



Minimum Overlap Guidance

Lower PV Field
S4 System to Bottom Flashing Interface

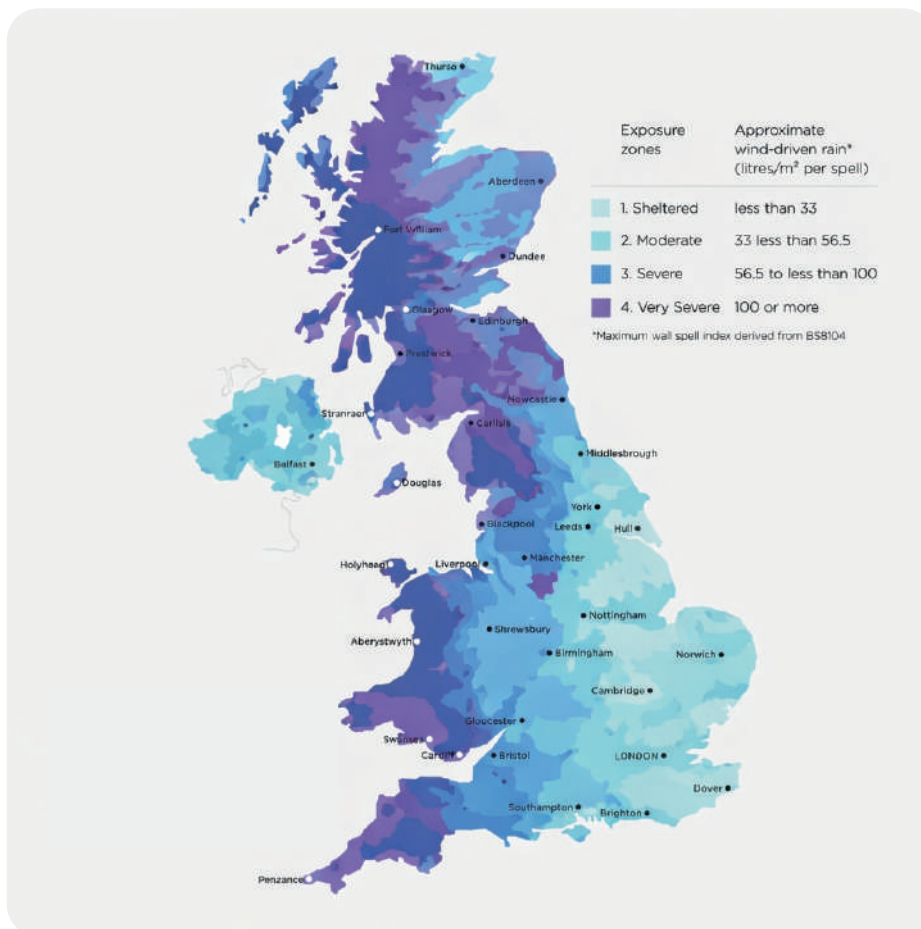
1- SCOPE

This document defines the minimum recommended lap of lower flashings (weathering aprons) installed beneath the S4 tray mounting system when used on pitched roofs with natural slate, fibre-cement slate, or profiled tile coverings in the United Kingdom.

The S4 mounting system has been tested and validated for roof pitches from 12° to 70°. The guidance in this document covers the full validated pitch range. The guidance applies to roof-integrated photovoltaic mounting systems where the S4 tray replaces one or more courses of the existing roof covering. The flashing lap dimension is the vertical overlap between the lower edge of the S4 tray apron and the head of the roof covering course immediately below.

This document is intended to be read in conjunction with:

- The S4 system installation manual
- The roof covering manufacturer’s fixing recommendations
- Site-specific wind load calculations in accordance with BS EN 1991-1-4 and its UK National Annex



This map shows the annual driving rain index.

■ 2- NORMATIVE REFERENCES

The following standards and codes of practice are referenced in this document.

Where dated, only the edition cited applies.

Where undated, the latest edition (including any amendments) applies.

| STANDARD | TITLE / SCOPE |
|-----------------------------|--|
| BS 5534:2014+A2:2018 | Code of practice for slating and tiling (including shingles) |
| BS 8104:1992 | Code of practice for assessing exposure of walls to wind-driven rain |
| BS EN 12326-1:2014 | Slate and stone products for discontinuous roofing and cladding – Product specification |
| BS EN 1991-1-4:2005+A1:2010 | Eurocode 1: Actions on structures – General actions – Wind actions |
| NA to BS EN 1991-1-4 | UK National Annex to Eurocode 1: Wind actions wind speed map, terrain categories, directional factors |
| BS 8000-6:2013 | Workmanship on building sites Code of practice for slating and tiling of roofs and claddings |
| BS EN 13707:2013 | Flexible sheets for waterproofing – Reinforced bitumen sheets for roof waterproofing |
| BS 5250:2021 | Management of moisture in buildings – Code of practice |
| BS 1202 (Parts 1-3) | Specification for nails |
| BS EN 1991-1-3:2003 | Eurocode 1: Actions on structures Snow loads (informative for combined loading assessment) |

■ 3. DEFINITIONS





3.1 FLASHING LAP

The vertical dimension of overlap between the lower apron of the S4 tray and the head of the course of slates or tiles immediately below, measured on the slope.

3.2 EXPOSURE ZONE

A classification of the severity of wind-driven rain at a given site, derived from the annual driving rain index as defined in BS 8104 and referenced in BS 5534.

The UK is divided into four zones based on the maximum wall spell index:

-  Zone 1 – Sheltered: less than 33 l/m² per spell
-  Zone 2 – Moderate: 33 to less than 56.5 l/m² per spell
-  Zone 3 – Severe: 56.5 to less than 100 l/m² per spell
-  Zone 4 – Very Severe: 100 l/m² or more per spell

In general, any area within approximately 30 miles (48 km) of a west-facing coastline is considered to be in a Severe exposure zone (BS 8104). Localised effects such as altitude, topography and orientation must also be assessed.

3.3 ROOF PITCH

The angle of the roof slope measured from the horizontal, in degrees. The S4 system is validated for pitches from 12° to 70°.

3.4 RAFTER LENGTH

The distance from the eaves to the ridge measured along the slope of the roof.

■ 4. DESIGN PRINCIPLES

4.1 WIND-DRIVEN RAIN PENETRATION

When wind-driven rain impacts a pitched roof, water may be driven upslope beneath lapped joints by a combination of:

- a) Dynamic wind pressure acting on the roof surface, creating positive pressure on the windward face and negative pressure (suction) on the leeward face, in accordance with BS EN 1991-1-4 and the UK National Annex.
- b) Capillary action between closely spaced surfaces
- c) Gravity head of accumulated water at low pitches
- d) Thermal stack effect drawing moist air through gaps

4.2 RISK FACTORS

The risk of water ingress beneath the S4 tray system increases when:

- Roof pitch decreases (longer water path on the slope surface)
- Exposure to wind-driven rain increases (higher dynamic pressure)
- Rafter length is greater (larger volume of water reaching each lap joint)
- Building height is greater (increased wind speed and exposure at roof level)
- Complex roof geometry creates funnelling or concentration of water flow

4.3 DESIGN METHODOLOGY

The lap values given in this document are S4 manufacturer recommendations derived from the following methodology:

- Exposure zone classification in accordance with BS 8104 and the driving rain map referenced in BS 5534 Annex A
- Wind pressure calculation principles from BS EN 1991-1-4 and the UK National Annex (basic wind speed, terrain roughness, orography, site altitude)
- Headlap design principles from BS 5534 Section 6 (weather resistance of lapped joints)
- Industry best practice for roof-integrated solar mounting systems

5. MINIMUM RECOMMENDED FLASHING LAP

Table 1 below gives the minimum recommended vertical flashing lap (measured on the slope) between the S4 tray apron and the underlying roof covering, as a function of roof pitch and wind-driven rain exposure zone.

| EXPOSURE ZONE (BS 8104) | 12° - 15° | 15° - 20° | 20° - 25° | 25° - 35° | 35° - 45° | 45° - 70° |
|--|-----------|-----------|-----------|-----------|-----------|-----------|
| Zone 1 Sheltered (< 33 l/m ²) | 150 mm | 120 mm | 100 mm | 100 mm | 100 mm | 100 mm |
| Zone 2 Moderate (33 to < 56.5 l/m ²) | 200 mm | 150 mm | 120 mm | 100 mm | 100 mm | 100 mm |
| Zone 3 Severe (56.5 to < 100 l/m ²) | † | 200 mm | 150 mm | 120 mm | 100 mm | 100 mm |
| Zone 4 Very Severe (≥ 100 l/m ²) | † | † | 200 mm | 150 mm | 100 mm | 100 mm |

† Project-specific engineering assessment required. At very low pitches combined with high exposure, enhanced detailing beyond standard lap dimensions is necessary. Contact S4 technical department.

NOTE 1:

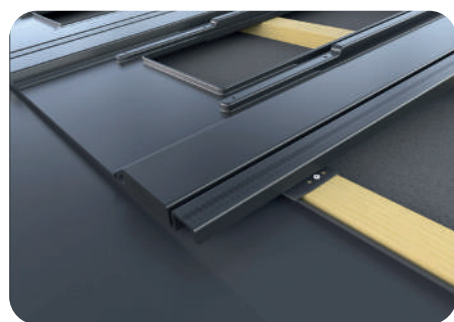
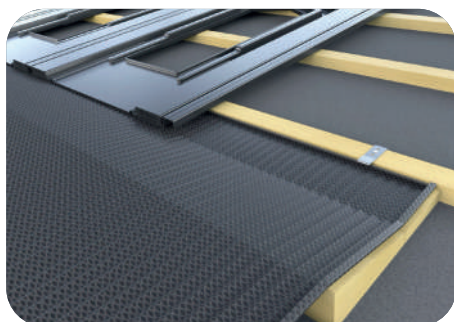
The minimum lap shall not be less than 100 mm under any circumstances. This is an absolute minimum regardless of pitch, exposure or other factors.

NOTE 2:

The S4 system is validated for roof pitches from 12° to 70°. Values in this table cover the full validated range.

NOTE 3:

The values in Table 1 are S4 manufacturer engineering recommendations. They are derived from the exposure classification principles of BS 8104 and the weather resistance design methodology of BS 5534, but are not directly prescribed by those standards. They represent S4's assessment of the minimum lap required for adequate weather resistance when integrating the S4 tray system with the existing roof covering.



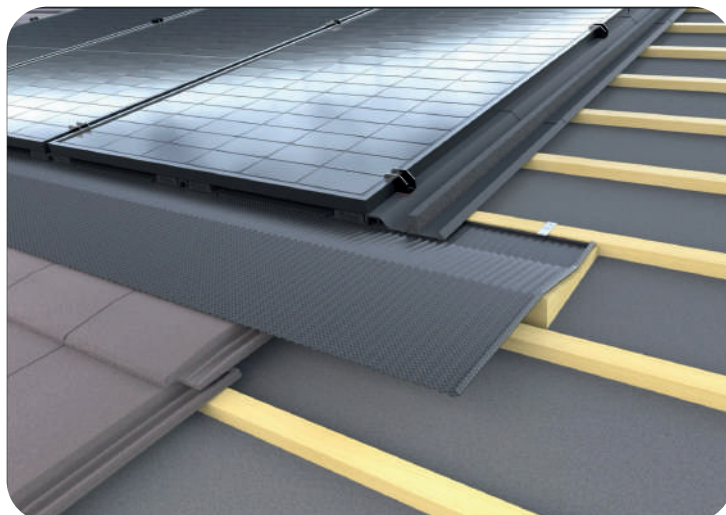
6. CORRECTION FACTORS

Where any of the site conditions listed in Table 2 apply, the flashing lap should be increased to the next higher category. Where multiple conditions apply simultaneously, the most onerous single factor should be used to determine the applicable lap increase.

In exceptional cases where two or more significant factors clearly combine (e.g. building height > 10 m on an exposed coastal site), a maximum of two category increments may be applied, subject to the overall maximum of 200 mm.

| SITE CONDITION | ADJUSTMENT |
|---|---|
| Rafter length > 6 m in Severe / Very Severe zones | Increase lap by one category (e.g. 120 → 150 mm) |
| Rafter length > 6 m in Severe / Very Severe zones | Increase lap by one category (e.g. 120 → 150 mm) |
| Building height > 10 m above ground level | Increase lap by one category |
| Within 30 miles of west-facing coastline | Minimum Severe zone values apply regardless of map zone |
| Complex geometry (valleys, dormers, penetrations) | Increase lap by one category |
| Altitude > 100 m above sea level | Consider next higher exposure zone |

For rafter lengths and exposure zone limits, refer to BS 5534 which states that minimum headlap recommendations generally apply to rafter lengths of not more than 9 m in moderate exposure zones and 6 m in severe exposure zones.



■ 7. SUPPLEMENTARY MEASURES

The following measures may be used to enhance weather resistance but do not replace the minimum lap dimension specified in Table 1:

- **PRE-COMPRESSED EXPANDING FOAM SEALS:**

Provide additional protection against wind-driven rain ingress at the lap joint. These are considered supplementary and should not be used to justify a reduction in lap dimension.

- **REINFORCED UNDERLAY:**

A suitable underlay to BS EN 13707, compliant with BS 5534, should be installed beneath the S4 system and the adjacent roof covering. The underlay provides a secondary barrier against water penetration.

- **SEALANT BEADS:**

Where site-specific conditions warrant, a continuous bead of compatible sealant may be applied at the lap joint. This is considered supplementary protection only.

■ 8. WIND LOAD CONSIDERATIONS

The S4 system must be designed to resist wind uplift forces calculated in accordance with BS EN 1991-1-4:2005+A1:2010 and the UK National Annex (NA to BS EN 1991-1-4). The key parameters to determine are:

- Fundamental basic wind velocity ($v_{b,map}$) from the UK National Annex wind speed map
- Altitude factor, directional factor, seasonal factor, and probability factor per the UK NA
- Terrain roughness category and orography factor
- External and internal pressure coefficients for the specific roof geometry

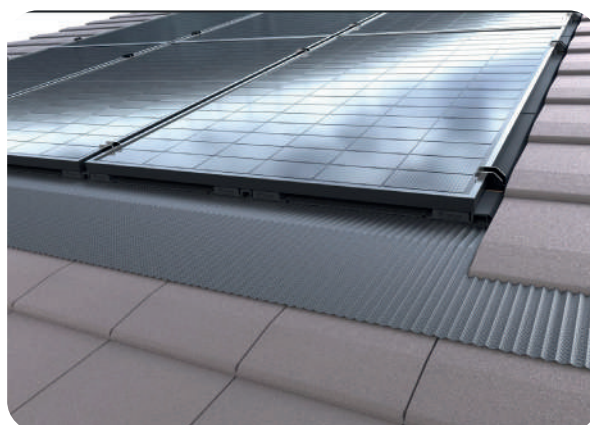
The fixing specification for the S4 tray system is determined separately by the S4 configurator tool, which calculates the design wind load for a given site and roof configuration. The flashing lap values in this document address weather resistance (rain penetration) and are not a substitute for the structural wind load calculation.

■ 9. COMPATIBILITY WITH ROOF COVERING

The S4 system is designed to be compatible with natural slate roofing products conforming to BS EN 12326-1:2014 and fibre-cement slates conforming to BS EN 492.

The lap values in this document have been established with reference to the headlap recommendations for these covering materials as published in BS 5534 and by leading UK slate manufacturers.

Where the roof covering manufacturer specifies a minimum headlap greater than the values in Table 1 for the same pitch and exposure conditions, the larger value should be adopted.



■ 10. DISCLAIMER

The values in this document are S4 manufacturer engineering recommendations based on the design principles of BS 5534, the exposure zone methodology of BS 8104, wind action assessment per BS EN 1991-1-4 and its UK National Annex, and industry best practice for roof-integrated solar mounting systems.

These recommendations do not replace the requirement for a site-specific assessment by a competent designer. Final responsibility for detailing and installation rests with the designer and installer in accordance with all applicable Building Regulations, British Standards, and project-specific conditions.

For any project-specific queries or conditions not covered by this guidance, contact the S4 technical department.



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