Fire Safety Guidance Note: 
Retrofitting Automatic Fire Suppression Systems in Residential Premises

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This Guidance Note provides fire safety advice in respect of Retrofitting Automatic Fire Suppression Systems in Residential Premises.

This Note is one of a series produced by the Fire Authority to provide advice on various aspects of fire safety. If you require any further guidance on the advice given or require advice on another topic please visit your local Fire Safety Office, telephone 020 8555 1200 and ask for the nearest FSR Admin, or visit the London Fire Brigade web site at http://www.london-fire.gov.uk

1 Introduction.

1.1 London Fire Brigade (LFB) is committed to reducing the impact of fire on people, property and the environment. There is clear evidence that Automatic Fire Suppression Systems (AFSS) can be effective in the rapid suppression of fires and can therefore play an important role in achieving a range of benefits for both individuals and the community in general.

1.2 The term Automatic Fire suppression Systems can be divided into two categories domestic/residential and commercial. This policy focuses on the former.

1.3 In accordance within the aims and objectives contained within the Authority’s London Safety Plan, the Authority produced an AFSS position statement which captures our commitment to the promotion of AFSS in London.

1.4 Within the statement our objective of playing a key leadership role in promoting a better understanding of AFSS and encouraging building owners and developers to install these systems is reaffirmed, especially in domestic, residential and educational premises where vulnerable people live or regularly visit.

1.5 AFSS provide a high level of protection for vulnerable residents, especially for those likely to be affected with long term impairments which could potentially restrict their ability to respond in an emergency situation. AFSS provides protection against the potential damages caused by fire as well as aid the protection of residents. This is especially so where there is increased likelihood that the effects of age or deterioration on mobility sensory facilities and cognitive ability could impair their evacuation response.

1.6 The National Fire Chiefs Council and the National Fire Sprinkler Network have worked together to investigate the ‘Efficiency and Effectiveness of sprinkler systems’. This report indicates that where installed, sprinkler systems operate on 94% of occasions, demonstrating very high reliability. Furthermore, it is evident that when they do operate, they extinguish or contain the fire on 99% of occasions which demonstrates that they are very effective. The research also found that in both converted and purpose built flats, sprinklers are 100% effective in controlling fires.

1.7 It has become evident, for the retrofitting of AFSS, that local authorities, social housing partners, care operators, housing associations, private landlords and others in the housing sector have limited knowledge and/or experience of the systems available and their design parameters.

1.8 This document provides practical guidance and advice on issues that should be considered in the design and installation of the retro-fitting of a domestic/residential AFSS in the following stages:

- Pre installation
- During installation
- Post Installation
2 Automatic Fire Suppression Systems

2.1 There are a range of different types of AFSS used in domestic/residential premises.

2.2 Such systems are designed to detect a fire and then control and suppress it, thus preventing the spread of the fire. AFSS in their simplest form consist of a network of pipes charged with water from a water main or fire pump and tank. Nozzle heads are fixed to the pipework for the locations to be protected.

2.3 A common myth is that when one nozzle head operates they all actuate. This is not the case. Nozzle heads are activated by heat, only the nozzle head nearest to the fire will actuate when the temperature is between 68 – 74 degrees Celsius.

2.4 Two of the most widely used types of nozzle heads are the Pendant and Concealed. Both can be wall or ceiling mounted, the pendant nozzle could be used when there is insufficient space to fit a concealed nozzle head.

Concealed nozzle head  Pendant Nozzle

2.5 AFSS should be designed and installed in accordance with the following standards for residential/domestic premises:

- **BS 9251:2014** Fire sprinkler systems for domestic and residential occupancies-Code of practice for design and installation.
- **BS 8458:2015** Fixed fire protection systems-Residential and domestic watermist systems-Code of practice for design and installation.
- **LPS 1655:Issue 1**, Requirements and Test Methods for the LPCB Approval and Listing of Personal Protection Watermist Systems

2.6 BS 9251:2014 is the most widely used standard for domestic and residential occupancies. However, it is anticipated that this standard will be withdrawn in 2018 and replaced with European standard EN 16925.

2.7 For a BS8458 watermist system to be accepted for use in a building, it is necessary to undertake a full review of a particular system in the context that it will be used. This is because individual manufacturers of watermist systems have their own design specifications. System variations include nozzle type, nozzle spacing, maximum and minimum operating pressures and flow rates. Essential parameters that need to be considered are fire load and compartment volume.

2.8 A key part of this review is a requirement to demonstrate the effectiveness of the system in fire performance tests that are appropriate to the real life application. These fire performance tests
are now specified in the standards that cover residential and commercial watermist fire suppression systems.

2.9 It is recommended that the appropriate data sheets are requested for the mist nozzles confirming that the nozzle has passed testing as per BS8458 at a laboratory such as Warrington FIRAS or the Building Research Establishment.

3 Legislation

3.1 In England, there is no obligation on housing providers/developers to install AFSS for a retrofit in existing dwellings whatever the height.

3.2 For life safety, new purpose built residential blocks over 30m high must be fitted with AFSS in accordance with the requirements of Approved Document B (Fire safety) Volume 2 - Buildings Other Than Dwelling Houses.

4 Mobility Scooters

4.1 The position of the LFB regarding mobility scooters is that the provision of an AFSS does not compensate for allowing a mobility scooter to be parked/charged in the protected route.

4.2 Where the premises is a high rise (18m+) residential building with a cladding system which does not fully conform to Building Regulations Guidance, a zero tolerance to mobility scooters being stored or charged within the common parts is likely to be necessary.

4.3 It should be noted that fire testing is currently being completed for development of a non flammable scooter.

4.4 If it is identified that an engineered solution or a compensatory feature is proposed for the storage/charging of mobility scooters that includes the provision of AFSS we request contact is made with the LFB Sprinkler Coordinator Email: SPRINKLERS@london-fire.gov.uk.

4.5 Further guidance can be found in the National Fire Chiefs Council (NFCC) publication "Fire Safety In Specialised Housing" where a number of solutions are proposed for the safe storage and charging of these vehicles.

5 Personal Protection Systems

5.1 The current range of Personal Protection Systems (PPS) are local application watermist systems designed to detect and suppress a fire at a very early stage before significant heat and smoke has developed and caused serious injury.

5.2 They are designed to protect vulnerable persons in residential and domestic occupancies. PPS are a semi portable risk reduction measure which means that they can be quickly installed to protect a vulnerable person and also moved or re-used as required.

5.3 They are not a substitute when coverage is required to all areas, where a BS 8458:2015 or BS 9521:2014 compliant system would be the required standard.

5.4 Currently there are only a few manufacturers of PPS and a limited number of installations, however, they are becoming increasingly popular. In particular local authorities and housing providers are deploying these systems where vulnerable residents are identified as being at risk from fire and are likely to have difficulties in self evacuating.

5.5 PPS manufacturing companies have carried out their own bespoke tests and demonstrations over the past few years however, there is now a recognised testing standard. Building Research
Establishment Global (BRE) have now published a testing standard - LPS 1655 - "Requirements and test methods for LPCB approval and listing of personal protection watermist systems 2015".

5.6 LPS 1655 is a specification which outlines the test criteria and minimum levels of performance for PPS, it will not assist the end user in confirming if a PPS is suitable given the vulnerable persons characteristics and home environment.

5.7 To overcome this BRE Global (Building Research Establishment) has co-authored guidance with the LFB on identifying vulnerable people at risk and assessing when a PPS or other measures should be implemented. This guidance is available in the published document ‘Guidance on the use, deployment and limitations of personal protection watermist systems in the homes of vulnerable people’.

6 Pre-Engineered Residential Water Mist Suppression Systems

6.1 Pre-engineered systems are packaged systems where the hydraulic design has been pre calculated by the manufacturer to eliminate the need for engineering work beyond the original product design. Due to the design of these systems it must be understood that it may not be possible for them to comply with BS 8458:2015 due to various elements of their design falling outside of the scope of the standard, and these systems may not comply with Building Regulations.

6.2 These systems are increasingly being applied by designers to domestic occupancies, including blocks of flats.

6.3 Proposals to apply these systems are being submitted to the LFB as part of Building Regulations and HMO (Houses Multiple Occupancy)/Housing Act consultations as an alternative to providing BS9251:2014 or BS8458:2015 Automatic Fire Suppression System protection in blocks of flats.

6.4 Examples of where these systems have been proposed to fire safety teams to justify/support designs include:

- Open plan flat designs, i.e. where BS9991:2015 (Fire safety In the design, management and use of residential buildings) guidance is being adopted.
- Where restricted fire service access and facilities exists, for example developments situated more than 45m from fire appliance access.
- To compensate for the non-provision of common lobbies between flats and protected escape routes.

6.5 While the use of these systems may be acceptable in some circumstances – for example, as an enhancement to an otherwise code-compliant fire safety design scheme – for consistency, where one of the above water mist fire suppression systems are proposed, contact should be made with the appropriate Authorities Having Jurisdiction (AHJ) – Organisations/individuals responsible for enforcing requirements of legislation/standards – for further guidance.

7 Pre Installation

7.1 When considering installation of AFSS, the responsible person should seek advice in the early design stages; communication is crucial between all the relevant stake holders. It is strongly recommended advice is sought from the LFB and the fire sprinkler industry:-

- LFB have a designated Coordinator who deals with AFSS enquiries, contact email :- SPRINKLERS@london-fire.gov.uk.
- Residential Sprinkler Association, a non-profit organisation providing support to the residential sector.
• **British Automatic Fire Sprinkler Association**, the UK’s trade association for the fire sprinkler industry, whose primary objectives include providing authoritative information on the benefits of AFSS and how sprinklers can play a significant role in saving life and property from the devastating effects of fire.

7.2 The responsible person should choose a contractor with care and confirm all trades are suitably qualified, with the appropriate third party accreditation. Within the building regulations, **Approved Document B (Fire safety) Volume 2-Buildings Other Than Dwelling Houses**, identifies the need for third party accreditation.

• **FIRAS** is a voluntary, third party certification for installation contractors of both passive and active fire protection systems, operated by Warrington Certification, and accredited by UKAS to EN 45011.
• Further guidance can be found in the **BAFSA Information file Third Party Certification, number 20**
• **Loss Prevention Certification Board (LPCB)** offers third-party approval confirming that products and services have met and will continue to meet these standards.
• **IFC Certification Ltd** is a UKAS accredited and internationally recognised provider of high quality, customer focused, independent, third party certification.

**Feasibility Study**

7.3 It is advisable for the client to ascertain the suitability of the existing building construction and services for the retro-fitting of AFSS. Being immediately able to identify areas that may prove impracticable is advantageous.

7.4 It is recommended that guidance is sought from an approved suppression contractor with third party accreditation who has expertise in accordance with the aforementioned British Standards.

7.5 The designer should, at an early stage, ensure that consultation has taken place with any relevant Authorities Having Jurisdiction (AHJ) or others who might have a direct interest in the installation, allowing the appropriate AFSS to be integrated into the overall design.

7.6 **Areas to be considered include**: -

7.7 Sample individual dwelling layouts in the building with assessment of the following:
• Routes of horizontal pipe work and the necessity for core holes to be formed
• Existing electrical and mechanical services that may be affected including the dwelling fire alarm, if appropriate.

7.8 Communal areas, floors, entrances, corridors, plant rooms with assessment of the following:
• Location of existing risers and suitability for use as AFSS risers or drops
• Location of proposed new risers if the existing riser is unsuitable
• Routes of horizontal and vertical pipe work and the necessity for core holes to be formed/flooring removed
• Existing electrical and mechanical services that may be affected including the premises fire alarm if appropriate/telecare remote monitoring
• Location of isolation valves

7.9 Drawings/plans, if available should be provided to the AFSS contractor:
• Construction, room shape, dimensions
• Structural beams, steelwork
• Services, mechanical i.e. water services, plant locations electrical

7.10 Identify water supplies:
• Town mains
• Cold water tanks and booster pumps
• Dedicated tank and pump - identify possible sites with consideration to using structural engineers who may recommend joists/flooring to be reinforced

Cost/value for money
7.11 Costing can vary depending on whether the project is a new build or a retrofit. An analysis of retrofitting work in high rise residential blocks completed from 2012-2017 by the Residential Sprinkler Association confirms that costs per flat average between £1500 and £2500.

7.12 These figures are further endorsed by the 2014 LFB Sprinkler Match Competition, a competition designed to promote the Authority’s AFSS strategy and to assist in protecting London’s vulnerable people by increasing the number of AFSS in vulnerable persons homes in London. Local Authorities and private housing providers could apply for match funding to assist meeting the costs of installing AFSS.

7.13 One of the successful Sprinkler match applicants, the London Borough of Barking & Dagenham obtained funding to provide a BS9251:2014 system for four specialised housing units, the average individual cost per flat for one of the schemes was £1,632.00.

<table>
<thead>
<tr>
<th>Individual flats</th>
<th>£1,632.00</th>
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<tbody>
<tr>
<td>Total for all 35 flats</td>
<td>£57,120.00</td>
</tr>
<tr>
<td>Total cost for the common parts including Atrium area</td>
<td>£14,980.00</td>
</tr>
<tr>
<td>Total overall cost</td>
<td>£72,000.00</td>
</tr>
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7.14 The system is bespoke; the more valve groups (flow switch/isolation valve) you have, the greater the cost, which could increase the overall price by 25%. Therefore consideration has to be given to the occupancy of the building, cause and effect and premises emergency plan.

7.15 Extent of protection: Where AFSS is to be installed to mitigate a deficiency then a part install is unlikely to be sufficient. All dwellings/flats should be retrofitted in accordance with the relevant standard, any deviations from this standard should be agreed with the AHJ.

7.16 The Premises Fire Risk Assessment is be completed/reviewed taking into consideration the benefits to both the premises, the occupants and any vulnerable persons; in the areas where the AFSS system is to be installed.

7.17 Consideration should be given to the guidance provided in the National Fire Chiefs Council publication Fire Safety in Specialised Housing regarding AFSS back up pumps/stand by power supplies. Further commentary regarding power supplies, cabling and installation can be found in BS9991:2015 Fire safety in the design management and use of residential buildings where alternative solutions are referred to.

Landlord & Tenant Issues
7.18 In residential high rise blocks a significant percentage of dwellings may be found to be leasehold. These residents own their homes and pay a service charge to the landlord for servicing and cleaning of common areas and general maintenance/repair.

7.19 Depending on the lease agreements it may be found that the landlord does not have a legal right to access the leasehold dwellings to install/maintain a retrofitted AFSS.
7.20 If this is the case, the proposed works would require full consent of the leaseholder. Prior to the start of the proposed installation, it is recommended that a formal consultation process with the premises leaseholders is commenced in accordance with the Commonhold and Leasehold Reform Act 2002.

**Communication with Residents**

7.21 It is recognised that in order to complete the installation successfully whilst the premises is occupied, the full support and cooperation of the residents is required.

7.22 Consider “Meet the Builder” meetings before the planned commencement of the installation programme, allowing residents concerns to be addressed regarding AFSS. This was successfully demonstrated in the Sheffield Low Rise Sprinkler Installation project & Callow Mount Sprinkler Retrofit Project.

7.23 The provision of resident information packs are recommended in order to explain the scope of the works focusing on sprinkler facts/myths/frequently asked questions.

7.24 Alternatively, consideration should be given to the appointment of a Communications Consultant to develop a consultation strategy. The primary objective being to encourage local residents to fully engage in the proposal.

7.25 It is crucial that homeowners/residents understand how sprinklers operate. The publication ‘Householders guide to sprinklers’ provides specific information for new homeowners on domestic fire sprinkler systems. This guidance is produced by the Welsh Government, and provides suitable guidance on AFSS in residential premises that can be applied across the UK.

**Water Supply**

7.26 For a small AFSS connecting to the existing supply within the property is the most cost effective method of supplying water to the installation.

7.27 In the event that the existing supply is not suitable, an application will need to be made to the water authority for a water supply upgrade. Your sprinkler contractor will assist in completion of this application, as the authority will require details of the flow and pressure required for the proposed system. This will determine if the water pressure is adequate and what diameter supply pipe will be required, typically 32 or 50mm. The water authority will upgrade the supply from the town main to the boundary of the property. The pipe from this point will need to be installed by others. This pipe will then be connected to the AFSS valve group.

7.28 Alternatively, if the current cold water tank and cold water booster sets are adequate they can be used to drive the AFSS.

7.29 In the event the existing supply is not suitable a static bespoke water storage supply can be used with a bespoke pump, the capacity dependent on the system design. A system in a domestic property must be capable of putting water on the fire for a minimum of 10 minutes and will typically require a storage capacity of between 500 and a 1000 litres. For a residential system the run time must be 30 minutes and will require a minimum water storage capacity of 6000 litres. In accordance with the appropriate standard.

7.30 The water sector regulator Ofwat sets the standards covering the flow and pressure of water supplies which are specific to domestic/residential properties.

7.31 Flows and pressure will vary throughout the day, seasonally and supplies may be interrupted at any time for various other reasons. The water company may need to carry out planned and
unplanned maintenance on its network and on rare occasions the network can be affected by third party activity.

7.32 All of these factors mean that flow and pressure cannot always be guaranteed. It is paramount that the designers take these factors into account when designing a system that relies on direct mains flow, pressure and continuity of supply for their satisfactory operation.

7.33 Consultation and approval from the water company will always be required for AFSS installations where it is necessary to connect to the water mains or where a larger diameter main is required to achieve the necessary AFSS flow rates.

7.34 Further information is available in the following publications “Guideline For The Supply Of Water To Automatic Fire Sprinkler Systems”, published by Water UK alternatively Thames Water have produced a sprinkler connection policy.

Microbial Risk
7.35 There are a number of guides and regulatory documents that should be referred to when managing the risk of legionella in fire sprinkler systems one such publication is RC63: Recommendations for minimising the impact of legionella in firefighting systems developed thorough RISCA Authority, published by the Fire Protection Association.

AFSS Alarm Device
7.36 Confirmation is to be sought prior to the start of the project on how the AFSS alarm system is to be incorporated into the fire strategy. In accordance with the standard the device should initiate an AFSS alarm signal instigating the appropriate emergency procedure.

7.37 In high rise residential blocks the alarm may be configured to serve an alarm zone, rather than each individual dwelling provided:

(a) the alarm zone should cover no more than a single floor

(b) Individual dwellings should be fitted with an BS5839 Part 6 2004, LD1 alarm* connected to suitable control and indicating equipment in accordance with the appropriate BS Standard.

*A system installed throughout the dwelling incorporating detectors in all circulation spaces that form part of escape routes and all areas where a fire might start, other than bathrooms, shower rooms or toilets.

Maintenance
7.38 Consideration should be given to ensure a maintenance regime is in place prior to the installation warranty expiring. It is highly recommended that the servicing is completed by reputable sprinkler companies accredited with appropriate third party accreditation.

8 During Installation

8.1 It is best practice that site management should be informed as early as possible to ensure the AFSS requirements are taken into account regarding future work, and resolve any arising issues resulting from or impacting on the AFSS.

8.2 On appointment of a contractor, method statements should be agreed, stipulating processes and sequence of works including:

• Temporary and permanent fire stopping procedures for duration of installation works

• Liaising with other trades
• Systems to be enclosed/concealed, ensure pressure testing is run prior to final enclosure. (Post install leakage in concealed spaces will lead to additional works and expense)
• Ensuring compressive checking systems are put in place to snag and de-snag all areas
• Unwanted fire signals (UwFS) hot works, arrangements are to be made by the responsible person raising the awareness of false alarms and UwFS.

8.3 Where variations of design are identified, agree deviations as soon as possible. Look to the contractor to provide alternative solutions.

8.4 Protection of installation: Malicious damage is not a major issue however consideration should be given to:
• Concealed sprinkler heads and pipe work
• Keeping sprinkler controls out of public areas, restricting access
• Routing of pipework within communal areas
• Ensuring building security throughout duration of contract
• Agreeing site storage areas within the blocks and ensuring these are kept tidy
• Design features to stop occupants tampering with component lockable locks provided on individual isolation valves if fitted

9 Post Installation

9.1 Commissioning of the system is to be completed in accordance with the appropriate standard with consideration to the attendance of the LFB for larger Residential premises including High rise/Specialised Housing and care homes. This will allow Operational Crews/Fire Safety Inspecting Officers to familiarise themselves with the fixed installations and update records accordingly.

Information for the LFB

9.2 Increasingly, fixed fire safety installations are being incorporated into buildings. Attending crews may have to interact with these systems and therefore need accurate, concise and up to date information when developing firefighting tactics.

9.3 The indicator panel is to be located at an appropriate location for both staff and firefighters responding to a fire/AFSS signal. This should normally be in an area on the ground floor close to the entrance of the building likely to be used by The LFB, or a suitably sited, continuously staffed control room.

9.4 Following the actuation of the system, water damage can be a major issue, particularly if insufficient information is available allowing operational crews to isolate the supply following the successful extinguishment of the fire.

9.5 It is recommended that arrangements are made allowing the locations of the isolation valves to be identified/isolated as required.

9.6 In addition to the standard, consideration should be given to the provision of Premises Information Boxes. These plans boxes will provide information which should be simple and useable relating to your building. The information contained is immediately available to the LFB on arrival.

9.7 Further guidance can be found in the Fire Safety Guidance Note 70, LFB Premises Information Boxes. available from our fire safety admin team, email: FSR-AdminSupport@london-fire.gov.uk
9.8 Block/schematic plans showing coverage of the system is to be displayed adjacent to the AFSS alarm/fire alarm panel clearly indicating the location of the AFSS tank room/isolation valve and relevant signage.

10 Further information


Prior to the Welsh statutory requirement for sprinklers to be installed in all new and converted flats from 1st January 2016, the Welsh Government provided funding for the installation of a number of sprinkler systems in social housing schemes in Wales. The objective of this initiative was to undertake research into the issues associated with the design and installation of sprinkler systems, including costs.

10.2 Callow Mount Sprinkler Retrofit Project, A project funded and directed by the British Automatic Fire Sprinkler Association (BAFSA) for the Sprinkler Coordination Group (SCG) with the main objective of seeing if it was practical to fit a sprinkler system without relocating residents in a high rise block.

10.3 Sheffield Low Rise Sprinkler Installation report, Sheffield City council identified a serious fire risk potential in a specific type of property in their property portfolio with a decision taken to install a suppression system in 540 individual ranch style properties sited in four locations.

10.4 Thames Water This publication is a clear and concise Asset management policy “Fire Fighting Supplies in Domestic, Commercial and Industrial premises” it should be noted that every water company have a different set of standards.

10.5 Water Uk, “Guideline For The Supply Of Water To Automatic Fire Sprinkler Systems” This guide has been developed to reflect the legislative framework at the time of writing.

10.6 Fire Safety In Specialised Housing, This guide provides specific guidance regarding the provision of Automatic Fire Suppression Systems in Specialised Housing.

10.7 Studley Green Experience: Ten years on. This report details the success on the UK’s first large scale fitting of sprinklers in social housing.

11 Acknowledgements

11.1 London Fire Brigade would like to acknowledge the contributions and support of the following:

- British Automatic Fire Sprinkler Association
- Water UK
- Residential Sprinkler Association
- National Fire Chiefs Council
- National Fire Sprinkler Network
12 Bibliography

Detailed guidance on the various standards referred to in this guidance note may be obtained from the following bibliography. You can also obtain fire safety advice on other subjects by visiting the LFEPA’s website at [www.london-fire.gov.uk](http://www.london-fire.gov.uk).

The publications can be obtained from the following addresses:

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<td>UK</td>
<td>(This should be considered if the use of BS9251:2014/BS 8458:2015 is not suitable /adequate for a specific premises)</td>
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<td>Redbook Live</td>
<td>LPS 1655 - 1.0 - Requirements and test methods for LPCB approval and listing of local application watermist systems for use as Personal Protection Systems (PPS) in residential and domestic occupancies within buildings.</td>
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The above publications are current at the time of preparation of this Guidance Note (see date in footer).

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