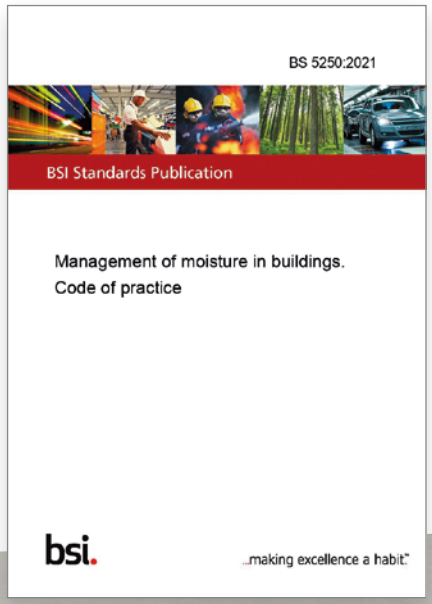
glidevale protect

BS 5250:2021

Management of moisture in buildings
Code of practice



White Paper

BS 5250:2021

This revision of BS 5250 comes at a time when buildings are under increasing stress from moisture for two complementary reasons:

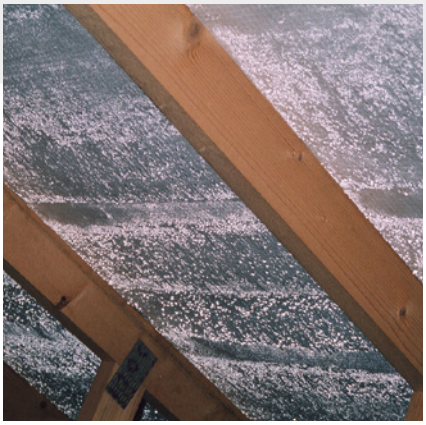
- **The effects of climate change will impact directly on buildings because of increased penetration of driving rain, more frequent, deeper and longer lasting flooding and increased atmospheric humidity that slows drying rates.**
- **Energy conservation measures to combat climate change include a reduction in ventilation, which increases internal humidity, and increased levels of thermal insulation, which makes the outer layers of the fabric colder. Energy saving retrofit of traditional buildings, which have been in equilibrium with the ambient climate for many years, can lead to significant moisture problems in the structure.**

Condensation in roof spaces

A number of factors in modern constructions have led to increased risks of condensation within roof spaces:

- **Fortuitous natural ventilation within buildings has been reduced by the use of high-performance draught-proof doors and windows and the blockage or elimination of open-flued chimneys.**
- **Modern lifestyles generate higher amounts of water vapour.**
- **Average air temperatures within buildings have increased, thereby allowing more water vapour to be carried in the air.**
- **Increased amounts of insulation at ceiling level have led to colder roof voids.**
- **The widespread use of roofing underlays has greatly reduced the amount of natural ventilation of the roof space.**
- **The use of vapour permeable (Type LR) underlays, with sealed laps reduce the amount of ventilation in the roof space.**

Research has shown that about 20% of the air that enters a building, and in particular dwellings, leaves via the roof with an additional moisture load, and that typically 80% of any water vapour transported into the roof is by air motions (convection) through the ceiling via gaps and cracks. Condensation in the roof, taking place out of sight of the occupier, can cause serious damage, including severe structural weakening by wet or dry rot, loss of effectiveness of insulation, and damage to decoration through staining and mould growth.



What causes condensation?

Warm air can hold more water vapour than cold air. Condensation begins when air temperature drops to the dew point, or when warm moist air comes into contact with a cold surface. Water vapour can pass through most building materials including brick, concrete, plaster and plasterboard (unlined), wood and insulation. Warm air from within the building, carrying water vapour, can pass through ceilings into roof spaces. Since the roof space is likely to be colder, condensation will occur as soon as the air meets a cold surface; this is termed the *'wetting-out phase'*.

Building Regulations

All Building Regulations for the UK and the Republic of Ireland make requirements for the prevention of harmful effects caused by condensation in roofs.

The relevant documents are:

- **England & Wales:**
  Approved Document C2 2004 amd 2010 & 2013 'Resistance to moisture'.
- **Scotland:**
  Technical Handbook 2022 Domestic Buildings Section 3.15.3 'Control of condensation in roofs'.
- **Northern Ireland:**
  Technical Booklet C 2012 amd 2022 'Site preparation and resistance to moisture'. Regulation C4 Section 7 'Roofs'.
- **Republic of Ireland:**
  Technical Guidance Document F 'Ventilation' 2019. Section 2 'Condensation in roofs'.

Meeting the requirements

All the regulations and supporting documents throughout the UK and Ireland now cite BS 5250:2021 ‘Management of moisture in buildings – Code of practice’ as the main means of compliance. Section 12 refers to roofs and is subdivided into cold roofs with large voids above horizontal insulation and warm roofs with small or no voids above sloping insulation. The harmful effects of condensation can be controlled by the ventilation provisions shown here.

Notes to drawings

Figures are given in 000s of mm² per metre, e.g. 5 = 5,000 mm²/m

- Impermeable underlays (Type HR)
- Vapour permeable underlays (Type LR)
- Air and vapour control layer

Warm roofs with small or no voids above sloping insulation

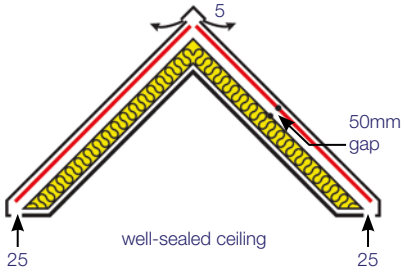
Impermeable underlays (Type HR)

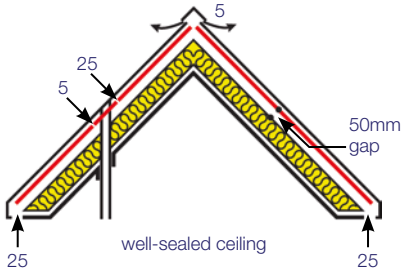
All roof types

All roof pitches: Ventilation beneath the underlay and above the insulation of 25,000 mm²/m at eaves or low level and 5,000 mm²/m at ridge or high level.

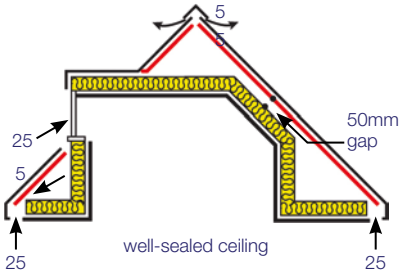
A *‘well-sealed ceiling’* must be provided as defined by BS 5250 section 12, and a separate air and vapour control layer on the warm side of the insulation. The ventilated void should take into account the underlay drape, which can reduce the effective ventilation air path. For design purposes, the depth of the ventilated void should be 25 mm plus the maximum allowable drape of the underlay, which is 15 mm.

Obstructions such as dormers, valleys, roof windows, compartment walls, fire barriers and changes in pitch create separate voids below the roof slope. Provide ventilation openings to each void at high and low level as shown in the examples.





Ventilation at compartment walls or fire barriers

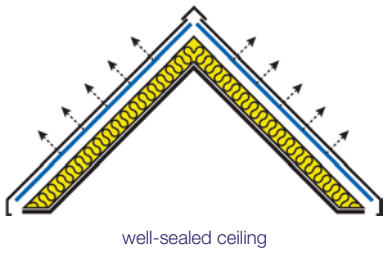


Room in the roof construction

Vapour permeable underlays (Type LR)

All roof types with an air and vapour control layer

All roof pitches: No ventilation is required provided that there is a vapour permeable underlay, either fully supported on insulation or draped unsupported, a well-sealed ceiling, and a separate continuous and effectively sealed air and vapour control layer on the warm side of the insulation. If there is any doubt about the ability to provide and maintain the air and vapour control layer, provide ventilation as if the underlay were impermeable (as below).



No ventilation required subject to conditions

Cold roofs
with large voids above horizontal insulation

Impermeable underlays (Type HR)

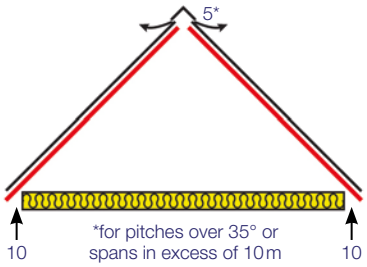
All roof types

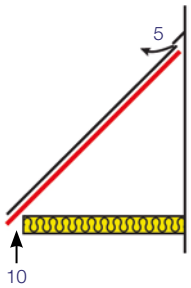
Roof pitch more than 10°: Ventilation beneath the underlay (or beneath timber sarking boards or sheets in Scottish practice) of 10,000 mm²/m at eaves or low level.

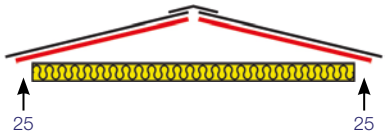
Roof pitch above 35°, or monopitch or lean-to roofs, or where roof span exceeds 10 m: Additional ventilation of 5,000 mm²/m at ridge or high level.

Roof pitch 10° or less: Ventilation beneath the underlay (or beneath timber sarking boards or sheets in Scottish practice) of 25,000 mm²/m at eaves or low level.

Flat roofs: Ventilation of 25,000 mm²/m at two opposite roof edges.







Vapour permeable underlays (Type LR)

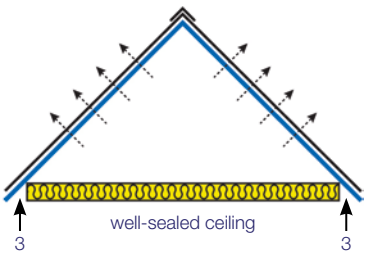
Dwelling-sized roofs

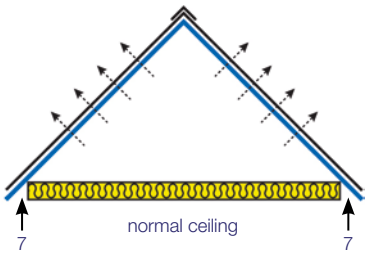
All roof pitches, with *'well-sealed ceiling'* as defined by BS 5250 clause 12.4.2: Ventilation beneath a vapour permeable underlay (or beneath sarking boards such as 150 mm planks in Scottish practice) of 3,000 mm²/m at eaves or low level.

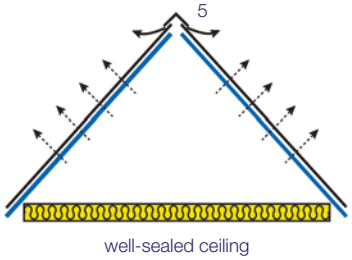
This reduction is possible due to the vapour permeability of the underlay.

All roof pitches, with ceiling not well-sealed (likely in re-roof situations): Ventilation of 7,000 mm²/m at eaves or low level.

Alternative solution: Ventilation of 5,000 mm²/m at ridge or high level only.



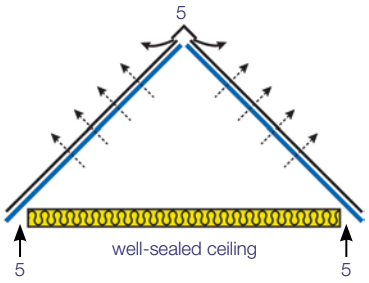


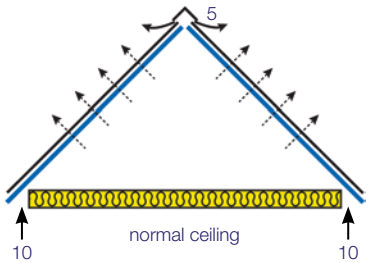


Larger than dwelling-sized roofs

All roof pitches, with *'well-sealed ceiling'* as defined by BS 5250 clause 12.4.2: Ventilation beneath a vapour permeable underlay (or beneath sarking boards such as 150 mm planks in Scottish practice) of 5,000 mm²/m at eaves or low level plus ventilation of 5,000 mm²/m at ridge or high level.

All roof pitches, with ceiling not well-sealed (likely in re-roof situations): Ventilation of 10,000 mm²/m at eaves or low level plus ventilation of 5,000 mm²/m at ridge or high level.





Air & vapour permeable underlays

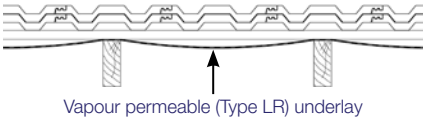
'Most LR underlays are airtight, however some are designed to be air permeable; this property can allow air movement from the loft space through the underlay into the batten space thereby reducing the risk of condensation on the underlay and cold structure.'

'Where limited or no ventilation to the loft space is proposed, reference should be made to the conditions attached to Technical Approvals given by UKAS (or European equivalent) accredited technical approval bodies.'

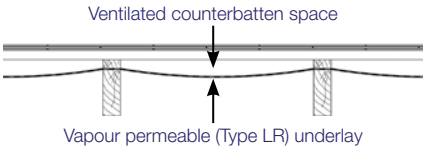
Other considerations

Roof coverings and batten space ventilation using vapour permeable underlays (Type LR)

Where vapour permeable underlays (Type LR) are used in both cold and warm roofs to contribute to the control of condensation, they do so by allowing water vapour to escape through the material by diffusion. It is important that this water vapour can escape through the roof covering to atmosphere from the tiling batten space. BS 5250 defines the level of air openness required of the roof covering and the test method. Traditional concrete and clay tiles should be sufficiently air open, but advice should be sought from the roof covering manufacturer/supplier.



Roof covering sufficiently air-open



Roof covering insufficiently air-open

In accordance with the requirements of 12.4.3.2, fibre cement slates are considered an airtight, close fitting roof covering. When tight outer coverings are applied, there is a risk of interstitial condensation on the underside of the underlay and the external covering. To minimise such risk, BS 5250 advises a ventilated batten space with counter-battens.

Section 12.4.3.2 of BS 5250:2021 states:

'*The outer weatherproof covering is deemed to allow sufficient air movement and be air permeable if the airflow in m^3/h at a differential of 10 Pa is greater than 17.4 Ar, where Ar is the area of the outer weatherproof covering under test in m^2. If the airflow is not greater than 17.4 Ar (in m^3/h), then the outer weatherproof covering is deemed air impermeable.'*

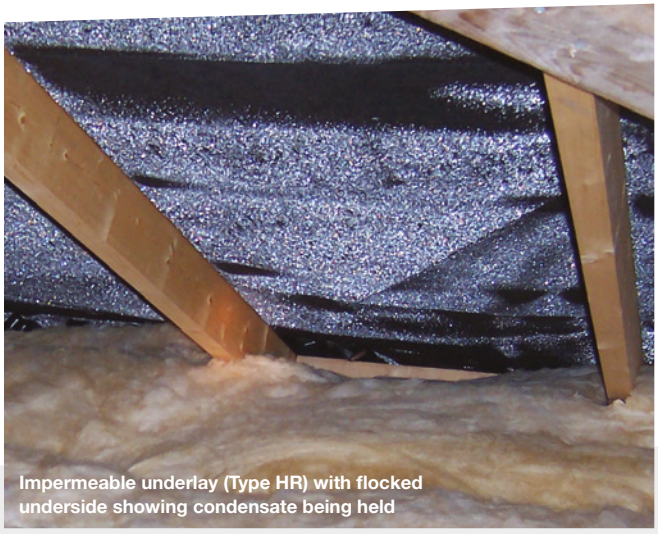
'If the outer weatherproof covering of the roof is not sufficiently air permeable, then the provisions in 12.4.3 should be followed.'

This would result in a requirement of 25,000mm^2/m eaves ventilation and 5,000mm^2/m ridge ventilation within the counter-batten space to ensure compliance to BS 5250 and reduce the risk of interstitial condensation forming on the underside of the roof covering.

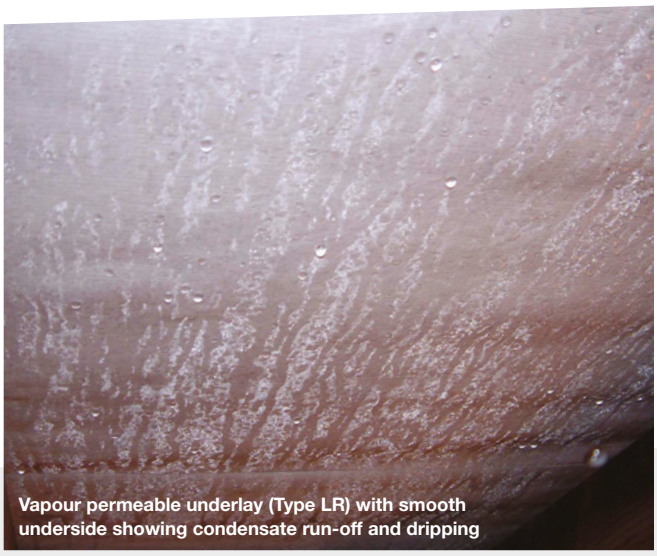
'An underlay which offers low resistance to the passage of water vapour tends to lower the risk of condensation in the loft but might increase the risk of condensation in the batten space, possibly increasing the risk of decay of timber battens, or corrosion of metals, unless there is sufficient air movement between the battens and through the external covering'.

The use of an LR underlay would increase the risk of interstitial condensation forming within the batten space. Any roof of this construction would not be compliant to BS 5250 unless a ventilated counter-batten space has been included.

When a high vapour resistance (HR) underlay is applied, BS 5250 does not require a ventilated counter-batten space. The HR underlay should prevent moisture from reaching the exterior layers above the underlay. This approach would still require both eaves and ridge ventilation to comply with the ventilation requirements stated in 12.5.2 'Cold pitched roof with HR underlay' and 12.6.2 'Warm pitched roof with HR underlay'.



Impermeable underlay (Type HR) with flocked underside showing condensate being held



Vapour permeable underlay (Type LR) with smooth underside showing condensate run-off and dripping

The consequences of inadequate roofspace ventilation

Sarking boards

An LR underlay, which is fully supported on material which offers a high resistance to the passage of air or water vapour, such as plywood, oriented strand board (OSB) or chipboard, should be treated for design purposes as an HR underlay. LR underlays laid on open jointed square-edged board sarking, typically 150 mm wide with minimum 2 mm gaps between each board, may be treated, for design purposes, as unsupported LR underlays.

Other recommendations

To achieve good air circulation within any ventilated large void in a roof, openings should be placed on the longer sides of a roof; if this is not possible, provide equivalent openings on the shorter sides that will allow good through ventilation, avoiding stagnant air pockets. The entry of rain, snow, birds and large insects should be prevented. The latter can be achieved by a nominal 4 mm mesh/grille, which will also avoid excessive airflow resistance.

Ventilation openings should provide a continuous weatherproof path between the roof space and the outside air without compromising the weatherproof function of the underlay or the roof covering. Both vapour permeable (Type LR) and impermeable (Type HR) underlays with a smooth underside can cause problems from condensate run-off. Underlays which can hold or absorb moisture on their underside and re-evaporate it when conditions are more favourable are preferable.

Sealed ceilings

Sealing the ceiling of any building will reduce both moisture transfer and heat loss, thus minimising the risk of condensation in the roof. However, a totally airtight ceiling is extremely difficult to achieve in practice.

A *'well-sealed ceiling'* is more possible but requires high standards of workmanship by the trades involved installing plasterboard or other ceilings, plumbing and electrical services.

It is important to consider at design stage how construction details can be achieved that are robust over the lifetime of the building. When existing buildings are being refurbished or re-roofed, the advantages of improving the existing ceiling should be considered. It may, however, not be possible to achieve a well-sealed ceiling and that should be borne in mind when determining the form of construction and ventilation provision.

Glidevale Protect has it covered

A comprehensive choice of roofing underlays

Whatever your pitched roofing project, Glidevale Protect's broad collection of underlays has it covered. Providing the complete solution for all types of slate or tile roofs to meet the key requirements of water tightness, strong wind uplift resistance and condensation control, Glidevale Protect gives unrivalled choice in specification and complete peace of mind.

Impermeable & airtight (Type HR)

- **Protect A1T3 Plus**
- **Protect A1**
- **Protect Wunderlay**

Vapour permeable & airtight (Type LR)

- **Protect VP400 Plus LR**
- **Protect Zytec**
- **Protect VP300**
- **Protect VP200**

Air & vapour permeable (Type LR)

- **Protect Viking Air**

Roofing ventilation range

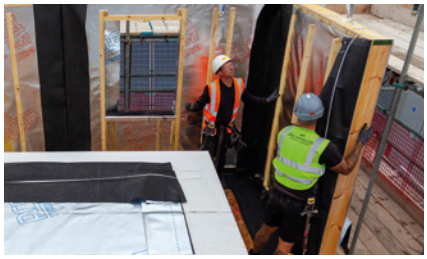
Suitable for all tile and slate roofs, the wide array of Glidevale Protect ventilation products helps reduce the condensation risk for the full cold or warm roof structure, delivering the required airflow requirements when used in conjunction with roofing underlays The range includes:

- **G Range Slate & Tile Ventilators**
- **In-Line® Slate, Tile & Ridge Ventilators**
- **Universal In-Line® Slate Tile Ventilators**
- **Versa-Tile G5 Ventilator / Terminal**
- **Rafter Ventilators**
- **Fascia Ventilators**
- **Soffit Ventilators**
- **Abutment Ventilator**
- **Monovent (Lean to Roof) Ventilator**
- **Ventilated dry fix ridge and hip systems**

Roofing accessories range

A full package of roofing accessories for all tile and slate roofs is also available, designed to complement the roofing product collection and offering an ideal alternative to traditional products. The range includes:

- **AluFlash lead-free alternative flashing**
- **Universal Dry Verge Systems for slates and interlocking tiles**
- **Universal Dry Fix Valley Trough**
- **Universal Valley Trough**
- **Universal Bonding Strip**
- **OFV Eaves Skirt & Eaves Comb**
- **Solar Inlet Terminal**



Construction division

A whole range of product options are available from Glidevale Protect's Construction Division. This includes a range of external wall membranes, internal airtightness and vapour control membranes for walls, floors and ceilings, sealing tapes, cavity trays, underfloor and cavity wall ventilation, intelligent passive stack ventilation, trickle vents and loft access hatches.

For more information, visit our website at: **glidevaleprotect.com**

Glidevale Protect, 2 Brooklands Road, Sale, Cheshire, M33 3SS
T: +44 (0)161 905 5700 F: +44 (0)161 905 2085
info@glidevaleprotect.com
Glidevale Protect
glidevaleprotect.com

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