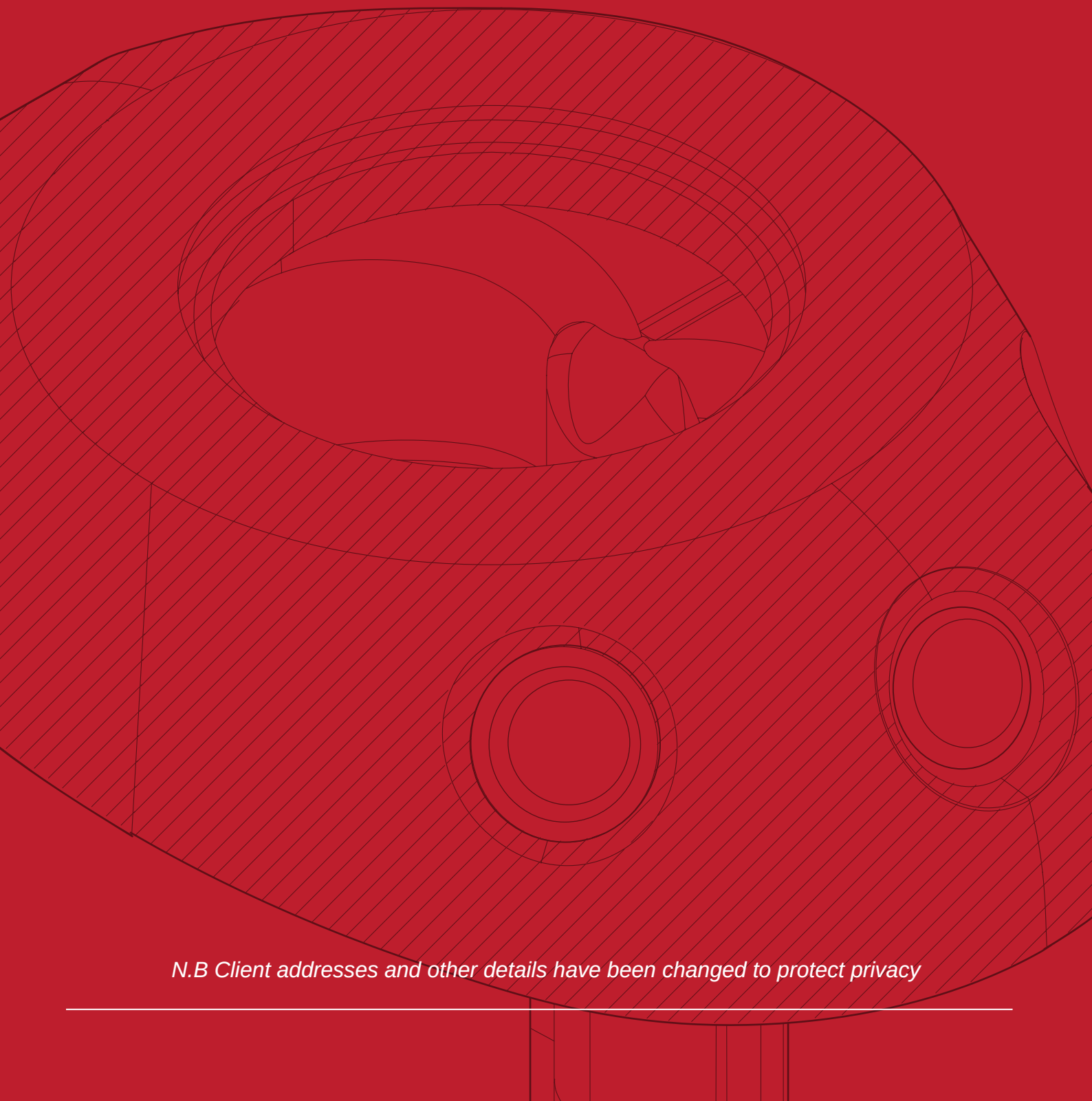
Automist™ Fire Engineering Reports Examples

Independently prepared by qualified Fire Engineers to justify the use of Automist in a Domestic Properties

1. 14a Castle Terrace, Edinburgh
2. Paddington, high Street, London



N.B Client addresses and other details have been changed to protect privacy

Example 1 - 14a Castle Terrace, Edinburgh

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Design Note No. DN01

Project St Ives, Cornwall **Date** 18 March 2012

Subject Automist Fire Suppression Application

1.0 DOCUMENT CONTROL

Issue	Date	Description	Author	Reviewed
1	18/03/12	Initial issue	BW	DA

2.0 INTRODUCTION

This design note provides an overview of the application of Automist fire suppression systems to the open plan apartment designs proposed on the development at St Ives in Cornwall.

The note has been based on a review of the apartment layouts to the first and second floors along with the proposed installation details for Automist fire suppression systems as mitigation for these layouts. Open plan layouts are not considered within Approved Document B, although they have become more accepted following recent research by the Building Research Establishment (BRE) on behalf of the NHBC Foundation and subsequent reference in the recently released BS9991. This note does not consider the validity of open plan layouts themselves and instead considers the application of Automist suppression as an alternative suppression system forming part of the provisions to support these open plan layouts.

Following the discussions and rationale given in this design note it is our opinion that the proposed use of Automist provides a similar level of performance and robustness to that of other solutions more formally recognised in design guidance. On this basis it is our opinion that the proposals meet the functional requirements of the Building Regulations with regards to means of escape, providing the Automist suppression is supported by an LD1 standard automatic fire alarm and detection system installed throughout the apartments concerned.

The remainder of this design note discusses the specific details of the scenario.

It should be noted that this design note covers the specific aspects of the design considered herein and will not extend to any other applications or projects.

3.0 BUILDING LAYOUTS

The first and second floor apartments have been designed with an open plan layout whereby the kitchen-living space is open to the internal corridor that serves the bedrooms. In the case of the first floor apartment escape to the communal areas is directly from the main living space, whilst in the second floor apartment the apartment exit is from the centre of the internal corridor; however a further living space is accessed via an open stair off the living space. The open stair discharges directly in front of the internal circulation corridor.

The scope of this assessment is not to determine the acceptability and practicalities of implementing open plan layouts within apartments. Such layouts have become popular over the last 5 years or so, although they have not yet been embraced within Approved Document B (primarily due to the time of the last update). However the very recently released BS9991 guide (the British Standard that replaces BS5588 Part 1, and pre-cursor design guide to Approved Document B) does acknowledge the introduction of sprinklers and enhanced fire alarm and detection systems as reasonable justification for open plan layouts.

Based on this guidance it is proposed that the concept of using fire suppression and early warning to justify the open plan layouts proposed on this project is reasonable. Therefore, the main consideration of this design note is to determine the suitability of the proposed fire suppression system as an alternative for the residential sprinkler system that would typically be recommended in guides like BS9991.

4.0 AUTOMIST INSTALLATION

If fire suppression was provided via residential sprinklers reference would be made to British Standard, BS9251. This standard outlines the basic installation detail and method of operation for the equipment composing the residential sprinkler system.

Where an alternative suppression is proposed it is important that a similar, or better, level of performance and robustness is achieved by the alternative system to those traditional solutions. As Automist does not fall into any specific existing design guide it is proposed that the robustness and appropriateness of the system can only be made by comparison of the system installation with other more recognised solutions.

4.1 Basic Overview of Automist Systems

Automist is based on "tried and tested" water mist technology that has been modified for practical use in a residential environment. The manufacturers, Plumis, have taken industry standard water mist suppression heads and developed discreet mounting units to encase the water mist heads into practical locations within the home. In conjunction with the disguising of the suppression nozzles themselves Plumis have also developed a compact high pressure pump and control unit that is capable of being linked to conventional heat detectors to enable the water mist units to be activated in the room of origin.

For cost effectiveness the Automist units are self contained with each unit covering up to two rooms (i.e. one suppression head in each room, fed from a central pump and control panel).

Unlike a sprinkler, there is no activation mechanism inbuilt into the suppression heads therefore activation is based on the operation of a local detector device (typically a heat detector). In order to ensure that the closest and most appropriate Automist unit operates each unit includes dedicated heat detection within the room(s) as part of the system. As most domestic fire detection and alarm systems are not addressable Automist cannot be controlled from the domestic fire alarm therefore additional detection is provided purely for the operation of the Automist units.

Each Automist unit is installed in close proximity to a water supply serving kitchen or bathroom sinks generally. The Automist units are connected directly to the cold water supply.

4.2 Performance Concept Discussion

Water mist technology has been applied for several years to the marine industry and is also used for some specific applications in buildings. Clearly from the pedigree and background the use of water mist technology deserves recognition as a means of suppressing fires.

Fires produce hot combustion products which rise under their own buoyancy with cool ambient air drawn into the combustion zone at the base of the plume, providing oxygen to sustain the combustion process. Once the Automist system is activated, water mist particles are released to fill the compartment and are entrained by the fire into the combustion zone. The water particles are evaporated within the combustion zone, removing heat and directly inhibiting the combustion process, as well as cooling the combustion gases produced. Over time conditions in the fire compartment will stabilise such that compartment itself is cooled.

Due to the small diameter of the water mist droplets they have little mass or momentum so tend to move based on the air currents present within the compartment of release. This behaviour is especially useful in small volume compartments where the air currents are strong and droplet travel distances are relatively short (ensuring that droplets reach the fire source before they evaporate). Given these parameters water mist technology is particularly effective and well suited to residential environments.

Another advantage of water mist suppression is that they can also suppress fires sources that are shielded from the initial misting spray (due to the droplet entrainment into the combustion zone). Conventional sprinklers work more on a principle of wetting the fire source directly so need direct line of sight between the fire and the spray.

Whilst Plumis have implemented the water mist technology based on previous suppression data Plumis have also commissioned real full scale fire tests to further validate the suppression capabilities of the Automist product. The most recent tests were carried out by the Building Research Establishment (BRE) during 2010. The tests were based on BS EN 1869:1997, DD 8458 1:2010, and the criteria of Scandinavian SRSA/DSB "Easily installed automatic extinguishing systems". Critically, Fractional Effective Dosage (FED) measurements and "free burn"

control tests were included to allow a complete and objective assessment. The tests were carried out in the BRE's Watford Burn Hall facility and mimicked both furniture and kitchen fires.

As with the BRE residential sprinkler tests (also known as the Cardington tests), the Automist system did not result in tenable conditions being maintained in all scenarios. However, the Automist system did in most instances extend significantly the time taken for conditions to become untenable when compared to no suppression systems being provided. The tests also demonstrated that the Automist system in most instances was effective in reducing the gas temperatures, improving air quality and assisting to extinguish the fire and prevent further fire spread following activation.

In this particular design the Automist systems are primarily intended to reduce and control the fire source such that less products of combustion are produced and secondly that the tenability within the escape route is prolonged. From the findings of the BRE fire tests it is clear that the suppression effects of the Automist systems are very effective at reducing temperatures within the fire compartment, controlling fire growth and spread and as a consequence improving conditions and tenability within the compartments. On this basis it is proposed that the Automist system is acceptable for application on this project as an alternative automatic fire suppression system.

4.3 Equipment & System Performance Discussion

Following the establishment that the basic suppression concept is valid for this application the next stage is to consider the system itself, specifically its components, their configuration and implementation.

Based on guidance and information provided by FireMaster all components forming the Automist system are CE marked as meeting EU consumer safety, health & environmental requirements. Additionally the Automist system has been approved under the Water Regulatory Advisory Scheme as complying with the requirements of the United Kingdom Water Byelaws (Certificate Number 1102330). The components forming the control and activation mechanism for the Automist system also comply with the relevant recommendations of BS5839 Part 6.

Given the above the individual components have a good basis for producing a reliable and robust suppression system providing these components are implemented effectively. Currently there is no standardised public guidance or British Standards available that directly cover Automist systems therefore the appropriateness of the system installation has been based on comparison of the system configuration against similar known systems. In this case it is proposed that providing the Automist system's physical installation is of a comparable standard in terms of operation, connection to both electrical and water supplies as the standards for the recognised residential sprinkler systems then the Automist system would demonstrate an adequately robust system, suitable for application in residential settings.

The following table discusses the individual elements for a residential sprinkler system based on the recommendations of BS9251 (component layouts for a residential sprinkler system that is currently considered to be of an adequate standard for life safety applications) and compares these to the configuration of Automist systems.

Design Aspect	BS9251 Recommendations	Automist	Comments
Suppression system	Domestic cold water wet pipe system, operating pressure 0.5 bar	Domestic cold water dry pipe system, operating pressure 80 bar	
Activation	Fusible link or glass bulb sprinkler heads which have an activation temperature in excess of 20°C above the highest expected ambient temperature.	BS5446 Part 2 Heat Detector/Sounder	**Achieved**. Automist uses proven technology used readily in life safety fire alarm and detection systems.
Activation temperature	57°C or 68°C for most general applications	57°C	**Achieved**. The Heat Detection used for Automist is more likely to respond earlier than a recessed sprinkler head.

Warning Device	An audible alarm operated from an electrically operated flow switch.	BS5446 Part 2 Heat Detector/Sounder linked to the Automist control panel and water mains supply valve.	**Achieved**.
Areas of Coverage	Whole house / apartment coverage	Identified fire risk room(s) – In this case units are provided to suppress a fire in the open plan areas only.	**N/A.** See notes below.
Water supplies	Mains or tank supplied providing a minimum 60 l/min to one sprinkler head or 42 l/min through at least two sprinkler heads (subject to domestic or residential classification).	Mains fed providing a minimum 5.5 l/min.	**N/A.** Being water mist based Automist uses approximately 10% of the water requirements for residential sprinklers.
Water supply tolerance	Minimum operating pressure of 0.5 bar. Where mains supplies are used then either a priority valve should be used or the system is designed to operated with either a 25 l/min or 50 l/min depending on the system classification.	For life safety applications Automist will be designed based on the adoption of BS9251 mains water supply tolerances.	**Achieved**. An identical level of design redundancy is included into the Automist system as would be expected of a residential sprinkler system.
Electrical supplies	A separately fused connection to the fire pump taken after the meter and from the supply side of the domestic fuse box using fire resisting cable. All other devices on the system should continue to function in the event of a complete failure of mains power (as per BS5839 Part 6)	Automist must remain powered in the event of a fire and therefore must not share a mains circuit or RCD with appliance and sockets. The pump unit electrical supply will adopt the BS9251 installation recommendations. The control devices include a battery back up.	**Achieved**. An identical level of design redundancy is included into the Automist system as would be expected of a residential sprinkler system.
Installation	Requires an Approved Installer to run pipes from the services routes and sign off the system installation.	Requires a Plumis Certified and Approved Installer / Reseller to verify that a qualified electrician and plumber have installed Automist correctly.	**Achieved**.
Typical run time	Minimum of 10 minutes for domestic occupancies and 30 minutes for residential occupancies.	30 minutes (default) or configurable with the fire panel	**Achieved**. Due to the lower water supply requirements the Automist is capable for being run for extended periods more easily than residential sprinklers.
Commissioning	Pressure test to 1.5 times	A simple commissioning	**Achieved**. Automist

	the working pressure or 12 bar for 1 hour. Plus a pressure and flow test.	procedure during which the pump runs for 20 seconds	includes self diagnostics on the control panel to monitor flow and pressure requirements which can be easily checked at any time.
Maintenance	Annual inspection and testing by a suitably qualified contractor.	An annual recommissioning procedure provided by the Plumis Approved Installer ensures that the installation remains serviced, maintained, tested and is found in place so as to ensure continued compliance with Building Regulations.	**Achieved**. An identical level of design redundancy is included into the Automist system as would be expected of a residential sprinkler system.

Notes - BS9251 does not give any consideration or variation in the levels of coverage to only specific fire risk areas, with the exception of limited bathrooms and cupboards. This is primarily as the standard is intended for widespread use and has generally been adopted in Approved Document B and other guides as an acceptable standard to produce other design concessions other than purely justifying unusual escape routes. In contrast Automist is itself a fire engineering installation so providing the system coverage addresses the fire risks that it is designed to protect then the system achieves a similar level of performance. After reviewing the layouts and Automist proposals the area of risk that requires protecting is the access room to the inner accommodation, in this case the living-kitchen. The Automist proposals cover this area adequately and have sufficient Automist units present to remain within the validity of Plumis' fire test research.

Based on the above table the Automist systems achieve a similar level of robustness to a residential sprinkler system in terms of the system implementation.

5.0 CONCLUSIONS

Following the discussions and rationale above it is my opinion that the proposed use of Automist provides a similar level of performance and robustness to that of other solutions more formally recognised in design guidance. On this basis it is our opinion that the proposals meet the functional requirements of the Building Regulations with regards to means of escape, providing the Automist suppression is supported by an LD1 standard automatic fire alarm and detection system installed throughout the apartments concerned.

Example 2 - Paddington, high Street, London

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Executive Summary

The proposal presented in this submission gives an alternative method of complying with the functional requirements of Part B1 of the Building Regulations that provides greater protection to all residents.

This greater protection is provided by a 24 hour, 7 day a week active fire suppression system which compares favourably with the passive ADB proposal as it removes the need for residents to keep all internal fire doors closed.

Approved Document B (ADB) Paragraph 2.21 and Diagram 9 (b) describes the fire safety requirements for a single staircase building with 8 flats spread over 4 floors. The functional requirement of the Building Regulations for small single stair buildings with no more than 2 dwellings per storey is to have a lobbied approach OR a protected entrance hall between the dwelling and common stair.

The ground, first, second and third floors all comply with the requirements of Approved Document B (ADB) Paragraph 2.21 and Diagram 9 (b), it is not unreasonable to assume that as the ground floor is completely separated from the staircase that a flat on the fourth floor also complies with the functional requirements of ADB.

This project proposes 5 flats over 5 floors and provides additional protection to all flats to enable the flats on floors 4 and 5 to comply with the functional requirements of ADB. Our solution involves the provision of both an Automist fire suppression system and a protected entrance hall to the flats on floors 1 to 3 and the use of the Automist fire suppression system in flats 4 and 5. Two sets of cold smoke seals are also included for all flat entrance doors as an additional protection device.

Our solution involves the provision of both an Automist fire suppression system and a protected entrance hall to the flats on floors 1 to 3 and the use of the Automist fire suppression system in flats 4 and 5. Two sets of cold smoke seals are also included for all flat entrance doors as an additional protection device.

The proposal invokes the normally adopted stay put policy for buildings of this type, negating the need for a communal fire alarm system to be interlinked between all dwellings.

Approved Document B Definition

Means of Escape in Common Parts of Flats

The functional requirement of the Building Regulations for small single stair buildings with no more than 2 dwellings per storey is to have a lobbied approach or a protected entrance hall between the dwelling and common stair.

The guidance on how to achieve this is set out in Approved Document B1 paragraph 2.21 and Diagram 9.

ADB 2.21 states that a single stair protected in accordance with Diagram 9 may be used provided that:

a) The top floor of the building is no more than 11m above ground level
b) There are no more than 3 storeys above the Ground Level
c) The stair does not serve ancillary accommodation unless the ancillary accommodation is separated from the stair by a protected lobby, or protected corridor which has not less than 0.4m^2 permanent ventilation or is protected from the ingress of smoke by a mechanical smoke control system and
d) A high level openable vent for fire and rescue service use is provided at each floor level with a minimum free area of 1m^2. Alternatively a single openable vent may be provided at the head of the stair which may be remotely operated from fire and rescue service access level.

In addition ADB calls for all new flats to have a BS 5839 Part 6 LD3 Grade D system.

Proposal

Currently the Paddington High Street layout accords with the layout provision set out an ADB1 2.21 with the exception of the following:

- The top floor is higher than 11m but its means of escape route is to be protected by an Automist fire suppression system. In addition this flat is to be provided with an Automist Suppression system.
- There are more than 3 floors above the ground floor but the lowest flat is actually at first floor level and the ground floor is completely separated from the staircase. This increases the overall travel distance but still complies with ADB Paragraph 4.36 Exits from protected stairways. In addition all flats on floors 1 to 3 are to be provided with both an Automist fire suppression system and protected entrance hall approach and flats 4 and 5 with an Automist Suppression system.
- The staircase is lobby protected from the ancillary accommodation at basement level however this lobby cannot be vented and so an Automist suppression system is to be provided to the basement area.
- A smoke vent is to be provided at the top of the staircase linked to local smoke detection with remote operation at entrance level.
- The flats in this building are all on one level and a BS 5839 LD2 Grade D fire alarm system is to be installed.

Fire development within a dwelling

It is within the house, flat or maisonette itself that the most direct and serious risks to life arise and the following 3 situations should be addressed.

1) The risk is more serious in two storey dwellings as in maisonettes rather than in flats, due to the greater speed with which heat transfer takes place upwards rather than sideways.

   A fire may start in an unoccupied room because of discarded smoking materials, electrical faults, furniture left too close to heating appliances, etc. The risk will be to all occupants of the dwelling, particularly any who may be asleep, but a fire will take time to develop unless the room door is open.

   If the latter is the case, an immediate danger arises of other occupants being trapped by the presence of the products of combustion between them and the exit door of the dwelling. If the door of the room of origin is closed, the fire will not emerge from the room for some time, during which time the occupants may become aware of it.

   If they do not, their escape will be threatened when the products of combustion penetrate the door of the room of origin; even more so in a multi-storey situation when smoke permeates the stairway or fire penetrates through the ceiling of the room of origin.

   The flats in this building are all on one level and a BS 5839 LD2 Grade D fire alarm system is to be installed.

2) Conceivably, a fire may start or be started in the entrance hall or circulation spaces (corridors, stairways, etc.) of the house, flat or maisonette, which will present the most immediate and severe danger possible to the occupants, particularly on any upper floor.

   For this reason, it is essential to ensure, so far as possible at the design stage, that the potential for a fire starting in an entrance hall or circulation space is minimized.

   The risk to occupants from a fire within a building depends upon the occupancy characteristic that is principally determined according to whether the occupants are familiar or unfamiliar with the building and whether they are likely to be awake or asleep.

   The flats in this building have been designed to maintain the entrance hall as a sterile area and all residents will be informed of the need to maintain this protection. The residents will be familiar with the means of escape as this is a single stair building and they will be alerted to any fire in their flat by the LD2 fire alarm within the flats.

3) Owing to the high degree of compartmentation provided in blocks of flats and/or maisonettes, the spread of fire from one dwelling to another is unusual. It is, therefore, no longer assumed that in the event of fire it is necessary to evacuate the whole building, whole floors or even dwellings adjacent to the fire.

   This refers to the 60 mins fire separation between flats with 30 mins separation sufficient to provide protection internally.

The flats in this building will all be provided internally with two 30 minutes fire door separation between any risk and the staircase or one 30 minute fire door and a minimum of 30 minutes fire suppression.

Means of Escape Solution

As stated currently the layout does not comply with ADB1 2.21.

To comply in functionality with ADB1 we propose the following solutions:

- Flats on floors 1 to 3 are to be provided with an Automist fire suppression system and a protected entrance hall protection.
- An Automist fire suppression system to be provided to the flat with a floor level above 11m.
- An Automist fire suppression system to be provided to all flats above third floor level.
- A Lobby protection is to be provided to the basement level. This level is to be maintained sterile with mainly toilet accommodation.
- An Automist fire suppression system in lieu of lobby protection to flats four and five. This will provide 30 minutes Fire Suppression in lieu of 30 minutes fire resistance.
- Automatic Opening Vent linked to a BS 5839 Part 1 detection system in the staircase.
- The flat entrance doors are all to have an additional cold smoke seal such as the Lorient Curved Fin Batwing® smoke seal.

The Automatic Opening Vent will provide a $1m^2$ clear opening and will also be capable of being operated by a remote control switch located at the ground floor entrance lobby.

How Lobby Protection Works

Smoke requires a large amount of energy in order to force its way around a fire door. This energy is provided due to the compartment involved in fire becoming 'over pressure' above the neutral plane. This increase in pressure provides sufficient energy to force smoke through the gaps around a door frame but this action also reduces both the energy available and the temperature of the resultant smoke.

This is an over simplification of the process involved but conveys the actual result of smoke passing through a narrow gap. The resultant smoke that 'leaks' past the door no longer has sufficient energy to pass through a second fire door. This is how lobby protection maintains smoke free passageways.

Therefore we propose that a Plumis Automist fire suppression system to be installed in the space behind the flat entrance door in lieu of lobby protection.

Should a fire start the system is triggered either automatically by a heat alarm or by a fire panel override switch. Detection is based on a BS 5839 Pt 6 alarm as recommended in ADB.

Once triggered the pump drives mains water through the unique nozzle unit, quickly filling the compartment with a dense fog. Water mist removes heat and displaces oxygen from the fire zone, resulting in fire control, suppression or extinguishment.

The intention is to lower the temperature, lessen the radiative heat and therefore reduce the pressure levels in the smoke to such an extent that it no longer has enough energy to be able to force its way past the double smoke seal entrance doors.

This also ensures that combustion can no longer be maintained and therefore reducing damage and maintaining tenable conditions.

It is proposed to install the system in the entrance halls of flats 1 to 3, this will operative by a heat detector outside the kitchen/lounge doors.

The system will also be installed in the kitchen areas of both apartments 4 & 5 with an additional nozzle in each Lounge area.

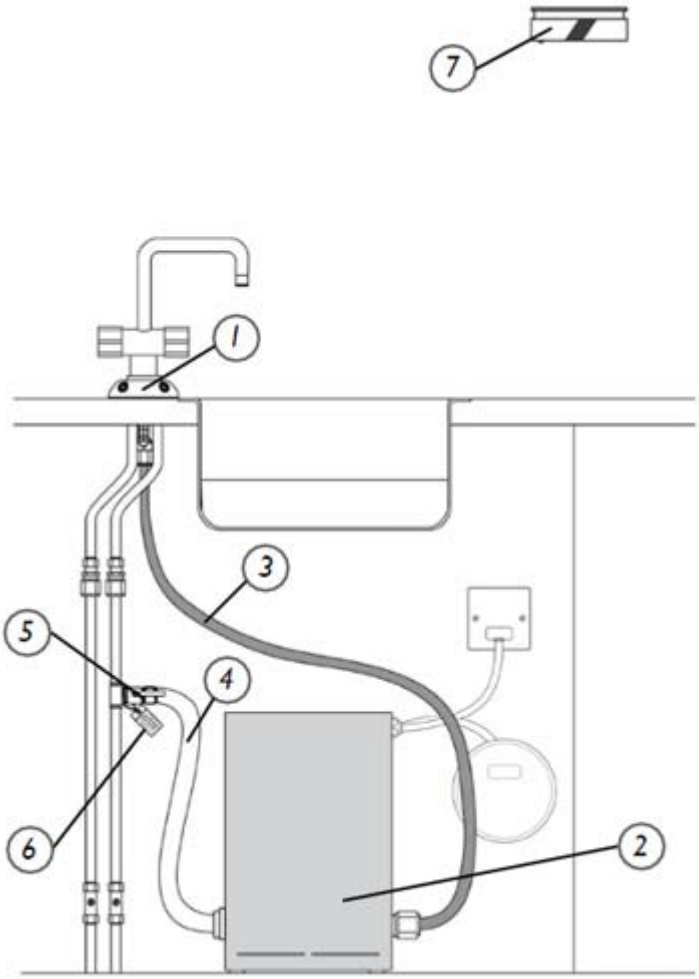
Plumis Automist System

Provision should be made on site to facilitate the installation of the system:

Sufficient space to install the pump. The pump is 271 mm by 339 mm by 88 mm and weighs 11.2 kg.

A reliable cold water supply (6 lpm flow and 0.5 to 10 bar pressure) with a standard washing machine connection (3/4").

Automist should be powered by an independent circuit either via a delayed action RCD or no RCD (1.33kW, 230V and 50Hz) with an unswitched fused connection unit.



Standard under tap installation:-

1. Automist emitter

- utilises watermist nozzles from the commercial fire fighting industry. Silicon protective caps protect the nozzles from limescale, dirt and cleaning products.

2. Automist Pluvia Pump

- water is driven by a positive displacement pump, powered by a 1.7 kW AC induction motor to deliver 5.3 lpm at 80bar.

3. High pressure hose

4. ¾" braided stainless steel hose

5. ¾" approved single check valve

6. Heat alarm

- sensing is based on heat detection as recommended in Approved Document B, effectively eliminating nuisance alarms.

Figure 1: Automist Tap Mounted System

We also propose that the Entrance doors to all apartments remain as FD30S but fitted with double smoke seals such as the Lorient Curved Fin Batwing® smoke seal.

The building will adopt the standard stay put evacuation policy.

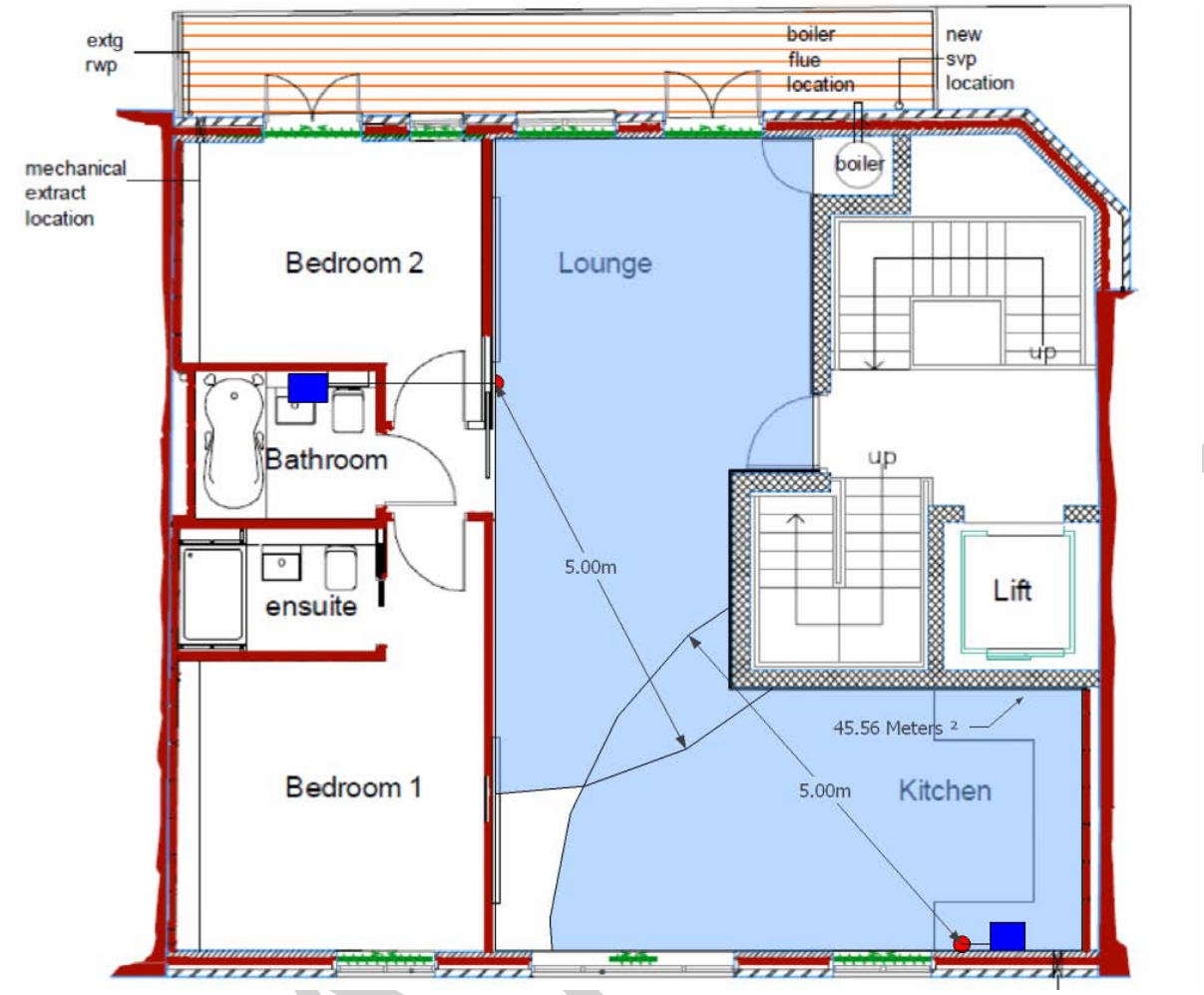


Figure 2: Apartment 4 Automist to be provided in the kitchen and outside the bedroom/bathroom lobby.

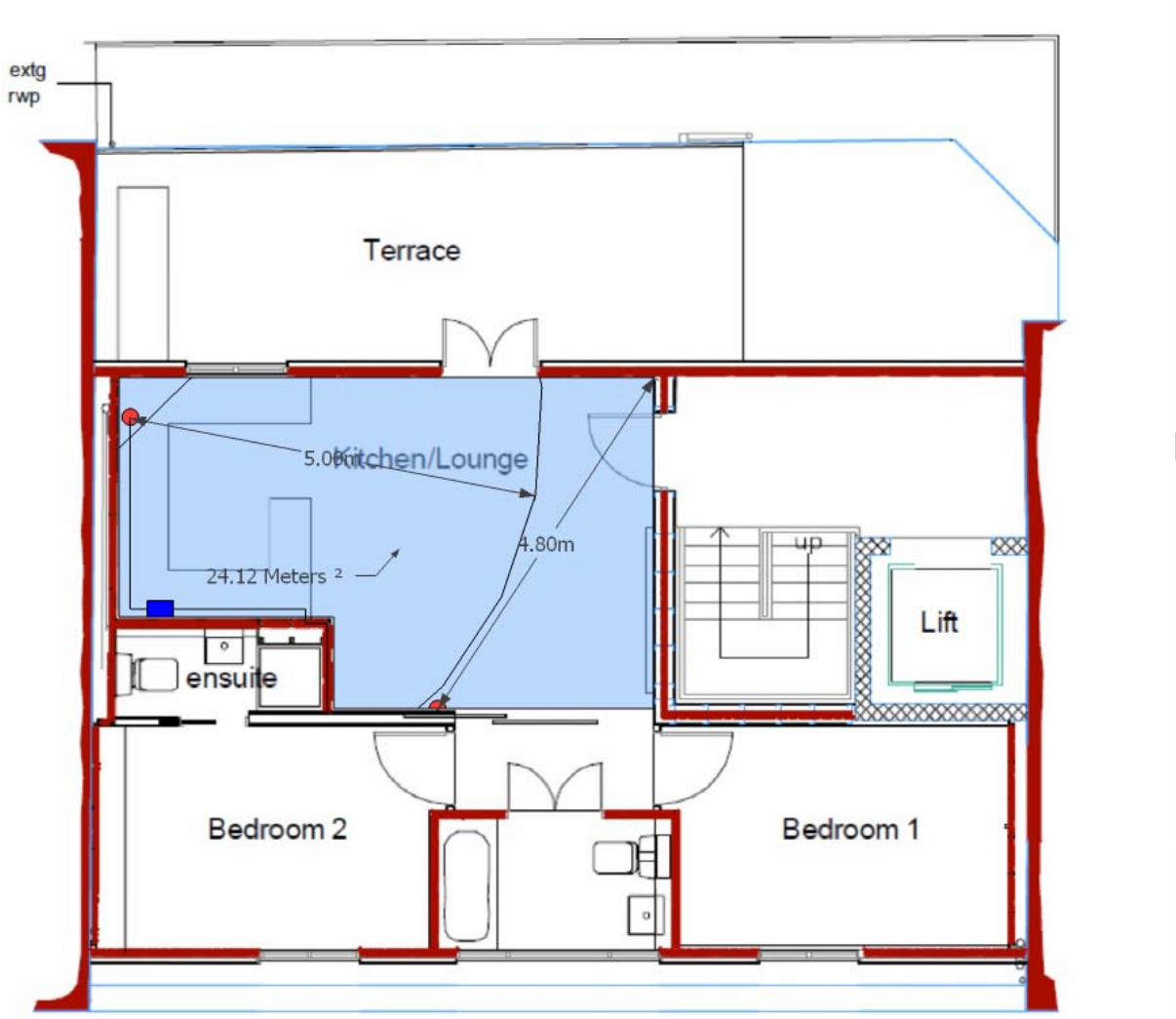


Figure 3: Apartment 5 Automist to be provided in the kitchen and lounge side of the 'nib' of the wall to bedroom 1.

Summary

The proposal presented in this submission gives an alternative method of complying with the functional requirements of Part B1 of the Building Regulations that provides greater protection to all residents.

This greater protection is provided by a 24 hour, 7 day a week active fire suppression system which compares favourably with the passive ADB proposal as it removes the need for residents to keep all internal fire doors closed.

Our solution involves the provision of both an Automist fire suppression system and a protected entrance hall to the flats on floors 1 to 3 and the use of the Automist fire suppression system in flats 4 and 5. Two sets of cold smoke seals are also included for all flat entrance doors as an additional protection device.

The proposal invokes the normally adopted stay put policy for buildings of this type, negating the need for the fire alarm system to be interlinked between all dwellings.

An Automatic Opening Vent is included at the head of the stairs to provide a $1m^2$ clear opening. The vent will be operated either automatically by smoke detection or via a remote control switch at Ground Floor Level.