WELSH SLATE
Part of the Breedon Group

# ROOFING



www.welshslate.com

Front Cover Image: Queens Lace, Surrey, 500mm x 250mm Cwt-Y-Bugail Celtic Grade

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# INTRODUCTION

**Welsh Slate is the world's leading supplier of high-quality slate for a range of exterior and interior design applications. Over 500 million years old, the material is widely recognised as the finest natural slate in the world.**

Welsh Slate own and operate the famous Penrhyn, Ffestiniog and Cwt-y-Bugail quarries in North Wales and has been supplying the world with high quality slate for hundreds of years. Penrhyn Quarry has been producing roofing slate since the thirteenth-century and has been the centre and the focal point for UK natural stone for over 700 years.

In recent decades new sources of roofing slate have come into production from all over the world but none have come close to matching the appearance and performance of Welsh slate. Indeed Welsh Slate has been exporting to the known world since shipping began and its export markets continue to grow.

Welsh Slate is committed to conducting its business in an environmentally responsible manner by maximising the environmental benefits, minimising the environmental impact and promoting sustainable development within its operations and services.

The lifetime of a building begins with the choice of materials and for hundreds of years, architects and designers have been inspired by the natural beauty of slate. Through its aesthetic potential and practical qualities this material's unique character enhances the architectural vision.

Welsh Slate roofing is extracted from some of the world's finest deposits. Formed up to 590 million years ago, each piece of slate has its own unique fingerprint that reflects the power and presence of the landscapes from which it was hewn.

While others make slates of various qualities and market them as "Standards", "Heavies" or "ecos"; we only produce a first quality roofing slate of the highest standard, three colour choices; three thickness grades; one quality

**SUSTAINABILITY AND VALUE**

There is no other roofing material which has demonstrated the extraordinary durability of Welsh Slate.

Welsh Slate is a sustainable material with a useful life of well in excess of 100 years, very cost effective, eco-friendly with little or no further processing and has a low carbon footprint in the UK

At Welsh Slate we are resolved to utilising every tonne of slate, where possible, for its optimum performance and value to provide a diverse range of high quality products.



Cwt-y-Bugail Pillared & Rustic Walling



Cwt-y-Bugail Paving, Walling & Coping Stone



Welsh Slate roofing material is available in three colours that reflect the true nature of beauty. These subtle and elegant colours are further complemented by the distinctive natural texture of slate, creating an added dimension to any roof whilst the variety of colours can be used to create a pattern or subtle contrast in a design.

These aesthetic qualities are combined with the material's natural durability and resistance to weather and temperature, making slate superbly adaptable and ideal for all environments.

As Welsh Slate produces only natural products from the finest raw material each slate has its own unique visual characteristics. Cwt-y-Bugail and Ffestiniog slate features natural Blue Grey banding. Penrhyn Quarry slate has natural Heather Blue tonal variations and may include natural green marking.

The quality of slate allows roofing slate to be produced up to 42" long as standard.

**BENEFITS OF WELSH SLATE ROOFING**

- Aesthetically pleasing
- Colour-fast
- Highly durable
- UK manufactured
- Sustainable material – 100 year+ useful life
- Low carbon footprint in the UK
- Eco friendly
- Unaffected by normal extremes of temperature
- Highly resistant to acids, alkalis and other chemicals

**WELSH SLATE MANUFACTURE THE FOLLOWING PRODUCTS**

- Roofing
- Walling
- Flooring
- Paving
- Aggregates
- Minerals
- Cladding
- Hard Landscaping

St Pancras Station, London,
Ffestiniog Blue Grey
Capital & County Grade Roofing



Penrhyn
Heather Blue



Cwt-y-Bugail
Dark Blue Grey



Ffestiniog
Blue Grey



Kings College, Cambridge,
Penrhyn Randoms

# ADVANTAGES OF SLATE

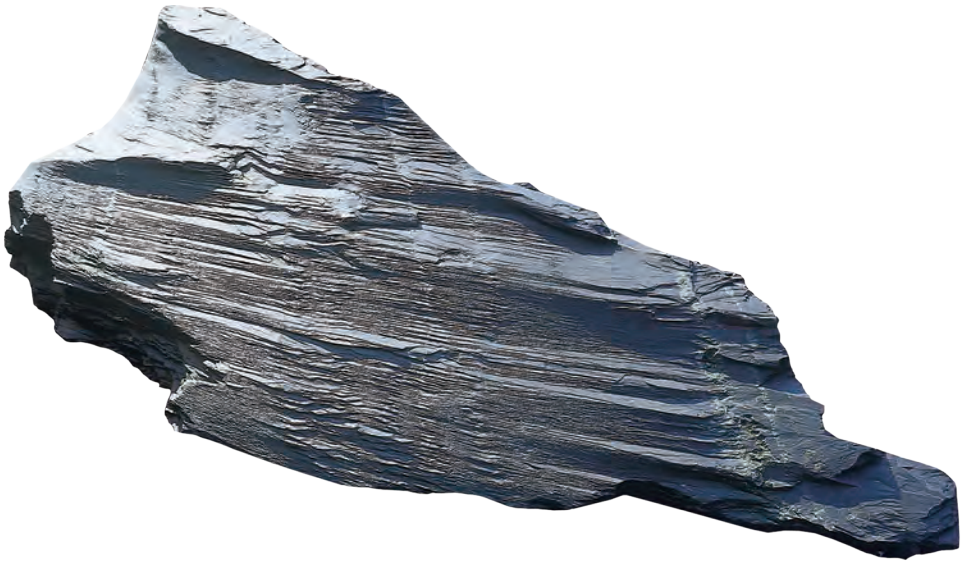
**PRACTICAL**
Welsh Slate is exceptionally durable. It is unaffected by normal extremes of temperature and is highly resistant to acids, alkalis and other chemicals. It retains its colour, even in UV light and is impermeable to water. Welsh Slate is non combustible and is compatible with all other building materials.

**AESTHETIC**
Welsh Slate combines beautifully with traditional and modern materials and provides the designer with a choice of colours and a natural distinctive texture. A Welsh Slate roof adds character and quality to any building.

**PROVEN LONGEVITY**
Welsh Slate has hundreds of years of history and has proven to be the highest quality roofing material in the world. Welsh Slate can provide numerous case studies and 100 year guarantees are available.

**COST EFFECTIVE**
Although with an initial higher cost outlay, Welsh Slate is proven cost effective over the lifetime of the building. Welsh Slate is less costly to maintain than cheaper alternatives.

**ENVIRONMENTALLY RESPONSIBLE**
Unlike many other roofing products, Welsh Slate is entirely produced in the UK. Our roofing slate is 100% natural and has a low carbon footprint to the UK market. In addition, all Welsh Slate products are produced to the exacting standards of ISO 14001 Environmental Management System (see page 31 for more details).







# MANUFACTURING PROCESS



**Welsh Slate roofing slate is crafted using traditional skills, hand split with a hammer and chisel by experienced splitters, using techniques passed down through generations and developed over centuries, and combined with modern production processes to ensure all our roofing slates are of the highest standard.**

Quality control is paramount, and the slate is inspected at every stage of the process to ensure it meets specific requirements. Welsh Slate manufactures under an accredited Quality Assurance Scheme which complies with BS EN ISO 9001:2015 to ensure we continue to produce the finest quality slate. Roofing slates produced at Penrhyn, Cwt-y-Bugail and Ffestiniog are accredited with the kite-marked status. Penrhyn and Cwt-y-Bugail roofing slate hold the Belgium ATG accreditation, to BS EN 12326-1:2014. Each crate is uniquely labelled to enable traceability from rock face to roof.









Campbell Stores, Australia,
Penrhyn Capital Grade Roofing

# CUSTOMER SERVICES

**TECHNICAL SUPPORT AND ADVICE**
Welsh Slate is dedicated to satisfying the needs of its customers through the provision of quality services and products combined with comprehensive after sales support.

Detailed technical advice is freely available from the company's highly trained and experienced Technical Department with an unrivalled knowledge of natural roofing slates. This includes assistance with roof specification, cost estimates and standard CAD details.

Welsh Slate also offers NBS Source, allowing easy access and the accurate specification of Welsh Slate roofing.

**RIBA APPROVED SEMINARS & FACTORY TOURS**
Welsh Slate provide architects and designers with free CPD seminars and factory tours on Welsh Slate as a building material.

If you would like to find out more please contact **+44 (0) 1248 600 656**.

# REFERENCES

**The most recent versions of the following References and Standards should be referred to when specifying or fixing natural slate roofing products.**

**BS EN 12326-1**
Specification for slate and stone products for discontinuous roofing and cladding.

**BS EN 13707**
Specification for flexible sheets for waterproofing.

**BS 5534**
Code of practice for slating and tiling.

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

**BS 1202**
Specification for nails.

**BS EN 1991**
A specification for assessing wind loads on building structures.

**BS 5250**
Code of practice for control of condensation in buildings.

**BS 8104**
Code of practice for assessing exposure to wind-driven rain.

All Standards and References used throughout our information are the most recent applicable versions.



Westerlo Town Hall, Belgium, Ffestiniog Capital Grade Roofing

# DESIGN SPECIFICATION

General guidance on design is given here based on the recommendations of BS 5534. For further detail, please refer to a full version of BS 5534 Code of Practice for Slating and Tiling.

## DESIGN SPECIFICATIONS


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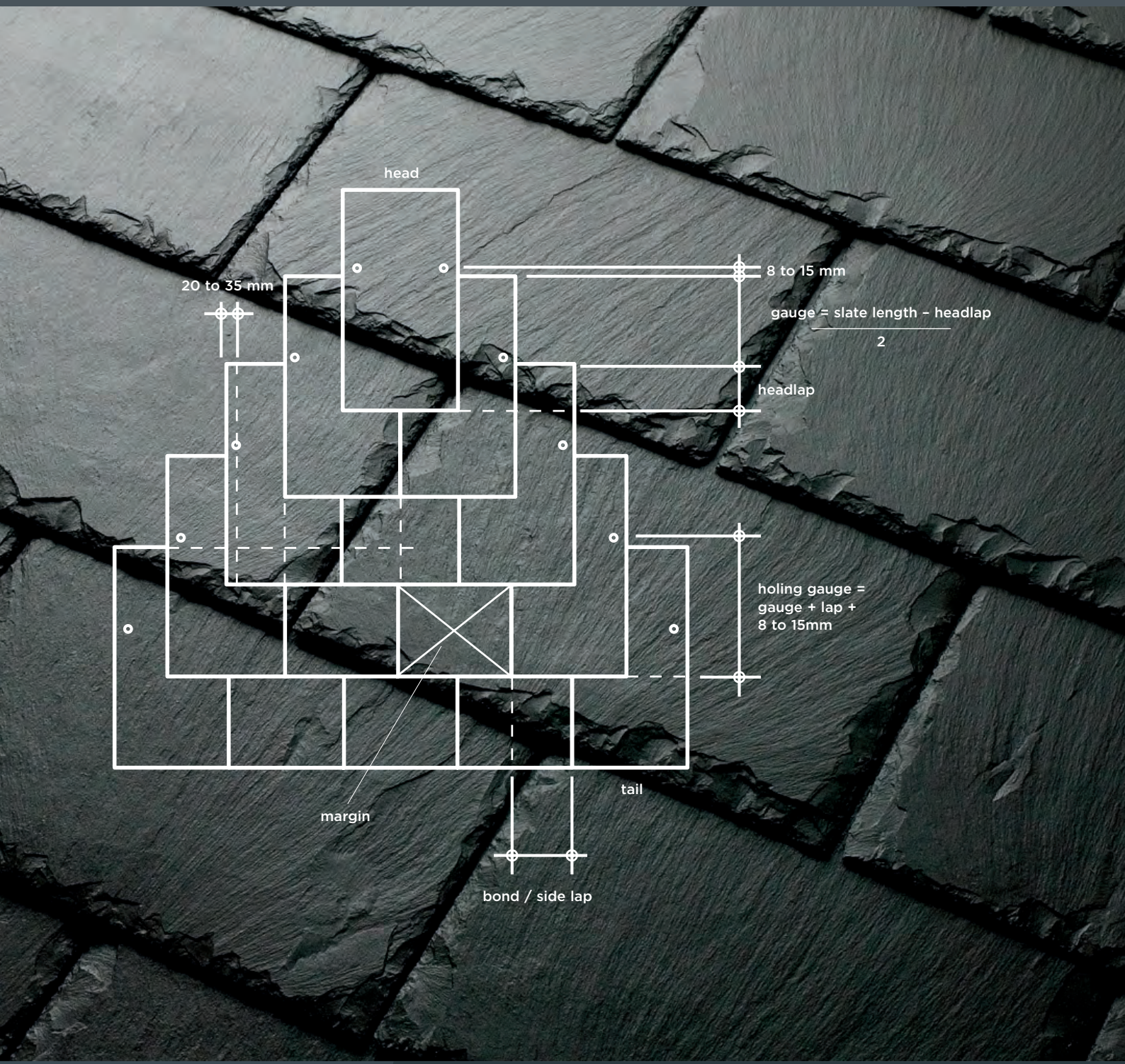
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# TERMINOLOGY

The diagram below gives a brief explanation of the terms that are commonly used throughout the roofing industry. They are by no means comprehensive and the terms may vary in different parts of the country. We suggest that further reference is made to BS 6100 Building & Civil Engineering Terms.

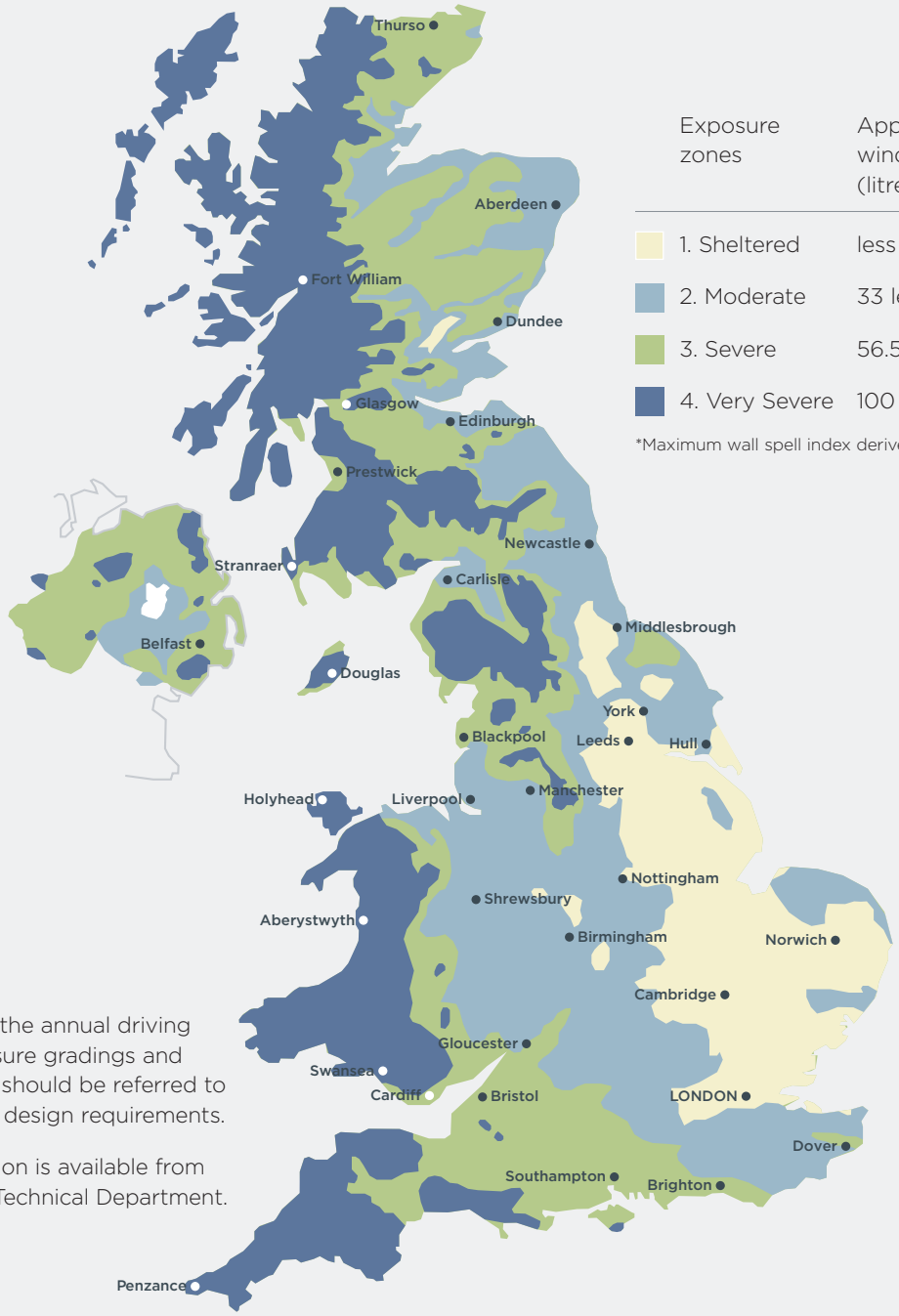


# ANNUAL DRIVING RAIN INDEX

**UNITED KINGDOM**
In general, any area within 30 miles of a west facing coastline is considered to be in a severe exposure area.

However, localised effects on any site must also be taken into consideration.

Further reference to BS 8104 is advisable to ascertain localised effects. Map based on BS 5534.




| Exposure zones | Approximate wind-driven rain* (litres/m² per spell) |
|---|---|
| 1. Sheltered | less than 33 |
| 2. Moderate | 33 less than 56.5 |
| 3. Severe | 56.5 to less than 100 |
| 4. Very Severe | 100 or more |

*Maximum wall spell index derived from BS8104

This map shows the annual driving rain index. Exposure gradings and local knowledge should be referred to when discussing design requirements.

Further information is available from the Welsh Slate Technical Department.

# MINIMUM RECOMMENDED HEADLAPS

The recommendations for minimum pitches and laps for slate apply to normal situations. In general, the recommendations apply to rafter lengths of not more than 9m in moderate driving rain exposures and 6m in severe driving rain exposures. Specifiers should take account of any abnormal condition that might apply and may need to specify greater values than the recommended minima. If it is necessary to use pitches lower than the recommended minima please contact Welsh Slate technical department.

This table gives a range of sizes for your information Traditional sizes that are not listed below and random diminishing slates can be made to special order, please contact us for more information.

**WIND LOAD AND WEATHER RESISTANCE**
Slates fixed in accordance with the details given in this guide will have adequate resistance to wind loads, wind uplift and rain penetration under most conditions.
The tables below give minimum recommended laps according to exposure, roof pitch and slate size. Detailed guidance on wind load calculations is given in BS 5534 and BS EN 1991.

**MODERATE EXPOSURE LESS THAN 56.5L/M²/SPELL**

| Slate Size mm | Roof Pitch | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 20º | 22.5º | 25º | 27.5º | 30º | 35º | 40º | 45º to 75º | 85º |
| 600x350 | 115* | 105* | 95* | 85* | 80* | 70* | 60* | 55* | 45* |
| 600x300 | 190* | 130* | 95* | 85* | 80* | 70* | 60* | 55* | 45* |
| 550x300 | 135* | 105* | 95* | 85* | 80* | 70* | 60* | 55* | 45* |
| 500x300 | 115* | 105* | 95* | 85* | 80* | 70* | 60* | 55* | 45* |
| 500x250 | - | 125* | 95* | 85* | 80* | 70* | 60* | 55* | 45* |
| 455x250 | - | 105* | 95* | 85* | 80* | 70* | 60* | 55* | 45* |
| 400x250 | - | - | - | - | - | 70 | 60 | 55 | 45 |
| 400x200 | - | - | - | - | - | 70 | 60 | 55 | 45 |
| 350x300 | - | - | - | - | - | 70* | 60* | 55* | 45* |
| 350x250 | - | - | - | - | - | 70 | 60 | 55 | 45 |
| 350x200 | - | - | - | - | - | 70 | 60 | 55 | 45 |
| 300x200 | - | - | - | - | - | 70 | 60 | 55 | 45 |
| 270x180 | - | - | - | - | - | 70 | 60 | 55 | 45 |
| 250x150 | - | - | - | - | - | 70 | 60 | 55 | 45 |

**SEVERE EXPOSURE 56.5L OR GREATER/M²/SPELL**

| Slate Size mm | Roof Pitch | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 20º | 22.5º | 25º | 27.5º | 30º | 35º | 40º | 45º to 75º | 85º |
| 600x350 | 150* | 130* | 120* | 110* | 100* | 85* | 80* | 70* | 50* |
| 600x300 | - | 165* | 130* | 110* | 100* | 85* | 80* | 70* | 65* |
| 550x300 | 180* | 130* | 120* | 110* | 100* | 85* | 80* | 70* | 50* |
| 500x300 | - | 130* | 120* | 110* | 100* | 85* | 80* | 70* | 50* |
| 500x250 | - | 150* | 125* | 110* | 100* | 85* | 80* | 70* | 70* |
| 455x250 | - | - | 120* | 110* | 100* | 85* | 80* | 70* | 50* |
| 400x250 | - | - | - | - | 100 | 85 | 80 | 70 | 50 |
| 400x200 | - | - | - | - | 100 | 85 | 80 | 80 | 80 |
| 350x300 | - | - | - | - | 100* | 85* | 80* | 70* | 50* |
| 350x250 | - | - | - | - | 100 | 85 | 80 | 70 | 50 |
| 350x200 | - | - | - | - | 100 | 85 | 80 | 70 | 50 |
| 300x200 | - | - | - | - | 100 | 85 | 80 | 70 | 50 |
| 270x180 | - | - | - | - | 100 | 85 | 80 | 70 | 50 |
| 250x150 | - | - | - | - | 100 | 85 | 80 | 70 | 50 |

* Marked items may require longer or improved ring shank nails or increase slate thickness laps etc in areas likely to be exposed to very high winds. Project specific calculations can be carried out. **For further details please contact Welsh Slate Technical Department.**

# GENERAL PROPERTIES


British Library, London

Welsh Slate benefits from a number of highly practical properties. It is exceptionally durable, unaffected by normal extremes of temperature and is highly resistant to acids, alkalis and other chemicals.

In addition, slate is non – combustible, retains its colour, even in UV light and is impermeable to water.

Further technical properties and test results are available from the Welsh Slate Technical Department or online at **www.welshslate.com**

| | |
|---|---|
| **Water permeability** | Impermeable |
| **Sunlight unfading** | Unaffected by UV light |
| **Heat** | Unaffected by normal heating, freezing and thermal cycling |
| **Chemical resistance** | Unaffected by atmospheric pollution, sea air and sea spray |
| **Biological resistance** | Unaffected by vegetable growth, rot or insect attack |
| **Compatibility** | Compatible with all building materials |
| **Fire resistance** | Slate is non combustible and does not support combustion. AA fire rating |
| **Thermal expansion** | 8.5 – 11x10-6 mm per 0ºC |
| **Thermal conductivity** | Approx. 2.0 W/mk |

Certificates of compliance can be downloaded from our website **www.welshslate.com**

**CONFORMITY TO ASTM**

Requirements for S1 classification (expected use of 75 years plus)

**C120** Breaking load > 2558N
**C121** Water absorption <0.25%
**C217** Weather resistance <0.05mm

All slates comply with S1 classification.

**CONFORMITY AND TESTING TO BS EN 12326**

All our slates comply with W1, S1, and T1 classification.
Conformity also ensures that all slates are CE marked.

Roofing slate produced at Penrhyn and Cwt-y-Bugail quarries are certified by the Belgium Construction Certification Association, and carry the ATG mark.

H631
H747

# SLATE SIZES AND WEIGHTS

The weights shown are exclusive of any packaging, or crating material. The weights for other thicknesses or sizes are available on request from our Technical Department.

The weights shown below are approximate. Slate thickness quoted are nominal and subject to variation.

**Bespoke sizes are available, including large format up to 1 metre, please contact us for further information.**

**STANDARD SIZES & WEIGHTS IN TONNES PER 1000 SLATES**





| Size (Nominal) mm | Penrhyn Heather Blue | | | Cwt-y-Bugail Dark Blue Grey | | | Ffestiniog Blue Grey | | |
|---|---|---|---|---|---|---|---|---|---|
| | Capital | County | Celtic | Capital | County | Celtic | Capital | County | Celtic |
| | 5.5mm | 7mm | 9mm | 5.5mm | 7mm | 9mm | 5.5mm | 7mm | 9mm |
| 600x350 | 3.23 | 4.12 | 5.29 | 3.12 | 3.97 | 5.10 | 3.12 | 3.97 | 5.10 |
| **600x300** | **2.77** | **3.53** | **4.54** | 2.67 | 3.40 | 4.37 | 2.67 | 3.40 | 4.37 |
| 550x300 | 2.54 | 3.23 | 4.16 | 2.45 | 3.12 | 4.01 | 2.45 | 3.12 | 4.01 |
| **500x300** | **2.23** | **2.94** | **3.78** | 2.23 | 2.84 | 3.65 | **2.23** | **2.84** | **3.65** |
| **500x250** | 1.93 | 2.45 | 3.15 | **1.86** | **2.36** | **3.04** | 1.86 | 2.36 | 3.04 |
| 455x250 | 1.75 | 2.23 | 2.87 | 1.69 | 2.15 | 2.76 | 1.69 | 2.15 | 2.76 |
| 400x300 | 1.85 | 2.35 | 3.02 | 1.78 | 2.27 | 2.92 | 1.78 | 2.27 | 2.92 |
| **400x250** | **1.54** | **1.96** | **2.52** | **1.49** | **1.89** | **2.43** | **1.49** | **1.89** | **2.43** |
| 400x200 | 1.23 | 1.57 | 2.02 | 1.19 | 1.51 | 1.94 | 1.19 | 1.51 | 1.94 |
| 350x300 | 1.62 | 2.06 | 2.65 | 1.56 | 1.98 | 2.55 | 1.56 | 1.98 | 2.55 |
| 350x250 | 1.35 | 1.72 | 2.21 | 1.30 | 1.65 | 2.13 | 1.30 | 1.65 | 2.13 |
| 350x200 | 1.08 | 1.37 | 1.76 | 1.04 | 1.32 | 1.70 | 1.04 | 1.32 | 1.70 |
| 300x300 | 1.51 | 1.76 | 2.27 | 1.34 | 1.70 | 2.19 | 1.34 | 1.70 | 2.19 |
| 300x250 | 1.16 | 1.47 | 1.89 | 1.11 | 1.42 | 1.82 | 1.11 | 1.42 | 1.82 |
| **300x200** | **0.92** | **1.18** | **1.51** | **0.89** | **1.13** | **1.46** | **0.89** | **1.13** | **1.46** |

Our core production sizes are highlighted bold

# COVERAGE

**COVERAGE AND COST**
The actual cost of a roof per unit floor area of the building is determined by a number of factors, including roof pitch, slate size and head lap.

**ROOF PITCH AND LAP**
Project specific advice is available from the Welsh Slate Technical Department.

This table gives a range of sizes for your information. **Other sizes may be available, please contact us for further information.**

**COVERAGE: SLATES/M²**

| Size (Nominal) mm | Lap mm | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **50** | **55** | **60** | **65** | **70** | **80** | **90** | **100** | **105** | **110** | **115** | **120** | **125** | **130** | **135** | **150** |
| 600 x 350 | 10.2 | 10.3 | 10.4 | 10.5 | 10.6 | 10.8 | 11.0 | 11.3 | 11.4 | 11.5 | 11.6 | 11.7 | 11.9 | 12.0 | 12.1 | 12.5 |
| 600 x 300 | 11.9 | 12.0 | 12.1 | 12.3 | 12.4 | 12.6 | 12.9 | 13.1 | 13.2 | 13.4 | 13.5 | 13.7 | 13.8 | 14.0 | 14.1 | 14.6 |
| 550 x 300 | 13.1 | 13.2 | 13.4 | 13.5 | 13.7 | 14.0 | 14.3 | 14.6 | 14.7 | 14.9 | 15.1 | 15.2 | 15.4 | 15.6 | 15.8 | 16.4 |
| 500 x 300 | 14.6 | 14.7 | 14.9 | 15.1 | 15.2 | 15.6 | 16.0 | 16.4 | 16.6 | 16.8 | 17.0 | 17.3 | 17.5 | 17.7 | 18.0 | 18.7 |
| 500 x 250 | 17.4 | 17.6 | 17.8 | 18.0 | 18.2 | 18.7 | 19.1 | 19.6 | 19.9 | 20.1 | 20.4 | 20.6 | 20.9 | 21.2 | 21.5 | 22.4 |
| 455 x 250 | 19.4 | 19.6 | 19.9 | 20.1 | 20.4 | 20.9 | 21.5 | 22.1 | 22.4 | 22.7 | 23.1 | 23.4 | | | | |
| 400 x 250 | 22.4 | 22.7 | 23.1 | 23.4 | 23.8 | 24.5 | 25.3 | 26.1 | | | | | | | | |
| 400 x 200 | 27.9 | 28.3 | 28.7 | 29.1 | 29.6 | 30.5 | 31.5 | 32.5 | | | | | | | | |
| 350 x 200 | 32.5 | 33.1 | 33.6 | 34.2 | 34.8 | 36.1 | 37.5 | 39.0 | | | | | | | | |
| 300 x 200 | 39.0 | 39.8 | 40.7 | 41.5 | 42.4 | 44.3 | 46.5 | | | | | | | | | |

Values calculated using nominal sizes and incorporating a 5mm joint gap as per BS 8000: Part 6. We recommend the addition of at least 5% wastage allowance.

For Slate Sizes or Headlaps not listed on page 15 the following formulae can be used:-

**BATTEN GAUGE** (Slate Length minus headlap) divided 2
Example 500x300 mm @ 120mm headlap:- (500 – 120) / 2 = 190mm Batten Gauge

**LIN M BATTEN PER M²** 1 divided Batten Gauge in metres
Example 500x300 mm @ 120mm headlap:- 1 / 0.190m = 5.26 lin m

**HOLING GAUGE** Batten Gauge + Headlap + 10mm
Example 500x300 mm @ 120mm headlap:- 190mm + 120mm + 10mm = 320mm Holing Gauge

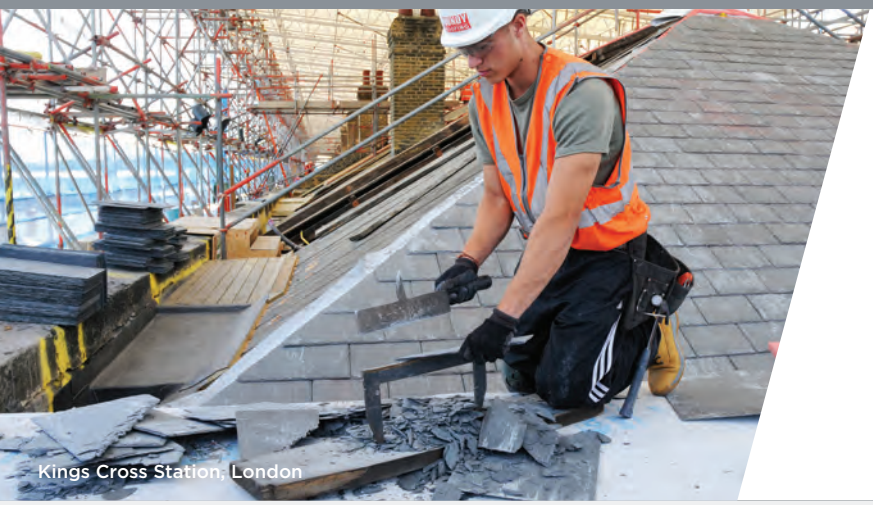
# BATTENING AND HOLING GAUGES

The table below gives a range of sizes for the correct Batten Gauge (distance between battens) for your chosen slate length and lap. It also allows you to determine the holing gauge (distance from hole to tail of slate) and the number of linear metres of batten per $m^2$ of roof.

**Other sizes may be available, please contact us for further information.**

| | Batten Gauge mm | Lin m Batten per $m^2$ | Holing Gauge mm | Batten Gauge mm | Lin m Batten per $m^2$ | Holing Gauge mm | Batten Gauge mm | Lin m Batten per $m^2$ | Holing Gauge mm | Batten Gauge mm | Lin m Batten per $m^2$ | Holing Gauge mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Headlap** | | **45mm** | | | **50mm** | | | **55mm** | | | **60mm** | |
| **Slate Length mm** | | | | | | | | | | | | |
| 600 | 278 | 3.60 | 333 | 275 | 3.64 | 335 | 273 | 3.67 | 338 | 270 | 3.70 | 340 |
| 550 | 253 | 3.96 | 308 | 250 | 4.00 | 310 | 248 | 4.04 | 313 | 245 | 4.08 | 315 |
| 500 | 228 | 4.40 | 283 | 225 | 4.44 | 285 | 223 | 4.49 | 288 | 220 | 4.55 | 290 |
| 455 | 205 | 4.88 | 260 | 203 | 4.94 | 263 | 200 | 5.00 | 265 | 198 | 5.06 | 268 |
| 400 | 178 | 5.63 | 233 | 175 | 5.71 | 235 | 173 | 5.80 | 238 | 170 | 5.88 | 240 |
| 350 | 153 | 6.56 | 208 | 150 | 6.67 | 210 | 148 | 6.78 | 213 | 145 | 6.90 | 215 |
| 300 | 128 | 7.84 | 183 | 125 | 8.00 | 185 | 123 | 8.16 | 188 | 120 | 8.33 | 190 |
| **Headlap** | | **65mm** | | | **70mm** | | | **80mm** | | | **85mm** | |
| **Slate Length mm** | | | | | | | | | | | | |
| 600 | 268 | 3.74 | 343 | 265 | 3.77 | 345 | 260 | 3.85 | 350 | 258 | 3.88 | 353 |
| 550 | 243 | 4.12 | 318 | 240 | 4.17 | 320 | 235 | 4.26 | 325 | 233 | 4.30 | 328 |
| 500 | 218 | 4.60 | 293 | 215 | 4.65 | 295 | 210 | 4.76 | 300 | 208 | 4.82 | 303 |
| 455 | 195 | 5.13 | 270 | 193 | 5.19 | 273 | 188 | 5.33 | 278 | 185 | 5.41 | 280 |
| 400 | 168 | 5.97 | 243 | 165 | 6.06 | 245 | 160 | 6.25 | 250 | 158 | 6.35 | 253 |
| 350 | 143 | 7.02 | 218 | 140 | 7.14 | 220 | 135 | 7.41 | 225 | 133 | 7.55 | 228 |
| 300 | 118 | 8.51 | 193 | 115 | 8.70 | 195 | 110 | 9.09 | 200 | 108 | 9.30 | 203 |
| **Headlap** | | **90mm** | | | **95mm** | | | **100mm** | | | **105mm** | |
| **Slate Length mm** | | | | | | | | | | | | |
| 600 | 255 | 3.92 | 355 | 253 | 3.96 | 358 | 250 | 4.00 | 360 | 248 | 4.04 | 363 |
| 550 | 230 | 4.35 | 330 | 228 | 4.40 | 333 | 225 | 4.44 | 335 | 223 | 4.49 | 338 |
| 500 | 205 | 4.88 | 305 | 203 | 4.94 | 308 | 200 | 5.00 | 310 | 198 | 5.06 | 313 |
| 455 | 183 | 5.48 | 283 | 180 | 5.56 | 285 | 178 | 5.63 | 288 | 175 | 5.71 | 290 |
| 400 | 155 | 6.45 | 255 | 153 | 6.56 | 258 | 150 | 6.67 | 260 | 148 | 6.78 | 263 |
| 350 | 130 | 7.69 | 230 | 128 | 7.84 | 233 | 125 | 8.00 | 235 | 123 | 8.16 | 238 |
| 300 | 105 | 9.52 | 205 | 103 | 9.76 | 208 | 100 | 10.00 | 210 | 98 | 10.26 | 213 |
| **Headlap** | | **110mm** | | | **115mm** | | | **120mm** | | | **125mm** | |
| **Slate Length mm** | | | | | | | | | | | | |
| 600 | 245 | 4.08 | 365 | 243 | 4.12 | 368 | 240 | 4.17 | 370 | 238 | 4.21 | 373 |
| 550 | 220 | 4.55 | 340 | 218 | 4.60 | 343 | 215 | 4.65 | 345 | 213 | 4.71 | 348 |
| 500 | 195 | 5.13 | 315 | 193 | 5.19 | 318 | 190 | 5.26 | 320 | 188 | 5.33 | 323 |
| 455 | 173 | 5.80 | 293 | 170 | 5.88 | 295 | 168 | 5.97 | 298 | | | |
| **Headlap** | | **130mm** | | | **135mm** | | | **150mm** | | | **180mm** | |
| **Slate Length mm** | | | | | | | | | | | | |
| 600 | 235 | 4.26 | 375 | 233 | 4.30 | 378 | 225 | 4.44 | 385 | 210 | 4.76 | 400 |
| 550 | 210 | 4.76 | 350 | 208 | 4.82 | 353 | 200 | 5.00 | 360 | 185 | 5.41 | 375 |
| 500 | 185 | 5.41 | 325 | 183 | 5.48 | 328 | 175 | 5.71 | 335 | 160 | 6.25 | 350 |
| **Headlap** | | **190mm** | | | | | | | | | | |
| **Slate Length mm** | | | | | | | | | | | | |
| 600 | 205 | 4.88 | 405 | | | | | | | | | |

# THE SLATING PROCESS



Kings Cross Station, London

**SETTING OUT THE ROOF**

For a detailed description of the process of roof slating, reference should be made to code of Practice for Slating and Tiling and BS 8000 Workmanship on Building Sites.

However, the basic steps are set out below:

**1.1** Sort and hole slates where required. Slates should be holed from the underside to the correct gauge measured from the tail of the slate using a threaded action slate holing machine. At the same time the slates should be sorted into groups of equal thickness where required.

**1.2** Fix the underlay as specified.

**1.3** Mark out the roof to the correct battening gauge. The gauge may be adjusted to divide the slope length into equal margins provided the specified lap is not reduced.

**1.4** Batten the roof (see Battening Gauges table).

**1.5** Check the actual width of slates and mark out perpends on battens at correct centres allowing 5mm joint gaps.

**SLATING**

**1.6** Where required load out the slates on the roof so that the thickest slates are in the lowest courses and the thinnest near the ridge.

**1.7** Fix undereaves courses bed up.

**1.8** Fix the slates to perpend lines, cutting individual slates as necessary to fit hips and valleys. Each slate must be fixed with two nails.

**SLATE NAILS**

**1.9** Slate or clout nails should be aluminium to BS 1202: Part 3, copper to BS 1202: Part 2, or silicon-bronze.

In corrosive or marine atmospheres copper nails are preferable and in severe conditions silicon-bronze nails should be used.

**CUTTING SLATES**

**1.10** In order to maintain adequate laps and allow proper fixing, slates must not be cut too narrow. In general no slates should be less than 150mm wide.

At all verges and abutments, alternate courses must be started either with half-width slates or with slate-and-a-half widths to maintain bond. If the half-slate would be less than 150mm, slate-and-a-half widths must be used.

At valleys, hips and other places where slates must be cut on the rake, it is essential that slates are of an adequate width to accommodate secure fixings.

# TRADITIONAL SCOTTISH ROOFING PRACTICE

**FIXING**

Full details of the roof slating process are given in BS 5534. However, the main stages of the Traditional Scottish Practice are outlined below:

**2.1** The roof should be covered with square edged sarking boards, covered with bitumen underlay or breather membrane, as specified by the architect. (Battens, although not generally specified, can be used to create a warm roof construction).

**2.2** Sort and hole slates into at least three groups of equal thickness.

**2.3** Hole the slates to the correct gauge, measuring from the tail of the slate.

**2.4** Fix the underlay temporarily.

**2.5** Mark out the roof to the correct gauge. This may be adjusted to divide the slope length into equal numbers of courses. Care must be taken not to reduce the specified lap.

**2.6** Load out the slates on the roof so that the thickest slates are in the lowest courses and the thinnest near the ridge.

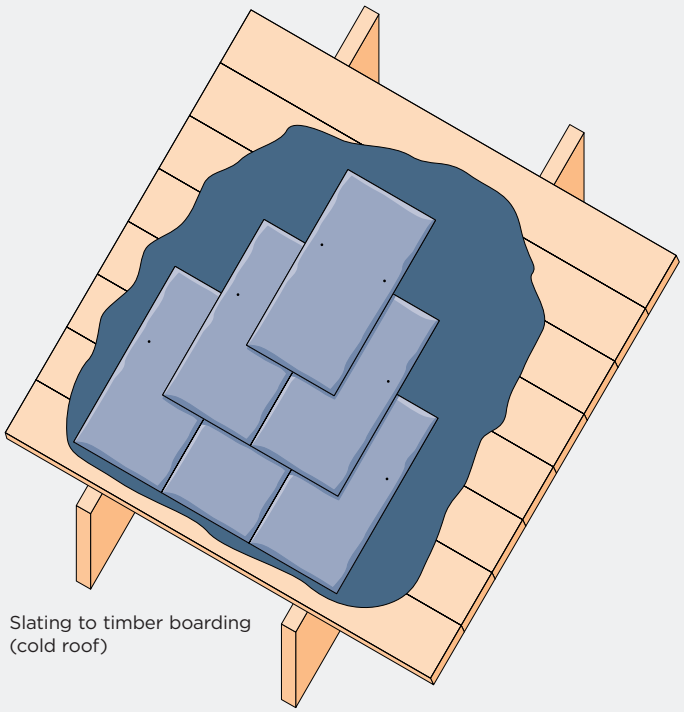
**2.7** Fix undereaves courses (bed side up).

**2.8** Fix slates to perpend lines, cutting slates as necessary to fit hips and valleys.

**2.9** Although BS 5534 recommends fixing with two nails, it is generally recognised that single head nailing is acceptable where slates are small and heavy. It is also recommended that proportion of the slates (normally every third course) should be double nailed.

**2.10** Slate or clout nails should be aluminium to BS 1202: Part 3, copper to BS 1202: Part 2, or silicon-bronze.

In corrosive or marine atmospheres copper nails are preferable, and in severe conditions silicon-bronze nails should be used. Slating nails should not penetrate through the board.



Slating to timber boarding (cold roof)

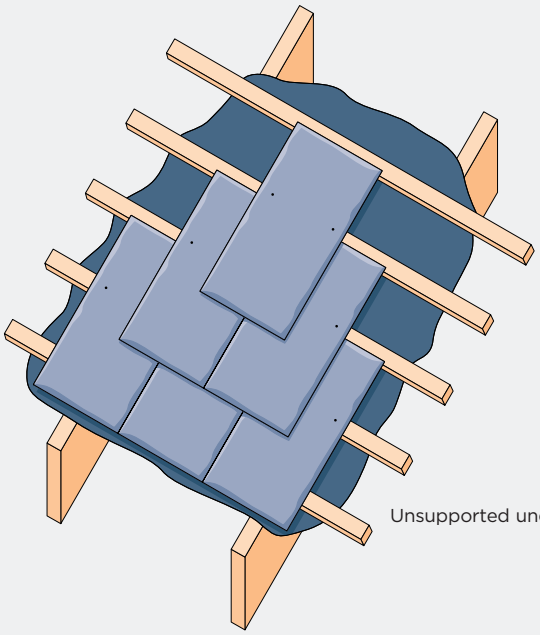
**HOLING SLATES**

**2.11** Should slates need to be holed this must be done from the underside, using a threaded action slate holing machine. The resultant spalling on the upper surface forms a countersink for the head of the nail.

# BATTENING

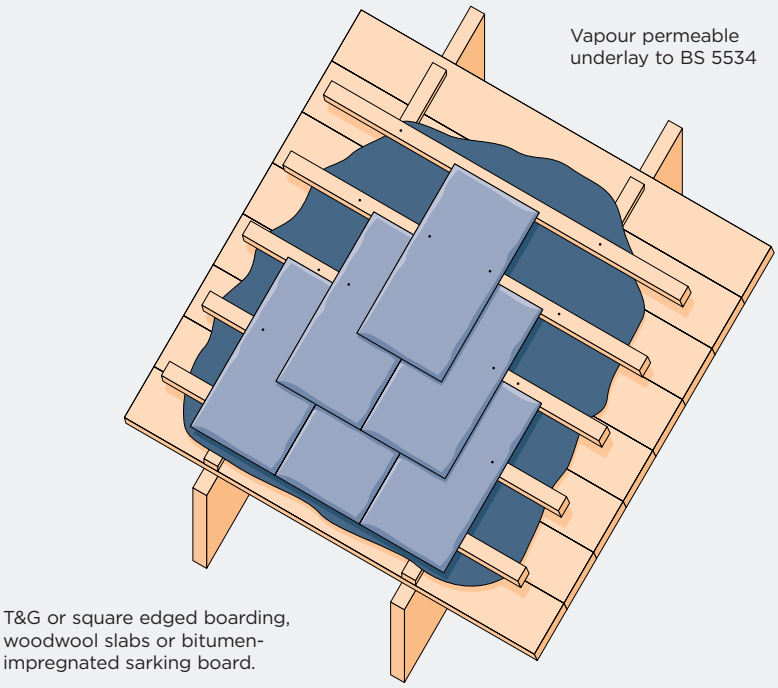


**OPEN RAFTERS**
Underlay should be either reinforced bitumen felt Type 1F or an approved flexible roofing membrane to BS EN 13707 and complying with the requirements of BS 5534.




**BOARDED ROOFS**
Underlay laid directly onto boards should be either reinforced bitumen felt Type 1F or an approved flexible roofing membrane to BS EN 13707 and complying with the requirements of BS 5534.

Boarded roofs should be counter battened to allow ventilation under the slates and free drainage of any water that may reach the underlay.



**LEAD STAINING**
Lead develops a patina of lead carbonate which can be washed off by rain and can cause staining of slates. It is strongly recommended that all lead which may discharge water onto slate, including soakers, should be treated with patination oil as it is fixed.

For more information contact the
**The Lead Contractors Association**
**Centurion House**
**36 London Road**
**East Grinstead**
**West Sussex**
**RH19 1AB**

**Email: info@leadcontractors.co.uk**
**www.leadcontractors.co.uk**

## NAIL SIZES

| Slate Grade<br>Nominal Thickness | Nail Length x 3.35mm dia.<br>Minimum 10mm Nailhead |
|---|---|
| <7mm | 30mm minimum |
| >7mm | 40mm minimum |

Nails used throughout any roof structure should comply with the standard set out in BS 1202 : parts 2 & 3

Nail lengths should be calculated in accordance with BS 5534. The tables on page 10 give guidance to situations where the nail recommendations above should be reviewed.

## MINIMUM BATTEN SIZES

| 450mm Rafter Centres | 600mm Rafter Centres |
|---|---|
| 50mm wide x 25mm deep | 50mm wide x 25mm deep |
| 50mm wide x 25mm deep | 50mm wide x 25mm deep |

## MINIMUM RECOMMENDED LEAD CODES

| Application | BS 5534 Code | LSA Code |
|---|---|---|
| Flashings | 4 | 4 |
| Soakers | | |
| Abutment | 3 | 3 |
| Mitred hip | 3 | 3 |
| Mitred valley | 3 | 3 |
| Aprons | | |
| Chimney | 4 | 4 |
| Roof head | 4 | 4 |
| Gutters | | |
| Chimney | 5 | 5 |
| Lining | 5 | 5 |
| Ridge rolls | 4 | 4 |
| Hip rolls | 4 | 4 (or 5) |
| Valley linings | 4 | 4 (or 5) |
| Saddles | 4 | n/a |

## RECOMMENDED HEADLAPS FOR UNDERLAYS

| | Minimum Headlap | |
|---|---|---|
| Pitch | Fully Supported | Not Supported |
| 20º-34º | 100mm | 150mm |
| + 35º | 75mm | 100mm |


Penrhyn County Grade Roofing

# EAVES AND VERGES

**EAVES**

Dress underlay into gutter and pull tight to ensure no water retaining troughs and support with tilting fillet. Fix undereaves and eaves course of slates with tails aligned and projecting 45mm (minimum) to 55mm (maximum) beyond the fascia tilting fillet or wall face. Longer slate nails may be required at the eaves courses. Eave length should equal battening gauge plus headlap plus 25mm.

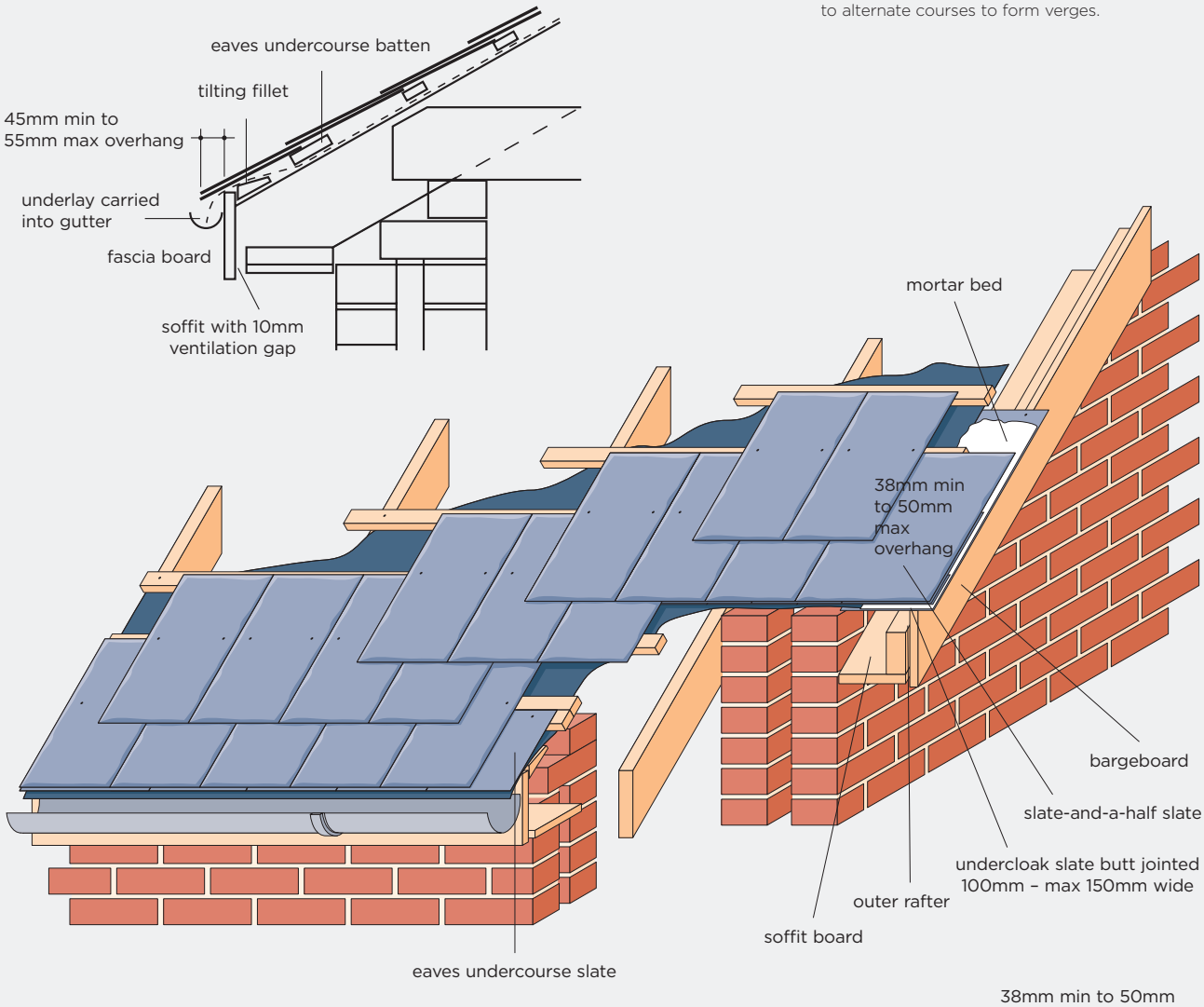
**VERGE ON BRICKWORK**

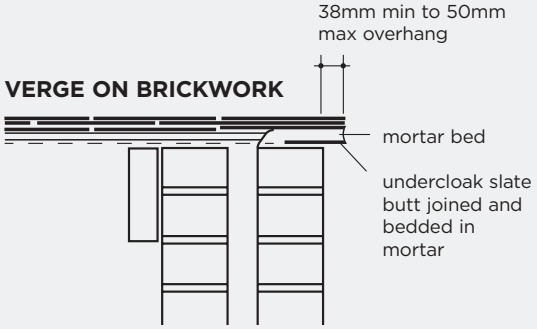
Ensure that undercloak and underlay are well lapped. Bed undercloak in mortar fair face down, to a true line, projecting 38mm (minimum) to 50mm (maximum) beyond face of wall, and point neatly to match in with joints in walling. Cut verge slates as necessary and fix flush with undercloak. Fill the gap between undercloak and slates with mortar, and strike off to give a neat, flush joint. Mortar for bedding and pointing, 1:3 cement:sand pigmented to match colour of slates.

**VERGE ON BARGEBOARD**

Ensure that undercloak and underlay are well lapped. Nail undercloak fair face down, to a true line and projecting 38mm (minimum) to 50mm (maximum) from face of bargeboard. Fill the gap between undercloak and slates with mortar, and strike off to give a neat, flush joint. Mortar for bedding and pointing, 1:3 cement:sand pigmented to match colour of slates.

Note: Where possible use slate-and-a-half slates to alternate courses to form verges.

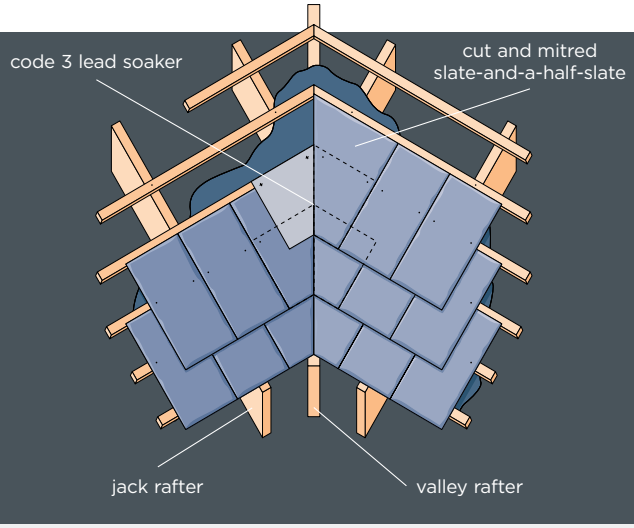


# VALLEYS

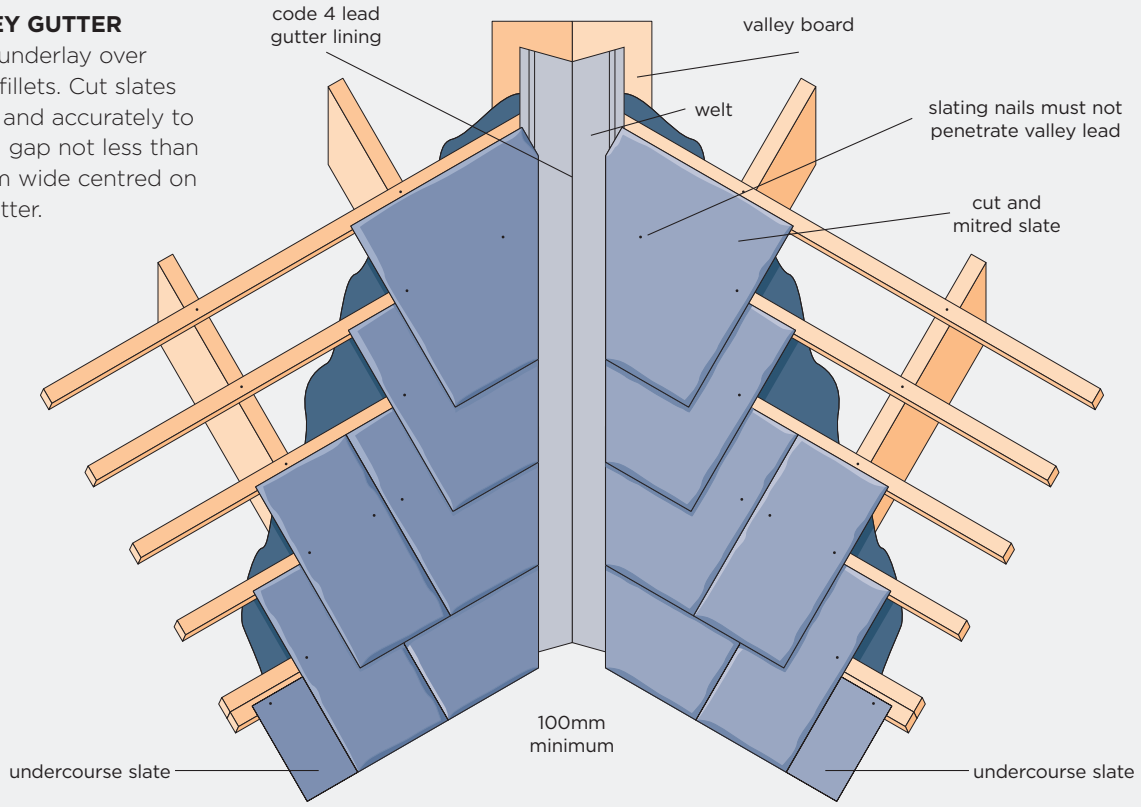
**MITRED VALLEY**

Cover with a strip of underlay 600mm wide, underlapping general underlay. Cut slates neatly and accurately and interleave with lead soakers to form a straight, close, weathertight mitred junction. Fix soakers by nailing to battens at the top edge. Minimum recommended pitch is 50˚, for pitches below this please contact Welsh Slate Technical Department.




**VALLEY GUTTER**

Dress underlay over tilting fillets. Cut slates neatly and accurately to form a gap not less than 100mm wide centred on the gutter.

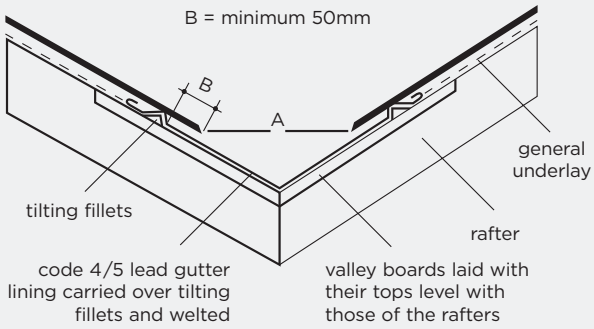



**MINIMUM RECOMMENDED OPEN LEAD VALLEYS (MM)**

| Roof pitch° | Area m² (on plan) | Rain fall rate mm/hr 75 | 150 | 225 |
|---|---|---|---|---|
| 20-22 | <25 | 100 | 125 | 125 |
| | 25-100 | 125 | 150 | 200 |
| 22.5-29 | <25 | 100 | 100 | 100 |
| | 25-100 | 100 | 125 | 125 |
| 30-34 | <25 | 100 | 100 | 100 |
| | 25-100 | 100 | 125 | 125 |
| 35+ | <25 | 100 | 100 | 100 |
| | 25-100 | 100 | 100 | 100 |

Rafter length maximum = 5m for areas of up to 25m²
Rafter length >5m and <10m for areas of up to 25-100m²
No vertical projections drain on to roof.
For further information please contact Welsh Slate Technical Department.

Valley gutter (cross section)
A = minimum 100mm
B = minimum 50mm



# HIPS

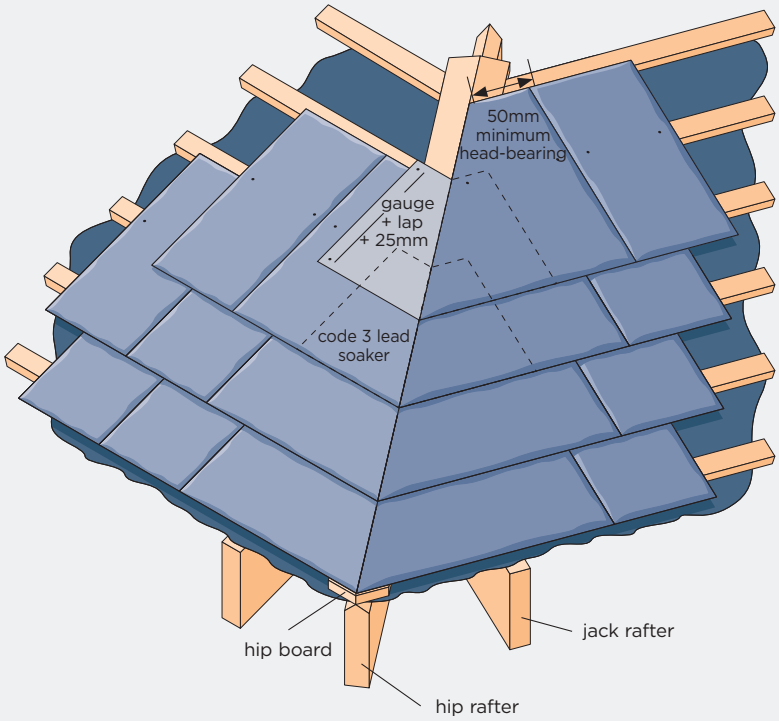


**MITRED HIP**

Cover with a strip of underlay 600mm wide, overlapping general underlay. Cut slates neatly and accurately, bevelled edge down. Interleave with lead soakers to form a straight, weathertight, close-mitred junction. Fix soakers by nailing to battens at the top edge.

N.B. Careful consideration must be given to mitred hip details at low roof pitches and in areas of severe exposure – contact Welsh Slate Technical Department

Mitred hips are not generally recommended below 300 pitches.




**MITRED HIP SOAKER WIDTHS**

| Pitch | Minimum Width at Head |
|---|---|
| 30º-35º | 150mm |
| 35º + | 100mm |



**TILED HIP**

Cover with a strip of underlay 600mm wide, overlapping general underlay. Fix hip iron to hip rafter with 5mm hot dipped galvanised screws or nails.

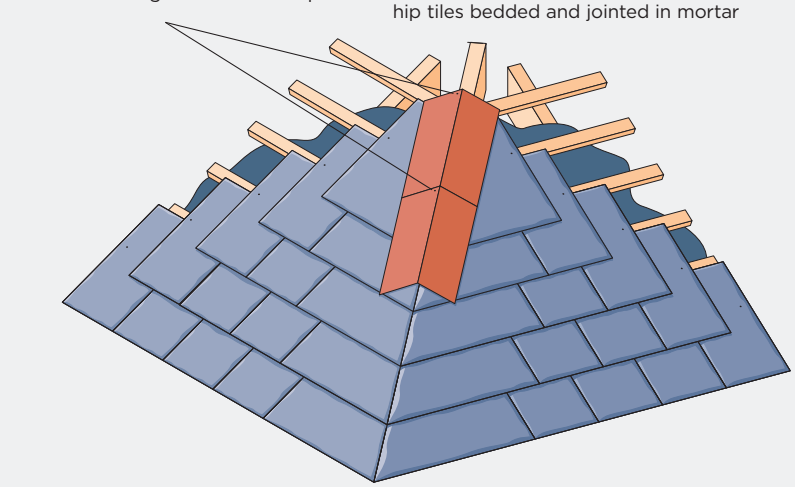
Hip irons to BS 5534, hot-dip galvanised after manufacture. Cut slates to fit closely at junction. Make weathertight with ridge tiles laid to a true line with edges and joints, solidly bedded in mortar. Provide mechanical fixing to each hip tile (generally a screw and sealing washer fixed into hip rafter or extra hip batten), and neatly strike off flush with mortar as work proceeds. Shape first tile to align with corner of eaves and fill end with mortar and slips of slate finished flush. Mortar for bedding hip tiles 1:3 cement:sand pigmented to approved colour.

**METAL ROLL HIPS**

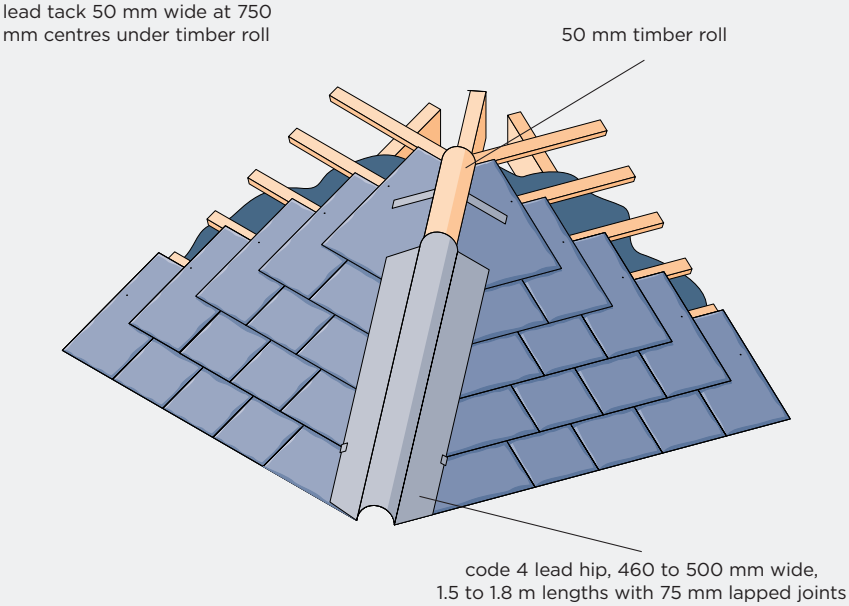
Metal roll hips should conform with sheet metal technical recommendations.

For advice on pitches less then 30˚, contact the Welsh Slate Technical Department.

**TILED HIP**




**HIP WITH LEAD ROLL**



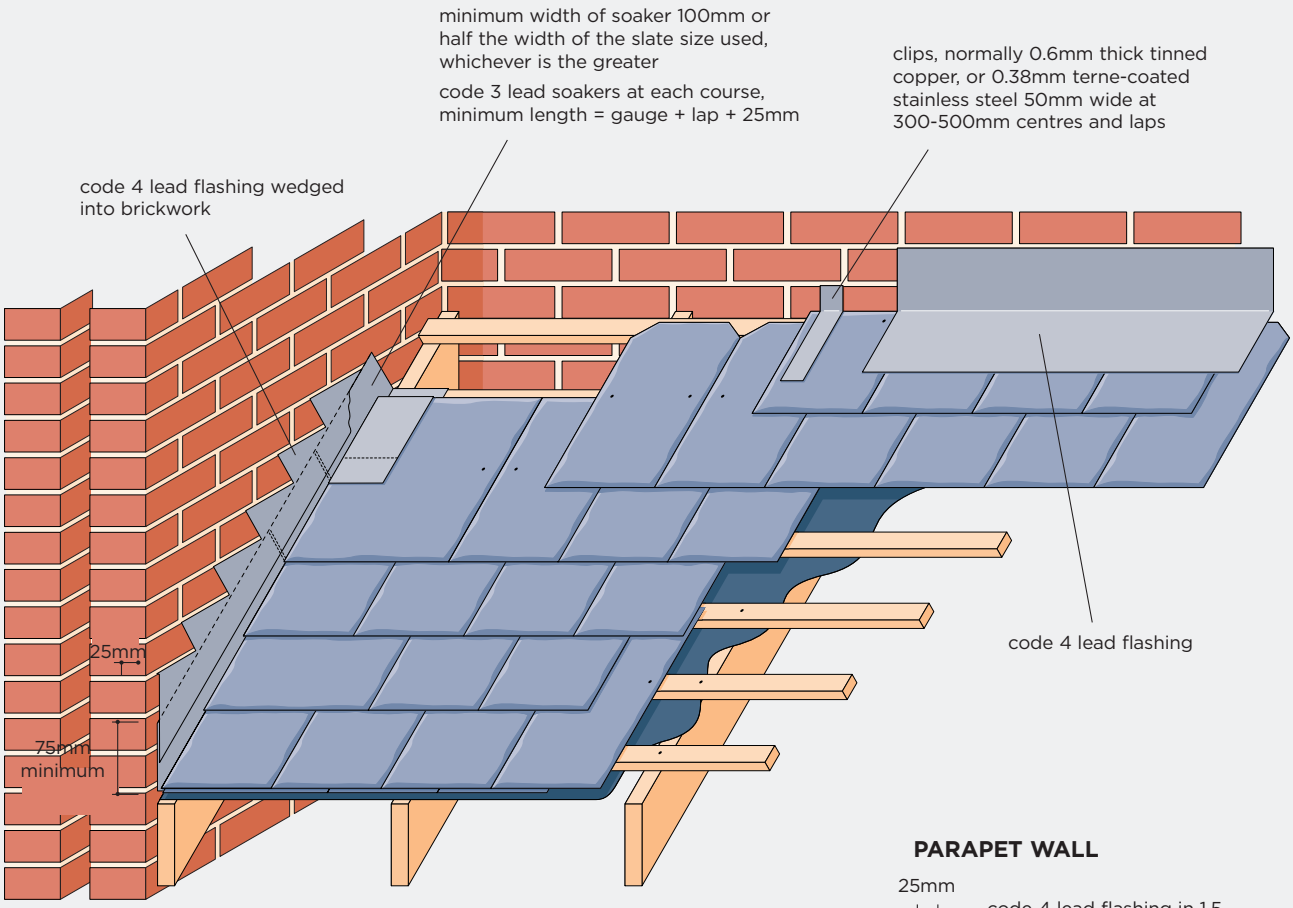
# ABUTMENTS

**SLOPING EDGE**

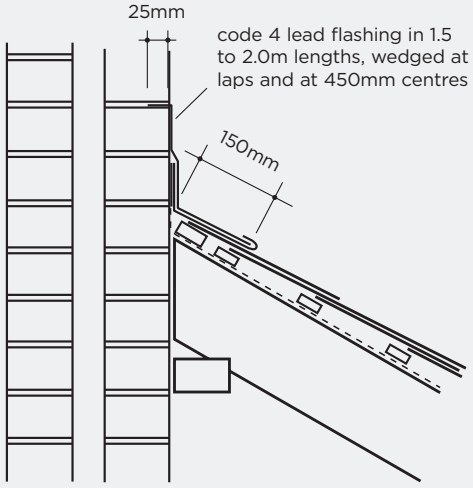
Cut slates as necessary and interleave with lead soakers to form a close, weathertight abutment. Fix soakers by turning down over the head of each slate. Ensure that lead flashings are neatly dressed down over soakers immediately after slating is complete.

**TOP COURSE**

Turn underlay 100mm up abutment. Finish slating with a head-nailed short course to maintain gauge. Ensure that flashings are fixed immediately after slating is complete.




**PARAPET WALL**



# RIDGES

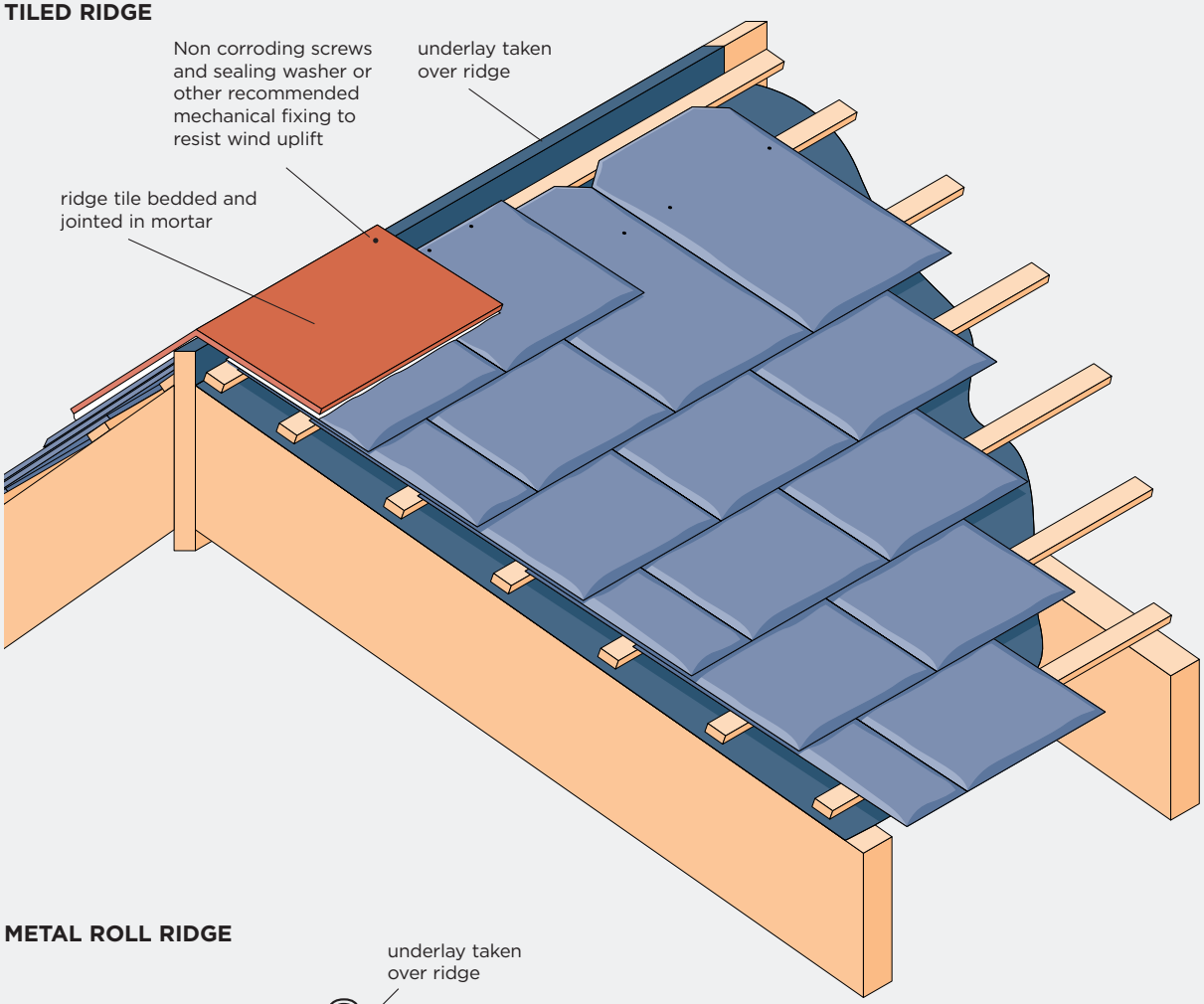
**TILED RIDGE**

Lay a length of underlay over ridge to overlap general underlay by not less than 150mm. Finish slating with a head-nailed short course to maintain gauge. Make weathertight with ridge tiles laid to a true line with edges and joints solidly bedded in mortar. Provide mechanical fixing to each ridge tile (generally a screw and sealing washer fixed into ridge board or extra hip batten), and neatly strike off flush with mortar as work proceeds. Fill ends of ridges at gables with mortar and slips of slate finished flush. Mortar for bedding ridge tiles,1:3 cement:sand pigmented to approved colour. Where it is necessary to adjust gauges to ensure adequate ridge covering overlap, the last two courses may be cut providing that the minimum headlap is maintained.

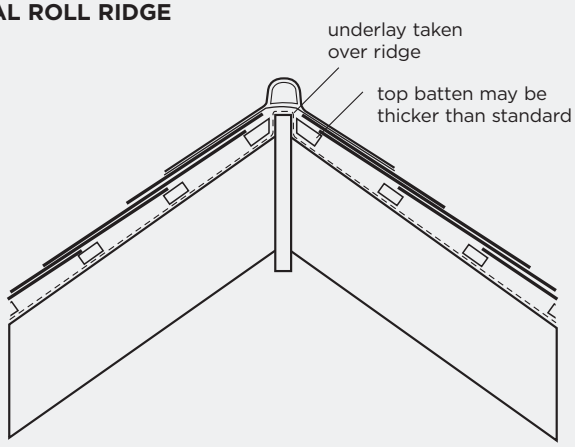
**METAL ROLL RIDGE**

Code 4 or 5 lead ridge, 460 to 500mm wide, 1.5 to 1.8 metre lengths with welted joints. Lead tack 50mm wide at 150mm centres, under timber roll. Horizontal laps at 150mm.

**TILED RIDGE**




**METAL ROLL RIDGE**

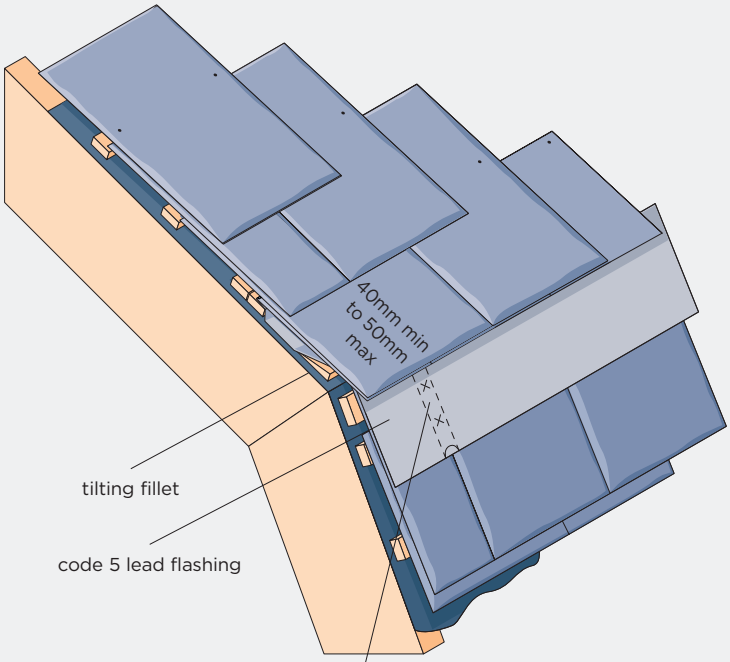


# CHANGES IN ROOF PITCH

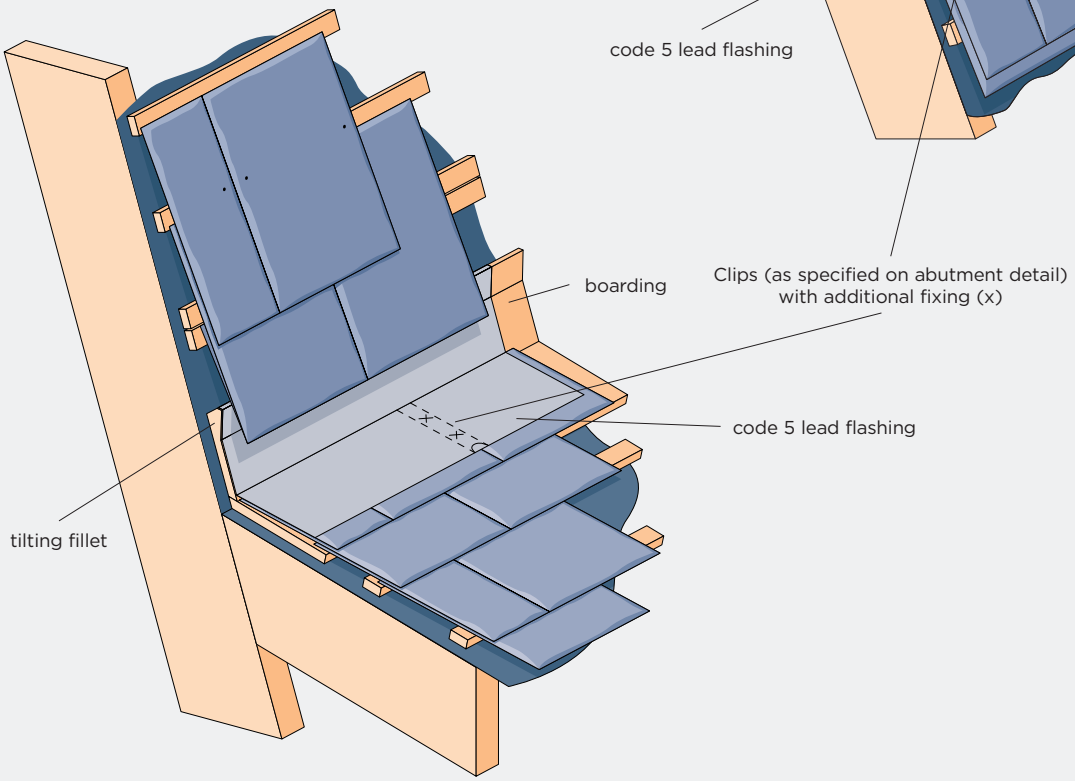




**MANSARD ROOF**




**CHANGE IN PITCH: GREATER THAN 150º**



# VERTICAL SLATING



**VERTICAL SLATING**
Fix Welsh Slate roofing in accordance with BS 5534.

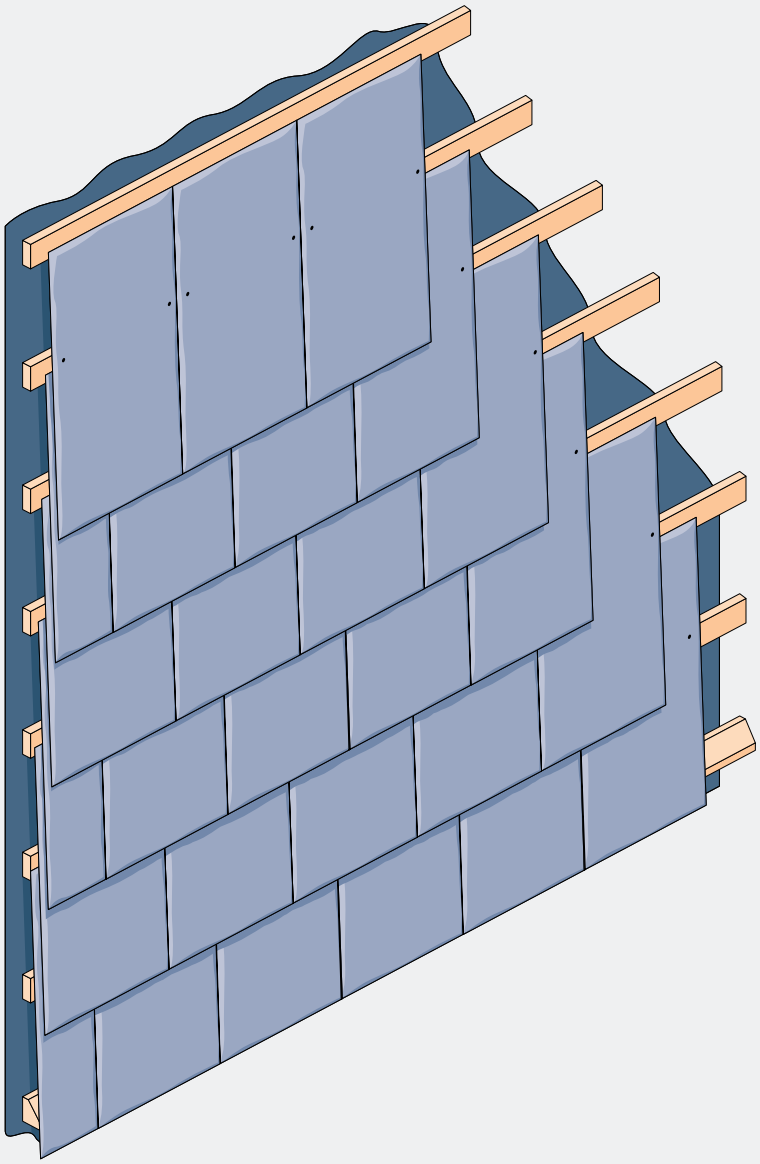
**BOTTOM EDGES**
Fix additional batten for under eaves course. Fix slates with tails neatly aligned. A tilting fillet should be used to support the eaves course.

**TOP EDGES**
Finished with head-nailed short course to maintain gauge.

**ABUTMENTS**
Cut slates as necessary to leave a neat 5mm gap adjacent to abutment, or use purpose-made slate-and-a-half.

**ANGLES**
Cut slates as necessary and interleave with lead soakers to form a neat, weathertight, close mitred junction. Fix soakers by nailing to battens at the top edge.

**ROOF VERGES**
Splay cut slates at ends of courses to fit closely under verge.



# ROOFING VENTILATION

Building Regulation Approved Document F2 (England and Wales), Building Standards (Scotland) G4.1 and Building Regulation (Northern Ireland) C8 require that adequate provision is made in all roof voids to prevent excessive condensation.

Further guidance is also given in BS 5250 Code of Practice for the Control of Condensation in Buildings.

The most effective means of controlling harmful condensation is to provide efficient roofspace ventilation. This can be achieved by providing eaves/low level through to ridge/high level ventilation.

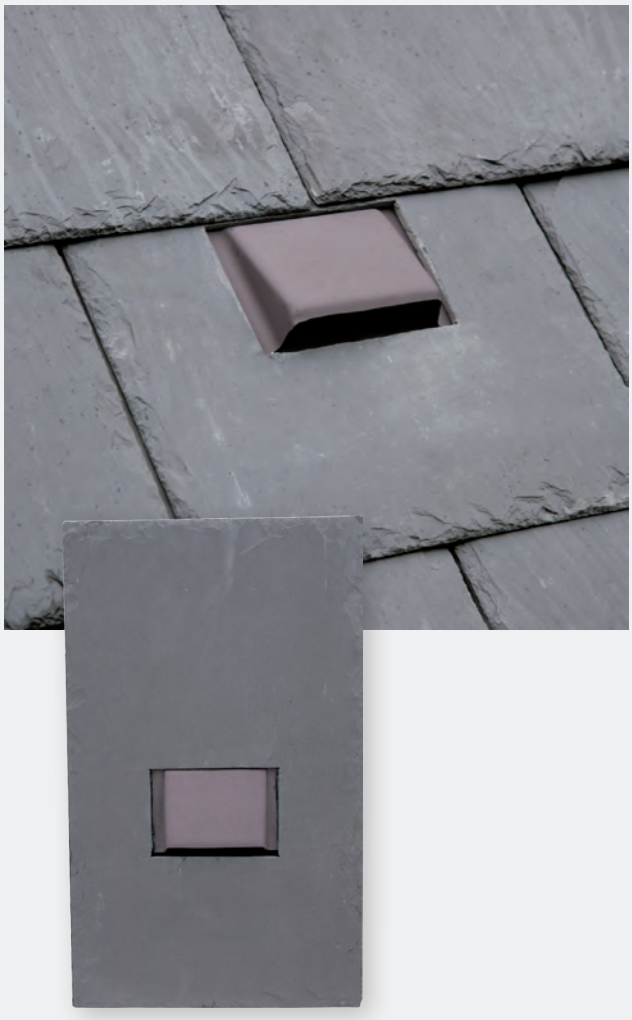
Welsh Slate ventilators have been purpose designed to provide efficient roof ventilation terminals. These ventilators are supplied with any of our natural roofing slates as a discreet, integral, roof ventilation unit.

The Welsh Slate ventilators can be used as roof terminals for natural ventilation and with adaptors as mechanical ventilation and soil pipe ventilation terminals. **For further information please contact the Welsh Slate Technical Department.**

**DISCREET TOP VENT UNIT**



**BAT ACCESS UNIT***



* Designed to allow the entry of bats into the batten cavity/roofspace. Guidance must be sort from a Bat Conservation Trust approved ecologist or from the BCT.

# NATURAL SLATE VENTILATORS

**BENEFITS**

- Suitable for mechanical, soil pipe and natural ventilation
- Sidelap feature to accommodate angle of creep requirements
- Driving rain resistant – tested at the Building Research Establishment
- 4mm large insect grille
- Injection moulded lower tray and grille

**SPECIFICATION CLAUSES:**

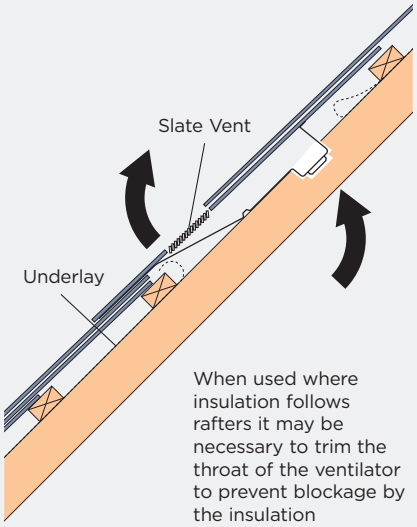
**Roofspace Ventilation** Provide low/high level roofspace ventilation by means of a Welsh Slate Ventilator. Install at 2m or 1m centres to provide ventilation equivalent to 5,000 / 10,000mm 2/metre in accordance with Building Regulations Approved Document F2 and BS 5250. Fix in accordance with manufacturers instructions.

**SOIL VENT PIPE AND MECHANICAL EXTRACTION TERMINALS**

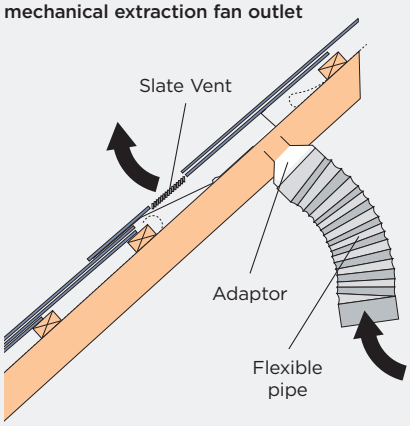
Soil vent pipe stacks/mechanical extraction ducting to be terminated at the roofslope using a Welsh Slate Ventilator. Attach Welsh Slate Vent Pipe Adaptor and Flexible Pipe, ensure all joints and connections are airtight in accordance with Building Regulations Approved Document H1. Fix in accordance with manufacturers instructions. All pipes and ducts in cold roofspaces are to be insulated.

## INSTALLATIONS

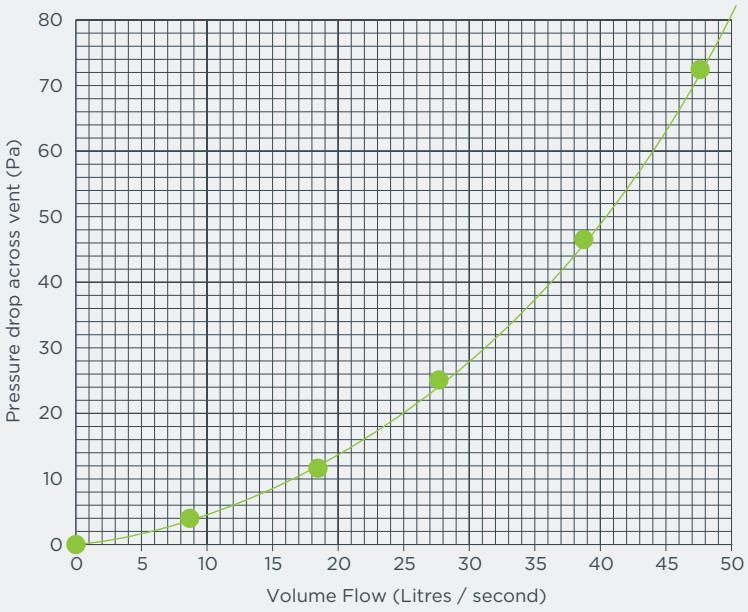
**Slate Vent installed as roof space ventilator**




**Slate Vent installed as soil vent or mechanical extraction fan outlet**




## EXHAUSTING AIR TO ATMOSPHERE




**PERFORMANCE:**

| | |
|---|---|
| Nett free ventilation area: | 10,000mm² |
| Minimum pitch in moderate exposure: | 20° |
| Spacing centres to achieve ventilation area of: | |
| 5,000mm²/metre | 2.0m |
| 10,000mm²/metre | 1.0m |
| Airflow resistance with pipe adaptor at: | |
| 18 litres/second | 12.0 Pascals |
| 30 litres/second | 30.0 Pascals |
| 47 litres/second | 72.0 Pascals |

**REFERENCES**

Building Regulation Approved Document F2 'Condensation in Roofs'

Building Regulation Approved Document H1 'Sanitary Pipework and Drainage'

BS 5250 'Code of Practice for Control of Condensation in Buildings'

BS 5534 'Code of Practice for Slating and Tiling',

British Standards (Scotland) Regulations, Technical Standards for Compliance G4.1

'Interstitial Condensation' British Regulations (Northern Ireland) C8.

# CASE STUDIES



Waterloo Mansions, Kent



Coal Drops Yard, London

**WATERLOO MANSIONS**

An unusual double-mansard roof on a Grade II listed seafront mansion block is enjoying a new lease of life, thanks to Welsh Slate. Some 11,000 Penrhyn Heather Blue Capital-grade slates from Welsh Slate now adorn the roof and elevations of Waterloo Mansions, part of a Georgian terrace which overlooks Dover harbour, designed in the 1830s by Philip Hardwick, architect of the Euston Arch. The multi-million pound project to refurbish the six-storey building envelope for client Dover Harbour Board was completed this summer by main contractor Walker Construction after several years, and several Covid lockdowns.

**COAL DROPS YARD**

Formerly a seedy area worth avoiding, London's Kings Cross has now been transformed into a go-to destination for office workers, students and tourists. Developer Argent's regeneration of the area has sensitively re-purposed the early Victorian railway buildings into variously, a college campus, supermarket and offices, in which the interior changes are radical but the exteriors have been left largely unaltered. The new roofs of the ornate cast-iron and brick structures have been slated with 92,000 new versions of the original Welsh Slates – 500mm x 250mm Cwt Y Bugails from the manufacturer's Llan Ffestiniog quarry in North Wales.



King's Cross Station, London



Rijksmuseum in Amsterdam

**KING'S CROSS STATION LONDON**

Built in the second half of the 19th Century, King's Cross Station is an icon of Victorian architecture and, like many buildings of this vintage, was roofed with quality Welsh slate. After more than 100 years of exposure to the elements the roof at King's Cross railway station is again roofed with Welsh Slate, an indication of the quality and durability of natural Welsh Slate. Welsh Slate supplied 30,000 Ffestiniog Blue Grey slates for the restoration of the slate roof in the eastern range whilst managing to salvage about 20% of the original slates, all of them Welsh.

**RIJKSMUSEUM IN AMSTERDAM**

After years of restoration and renovations, the Rijksmuseum in Amsterdam stands out as both a fusion of new and old, national and international, and reclaims its title as one of the best museums in Europe. The entire roof has now been restored to its former glory using Welsh Slate's Ffestiniog Blue Grey Capital slate. The stone cleaved from 500 million year old Ordovician slate beds to produce natural slate was the material of choice for the architect and client given Welsh Slate's Ffestiniog Blue Grey colour, durability and longevity. Visitors can expect a spectacular new entrance hall and the entire collection reordered chronologically, plus the return of Rembrandt's The Night Watch.



# QUALITY ASSURANCE

**QUALITY ASSURANCE**
Welsh Slate were the first natural slate manufacturer in the world to achieve ISO9002 accreditation to produce roofing slates satisfying BS680. The company exercises stringent quality control measures at all stages of extraction and manufacture through to delivery.

Welsh Slate roofing is produced in accordance with BS EN 12326 and surpass its requirements for use in all conditions. In line with this, Welsh Slate Penrhyn, Cwt-y-Bugail and Ffestiniog roofing products are certified by the British Standards Institution kitemark licence, KM08014. Penrhyn and Cwt-y-Bugail are also certified by the Belgium Construction Certification Association and carry the ATG mark. ATG Certificate numbers; Penrhyn H631, Cwt-y-Bugail H747.

Today, Welsh Slate roofing is produced in accordance with ISO9001 Quality Management System, FM539236.

**ENVIRONMENTAL RESPONSIBILITY**
Welsh Slate is committed to conducting our business in an environmentally responsible manner. We have a responsibility to maximise the environmental benefits, to minimise the environmental impact and to promote sustainable development within our operations and the services we provide.

Welsh Slate operates an Environmental Management System, EMS 539237, certificated to ISO 14001.

Welsh Slate is committed to restoring and remodelling landscapes that are affected by quarrying. Exceptionally high environmental performance standards have been achieved and are continued through development programmes that use natural materials and processes to recreate the unique character of each site.

ISO 9001 ISOQAR REGISTERED
Cert No. 14622

ISO 14001 ISOQAR REGISTERED
Cert No. 14622

OHSAS 18001 ISOQAR REGISTERED
Cert No. 14622

bsi
BS EN 12326
KM 08014

atg
H631
H747

CE
0086

Roofing / Walling / Flooring / Paving / Aggregates / Minerals / Cladding / Hard Landscaping

**CUSTOMER SERVICES**
Welsh Slate offer the following free services:

Technical Advice
Sample Service
Model Specification
Guide Price Costings
CAD Drawings
RIBA Approved CPD Seminars & Factory Tours

WELSH SLATE
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For more information or to request a sample please contact our sales office on **01248 600 656** or email **enquiries@welshslate.com**.

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Published January 2023

Federation Stone Great Britain
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NBS