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Dow - Building Solutions



Insulating pitched roofs with **STYROFOAM**

Insulating pitched roofs

Introduction

Pitched roofs can be insulated at ceiling level or at rafter line: applying insulation at rafter line brings all the building volume within the insulation envelope (figure 60).

By insulating at rafter line:

- »» the insulated space enclosed by the building envelope is substantially increased without altering the structural design; the additional space can be used as part of the initial design or converted for use at a later date.
- »» the whole of the building fabric is kept at a similar temperature, thereby reducing the risk of condensation on structural members.
- »» thermally induced movement is reduced because the roof structure is not subject to extremes of temperature.
- »» a board-insulated roof offers greatly improved resistance to wind-driven rain and fine snow.
- »» pipes, tanks and services in the loft space are protected from freezing temperatures.
- »» pipes and wiring at ceiling level are not hidden by insulation.

Insulating warm roofs

Warm roofs may be formed with the insulation installed part above and part between the rafters (figure 60).

Warm pitched roof constructions are not covered by any British Standard, although some guidance is contained in BS 5250, BS 5534 and BRE document 'Thermal insulation: avoiding risks'.

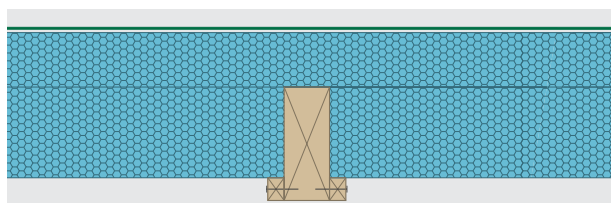


Figure 60 >> Insulating above and between the rafter with ROOFMATE RL-X

STYROFOAM Solution

The STYROFOAM™ solution for insulating pitched roofs at rafter line is ROOFMATE™ RL-X, a tongue and grooved STYROFOAM board (figure 61).

Agrément Certificate 87/1836 covers the use of ROOFMATE RL-X in warm pitched roof construction.

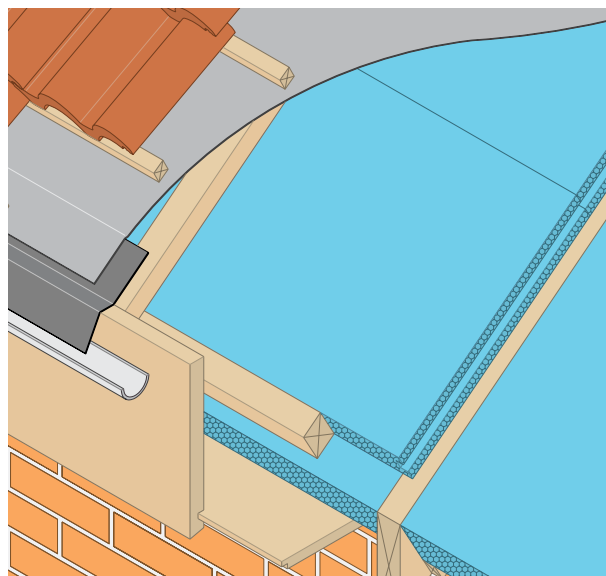


Figure 61

Insulating pitched roofs

Fixing ROOFMATE RL-X boards

ROOFMATE RL-X boards installed over the rafter are secured by the fixings used to secure the counterbattens, which pass through the insulation and into the rafters. The counterbattens, which will normally be 32 or 50mm thick, support the tiling battens (figure 61).

The counterbattens are secured using specialised fasteners, e.g. Helifix Inskew, Proctor PR nail, Ancon Staifix - Thor Helical Batten fixings. The type and number of fasteners should be calculated using the methods in BS 5534: Part 1 and fasteners manufacturer's data.

The tiling battens can be secured directly to the counterbattens using normal fasteners.

Joints between adjacent boards of ROOFMATE RL-X do not require cross noggins: the tongued and grooved edges of ROOFMATE RL-X are self-supporting and ensure continuity of insulation at all joints.

However, the boards must never be stood on or used as a working platform.

The ROOFMATE RL-X boards should be laid with their length parallel to the ridge/eaves with the tongue facing up the roof slope (figure 62).

ROOFMATE RL-X boards cut-to-size can be installed between the rafters and secured in place by support battens

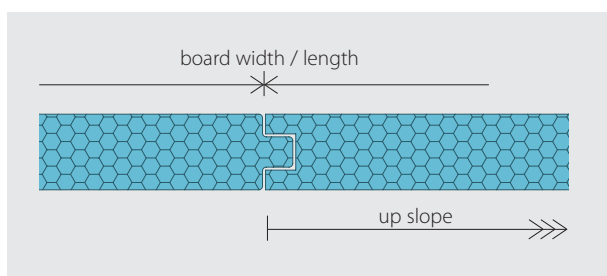


Figure 62 >> Joints in ROOFMATE RL-X

† A trade name of Don & Low Nonwovens

†† A trade name of Du Pont

††† A trade name of Klover Limited

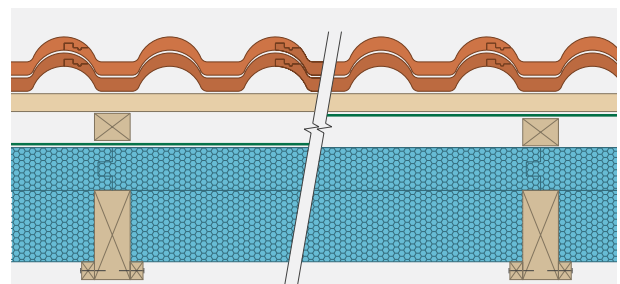
Underlays

Roofing underlays form a second line of defence against wind-driven rain and snow. Underlays used in warm pitched roof constructions should:

- » have very low resistance to the passage of water vapour.
- » be compatible with the insulation.
- » not "tent" when laid in contact with the insulation.

For this application Dow recommend water vapour permeable underlays with a water vapour resistance less than 0.25MNs/g (such as ROOFSHIELD[†], TYVEK^{††} or PERMO^{†††}) certified by Agrément.

The underlay may be laid either directly on the ROOFMATE RL-X boards or over the counter battens (figure 63). A rigid carrier may be required to prevent ponding at the eaves (figure 64).



underlay laid directly on ROOFMATE-RL-X

underlay draped over the counter battens

Figure 63

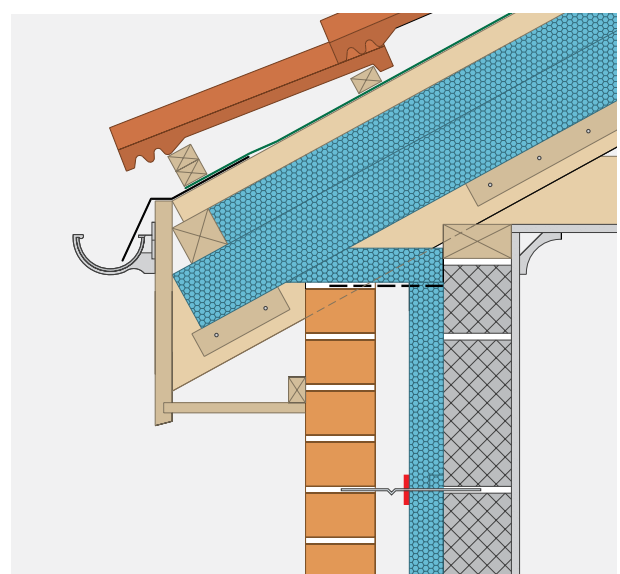


Figure 64

Insulating pitched roofs

Thermal performance

Table 12 below shows the amount of ROOFMATE RL-X required to achieve a range of U-values..

Table 18 ROOFMATE RL-X thickness (mm) to achieve U-values (W/m².K)

	0.14	0.16	0.18	0.20	0.25
Above rafter	Between rafter				
60mm	180	140	120	100	60
80mm	160	120	100	60	50

8.3% timber fraction 50mm rafters at 600mm spacing

Continuity of thermal insulation

Thermal insulation of the roof should be continuous, with gable ends being insulated to their full height.

Thermal bridging can occur where boards are cut to fit as at junctions, ridges, abutments and penetrations. Fill all gaps with sprayed polyurethane foam or flexible foam strip to avoid air leakage which may lead to localised condensation.

Please refer to DEFRA/DTLR 'Robust Details' and BR 262 'Thermal Insulation - avoiding risks'

Condensation

Adopting a warm roof construction moves the condensation plane to the batten space where any condensation which occurs can be dispersed by natural air movement. The closed cell structure of ROOFMATE RL-X insulation makes it resistant to the passage of water vapour: calculation will often show no need for a vapour control layer.

It is however advisable to install a vapour control layer ensuring that it is as convection tight as possible. Where the building is likely to have a high level of humidity, as in the case of swimming pools or commercial kitchens, condensation risk assessment should be undertaken by a suitably qualified professional. A method for calculating the risk of interstitial condensation is given in BS EN ISO 13788.

Ventilation

The loft space enclosed within a warm roof construction does not require provision for ventilation to remove condensation. If the loft is to be used as habitable space, it will need to comply with the requirements of Building Regulation F1 (Regulation 23 in Scotland).

Moisture build up in the space between the outer roof covering and the water vapour permeable underlay must be prevented by venting moist air to atmosphere. The surface irregularities of natural slates and cambered plain tiles will usually provide sufficient air paths. However, close-fitting coverings, such as those formed with tightly interlocking tiles, synthetic resin slates or profiled metal sheets, will require specific provision for air movement in the form of vents, especially if the roof pitch is low or the roof slopes are large or of complex shape.

Ventilation is not however required between the underlay and insulation.

Fire

The use of ROOFMATE RL-X insulation boards will not affect the fire rating of tiled roofs when evaluated by assessment or when tested to BS 476: Part 3: 1958. To comply with Building Regulation B2 (Regulation 12 in Scotland) for internal fire spread ROOFMATE RL-X boards must be protected by a lining, such as plasterboard.

For further information on the fire performance of ROOFMATE RL-X boards see BS 6203 and Agrément Certificate 87/1836.

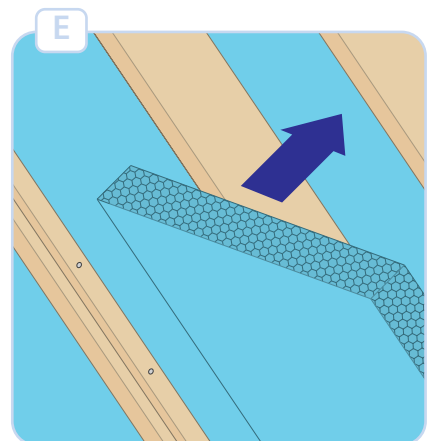
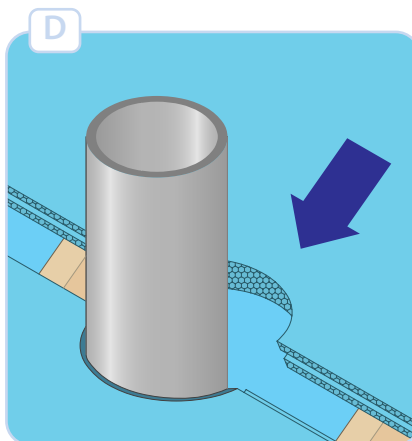
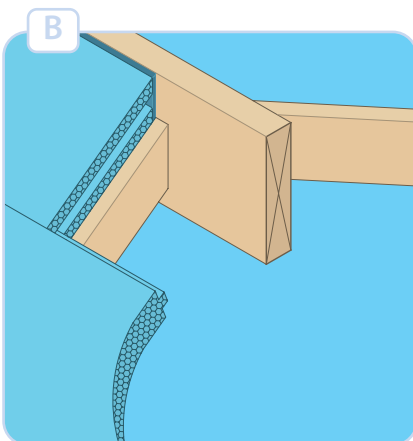
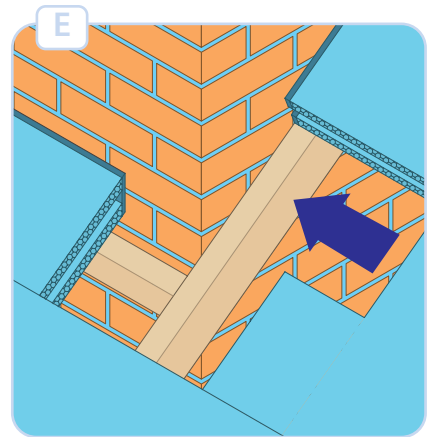
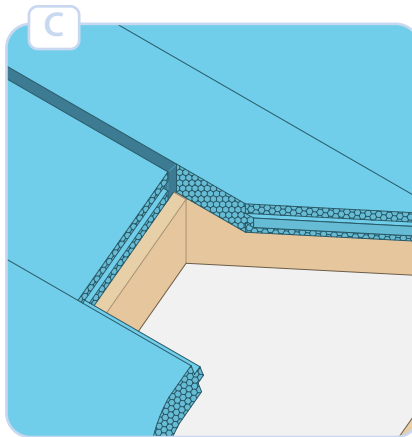
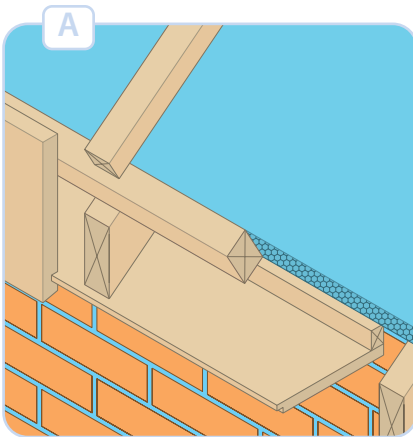
Insulating pitched roofs

Installation sequence

1. Fix a 60mm thick timber stop batten across the rafters at eaves (A).
2. Lay ROOFMATE RL-X boards with long edges at right angles to the rafters and with the tongue pointing up the slope (B).
3. Butt the first row of boards tight against the stop batten. Continue laying up the slope towards the ridge. At ridge butt ROOFMATE RL-X to the ridge board (B) or to ROOFMATE RL-X on the opposite slope. (C).
4. Fix ROOFMATE RL-X boards temporarily by occasional nailing until permanently secured by the counter battens.
5. At all cut edges, junctions and penetrations trim ROOFMATE RL-X boards neatly to fit (D) (E). Seal any gaps with polyurethane foam.
6. either: **(a)** lay the underlay directly onto the ROOFMATE RL-X boards and secure with counter battens; or **(b)** secure the ROOFMATE RL-X boards with counter battens, then drape the underlay over the counter battens and secure with tiling/slating battens.
(Refer to underlay supplier's instructions).
7. Fit ROOFMATE RL-X boards cut-to-size between the rafters from within the loft space. Press tight against the ROOFMATE RL-X boards and fix by nailing support battens to the rafters (F).

Key points

- » Ensure ROOFMATE RL-X boards interlock tightly.
- » Cut and fit boards neatly.
- » Seal any gaps, particularly at cut joints.
- » **Do not stand on ROOFMATE RL-X or use as a working platform.**



References

Agrément certificates

- »» 87/1836 Pitched roofs - warm roof concept
- »» 88/2105 Cavity walls
- »» 92/2782 Floors
- »» 97/3431 Inverted roofs

Building Regulations

- »» Approved Documents to the Building Regulations
 - A Structure
 - B Fire safety
 - C Site preparation and resistance to moisture
 - E Resistance to the passage of sound
 - L1A Conservation of fuel and power in new dwellings
 - L1B Conservation of fuel and power in existing dwellings
 - L2A Conservation of fuel and power in new buildings other than dwellings
 - L2B Conservation of fuel and power in existing buildings other than dwellings
- »» Technical Handbooks to Building Standards Scotland Regulations

BRE publications

- »» Thermal insulation: avoiding risks BR 262:2002.
- »» Conventions for U-value calculations
 - B. Anderson BR443: 2006
- »» Building Elements: 'Floors and Flooring' – PW Pye and HW Harris BR 332: 1997
- »» Foundations, basements and external walls BR 440: 2002.
- »» BRE Digest 311. Wind scour of gravel ballast on roofs.
- »» BRE IP 17/01. Assessing the effects of thermal bridging at junctions and around openings in the external elements of buildings.

British Standards

- »» BS 743: 1970: Specification for materials for damp proof courses.
- »» BS 476: Fire tests on building materials and structures.
 - Part 2: 1987. Methods for determination of the fire resistance of loadbearing elements of construction.
 - Part 3: 1958: External fire exposure roof test
- »» BS 743:1970: Specification for Materials for Damp proof courses.
- »» BS 1202: Specification for nails.
 - Part 1: 2002: Steel nails.
- »» BS 5250: 2002: Code of practice for control of condensation in buildings.
- »» BS 5427: Code of practice for the use of profiled sheet for roof and wall cladding on buildings.
 - Part 1: 1996: Design.
- »» BS 5950: Structural use of steelwork in building.
 - Part 4: 1994 Code of practice for design of composite slabs with profiled steel sheeting.
- »» BS 5268: Structural use of timber.
 - Part 4: Fire resistance of timber structures.
 - Section 4.2: 1990: Recommendations for calculating fire resistance of timber stud walls and joisted floor constructions.
 - Part 7: Recommendations for the calculation basis for span tables.
 - Section 7.1: 1989: Domestic floor joists.
- »» BS 5502: Buildings and structures for agriculture.
 - Part 23: 1990: Code of practice for fire precautions.
 - Part 42: 1990: Code of practice for design and construction of pig buildings.
 - Part 71: 1992: Code of practice for design and construction of ventilated stores for potatoes and onions.
- »» BS 5534: 2003: Code of practice for slating and tiling.
- »» BS 5628: Code of practice for use of masonry.
 - Part 3: 1985: Materials and components, design and workmanship.
- »» BS 6203: 1991 (1996) Guide to fire characteristics and fire performance of expanded polystyrene materials used in building applications.
- »» BS 6229: 2003: Code of practice for flat roofs with continuously supported coverings.
- »» BS 6398: 1983: Specification for bitumen damp proof courses for masonry.
- »» BS 6399: Loading for Buildings
 - Part 1: 1996: Code of practice for dead and imposed loads.
 - Part 2: 1997: Code of practice for wind loads.
 - Part 3: 1988: Code of practice for imposed roof loads.

References

- »» BS 6515: 1984 (1996) Specification for polyethylene damp-proof courses for masonry.
- »» BS 8000: Workmanship on building sites.
Part 4: 1989: Code of practice for waterproofing.
- »» BS 8102: 1990: Code of practice for protection of structures against water from the ground.
- »» BS 8103 Structural Design of low-rise buildings.
Part 1: 1995: Code of practice for stability, site investigation, foundations and ground floor slabs for housing.
- »» BS 8110: Structural use of concrete.
Part 1: 1997: Code of practice for design and construction.
- »» BS 8203: 2001 Code of practice for resilient floor coverings.
- »» BS 8204: Screeds, bases and in-situ floorings.
Part 1: 1999 Code of practice for concrete bases and cement sand levelling screeds to receive floorings.
Part 2: 1999: Code of practice for concrete wearing surfaces.
- »» BS 8215: 1991: Code of practice for design and installation of damp proof courses in masonry construction.
- »» BS 8218: 1998: Code of practice for mastic asphalt roofing.
- »» CP 1018: 1971 (1993) Electric floorwarming systems for use with off-peak and similar supplies of electricity.

European standards

- »» BS EN 1264: Floor heating. Systems and components.
Part 4: 2001 Installation
- »» BS EN 12056: Gravity drainage systems inside buildings.
Part 3: 2000: Roof drainage, layout and calculation.
- »» BS EN 13164: 2001 Thermal insulation products for buildings - Factory made products of extruded polystyrene (XPS) specification.
- »» BS EN 13501: Fire classification of construction products and building elements.
Part 1: Classification using test data from reaction to fire tests
- »» BS EN 13370: 1998 Thermal performance of buildings – Heat transfer via the ground – Calculation methods
- »» BS EN 13789: 1999: Thermal performance of buildings - Transmission heat loss coefficient - Calculation method.

International standards

- »» BS EN ISO 6946: 1997 Building components and building elements – Thermal resistance and thermal transmittance – Calculation method.

Other publications

- »» CIBSE Guide A (1999)
- »» DEFRA/DTLR Robust Details – Limiting thermal bridging and air leakage: Robust Construction details for dwellings and similar buildings. 2002
- »» NBS Domestic Heating Compliance Guide: 2006

Recommendations

The STYROFOAM range of blue extruded foamed polystyrene insulation products includes FLOORMATE, ROOFMATE, WALLMATE and PERIMATE.

STYROFOAM products contain a flame retardant additive to inhibit accidental ignition from a small fire source. STYROFOAM is, however, combustible and if exposed to an intensive fire may burn rapidly.

During shipment, storage, installation and use STYROFOAM products should not be exposed to flames or other ignition sources.

Fire classification is based on small-scale tests, which may not reflect the reaction of the products in its end use state under actual fire conditions.

STYROFOAM products should, when installed, be adequately protected from direct exposure to fire.

Recommendations about the methods, use of materials and construction details are given as a service to designers and contractors. These are based on the experience of Dow with the use of STYROFOAM products. Any drawings are meant only to illustrate various possible applications and should not be taken as a basis for design. Since Dow is a materials supplier and exercises no control over the installation of STYROFOAM products, no responsibility is accepted for such drawings and recommendations.

In particular, no responsibility is accepted by Dow for the systems in which STYROFOAM is used or the method of application by which it is installed. The legal obligations of Dow in respect of any sale of STYROFOAM products shall be determined solely by the terms of the respective sales contract.

Notes

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