Technical Data

Slates

ARDONIT, MONTANA & FASONIT

Export

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This technical information is meant to inform you about the SVK slates and how to apply them.

Information about the bearing construction, fixing materials and other products / accessories is only informative and not binding. Always ask information from the manufacturer or the supplier of these products and follow their advice.

SVK slates must be applied in compliance with the national and/or local building regulations and guidelines. If these do not correspond with the SVK-guidelines, SVK must be contacted before construction starts.

Our product guarantee is only valid if construction is carried out conform our most recent technical data, which can be acquired by simple demand. You can also find them on our website www.svk.be.

MATERIAL DATA

1 INTRODUCTION

SVK has over 100 years of manufacturing, supply and technical expertise. As one of the biggest manufacturers of building materials in Europe, SVK offers one of the most comprehensive portfolios of fibre cement products.

Strength and durability are considered key features of SVK slates. Our slate range is an economical, authentic and easily installed alternative to the natural slate. With environmentally friendly systems and technologies in place, SVK ensures that clients are able to design and build homes aesthetically pleasing and in harmony with the local environment.

SVK fibre cement slates Ardonit, Fasonit and Montana and their fittings are manufactured in accordance with the requirements of BS EN 492.

1.1 SCOPE

Ardonit, Montana and Fasonit slates are used for roofing and cladding, all conservations must be applied in accordance with the technical date and the national standards and regulations. The guarantees and warranties given with SVK Slates are conditional upon adherence to the instructions given in the fixing manual.

1.2 COMPOSITION AND MANUFACTURE

Ardonit, Montana and Fasonit slates are small size double pressed fibre cement flat sheets, composed of Portland cement, organic fibres of superior quality, mineral additives and water. All slates are identifiable by a printed code on their backside.

1.2.1 COATED SLATES

The natural colour of the slates is grey. The front and the sides of the slates are finished with a multi-layer acrylic based coating, highly counteracting the growth of moss. In order to prevent moss growth, special moss inhibiting constituents are added to the coating. The underside of the slates is treated with a one layer coating and a colourless water-repellent layer. This finishing offers optimal protection under all weather conditions.

1.2.2 NATURAL GREY SLATES

The natural colour of the slates is grey in the mass, their surface and edges are not treated.

As the slates are not treated they are susceptible to the typical cementitious surface phenomena as shades of grey, these underline the natural character of the material. Because differences in colour nuances are possible, we suggest to order the slates for a continuous surface in one time, such to minimize the differences. Even so uniformity of the colour cannot be guaranteed. The slates are untreated, this means that there is no coating applied. Natural grey slates are not sorted out, because of this it is possible that staining, efflorescence or stains of production oil might be visible. Also the presence of small variations (inclusions) in the panel surface belongs to the normal aspect of the slates. The above mentioned phenomena cannot be considered as a shortcoming.
With time these effects will largely even out by patination.

A second possible phenomena that can occur is efflorescence. When water and cement are added together they react and form cement stone. This reaction also creates “free chalk” (calcium hydroxide). This is partially dissolved in water. The free chalk reacts with CO_2 in the air and in the presence of water calcium carbonate (efflorescence) is formed.
These phenomena are not necessarily immediately visible but might over time or after installation, become visible. Important measures to this matter are to ensure a dry, ventilated storage of the slate (is not allowed to store the slates outside, not even under a watertight canvas), always process (drill or saw) the slates dry and immediately remove the drill or sawing dust off the slates. Cement dust that is left on the slates surface attaches itself firmly in the pores and causes unwanted visual effects on the slates after their exposition to weather circumstances.

Avoid staining of the slates, wear clean gloves during processing and installing of the slates. Avoid stains of glue, silicone, polyurethane foam, etc. as these can leave irremovable stains. Do not stick labels, tape of any type of adhesive tape on the decorative surface of the slates. These can leave glue residue on the slates and could affect the decorative surface. The intensity of the efflorescence will diminish with time under influence of the weather. As this is a very slow process it is difficult to predict the total duration before the slates will get a more uniform appearance. This depends on the severity of the efflorescence and the degree of influence of the weather.

The removal of efflorescence is not easy. Therefore it is advisable to initially not take any action. However if immediate action is desired, the easiest way is to mechanically remove the efflorescence by lightly sanding the slates with an open sponge „Scotch-Brite 3M 7447“ and rinse the chalk dust away. It is possible however that slates treated this way, may again show efflorescence in the future.
SVK wishes to underline that these aesthetic phenomena in no way affect the properties of the slates. The slates comply in regards to the mechanical and physical requirements and durability with the prescriptions of the European Standard 492 “Fibre-cement slates and fittings - Product specification and test methods.”

1.2.3 ENVIRONMENTALLY FRIENDLY

SVK is aware of its environmental responsibilities. Excess production water is recycled and reused. Also waste material and cuttings are reused in production. The slates are coated with a water based coating.

1.3 PRODUCT RANGE

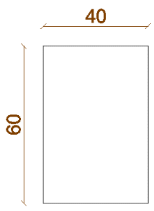
1.3.1 SLATES

SVK is entitled to remove or add colours without prior warning. The colour is measured according CieLab. The tolerance of the standard colours is: ΔE* ± 1,00.
Important: **Only slates with the same production date should be placed on the same roof/facade surface. Slates with different production dates should not be installed on the same roof/facade surfaces.**

Ardonit slates (smooth surface)

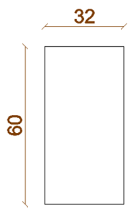
Size **60/40** cm
Production dimensions
600/400 mm

Straight edges, installed vertically.
Weight: 2,04 kg



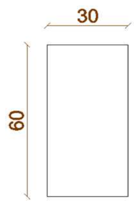
Size **60/32** cm
Production dimensions
600/320 mm

Straight edges, installed vertically.
Weight: 1,63 kg



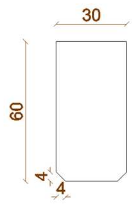
Size **60/30** cm
Production dimensions
600/300 mm

Straight edges, installed vertically.
Weight: 1,53 kg



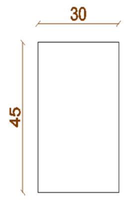
Size **60/30** cm
Production dimensions
600/300 mm

Cut/Straight edges, below, depending on desired look
Weight: 1,53 kg



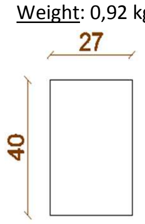
Size **45/30** cm
Production dimensions
450/300mm

Straight edges, installed vertically
Weight: 1,08 kg



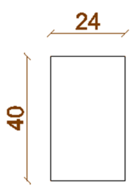
Size **40/27** cm
Production dimensions
400/270 mm

Straight edges, installed vertically.
Weight: 0,92 kg



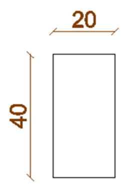
Size **40/24** cm
Production dimensions
400/240 mm

Straight edges, installed vertically.
Weight: 0,82 kg



Size **40/20** cm
Production dimensions
400/200 mm

Straight edges, installed vertically.
Weight: 0,68 kg

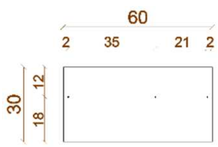


Size **30/20** cm
Production dimensions
300/200 mm

Straight edges, installed vertically.
Weight: 0,51kg

Size **60/30/5** cm
Production dimensions
600/300 mm

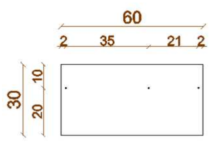
Provided with 3 holes for horizontal, double lap bond with vertical **lap of 5 cm**, for **cladding only**.
Weight: 1,53 kg



Size **60/30/9** cm
Production dimensions
600/300 mm

Provided with 3 holes for horizontal, double lap bond with vertical **lap of 9 cm**, for **roofing**.

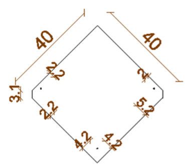
Weight: 1,53 kg



Size **40/40/5** cm
Production dimensions
400/400/31 mm

Provided with 3 holes, with **overlap 5 cm**, for **cladding only**.

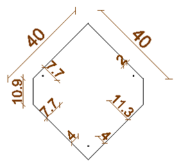
Weight: 1,33 kg



Size **40/40/10** cm
Production dimensions
400/400/109 mm

Provided with 3 **holes**, with **overlap 10 cm**, for **roofing** and **cladding**.

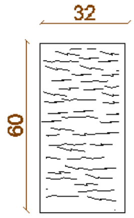
Weight: 1,31 kg



Ardonit slates (textured surface)

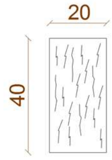
Size 60/32 cm
Production dimensions
600/320 mm

Straight corners, installed vertically.
Weight: 1,63 kg



Size 40/20 cm
Production dimensions
400/200 mm

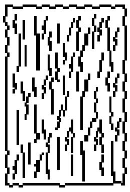
Straight corners, installed vertically.
Weight: 0,68 kg



Montana slates (dressed edges and textured surface)

Size: 60/40 cm
Production dimensions: 595/395 mm

Weight: 1,97 kg

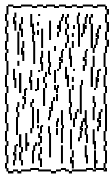


Size 60/30 cm
Production dimensions 595/295 mm

Weight: 1,48 kg

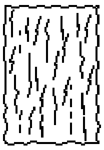
Size 45/30 cm
Production dimensions 445/295 mm

Weight: 1,04 kg



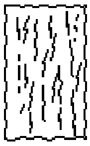
Size 40/27 cm
Production dimensions 395/265 mm

Weight: 0,89 kg



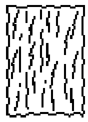
Size 40/24 cm
Production dimensions 395/235 mm

Weight: 0,79 kg



Size: 33/23,5 cm
Production dimensions 325/230 mm

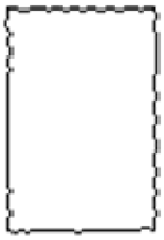
Weight: 0,66 kg



Montana slates (dressed edges and smooth surface)

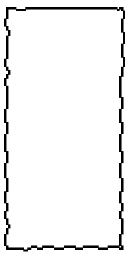
Size: 60/40 cm
Production dimensions: 595/395 mm

Weight: 1,97 kg



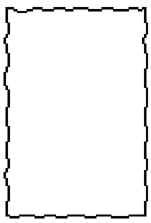
Size 60/30 cm
Production dimensions 595/295 mm

Weight: 1,48 kg



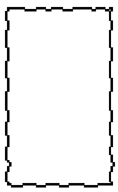
Size 45/30 cm
Production dimensions 445/295 mm

Weight: 1,04 kg



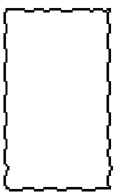
Size 40/27 cm
Production dimensions 395/265 mm

Weight: 0,89 kg



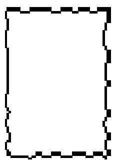
Size 40/24 cm
Production dimensions 395/235 mm

Weight: 0,79 kg



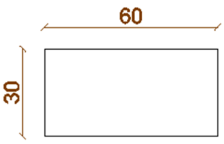
Size: 33/23,5 cm
Production dimensions 325/230 mm

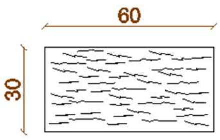
Weight: 0,66 kg

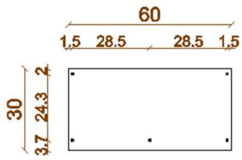


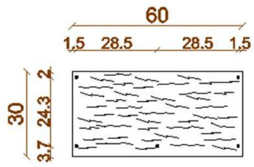
Fasonit slates (smooth or textured surface)

Size 60/30 cm	Size 60/30 cm	Size 60/30 cm	Size 60/30 cm
Production dimensions	Production dimensions	Production dimensions	Production dimensions
600/300 mm	600/300 mm	600/300 mm	600/300 mm
Vertical or horizontal, depending on the slating system.	Vertical or horizontal, depending on the slating system.		
Weight: 1,53 kg	Weight: 1,53 kg	Weight: 1,53 kg	Weight: 1,53 kg







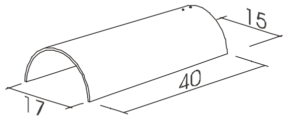


The dressed edges and the textured surface are portrayed schematically, not realistically.

The product range brochure is available from SVK.

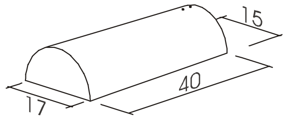
1.3.2 ACCESSORIESP

1.3.2.1 Half round ridge



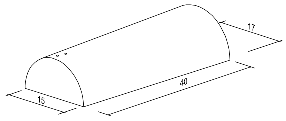
Number per m: 3,03
Effective length: 33 cm
Weight per piece: 1,420 kg
(Minimum roof pitch: 35 °)

1.3.2.2 Half round start end for half round ridge



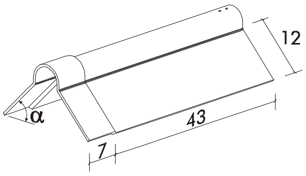
Effective length: 33 cm
Weight per piece: 1,480 kg

1.3.2.3 Half round stop end for half round ridge



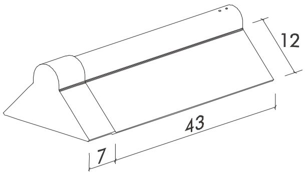
Effective length: 33 cm
Weight per piece: 1,480 kg

1.3.2.4 Roll-top ridge type A



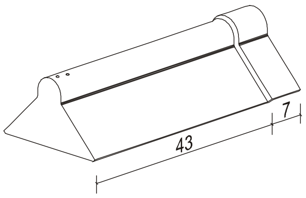
Number per m: 2,33
Effective length: 43 cm
Weight per piece: 1,820 kg
Roof pitch α: 30° (ridge angle 120°)
45° (ridge angle 90°)

1.3.2.5 Start end for roll-top ridge type A



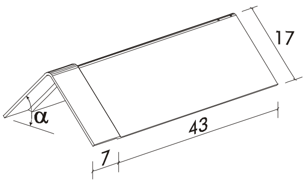
Effective length: 43 cm
Weight per piece: 1,900 kg

1.3.2.6 Stop end for roll-top ridge type A



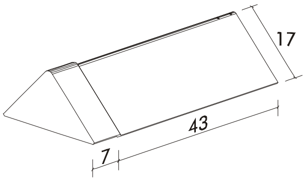
Effective length: 43 cm
Weight per piece: 1,900 kg

1.3.2.7 Plain angle ridge type B



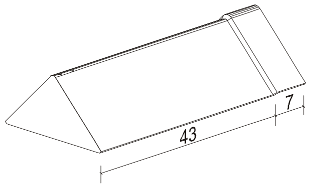
Number/m: 2,33
Effective length: 43 cm
Weight/piece: 2,0 kg
Roof pitch α: 25° (= ridge angle 130°)
30° (= ridge angle 120°)
40° (= ridge angle 100°)
45° (= ridge angle 90°)

1.3.2.8 Start end for plain angle ridge type B



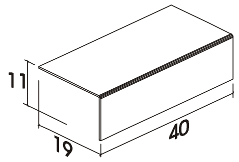
Effective length: 43 cm
Weight/piece: 2,1 kg

1.3.2.9 Stop end for plain angle ridge type B



Effective length: 43 cm
Weight/piece: 2,1 kg

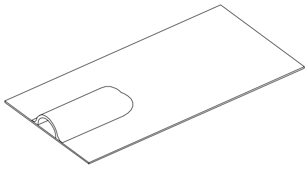
1.3.2.10 Verge slate



Weight/piece: 0,960 kg
Overlap: subject to exposition and roof pitch.
The verge slates are placed on top of the regular slates.

Overlap (cm)	Number/m
9	3,23
11	3,45
13	3,70

1.3.2.11 Fibre-cement ventilation slate

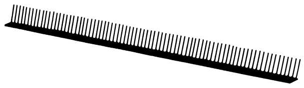


Sizes	Weight
60 x 30 cm	1,80 kg
45 x 30 cm	1,40 kg
40 x 27 cm	1,07 kg
40 x 24 cm	0,98 kg
40 x 40/10 cm	1,50 kg

Ventilation section: ca. 45 cm²

To achieve ventilation for the space below, an opening must be made in the underlying slates at the same height of the opening of the ventilation slate.

1.3.2.12 Polypropylene comb filler

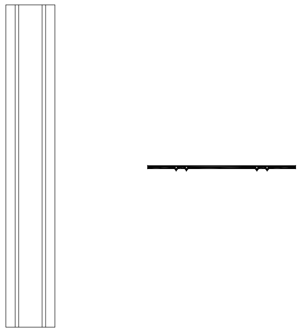


Length: 100 cm
Colour: black

1.3.2.13 Synthetic ventilation under-ridge

Length: 5 m/roll
Width: 22 cm - halfround ridge (see § 1.3.2.1)
30 cm - ridge type A (see § 1.3.2.4)
- ridge type B (see § 1.3.2.7)
Ventilation section: 160 cm²/m
Colour: black

1.3.2.14 Polyethylene for joints



Length: 30 cm
Width: 5 cm
(for horizontal, single lap)

1.3.2.15 Slate nail

1.3.2.16 Slate nail – crenelated

1.3.2.17 Disc rivet

1.3.2.18 Ridge clip

1.3.2.19 Drive hook

1.3.2.20 Drive hook with hump

1.3.2.21 Wrap hook

1.3.2.22 Wrap hook with hump

1.3.2.23 Drive hook type crosinus

The drive and wrap hooks are available in the following materials: copper, stainless steel and black stainless steel.

1.4 PRODUCT QUALITY

1.4.1 MECHANICAL AND PHYSICAL CHARACTERISTICS

Dimensions		Tolerances
Length	200 – 600 mm	± 3 mm
Width	200 – 600 mm	± 3 mm
Thickness	4 mm	- 0,4 mm / + 1,0 mm
Squareness	≤ 2 mm	≤ 2 mm

Mechanical characteristics		Standard
Bending moment		EN 492
$h \leq 350$ mm	30 Nm/m	
$350 < h \leq 450$ mm	40 Nm/m	
$450 < h \leq 600$ mm	45 Nm/m	
Elasticity modulus (wet)	ca. 16.000 N/mm²	
Thermal linear expansion coefficient α	$7{,}5 \times 10^{-6}$ m/mK	

Durability		
Water impermeabilty	No water drops	EN 492
Wet-dry cycles	L ≥ 0,75	
Warm water	L ≥ 0,75	
Frost-thaw cycles	L ≥ 0,75	
Warm-rain cycles	OK	

Reaction to fire		
Class	A2-s1, d0	EN 13501-1

Physical characteristics		
Density (ovendry)	ρ ≥ 1.700 kg/m³	
Weight (at moisture content: 12%)	8 kg/m²	
Coefficient of heat conductivity: λ	0,72 W/mK	
Water uptake (coated slates)	< 4% (weight)	
Paint adhesion	Class 0	DIN EN ISO 2409

1.4.2 QUALITY CERTIFICATES

0749

BB - 212 - 683 - 492 - 01

CSTB
84 avenue Jean Jaurès -
Champs sur Marne
F-77447 Marne-la-Vallée

Ardoises en fibres ciment
http://evaluation.cstb.fr

K24136

<u>Note</u>:
From here onwards we always mention “slates”, when referring to the whole slate range of “Ardonit, Montana and Fasonit”, unless otherwise mentioned.

1.4.3 WARRANTY

SVK warrants its slates and accessories in fibre cement insofar as the storage, treatment, construction and maintenance of the SVK slates and accessories take place in accordance with the rules and the guidelines of our most recent applicable technical specifications, all of which under normal atmospheric conditions and conditions of use.
The warranty conditions which must be met in order for the warranty to be fully applicable, are mentioned in the warranty statement. This statement is available on request.

2 DESIGN CRITERIA

2.1 RAIN AND SNOW RESISTANCE

SVK slates are one of the most watertight roof coverings available and offer a full protection from water ingress under normal conditions.
In unfavourable weather conditions however, water penetration through the slates is sometimes unavoidable.
It is essential to avoid/minimise the risk of water ingress by careful design, detailing and workmanship, attuned to the local exposure conditions.

The roof of a building should be designed and constructed in a way that prevents any moisture infiltration to the fabric or the inside of the building. Any water ingress through the slates, in prolonged periods of wind-driven rain or other exceptional weather circumstances, must be evacuated from the building by a high quality underlay.
It is important that the exposure to local wind-driven rain of the site of construction is assessed and the local norms to be respected.

2.2 SAFETY

To lay a roof is a hazardous activity and statutory legislation applies to all types of roofing work. Particular attention is drawn to the Code of Practice for safety in Roof work and all other legislation setting out the duties of owners, employers and employees in relation to the construction and maintenance of buildings. Owners, designers, building contractors and roofers should ascertain the latest legislation in force at the time of building.
Under no circumstance is it allowed to walk directly on the slates. Where access is required, ladders or crawl boards should be used.

2.3 TRANSPORT AND STORAGE

Slates and accessories should be transported, unloaded and handled with care to avoid damage, soiling or breakage.

The slates are bundled in small packs and delivered on pallets, wrapped in shrink foil.
This wrapping only prevents the slates from sliding during transport, it does not offer adequate protection against weather circumstances. Covered transport is therefore obligatory.

Store the slates on a dry, firm and level surface, in a covered and thoroughly ventilated area safe from all traffic, in warehouse as well as on the building site. Maximum stack height for storage is 4 pallets.

In case there is no possibility to store the slates in a covered area on site, the shrink foil has to be removed or partially opened and the pallets must be covered at all times by a watertight but vapour permeable tarpaulin. Condensation and rainwater ingress between stacked slates must absolutely be prevented, to avoid efflorescence.
In case of storage for a prolonged period we strongly advise to partially open up the shrink film, even in case of storage under cover, to prevent condensation under the foil, and thus efflorescence.

Remainders of a pallet of slates, that will not be used shortly, are stocked as described above, either vertically on two battens or horizontally on a level and perfectly dry surface.
When transporting and manipulating building materials, the legislation concerning lifting and hoisting must be respected at all times.

Underlays, battens and counter-battens, accessories and all other materials needed for the roofing work must be stored in accordance with the local regulations and the product storage prescriptions.
Avoid staining and wear gloves when handling the slates. Avoid stains of glue, silicone, polyurethane foam, adhesive tape, render as these can leave irremovable stains.

2.4 CUTTING AND DRILLING SLATES

2.4.1 GENERAL

When cutting slates, measures to reduce the effect of dust should be taken in accordance with the relevant local legislation. After cutting or drilling, avoid drilling and cutting dust sediment on the slate surface. In case there is dust on the slates, it should be removed immediately by means of a soft, dry and pure micro-fibre cloth or a soft brush, before the slates are processed any further, exposed to rain or restacked. Cement dust that is left on the slates surface causes unwanted visual effects on the slates after their exposition to weather circumstances.

2.4.2 CUTTING

SVK slates can be cut in different ways:

- Score the face of the slate with a scribing tool and snap over a straight edge.
- Cut with a slate guillotine. Place the slate face side up, because the guillotine produces a chamfered cut edge.
- Use a hand slate cutter.
- It is not recommended to use angle grinders, because of their high dust production levels.
- To cut large quantities of slates, use a bench saw with diamond dusted blade and provide dust extraction.
- Remove cutting dust immediately from the slates.

2.4.3 DRILLING

When required to drill holes, up to maximum ten slates can be stacked and holes be drilled with a 4.5 mm sharpened steel drill bit, suitable for fibre-cement. It is also possible to punch additional holes. Remove drilling dust immediately from the slates.

2.5 FIXINGS

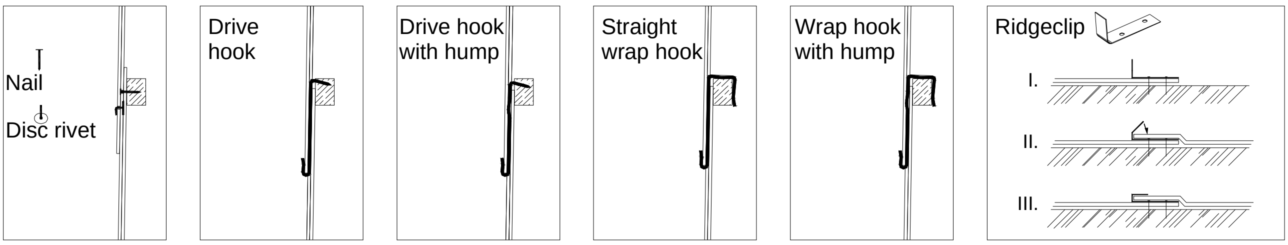
The exposure conditions, the roof pitch and the height of the building determine the requirements for the fixing of the slates. Local rules and norms must be respected. In case of contradiction between the local rules and these technical data, please contact SVK prior to installation.

2.5.1 GENERAL

The fixing materials have to be made out of corrosion-resistant material such as copper, stainless or galvanised steel.
The type of slate, the kind of roof structure and the slating method used determines the nature and number of the fixings.
In general, the slates are fixed with two nails and a disc headed copper rivet. The rivet holds together the tail, on the centre-line of each slate, to the two slates in the course below, through the gap between them.
The nails must comply with BS EN 1202-2 and 3. The nail shank should be **not less than 2,65 mm** and the length should be approximately 30 mm so a **penetration of at least 15 mm** into the batten is provided.
Use disc rivets with stem of minimum 19 mm long and diameter less than 2 mm. The disc base of the disc rivet should be formed of 0,5 mm thick copper sheet and have a diameter of minimum 19 mm. Use appropriate disc rivets to obtain sufficient uplift resistance. Disc rivets are bent downwards; not too tight, so some movement of the slate is still possible.
The exposure conditions, the roof pitch and the height of the building determine the requirements for the fixing of the slates.
The number of applicable Fixings can be found in the chapter about slating systems (see § 3).
Some remarks:

- building height ≤ 12 m;
- in the edge areas or the areas surrounding roof punctures, all slates within 1 m have to be fastened with at least 2 nails.

The Fixings and other metal accessories, that are used for Fixing and finishing, must be made from a metal that is compatible with the slates and accessories.



2.5.2 FIXING METHODS

2.5.2.1 Centre-nailing

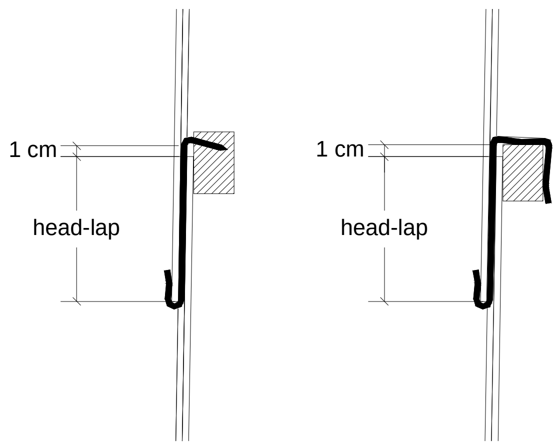
The slates are fixed with two nails close to the side edge (20 mm to the inner edge of the nail hole) of the slate and positioned immediately above the head of the slates below.

- When nailing the slates the holes are pre-pinned with a diameter greater than the slating nail.
- It's better to use crenelated nails than the normal slating nails because of a higher outpull-resistance.
- 1 slate should be fixed with minimum 2 nails.
- Slates for vertical work need to be centre-nailed.
- Undereaves slates and ridge (top course) slates should be head nailed only.

2.5.2.2 Hook-fixing

Though this is not customary in every country, this fixing method is a very good alternative to the nail fixing of slates.
When applying hook fixing:

- The hooks must never be pushed in order to counteract as much as possible capillary action and creep.
- When using a wrap hook, take the thickness of the batten into account. The use of wrap hooks is not recommended.
- Crimped hooks should be used at pitches of 30° or less.
- Length of the hook = head-lap + 1 cm.
- The drive or wrap hooks are only used on facade or roof pitches of 70° and up. On lower roof pitches the hump on the hook will widen the fine channels, which reduces the capillary action greatly (see § 2.6.1).
- The hook shank diameter should be greater than 2.5 mm and smaller than the minimum slate thickness.



2.5.2.3 Copper tail rivet fixing

The copper tail rivet is positioned in the centre of the slate, close to the leading edge, so the top slate is clamped to the two lower slates. It is slid up in the gap between the lower slates and goes through a pre punched hole in the top slate. The pin is bent over to lock the slates and the rivet together. The the gap between the slates should not be wider than 5 mm, when a rivet with a base diameter of 19mm is used. This makes that up to 8mm of the disc lays under each of the lower slates. If the slates are laid with a gap greater than 5mm, there is a risk that the rivet will be pulled through the gap during strong winds. The rivet pin has to be sufficiently long, so it can be bent over far enough at right angles onto the top surface of the top slate.

2.5.3 COMPLEMENTARY PRODUCTS

2.5.3.1 Fixing accessories

All fixing accessories, used at junctions or finishings, must be of a material that is compatible with the fibre cement slates and their fixings. Avoid staining, corrosion or other reactions, leading to damage.

2.5.3.2 Dry roofing products - Mortar mix.

Try to avoid mortar mix. SVK strongly advises to use dry roofing products and systems instead. Use systems offering a proven resistance to wind load, driving rain and durability.
If however mortar mix is used, plasticizing admixtures must be added, in accordance to the advice of their manufacturer.
Wherever problems occur, which could be caused by the fact that the mortar fixing prevents the normal working of the fibre cement roofs or accessories under weather circumstances, SVK guarantee cannot be invoked.

2.5.3.3 Flashings, junctions and projections

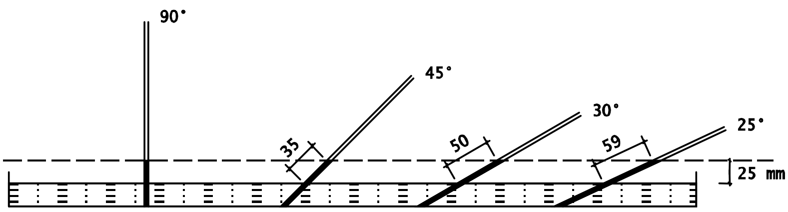
Flashings and junctions must be detailed to prevent the entry of rainwater.
We refer to the manuals of the technical manuals of the manufacturers or Product Federations.
The integrity of the underlay as a barrier to wind and water ingress should be maintained around all projections.

2.6 COVERING

The waterproofness of a slate roof depends on several factors, of which the most important ones are capillarity, weather conditions, length of the roof side (from gutter to ridge) and roof pitch.
These factors together determine the slate head-lap.

2.6.1 CAPILLARITY

Capillarity is the phenomenon where when two plates are pressed firmly together, fluid will rise between them.
The harder the slates are pressed against each other, the higher the rain will rise between them. The maximum gauge difference between the slates is 25 mm, and this regardless of the fact that they are placed perpendicular or sloping.



The actual rise between the slates varies depending on the inclination they are given. It rises if the roof pitch shrinks. Driving rain and dust building between the slates strengthen the capillary effect.

The drawing above shows that the smaller the inclination the bigger the head-lap needs to be. To minimise the risk of water infiltration by capillary action, we advise to use hooks instead of nails for fixing slates, because with hook fixing the slates are less close-fitting.

2.6.2 WEATHER CONDITIONS

When a roof surface is strongly exposed to the predominant winds, the wind will try to hold up the water that flows down at the bottom edge of the slates and then propel it underneath. In dry weather dust is blown between the slates and in the joints. These factors influence the capillary process greatly. The measure in which a roof is protected or exposed to heavy wind and rain can only be determined at the site (see 2.1), taking into account several factors:

- screening by surrounding buildings;
- hilly or plane landscape;
- sea or mountain region.

2.6.3 LENGTH OF THE ROOF SLOPE

Since all the rain falling on the roof flows towards the gutter, the amount of water increases on the lower part of the roof. The longer the slope, the more water accumulates at the bottom part of the roof slope. Our technical data are valid for all roof slopes with a length - measured by horizontal projection - of max. 6 metres.
The maximum rafter length to which the recommendations for minimum roof pitch, head-laps and side-laps apply, is:

Maximum rafter length = $\frac{6\ meter}{cosine\ (angle\ of\ roof\ pitch)}$

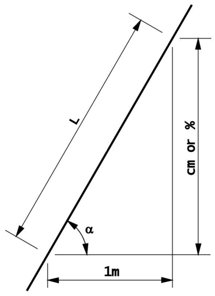
In all other cases, an evaluation of the specific situation is needed and the appropriate measures must be taken (increasing the head-lap or making other provisions).

2.6.4 ROOF PITCH

When discussing the capillarity (see § 2.6.1) it was demonstrated that the actual rise of the capillary water grew as the inclination shrank. The smaller the inclination, the more the actual roof length approaches the horizontal projection. Moreover the speed at which the water flows down the roof gets slower when the roof has a fainter inclination. The flowing off takes longer which makes the water layer even thicker. Add to that the fact that with smaller inclinations the side lap, and consequently the width of the slate, start playing a bigger role, it is without a doubt clear that for the watertightness of a slate roof the roof pitch is a very important factor. Consequently with lower roof pitches a bigger head-lap is necessary to guarantee the watertightness.

The minimum pitch is dependent on the roofing system used (see § 3).
he roof pitch can be represented in 2 ways:

- in degrees;
- in cm per meter (or %).



Comparison degrees – percentages:

α (degrees)	%	Length of roof surface L per meter horizontal projection	α (degrees)	%	Length of roof surface L per meter horizontal projection
25	47	1.103	51	123	1.589
26	49	1.113	52	128	1.624
27	51	1.122	53	133	1.662
28	53	1.133	54	138	1.701
29	55	1.143	55	143	1.743
30	58	1.155	56	148	1.788
31	60	1.167	57	154	1.836
32	62	1.179	58	160	1.887
33	65	1.192	59	166	1.942
34	67	1.206	60	173	2.000
35	70	1.221	61	180	2.063
36	73	1.236	62	188	2.130
37	75	1.252	63	196	2.203
38	78	1.269	64	205	2.281
39	81	1.287	65	214	2.366
40	84	1.305	66	225	2.459
41	87	1.325	67	236	2.559
42	90	1.346	68	248	2.669
43	93	1.367	69	261	2.790
44	97	1.390	70	275	2.924
45	100	1.414	75	373	3.864
46	104	1.440	80	567	5.759
47	107	1.466	85	1.143	11.474
48	111	1.494	90	-	-
49	115	1.524			
50	119	1.556			

The roof pitches in this manual are pitches **measured on the slates**. This pitch is slightly inferior to the pitch of the rafters.

If the pitch is measured on the rafters, a correction factor has to be deducted.

Correction factors for a slope, measured in degrees, are:

- lap 90 mm: 0.90 °
- lap 100 mm: 0.92 °
- lap 110 mm: 0.94 °

2.7 MAINTENANCE

Just like any other roofing material, slates are subject to pollution and ageing. In time dust and atmospheric pollution sedimentation appear on the roofing. Moss is also hard to prevent and it does not depend on the type of roofing; moss can attach itself to any kind of material.

Even though there is a moss-inhibiting component in the coating of the slates, external factors play a large part in the roof becoming green or not. It actually aren't the slates that become green, it's the dust and the dirt on the slates that is an excellent soil for moss and algae.

Pay attention to safety during these works, national standards and local regulations must be followed.

2.7.1 CAUSE OF THE POLLUTION

The intensity of the moss development is highly dependable on:

- Roof orientation
  - Mosses mainly develop on the parts of the roof that are exposed to little or no sunshine, such as the roof surfaces facing north or those that are permanently lying in the shadow.

- Ventilation between underlay and slates
  - Good ventilation ensures that the roof covering remains damp less long. Mosses and algae develop on the sand and dust particles that attach themselves easiest to a wet surface. A good ventilation between the underlay and the slates contributes significantly to the roof surface drying up more quickly and consequently slows down moss development.

- The presence of trees and plants in the immediate environment
  - The presence of trees and plants in the vicinity naturally has a negative effect.

- Acid rain
  - The acid rain forms an acid environment on the roof in which moss and algae thrive.

The slates becoming green has no effect whatsoever on the quality of the slates. But to ensure the appearance, the life span and watertightness of the roof, the standards and prescriptions recommend regular maintenance.
This can be done by a firm specialised in cleaning roofs. If you want to do it yourself, there are chemical products on the market to clean the roof surface.

2.7.2 METHOD

2.7.2.1 Mechanical cleaning

The moss is removed by brushing the roof with a hard, but not a metal, bristle. Be sure not to scratch the surface of the materials as dust particles adhere themselves quicker on a rough surface, which aids moss development.
Finally the roof surface is thoroughly rinsed. Be sure to prevent dust and moss from ending up in the rainwater-well.

A second possibility is the cleaning of the roof with a high-pressure washer. These works are preferably carried out by a specialised firm because of the risks it holds.

2.7.2.2 Chemical cleaning

When the roof is fully dried out, a good moss detergent is applied that penetrates the material sufficiently to destroy all moss and algae buds.

Depending on the product used it may be necessary to, after sufficient absorption of the product, remove the remaining pieces of moss from the roof by bristling or rinsing. Detach the drains to prevent these moss remains and the applied product from entering the water drainage system.

Products that might affect the slates, their coating or the metal parts used for roofing (nails, disc rivets, hooks, gutters, etc.) are not to be used.

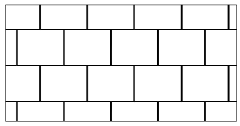
3 SLATING SYSTEMS

The guidelines shown below are general and may not comply with local regulation. In case of contractions SVK should be contacted prior to installation.

3.1 VERTICAL DOUBLE-LAP (ROOF - FACADE)

3.1.1 PRINCIPLE

Vertical, double-lap slating is the common way of working and is suitable for all rectangular slates. The slates are laid in broken bond. Double-lap means that each row of slates is partly covered by the two rows above. The head-lap is the distance by which the upper course of slates provides a lap with the next but one course below.

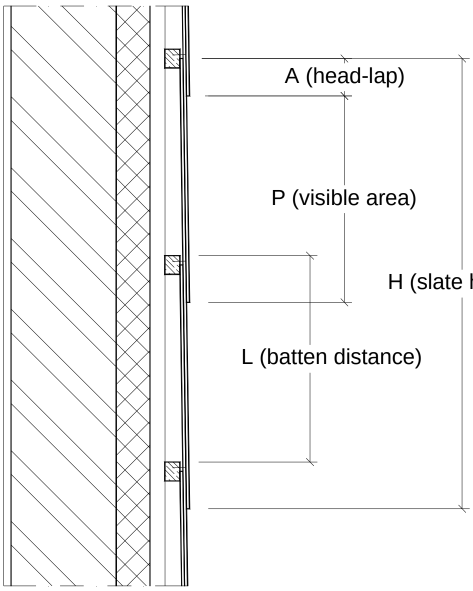


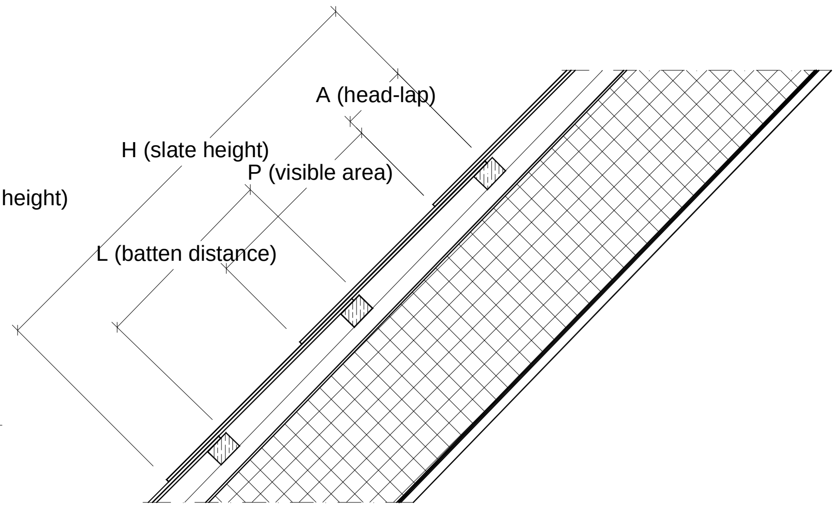
This way, each slate can be divided into three areas (see figure below):

- visible area;
- single lap area;
- double-lap area (= head-lap).

The double covered part is called the head-lap. The height of each of the two other parts equals the batten distance and is determined as following:

$$L(batten\ distance) = \frac{H(slate\ height) - A(headlap)}{2} = P(visible\ area) = single\ lap\ area$$





FACADE CLADDING

ROOF COVERING

The minimum head-lap is determined in function of the roof pitch and the exposure of the roof.

3.1.2 MINIMUM HEAD-LAP – ROOF PITCH

SVK double lap slates can be laid on roofs with a pitch greater than or equal to 25°.
Due to capillary action roofs with a lower slope cannot be guaranteed. Moreover, the lower the pitch, the more head-lap one has to provide to obtain a watertight covering.

Roof pitch α (°)	Minimum head-lap (mm)	
	Minimum head-lap under moderate exposure	**Minimum head-lap under severe exposure**
α ≥ 70°	50	50
70° > 35°	90 underlay advised	100 underlay advised
30° ≤ α < 35°	100 underlay strongly advised	110 underlay strongly advised
25° ≤ α < 30°	110 underlay obligatory	110 superior quality underlay obligatory

If the prescriptions for head-laps and minimum roof pitch are not respected, the SVK product guarantee is nullified.
For pitches lower than 25° please contact SVK.

The above recommendations are valid for normal and severe exposure. Any area where abnormal weather conditions can be expected (heavy snowfalls and/or severe exposure to wind-driven rain) special precautions may have to be taken to ensure watertightness of the roof structure.

In order to obtain a watertight roof covering, the following ratio between dimensions and laps must be respected with full size as well as with cut slates (wherever possible):

- The width of the slate is minimum twice the head-lap.
- The height of the slate is minimum three times the head-lap.
- The side-lap is minimum equal to the head-lap.

3.1.3 FIXING

- Slates greater than 40 x 20 cm are fixed with 2 nails and have a disc rivet at the tail.
- Hooks should not be used for pitches less than 25°.
- Crimped hooks should be used at pitches of 30° or less.

With façade cladding (> 70°) wrap hooks are recommended instead of drive hooks. For large façades (height > 5 m) wrap hooks are strongly recommended. The wrap hook needs to be adjusted to the thickness of the batten + the thickness of one slate.

With drive and wrap hooks the hooks are placed 1 cm higher than the top edge of the slates. This means that the hooks are 1 cm longer than the vertical lap. It is advisable to only use stainless steel hooks.

Nails should be fixing in the middle of the battens.

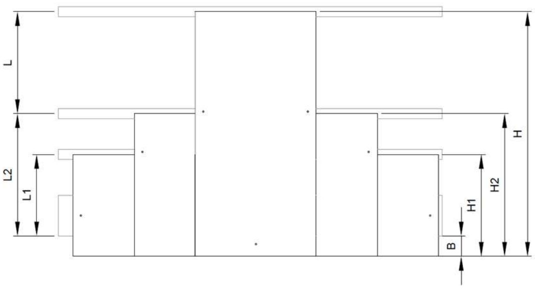
3.1.4 NUMBER AND DIMENSIONS

Size [cm]	Head-lap A [cm]	Appx. batten gauge L [cm] – Ardonit & Fasonit	Appx. batten gauge L [cm] – Montana	Appx. pieces per m² – Ardonit & Fasonit	Appx. pieces per m² – Montana	Appx. weight [kg/m²] – Ardonit en Fasonit	Appx. weight [kg/m²] – Montana
60 x 40	5	27,5	-	9,00	-	18,36	-
	9	25,5	-	9,71	-	19,8	-
	11	24,5	-	10,1	-	20,61	-
	13	23,5	-	10,53	-	21,49	-
60 x 32	5	27,5	-	11,22	-	17,60	-
	9	25,5	-	12,10	-	18,98	-
	11	24,5	-	12,60	-	19,75	-
	13	23,5	-	13,13	-	20,59	-
60 x 30	5	27,5	27,25	11,96	12,27	18,30	18,12
	9	25,5	25,25	12,9	13,25	19,74	19,55
	11	24,5	24,25	13,43	13,79	20,54	20,36
	13	23,5	23,25	14,00	14,38	21,42	21,23
45 x 30	5	20,0	19,75	16,45	16,93	17,74	17,62
	9	18,0	17,75	18,28	18,84	19,71	19,61
	11	17,0	16,75	19,35	19,97	20,87	20,78
	13	16,0	15,75	20,56	21,23	22,18	22,10
40 x 27	5	17,5	17,25	20,86	21,55	19,14	19,09
	9	15,5	15,25	23,55	24,38	21,62	21,59
	11	14,5	14,25	25,17	26,09	23,11	23,10
	13	13,5	13,25	27,04	28,06	24,82	24,85
40 x 24	5	17,5	17,25	23,42	24,26	19,11	19,09
	9	15,5	15,25	26,44	27,44	21,58	21,60
	11	14,5	14,25	28,26	29,36	23,06	23,11
40 x 20	5	17,5	-	28,01	-	19,05	-
	9	15,5	-	31,63	-	21,51	-

The numbers are calculated with a **perpendicular joint of 4 mm.**

3.1.5 DIMENSIONS OF THE BOTTOM SLATES AND THE POSITION OF THE BOTTOM ROW BATTENS

The height of the first row of slates, 1st under-eaves course: $H_1 = L$
The height of the second row of slates, 2nd under-eaves course: $H_2 = L + A$
The bottom slates are fixed with 2 nails.
Batten distances are calculated as following:
$L_1 = L - B$ & $L_2 = L + A - B$
A = head-lap
B = overhang of the bottom slates past the lowest batten (max. 5 cm)
L = batten gauge centre-to-centre, depending on slate height H and head-lap A



Height slate H [cm]	Head-lap A [cm]	Ardonit & Fasonit – L [cm]	Ardonit & Fasonit – H_1 [cm]	Ardonit & Fasonit – H_2 [cm]	Ardonit & Fasonit – L_1 [cm] (B = p. ex. 5 cm)	Ardonit & Fasonit – L_2 [cm] (B = p. ex. 5 cm)	Montana – L [cm]	Montana – H_1 [cm]	Montana – H_2 [cm]	Montana – L_1 [cm] (B = p. ex. 5 cm)	Montana – L_2 [cm] (B = p. ex. 5 cm)
60	5	27,5	27,5	32,5	22,5	27,5	27,25	27,25	32,25	22,25	27,25
	9	25,5	25,5	34,5	20,5	29,5	25,25	25,25	34,25	20,25	29,25
	10	25,0	25,0	35,0	20,0	30,0	24,75	24,75	34,75	19,75	29,75
	11	24,5	24,5	35,5	19,5	30,5	24,25	24,25	35,25	19,25	30,25
45	5	20,0	20,0	25,0	15,0	20,0	19,75	19,75	24,75	14,75	19,75
	9	18,0	18,0	27,0	13,0	22,0	17,75	17,75	26,75	12,75	21,75
	10	17,5	17,5	27,5	12,5	22,5	17,25	17,25	27,25	12,25	22,25
	11	17,0	17,0	28,0	12,0	23,0	16,75	16,75	27,75	11,75	22,75
40	5	17,5	17,5	22,5	12,5	17,5	17,25	17,25	22,25	12,25	17,25
	9	15,5	15,5	24,5	10,5	19,5	15,25	15,25	24,25	10,25	19,25
	10	15,0	15,0	25,0	10,0	20,0	14,75	14,75	24,75	9,75	19,75
	11	14,5	14,5	25,5	9,5	20,5	14,25	14,25	25,25	9,25	20,25

The numbers are calculated with a **perpendicular joint of 4 mm.**

3.2 HORIZONTAL DOUBLE-LAP (ROOF - FACADE)

3.2.1 PRINCIPLE

This method is a variation to the double-lap method. The rectangular slates are placed horizontally here.
This method can be applied for both **facade cladding** and **roofing** in normal situations.

The minimum pitch is 27.5°, measured on the slate.

The recommendations apply for rafter lengths of maximum 9m in driving rain exposure of less than 56.5 l/m² per spell and 6 m in driving rain exposures of 56.5 l/m² per spell or more.

The recommendations for laps given below might not be adequate for roof pitches of **30° or less**:

- for driving rain exposure of less than 56.5 l/m² per spell, for rafter lengths greater than 9m;
- for driving rain exposure of 56.5 l/m² per spell or greater, for rafter lengths greater than 6m.

In this case the placement of a sub-roof and/or intermediate gutters should be considered.

The minimum slate width is determined by several factors: the slate length, the head-lap, the roof pitch, the driving rain exposure and the distance from the side edge of the slate to the inner nail hole. Calculation needs to be done according to BS 5534.

3.2.2 MINIMUM HEAD-LAP – ROOF PITCH

- The minimum vertical head-lap [A] in mm (according to BS 5534) for following roof pitches is:

Roof pitch [°]	Minimum head-lap [cm]	
	Moderate exposure	**Severe exposure**
27.5 - 30	10	**11**
30 - 75	10	10
≥ 75	5	5

3.2.3 FIXING

The slate 60x30 or bigger is fixed with 3 jagged nails. Smaller sizes are fixed with 2 jagged nails.
For the position of the middle fixing, one should take the driving wind direction into account. The slates need to be pre-pinned (position of the holes, see drawings in table § 0).

3.2.4 DIMENSIONS OF THE BOTTOM SLATES AND THE POSITION OF THE BOTTOM ROW BATTENS

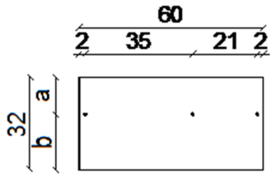
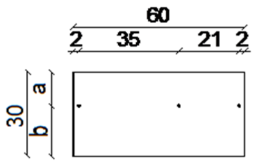
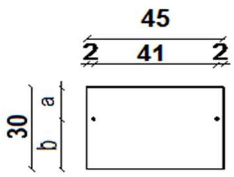
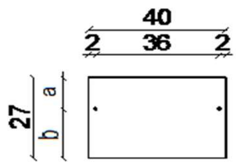
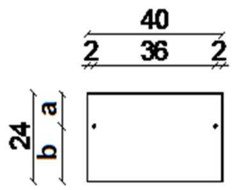
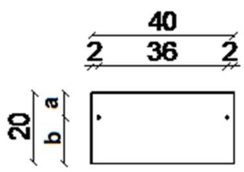
The height of the first row of slates, also called 1st under-eaves course: $H_1 = L + A - 2.5\ cm$
The height of the second row of slates, also called 2nd under-eaves course: $H_2 = L + A$
The bottom slates are fixed with 3 nails.
Batten distances are calculated as following:
$L_1 = L + A - (B + 1\ cm)$ & $L_2 = H - B$

A = head-lap
B = overhang of the bottom slates past the lowest batten (max. 5 cm)
L = batten gauge centre-to-centre, depending on slate height H and head-lap A

Height slate H [cm]	Head-lap A [cm]	Ardonit & Fasonit				
		L [cm]	H_1 [cm]	H_2 [cm]	L_1 [cm] (B = p. ex. 5cm)	L_2 [cm] (B = p. ex. 5cm)
32	5	13.5	16.0	18.5	12.5	27.0
	10	11.0	18.5	21.0	15.0	27.0
	11	10.5	19.0	21.5	15.5	27.0
30	5	12.5	15.0	17.5	11.5	25.0
	10	10.0	17.5	20.0	14.0	25.0
	11	9.5	18.0	20.5	14.5	25.0
27	5	11.0	13.5	16.0	10.0	22.0
	10	8.5	16.0	18.5	12.5	22.0
	11	8.0	16.5	19.0	13.0	22.0
24	5	9.5	12.0	14.5	8.5	19.0
	10	7.0	14.5	17.0	11.0	19.0
	11	6.5	15.0	17.5	11.5	19.0
20	5	7.5	10.0	12.5	6.5	15.0
	10	5.0	12.5	15.0	9.0	15.0
	11	4.5	13.0	15.5	9.5	15.0

The numbers are calculated with a **perpendicular joint of 4 mm.**

3.2.5 NUMBER AND DIMENSIONS

Size	Head-lap [cm]	a ; b [mm]	Visible area BxH [cm]	Batten distance [cm]	Amount [st/m²]	Weight [kg/m²]	Battens [lm/m²]
60x32  Holes to be pre-drilled on site.	5	a=13,0; b=19,0	60x13,5	13,5	12,26	19,98	7,4
	6	a=12,5; b=19,5	60x13,0	13,0	12,74	20,77	7,7
	7	a=12,0; b=20,0	60x12,5	12,5	13,25	21,60	8,0
	8	a=11,5; b=20,5	60x12,0	12,0	13,80	22,49	8,3
	9	a=11,0; b= 21,0	60x11,5	11,5	14,40	23,47	8,7
	10	a=10,5; b=21,5	60x11,0	11,0	15,05	24,53	9,1
	11	a=10,0; b=22.0	60x10,5	10,5	15,87	25.87	9,5
60x30  Ardonit pre-holed on stock.	5	a=12,0; b=18,0	60x12,5	12,5	13,25	20,27	8,0
	6	a=11,5; b=18,5	60x12,0	12,0	13,8	21,11	8,3
	7	a=11,0; b= 19,0	60x11,5	11,5	14,4	22,03	8,7
	8	a=10,5; b=19,5	60x11,0	11,0	15,1	23,10	9,1
	9	a=10,0; b=20,0	60x10,5	10,5	15,8	24,17	9,5
	10	a= 9,5 ; b=20,5	60x10,0	10,0	16,6	25,40	10,0
45x30  Holes to be pre-drilled on site.	5	a=12,0; b=18,0	45x12,5	12,5	17,62	19,03	8,0
	6	a=11,5; b=18,5	45x12,0	12,0	18,36	19,83	8,3
	7	a=11,0; b= 19,0	45x11,5	11,5	19,15	20,68	8,7
	8	a=10,5; b=19,5	45x11,0	11,0	20,02	21,62	9,1
	9	a=10,0; b=20,0	45x10,5	10,5	20,98	22,66	9,5
	10	a= 9,5 ; b=20,5	45x10,0	10,0	22,03	23,79	10,0
40x27  Holes to be pre-drilled on site.	5	a=10,5; b=16,5	40x11,0	11,0	22,5	20,70	9,1
	6	a=10,0; b=17,0	40x10,5	10,5	23,6	21,71	9,5
	7	a=9,5 ; b=17,5	40x10,0	10,0	24,8	22,82	10,0
	8	a=9,0 ; b=18,0	40x9,5	9,5	26,1	24,01	10,5
	9	a=9,5 ; b=18,5	40x9,0	9,0	27,5	25,30	11,1
40x24  Holes to be pre-drilled on site.	5	a=9,0 ; b=15,0	40x9,5	9,5	26,06	21,37	10,5
	6	a=8,5 ; b=15,5	40x9,0	9,0	27,5	22,55	11,1
	7	a=8,0 ; b=16,0	40x8,5	8,5	29,1	23,86	11,7
	8	a=7,5 ; b=16,5	40x8,0	8,0	30,9	25,34	12,5
40x20  Holes to be pre-drilled on site.	5	a=7,0 ; b=13,0	40x7,5	7,5	33,0	22,44	13,3
	6	a=6,5 ; b=13,5	40x7,0	7,0	35,4	24,07	14,3

The numbers are calculated with a **perpendicular joint of 4 mm**.

3.3 DIAMOND COVERING (ROOF-FAÇADE)

3.3.1 PRINCIPLE

Diamond slates are square slates, 40x40cm format, where 2 opposing corners are cut parallel to each other. The specified overlap **A** is measured perpendicular to the side of the slate. In reality, the actual overlap is bigger as this is determined by the direction of the flow of the run-off water thus perpendicular to the battens.
Since the diamond covering is a single-lap covering, the allowed field of application is limited. The diamond covering is less suitable for roof surfaces with severe weather exposure or roofs on high buildings.

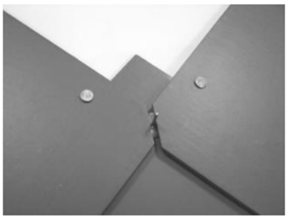
3.3.2 MINIMUM HEAD-LAP – ROOF PITCH

Minimum roof pitch	**Moderate Exposure** **<56,5 l/m² per spell** **rafter length ≤ 9m**	**Severe Exposure** **≥56,5 l/m² per spell** **rafter length ≤ 6m**
40/40/5	70°	70°
40/40/10	31°	39°
40/40 Standard	50°	54°

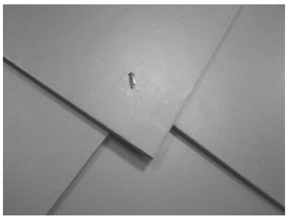
A watertight underlay is required.
The overlap for roof covering with diamond slates is 8,4 / 10cm, depending on the format, 5cm for façade cladding, measured perpendicular to the side of the slate.

3.3.3 FIXATION

40/40/10 2 nails + one disc rivet
40/40/5 2 nails + one disc rivet



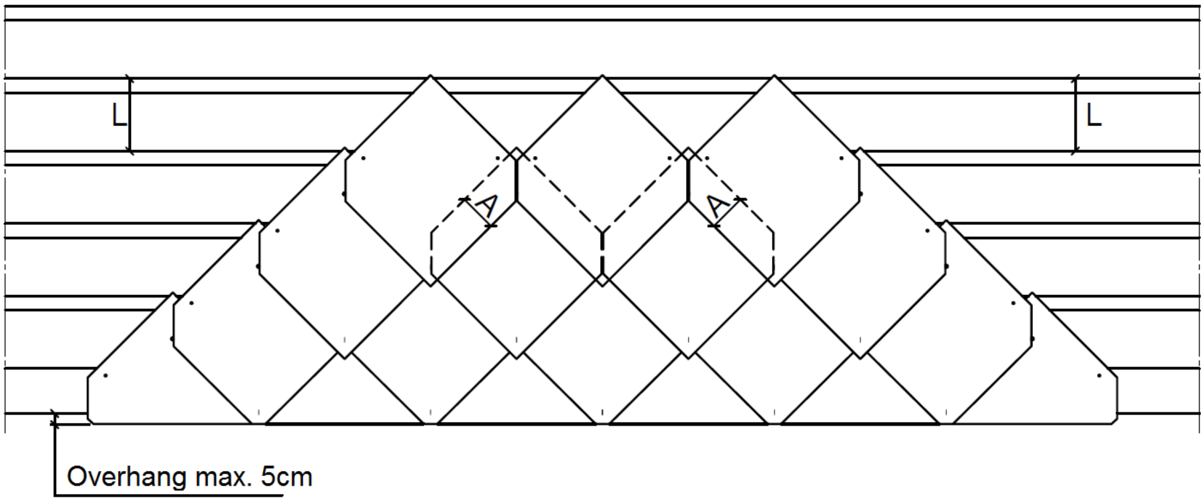
Placing of the disc rivet in the joint in-between 2 slates



Placing of the next slate over the disc rivet and bending of the disc rivet, not to strong so that movement of the slate is still possible

Slates cut to size are used in the lowest 2 rows where dependent from the cut of the 'foot slates" extra nails may be required.
To support the slates at the edges of the roof or façade, extra battens might be required in between the normal battens.

3.3.4 NUMBER AND DIMENSIONS



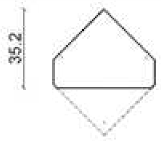
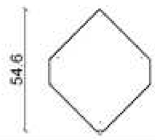
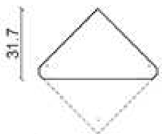
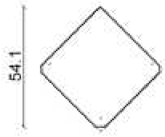
Slate Type in cm	40/40/5	40/40/10
Number of pieces/m²	8,2	11,2
Overlap A in cm	5,0	10,0
Weight kg/m²	11,0	14,7
Batten distance in cm	22,6	19,4
Amount of battens m/m²	4,4	5,2

The numbers per m² are calculated with a perpendicular joint of **4 mm**.

* Width of battens = 50mm

3.3.5 DIMENSIONS FOOT SLATES

The above given drawing is the most common start of a roof or façade. This is finished with slates cut to size as given below:

	First row of slates (foot slates)	Second row of slates
40/40/10		
40/40/5		

Dimensions in cm for an overhang of 5cm.

3.4 OTHER SLATING SYSTEMS

For other slating systems, SVK advice should be sought.

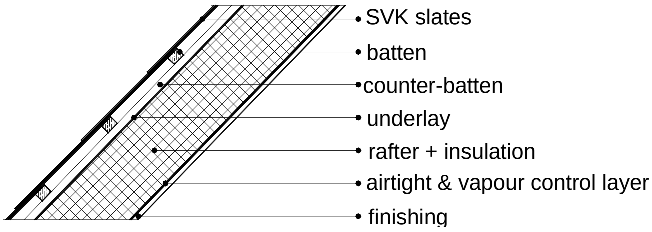
4 CONSTRUCTION

4.1 ROOFING COMPONENTS

In this section SVK does not necessarily give complete information on all the different components and their properties. For further information we refer to the local standards, which have to be respected at all times.

To allow a high quality and aesthetic slating, it is important that the roof structure is adequately designed and executed, according the valid Code of Practice and all other building regulations.

VENTILATION UNDER SLATES



4.1.1 ROOF STRUCTURE

The roof structure must be professionally designed so it can bear the roof covering and all extra loads (wind, snow …) acting on it, respecting the admissible deformations and tensions in the materials.
It is advisable to bear in mind the slate dimensions when drafting the roof plan, in order to avoid unnecessary cutting of slates and to prevent that small pieces of slate have to be used.

4.1.2 ROOFING UNDERLAY

Because the roof covering itself cannot offer a complete protection from water and dust, it is strongly advised, and often necessary, to install a watertight underlay which evacuates all moisture out of the building structure.
This underlay also provides a barrier to minimise the effects of the wind load acting on the slates.

Always use a high quality underlay, with a high resistance and stiffness against wind uploads and all other forces. Use a damp open underlay, with good moisture absorption properties.
Install it carefully, in order to avoid any risk of contact with the underside of the slates, even in the worst conditions.

We refer to the local regulations for more information on the underlay.

4.1.3 COUNTER-BATTENS

For accepted timber species, permissible defects and characteristics, we refer to the local norms.

Counter-battens are fully supported, they must have a depth of min. 22 mm, their width is equal to that of the supporting rafter; they are fixed through the underlay into the rafter.
The counter-battens create a space underneath the battens, which makes sure that any water ingress, retained by the underlay, is evacuated out of the roof structure and that the moisture content of the battens is minimised. They also provide the necessary gap for ventilation above the underlay. See § 4.3.1.1
The fixings of both battens and counter-battens must penetrate deep enough in the roof structure to provide adequate withdrawal resistance of the fixing.

In cases of vertical slating, the battens and counter-battens usually are fixed to a solid wall. Use fixing devices with a proven adequate pullout resistance. Nail type, length and diameter: see local regulations.

4.1.4 BATTENS

Battens should have adequate strength to support the dead load, the imposed load and the wind load on the roof. They must have adequate stiffness to satisfy the requirements of alignments and to avoid excessive bounce or spring when fixing slates. Use planed, straight battens of equal thickness. A perfectly level surface of the supporting frame for the slates is required to obtain an even and level finished roof surface.

The quality of the timber must be adequate, local regulations need to be respected.

The section of the battens must be sufficient to prevent any splitting and any penetration of the underlay by the slate fixings.
Battens must have a length of min. 1200 mm and must be supported at their ends and at least one intermediate support. Butt joints over intermediate supports must be staggered, cantilevering or splicing of battens between supports is not permitted.

Sizes for timber battens:

Rafter centres*	Nominal [mm] width x depth	Minimum [mm] width x depth
≤ 400 mm 400 mm < d ≤ 600 mm	50 x 25 50 x 36	47 x 22 47 x 35

* absolute dimensions
Rafter centres exceeding 600 mm are not allowed.

4.1.5 PRESERVATIVE TREATMENT

Impregnation of the timber used for battens and counter-battens should be considered where they are at risk from attack by wood-rotting fungi, see local regulations.

4.1.6 INSULATION, AIR AND VAPOUR TIGHTNESS

4.1.6.1 Insulation

These days it is very common to insulate the roofspace. Insulation thicknesses keep increasing and, as a consequence, the temperature differences between the insulated and non-insulated areas of roof constructions are bigger.
This has led to an increased risk of condensation in the cold roof spaces.

In many countries, the space between insulation and underlay is often ventilated, whilst the space between underlay and slates is not. To minimise the risk of condensation, an airtight layer or more often a vapour control layer on the warm side of the insulation is indispensable.

Whether an airtight layer is sufficient or a vapour control layer must be placed depends on whether the construction is a cold roof (large ventilated space between insulation and underlay) or a warm roof (limited space between insulation and underlay, often not adequately ventilated). It also depends on the moisture content of the air in the building. Each situation has to be assessed individually.

SVK strongly advises to use a vapour permeable underlay and to ventilate the gap between underlay and slates. The area between insulation and underlay is not ventilated. This way there is less risk of condensation.

<u>**Control of internal pressure**</u>:
Roofs, particularly of buildings under construction, can be susceptible to damage arising from wind induced pressure A substantially impermeable ceiling of adequate resistance to internal pressure helps to reduce the internal wind-induced pressure transmitted to the roofing underlay and roof covering. Normal ceiling constructions in houses, when executed and having sufficient dead weight, or mechanical fastening resisting the pressure involved, offer adequate protection.

4.1.7 WHY IS IT BETTER TO VENTILATE ABOVE THE UNDERLAY

All air contains water vapour. The colder the air, the less water vapour it can contain. When the air is saturated, the vapour condenses. This can happen within a structure or system (interstitial condensation) but more often on the colder surfaces.
It is very important to prevent hot air – often containing a lot of moisture – from entering the roof area and passing through the insulation layer, by applying a perfectly airtight and often also water vapour tight barrier on the 'warm' side of the insulation.
If this barrier is not provided or badly placed, condensation within the roof space leads to a high moisture content of the insulation layer, or worse, to timber rot or damage to other materials.
In any case, when placing the airtight, respectively vapour control layer, special attention is needed at joints and edges, joints are to be sealed and all gaps or other apertures are to be avoided.

The underlay itself provides a second airtight (but water vapour permeable!) layer. See to it that the joints and apertures are sealed. This way the risk of condensation is minimised.

4.1.7.1 Realisation of ventilation above the underlay

The counter-battens create the necessary gap for ventilation between the underlay and the slates.
See to it that this gap is at least 22 mm and is uninterrupted from eaves to ridge.
Ventilation is realised by an air inlet at the eaves, and an air outlet at the ridge, each having a minimum section of 1/2000 of the roof surface.

Information on methods available to control excessive condensation, including ventilation, is also given in the Irish Building Regulations, Technical Guidance Document F, Ventilation.

In chapter 4.3 we will give not only the roofing details for constructions ventilated conform the Irish Code of Practice, but also the alternative detailing of eaves and ridge finishing for roofs that are ventilated above the underlay

4.2 SLATE FIXING METHOD

Before starting work, the area to be slated should be checked, to ensure that all preparatory work has been executed to standard and nothing will hamper the quality of the roofing work.

The roof is to be set out carefully, to ensure that a minimum cutting of slates is necessary. Especially try to avoid using small parts of slates. No slate less than half the width of a full slate should be used under any circumstances as this would compromise the side lap.

4.2.1 SETTING OUT OF THE BATTENS AND COUNTER-BATTENS

The prescriptions of the local regulations must be respected.

The underlay is to be laid according to the manufacturers prescriptions.
To start with, counter-battens are placed, coinciding with the rafters / trusses. They are fixed at max. centres of 300 mm. See § 4.1.3 for more information.

Then the roof is to be set out with battens. The battens are fixed, in straight lines, to the appropriate gauge (batten distance) – see § 4.1.4.
The battens are parallel with the ridge (or at right angles to the line of drainage). Alternate the joints in the battens, no more than one joint in four consecutive battens should be on the same support.
Set out the battens, remembering to allow eaves slates to overhang the gutter to ensure water discharge into the gutter.
The overhang is the lesser of:

- 45 to 50 mm
- the centre of the gutter.

We advise to fix a vertical batten at the roof verge and at intersections.

4.2.2 LOADING-OUT ON ROOF

Load-out SVK slates on the roof safely to avoid slippage and distribute them evenly to prevent overloading of the roof structure.

4.2.3 SVK SLATE FIXING METHODE

Important: **Only slates with the same production date should be placed on the same roof surface. Slates with different production dates should be installed on different roof surfaces to minimize colour differences**.

1. Set out both under-eaves battens as shown in figure A. Their gauge is determined by the under-eaves slate length following the correct laps, as given in the table below.

2. The first under-eaves course is cut and head-nailed to the eaves batten (see figure B). The length of the first under-eaves course is equal to the gauge. The length of the second under-eaves course is equal to the gauge plus the head-lap, the slates are center nailed through site drilled holes to the eaves batten. This first under-eaves course supports the crampions and stiffens the eaves.

   The sum of the lengths of both under-eaves courses is equivalent to the full slate length, so both can be obtained by cutting a full-length slate into two unequal lengths.
   The tails of both under-eaves courses and the first full slate should be aligned.

   Length of under-eaves fibre-cement slate courses (dimensions in cm):

Slate Size	Lap	1st under-eaves slate length (A)	2nd under-eaves slate length (B)
60 x 30	11	24.5	35.5
60 x 30	10	25.0	35.0
60 x 30	9	25.5	34.5

3. Fix the slates for the second under-eaves course to the lower of the two under-eaves battens. Use an SVK slate-and-a-half width at the verge, to obtain a broken bond over the first course. Prior to fixing this, drill an extra hole, half a slate width in from the verge and 30 mm up, to allow for the copper crampion that will fix the first full slate course, see figure C.

4. Fix the first course of full size SVK slates. At the verge, an additional hole is drilled 50 mm from the outside edge of the slate, and 30 mm plus gauge from the bottom edge, see figure D. This hole is required for the extra copper crampion in the next course.

5. Each slate of the first full size row is now fixed with
   - two nails, firmly driven into the batten. The hole in the slates is larger than the nail diameter to allow working.
   - the slates must always be centre-nailed;
   - a crampion placed between the edges of the two lower slates. The shaft of the crampion projects through the hole in the tail of the appropriate slate in the next course and is bent down the roof slope to secure the tail of the slate, not too tight however, to allow the working of the slates.

6. At the verge, every second course a slate-and-a-half width slate is used. Drill 3 nail holes in the slate on the batten line for nailing, and two additional holes for the copper disc rivets, see figure E.

7. Proceed (see figure F) as described above to cover the whole roof area.
For the remaining courses, a third copper crampion hole is required in the slate-and-a half slates, to accommodate the crampion for the next single width verge slate. Drill this hole half the single slate width from the side and 30 mm + gauge from the bottom edge (or tail).

8. Trim to verges, hips, valley and ridges as necessary.

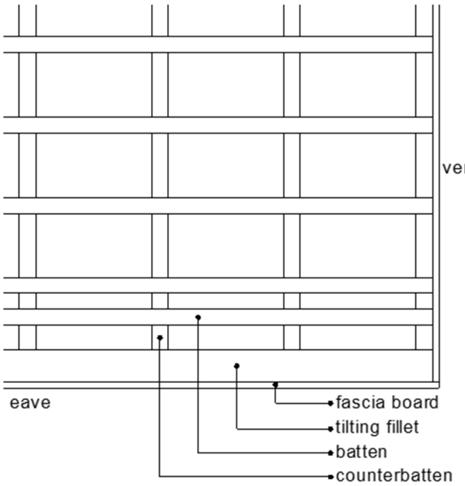


Fig A - Batten configuration at eaves

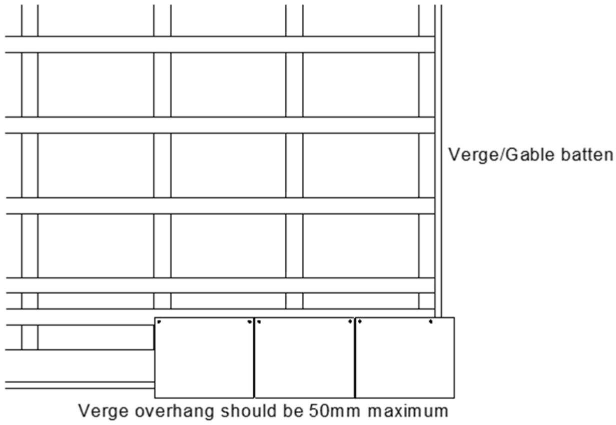


Fig B - Eaves - 1st under eaves course

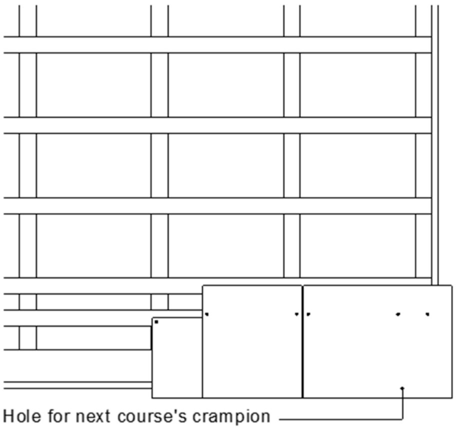


Fig C - Eaves - 2nd under eaves course

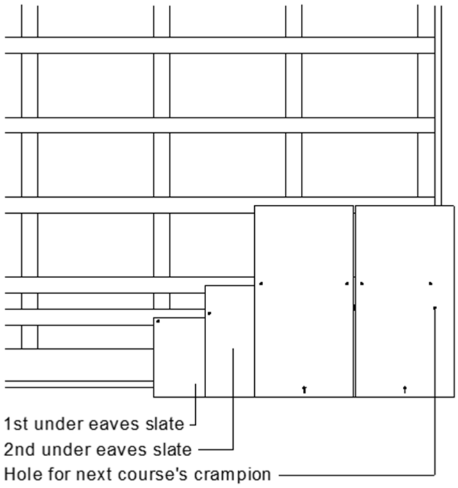


Fig D - Eaves - 1st course of standard eaves

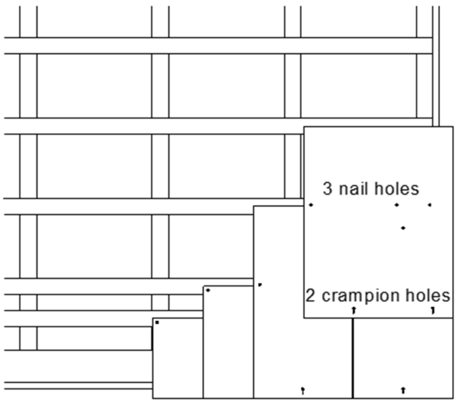


Fig E - Verge - using slate-and-a-half to break bond

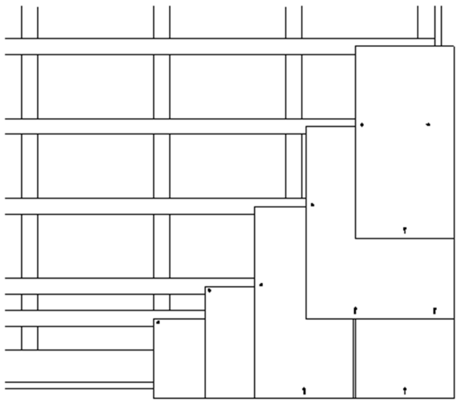


Fig F

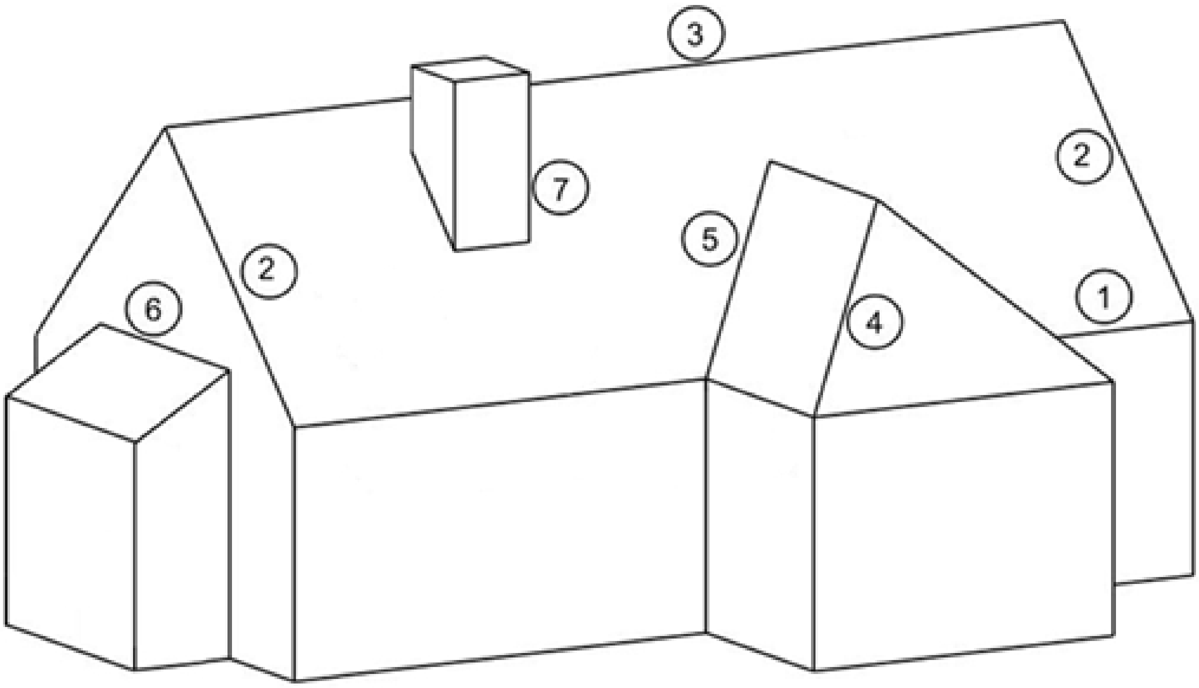
4.3 PRINCIPAL PARTS OF A ROOF

Apart from the detailing given in this chapter, other situations may require a specific execution, which is not treated here.
In case of doubt, do not hesitate to ask for advice from our Technical Department.

In any case, a number of basic rules must always be respected:

- The gap created by the counter-battens must guide any water ingress to the bottom of the roof. See to it that this space is always kept free.
- Take all necessary measures to obtain a watertight roof.
- See to it that the dividing layer between the inside of the building and the roof area is airtight and, if necessary, an effective water vapour barrier is applied (even when this is not visible in the detail).
- Insulation must be applied continuously, avoiding thermal bridges (to keep the details clear insulation may in some places be omitted from the drawings).

Wherever possible, we advise to use proprietary dry roofing products and systems to guarantee watertightness of the different roof details. Only where these are unavailable do we advise to use other materials (e.g. zinc, lead, etc.).



1. eaves (see § 4.3.1)
2. verges (see § 4.3.2)
3. ridges (see § 4.3.2)
4. hips (see § 4.3.4)
5. valleys (see § 4.3.5)
6. abutments (see § 4.3.6)
7. chimneys (see § 4.3.6.4)

Except when otherwise stated, all roofing details are given for a ventilated roof covering (ventilation above the underlay).

4.3.1 EAVES

The Building Regulations require the ventilation of roofs to avoid condensation. For roof pitches 25 – 35 degrees the requirement is for the equivalent to a continuous 10mm opening at the eaves for standard roofs, and for non-standard the equivalent of a continuous 5mm opening.

To ensure the long term performance and functionality of the roof, three courses of fibre cement slates are laid at all eaves. The dimensions of the typical under-eaves slates can be found in the table below.

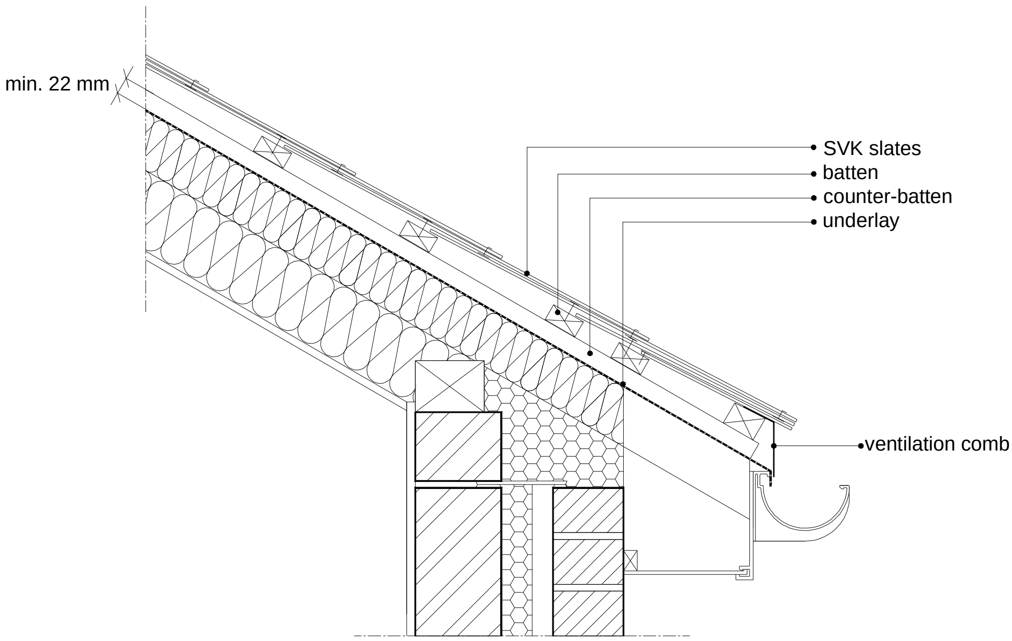
Format [mm]	Laps [mm]	1st under eaves slate Length A [mm]	2nd under eaves slate Length B [mm]
600x300	90	255	345
600x300	100	250	350
600x300	110	245	355

4.3.1.1 Ventilation above the underlay

We strongly advise to use ventilation above the underlay. The counter-battens provide an uninterrupted gap so the evacuation of the infiltrated water into the gutter and the section ventilation inlet at the eaves are guaranteed.
The bottom batten is 4 mm thicker than the other battens, to obtain the same pitch of the slates over the whole roof surface. It is strongly advisable to put a comb filler at the eaves, this avoids blockage of the ventilation gap by dry leaves, bird nests, etc.

The recommended overhang for:

- a 100 mm wide gutter is 45 to 55 mm, measured horizontally from the fascia, tilting fillet or wall face.
- gutters of different widths should be taken to the center-line of the gutter or 45 to 55 mm, whichever is the lesser.



4.3.2 VERGES

Verges may be straight or raked. The undercloak should be bedded in mortar when laid on brickwork or masonry.

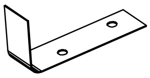
Verges, being situated at the edge of a roof surface, are exposed to high and turbulent wind loads. Therefore they must be adequately secured against lifting.
See § 4.3.2 for laying and fixing the slates at the verge.

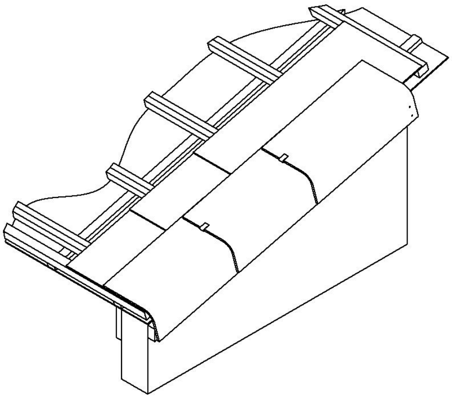
The plain overhanging verge, where slates overhang the gable or bargeboard, used to be a common way of forming verges. If unsupported, the verge overhang should be greater than or equal to 38 mm and not greater than 50 mm.
We strongly advise however to use verge slates or proprietary systems.

Bedded Verges are not recommended by SVK.

4.3.2.1 Verges finished with verge slates

The verge slates are laid on top of the slates. They are fixed on their vertical side by 2 nails, diameter 2.65 mm, in the lap area of the slates. Predrill the holes with a diameter of 4 mm, to allow the working of the verge slates. Except for roofs in very sheltered areas, it is also necessary to fix the upper surface of the verge slates. Predrill two 4 mm diameter holes in the slate underneath and fix with a ridge hook.

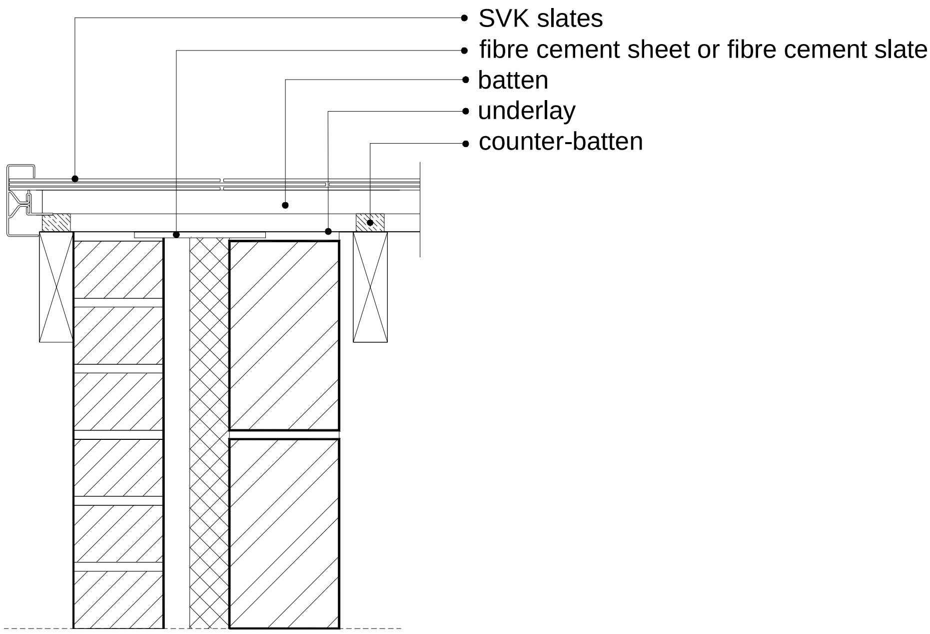




4.3.2.2 Verges finished with dry-fix verge trims

Dry-fix verge trims are an alternative to verge slates.

Lay dry verge systems in accordance with their manufacturers' instructions.
See to it that the verge strip leads the water away from the facade surface. Ensure that the verge slates are extended fully into the verge strip and that the latter firmly holds them.

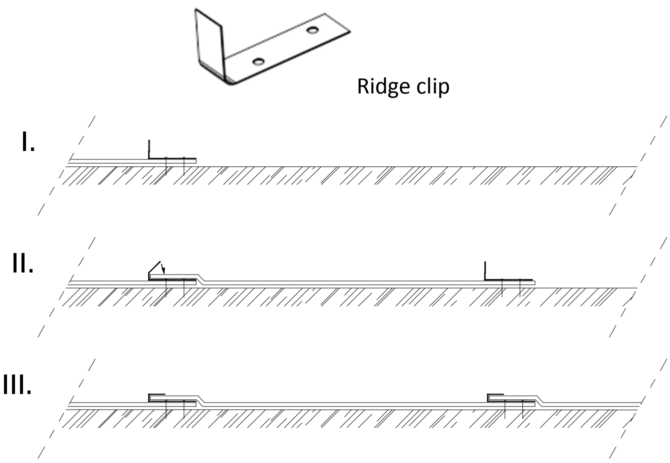


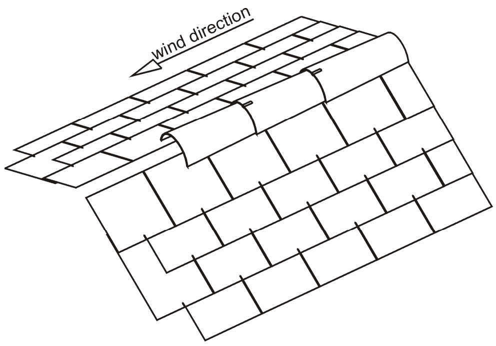
4.3.3 RIDGES

For roofs laid with double lap SVK fibre-cement slates, there are many possibilities for dry ridge finishing.

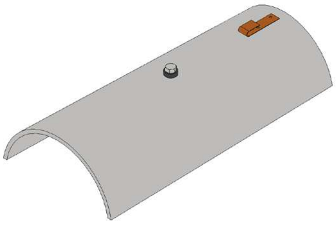
Ridges of fibre-cement in different degrees are readily available. At the ridge the length of the top two courses of slate should ensure the minimum head-lap is maintained. Slates laid to a fixed batten gauge or head-lap may not provide the minimum head-lap cover by the ridge. It is recommended that the top two courses are set out with shortened slates, if necessary, to ensure that the minimum head-lap of the ridge over the penultimate course is achieved.

Position and fix the top slating battens or additional battens to suit the fixing of the SVK ridge cappings. Use a raised ridge board of at least 25 mm thick. An additional ridge fix batten downslope is required for the fixing of a self-sealing wood screw, minimal dimension 60mm x 6.3mm. Lay the ridge pieces with the internal socket joints facing towards, or the external socket joints facing away from, the prevailing wind. Fix the ridge cappings into the ridge board to a true line with a ridge hook and two screws. Use the factory-provided holes for fixing the head-lap.
Drill the ridges as required for the additional self-sealing screws, the screws penetrate the ridge in the middle on both sides, 50mm from the bottom edge. The pre-drilled hole should be wide enough to allow movement of the ridge but not too wide so that the watertightness is still guaranteed. End ridge units should always be full length. The ridges are laid with a lap equal to the socket length (70 mm).

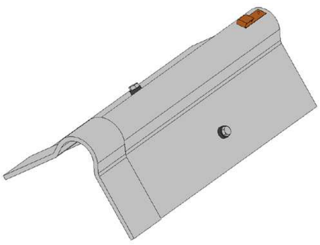




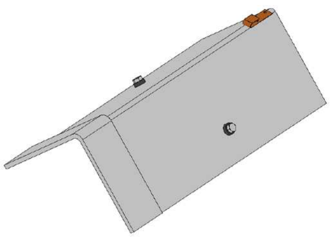
Possible ridge types:



Half-round ridge



Roll-top ridge type A



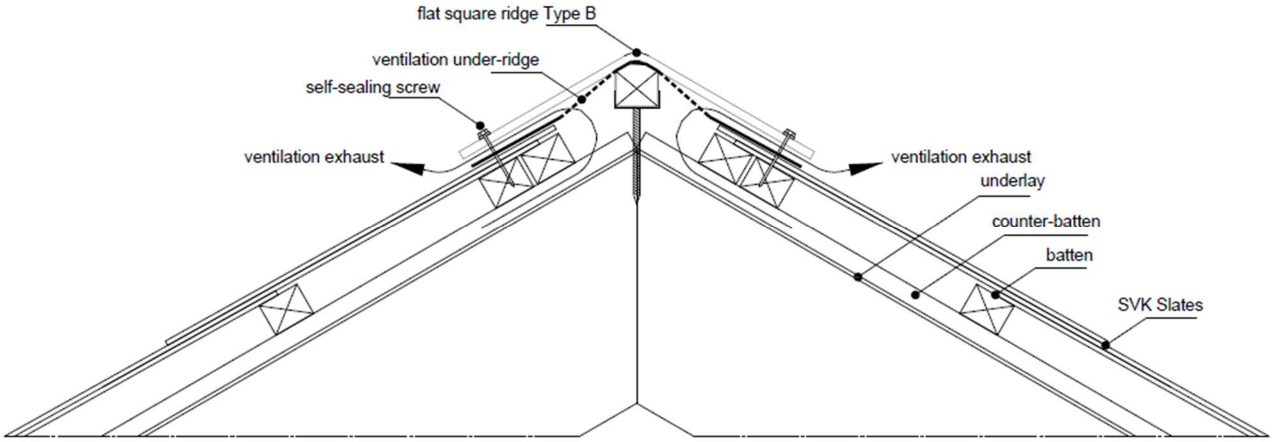
Flat square ridge type B

In case dry ridges are used in another material (concrete, clay, sheet metal ridges), they should be laid in accordance with the slate and/or the sheet metal manufacturer’s technical recommendations.

Bedded ridges are not recommended by SVK.

Special attention has to be paid to the underlay at the ridge, local regulations for further details.

4.3.3.1 Ventilated ridge finishing



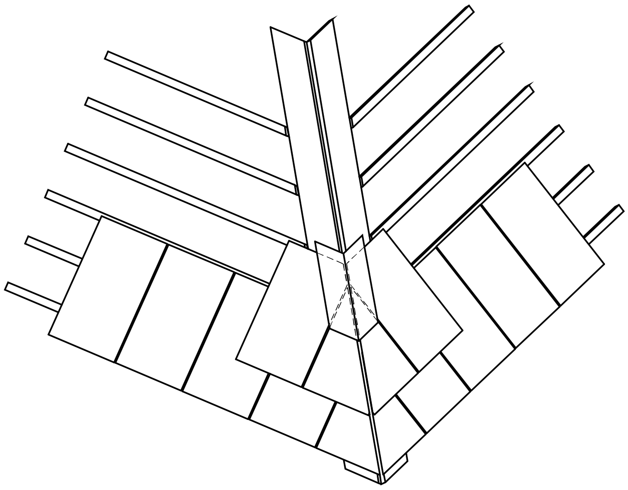
For roofs finished with fibre cement ridges, use a ventilation under-ridge to provide the necessary ridge ventilation. Install it in accordance with the manufacturer's instructions. Leave sufficient space between the slated surfaces and the ridge to allow for ventilation.

4.3.4 HIPS

The conversion table below indicates the required angle of the plain angle ridges type B used as capping, for a specific roof pitch.

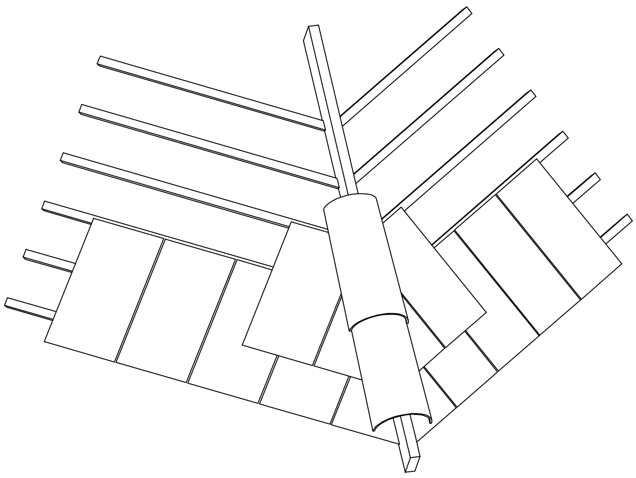
Ridge application for roof pitch of:	Ridge angle	Conversion to roof pitch when used as hip ridge on 2 identical roof pitches of:
25°	130°	37°
30°	120°	45°
40°	100°	65°

4.3.4.1 Mitred hips



A roof pitch of min. 35° is recommended.
Mitred hips require an equal roof pitch on both sides of the hip. Cut slates to a close mitre to the hip line. Make sure the head of the slates is always min. 100 mm wide. Use wide slates (cut from doubles) rather than using small pieces of slate.
Lay cut soakers with each course, extend minimum half the slate width each side of the hip line. These soakers have a minimum length of (batten gauge + head-lap + 25 mm). They are fixed into the support with two slate nails per roof pitch.
The slates themselves are fixed with at least two nails and a crampion.
With pitches less than 45° external tail fittings are required to resist high wind loads, except in sheltered locations.

4.3.4.2 Hips finished with SVK fibre-cement cappings



The hips are basically finished the same way as ridges (see § 4.3.3).
Position and fix a raking batten to either side of the hip rafter to suit the fixings of the hip cappings. Rake cut slates to the hip line. Wherever this is necessary, make extra holes for fixing the slates. Cut the slates close to the hip line, the head-lap of the slates by the hip capping must be minimum the head-lap. The slates are fixed alongside the hip line supplementary with 2 nails.
When using hook fixing at hips, the slates should be hooked and nailed. The hip must be capped.
The ridges are placed with a downward socket. Cut the bottom hip cappings from a full-length unit to align with the eaves.

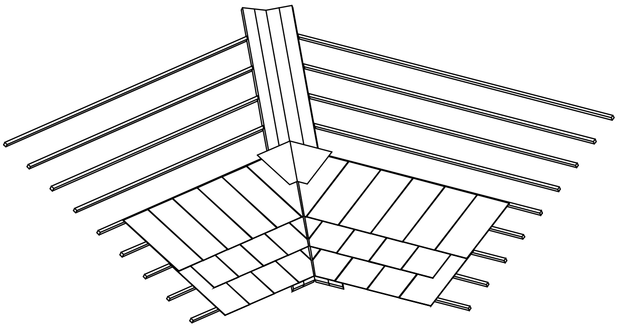
4.3.4.3 Other hip cappings

In case dry hip cappings in another material are used (concrete, clay, sheet metal ridges), they should be laid in accordance with the slate and/or the sheet metal manufacturer's technical recommendations.

Bedded hip cappings are not recommended by SVK.

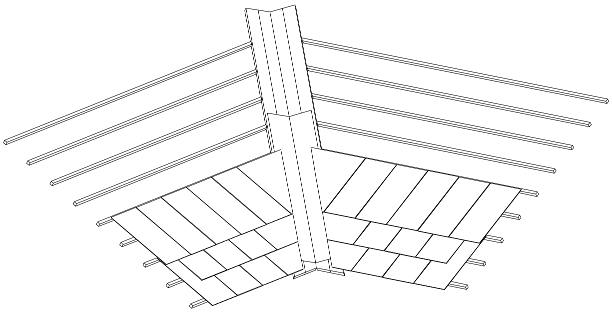
4.3.5 VALLEYS

4.3.5.1 Mitred valleys



Cut slates to a close mitre to the valley line. Make sure the tail of the slates is always min. 150 mm wide. Wide slates (cut from doubles) must be used rather than small pieces of slate.
Lay cut soakers with each course. These soakers extend minimum 150 mm each side of the valley line. Butterfly wing shaped soakers have a minimum length of the slate (measured along the valley line) + 25 mm. They are fixed into the support with two slate nails per roof pitch.
The slates themselves are fixed with at least two nails and a crampion or another appropriate tail fixing. Wherever this is necessary, make extra holes for fixing the slates. Should a double width slate be installed it should fixed with at least two nails and have two crampion rivets.
Mitred valleys are not recommended in exposed locations, nor if the roof pitch is less than 35° or the valley length is greater than 6 m.
Avoid mitred valleys at pitches below 50°, if the roof pitches intersect at an angle more acute than 90° on plan or have different roof pitches.

4.3.5.2 Open valleys

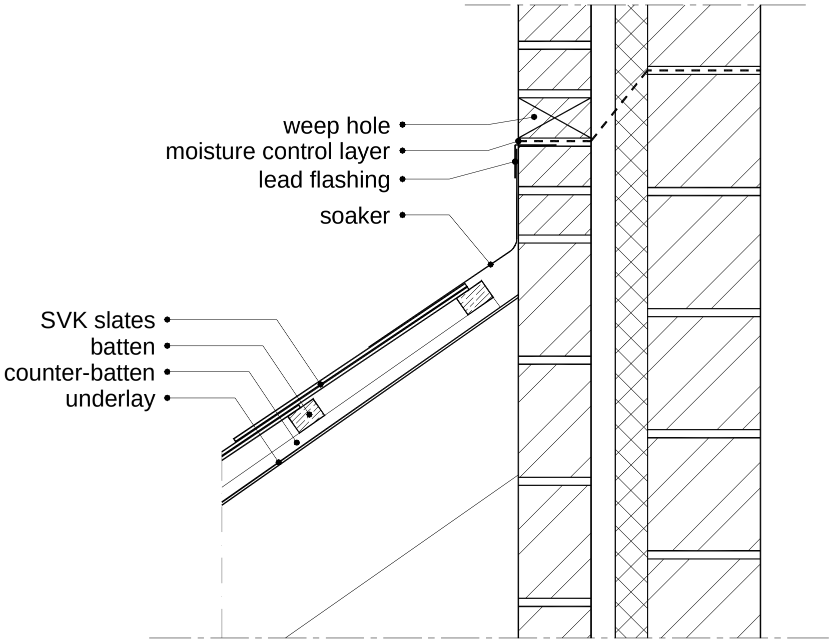


On both sides of the valley line a timber lay-board is applied. On top On both sides of the valley line a timber valley board is applied. On top of these a sheet metal valley is laid
The slates are cut to rake, parallel to the valley centre. Use wide slates (cut from doubles) rather than using small pieces of slate, ensuring that the tail of no slate is less than 150 mm wide.
In the centre is an open channel, with slates overhanging the valley edge by 80 mm.
The slates themselves are fixed with at least two nails and a crampion or another appropriate tail fixing. Wherever this is necessary, make extra holes for fixing the slates. Should a double width slate be installed it should fixed with at least two nails and have two crampions rivets.
Never bend any slates.

4.3.6 ABUTMENTS

4.3.6.1 Top abutments

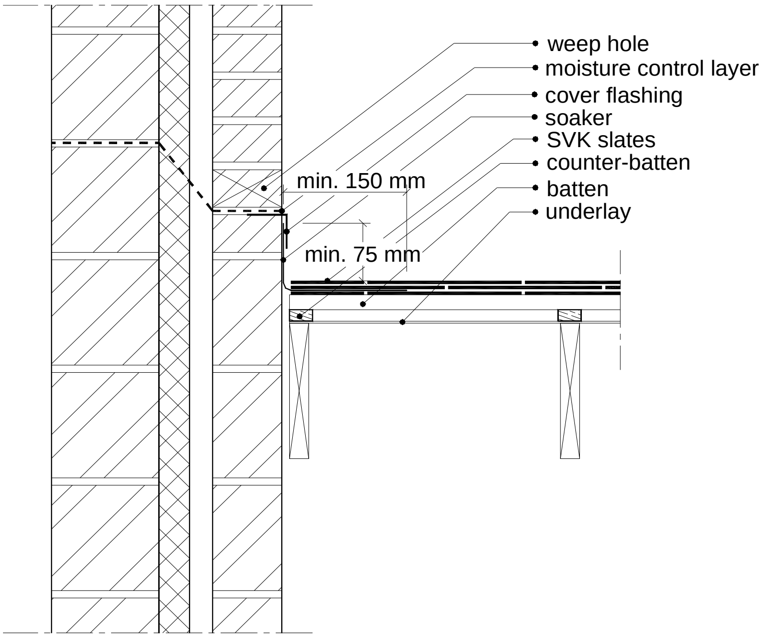
The length of the top two courses of slates should ensure the minimum lap is maintained in combination with an apron and cover flashing.
If ventilation has to be provided, it has to be realised with ventilation slates.
In the wall above, an effective flashing must be provided, to avoid water ingress to the inside of the construction.



4.3.6.2 Side abutments

Slating should be finished close to the abutment. Use L-shaped soakers with a length ≥ the length of (batten gauge + head-lap + 25 mm). The top of the soaker should be turned down over the head of the batten and secured. The horizontal side of the soaker should be covered by the slate, at least half a slate width, the vertical side of the soaker reaches at least 75 mm above the slate surface.

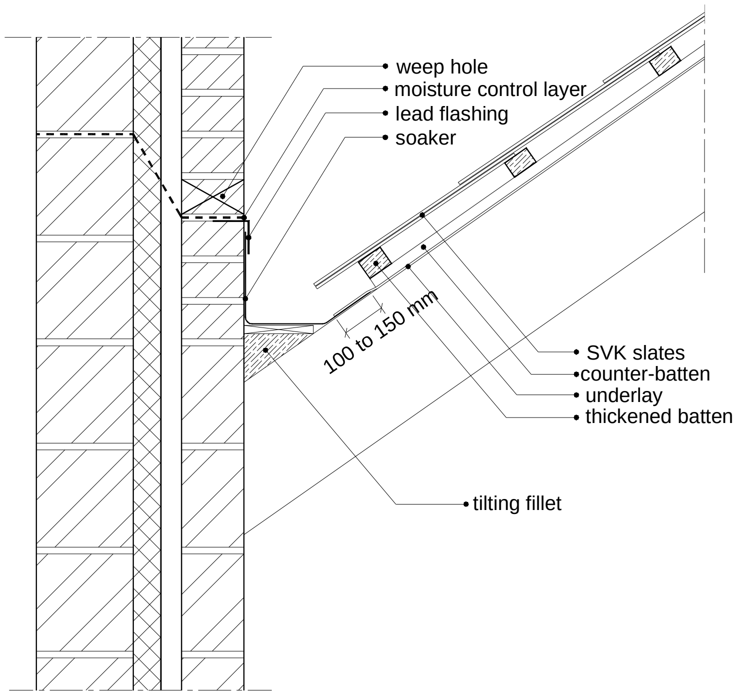
Where used, proprietary abutments or secret gutters are detailed according to the manufacturer's recommendations and should be adequately sized for the length of the abutment with sufficient provision for water outlet. Where there is a risk of blockage by debris, a combination of a cover flashing and abutment gutter could be necessary.



4.3.6.3 Back abutments

For SVK fibre-cement slates intended for the use at a back abutment, the following should be considered:

- The bottom course should overhang into the back gutter by 45 mm to 55 mm horizontally or to the center of the gutter, whichever is the lesser.
- Ensure the bottom course is not kicked up and is in the same plane as the adjacent courses.
- A double course of slates, laid to give a broken bond, should be used at the bottom course.
- The flashings must ensure that, in case of blockage by debris, no water ingress into the building can occur.
- The underlay should extend over the soaker by 100 mm to 150 mm.



4.3.6.4 Chimneys

Finish the roof at the top, the side and the bottom, as described above – as top, side and back abutment. Give special attention to the connections of the different flashings at the angles.

5 REFERENCES

- EN 492 - Fibre-cement Slates and their Fittings for Roofing – Product Specification and Test Methods.
- EN 13501-1 - Fire classification of construction products and building elements - Part 1: Classification based on results of testing of the fire behavior.
- ICP 2 SR 82- Irish Code of Practice for Slating and Tiling.
- BS 5534 - Code of practice for slating and tiling (including shingles).
- BS 8000-6 - Workmanship on building sites – Code of practice for slating and tiling of roofs and claddings.
- All relevant standards, regulations, guiding documents etc… listed in the reference chapter of the above standards.