SPRA
Single Ply Roofing Association

SPRA TECHNICAL GUIDANCE S19/24

FIRE CLASSIFICATION OF CONSTRUCTION PRODUCTS AND BUILDING ELEMENTS

INTRODUCTION

The guidance provided by Approved Documents, Technical Booklets and Technical Handbooks refers to performance classifications detailed in British and European standards. For a construction product or system to be compliant with the relevant Building Regulations, it is necessary to demonstrate that it can meet the minimum required performance classification. Typically, for construction products used in single ply roofing systems – and flat roofing systems generally – this is achieved by testing in accordance with the relevant test methods and classification in accordance with the relevant classification systems for Reaction to Fire and External Fire Exposure.

REACTION TO FIRE

EN 13501-1 *Fire classification of construction products and building elements. Part 1: Classification using data from reaction to fire tests* defines Reaction to Fire as *'the response of a product in contributing by its own decomposition to a fire to which it is exposed, under specified conditions.'* Construction products, excluding floorings and linear pipe thermal insulation products, are classified A1, A2, B, C, D, E or F (with class A1 being the highest performance level and class F being the lowest) in accordance with EN 13501-1. Untested products cannot be classified in accordance with EN 13501-1.

- **A1 and A2-s1, d0** Formerly referred to as *non-combustible*
- **A2 (excluding A2-s1, d0)** Formerly referred to as *of limited combustibility*
- **B, C, D, E and F** Increasing contributions to fire from B to F

Reaction to Fire classifications apply to individual construction products and do not apply to systems.

Smoke Production

Products classified A2, B, C, D obtain an additional classification of s1, s2 or s3 regarding smoke production, with s1 indicating the lowest production. Smoke Growth Rate (SMOGRA) is the rate at which smoke production increases during the full 20-minute exposure period. Total Smoke Production (TSP) is the total smoke produced during the evaluation period.

- **s1** SMOGRA ≤30m²/s² and TSP ≤50m² within the evaluation period
- **s2** SMOGRA ≤180m²/s² and TSP ≤200m² within the evaluation period
- **s3** Product does not comply with either of the above

Flaming Droplets and/or Particles

Products classified A2, B, C, D obtain an additional classification of d0, d1 or d2 regarding the production of flaming droplets and/or particles as follows, with d0 indicating the lowest production:

- **d0** if no flaming droplets/particles occur within the evaluation period
- **d1** if no flaming droplets/particles, persisting longer than ten seconds, occur within the evaluation period
- **d2** if no performance is declared, or if the product does not comply with the d0 and d1 classification criteria above, or ignites the paper in the ignitibility test, EN ISO 11925-2[1]

For products classified E, if ignition of the filter paper occurs in EN ISO 11925-2, a d2 classification is given for flaming droplets and particles. If no ignition of the filter paper occurs, class E is obtained and no indication is given for d. The d classification is not applicable for class F.

When a classification includes s3, d2 this means that there is no limit set for smoke production, flaming droplets and/or particles. Such additional classifications do not apply to A1 Reaction to Fire classifications.

EXTERNAL FIRE EXPOSURE TO ROOFS

Performance of the resistance of roofs to external fire exposure is measured in terms of penetration through the roof construction and the spread of flame over its surface. Roof constructions are classified in accordance with EN 13501-5 *Fire classification of construction products and building elements. Part 5: Classification using data from external fire exposure to roofs tests.* EN 13501-5 refers to four separate roof tests as detailed in DD CEN/TS 1187 *Test methods for external fire exposure to roofs,* with Test 4 (t4) applicable in the United Kingdom and Ireland. Roof constructions are classified as B_{ROOF} (t4), C_{ROOF} (t4), D_{ROOF} (t4), E_{ROOF} (t4) or F_{ROOF} (t4). The highest performance is indicated by B_{ROOF} (t4) and the lowest by F_{ROOF} (t4).

Note that there are roof covering products/materials that may constitute the top layer of a flat roofing system that 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. These are listed in European Commission Decision 2000/553/EC, as regards the external fire performance of roof coverings.

Best practice guidance for green roofs can be found in *Fire Performance of Green Roofs and Walls,* published by the Department for Communities and Local Government, and *The GRO Green Roof Code,* published by the Green Roof Organisation.

External Fire Exposure classifications apply to systems (excluding details, e.g. abutments and penetrations) and do not apply to individual construction products.

Irrespective of the Reaction to Fire performance of its components, a flat roofing system can potentially achieve a B_{ROOF} (t4) External Fire Exposure classification.

APPROVED DOCUMENT B: FIRE SAFETY

The Approved Documents set out what, in ordinary circumstances, may be accepted as one way to comply with the Building Regulations 2010 (as amended – for England). Most building work (as defined by Regulation 3) being carried out in England must comply with the Building Regulations 2010. Approved Document B (AD B) relates to fire safety and is published in two volumes. Volume 1 deals solely with dwellings, including blocks of flats, while Volume 2 deals with all other types of building covered by the Building Regulations.

There may be some products lawfully on the market using national classifications for Reaction to Fire (in accordance with BS 476-11[2], BS 476-7[3] and/or BS 476-6[4]). Where this is the case, Table B1 of AD B, Volumes 1 and 2, outlines how classifications in accordance with EN 13501-1 may be transposed to national classifications.

Equally, there may be some products lawfully on the market using national classifications for the performance of the resistance of roofs to external fire exposure (in accordance with BS 476-3 *Fire tests on building materials*

[1] EN ISO 11925-2 Reaction to fire tests. Ignitability of products subjected to direct impingement of flame. Single-flame source test

[2] BS 476-6 Fire tests on building materials and structures. Part 6: Method of test for fire propagation for products

[3] BS 476-7 Fire tests on building materials and structures. Part 7: Method of test to determine the classification of the surface spread of flame of products

[4] BS 476-11 Fire tests on building materials and structures. Part 11: Method for assessing the heat emission from building materials

and structures. Classification and method of test for external fire exposure to roofs). Where this is the case, Table B2 of AD B, Volumes 1 and 2, outlines how classifications in accordance with EN 13501-5 may be transposed to national classifications.

The national classifications for Reaction to Fire and the performance of the resistance of roofs to external fire exposure do not automatically equate with the transposed European classifications, however, therefore products cannot typically assume a European class unless they have been tested accordingly.

Note that the devolved nations of the United Kingdom (Northern Ireland, Scotland and Wales) can have different requirements. Refer to Technical Handbook E (Northern Ireland), Building Standards Technical Handbooks Section 2 (Scotland) and Approved Document B (Wales) for further guidance.

Requirement B1

Requirement B1 gives practical guidance about escape routes over balconies and flat roofs. Where a flat roof forms part of a means of escape, it should comply with all of the following:

- It should be part of the same building from which escape is being made;
- The route across the roof should lead to a storey exit or external escape route;
- The part of the roof (including its supporting structure) forming the escape route, and any opening within 3m of the escape route, should be of fire resisting construction (minimum REI 30 – measured from the inside and typically achieved by the ceiling finish, flat roof deck, or a combination of the two); and
- The route should be clearly defined and guarded by walls and/or protective barriers to protect against falling.

BS 8579 *Guide to the design of balconies* and terraces notes that, *'a terrace (being an occupied roof) performs the function of a floor, therefore a terrace or access terrace as part of a building with an occupied floor over 11m above the lowest ground level build-up within 3m of an extensive vertical facade above may be limited to classification B_{ROOF} (t4) in accordance with EN 13501-5.'*

Requirement B3

Requirement B3 gives practical guidance about the junction of a compartment wall with a roof. *'A compartment wall [that does not extend through a roof] should meet the underside of the roof covering or deck, with fire-stopping to maintain the continuity of fire resistance,'* and, *'be continued across any eaves.'*

'To reduce the risk of fire spreading over the roof from one compartment to another, a 1,500mm wide zone of the roof, either side of the wall, should have a covering classified as B_{ROOF} (t4) on a substrate or deck of a material rated class A2-s3, d2 or better. Roof covering and deck could be composite structure, e.g. profiled steel cladding.'

'Materials achieving class B-s3, d2 or worse used as a substrate to the roof covering... may extend over the compartment wall in buildings that are... a maximum of 15m high,' and, *'in one of the following purpose groups: [Residential (dwellings)] (purpose group 1); [Residential (other) (purpose group 2(b)]; Office (purpose group 3); [and] Assembly and Recreation (purpose group 5). Thermoplastic insulation materials should not be carried over the wall.'*

- **[Roof] covering** refers to a complete flat roofing system and not just the waterproof covering, as it is required to have a B_{ROOF} (t4) classification. Such a classification could not apply solely to the waterproof covering;
- Where they apply to flat roofing, both **deck** and **substrate** refer only to a structural flat roof deck and no other component of a flat roofing system, such as thermal insulation (in AD B, the word *substrate* was intended to refer to roofs without a deck, such as pitched roofs);
- A roof covering classified as B_{ROOF} (t4) on a structural flat roof deck of a material rated class A2-s3, d2 or better may extend over any compartment wall on any building regardless of height and purpose group. Insulation materials may be thermoplastic (expanded polystyrene (EPS) or extruded polystyrene (XPS)) or thermoset plastic (polyisocyanurate (PIR));
- A roof covering classified as C_{ROOF} (t4) or worse may not be installed in the 1,500mm wide zone of a roof either side of a compartment wall;
- Materials achieving class B-s3, d2 or worse used as a structural flat roof deck may not be installed in the 1,500mm wide zone of a roof either side of a compartment wall in buildings that are taller than 15m; or extend over any compartment wall in Residential (institutional), Shop and Commercial, Industrial, or Storage and Other Non-Residential buildings regardless of height;
- Where a material achieving class B-s3, d2 or worse is used as a structural flat roof deck, EPS and XPS insulation materials should not be carried over a compartment wall.

Except for a structural flat roof deck, Requirement B3 makes no provision for the minimum Reaction to Fire classification of any other flat roofing system component that extends over a compartment wall.

ROOFLIGHTS

Requirements B1, B2, B3 and B4 each give practical guidance about rooflights.

Requirement B1

Where a flat roof forms part of a means of escape, the part of the roof (including its supporting structure) forming the escape route, and any opening within 3m of the escape route, should be of fire resisting construction (minimum REI 30).

Requirement B2

Non-plastic rooflights should meet the relevant classifications in AD B, Volume 1, Table 4.1/AD B, Volume 2, Table 6.1.

Plastic rooflights should be a minimum class D-s3, d2 rating. Otherwise they should meet the relevant classifications for non-plastic rooflights.

In rooms and circulation spaces other than protected stairways, rooflights may be constructed of thermoplastic material if the lower surface is classified as TP(a) rigid or TP(b) and the size and location of the rooflights follow the limits in AD B, Volume 1, Table 4.2/AD B, Volume 2, Table 6.2.

Requirement B3

To reduce the risk of fire spreading over the roof from one compartment to another, a 1,500mm wide zone of the roof, either side of the wall, should have a covering classified as B_{ROOF} (t4) [EN 13501-5] on a substrate or deck of a material rated class A2-s3, d2 [EN 13501-1] or better. Thermoplastic roof lights that... are regarded as having a B_{ROOF} (t4) classification are not suitable for use in that zone.

Requirement B4

Polycarbonate or uPVC rooflights achieving a minimum Reaction to Fire classification C-s3, d2 can be regarded as having a B_{ROOF} (t4) classification, though they are not suitable for use in the 1,500mm wide zone of a roof either side of a compartment wall.

When used in rooflights, unwired glass a minimum of 4mm thick can be regarded as having a B_{ROOF} (t4) classification.

AD B, Volume 1, Table 12.2 and Diagram 12.1/ AD B, Volume 2, Table 14.2 and Diagram 14.1 set the limitations for using plastic rooflights whose lower surface has a minimum class D-s3, d2 rating.

AD B, Volume 1, Table 12.3/AD B, Volume 2, Table 14.3 set the limitations for using thermoplastic materials with a TP(a) rigid or TP(b) classification. For the method of classifying thermoplastic materials, refer to AD B, Volumes 1 and 2, Appendix B13.

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Requirement B4

Requirement B4 gives practical guidance about balconies; external walls; and separation distances from the relevant boundary[5]. (For the purposes of this document, the provisions of Regulation 7(2) will be discussed separately. Note that where Regulation 7(2) applies, that Regulation prevails over all the provisions of Requirement B4.)

In buildings that include a residential purpose (purpose groups 1 and 2) with a storey 11m or more in height, balconies should only contain materials achieving class A1 or A2-s1, d0. This does not apply to membranes. Refer to AD B, Volume 1, Section 10.10a/AD B, Volume 2, Section 12.11a.

Purpose groups 1 and 2 include flats; dwellinghouses; hospitals, homes, schools, or other similar establishments where people sleep on the premises; hotels, boarding houses, residential colleges, halls of residence, hostels, or any other residential purpose not described above. Refer to AD B, Volumes 1 and 2, Table 0.1.

AD B, Volume 1, Table 10.1/AD B Volume 2, Table 12.1 list the minimum Reaction to Fire classifications of the external surfaces of external walls. The outermost external material of a wall less than 1,000mm from the relevant boundary should achieve at least class B-s3, d2 or better, depending upon building type and/or height. The outermost external material of a wall 1,000mm or more from the relevant boundary should achieve at least class C-s3, d2 or better – again depending upon building type and/or height – with few exceptions where there are no provisions. Moreover, AD B, Volume 1, Section 10.21a/AD B, Volume 2, Section 12.22a state that membranes used as part of the external wall construction above ground level should achieve a minimum of class B-s3, d0.

At the time of writing, a typical flat roof waterproof covering available on the UK market achieves class E or F. To be compliant with BS 6229 *Flat roofs with continuously supported flexible waterproof coverings. Code of practice*, however, at all abutments the waterproof layer should be turned up to a level not less than 150mm above the adjacent finished roof system (or top horizontal floor layer of a balcony). This includes abutments to external walls. Practically, the provision of BS 6229 should take precedence over the provision of Requirement B4 to avoid issues – and subsequent insurance claims – caused by water ingress.

At abutments to external walls that adjoin a space within a building to which persons have access only for the purpose of carrying out repairs or maintenance – e.g. lift and stair overruns and parapet walls – it is acceptable for the waterproof layer to become part of the external wall where its height above the adjacent finished roof system does not exceed the guarding height of 1,100mm.

Where the minimum distance from a roof, or part of a roof, to the relevant boundary is less than 6m, the roof covering, or part of the roof covering, should be classified as B_{ROOF} (t4). *Roof covering* refers to a complete flat roofing system and not just the waterproof covering, as it is required to have a B_{ROOF} (t4) classification. Such an External Fire Exposure classification could not apply solely to the waterproof covering.

A roof, or part of a roof, with a covering classified as C_{ROOF} (t4), D_{ROOF} (t4), or E_{ROOF} (t4) should be at least 6m from any point on the relevant boundary, though caveats apply depending upon building use, cubic capacity and/or roof area. A roof, or part of a roof, with a covering classified as F_{ROOF} (t4) should be at least 20m from any point on the relevant boundary. Again, caveats apply depending upon building use, cubic capacity and/or roof area. Refer to AD B, Volume 1, Table 12.1/AD B, Volume 2, Table 14.1.

Best practice guidance for green roofs can be found in *Fire Performance of Green Roofs and Walls*, published by the Department for Communities and Local Government, and *The GRO Green Roof Code*, published by the Green Roof Organisation.

Note that a local building control body and its officers may interpret Requirements B3 and B4 differently. It is advisable to clarify their requirements prior to works starting on site – ideally when applying for building regulations approval and especially for refurbishment.

Regulation 7(2)

Regulation 7 relates to materials and workmanship. Regulation 7(2) states that building work shall be carried out so that materials which become part of an external wall, or Specified Attachment, of a Relevant Building are of European Classification A2-s1, d0 or A1, classified in accordance with BS EN 13501-1. This does not apply, however, to any part of a roof... if that part is connected to an external wall; membranes; or thermal break materials. Refer to Regulation 7(3).

Except for Requirement B2 (rooflights); Requirement B3 (materials used as a deck or substrate to a roof covering that extend over a compartment wall); Requirement B4 (balconies and external walls); and Regulation 7(2) (materials which become part of an external wall, or Specified Attachment, of a Relevant Building), AD B makes no other provisions for the Reaction to Fire classifications of flat roofing system components.

The definition of a Specified Attachment includes a balcony attached to an external wall; a device for reducing heat gain within a building by deflecting sunlight which is attached to an external wall; or a solar panel attached to an external wall.

A Relevant Building is defined as a building with a storey (not including roof-top plant areas or any storey consisting exclusively of plant rooms) at least 18 metres above ground level and which contains one or more dwellings; contains an institution; or contains a room for residential purposes

AD B does not define the terms 'balcony' or 'terrace,' so the flat roofing industry and other relevant bodies agree that the definitions in BS 8579 should apply:

- **Balcony** Accessible external amenity platform above ground level exterior to and with direct access from a building. A balcony is formed above an external space that is not a habitable room. *For the purposes of fire, a balcony is not a roof.*
- **Terrace** External accessible surface above an internal space above ground level exterior to and with direct access from a building to occupants for purposes other than exclusively maintenance. *A terrace is a roof for the purposes of fire and waterproofing. Additionally, for fire purposes, a terrace can also perform the function of a floor.*

Balconies and External Walls

In compliance with the provisions of Requirement B4 and Regulation 7(2), a flat roof waterproof covering can become part of a balcony (including those defined as a Specified Attachment) attached to a residential building or a Relevant Building, as AD B, Volume 1, Section 10.10a/AD B, Volume 2, Section 12.11a and Regulation 7(2) do not apply to membranes.

A terrace is a roof for the purposes of fire and waterproofing, therefore a (roof) terrace can connect to an external wall of a Relevant Building, as Regulation 7(2) does not apply to any part of a roof.

The waterproof layer can become part of an external wall to a level not less than 150mm above the top horizontal floor layer of a balcony (including those defined as a Specified Attachment) or adjacent finished roof system in accordance with BS 6229. Refer to this document's guidance about Requirement B4, above.

Combustible thermal break materials should not span two compartments and should be limited in size to the minimum required to restrict thermal bridging – typically no thicker than 60mm and terminated 300mm above finished structual flat roof deck level. Beyond these dimensions, thermal breaks are recommended to be non-combustible.

Further technical guidance is available to view and download at **www.spra.co.uk**.

[5] **Relevant boundary** The boundary or notional boundary that one side of the building faces and/or coincides with, and that is parallel or at an angle of a maximum of 80 degrees to that side of the building.

SINGLE PLY ROOFING ASSOCIATION
Unit 26 Coney Green Business Centre, Wingfield View, Clay Cross, Derbyshire, S45 9JW
technical@spra.co.uk www.spra.co.uk
@singleplyroofing
The Single Ply Roofing Association (SPRA)
@singleply