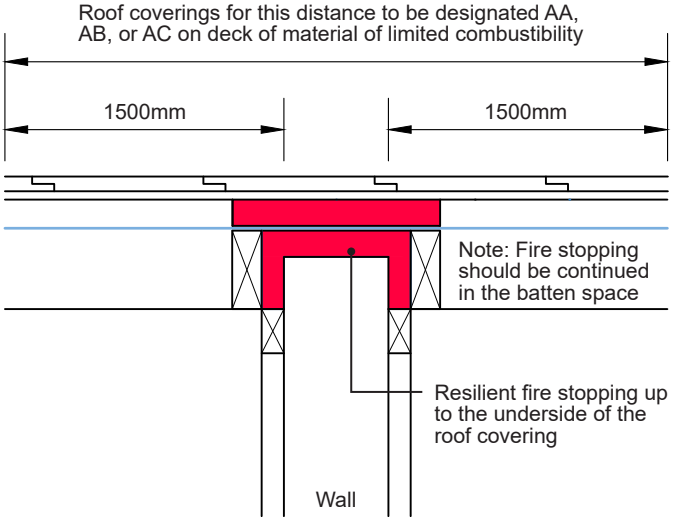
The spread of fire within a building can be restricted by sub-dividing it into compartments separated from one another by walls and/or floors of fire-resisting construction. The roof void, like most spaces within a building, can provide a route for the spread of fire and smoke. As an often-concealed space, it is particularly vital that fire-resistant cavity barriers are provided at the following points:

- At junctions of separating wall and external cavity wall.
- At junctions of compartment wall and compartment floor (not illustrated).
- At junctions of separating wall with roof, under roof tiles.
- Within boxed eaves at separating wall position.

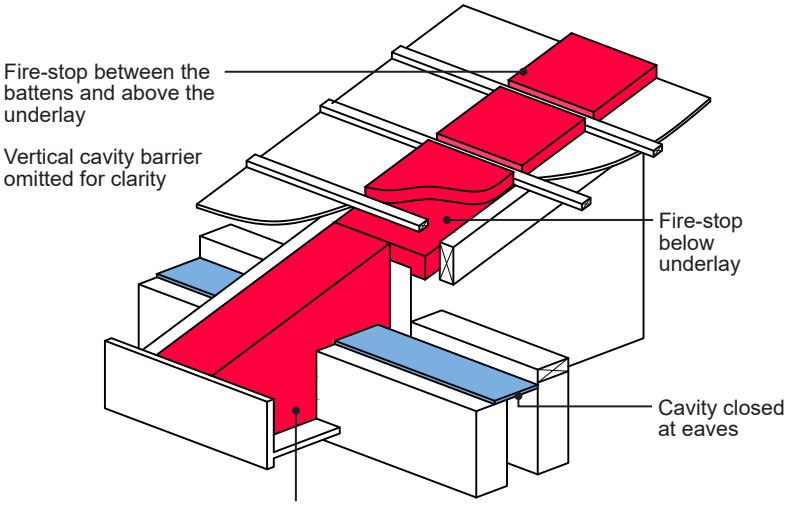
Drawings showing the lines of compartmentation and the lines of fire-resisting construction should be provided to the Surveyor and the Builder. The drawings should also give the required level of fire resistance for each element.

Junctions of compartment walls with roof

A compartment wall should be taken up to meet the underside of the roof covering or deck, with fire stopping, where necessary, at the wall/roof junction to maintain the continuity of fire resistance. The compartment wall should also be continued across any eaves cavity. If a fire penetrates a roof near a compartment wall, there is a risk that it will spread over the roof to the adjoining compartment. To reduce this risk, a roof zone 1500mm wide on either side of the wall should have a covering of designation BROOF (t4) to BS EN 13501-5 classification.



Fire stopping at roof level between party walls



Fire stopping to be provided within boxed eaves in line with the compartment wall and as per relevant Building Regulations

Fire stopping should be provided in accordance with the relevant Building Regulations

- Party/separating walls 25mm below the top of the rafter line and a soft fire-resistant packing, such as mineral wool, should be used to allow for movement in roof timbers and prevent distortion of the roof tiles.
- The fire stopping should be continuous to eaves level and provided within the boxed eaves in line with the compartment wall and as per relevant Building Regulations.