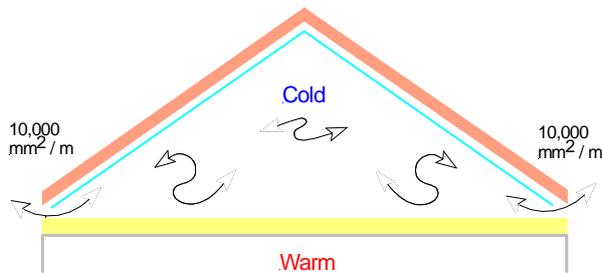


Roofs with a 'Normal Ceiling'

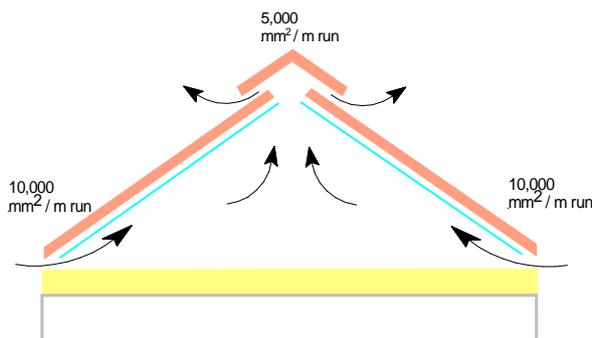
Cold Roof Construction

Bituminous felts and non-vapour impermeable underlays (high resistance)

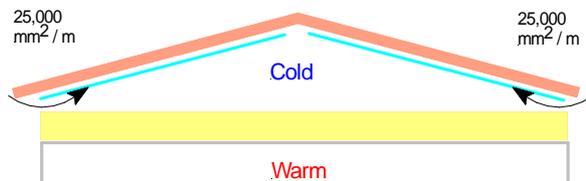
Ventilation of the loft space under a traditional bituminous felt or non-vapour permeable underlay has proven to be an effective and robust solution. Eaves-to-eaves ventilation installed on the longer sides of a typical rectangular roof, and eaves-to-ridge ventilation for pitches over 35° or with spans greater than 10 m, have been successfully installed in millions of homes, shops and offices over the last 30 years.



Pitches of 35° or less, or with roof spans of 10 m or less



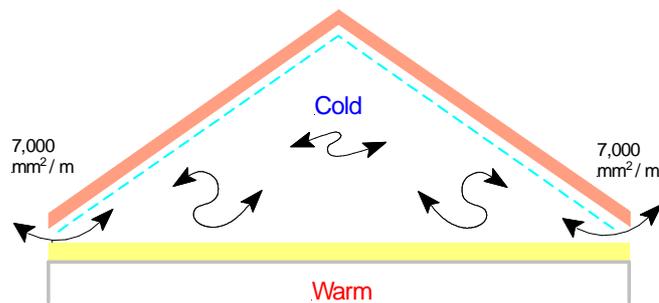
Pitches over 35° or with roof spans greater than 10 m



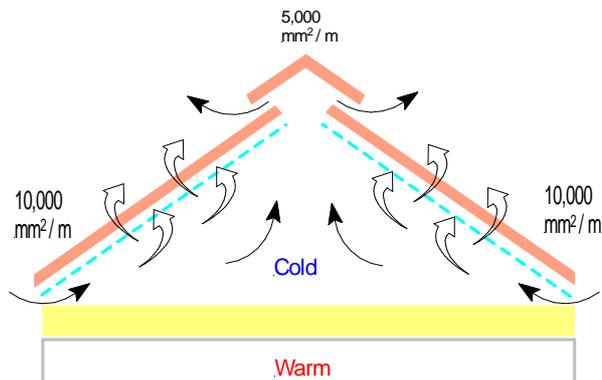
Pitches of 15° or less

Vapour permeable underlays (low resistance)

Vapour permeable underlays are defined as having a moisture vapour resistance of less than 0.25 MNs/g. On fully boarded roofs, common in Scottish practice, all underlays should be treated as impermeable and the roof space below ventilated in accordance with the high resistance underlay requirements described in previous section.



All pitches with roof spans of 10 m or less

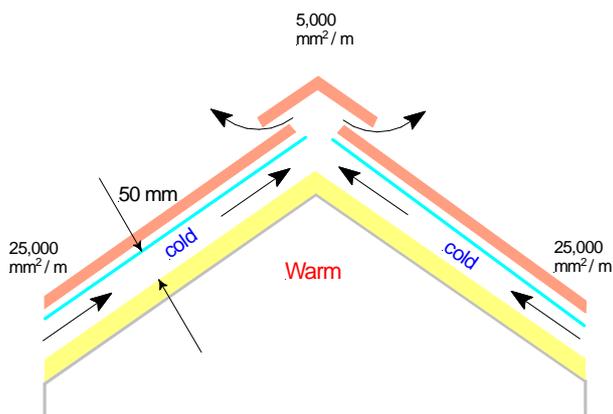


All pitches with roof spans greater than 10 m

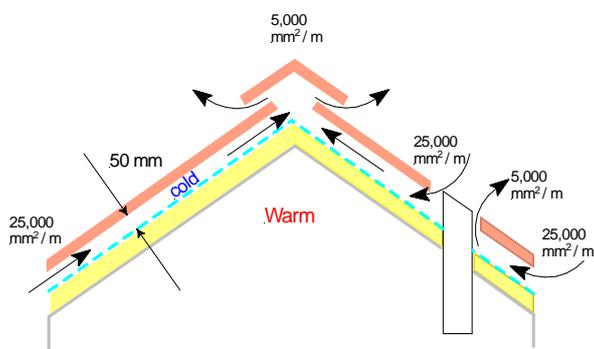
Roofs with a 'Normal Ceiling'

Warm Roof Construction

All warm roof constructions require a continuous vapour control layer (VCL) to be installed on the warm side of the insulation. The VCL should be lapped and sealed and all penetrations of the VCL, e.g. pipes, wires etc. should be sealed to prevent moisture transfer into the insulation and the fabric of the roof structure. If a well-sealed ceiling is not provided and / or the integrity of the VCL cannot be maintained then, regardless of the underlay type used, a ventilated air space should be provided.



Traditional underlay and 'normal ceiling'



Vapour permeable underlay and 'normal ceiling'

Batten Space Ventilation

BS 5250:2011 requires that the air openness of the roof covering is 7.8 m³/m²/hr and suggests that most traditional unsealed slating and tiling will meet this requirement. Where this requirement is met ventilation of the batten cavity is not required. Where the air openness cannot be achieved, e.g. fibre cement slates and other close fitting products or roofs subject to excessive dirt, moss or lichen, then ventilation of the batten cavity should be provided. Where batten cavity ventilation is required the ventilation should be 25,000 mm²/m at eaves or low level and 5,000 mm²/m at ridge or high level.

Roofs with a 'Well-Sealed Ceiling'

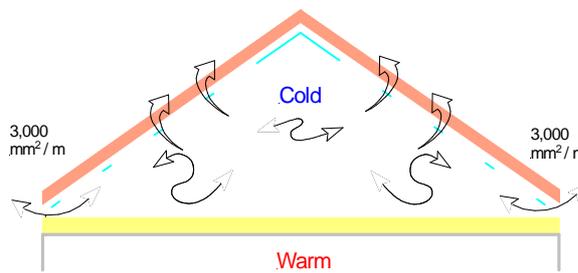
Cold Roof Construction

Bituminous felts and vapour impermeable underlays (high resistance)

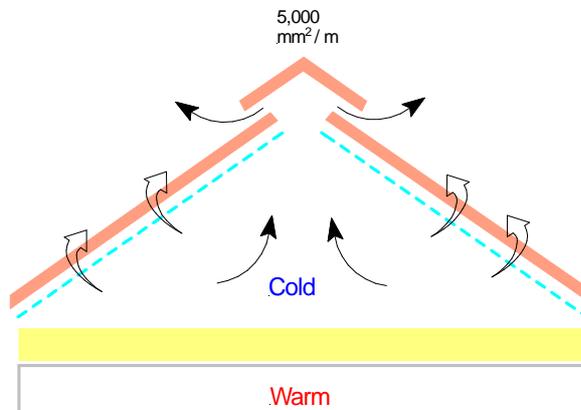
The ventilation requirements for cold roofs with vapour impermeable underlays and 'well-sealed ceilings' are the same as the without 'well-sealed ceilings'. Installing a 'well-sealed ceiling' will make the conventional roof energy efficient because the airtightness of the 'well-sealed ceiling' will have prevented the heat loss through the ceiling by convection. The heat loss due to low speed air currents over the cold side of the insulation caused by ventilation of the loft space is negligible.

Vapour permeable underlays (low resistance)

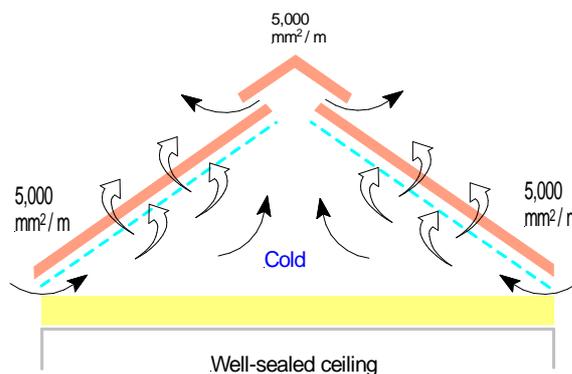
The installation and maintenance of a 'well-sealed ceiling' with a vapour permeable underlay reduces the ventilation requirements.



All pitches with roof spans of 10 m or less



All pitches with roof spans of 10 m or less

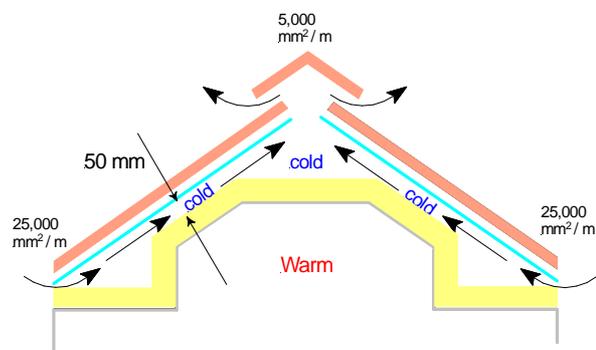
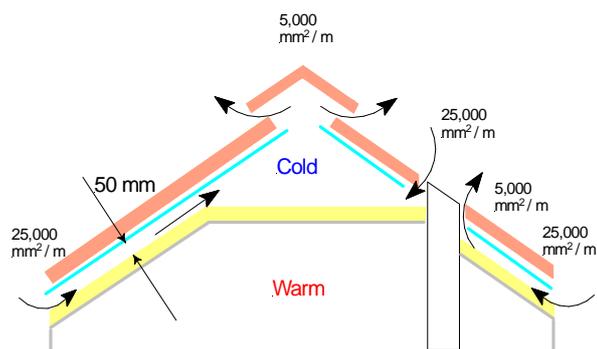
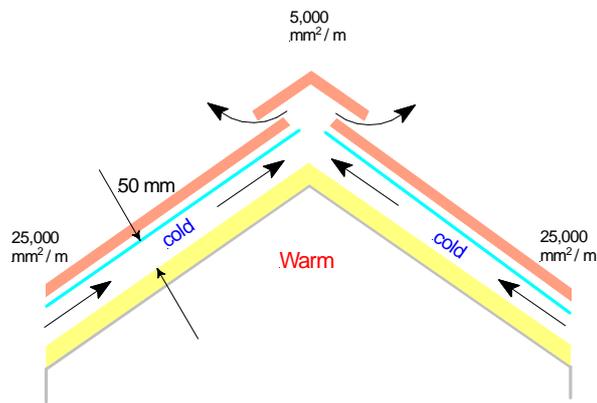


All pitches with roof spans greater than 10 m

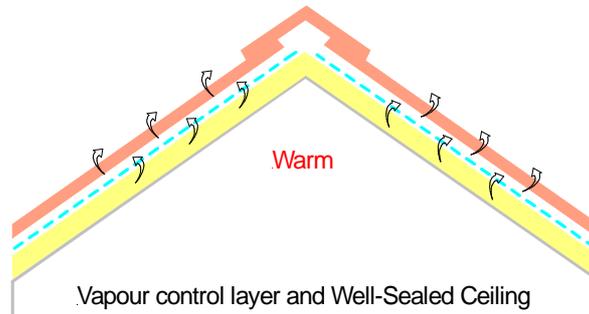
Roofs with a 'Well-Sealed Ceiling'

Warm Roof Construction

Bituminous felts and vapour impermeable underlays (high resistance)



Vapour permeable underlays (low resistance)



Where a VCL and a 'well-sealed ceiling' have been installed the harmful effects caused by condensation can be controlled by the use of a vapour permeable underlay without ventilation. The vapour permeable underlay may be laid fully supported on the insulation or draped unsupported. A 'well-sealed ceiling' is essential as is a separate vapour control layer used on the warm side of the insulation. If there is any doubt about the ability to provide and maintain an effectively sealed vapour control layer then ventilation should be provided as if the underlay were impermeable.

Alternative Approach

The Building Regulations allow compliance to be demonstrated through the use of products complying with UKAS approved third party product certificates for the product and their installation. Some third party certificates for vapour permeable underlays allow the underlay to be used without ventilation provided a number of conditions are met. Principal among the requirements are:

the products can only be used on dwellings (large buildings, schools, factories, shops are not permitted)

a convection-tight loft space shall be achieved (Note: it is recognised that a well-sealed ceiling is difficult to install in practice and the higher standard required to achieve and maintain a 'convection-tight' loft space would be extremely difficult to do).

Condensation Control and Energy Efficiency

'Improved Thermal & Moisture Performance of Pitched Roofs'

Partners in Innovation Project

This project highlighted that 50% of the heat lost through the ceiling and 80 % of the moisture transferred to the roof space is through air leaking through holes and cracks in the ceiling. The balance of the heat loss and moisture transfer is by conduction and diffusion through the fabric of the ceiling.

The project led to an amendment of BS 5250 in 2002. The amended standard, recently published as BS 5250:2011, allows the concept of a 'well-sealed ceiling' to be used to reduce the heat and moisture transfer into the roof space reflecting modern practice. The 'well-sealed ceiling' simultaneously contributes to the airtightness (energy efficiency) of the building and reduces the amount of ventilation required to control the risk of harmful condensation.

The 'Accredited Details' for the implementation of Approved Document L include guidance on how to improve the airtightness of buildings and BS 9250 gives specific guidance on improving the airtightness of ceilings.

For England and Wales Approved Document C specifically refers to BS 5250 as the means of compliance. BS 5250 has always been the means of compliance with the equivalent Scottish and Northern Ireland regulations. BS 5250:2011, also gives advice on how to control the risk of condensation when it is not possible to install a 'well-sealed ceiling', e.g., refurbishment of existing buildings.

Well-Sealed Ceiling

BS 5250:2011 defines a well-sealed ceiling as follows:

The design avoids constructional gaps, especially at the wall ceiling junction with dry lining construction, and holes in the ceiling.

No access door or hatch should be located in rooms where large amounts of moisture are produced, including kitchens or bathrooms. The air leakage rate through an access hatch, including its frame, when tested to BS EN 13141-1:2004 4.3 is less than 1 m³/hr at a pressure difference of 2Pa. It can be assumed that "push-up" wooden hatch covers in a frame, constructed in-situ, with continuous compressible seals, will meet this criterion provided the weight of the door is at least 5.5 kg. Hatch covers should either be heavy enough to compress a seal or be clamped, with closed cell compressible seal, or "o-ring" between it and the frame. Drop-down hatch covers are more difficult to seal; it is recommended that proprietary units with a supplied hatch cover in a frame are used. Manufacturers can provide third party evidence that the leakage criterion is met.

Penetrations, such as those for services and rooflights, are permanently sealed with suitable proprietary products.

The ceiling is sealed to the external walls to limit any leakage through cracks.

Recessed light fittings should comply with BS EN 60529 and be rated IP60 to IP65 (depending on room use), or incorporate an appropriate sealed hood or box which meets the following test criteria. The total leakage through downlighters should not exceed 0.06 m³/h.m² of ceiling at 2 Pa.

The head of all cavities in the external walls, party walls and partition walls is sealed to prevent transfer of warm moist air into the loft.