Project:	HSE: Real fires contract
Project number:	OX21041
Title:	Summary report: retrospective roof insulation fire testing
Date:	03/07/2024
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Review by:	Michael Spearpoint
Approved by:	Danny Hopkin
Issue:	R00

1 INTRODUCTION

1.1 Appointment

OFR Consultants Ltd have been engaged by the Building Safety Regulator (BSR), who are part of the Health and Safety Executive (HSE), to deliver the "Real Fires" project in support of fire safety technical policy. The Technical Policy Division of the Department for Levelling Up, Housing and Communities (DLUHC, formerly the Ministry for Housing Communities and Local Government, MHCLG, and whose responsibilities are now held by the BSR), originally commissioned this project on the 22nd of October 2021. The duration of the contract still stands from its initial award by DLUHC, running from the original commissioning date for three years.

As part of this project, the contract makes allowance for ad-hoc research to be undertaken to support fire safety technical policy on matters that emerge through dialogue with industry or through observations of real fires. Through this mechanism, OFR have been engaged to undertake research on the fire performance of roofs on residential buildings afforded retrospective spray applied foam insulation.

1.2 Background

On the 8th of April 2022, OFR attended an on-line meeting with (then) DLUHC staff from both the fire technical policy and sustainability divisions. At this meeting, DLUHC relayed their observations that suppliers in industry were incentivising the use of retrofitted spray applied closed and open-cell polymeric insulation to the underside of roofs of dwelling properties, with the intent of improving thermal performance of the buildings. However, there is a concern that such a retrofit could constitute a worsening of the existing fire safety expectations owing to a change in the fire performance of the roof to which it is applied. To this end, OFR were instructed to undertake a programme of experiments to establish the extent to which such products present an additional fire hazard, with any outcomes having the potential to impact technical policy on their future use.

1.3 Method of investigation

OFR were instructed to investigate the implications of retrospectively applied spray foam roof insulation in terms of the implications for compliance with Regulation B4(2). Compliance with Regulation B4(2) is typically addressed through the application of guidance in Approved Document B [1] (ADB) with the intention that: *"Flame spread over the roof and/or fire penetration from external sources through the roof is restricted."* In ADB, roof coverings are expected to achieve classifications to address the prospect of external fire spread. These classifications are expressed in function of the proximity of the roof to the relevant boundary. The classifications are evaluated through roof testing procedures, with the focus principally on fire penetration of a roof from outside-to-in. In England, BS 476-3 [2] is adopted for the purpose of classification testing of roofs, which is known as CEN/TS EN 1187-4:2012 [3] test 4 (t4) within the BS EN 13501-5:2005 [4] classification framework. The test method can be described as two-stage, incorporating the effects of burning brands, wind and supplementary radiant heat.

This research study makes use of an ad-hoc format of the BS 476-3 protocol to investigate the implications of retrospectively applied, sprayed foam insulation on the fire penetration performance of three different roof coverings. The tests were undertaken at the Building Research Establishment (BRE) between June 2023 and November 2023.

1.4 Scope of this report

This report has been prepared to summarise the findings of the three BS 476-3 roof tests undertaken and to set out OFR's view on the implications for technical policy. It then makes recommendations in respect of potential future work / research.

1.5 Outstanding information

At the time of writing, OFR are yet to receive BRE's final consolidated report. Therefore, this report is based on interim information received by way of data logger information, test classification reports (see Appendix A), images and OFR's observations having attended the tests. It is expected that a revision will be required as certain details require confirmation (from BRE) at the time of writing.

2 TEST SAMPLES

Samples were prepared in line with the expectations of CEN/TS EN 1187-4:2012, test 4 (BS 476-3). Three configurations were tested as set out in Table 1, with no replicates. Corresponding images are shown in Figure 1 to Figure 3. An illustration of a cross section of the samples is shown in Figure 4.

Table 1. Summary of test samples

Sample	Designation	Description
A	Old plain clay without sarking	Red clay roofing tiles, two layers deep. No membrane. Over-sprayed with off-white rigid foam insulation. Encased in a timber frame.
B	Very old plain clay with sarking	Red clay roofing tiles, two layers deep. Over grey fabric membrane. Over-sprayed with off-white rigid foam insulation. Encased in a timber frame.
C	Very old slate without sarking	Old double lapped slate. No membrane. Over-sprayed with off-white rigid foam insulation. Encased in a timber frame.

The sprayed insulation was ISOTHANE water blown foam (WBF) open cell spray insulation. It is a two component 1:1 ratio, soft foam system which when processed through suitable spray machinery will produce a rigid foam of approximate density 10 kg/m^3. Whilst the depth of fill varied (as evident in Figure 1 to Figure 3), it was broadly to the full depth of the rafters, i.e., ca. 90 mm. However, in places, this was as low as 30 to 50 mm. The insulation provider was selected by the BRE and was considered to be broadly representative of the products brought to market.

Figure 1. Old plain clay without sarking (Sample A)

Figure 2. Very old plain clay with sarking (Sample B)

Figure 3. Underside of very old slate without sarking (Sample C)

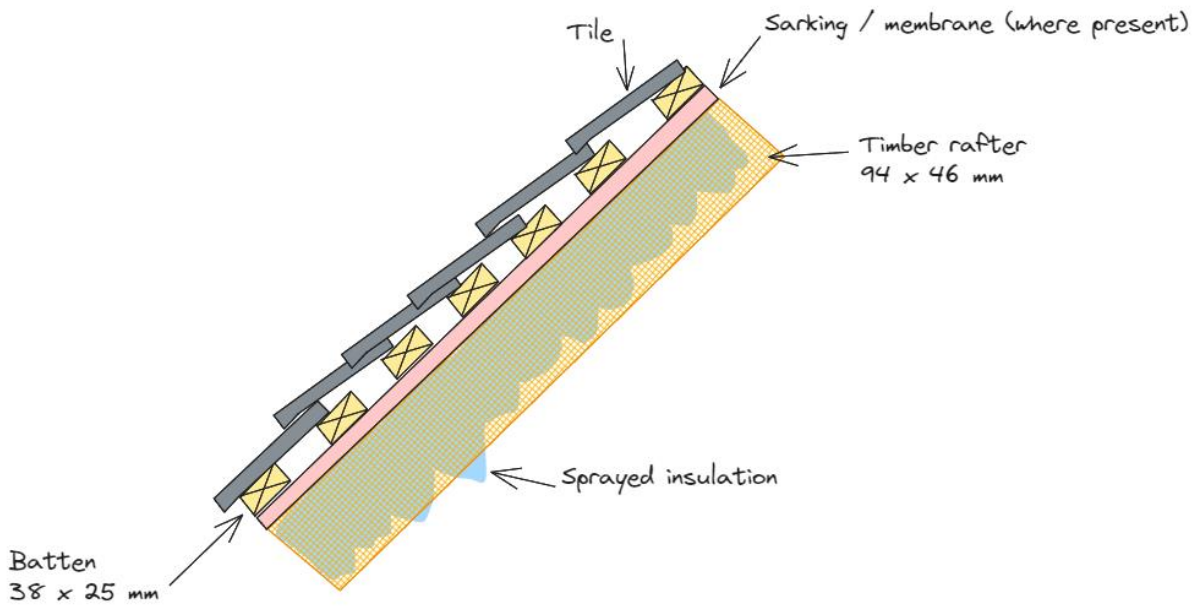

Figure 4. Illustration of samples (cross section)

3 TEST PROTOCOL

The test protocol was an ad-hoc form of the CEN/TS 1187-4:2012 test 4, with focus on fire penetration performance. This is aligned with BS 476-3. The test was ad-hoc as it did not follow the procedure in its entirety, omitting stage 1 "*Preliminary ignition test with burning brands*" and stage 2 "*Spread of flame test with burning brands and supplementary radiant heat*". The test did adopt stage 3 "*Penetration test with burning brands, wind and supplementary radiant heat*". This involved applying a burning brand to the surface of the sample after 5 min from the application of radiant heat.

3.1 Penetration test

The penetration test (Figure 5) is run for 60 min with the specimens exposed to the 12.5 ±1.5 kW/m^2 radiant heat flux from the panels. Once the specimen is mounted in the test frame and exposed to the radiant heat, the pressure on the underside is reduced. After 5 min, a simulated burning brand is applied to the surface by moving a gas flame once up and down the centre of the specimen in a continuous movement over a 1 min period.

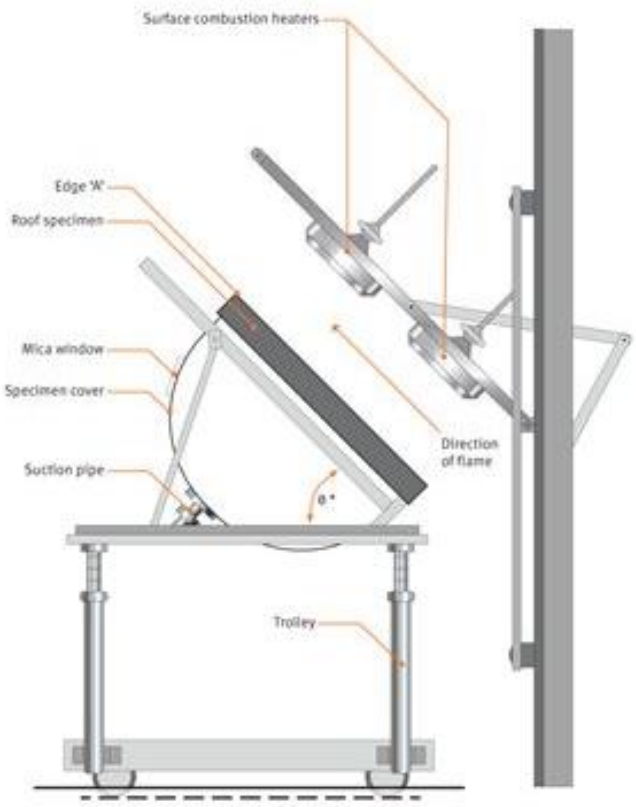

Figure 5. BS 476-3 test arrangement

3.2 Classification criteria

Stage 3 records the time at which penetration occurs. It also notes occurrence of melting of the test specimens and the production of molten droplets or debris, and any mechanical

failure, or the development of holes, without penetration by fire. For the test, penetration is defined as "*appearance of glowing or flaming on the underside of the specimen other than that of the test flame*".

Whilst a formal classification is not possible due to the omission of stage 1 and 2, from a penetration performance perspective, the following is required to achieve classifications B through F:

CEN/TS 1187 Test 4	$B_{ROOF}(t4)$	— No penetration of roof system within 1 h. — In preliminary test, after withdrawal of the test flame, specimens burn for < 5 min. — In preliminary test, flame spread < 0,38 m across region of burning.
	$C_{ROOF}(t4)$	— No penetration of roof system within 30 min. — In preliminary test, after withdrawal of the test flame, specimens burn for < 5 min. — In preliminary test, flame spread < 0,38 m across region of burning.
	$D_{ROOF}(t4)$	— Roof system is penetrated within 30 min but is not penetrated in the preliminary test. — In preliminary test, after withdrawal of the test flame, specimens burn for < 5 min. — In preliminary test, flame spread < 0,38 m across region of burning.
	$E_{ROOF}(t4)$	— Roof system is penetrated within 30 min but is not penetrated in the preliminary test. — Flame spread is not controlled.
	$F_{ROOF}(t4)$	— No performance determined.

Figure 6. Classes of performance from test 4 from BS EN 13501-5:2016

4 RESULTS

4.1 Classification

Table 2 summarises the penetration time of the three samples tested. In all three instances, subject to satisfying the preliminary test criteria, the samples would achieve $B_{roof}(t4)$. This is the highest classification standard called for within Approved Document B (ADB) for roofs and the highest classification standard achievable within the BS EN 13501-5 framework.

Table 2. Summary of penetration results and observations

Sample	Designation	Penetration	Observations
A	Old plain clay without sarking	No penetration in 60 min	No ignition of roof structure / insulation
B	Very old plain clay with sarking	No penetration in 60 min	
C	Very old slate without sarking	No penetration in 60 min	

4.2 Qualitative results

It was observed that generally the roof covering, i.e., in this case tiles, is the governing component of the roof build-up, heavily influencing the involvement or otherwise of the insulation beneath. The Commission Decision of 6 September 2000 implementing Council Directive 89/106/EEC [5] as regards the external fire performance of roof coverings gives specifications of tiles that can *"be considered to fulfil all of the requirements for the performance characteristic 'external fire performance' without the need for testing, subject to compliance with any national provisions on the design and execution of works."*

Extracts relevant to clay and slate are shown in Figure 7.

Roof covering products (and/or materials) which can be considered to fulfil all of the requirements for the performance characteristic 'external fire performance' without the need for testing, subject to any national provisions on the design and execution of works being fulfilled

Roof covering product/material	Specific conditions
Slates: natural slates, stone slates	Satisfies the provisions of Commission Decision 96/603/EC
Tiles: stone, concrete, clay, ceramic or steel roof tiles	Satisfies the provisions of Commission Decision 96/603/EC Any external coating shall be inorganic or have a PCS ≤ 4,0 MJ/m² or a mass ≤ 200 g/m²

Figure 7. Extract from EC Decision 89/106/EEC

With reference to Figure 7 the findings in Table 2 are in accordance with the EC committee decision. Figure 8 shows "Sample A: Old plain clay without sarking", after the fire test and with the removal of the top row of tiles.

Figure 8. Discolouration of insulation below clay tiles (sample A)

Some minor discolouration of the insulation beneath was noted. However, there was no indication that this had ignited and become involved as a source of fuel. The same was observed for Sample B, albeit with progressively greater discolouration and extent noted as the condition and thickness of the tiles deteriorated.

For Sample C, involvement of the insulation was noted behind the slate tiles, as shown in Figure 9. The insulation had visibly recessed from the tiles' surface, when compared with the timber rafters. The surface of the insulation was exposed to conductive and radiant heating, where the insulation was in contact with the slate tiles or not, respectively. It can be seen from Figure 9 and Figure 10 that the insulation pyrolyzed to a certain extent, with the surface on the exposed side having experienced charring and the surface on the unexposed side having partially been discoloured. Figure 10 shows a gap on the insulation, due to the pyrolysis process. The formation of extensive regions of char suggests that combustion of the insulation occurred below the tiles. There was no obvious indication of flaming and, therefore, combustion was likely smouldering. Whilst involved as a source of fuel, indicating that the fire had penetrated the roof covering (tiles), the roof assembly met the penetration criterion in BS EN 13501-5 for $B_{roof}(t4)$. This is because glowing / flaming was not observed from the underside of the test specimen within a 60 min timeframe.

Figure 9. Smouldered insulation below the slate tiles (Sample C)

Figure 10. Penetration of the insulation and discolouration of the unexposed side

4.3 Quantitative results

A limited number of thermocouples (TCs) were included in the samples to observe temperature development across tests. These were included in two groups within the sample (defined as towards the front and rear of the laboratory by the BRE). Within each group, temperatures were measured at the mid-tile batten and mid-rafter.

Temperature versus time plots at the mid-tile batten and mid-rafter are shown in Figure 11 and Figure 12, respectively. The plots indicate the mean values as a dashed line and the minimum and maximum as a shaded region. Where there is no shaded region, i.e., mid-batten for the very old clay tile, this is due to a TC malfunction.

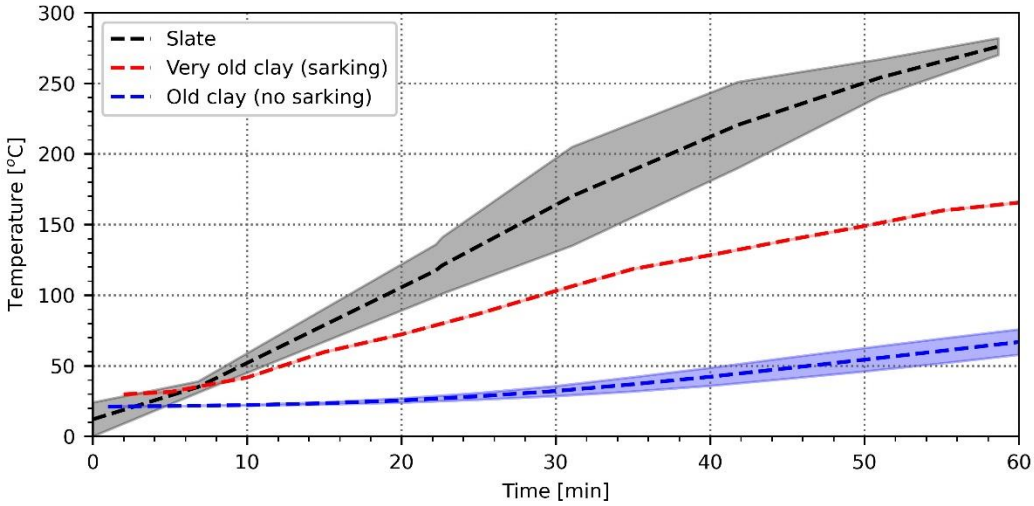

Figure 11. Time versus temperature – mid-tile-batten

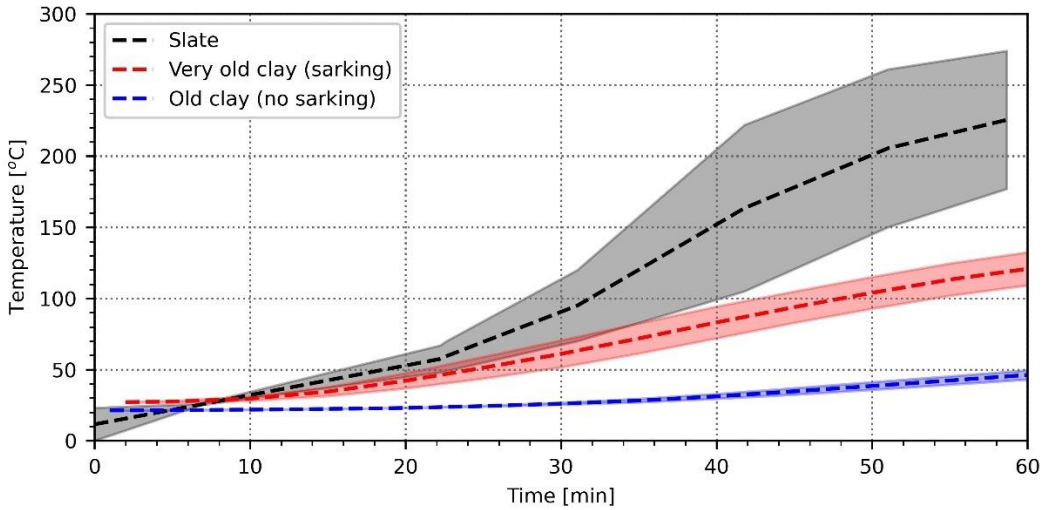

Figure 12. Time versus temperature – mid-rafter

The slate tile resulted in substantially higher temperatures versus the clay tile, i.e., by a factor of ca. two to four. Very old clay tiles demonstrated substantially poorer performance in terms of attained temperatures relative to old clay. However, in no instances was penetration observed.

Aligned with the observations made in Section 4.2, the tile covering, in particular its thickness and condition, were significant factors in the temperatures achieved at the mid-rafter and mid-tile batten. However, in all cases temperatures remained largely below that associated with the ignition of polymeric foam insulations [6], [7].

Hadden et al., studied polyurethane foam exposed to radiant heating [7]. The samples' temperatures, when these did not ignite, ranged from ca. 230 °C to ca. 345 °C. At the same time, the peak sample temperatures, where smouldering combustion was noted, ranged from ca. 375 °C to ca. 465 °C. Drysdale quotes critical surface temperatures for the ignition of polymeric foam materials ranging from 281 to 366 °C [6]. As the temperatures recorded for Sample 3 were shown to have almost reached the lowest threshold found in these two literature sources, it could be assumed this was the reason for the extensive charring of the insulation and further indicates that smouldering combustion likely occurred.

5 Discussion

5.1 Approved Document guidance

Guidance relevant to roofs can be found in Approved Document B in content related to both internal (B3) and external fire (B4) spread. In the case of the former, roof classifications are given where roof construction could provide a means for circumventing internal compartmentation (see Figure 13). In the case of the latter, the guidance seeks to defend against fire spread across a boundary, through classifications that seek to mitigate the penetration of fire from outside-to-in (see Figure 14).

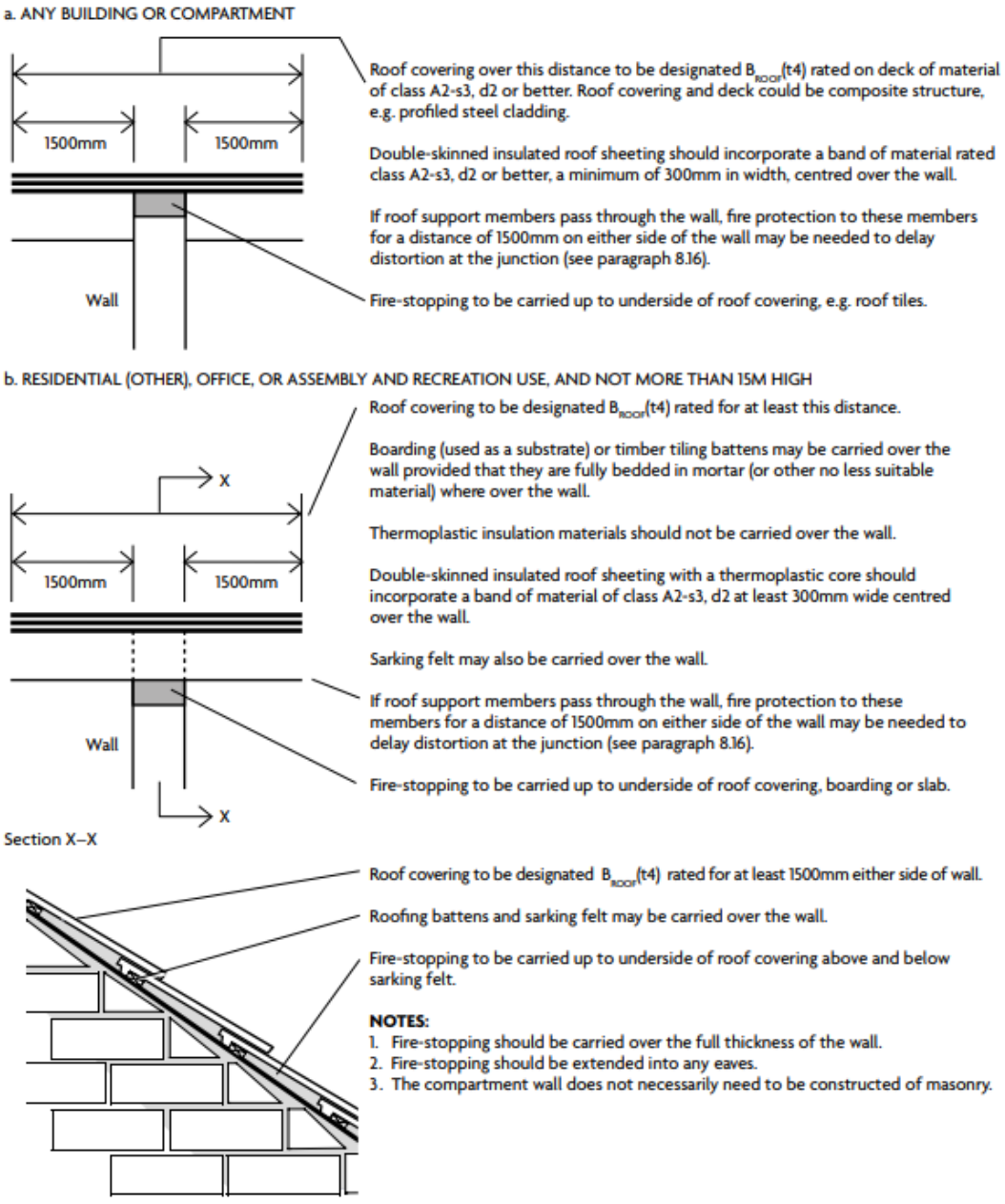

Figure 13. Roof classification near a compartment wall, extract from ADB

Table 14.1 Limitations on roof coverings

Designation[1] of covering of roof or part of roof	Distance from any point on relevant boundary			
	Less than 6m	At least 6m	At least 12m	At least 20m
B_{ROOF}(t4)	●	●	●	●
C_{ROOF}(t4)	○	●	●	●
D_{ROOF}(t4)	○	●[2][3]	●[2]	●
E_{ROOF}(t4)	○	●[2][3]	●[2]	●[2]
F_{ROOF}(t4)	○	○	○	●[2][3]

● Acceptable. ○ Not acceptable.

NOTES:

Separation distances do not apply to enclosed/covered walkways. However, see Diagram 8.2 if the roof passes over the top of a compartment wall.

Polycarbonate and uPVC rooflights that achieve a class C-s3, d2 rating by test may be regarded as having a B_{ROOF}(t4) classification.

1. The designation of external roof surfaces is explained in Appendix B
2. Not acceptable on any of the following buildings.
   a. Industrial, storage or other non-residential purpose group (purpose groups 6 and 7) buildings of any size.
   b. Any other buildings with a cubic capacity of more than 1500m³.
3. Acceptable on buildings not listed in (2) if both of the following apply.
   a. Part of the roof has a maximum area of 3m² and is a minimum of 1500mm from any similar part.
   b. The roof between the parts is covered with a material rated class A2-s3, d2 or better.

Figure 14. Roof classification in function of distance to the relevant boundary, extract from ADB

The guidance in ADB refers to roof coverings, with it noted that "*'Roof covering' describes one or more layers of material, but not the roof structure as a whole*". Referencing Figure 13, in the context of this study, a roof covering would generally be understood to be the roof tile, not the insulation underneath. This, combined with the EC committee decision on roof coverings (see Section 4.2) would suggest that the classification of roofs with retrospectively applied sprayed insulation could be achieved without any recourse to testing.

5.2 The test, the classification and compliance

The Building Act gives powers to the appropriate national authority (or a body designated by them) to approve and issue any document for the purpose of providing practical guidance with respect to the requirements of any provision of building regulations. In doing so, the Act notes that proof of compliance with such a document may be relied on as tending to negative liability. Thus, following the guidance in Approved Document B, inclusive of the classification criteria and associated test methods therein would be considered sufficient to comply with the Regulations for most common building situations.

The relationship between the test method, the specimen and the guidance in ADB does, in the contractor's view, create challenges with respect to adequately mitigating fire spread due to roof penetration.

Firstly, ADB speaks in terms of coverings, noting this to describe "one or more layers of material, but not the roof structure as a whole". To classify typical materials of longstanding use, the EC committee decision on roof coverings takes this to include singular layers, such as tiles. However, BS EN 13501-5 notes that:

> "The external fire performance of a roof/roof covering includes such aspects as external and internal fire spread, external and internal damage, fire penetration and the occurrence of flaming droplets or debris. The external fire performance of a roof/roof covering therefore does not only depend on the burning behaviour of the exposed surface, the roof covering, but also on the influences of several components of the roof, such as the nature and thickness of insulating layers and vapour barriers together with their supporting elements. It may also depend on the systems of attachment of all components, e.g. glued or mechanically fastened.
>
> Therefore, the test specimens shall be representative, in all details of practical application with regard to: a) substrate and deck; b) type, the number and the joining of all layers of roofing materials (including any insulation, vapour barriers, etc.); and c) fixing of the layers."

This creates a conflict where on the one hand, ADB makes recommendations specific to the roof covering, its relationship with boundaries, compartmentation, etc., yet the test method applies to a system. Isolated coverings seem only to be classified within the BS EN 13501-5 framework through EC committee decisions.

Secondly, the test 4 penetration method does not make provision for instrumentation and instead relies upon a qualitative judgement of whether penetration has occurred. This has previously been defined as "*appearance of glowing or flaming on the underside of the specimen other than that of the test flame*".

This BS 476-3 penetration classification criterion is considered problematic for two reasons:

(a) For penetration to be visible, combustible elements must be in proximity to the covering. Therefore, the test fails to capture the potentially poor resistance to penetration of thin non-combustible roof coverings (e.g., steel sheeting) that could get very hot and facilitate the ignition of the variable fire load that might be present within a roof space.

(b) Higher performance classifications can be achieved through the inclusion of large amounts of combustible material. Noting that the penetration criterion relates to visible glowing or flaming on the underside of the sample, placing thick charring materials below the roof covering will increase the apparent penetration time whilst simultaneously substantially increasing the fire load in a roof space. Sample C is one such case where clearly the covering has been 'penetrated', i.e., there has been combustion of the roof insulation, yet the penetration criterion was satisfied.

5.3 Worsening of an existing condition: penetration

Where a certain condition exists and it is modified, the Building Regulations make provision for consideration of whether there is a worsening or non-worsening of that condition. The minimum expectation is often that an existing condition is made no worse by any building work.

It is difficult to argue that the introduction of fire load (in the form of the roof insulation) that would not typically be present is not a worsening of an existing condition. The introduction of that fire load assures the proximity of combustible products to the roof covering which, if sufficiently heated, can smoulder and/or ignite. In contrast, if the insulation were not present, the fire load in proximity to the roof covering is likely to be relatively low, unless an occupant chooses to place materials nearby in the roof space.

Despite increasing the likelihood of penetration by assuring the presence of a fire load, the ad-hoc results presented in this report indicated that retrospectively spray insulated roofs with traditional coverings, such as slate or clay, are still capable of attaining the highest levels of classification.

5.4 Worsening of an existing condition: breach of compartmentation

The focus of Regulation B4(2) is on the vulnerability of roofs to penetration due to fire spread across a boundary and their ability to support fire spread over their surface. In both instances, exposure from outside-to-in is the relevant condition. However, should a fire originate in a dwelling and, thus, expose the insulation from the inside of the dwelling, this has the potential to result in a more severe internal enclosure fire. This increase in severity could be sufficient to breach internal compartmentation, allowing internal fire spread to occur where it may not have otherwise and, thus, has implications for Regulation B3(3). Currently, there is no specific guidance in ADB that places limitations on the reaction-to-fire classification of linings in a roof space. Therefore, it is foreseeable that exposed insulation could be present. This worsening of an existing condition should be considered from the perspective of:

(i) what additional fire load would be present,

(ii) how this might align with other fire loads in roof spaces (and their associated variability) and

(iii) the subsequent implications for the fire resistance required of elements of compartmentation that may separate such an insulated space from another. This is not within the scope of this study but is noted as an element of potential further work.

6 CONCLUSIONS

Retrospectively applied spray foam insulation is marketed as a means to simply upgrade the thermal performance of dwellings. The open or closed cell foam solutions are often applied by suppliers under the instruction of housing owners without specific consideration for the implications of Building Regulations compliance.

If the application of spray foam insulation were considered building work, from a fire safety perspective, the implications could affect compliance with Regulations B3(3) and B4(2). In the case of the former, it is noted that the extra fuel associated with the insulation could bring about a more severe enclosure fire if ignited. This could affect the fire separating ability of compartmentation elements and, thus, could represent a worsening of an existing condition. A further detailed study in such regard would be warranted but was not the focus of this study. This issue has been highlighted to the BSR as an area for additional work, who consider that this would be best taken forward at a future date as part of a broader piece of work.

In terms of compliance with B4(2), it is again clear that the introduction of a semi-permanent fire load increases the likelihood of fire spread across a boundary if the roof covering is penetrated and, thus, is a worsening of an existing condition. However, ad-hoc classification testing presented herein identifies that even traditional roof coverings that exhibit a poor performance, such as very old slate and clay tiles, can achieve the highest levels of roof classification when considering penetration performance. This is despite the inclusion of combustible sprayed insulation. This means such sprayed configurations can satisfy the highest demands for roof covering classification as currently included in ADB guidance.

No guidance currently exists in ADB that controls the reaction-to-fire classification of bounding surfaces in a roof space. Developing such guidance could be a means by which insulation could be encapsulated behind fire protective linings, as exposed insulation is likely to achieve poor fire growth rate indices and total heat release rates. In some product literature, e.g., British Board of Agrement (BBA) certificates, recommendations are made to enclose the insulation behind a plasterboard lining.

Finally, it is highlighted that the test 4 method in BS EN 13501-5 potentially presents challenges in terms of mitigating fire spread across a boundary or over compartment walls. This is because:

(a) The provisions in ADB focus on the “roof covering”, yet the test method applies to a broader system. It is therefore unclear how provisions for isolated roof coverings are meant to be addressed without recourse to EC Committee Decisions. Also, if systems achieving the classifications recommended in ADB can be used in locations where guidance for coverings is provided.

(b) The test provides no quantitative measure of penetration. By focussing on if flaming or glowing is visible on the underside of the sample, high classifications can be achieved through the inclusion of multi-layered roof systems that can include large amounts of combustible insulation. For example, Sample C would suggest that fire spread occurred (there was ignition of the insulation below the tile), yet penetration was not visible.

The contractor is therefore of a view that further research is warranted to consider: (a) the relationship between ADB provisions for "roof coverings" and tested systems; and (b) if refinement of the test 4 method is necessary to include quantitative indicators of penetration, particularly where thick layers of charring insulation may be used.

7 References

[1] HM Government, 'The Building Regulations 2010, Approved Document B (Fire Safety) Volume 1: Dwellings (2019 edition incorporating 2020 and 2022 amendments)', Dec. 2022.

[2] BSI, 'PD 476-3:2012 Classification rules for the end-use application of test results arising from BS 476-3, "Classification and method of test for external fire exposure of roofs"', BSI, London, 2012.

[3] BSI, 'DD CEN/TS 1187:2012 Test methods for external fire exposure to roofs', BSI, London, 2012.

[4] BSI, 'BS EN 13501-5:2005+A1:2009 Fire classification of construction products and building elements. Classification using data from external fire exposure to roofs tests', BSI, London, 2006.

[5] THE COMMISSION OF THE EUROPEAN COMMUNITIE, 'COMMISSION DECISION of 6 September 2000 implementing Council Directive 89/106/EEC as regards the external fire performance of roof coverings', EC, Brussels, Official Journal of the European Communities (2000/553/EC).

[6] D. Drysdale, *An Introduction to Fire Dynamics*, Third Edition. John Wiley & Sons, Ltd, 2011. doi: 10.1002/9781119975465.ch1.

[7] R. Hadden, A. Alkatib, G. Rein, and J. L. Torero, 'Radiant ignition of polyurethane foam: The effect of sample size', *Fire Technology*, vol. 50, pp. 673–691, 2014, doi: 10.1007/s10694-012-0257-x.

APPENDIX – BRE TEST REPORTS

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12 July 2023
Your Ref. P124214-1001
Our Ref. P124214-1001

Dear Mr Johnson

INDICATIVE TEST RESULTS – CEN/TS EN 1187 Test 4 (Penetration test only)

We are writing to report the results of the exploratory roof tests carried out on your samples as supplied on 18 May 2023 and tested on 08 June 2023.

The test results relate to an investigation which utilised the penetration test methodology given in CEN/TS EN 1187-4:2012; the full requirements of the standard were not however complied with. The information is provided for the test sponsor's information only and should not be used to demonstrate performance against the standard nor compliance with a regulatory requirement. The test was not necessarily conducted under the requirements of UKAS accreditation.

The test samples were supplied by the test sponsor. BRE Global (RTF) were not involved in the sample selection process and therefore cannot comment upon the relationship between samples supplied for test and the product supplied to market.

The samples were identified by the test sponsor as:

- Plain clay double lap tile ("very old") with sprayed foam insulation (BRE sample ref E14890)
- Plain clay double lap tile ("old") with sprayed foam insulation (BRE sample ref E14891)

Further details of the specimens tested are held on file by the test sponsor.

The specimens were not checked for conditioning prior to the test and were tested in the sloping position.

Description of the test specimens by BRE Global:

E14890
Red clay roofing tiles, 2 layers deep
Over grey fabric membrane
Over sprayed on off-white rigid foam
Encased in a timber frame.

E14891
Red clay roofing tiles, 2 layers deep
Over sprayed on off-white rigid foam
Encased in a timber frame.

12 July 2023
Your Ref. P124214-1001
Our Ref. P124214-1001

The following results were achieved:

Penetration test

Sample	Penetration time (min:s)	Observations
E14890 Plain clay double lap tile ("very old")	No penetration in 60 minutes	Did not ignite
E14891 Plain clay double lap tile ("old")	No penetration in 60 minutes	Did not ignite

This letter may only be distributed in its entirety and in accordance with the terms and conditions of the contract. Test results relate only to the items tested. BRE Global have no responsibility for the design, materials, workmanship or performance of the product or items tested. This report does not constitute an approval, certification or endorsement of the product tested.

This letter is written on behalf of BRE Global. By receiving the letter and action on it, the client accepts that no individual is personally liable in contract, tort or breach of statutory duty (including negligence). No third party has any right to rely on this report.

If you have any queries, please do not hesitate to contact us.

Yours sincerely

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Report ends

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02 January 2024
Your Ref. P124214-1006
Our Ref. P124214-1006

Dear Mr Johnson

INDICATIVE TEST RESULTS – CEN/TS EN 1187 Test 4 (Penetration test only)

We are writing to report the results of the exploratory roof tests carried out on your samples as supplied on 19 September 2023 and tested on 29 November 2023.

The test results relate to an investigation which utilised the penetration test methodology given in CEN/TS EN 1187-4:2012; the full requirements of the standard were not however complied with. The information is provided for the test sponsor's information only and should not be used to demonstrate performance against the standard nor compliance with a regulatory requirement. The test was not necessarily conducted under the requirements of UKAS accreditation.

The test samples were supplied by the test sponsor. BRE Global (RTF) were not involved in the sample selection process and therefore cannot comment upon the relationship between samples supplied for test and the product supplied to market.

The specimens were not checked for conditioning prior to the test and were tested in the sloping position.

Description of the test specimens by BRE Global:

E15028
Old, double-lapped slate. No membrane.
The slates were 460 mm x 237 mm and these averaged 5.5 mm thick and had a density of 13.6 kg/m2
The sample, was built in the conditioning room on 20th September 2023 minus foam. On 3rd October 2023 the sample was removed from conditioning, for two hours, for spraying. It was returned to the conditioning room where it stayed for a further two months.

The slates were nailed to 38 mm x 25 mm timber battens on 94 mm x 46 mm timber rafters.

02 January 2024
Your Ref. P124214-1006
Our Ref. P124214-1006

The following results were achieved:

Penetration test

Sample	Penetration time (min:s)	Observations
E15028 Old, double-lapped Slate tiles	No penetration in 60 minutes	Did not ignite

This letter may only be distributed in its entirety and in accordance with the terms and conditions of the contract. Test results relate only to the items tested. BRE Global have no responsibility for the design, materials, workmanship or performance of the product or items tested. This report does not constitute an approval, certification or endorsement of the product tested.

This letter is written on behalf of BRE Global. By receiving the letter and action on it, the client accepts that no individual is personally liable in contract, tort or breach of statutory duty (including negligence). No third party has any right to rely on this report.

If you have any queries, please do not hesitate to contact us.

Yours sincerely

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For and on behalf of BRE Global

Report ends