



Sprayed Foam Insulation applied to pitches of existing roofs in domestic buildings

**Information Paper containing observations
and recommendations for members of the
Property Care Association**

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SPRAYED FOAM APPLIED TO A COLD ROOF

Where sprayed polyurethane (PU) foam is applied to the pitches of an existing domestic timber roof to prolong the life of failing roof coverings, the roof void should remain a cold ventilated space.

Manufacturer's instructions tell installers to ensure the roof is made good before installation and that ventilation within the roof is maintained.

Sprayed foam insulation applied above a ventilated cold roof void will not significantly change or improve the energy performance of the building or the occupied spaces.

SPRAYED FOAM THAT CONVERTS A COLD ROOF TO A WARM ROOF

Where sprayed polyurethane foam is applied to the pitches of an existing domestic timber roof in order to improve the thermal performance of a residential property it effectively converts what was a 'cold' or ventilated roof void into a 'warm' unventilated space.

In effect this will reduce the opportunity for heat and air diffusion through gaps in the roof. This will increase the temperature within the roof space and may also increase the amount of moisture held in the air therein.

In circumstances where vapour production in the occupied building is high and ceilings between the occupied space and the roof void lack vapour resistance *and* the roof void is unvented, air moisture contents and relative humidity (RH) may increase.

As long as this moist air does not support mould growth, cause hygroscopic wood to reach a moisture content where it is susceptible to decay (or insect infestation) *or* lead to the deposition of free water, then no adverse effects from the use of sprayed foam that relate to water vapour created by occupation, should be seen.

Nevertheless, in these circumstances a risk of surface mould growth and / or interstitial condensation may be present. These issues may be seasonal and condensation events relatively brief but where moisture is persistent and condensation events become prolonged, the risk of timber decay should be considered.

In order to reduce the likelihood of excess water vapour transfer from the occupied rooms into an unventilated warm roof the building (occupied spaces) should be adequately ventilated, or the ceilings must be made to be adequately vapour resistant.

GENERAL

The presence of sprayed foams whether installed to stabilise failing roof coverings or improve the thermal performance of the building, can have the effect of disguising or displacing water that gets through the roof coverings. This is more likely when foams are denser and have a greater proportion of 'closed cells'.

Most PU foams are a creamy white when first applied (though other colours are used by some manufacturers). Colour change (darkening) tends to occur with time and exposure to light.

As far as we are aware these colour variations are not significant as they do not significantly alter the vapour permeability, bond strength or insulation performance of the foam.

Where leaks are detected internally or defects are seen in the external detailing of a roof where sprayed foam insulation has been used, the surveyor must exercise both caution and diligence.

Detailed investigations should be carried out to explore the implication and extent of any rainwater ingress and be sure that timbers that are adjacent to water pathways are the subject of a detailed inspection for evidence of decay or infestation. Susceptible elements may include wall plates, spa feet, valley boards, and purlins where any timber is built into masonry walls.

OPEN CELL SPRAYED POLYURETHANE FOAM INSULATION

- Used to improve the thermal performance of the building.
- Relatively soft – easy to squish – can push a probe into it easily.
- Varying degree of vapour permeability – Only ever applied to roofs with vapour permeable underfelts.
- Some risk of vapour transfer.
- Hygrothermal model is needed to confirm that condensation risk is managed.
- Can be made wet but will not significantly restrict the passage of free water.



Fig 1. Open Cell PU foam

These products are vapour permeable and will allow vapour transfer. Open cell foam is not recommended for applications directly to the underside of tiles, slates, or other domestic roof coverings. These foams should only ever be applied to the underside of vapour permeable roofing felts and breather membranes. In this way the risk of fungal decay and moisture related problems are minimised.

These underlays not only provide a moisture pathway for water vapour to escape to atmosphere but also acts to safely direct rainwater that gets through the primary roof covering.

Note - Problems could occur if open cell foams are applied to underlays that are not vapour permeable. The inappropriate use of reinforced, highly vapour resistant plastic underlays, was relatively common where roofs were being replaced during the 1980s and 1990s.

Open-celled PU foams are relatively weak and although they bond to substrates effectively and hold their shape permanently, they have little or no value as an adhesive or bonding agent.

The vapour conductivity of ceilings, occupation levels and the ventilation regime in the occupied parts of the house, all affect the condensation risk.

A vapour control layer (VCL) may sometimes be needed (recommended after a hygrothermal evaluation) on the warm side of open-cell sprayed foam insulation. This is required if there is a risk of interstitial condensation.

The presence of sprayed foam means that a simple visual inspection to establish the condition of roof timbers is impossible. Investigations performed to establish the condition of roof timbers will be difficult and limited.



Where evidence of roof leaks, timber decay or insect infestations are identified, the full extent of the problem and the extent of any repairs, treatment and drying can only be undertaken if the foam is removed.

CLOSED CELL POLYURETHANE SPRAYED FOAM

- Applied to tiles and slates or to underfelts within pitched domestic roofs.
- Can be used to stabilise failing roof coverings i.e., nail fatigue.
- Can be used to improve the thermal performance of the building.
- Has some vapour permeability but vapour transfer through the material is typically quite low.
- Very strong adhesive properties, bonds strongly to substrate.
- Relatively dimensionally strong and resists compression.
- The product is essentially waterproof resisting the passage of free water.



Fig 3. Closed cell PU foam

When used to stabilise failing roof coverings it is applied to a “dry” and defect free roof, the use of adhesive PU foams may work to delay the inevitable renewal of roof coverings.

However, their application may render roof coverings (slate, tile, and stone) unrecyclable. Foam removed from roof coverings, presents a waste disposal / recycling problem at the point when roof renewal is inevitably needed.

The presence of sprayed foam means that a simple visual inspection to establish the condition of roof timbers is impossible. Investigations performed to establish the condition of roof timbers will be difficult and limited.

Where evidence of roof leaks, timber decay or insect infestations are identified, the full extent of the problem and the extent of any repairs, treatment and drying can only be undertaken if the foam is removed.

Where timber decay or insect attack is discovered in a roof that has been coated in closed cell foam that has been applied directly to the roof coverings, it is likely that this will result in the full strip and recover of the roof as the foam will be extremely difficult to remove from localised areas.

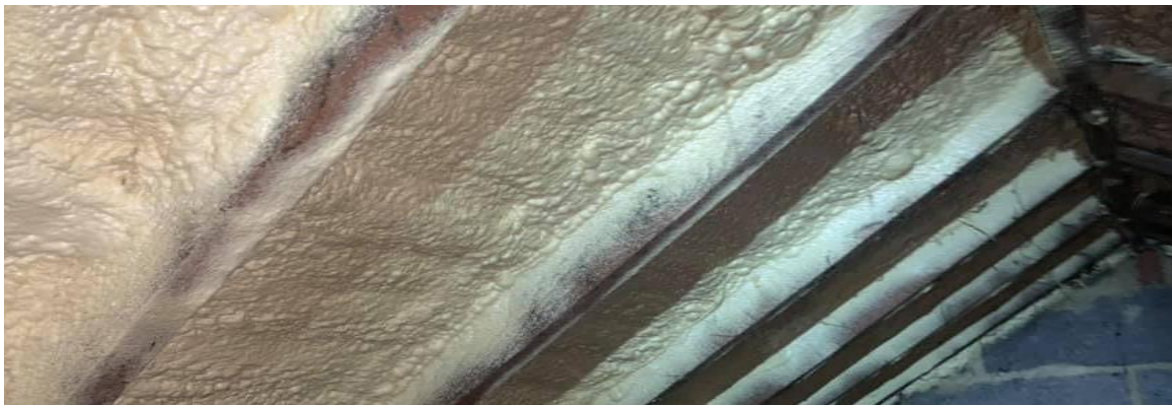


Fig 4. Closed cell PU foam

Note. In some regions of the UK, particularly in Scotland, older roofs were commonly constructed with a timber sarking board above the rafters. Originally, they would not have incorporated an underlay. When these roofs are recovered the roofer will often apply an underfelt over the sarking before installing new battens and replacing the tiles or slate.

The use of closed cell foams in these situations will not act to stabilise the roof coverings but may obstruct any early indications of roof leaks.

Open cell foam relies on the vapour permeability of the underlays. Unless the nature of any underlay that sits between the sarking boards and battens is known then condensation risk will be increased.

CONCLUSIONS

In most situations the presence of sprayed foam insulation is unlikely to have caused a problem with accelerated timber decay, mould growth or infestations by wood destroying insects. However, where incorrect or inappropriate sprayed foam installations have been undertaken, or roof coverings have deteriorated since the application of foams, problems may occur. The presence of the sprayed foam will make the recognition, investigation, and rectification of defects harder and more expensive.

Unless the surveyor understands:

- The constitution of the foam – open or closed cell.
- The reason for its installation i.e., insulation or prolonging the life of a failed roof.
- The construction of the roof.
- If the roof is a cold roof or a warm roof.
- Ventilation requirements of the roof void.

Then it is unlikely that it would be possible or reasonable to comment of the condition of the timber roof structures or speculate on risk.



Fig 5. Closed cell PU foam applied to the extent of the available access from the void. This has left an uninsulated / bonded section of roof / ceiling in the room below. The foam has also eliminated ventilation into what should have been a cold roof void.

In the absence of detailed information about the insulation present, the condition of the roof before the application of foam and hygrothermal modelling results then we would recommend a detailed investigation to the roof is undertaken.

This investigation may require the surveyor to establish

- The moisture content of timbers.
- The detail construction of the roof.
- The constitution of the foam used.
- The condition of the roof coverings, rainwater management systems, parapet walls, valleys, and gutters.
- The vapour permeability of underlays.
- The vapour permeability of ceilings.
- The adequacy of roof void ventilation (cold roofs).
- The air moisture management systems in the occupied rooms below the insulated roof.

We (PCA) are of the view that, open cell foam should not be applied directly to the primary roof coverings or non-vapour permeable underlays.



Fig 6. Closed cell foam used to stabilise a roof that has subsequently failed

Foams should not be applied to timber sarking unless the roof has been the subject of a detailed hygrothermal risk assessment that is based on actual product performance rather than any assumptions.

Closed cell foams cannot be used as a roof repair or stabilisation medium.

Where closed cell foams are found to have been applied directly to roof coverings then advice should be given to warn of the likely implications of the foam.

Ventilation must be retained if closed cell insulation is used and the roof void is intended to be cold.

Positive input ventilation units (PIV) (often sited in roof voids) are unlikely to work effectively when installed into warm unventilated roof spaces where sprayed foam has been applied.

Where sprayed foam is present the surveyors should not speculate on the condition of any concealed timbers as it is only possible to assess timber that can be seen, examined, and tested.



Fig 7. Closed cell PU foam applied to roof pitches and gable wall. Without detailed information from the installer, or opening up, it is not possible to assess the condition of purlin ends as they bear into the gable masonry or the wall plates or see if a breather membrane exists between the foam and roof coverings. Establishing if the void as a warm or a cold space (that should be adequately ventilated) may also be difficult here?

If there is any indication of active timber decay or insect infestation the surveyor should delay providing a specification and schedule for repairs until the all the foam is removed to allow a full detailed inspection of all roof timbers.



Fig 8. PU foam concealing the extent of decay in a tiled roof

DISCLAIMER

The information observations and recommendations set out in this document are an interpretation of the information gathered and evaluated by the PCA as part of a working group. The group was established by the RPSA and PCA that drew in contributions from a wide range of organisations and individuals. This included lenders, surveying groups and surveyors, PU foam suppliers, trade bodies and heritage organisations.

This document is published to inform members of the PCA. Where others use, reproduce, or draw value from the text we would be grateful if the source could be acknowledged.

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