CI/SfB (27.2) (L27)

Remedying condensation in domestic pitched tiled roofs

Good Repair Guide 30

good repair guide

One of the most common and cost-effective ways of saving energy in houses is to insulate the roof space, usually by laying insulation between the ceiling joists. But adding insulation increases the risk of condensation in the roof and can lead to damage to the contents of the loft, the insulation and possibly even the roof structure.

This Good Repair Guide describes how to find out whether a pitched tiled roof is at risk from condensation and how to minimise it.

Why condensation occurs in the roof space

Large amounts of water vapour are produced in houses, mainly in bathrooms and kitchens. Up to 30% of it can find its way into the roof space through holes in the ceiling, mostly through gaps round loft hatches and pipework. Smaller amounts get through gaps round light fittings and penetrate the ceilings themselves. When the warm air meets the cold surfaces in the roof space, the water condenses out into water droplets.

In recent years the risk of condensation in the roof has increased, due to a combination of factors. Houses are much better insulated and heated, so the air can hold larger quantities of water vapour and more finds its way into the roof space. Furthermore, the trend to higher levels of insulation means that roof spaces are colder. These factors combine to increase the risk of condensation. The best way of preventing this happening is to ventilate the roof space.

Current building regulations stipulate a minimum standard of roof ventilation and most modern roofs are properly ventilated. In many

Condensation in the roof space can lead to mould growth and rot in the timbers

Insulation packed into the eaves has blocked ventilation paths. When the insulation quilt was lifted it was saturated with water condensate

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uninsulated older houses there is also adequate ventilation, through purpose-built vents or through gaps in tiles or eaves. But if insulation is added or there are changes to the roof, there can be problems (see photo, page 1, bottom).

What are the symptoms of condensation?

Condensation in the roof space can go unnoticed for some time and damage can be quite serious before it becomes apparent. The first sign of trouble may be mould and mildew growing on any property stored in the loft. In roofs with sarking felt or plastics sheeting under the tiles or slates, droplets can form, wetting the insulation and reducing its effectiveness, and ultimately damaging the ceiling. Electrical services may be wetted, leading to shorting. The moisture can cause staining or mould growth, corrode metal fittings, and, in the worst cases, lead to dry or wet rot in the timbers. In roofs with an absorbent lining such as timber sarking, the boards may absorb moisture and swell or may rot and lose their strength.

Problems can be especially severe during a thaw if large amounts of ice have built up on the sheeting, and may be enough to give the impression of a major roof leak.

Checking for adequate ventilation in the roof space

- Look for daylight showing through spaces in the roof and note the freshness or otherwise of the air.
- Check whether there are any constraints that might prevent cross-ventilation.
- Check for rot or high water content in timbers, particularly where there is a sarking felt membrane, and for signs of dampness or condensation near metal components, eg water storage tank supports or the backs of gutters.

How to reduce condensation in the roof

It's not feasible to prevent all the water vapour produced inside the home travelling into the roof space. But the risk of condensation in the roof can be reduced very considerably by:

- extracting water vapour from the rooms where it is produced,
- limiting the amount of vapour getting into the roof space,
- covering water storage tanks and vent pipes,
- ventilating the roof space.

Extracting water vapour at source

Provide kitchens, utility rooms and bathrooms, where most of the water vapour is produced, either with extractor fans or passive stack ventilators, preferably with humidistat control. Make sure that there is an adequate air inlet on the opposite side of the dwelling to ensure cross-ventilation.

Clear any blocked air bricks, and consider opening blocked off fireplaces. Ensure that these changes do not impair the safe operation of gas and oil heating appliances.

If there has been any recent building work involving wet processes such as brick laying or plastering, ventilate it as much as possible to dry out construction moisture.

Preventing water vapour getting into the roof space

Improve the fit of loft hatch covers by fitting weatherstripping material. Provide catches or bolts for lightweight covers or increase their weight to make sure the seal is compressed.

Seal round pipes passing through the ceiling, especially in airing cupboards, using a flexible seal round hot water pipes. Screw badly fitting ceiling roses down tightly, perhaps providing a rubber gasket (Figure 1).

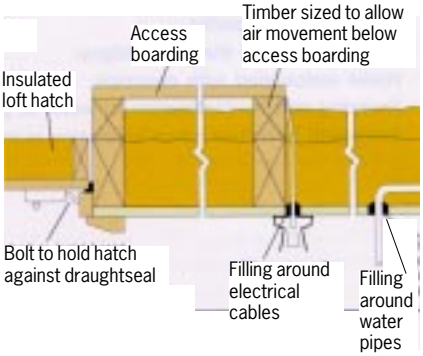


Figure 1 Seal gaps round the loft hatch and service penetrations

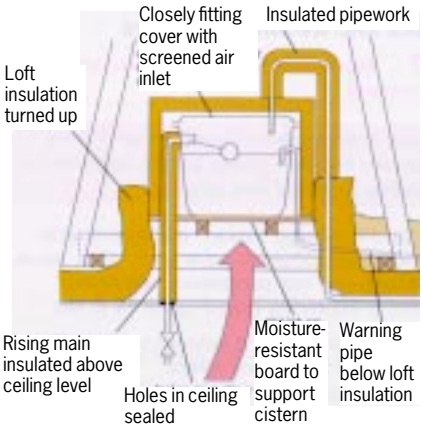


Figure 2 Insulate pipes and cisterns in the roof space

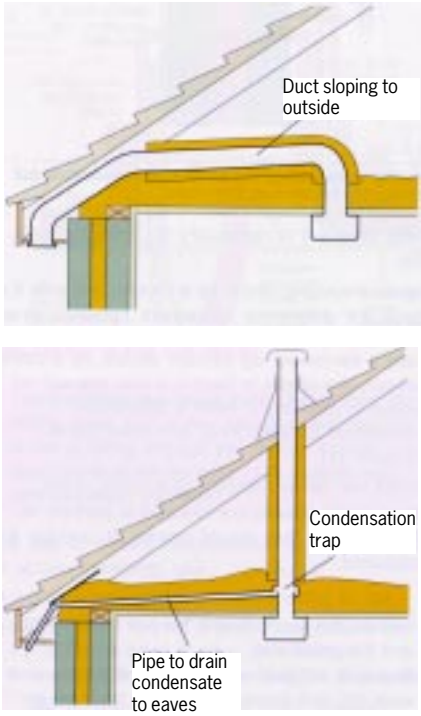


Figure 3 Insulate ducts passing through the roof space

Consider applying an impermeable decorative finish to the ceiling of bathrooms and kitchens.

Covering tanks and checking pipes in the roof space

When cold water storage tanks are correctly insulated, with the insulation over the tank to prevent freezing, the water can be warm enough to evaporate into a cold roof space. Make sure all tanks have closely fitting covers (Figure 2).

Make sure the central heating expansion pipe discharges over a covered header tank to prevent the possibility of water vapour entering the roof space.

Check ventilation ducts from kitchens or internal bathrooms passing through the roof space to make sure there are no leaking joints. To prevent moisture condensing inside the ducts when it passes through the cold roof space, insulate the ducts with at least 25 mm of insulation material. If the risk of condensation is high provide a condensation trap (Figure 3).

Checking existing ventilation openings

Check whether insulation pushed or blown too far into the eaves has blocked existing eaves vents. Make sure insulation is laid up to stops or spacers. Also, try to ensure that it covers the top of the wall and blocks the cavity.

How to ventilate existing roofs

For new houses, British Standard 5250 (to be published 2001) details ways of ensuring adequate ventilation in different types of roof; these are summarised in Box 1.

In remedial or refurbishment work this is the level of ventilation to aim for. However, whether you can achieve this will depend on the extent of rebuilding being undertaken.

The main objective is to provide ventilation to all parts of the roof space, so a large number of small vents spaced evenly across the roof surface is preferable to a few large ones. However, if fewer, large vents are the only practicable solution, position them so as to avoid dead spaces. Remember that the BS recommendations are a minimum — it is wise to err on the generous side. If the underlays are impermeable, increase the ventilation rate.

Later extensions or additions may have introduced compartments into the roof space or obstructed ventilation in some areas. Ideally the obstructions should be removed, or else the compartments should be interconnected.

Proprietary vents designed to meet the Standard are available for most situations from both the principal tile manufacturers and the specialist firms. Products that are independently approved are preferred. In retrofit work, you may have to combine or adapt different types of ventilation products to achieve the target ventilation rate.

When devising an installation, remember that the air pressure difference varies across the roof, depending on the roof shape and the wind direction. For details, consult Digest 406 *Wind actions on buildings and structures.*

Eaves ventilation (Figure 4)

In eaves with soffits, circular soffit vents probably provide the simplest retrofit option. Choose those which suit the thickness of the soffit, have a known vent area and which prevent the ingress of insects. The 'soffit box' is sometimes used for service runs, so take care when drilling.

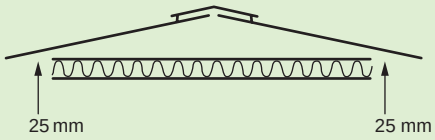
A 10 mm gap equivalent is easily achieved by this method, but the 25 mm required for shallow pitches could be difficult if the soffits are narrow. Slot vents could be the answer but they are more work to install. Another possibility is to drill holes through the fascia. Any of these methods could be used in combination.

Box 1 British Standard recommendations for ventilation in different roof types

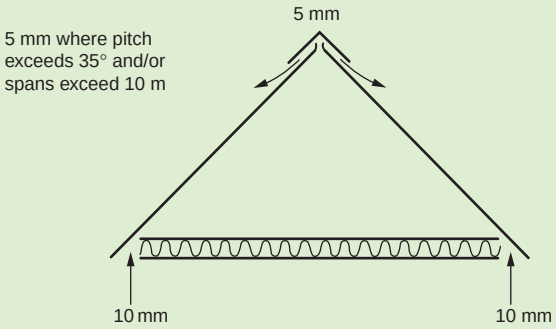
1 For roofs insulated at ceiling joist level

Duo pitches

- For all pitches below 15° and for rooms in the roof, the equivalent of a continuous 25 mm gap at the eaves, installed on both sides of the roof.

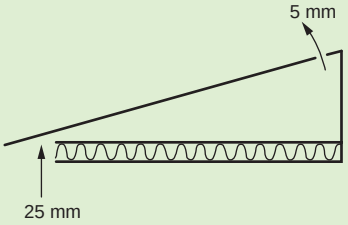


- For pitches 15° and above, the equivalent of a continuous 10 mm gap at the eaves on both sides. In addition, for pitches over 35° and spans in excess of 10 m, additional gaps equivalent to 5 mm at or near the ridge.

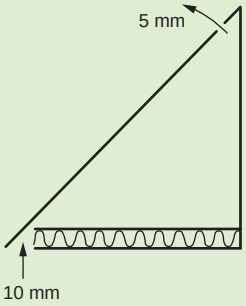


Monopitches and lean-to roofs

- For all pitches below 15°, the equivalent of a 25 mm gap at the eaves and 5 mm gap at or near the apex.

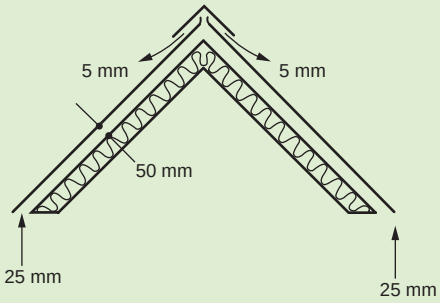


- For pitches of 15° or more, the equivalent of a 10 mm gap at the eaves and 5 mm at or near the apex.



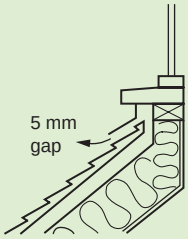
2 For roofs insulated along the rafters

- A continuous 50 mm gap between the top of the insulation and the underlay, in addition to the requirements for eaves and ridge ventilation in section 1, above.

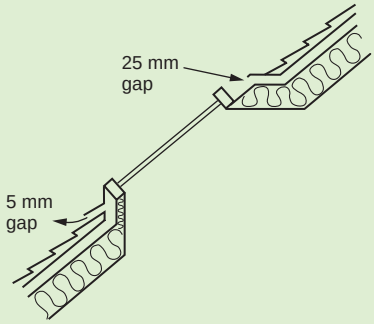


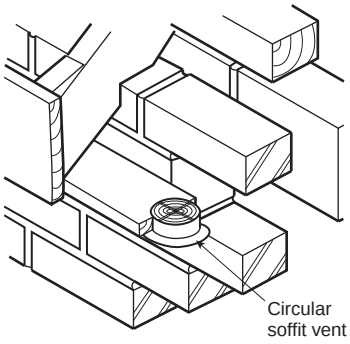
3 For obstructions in the slope

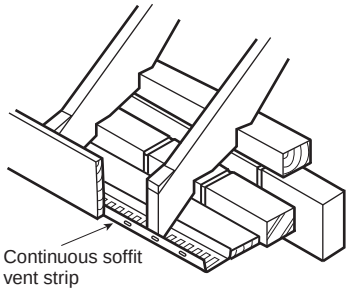
- For dormers, an additional 5 mm gap immediately below and a 10 mm gap above.



- For skylights, a 5 mm gap below and a 25 mm gap above.







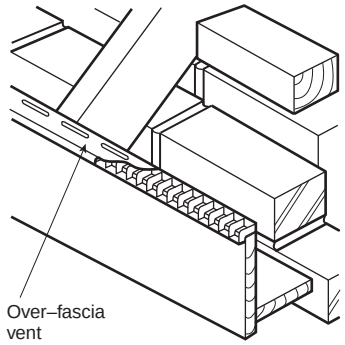


Figure 4 Methods of providing eaves ventilation
Modified from drawings by Furfix Ltd

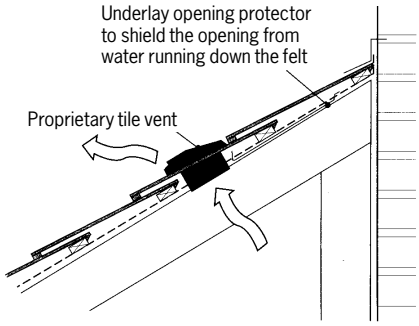


Figure 6 Typical slope ventilator

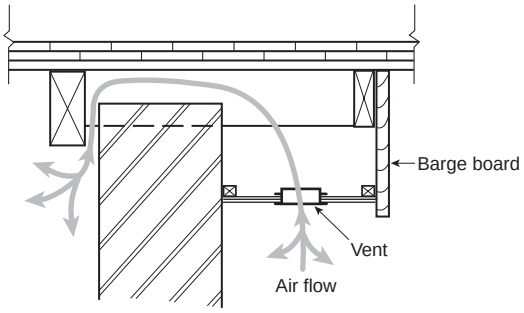


Figure 5 Using boxed eaves as roof ventilation ducts

In eaves with fascias flush to the wall or beam-filled, vents over the fascia or slope vents generally provide the easiest solution.

With some types of roof covering, such as single lap tiles, ventilation over the top of the fascia can be achieved by raising or removing the eaves tiles or reducing the height of the fascia, and then inserting a perforated vent strip along the top of the board. It is good practice to support the felt at this point on a ply strip or proprietary support tray to avoid ponding. It is important to ensure that the fall in the felt is adequate for drainage, which could be difficult in very shallow pitches. The 10 mm gap requirement can be achieved in this way in many cases, but 25 mm could be difficult and again may require a combination of vents.

Boxed eaves could provide a longitudinal air duct, fed by vents in the soffit or fascia or the barge board/fascia junction. Ridge venting may be needed in addition to achieve sufficient air flow (Figure 5).

With any form of eaves ventilation, provide ventilation trays to ensure a free air path of at least 25 mm between the underside of the sarking and the insulation. All openings should be covered with 4 mm mesh against insects, and shielded to keep water out.

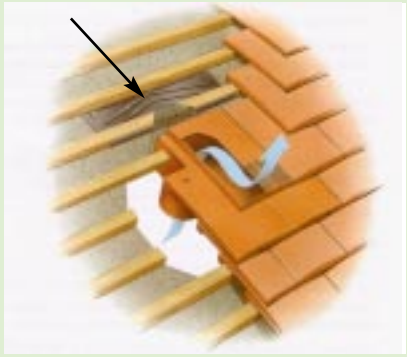
Avoid positioning eaves vents over the top of windows as this could aid the spread of fire into the roof space.

Slope vents

These can be used where ventilation by other means is not possible (Figure 6). While they are generally fitted in place of a proprietary tile, other types can replace plain tiles or slate (see Box 2).

Box 2 Choosing a slope vent

When selecting slope vents, look at the suitability of the vent for the location and whether it preserves the weathertightness of the sarking: some manufacturers supply underlay opening protectors, which are sited on top of the felt, above the cut for the vent.



Underlay opening protector (arrowed) for use in conjunction with a slope vent
Reproduced with permission of Marley

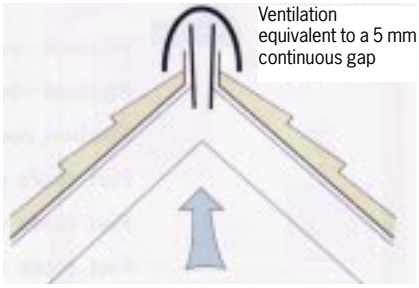


Figure 7 Ridge ventilation in wide or steep pitch roofs

Traditional gable end vents

If used instead of, or combined with, eaves vents, slope vents should be placed as close as possible to the eaves. Similarly, if they are used instead of, or combined with, ridge vents, they should be placed as close as possible to the ridge.

Ridge vents

Again these are available to suit proprietary roof coverings and some can be adapted for unusual situations (Figure 7). Ensure that the underfelt vent allows free flow of air while preventing ingress of water.

Gable end vents

In houses with two gable ends, air bricks and purpose-made, often decorative, openings, can be useful, either on their own or in combination with other types of vent (see photos, left).

If gable vents are used alone, they shoould be installed at both ends of the roof. Gable and ridge ventilators should not be used in the same roof as they may short-circuit the effect of eaves ventilation.

Box 3 shows correct and incorrect positions for roof vents.

Box 3 Installing roof vents

When installing vents at both low and high level in the roof, the area of low level vents should be roughly twice that of the high level vents.

Correct positioning

Incorrect positioning

Never fit ridge or high level vents as the only means of ventilation — they must always be used in conjunction with vents at or near eaves level. With high level vents alone, the air flow over the ridge creates a pressure drop inside the roof space, which sucks moist air from the house into the roof.

Roofs especially at risk

Some roof shapes and configurations are more likely to suffer from condensation than others and should be inspected closely.

Shallow pitches

The amount of water vapour that travels into the roof space is much the same in comparable size houses. However, roofs with shallow pitches contain a smaller volume of air than those with steep pitches and there is less convection, so condensation is more likely. Another factor is the greater likelihood of ventilation paths being blocked by loft insulation pushed into the eaves.

Rooms in the roof

These can take many forms, and may include dormers or windows in the roof slope or gable end, or a combination. But in all cases the same principle applies — the cold side of insulated partitions and roof slopes should be vented to the outside, and there should be no cold bridges.

Ways of achieving ventilation round a typical attic room are shown in Figure 8.

If comprehensive ventilation is difficult to achieve, install vapour control layers on the inside surfaces.

In existing uninsulated rooms, condensation problems are unlikely. However, look for signs such as damp staining.

Monopitches and lean-to roofs

Because there is no eaves-to-eaves cross-ventilation, monopitch roofs have to be ventilated at high level as well as the eaves (Figure 9). One possibility is to provide air paths under the flashing, alternatively use slope vents.

Pitched roof extensions

Cross-ventilation at eaves level is also difficult where a duo-pitch-roofed extension abuts another part of the building or an adjacent wall. The solution here is a combination of low-level slope vents and either ridge vents or high-level slope vents.

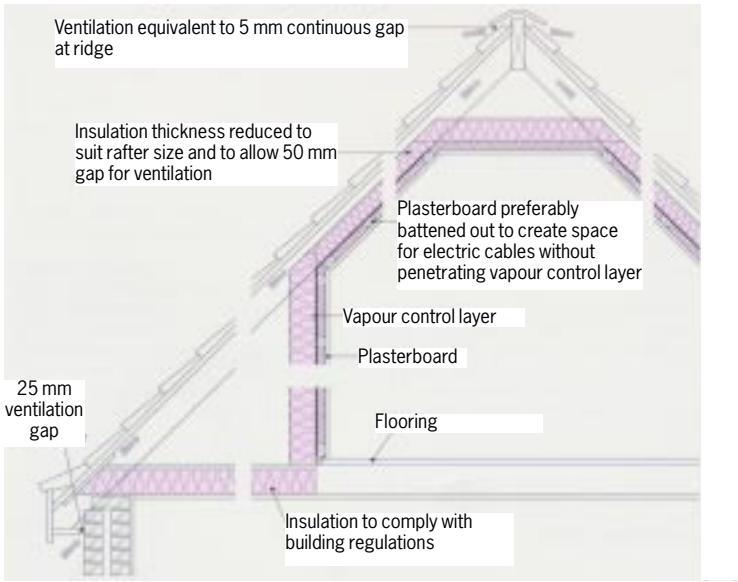


Figure 8 How to ventilate the roof space round an attic room

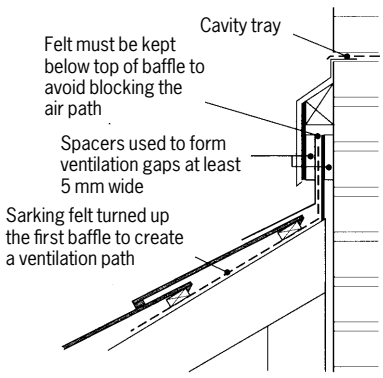


Figure 9 Providing high level ventilation for a monopitch roof

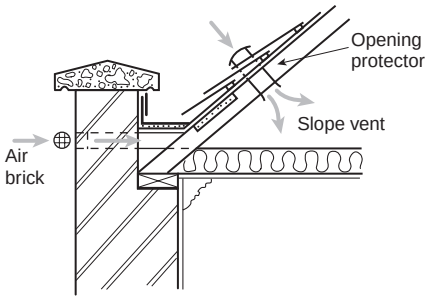


Figure 10 Possible method for ventilating a parapet roof

Listed buildings

Visible roof vents may be unacceptable on some listed buildings. It may be possible to conceal low-level vents behind parapet walls (Figure 10) and fascia vents could be hidden by the gutter. Another possibility is period-style air bricks, which can often be obtained from architectural salvage merchants.

Difficult to ventilate?

In buildings where there is a serious problem and no reasonable method of installing roof ventilators, the only alternative may be permanent mechanical ventilation of the roof space or of the rooms where moisture is produced.

BRECSU

The government's Energy Efficiency Best Practice programme produces information and guidance on all aspects of energy efficiency. In the building's sector, the programme is managed by a specialist BRE unit, BRECSU, which can supply copies of some of the publications referenced in this Guide.

More advice!

Good Repair Guides are accessible, illustrated guides to defect diagnosis, assessment, repair and rehabilitation. More detailed advice is available in the following publications.

BRE

- **Thermal insulation — avoiding risks.** 1994.
- **BRE Building Elements — Roofs and roofing.** H W Harrison. 1996.

Digests

- 180 – Condensation in roofs

Good Building Guide

- 37 – Insulating roofs at rafter level: sarking insulation

Energy Efficiency Best Practice programme — Good Practice Guides (available from BRECSU, see Box, left)

- 12 – Pitched roof insulation in existing housing: practical guide for specifiers
- 97 – Energy efficiency in new housing: pitched roofs
- 155 – Energy efficient refurbishment of existing housing

British Standards Institution

BS 5250: Code of practice for control of condensation in buildings (To be published 2001)

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Published by CRC Ltd,
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May 2001
ISBN 1 86081 474 3