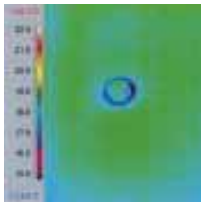

Kingspan® Insulation Solutions

Mineral Fibre Loft Insulation, Workmanship, Ventilation & Condensation

A White Paper

Contents

1 *Executive Summary*

1.1 Kingspan Insulation Ltd approached a local authority in the West Midlands for permission to carry out a roof survey of publicly owned properties which had mineral fibre installed as loft insulation so as to assess and record the condition of the mineral fibre as installed.

1.2 The local authority selected, at its discretion and with a totally free hand 35 properties. The properties had recently had their loft insulation upgraded.

1.3 The survey consisted of two phases. During May-June 1998 each loft space was accessed from the property below and a checklist was employed to record the relevant condition as found at the time of the inspection. Where appropriate, photographs were taken to record the condition of the loft. This was repeated with seventeen of the properties during January 1999.

1.4 All properties surveyed in May-June 1998 had some degree of blocked ventilation paths due to overfilling of the eaves and typically the majority of the spaces between rafters at the eaves were completely blocked by the mineral fibre quilt.

1.5 No vent trays could be identified. If they had been installed, then no care has been taken to ensure that a clear and continuous air path is provided into the loft space at the upper end of the tray. If they were installed, their lengths appear to be too short to provide effective ventilation.

1.6 Ten of the thirty five properties surveyed in May-June 1998 were found to have some signs of moisture staining or mould growth on the roof timbers. This mould growth is likely to be directly related to the lack of effective ventilation.

1.7 Of the seventeen properties re-surveyed in January 1999, sixteen were found to have condensation occurring on the underside of the sarking felt. Where condensation was present on the sarking felt, the adjacent rafters all had moisture contents which were above the critical level for dry rot (of 20% by weight) and which could support the germination and growth of moulds.

1.8 Signs of mould were identified on the rafters in four of the seventeen properties re-surveyed in January 1999. In each loft affected, the mould was forming on the side of the rafters adjacent to those areas with the most severe condensation.

1.9 The condensation problems are likely to continue throughout the winter period. Until proper remedial measures are taken to introduce effective ventilation, the timber rafters will continue to be wetted by condensation. The potential for degradation of the roof timbers due to fungal attack is extremely high.

1.10 Solutions to the problem would be to adjust the placement of the mineral fibre quilt at the eaves such that it was not blocking the ventilation path or better still would be the correct installation of proprietary eaves vent trays.

1.11 Perhaps the best remedy of all would have been to design out this workmanship risk and to move the insulation to rafter level thus allowing the loft space to be used freely for storage or living space (i.e. a loft conversion).

2 *Introduction*

2.1 This "White Paper" from Kingspan Insulation is one of a series, highlighting the serious implications that inadequate site workmanship and supervision can have on the performance of insulation materials.

2.2 Most insulation materials perform as claimed under controlled installation conditions and when tested in a laboratory environment. However, when taken into the world of real usage, not all may perform as predicted.

2.3 This "White Paper" focuses on the performance of mineral fibre as loft insulation when subject to real "in use" conditions. In particular it investigates the effects of workmanship and the consequences for ventilation rates and condensation.

2.4 The traditional pitched roof with a loft used on the majority of houses and many other buildings serves two purposes, to keep the weather out and heat in. In the latter case this function is carried out by loft insulation, typically glass or rock mineral fibre quilt.

2.5 The knock on effect of keeping heat in a building is that the surfaces outside of the insulation layer become cooler, and can drop below the dewpoint temperature for that construction and environment. In order to alleviate these conditions cross ventilation is introduced into the loft in order to exhaust moist air from it.

2.6 In the UK and Ireland, Building Regulations/Standards* require that adequate provision is made to prevent excessive condensation in the roof or roof void above an insulated ceiling.

2.7 This cross ventilation requires that openings are introduced around the periphery of the loft to facilitate air entry and exit. These openings are most commonly made at opposite eaves, at the ridge and eaves or within the tiles or slates in the form of ventilating tiles or slates.

2.8 Regulations/Standards* require that lofts should have eaves openings on opposite sides of the roof at least equal to continuous gap 10mm wide. BRE Report 262 (Thermal insulation: avoiding risks) recommends the provision of a 25mm air gap from eaves to loft and that ventilators be used provide for this.

2.9 It is therefore clear that the avoidance of condensation necessitates that these openings be kept clear and that design detailing is correctly applied on site.

2.10 For the purposes of this White Paper the definition of mineral fibre is taken from BS 3533 : 1981 and includes both glass fibre and rock fibre.

** The Building Regulations (Republic of Ireland) 1997. Technical Guidance Document F (Ventilation). The Building Regulations (England & Wales) 1991 (1995 Edition). Approved Document F (Ventilation). The Building Standards (Scotland) Regulations 1990, as amended. Technical Standard G (Preparation of Sites and Resistance to Moisture). The Building Regulations (Northern Ireland) 1994, as amended. Technical Booklet C (Resistance to Moisture).*

3 *Case Studies – Background*

3.1 Kingspan Insulation Ltd approached a local authority in the West Midlands for permission to carry out a roof survey of publicly owned properties which had mineral fibre installed as loft insulation so as to assess and record the condition of the mineral fibre as installed.

3.2 The local authority selected, at its discretion and with a totally free hand 35 properties. The properties had recently had their loft insulation upgraded.

3.3 The specification for the upgrading work was to strip the existing mineral fibre from the lofts and to lay mineral fibre to 150 mm thickness between joists. Eaves ventilation was to be effected by the introduction of eaves ventilators and vent trays, under which the mineral fibre quilt was to be tucked in order to avoid a cold bridge at the eaves.

3.4 The survey consisted of two phases. During May-June 1998 each loft space was accessed from the property below and a checklist was employed to record the relevant condition as found at the time of the inspection. Where appropriate, photographs were taken to record the condition of the loft. Seventeen of the properties were then reinspected during January 1999 to asses the extent and effects of any condensation.

4 *Case Study – Phase 1 (May-June 1998)*

4.1 All properties had some degree of blocked ventilation paths due to overfilling of the eaves and typically the majority of the spaces between rafters at the eaves were completely blocked by the mineral fibre quilt. In many cases the mineral fibre had been laid in such a manner that it contacted the underside of the sarking felt across the entire space between rafters. The majority of units were found to have 80% or more of the ventilation spaces filled with mineral fibre quilt.

4.2 No vent trays could be identified in the small canted/sloped sections of the ceilings which generally existed at the eaves, although plastic wrappers were found in one loft. If they had been installed, then no care has been taken to ensure that a clear and continuous air path is provided into the loft space at the upper end of the tray. If they were installed, their lengths appear to be too short to provide effective ventilation since none could be identified projecting above the upper surface of the mineral fibre quilt at the underside of the sarking.

Image 1

This image is of property #37 Street A. It shows mineral fibre blocking eaves ventilation.

Image 3

This image is of property #4 Street B. It shows mineral fibre blocking eaves ventilation.

Image 2

This image is of property #57 Street A. It shows mineral fibre blocking eaves ventilation.

Image 4

This image is of property #36 Street B. It shows mineral fibre blocking eaves ventilation.

4 Case Study – Phase 1 (May-June 1998)

4.3 The extent to which the ventilation has been blocked is of serious concern. Ventilation would be expected to be poor in the majority of these lofts.

4.4 Ten of the thirty five properties were found to have some signs of moisture staining or mould growth on the roof timbers. This mould growth is likely to be directly related to the lack of effective ventilation. While the majority of affected areas were relatively small and sporadically located, one loft (#65 Street A) in particular showed more advanced levels of mould growth and recorded an average timber moisture content of 18% by weight (normal acceptable range is 5-20% by weight). Another property (#29 Street A) showed larger patches of staining on one rafter in particular, however, the timber moisture content at the time of inspection was low (10% by weight). Areas of such moisture staining can be seen in images 5 & 6 below. In general the moisture content of the roof timbers ranged between 10-13% by weight.

4.5 It should be recognised that these inspections took place during the warmer summer period when the relative humidity in the loft and therefore the risk of condensation would be lower. Typical winter conditions would be expected to present a much higher risk of condensation formation in these loft spaces since the relative humidity would be higher and the surface temperature of the sarking felt would be lower. The higher levels of moisture vapour in the loft space air during winter will affect the roof timbers by raising their moisture content.

Images 5 & 6

These images are of property #65 Street A. They show moisture staining of timber rafters.

5 *Case Study – Phase 2 (January 1999)*

5.1 Of the seventeen properties surveyed, sixteen were found to have condensation occurring on the underside of the sarking felt.

5.2 This condensation appeared to have formed due to the lack of acceptable loft ventilation which was identified during phase one of this case study.

5.3 Where condensation was present on the sarking felt, the adjacent rafters all had moisture contents which were above the critical level for dry rot (of 20% by weight) and which could support the germination and growth of moulds.

5.4 In general, the condensation was concentrated on the sarking material around the lower levels of the roof spaces adjacent to the eaves. In most properties it appeared that the higher surfaces, being slightly warmer due to the stack effect, had little or no formation of condensation, although condensation up the entire roof pitch from eaves to ridge could be seen in #37, 51, 57 and 76 Street A.

5.5 Where condensation formed it typically covered the entire space between rafters and the size of the droplets ranged between 5-15mm.

Image 7

This image is of property #47 Street A. This image shows condensation occurring on the underside of the sarking felt covering the entire space between rafters. The droplets ranged between 5-10mm.

Images 8 & 9

These images are of properties #51& 57 Street A. They show condensation occurring on the underside of the sarking felt with a greater concentration of droplets around the lower levels of the roof space.

5 Case Study – Phase 2 (January 1999)

5.6 In properties where condensation was found, it generally affected two of the three pitches in the roof space (the properties were semi-detached). This can be explained by the orientation of the properties. Night sky radiation effects tend to cool north and east facing slopes for longer periods during the evening, while south facing pitches will tend to be raised in temperature during the day. As a result the majority of the condensation problems are located on the rear and side elevations of the odd numbered properties and on the front and side elevations of the even numbered properties.

5.7 Signs of mould were identified on the rafters in four of the seventeen properties surveyed. (#47, 81, 83 and 90 Street A.) In each loft affected, the mould was forming on the side of the rafters adjacent to those areas with the most severe condensation.

Images 10, 11 & 12

These images are of properties #81 & 83 Street A. They show signs of mould growth on rafter sides.

6 Case Study Results, Consequences & Remedies

6.1 Attics are dark, dirty and dusty environments. Working conditions are uncomfortable at best. Getting into the eaves of an attic is difficult if not impossible in some instances. Unless loft insulation is carried out on a DIY basis, the property owner or tenant has little impetus to check the quality of installation.

6.2 Non-DIY loft insulation is usually carried out by attic insulation contractors paid per unit insulated who may make use of short term unskilled labour which may have been provided with inadequate training. The impetus is for the work to be carried out as quickly and economically as is possible.

6.3 The result of the above issues with site workmanship and supervision can be seen in the surveys illustrated in the Case Study above.

6.4 The extent to which the ventilation spaces between rafters at the eaves have been blocked is of serious concern and the resulting condensation and mould growth even more so.

6.5 The condensation problems are likely to continue throughout the winter period. Until proper remedial measures are taken to introduce effective ventilation, the timber rafters will continue to be wetted by condensation. The potential for degradation of the roof timbers due to fungal attack is extremely high.

6.6 One solution to the problem would be to adjust the placement of the mineral fibre quilt at the eaves such that it was not blocking the ventilation path. There is, however, a risk that this may cause a cold bridge at the eaves as there would be no continuity between the loft insulation and cavity insulation. This could lead to localised surface condensation on the internal wall/ceiling junction.

6.7 A more improved method would be the installation of proprietary eaves vent trays under which the mineral fibre quilt could be tucked, thereby maintaining the continuity of insulation whilst not impeding ventilation.

6.8 Both of the above could have been done as part of the original works, but were not.

6.9 Perhaps the best remedy of all would have been to design out this workmanship risk and to move the insulation to rafter level thus allowing the loft space to be used freely for storage or living space (i.e. a loft conversion).

6.10 If the insulation is to be moved to rafter level, a warm pitched roof construction is the preferred option as it negates cold bridges through rafters, eliminates the need to ventilate and keeps the roof structure warm.

7 *Kingspan Insulation Solutions*

7.1 There is one solution to the problems identified in this "White Paper" that can be employed using Kingspan Insulation products.

7.2 One of Kingspan Insulation's products for pitched warm roof insulation can be used. The products are Kooltherm K7 Sarking Board and Thermapitch TP10. A typical thermographic image of a roof so insulated are shown below.

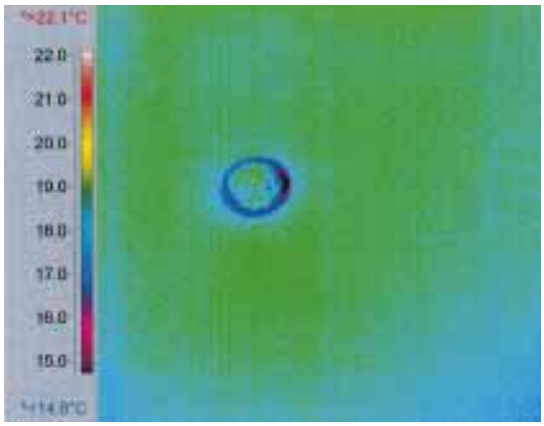

Image 13

The even surface temperature indicates a well performing Kingspan Insulation warm pitched roof system. The small circular shape in the centre of the image is a spot light fitting which is switched off.

Technical Advice

Kingspan Insulation Limited support all of their products with a comprehensive Technical Advisory Service for specifiers, stockists and contractors.

This includes a free computer-aided service designed to give fast, accurate technical advice. Simply phone our TECHLINE with your project specification and we can run calculations to provide U-values, condensation/dew point risk, required insulation thicknesses etc… Thereafter we can run any number of permutations to help you achieve your desired targets.

We can also give general application advice and advice on design detailing and fixing etc… Site surveys are also undertaken as appropriate.

Please call our Technical Services Department on the TECHLINE numbers below:

TECHLINE

UK	– **Free***fone 0800* **610061**	
	+44 (0) 1544 387260 (if dialling from outside the UK)	
	– Fax:	**01544 388888**
	– e-mail:	technical.services @kil.kingspan.co.uk
Ireland	– Telephone:	**042 9795032**
	– Fax:	**042 9746129**
	– e-mail:	technical.services @kil.kingspan.ie

Customer Service

For quotations, order placement and details of despatches please call our Customer Services Department on the numbers below:

UK	– Telephone:	**01544 388601**
	– Fax:	**01544 388888**
	– e-mail:	technical.service @kil.kingspan.co.uk
Ireland	– Telephone:	**042 9795000**
	– Fax:	**042 9746129**
	– e-mail:	customer.service @kil.kingspan.ie

NB

Kingspan Insulation reserve the right to amend product specifications without prior notice. The information, technical details and fixing instructions etc. included in this literature are given in good faith and apply to the uses described. For other applications or conditions of use, Kingspan Insulation offers a free Technical Advisory Service (see left) whose advice should be sought for all uses of Kingspan Insulation products that are not specifically described herein. When specifying the products that are described herein please check that your copy of this literature is current by calling our Technical Services Department (see left).

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