

Application of the Plumis Automist Smartscan system in two-storey, small paying guest sleeping accommodation

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1 Introduction

1.1 Document purpose

- 1.1.1 This work has been carried out by a third-party fire engineering consultancy ('the Author') and commissioned by Plumis ('the Client') with the intent to review the application and performance of the Plumis Automist Smartscan suppression systems for use in small paying guest sleeping accommodation.
- 1.1.2 This document is confidential and for the exclusive benefit of the Client in order to facilitate a dialogue with fire engineers, fire risk assessors, fire and rescue services, or authorities having jurisdiction (AHJ) when considering the use of the Plumis Automist Smartscan system. It may not be assigned to or relied upon by a third party without agreement of the Author in writing. The Author retains all copyright and other intellectual property in the document and its contents unless transferred by written agreement between the Author and the Client. This document should not be published or distributed to other parties without the permission of the Author and the Client.
- 1.1.3 The document focusses on the recommendations of guidance for the use of two-storey dwellinghouses in the context of small paying guest sleeping accommodation, reviewing whether a Plumis Automist Smartscan suppression system can be used to support designs where an open plan arrangement forms the access room for occupants escaping from bedrooms (inner rooms).
- 1.1.4 Section 2 provides a summary of relevant documents which may be used to support the design of small paying guest sleeping accommodation, with Sections 3 and 4 providing commentary on the application of this guidance and the routes available within the UK fire safety design process to consider alternative solutions and performance-based design options. Section 5 provides a brief commentary on the use of Plumis Automist Smartscan in the context of fire safety guidance expectations. Section 6 then provides a summary of recommendations for an open plan two-storey dwellinghouse arrangement.
- 1.1.5 This document is not applicable to any type of accommodation other than those described herein. Individuals referring to this document as a guide when providing any advice should ensure that they are familiar with the relevant documents referenced throughout.
- 1.1.6 This document is provided as general guidance to support the development of specific system design. The Author is therefore not professionally liable for the adequacy of any specific systems. Liability will reside with the relevant members of the design team working on each scheme where the specific system is being adopted. The relevant members of the design team will need to verify that the information presented in the document is appropriate and applicable for the building works being carried out.

1.2 Limitations

- 1.2.1 The advice provided within this document assumes a general needs occupancy for guests, consistent with mainstream housing with no special features. Greater consideration of fire safety provisions may be required in specialised housing, i.e., for occupants with a level of need requiring support or care services. Further discussion on the application of residential design guidance for paying guests can be found in Section 3.
- 1.2.2 This document considers the fire safety of occupants within single dwelling units only, without assessing the implication of wider building design. Where the exit of an individual dwelling does not

form the final exit to an external ground / access location (i.e., a place of ultimate safety), these situations will need to be covered in the fire strategy or fire risk assessment bespoke to each development, both of which are beyond the scope of this document.

- 1.2.3 The document assumes that a dwelling is occupied by a single familiar group of paying guests, such as a family or group of friends. It does not capture situations where each bedroom within a dwelling is rented individually.

2 Relevant fire safety documents

2.1 Design guidance

- 2.1.1 The primary documents used in England for the design of dwellings, including flats and dwellinghouses, are Approved Document B (ADB) vol. 1 [1] and the British Standard (BS) document BS 9991:2015 [2].
- 2.1.2 Further discussion on the application of these documents to small paying guest sleeping accommodation can be found in Section 4.

2.2 Fire risk assessment guidance

A guide to making your small paying-guest-accommodation safe from fire

- 2.2.1 The Home Office have commissioned a document entitled 'a guide to making your small-paying-guest-accommodation safe from fire' [3] (referred to hereafter as the SPGA guide for brevity). The guide is intended as an "entry level companion to Government guidance on premises in which people sleep" to support application of the Regulatory Reform (Fire Safety) Order 2005 (as amended) by the responsible person.
- 2.2.2 The guide provides practical guidance and recommendations for small premises with simple layouts designated as sleeping accommodation for short-term lets. The document covers four examples of common layouts, namely an open plan studio flat, a two-bedroom flat with a protected entrance hall, a two-storey house, and a two-storey cottage.
- 2.2.3 The guide states that it is not applicable where the design of fire safety measures in premises differ materially from those mentioned, such as open plan designs, instead referring to the fire safety risk assessment – sleeping accommodation guide [4]. In dealing with simple layouts, the guide also makes no reference to the use of suppression systems as a compensatory measure.
- 2.2.4 However, the SPGA guide acknowledges that it does not set "prescriptive standards that must be followed regardless of the actual risks identified in your fire risk assessment".

Fire safety risk assessment – sleeping accommodation guide

- 2.2.5 The fire safety risk assessment – sleeping accommodation guide provides a broad range of advice, noting that it covers all guest accommodation properties including bed and breakfasts, guest houses, individual self-catering accommodation, flats, serviced apartments, among many others. The advice in this document is somewhat limited in its specific reference to the internal arrangements of individual accommodation units, including flats and dwellings.
- 2.2.6 Within its preface, the sleeping accommodation guide states:
- "It does not set prescriptive standards but provides recommendations and guidance for use when assessing the adequacy of fire precautions in premises providing sleeping accommodation."
 - "Other fire risk assessment methods may be equally valid to comply with fire safety law."
- 2.2.7 The sleeping accommodation guide has not been referred to comprehensively herein, with greater focus instead placed on fire safety design guidance (ADB vol. 1 and BS 9991:2015) alongside the SPGA guide.

Applying the sleeping risk guide to existing holiday accommodation

- 2.2.8 The Professional Association of Self-Caterers UK (PASC) have commissioned separate guidance for the application of the sleeping accommodation guide to holiday accommodation [5].
- 2.2.9 This document acknowledges that, where the responsible person is not able to directly follow the sleeping accommodation guide (described above), then they can seek advice from a competent person and relevant authorities.
- 2.2.10 With respect to suppression systems, the PASC guidance suggests that water mist systems may be used as a compensatory measure, such as for unprotected staircases in open plan properties, and that they can be retrospectively fitted to existing buildings to address fire safety concerns.

2.3 Plumis Automist Smartsan research reports, technical documents, and publications

- 2.3.1 The following Plumis Automist Smartsan research reports, technical documents, and publications have been used to help inform the advice made within this document:
- E. Anderson and T. Kinder, 'BS 8458:2015: Annex C, method for measuring the capability of a watermist system to control a fire - room fire test for watermist systems with automatic nozzles', Warringtonfire, 514130, 2022 [6].
 - M. Spearpoint, C. Hopkin, Y. Muhammad, and W. Makant, 'Replicating the activation time of electronically controlled watermist system nozzles in B-RISK', *Fire Safety Journal*, 2022 [7].
 - C. Hopkin, M. Spearpoint, Y. Muhammad, and W. Makant, 'Estimating the suppression performance of an electronically controlled water mist system from BS 8458:2015 fire test data', *Fire*, 2022 [8].
 - C. Hopkin, M. Spearpoint, and T. Bentley, 'Plumis Automist Smartsan Hydra: Zone modelling of BS 8458 test programme', OFR Consultants, MA20196-R01, 2020 [9].
 - A. Farrelly-Waters and M. Spearpoint, 'Automist Smartsan Hydra, fault tree reliability modelling', OFR Consultants, MA20196-R01, 2022 [10].
 - J. H. Low and C. Hopkin, 'Plumis suppression system reliability research: Reliability target of the Plumis suppression system', Ashton Fire, AF2809-I02, 2022 [11].
 - J. H. Low and C. Hopkin, 'Plumis suppression system: Scope of application to BS 9991', Ashton Fire, AF2809-I02, 2022 [12].
 - C. Hopkin and J. H. Low, 'Plumis suppression system: Review of guidance recommendations for loft conversions and dwellinghouses', Ashton Fire, AF3336-I02, 2022 [13].
 - C. Hopkin and J. H. Low, 'Probabilistic modelling of open plan dwellinghouses: Plumis Automist', Ashton Fire, AF3336-I01, 2022 [14].

3 Using residential design guidance for small paying guest accommodation

- 3.1 ADB vols. 1 [1] and 2 [15], BS 9991:2015 [2], and BS 9999:2017 [16] do not provide specific reference of the design of small paying guest sleeping accommodation, such as short-term and long-term homestays in individual flats and houses.
- 3.2 ADB vol. 2 provides guidance for 'Residential (other)' accommodation, which is inclusive of hotels, boarding houses, residential colleges, halls of residence, hostels, or "any other residential purpose" not described elsewhere. However, ADB vol. 2 contains no guidance within it on the internal design of individual accommodation units. In these situations, reference is typically made to the guidance of ADB vol. 1 for dwellings.
- 3.3 In relation to the above, under both ADB volumes, the following definitions are applied for dwelling, dwellinghouse, and flat:
- A **dwelling** includes a dwellinghouse and a flat.
 - A **dwellinghouse** does not include a flat or a building containing a flat.

- A **flat** is a separate and self-contained premises constructed or adapted for use for residential purposes and forming part of a building from some other part of which it is divided horizontally.
- 3.4 In BS 9991:2015, the following definitions apply for a dwelling, house, and flat:
- A **dwelling** is a unit of residential accommodation, occupied (whether as a sole or main residence) either by a single person or by people living together as a family, or by not more than six residents living together as a single household, including a household where care is provided for residents.
 - A **house** is consistent with the above but does not include a flat or a building containing a flat.
 - A **flat** is a separate and self-contained premises, constructed or adapted for use for residential purposes and forming part of a building from some other part of which it is divided horizontally, having all its rooms on one level or not more than half a storey height apart.
- 3.5 The above definitions in both ADB and BS 9991:2015 make no reference to occupant familiarity and, as such, small paying guest accommodation appears to be within the scope of these definitions.
- 3.6 The above observation appears logical in the context of: a) the relative simplicity of individual dwelling design for means of escape purposes; and b) the familiarity that can be reasonably expected for dwelling occupants, which could include temporary guests, new tenants, part-time tenants, short-term tenants, etc.
- 3.7 BS 9999:2017 provides descriptions of different occupancy characteristics based on familiarity and whether occupants are expected to be awake or asleep, with category C recommended for occupants who are likely to be asleep. For individual flats, serviced flats, halls of residence, and sleeping areas of boarding schools, it states that these *“are covered in more depth in BS 9991”*. The only sleeping occupancy example provided where BS 9999:2017 is defined as applicable is for hotels.
- 3.8 Section 0.4 of BS 9991:2015 acknowledges that there is a broad spectrum of housing options available in the form of mainstream housing, specialised housing, and residential care. Table 1 of BS 9991:2015 refers to subcategories in the form of general needs, lifetime homes, adapted homes, sheltered / retirement housing, retirement villages, assisted living, extra care, etc. BS 9991:2015 is therefore considered applicable to a wide range of residential building situations, covering occupancies of differing level of needs, familiarity, and physical ability.
- 3.9 The only form of housing which is explicitly stated as falling outside the scope of BS 9991:2015 is residential care, or ‘care homes’, which *“offer institutional accommodation and personal care for people who might not be able to live independently”*.
- 3.10 Given the above series of observations, it appears reasonable to apply the recommendations of residential design guidance contained within ADB vol. 1 and BS 9991:2015 to small paying guest accommodation, supplemented by any additional guidance in the SPGA guide.

4 Alternative solutions and performance-based design

- 4.1 The guidance in documents like ADB and BS 9991:2015 provides one means of demonstrating compliance with the functional requirements of the Building Regulations for common buildings.
- 4.2 However, practitioners are allowed to adopt alternative solutions if they are adequately supported by a suitably qualified and competent professional, typically through the application of fire safety engineering principles and qualitative or quantitative analysis. This approach to fire safety design is acknowledged in ADB, where it is stated:
- *“Fire safety engineering might provide an alternative approach to fire safety. Fire safety engineering may be the only practical way to achieve a satisfactory standard of fire safety in some complex buildings and in buildings that contain different uses.”*
 - *“Fire safety engineering may also be suitable for solving a specific problem with a design that otherwise follows the provisions in this document.”*

- “BS 7974 and supporting published documents (PDs) provide a framework for and guidance on the application of fire safety engineering principles to the design of buildings.”
- 4.3 Similarly, BS 9991:2015 refers to the option of undertaking a qualitative design review (QDR) using BS 7974:2019 [17], the code of practice for the application of fire safety engineering principles to the design of buildings. BS 9999:2017 [16] explains three levels of guidance on fire safety as follows:
- “**General approach.** This level is applicable to the majority of building work undertaken within the UK. In this case the fire precautions designed into the building usually follow the guidance contained in the documents published by the relevant government departments to support legislative requirements.”
 - “**Advanced approach.** This is the level for which BS 9999 is provided. The provisions of this document allow a more transparent and flexible approach to fire safety design through use of a structured approach to risk-based design where designers can take account of varying physical and human factors. Many of the measures recommended in BS 9999 are based on fire safety engineering principles, although it is not intended as a guide to fire safety engineering.”
 - “**Fire safety engineering.** This is the level for which BS 7974 is provided. This level provides an alternative approach to fire safety and can be the only practical way to achieve a satisfactory standard of fire safety in some large and complex buildings, and in buildings containing different uses.”
- 4.4 The BS 7974:2019 code of practice provides a framework for a range of fire engineering approaches to be adopted in the fire safety design of buildings. The framework summarises a design process which considers: undertaking QDR and setting fire safety objectives; performing analyses of the design problem in the context of the defined objectives; and comparing the results of the analyses against acceptance criteria, to determine whether the design can achieve an adequate level of safety.
- 4.5 BS 7974:2019 notes that this approach to design can be used in conjunction with other standards (such as ADB, BS 9991:2015 and BS 9999:2017) and may also be used to support alternative approaches. BS 7974:2019 states that for any given functional requirement, the method of quantitative analysis can be either deterministic or probabilistic, and the acceptance criteria can be either absolute or comparative.
- 4.6 Hence, the functional requirements of the Building Regulations, and the framework of guidance that exists within England, provides the flexibility for competent practitioners to deviate from the guidance documents. This is inclusive of alternative solutions which consider the application of new fire safety systems, such as the Plumis Automist Smartscan suppression system, in lieu of conventional solutions.

5 The use of Plumis Automist Smartscan in residential design

5.1 Plumis Automist Smartscan and BS 8458:2015

- 5.1.1 It is understood that the Plumis Automist Smartscan system has been tested to Annex C [6] and fully complies with BS 8458:2015 [18], the British Standard for residential and domestic water mist systems. Therefore, it is reasonable to assume the system is adequate in situations where guidance allows for the adoption of a BS 8458:2015 tested system.
- 5.1.2 Research work [7]–[9] has been undertaken which demonstrates that, under tested fire scenarios, the performance of the Plumis Automist Smartscan system achieves equivalent or better performance than an equivalent sprinkler system with respect to response time, suppression performance, and minimum length of operation. As such, the system is considered to achieve adequate performance with respect to its intended objectives for use in dwellings [13].

5.2 BS 9991:2015 and permitted variations

- 5.2.1 ADB vol. 1 does not refer to the use of water mist systems, and instead only refers to sprinkler systems designed in accordance with BS 9251:2021 [19] for residential applications.
- 5.2.2 In contrast, both BS 9991:2015 and its 2021 draft revision [20] provides a series of building situations (referred to as 'permitted variations') where the adoption of a water mist system designed in accordance with BS 8458:2015 can be considered applicable in lieu of a sprinkler system.
- 5.2.3 Situations where the adoption of a water mist system is considered acceptable under BS 9991:2015 are summarised in Table 1, reproduced from elsewhere [12]. Based on the list of permitted variations, the Plumis Automist Smartscan system is considered applicable in most situations relevant to the internal design of flats and dwellinghouses, and these permitted variations are carried forward into the subsequent section.

Table 1 - Applicability of water mist in residential design

Provision of AWFSS	Water mist system confirming to BS 8458:2015 (e.g., Plumis Automist Smartscan)
Multi-basement buildings (in dwellings)	Applicable
Houses with one floor more than 4.5 m and less than 7.5 m above ground level	Applicable
Loft conversions	Applicable
Internal planning of flats and maisonettes	Applicable
Provision of inner rooms in flats not more than 4.5 m in height	Applicable
Extended travel distances within an open plan flat	Applicable
Extended travel distances within a flat entered from a floor below	Applicable
Maisonettes having a floor level higher than 4.5 m above access level	Applicable
Open plan flats	Applicable
Flats where occupants are not capable of independent evacuation	Applicable
Common areas (excluding common corridors and staircases) where occupants are not capable of independent evacuation	Applicable

6 Two-storey dwellinghouses with an unenclosed stair

6.1 Description

- 6.1.1 Figure 1 provides an example layout of an open plan two-storey dwellinghouse, where the stair discharges by an open plan arrangement at ground level.
- 6.1.2 This is the sort of arrangement which might be commonly adopted for small paying guest sleeping accommodation, in which occupants are located in an inner bedroom and have to escape via an

open plan staircase which also connects to some combination of a living area, dining area, and / or kitchen.

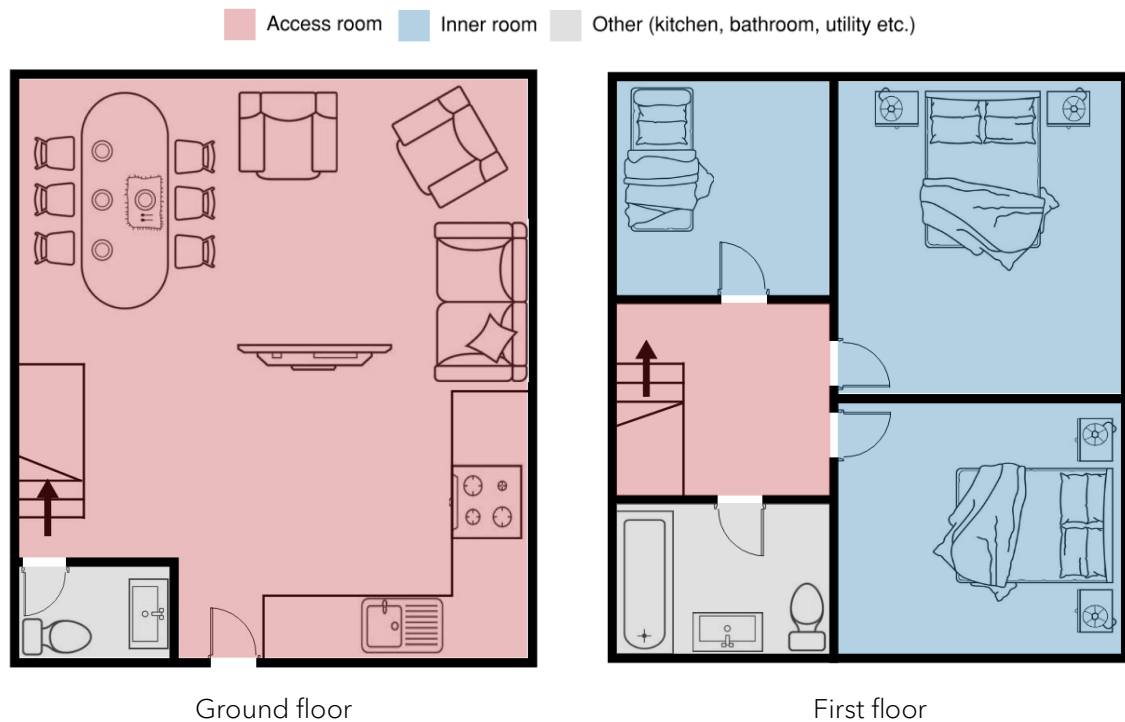


Figure 1 - Example layout for a two-storey dwellinghouse with an unenclosed stair

6.2 Guidance expectations

- 6.2.1 Under design guidance, two-storey dwellinghouses can be designed such that escape can either be via a protected hallway or stair (enclosed in fire-rated construction and access by fire doors), or each habitable room can be provided with an exit to outside in the form of a door or escape window.
- 6.2.2 In contrast, under the SPGA guide, it is not recommended that mobility impaired occupants are accommodated in rooms where the means of escape is reliant on escape windows. Therefore, the SPGA guide effectively precludes open plan dwelling arrangements where it cannot be guaranteed that mobility impaired occupants are not situated in inner bedrooms.
- 6.2.3 However, the SPGA guide does not yet make reference to whether suppression systems may be used to accommodate open plan arrangements. In such situations, it is therefore proposed that a Plumis Automist Smartsan system could be used as a fire safety design enhancement utilising a performance-based design route (described in Section 4).
- 6.2.4 Table 2 summarises the different guidance options and whether they propose a route to demonstrating an adequate solution. As noted above, a performance-based design option is considered feasible and is discussed further in Section 6.3 below.

Table 2 - Acceptability of a two-storey dwellinghouse with an unenclosed stair

Guidance	Stated as an adequate solution:	
	Without suppression	With Plumis Automist
ADB vol. 1	✓	✓
BS 9991:2015	✓	✓
SPGA guide	✗	Not specified

Guidance	Stated as an adequate solution:	
	Without suppression	With Plumis Automist
Performance-based solution	-	✓

6.3 Performance-based solution

- 6.3.1 An assessment was previously undertaken involving probabilistic computational fire modelling for a series of typical three-storey dwellinghouse arrangements [14]. The assessment included simulations of open plan three-storey dwellinghouse arrangements with the kitchen, living room, and dining areas connecting directly to a single escape stair on ground floor and first floor levels. These simulations were contrasted to a design where the stair was enclosed in fire-rated construction on every storey adopting a comparative approach, where demonstrating equivalence or improvement upon an accepted design is considered a valid means to demonstrate a design achieves an adequate level of safety [17].
- 6.3.2 The assessment considered occupants located on the uppermost storey escaping down the full height of the staircase to the ground floor level, excluding any consideration of possible escape windows situated at first floor level, as well as any benefit afforded by the provision of an enhanced smoke detection and alarm system.
- 6.3.3 The assessment focussed on the fractional effective dose (FED), a measure of airborne pollutants which may incapacitate occupants during escape. The Monte Carlo method was applied capturing variation in a number of inputs, including design fire parameters, system reliability, and behavioural assumptions. Further details of the assessment methodology can be found in the original study [14].
- 6.3.4 Ultimately, the assessment demonstrated that the inclusion of a Plumis Automist suppression system in a three-storey dwellinghouse arrangement with an open plan stair is shown to produce a design scenario which is no more likely to result in injury or fatality during a fire than an accepted design that follows recognised fire safety guidance.
- 6.3.5 Based on the above, it appears reasonable that the outcome of the three-storey dwellinghouse assessment can be extended to a two-storey form of small paying guest sleeping accommodation for the following reasons:
- Occupants located within the bedrooms of a two-storey arrangement will have fewer storeys to descend within the open plan area to reach a place of safety compared to a three-storey arrangement. As such, they are likely to be subject to fire-affected conditions for a shorter period of time when escaping.
 - The assessment addressed long pre-evacuation times, capturing the potential presence of unfamiliar occupants.
 - The assessment excluded any benefit of escape windows, where the SPGA guide recommends that occupants are not accommodated in rooms where the means of escape is reliant on escape windows.
 - The assessment excluded any benefit from the provision of an automatic and enhanced interlinked (LD1) smoke detection and alarm system, where the SGPA guide recommends this system as a minimum (see Paragraph 7.1.4 in the final recommendations).
 - The comparative case, with a protected staircase, met the recommendations of ADB vol. 1, BS 9991:2015, and the SPGA guide.

7 Recommendations and limitations

- 7.1.1 This document identifies that it appears reasonable for the Plumis Automist suppression system to be adopted as part of a performance-based, fire-engineered solution to support two-storey, small paying guest sleeping accommodation incorporating open plan areas.
- 7.1.2 With respect to the two-storey arrangement, the following limitations apply when using the Plumis Automist system to address an open plan design:
- Where practicable, fire-resisting partitions and doors should be provided to separate any bedrooms or sleeping accommodation from the open plan area(s) and / or associated staircase(s). Where this is not practicable, then bedrooms should at least be afforded smoke-retarding construction to reasonably limit the spread of smoke in the event of a fire in the open plan area(s).
 - The property should have a maximum of two-storeys, where the top storey is not situated more than 4.5 m above ground / access level.
 - Automatic suppression should be provided to the full extent of the open plan area of the property, in line with the Plumis installation guidelines within their design, installation, operation and maintenance manual (DIOM) [21].
 - The maximum travel distance that an occupant should be expected to travel within the open plan enclosure is 13.5 m (note: this does not refer to the total travel distance, but only travel within the open plan access room).
- 7.1.3 The above restrictions apply due to the extent of modelling, experimentation, and research which has been carried out to date. While deviating from these restrictions would not necessarily result in an arrangement which is not able to achieve an adequate level of safety, further analysis would likely be required.
- 7.1.4 As a general principle, it is also recommended that an automatic, interlinked smoke detection and alarm system is provided in any entrance halls, staircases, lounges, dining rooms and bedrooms. It is recommended that automatic heat detectors and alarms are installed in kitchens or any other rooms where nuisance alarms might occur from fumes, steam, dust, etc. (e.g., in laundry or utility rooms). This approach aligns with the general recommendations of the SPGA guide and would typically result in the recommendations of ADB vol. 1, BS 9991:2015, and BS 5839-6:2019+A1:2020 [22] being met or improved upon.

8 References

- [1] HM Government, 'The Building Regulations 2010, Approved Document B (Fire Safety) Volume 1 (2019 edition incorporating 2020 and 2022 amendments)', 2022.
- [2] BSI, 'BS 9991:2015 Fire safety in the design, management and use of residential buildings. Code of practice', BSI, London, 2015.
- [3] Home Office, 'A guide to making your small paying-guest-accommodation safe from fire', 2023.
- [4] HM Government, *Fire safety risk assessment - sleeping accommodation*. Norwich, UK: TSO, 2006.
- [5] P. Bray, 'Applying the sleeping risk guide to existing holiday accommodation', Professional Association of Self-Caterers UK (PASC), 2023.
- [6] E. Anderson and T. Kinder, 'BS 8458:2015: Annex C, method for measuring the capability of a watermist system to control a fire - room fire test for watermist systems with automatic nozzles', Warringtonfire, 514130, 2022. [Online]. Available: <https://plumis.co.uk/sites/default/files/2022-09/PDF.J514130-EA220225BS%208458.%201.pdf>
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- [9] C. Hopkin, M. Spearpoint, and T. Bentley, 'Plumis Automist Smartsan Hydra, zone modelling of BS 8458 test programme', OFR Consultants, MA20196-R01, 2020.
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- [15] HM Government, 'The Building Regulations 2010, Approved Document B (Fire Safety) Volume 2 (2019 edition incorporating 2020 and 2022 amendments)', 2022.
- [16] BSI, 'BS 9999:2017 Fire safety in the design, management and use of buildings. Code of practice', BSI, London, 2017.
- [17] BSI, 'BS 7974:2019 Application of fire safety engineering principles to the design of buildings. Code of practice', BSI, London, 2019.
- [18] BSI, 'BS 8458:2015 Fixed fire protection systems. Residential and domestic watermist systems. Code of practice for design and installation', BSI, London, 2015.
- [19] BSI, 'BS 9251:2021 Fire sprinkler systems for domestic and residential occupancies. Code of practice', BSI, London, 2021.
- [20] BSI, 'BS 9991 Fire safety in the design, management and use of residential buildings. Code of practice. 2021 draft for public comment', BSI, London, 2021.
- [21] Plumis, 'Automist Smartsan Hydra Design, Installation, Operation and Maintenance (DIOM) Manual', Version 2.00.0, 2020.
- [22] BSI, 'BS 5839-6:2019+A1:2020 Fire detection and fire alarm systems for buildings. Code of practice for the design, installation, commissioning and maintenance of fire detection and fire alarm systems in domestic premises', BSI, London, 2020.