LABSS INFORMATION PAPER INFOP32 - 2021 Version 3 – 22 February 2022

Building (Scotland) Regulations 2004
Sections 2 Fire, Section 3 Environment, Section 6 Energy

What type of cavity barriers are required and where should they be installed?

QUESTION: Can open state (intumescent) cavity barriers be used in any and every location as prescribed in guidance to the Mandatory Standards under Section 2 Fire?

BACKGROUND:

SECTION 2 FIRE:
This question impacts on Section 2 Fire in terms of Mandatory Standards 2.1 Junctions in compartment walls/floors, 2.2 Junctions in separating walls/floors, 2.4 Cavity protection in external wall, floor and wall elements, 2.6 Fire spread to neighbouring properties, 2.7 External wall cladding and 2.9 Escape.

SECTION 3 ENVIRONMENT:
Any consideration of where and what type of cavity barriers should be installed must also take due cognisance of the guidance contained in Section 3 Environment when considering Mandatory Standards 3.10 Precipitation and to an extent 3.15 Condensation risk.

SECTION 6 ENERGY:
Any consideration of where and what type of cavity barriers should be installed must also take due cognisance of the guidance contained in Section 6 Energy when considering the likelihood of cold bridging through and element. Non-repeating thermal bridging at the junctions of building elements and around openings in the building envelope form part of the calculation of energy performance.

PERFORMANCE OF BARRIER:
The design of cavity barriers must always be mindful of the need for the more onerous guidance in respect of fire-stopping when considering junctions between compartment and separating wall, floor and roof elements where the fire resistance needs are such that the barrier resistance must equal that of the wall, floor or roof element. LABSS have already considered this and advice has been circulated to all verifiers.

Section 2 Fire prescribes a need to restrict the spread of smoke and fire. There has been a recognition in more recent times that the spread of cold smoke is not such an issue and indeed guidance under Clause 2.4.1 Cavity barriers to both the Domestic and Non-Domestic Technical Handbooks emphasises this when referring to the use of open state cavity barriers. It is clear that the use of open state barriers in external walls wherever there is a prescribed need under Standards 2.1, 2.2. 2.4, 2.6, 2.7 or 2.9 is now a recognised method of meeting these Mandatory Standards.

In every case there is a need for whatever barrier is used to meet certain fire related performance levels.

- For cavity barriers installed under Mandatory Standard 2.4 Cavity barriers where they are NOT in association with a compartment or separating element as defined by Standards 2.1, 2.2 or in association with the protection of an escape route as defined in Standard 2.9 then the barrier must provide a protection level of **30 mins for integrity only** from the underside for horizontal barriers and from both sides for vertical barriers.

- For fire barriers installed under Mandatory Standards 2.1 Junctions in compartment walls/floors, 2.2 Junctions in separating walls/floors, 2.6 Fire spread to neighbouring properties, 2.7 External wall cladding and 2.9 Escape the barrier must provide a protection level as follows:
  - Compartment floor, separating floor or a floor, flat roof or access deck protecting routes of escape (see clause 2.0.6)
    - **Short** duration – **30 mins for load-bearing capacity, integrity, and insulation** – from the underside
    - **Medium** duration – **60 mins for load-bearing capacity, integrity, and insulation** – from the underside
    - **Long** duration – **120 mins for load-bearing capacity, integrity, and insulation** – from the underside

In essence, Section 3 Environment requires that due diligence is given to the risk of damage to the structure when installing external wall cladding from water penetration either from precipitation or from condensation and in general at least one of the primary protections against this happening is to provide an unrestricted cavity between the cladding and the main structure, to allow a free flow of air usually from bottom to top to ventilate this cavity. Care should be taken to ensure that horizontal barriers do not block cavity ventilation. The use of open state (intumescent) cavity barriers allows this design and installation aim to be met.

However, what is less clear is the use of open state barriers in other locations, such as roof elements and specifically at the junction between the wall and roof elements. There is clearly a need to provide a cavity barrier between the external wall cavity and the roof cavity. On balance, there is nothing to stop the use of open state (intumescent) barriers in such locations provided the roof ventilation needs for the roof cavity and the through ventilation needs of any external wall cavity are met and that the performance levels to provide the fire resistance needs are confirmed.

FIRE BARRIERS

A distinction is drawn between the protection afforded by a cavity barrier as opposed to a fire barrier when considering junctions between both compartment elements and separation elements of structure.

Guidance Clauses 2.1.15 & 2.2.7 Junctions

2.1.15 Where a compartment wall or floor or protected route of escape abuts a structure containing a cavity, a fire barrier should be installed so as to extend the line, and maintain the fire resistance, of the wall or floor.

2.2.7 Where a separating wall or floor abuts a structure containing a cavity, a fire barrier should be installed in the cavity so as to extend the line, and maintain the fire resistance, of the wall or floor.

NOTE: In this case the need for a cavity barrier under clause 2.4.2 must be read with this related requirement when dealing with a compartment wall or floor (or a separating wall or floor) junction. In such cases the open state cavity barrier could be suitable also for use as a cavity barrier AND a fire barrier meeting the more onerous requirements for fire resistance for load-bearing capacity, integrity and insulation. However, suitable test data MUST BE made available to confirm the more onerous criteria for a fire barrier can be met viz:

- **Short** duration – **30 mins for load-bearing capacity, integrity and insulation** – from the underside
- **Medium** duration – **60 mins for load-bearing capacity, integrity and insulation** – from the underside
- **Long** duration – **120 mins for load-bearing capacity, integrity and insulation** – from the underside

DECISION:

1. It is crucial to the understanding of containment that the relationship between "cavity barriers, fire barriers and fire stops" are understood and correctly installed to take account of:
    - junctions with elements within the cavity such as corners, window/door openings etc, (Clause 2.4.1),
    - area constraints in cavity sizes, (subject to exceptions and Standard 2.7) (Clause 2.4.2),
    - the nature of materials exposed within the cavity and within the external wall cladding system (combustibility, limited combustibility or non-combustible) (Standards 2.4 and 2.7) (BRE135 Report); and
    - junction protection at compartment/separating walls and compartment/separating floors, (Clause 2.1.15 ND; Clauses 2.2.7 ND and 2.2.10 D),
    - the storey height of the building (we need to note the different references to building height and storey height, i.e., ND2.7.1 refers to building height whereas 2.7.2 refers to storey height. Not sure if these differences are intentional but they would be different when considering the rules of measurement.

2. Every cavity barrier attracts a fire resistance performance and confirmation of such performance levels must be confirmed when specifying open state (intumescent) barriers.

3. Provided the performance levels can be confirmed then the current guidance within the Mandatory Standards would allow the installation of open state cavity barriers **in any location within the external wall element** provided they are designed to be suitable for their location, including at the junction between the external wall cavity and the roof cavity, and which meet the performance levels on fire resistance. This recognises the references in *"Clause 2.4.1 In an external wall, open state intumescent cavity barriers may be used to inhibit fire and smoke spread and seal the cavity. It is recognised that smoke will spread beyond the cavity barrier at the incipient and early fire growth phases prior to the intumescent material reacting to heat but this is not considered to be a major concern as the cavity is ventilated to atmosphere".*

4. Any consideration of where and what type of cavity barriers should be installed must also take due cognisance of the guidance contained in Section 3 Environment when considering Mandatory Standards 3.10 Precipitation and to an extent 3.15 Condensation risk, and in Section 6.2.3 Limiting heat loss through thermal bridging. In particular, the cavity barriers installed between the roof cavity and the external wall cavity must ensure that the ventilation needs for both are not compromised. This recognises the statements in *"Clause 2.4.1 Sealing cavities can sometimes create difficulties, especially where construction techniques rely on through ventilation of the cavity (see Section 3 Environment) or where the detailing should take into account the effect of thermal bridging (see Section 6 Energy).*

5. Any consideration of where and what type of cavity barriers should be installed must also take due cognisance of the guidance contained in Section 6 Energy when considering the likelihood of cold bridging through and element. Non-repeating thermal bridging at the junctions of building elements and around openings in the building envelope form part of the calculation of energy performance.

See **Appendix A: References to Technical Handbook and Other References**

Appendix A: References to Technical Handbook and Other References			
What type of cavity barriers are required and where should they be installed?	**Type of barrier?**	**Interpretation**	**Annexes 2A Domestic 2D Non-Domestic**
For the purposes of this paper, a **closed state cavity barrier** is deemed to be a construction element which totally seals the cavity against cold and hot smoke and fire spread. An **open state cavity barrier** is deemed to be a proprietary construction which seals the cavity when exposed to hot smoke or fire (intumescent constructions). In both instances the cavity barrier must achieve a resistance to fire spread		**Cavity barrier** means any construction provided to seal a cavity against the penetration of fire and smoke, or to restrict its movement within the cavity. **Location:** • Around ALL openings through the cavity. • Between adjacent roof spaces. • Between an external wall cavity and a roof space cavity.	9. Horizontal cavity barrier Short duration – **30 mins for integrity only** – from the underside 10. Vertical cavity barrier Short duration – **30 mins for integrity only** – from both sides
2.4.1 Cavity barriers			
A cavity barrier means any construction provided to seal a cavity against the penetration of fire and smoke or to restrict its movement within the cavity.			
In order to inhibit fire spread in a cavity, every cavity within a building should have cavity barriers with at least a short fire resistance duration (see annex 2.A) installed around the edges of the cavity. This includes for example, around the head, jambs and sill of an external door or window opening. A cavity barrier should also be installed between a roof space and any other roof space or between a cavity and any other cavity such as at the wall-head between a wall cavity and a roof space cavity.			

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However cavity barriers are not necessary at a junction between two cavity walls each comprising two leaves of masonry or concrete at least 75mm thick.	No requirement	No requirement	No requirement
Sealing cavities can sometimes create difficulties, especially where construction techniques rely on through ventilation of the cavity (see Section 3 Environment) or where the detailing should take into account the effect of thermal bridging (see Section 6 Energy).	Open state cavity barriers (intumescent) **Or** Closed state cavity barriers constructed from flexible material such as mineral wool socks.	NOTE: It is recognised that smoke will spread beyond the cavity barrier at the incipient and early fire growth phases prior to the intumescent material reacting to heat but this is not considered to be a major concern as the cavity is ventilated to atmosphere. An open state cavity barrier could be installed within the external wall cavity at wallhead level which effectively separates the external wall cavity from the roof cavity.	
In an **external wall**, open state intumescent cavity barriers may be used to inhibit fire and smoke spread and seal the cavity. It is recognised that smoke will spread beyond the cavity barrier at the incipient and early fire growth phases prior to the intumescent material reacting to heat but this is not considered to be a major concern as the cavity is ventilated to atmosphere.	Part of the debate here is whether this allowance in the use of open state cavity barriers is restricted only to **external wall elements** and therefore is a closed state barrier required between the wall and the roof cavity		

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2.1 Compartmentation The aim of compartmentation is to inhibit rapid fire spread within the building by reducing the fuel available in the initial stages of a fire. This is achieved by dividing the building into a series of fire tight boxes termed compartments which will form a barrier to the products of combustion; smoke, heat and toxic gases.	In such cases the open state cavity barrier could be suitable also for use as a cavity barrier AND a fire barrier meeting the more onerous requirements for fire resistance for load-bearing capacity, integrity and insulation (subject to suitable test data).	NOTE: In this case the need for a cavity barrier under clause 2.4.2 must be read with this related requirement when dealing with a compartment wall or floor (or a separating wall or floor) junction.	2. Compartment floor, separating floor or a floor, flat roof or access deck protecting routes of escape (see clause 2.0.6) **Short** duration – **30 mins for load-bearing capacity, integrity and insulation** – from the underside **Medium** duration – **60 mins for load-bearing capacity, integrity and insulation** – from the underside **Long** duration – **120 mins for load-bearing capacity, integrity and insulation** – from the underside
Common guidance - the guidance in clauses 2.1.14 (Openings and service penetrations), 2.1.15 (Junctions) and 2.1.16 (Fire resisting ceilings) is common, not only to compartmentation and sub-compartmentation, but also to the relevant guidance in Standards 2.2 separation, 2.4 cavities, 2.9 escape and the relevant guidance contained in the annexes.			
2.1.15 Junctions **General** Where a compartment wall or floor or protected route of escape abuts a structure containing a cavity, a fire barrier should be installed so as to extend the line, and maintain the fire resistance, of the wall or floor.			

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2.2 Separation The intention of separation is to limit fire growth and thereby give adjoining occupiers more time to escape before they are threatened by fire or smoke.	In such cases the open state cavity barrier could be suitable also for use as a cavity barrier AND a fire barrier meeting the more onerous requirements for fire resistance for load-bearing capacity, integrity and insulation (subject to suitable test data).	NOTE: In this case the need for a cavity barrier under clause 2.4.2 must be read with this related requirement when dealing with a compartment wall or floor (or a separating wall or floor) junction.	2. Compartment floor, separating floor or a floor, flat roof or access deck protecting routes of escape (see clause 2.0.6) **Short** duration – **30 mins for load-bearing capacity, integrity and insulation** – from the underside **Medium** duration – **60 mins for load-bearing capacity, integrity and insulation** – from the underside **Long** duration – **120 mins for load-bearing capacity, integrity and insulation** – from the underside
Common guidance - The guidance in clause 2.2.9 (Openings and service penetrations) and clause 2.2.10 (Junctions) is common, not only to separation, but also to the relevant guidance in Standard 2.4 Cavities and Standard 2.9 Escape.			
2.2.7 Junctions Where a separating wall or floor abuts a structure containing a cavity, a fire barrier should be installed in the cavity so as to extend the line, and maintain the fire resistance, of the wall or floor.			

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2.1.14 Openings and service penetrations **General** Fire-stopping may be necessary to close an imperfection of fit or design tolerance between construction elements and components, service openings and ventilation ducts. Proprietary fire-stopping products including intumescent products, should be tested to demonstrate their ability to maintain the appropriate fire resistance under the conditions appropriate to their end use.		**Fire-stop** means a seal provided to close an imperfection of fit or design tolerance between elements, components or construction so as to restrict the passage of fire and smoke through that imperfection. Fire-stopping and fire-stopped should be construed accordingly.	
Clearly, there needs to be an understanding about the relationship between a cavity barrier and a fire stop. As we know, a cavity barrier requires a limited period of fire resistance - e.g. normally only 30 minutes' period for integrity. However, a fire stop needs to "maintain the fire resistance of the compartment wall or compartment floor" which, of course, could be 60 minutes or 120 minutes etc but for all three criteria for load-bearing capability, integrity and insulation. It is crucial to the understanding of containment that the relationship between "cavity barriers and fire stops" are understood and correctly installed to take account of:			

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• junction protection at compartment/separating walls and compartment/separating floors, (Clause 2.1.15 ND; Clauses 2.2.7 ND and 2.2.10 D); • junctions with elements within the cavity such as corners, window/door openings etc, (Clause 2.4.1); • area constraints in cavity sizes, (subject to exceptions and Standard 2.7) (Clause 2.4.2); • the nature of materials exposed within the cavity and within the external wall cladding system (combustibility, limited combustibility or non-combustible) (Standards 2.4 and 2.7) (BRE135 Report); and • the storey height of the building (We need to note the different references to building height and storey height, i.e. ND2.7.1 refers to building height whereas 2.7.2 refers to storey height. Not sure if these differences are intentional but they would be different when considering the rules of measurement.			
3.10.6 Ventilation of wall cavities Ventilation of external wall cavities is necessary to prevent the build-up of excessive moisture that could damage the fabric of a building. Ventilation holes can also be used to drain excess water from the cavity that has entered through the outer leaf.		A **vented cavity** means a cavity with openings to the outside air placed so as to allow some limited, but not necessarily through air movement. The openings are	

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Timber frame - interstitial condensation is one of the major problems that need to be addressed in timber framed buildings. To reduce the amount of interstitial condensation to a level that will not harm the timber frame or sheathing, a cavity of at least 50mm wide should be provided between the sheathing and the cladding. Where timber, slate or tile cladding is used, the width of the cavity should be measured between the sheathing and the inner face of the cladding, ignoring the battens and counter battens. Where the outer leaf is of timber, slate or tile clad construction, a vented cavity should be provided. A ventilated cavity should be provided for extra protection in severely exposed areas. Where necessary refer to BS 8104: 1992. Due to the air gaps inherent between the components of a timber, slate or tile clad wall, no proprietary ventilators should be necessary and a 10mm free air space should be sufficient. Cavity barriers - where the wall cavity is sub-divided into sections by the use of cavity barriers e.g. at mid-floor level in a 2 storey house, the ventilators should be provided to the top and bottom of each section of the cavity. Care should be taken with rendered walls to prevent blockage of the ventilators.		normally located at low level where they can also act as weep holes to drain water from the cavity. A **ventilated cavity** means a cavity with openings to the outside air placed so as to promote through movement of air. The openings should be located at high and low level.	

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3.15.7 Roof constructions (pitched) Ventilation is vital for preventing excessive build-up of condensation in cold, pitched roof spaces. Where the insulation is at ceiling level the roof space should be cross ventilated. Special care should be taken with ventilation where ceilings following the roof pitch. The recommendations in BS 5250: 2002 should be followed.			
Timber cladding - Drainage Any rainwater not deflected from the cladding will tend to be drawn down the wall by gravity. The volume of run-off increases with the height of the building, but the path of any run-off is not always straight down, since wind will tend to push the water sideways. While the external face of the cladding should be able to deflect most wind-driven rain, it must always be assumed that some water will penetrate through it. Detailing should enable this to drain down the cavity and out through unrestricted openings at the base. In the UK, the cavity width for drained and back-vented cladding is recommended to be at least 19mm [(1)]. This is a minimum width and, in general, the principle is that the more open the cladding joints, the wider the cavity required.	This Scottish Government publication emphasises the need for cavity ventilation when the cladding is of timber.	It specifically highlights the conflict between the need for open ventilated cavities and the need for protection against fire spread. It was written before the use of open state cavity barriers became common place.	

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A WELL DRAINED CAVITY BEHIND THE CLADDING Water penetrating through cladding joints tends to run down the back surface of the boards where it can be intercepted and drained back to the outside. The cavity is maintained through the use of spacing battens and these should be designed to enable water to drain freely - battens are generally spaced at 600mm centres to give adequate support to most types of timber cladding. Where movement-prone timber (e.g. 'green' oak) is used, however, the spacing should be reduced to 400mm to provide additional support [(3)]. Care should be taken to ensure that horizontal battens do not block cavity ventilation. This usually requires the use of separate counter battens behind the horizontal battens. The base of a drained cavity should always allow free drainage and airflow, and all openings into the cavity should be fitted with an insect mesh. A conflict in the Scottish Building Regulations between the need to maintain unrestricted cavity drainage above a window or door, and the requirement (under Section 2 of the regulations) to provide a cavity barrier around an opening. The intention behind this requirement is to restrict the spread of smoke and flame from the room of			

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fire origin into the cavity and to restrict the fire spreading between cavities. In some cases, cavity barriers above openings will be required and, where this occurs, the durability of the cladding assembly could be compromised. A possible solution to this problem is to use cavity barriers made from 50mm thick wire-reinforced mineral wool which should permit a minimum level of drainage and ventilation			