Llywodraeth Cymru
Welsh Government

Automatic water mist systems for domestic and residential premises

Guidance

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Acknowledgement

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Introduction and background

Automatic fire suppression and Building Regulations in Wales

In April 2011, The Domestic Fire Safety (Wales) Measure brought in the mandatory requirement to provide automatic fire suppression in new residential premises in Wales. This was enacted in 2013 by Regulation 37A (Provision of automatic fire suppression systems) of the Building Regulations 2010 and the commencement of parts of the Domestic Fire Safety (Wales) Measure 2011.

Approved Document Part B (Wales) volumes 1 and 2 provide guidance on compliance with the requirements of these regulations. This refers to BS 9251 (*Fire sprinkler systems for domestic and residential occupancies. Code of Practice*) as the main standard by which the regulatory requirement can be met for domestic and residential occupancies. Where residences fall outside the scope of BS 9251, the relevant standard is BS EN 12845 (*Fixed firefighting systems – Automatic sprinkler systems – Design, installation and maintenance*).

Approved Document Part B (Wales) states “There are many alternative or innovative fire suppression systems available. Where these are used as an alternative to residential sprinklers, it is necessary to ensure that such systems have been designed and tested for use in domestic and residential buildings and are fit for their intended purpose.”

Note that the "use of water mist systems as a compensatory feature” referred to in BS 8458: 2015 (*Fixed fire protection systems. Residential and domestic watermist systems. Code of practice for design and installation*) is not applicable as the provision of fire suppression systems are now a regulatory requirement in Wales.

Automatic water mist system for domestic and residential buildings

An automatic water mist system is one type of alternative suppression system to residential sprinklers.

Water mist systems are seen as an evolving technology in the market but are sensitive to small design changes. Therefore, the successful implementation of a water mist system requires an in-depth knowledge of the system and its intended application.

Water mist systems have been demonstrated to be suitable and effective for the protection of spaces on board ships and are increasingly being used for life safety building applications. They have successfully been applied to protect assets, e.g. electronic equipment, machinery spaces and deep fat fryers in buildings and are currently being considered for a range of building applications, e.g. for domestic and residential premises.

Purpose of guidance

This guidance on automatic water mist systems is primarily intended for use by Building Control Bodies to assist them in assessing water mist systems for new and converted domestic and residential buildings in Wales, i.e. water mist systems for:

- new buildings
- conversions for existing buildings (change of use)
- extensions of an existing building already having a water mist system.

However, this guidance is also useful for automatic water mist system manufacturers, designers and installers as it details the essential information and supporting data required by Building Control Bodies. This guidance also suggests when it may be appropriate to obtain independent specialist advice. This is not a regulatory document. It should be read in conjunction with BS 8458: 2015 (*Fixed fire protection systems. Residential and domestic watermist systems. Code of practice for design and installation*).

This guidance applies to the majority of building types covered by Approved Document Part B (Wales) of Purpose groups 1a, 1b, 1c, 2a and 2b constructed in Wales, with the exception of hospitals, hotels, prisons and short stay hostels used for leisure purposes. This guidance also applies to homes for children under the age of 18 under the Domestic Fire Safety (Wales) Measure 2011.

Assessment of water mist systems requires case by case review. This guidance contains a checklist to assist Building Control Bodies in coming to a judgement on the suitability of a particular water mist system for life safety purposes in specific residential and domestic building applications.

This guidance also contains two example declarations of conformity forms: a) MDOC, manufacturer's declaration of conformity, for water mist nozzles and fire testing; and b) CDOC, Contractor's declaration of conformity, for design, installation and commissioning of a water mist system, for verification against the requirements of BS 8458: 2015.

This guidance does not cover local, portable or personal protection water mist systems.

Terms used

Authority having jurisdiction is an organisation, office, or individual responsible for enforcing the requirements of legislation or standards, or for approving equipment, materials, an installation, or a procedure.

Automatic water mist system is a distribution system connected to a water supply, fitted with one or more water mist nozzles and intended to control, suppress or extinguish fire.

Building control body is the local authority building control or the private approved inspector.

CDOC is a contractor's declaration of conformity form for design, installation and commissioning of a water mist system.

High pressure water mist system is a water mist system in which the system pressure is greater than or equal to 35 bar.

Local water mist system is a water mist system designed to discharge water mist directly onto an object or hazard. These systems have been installed to protect inside enclosures, unenclosed objects within buildings. (*Not covered in this guidance)*

Low pressure water mist system is a water mist system in which the system pressure is less than or equal to 12 bar.

Manufacturer's design and installation manual is a document containing design and installation instructions for all details of a water mist system.

Maximum operating pressure is the manufacturer-specified maximum pressure at a nozzle inlet with water flowing.

Maximum standby pressure is the maximum pressure to which the installed nozzle is exposed due to the effects of the pressure maintenance device and head of water, as specified by the manufacturer.

MDOC is a manufacturer's declaration of conformity form for water mist nozzles and fire test results.

Medium pressure water mist system is a water mist system in which the system pressure is between 12 and 35 bar.

Minimum operating pressure is the manufacturer-specified minimum pressure at a nozzle inlet with water flowing.

Minimum standby pressure is the minimum pressure to which the installed nozzle is exposed due to the effects of the pressure maintenance device and head of water, as specified by the manufacturer.

Operating pressure is the range of pressures between minimum and maximum operating pressures.

Personal protection water mist system is an automatic fire suppression system, fitted with one or more water mist nozzles and intended to suppress a fire in a defined area of a dwelling.

Residential sprinkler system is an automatic sprinkler system for domestic and residential premises, designed, installed and maintained to British Standard BS 9251 or BS EN 16925. *(Not covered in this guidance).*

Standby pressure is the pressure held in system pipework prior to system operation. This can be lower or higher than the operating pressure.

Water mist contractor is a contractor who is appropriately assessed, qualified and experienced to carry out design, installation and maintenance of water mist systems.

Water mist manufacturer is an organisation responsible for manufacturing water mist systems, including nozzles, and for producing the water mist system design manual and commissioning the fire test programmes to which it is linked.

Water mist nozzle is a component, with one or more orifices, which is designed to produce and discharge water mist automatically, held closed by an integral quick-response thermal release element.

Wet pipe system is a system in which the pipework is always charged with water.

Wholesome water is water suitable for human consumption, also see Water Supply (Water Fittings) Regulations.

Automatic water mist systems for domestic and residential premises

A water mist system is a fixed fire protection system, comprising components for automatic detection and actuation, water supply, delivery and water atomisation. A water mist system discharges a spray of small water droplets from the operating nozzle(s).

A system is designed to generate, distribute and maintain a concentration of small droplets for sufficient time to control and suppress a fire and meet the fire protection objectives. Water mist systems for domestic and residential premises are systems that achieve control of or suppress the fire. Water mist systems are described as either low pressure (lower than 12 bar), medium pressure (12 to 35 bar), or high pressure (above 35 bar, often circa 100 bar).

The pressure of a water mist system is directly associated with safety risks of the installation. Typically, low pressure systems are considered lower risk, while medium and high pressure systems present more of a challenge and more rigorous risk assessments are required. Hazards to occupants that should be assessed during the lifetime of the system include water at pressure and projectiles. Examples of possible causes of these hazards are trapped air, loose connections, insecure fittings, blockage of nozzle, damage to system and inadvertent interaction by occupants. Therefore, for a domestic and residential occupancy with a high pressure system or one with stored pressure cylinders, specific mitigation measures should be formally addressed.

The Pressure Equipment Directive (PED) 2014/68/EU applies to design, manufacture and conformity assessment of pressure equipment and assemblies of pressure equipment with a maximum allowable pressure greater than 0.5 bar, with the conformity requirements for manufacturing, design and installations becoming more onerous with increasing stored energy i.e. pressure times volume.

The Construction (Design and Management) Regulations 2015 (CDM 2015) are intended to ensure health and safety issues are properly considered during a project's development so the risk of harm to those who have to build, use and maintain structures is reduced. Domestic clients (non-commercial clients) have roles and responsibilities, which are normally passed to the contractor to ensure that all hazards are considered and mitigated. This could include on-going maintenance of risk mitigating items required by the domestic client.

In Wales, high pressure systems have been selected for domestic and residential buildings when installation advantages have been found. It should be noted that these systems will have critical ongoing requirements for the safety of people and any specific risk mitigation measures.

Water mist systems are single supplier systems; each supplier's product is distinctly different, and each installation and design is distinctly different. For instance, it is not generally possible to exchange the components (e.g. nozzles) from one manufacturer into an installation that has been designed for another manufacturer's components.

Water supplies

Water supply arrangements are: an automatic fire pump drawing water from a tank, an automatic fire pump drawing water from a town mains water supply or a regulated pressurized vessel (e.g. a cylinder).

If a direct town mains connection or a reduced capacity tank (where infill is required) is being considered, it is important to establish that the town mains will be adequate. At the design stage, the water mist supplier will determine whether this is the case in consultation with the water supply company. If the supply is insufficient or unreliable, a stored water supply should be used.

Where a stored water supply is chosen, a typical water supply arrangement would be an automatic fire pump drawing water from a tank with automatic infill. The tank can be dedicated to the system, or there can be a reserved portion of the tank allocated for water mist use.

Although the principal fire-fighting media in water mist systems is water, additives can be introduced to enhance the fire protection requirements and/or provide corrosion protection and/or provide frost protection. The media can be of the following types:

a) wholesome water

b) water with antifreeze

c) water with chemical additive(s)

d) water with inert gas or air.

Water mist systems for use in domestic and residential premises will typically utilise wholesome water. Water quality over the design life of the system is important to ensure water mist systems operate effectively.

Water mist system supplies should be reliable and provide sufficient flow and pressure to satisfy the system design requirements.

For a water mist system directly connected to the town mains, the water mist system should fully comply with national water regulations and permission for a water supply connection to the water mist system should be sought from the appropriate water supply company, at the earliest opportunity in the design process.

Other issues that need to be considered are:

- Suitable connections, pipes, and fittings, including backflow prevention devices, should be used for systems connected to the town mains.
- When the domestic water supply is metered, and a direct connection from the town mains to the water mist system has been agreed with the water supply company, the metering of the required supply of water to the water mist installation in a premises in Wales is subject to water company requirements/policy.
- The water supply should be tested during the commissioning process to establish that the design flows can be achieved at the water mist system test connections at the time of peak demand and, in some cases, at other times of concern.
- Suitable strainers and other means for control of contaminants and foreign bodies, avoidance of corrosion and prevention of bacterial growth.
- Protection measures against freezing, e.g. installing pipework within the heated envelope of the building, trace heating and the use of lagging.

Compared to sprinklers, water mist nozzles have smaller orifices which are more susceptible to blockage. Strainers are used to filter out any dirt particles or other debris in the water. Strainers should be installed at the water supply to the system, in each water supply connection, and at nozzles with small orifices. Strainers require on-going inspection and maintenance.

Water mist system detection and activation

Most water mist systems for use in domestic and residential premises will utilise automatic, glass bulb nozzles for fire detection and activation. Automatic nozzles contain a heat-sensitive device, which is usually a fluid-filled glass bulb holding a nozzle-sealing assembly closed against the water standby pressure. The thermal response characteristics of the nozzle will determine when and under what conditions the nozzle will operate. Nozzles for domestic buildings typically have glass bulb with a 'quick' thermal response and a 57°C or 68°C rating of nominal operating temperature.

When the liquid in the glass bulb reaches the predetermined nominal operating temperature when heated by the fire gases, the glass bulb shatters and the valve sealing assembly is released. This initiates a flow of water through the nozzle orifice(s). The falling standby pressure in the pipework is detected, the pump starts and delivers the operating pressure at the operated (open) nozzles. Water mist spray is produced and discharged into the room in the vicinity of the fire. This water flow should initiate an alarm inside the building. As only nozzles heated by the fire gases will operate, the number of nozzles that operate will depend on fire size and development. .

Alternatives to glass bulb nozzles are fusible link nozzles or nozzles activated by separate smoke detectors and actuators. Nozzles activated by separate smoke detectors and actuators are not covered in this guidance.

The delivery system from the water supply to the nozzles includes pipework, fittings, strainers (filters) and valves.

Water mist systems for use in domestic and residential premises should be wet pipe systems, i.e. ones which are permanently charged with water.

Water mist nozzles

There are several types of nozzle design for domestic and residential buildings being produced by different manufacturers. The nozzle design influences the performance of a water mist system. A water mist nozzle should be assessed to determine whether it has suitable water distribution characteristics and the capability to achieve its protection objective, as part of a system, established in fire performance tests.

Pendent, concealed, and sidewall nozzles are available:

- Pendent nozzles are usually installed immediately below the ceiling.
- Concealed nozzles are recessed into the ceiling and covered by a plate that detaches and falls away when affected by heat.
- Sidewall nozzles are mounted on the wall close to the ceiling.

Standards

Water mist systems for domestic and residential buildings should be designed, installed and maintained to an appropriate, fully implemented technical standard to ensure effective performance in the event of a fire and to satisfy Building Control Bodies.

Design, installation and maintenance standard

Principal standard BS 8458

BS 8458: 2015 *Fixed fire protection systems. Residential and domestic watermist systems. Code of Practice for design and installation* is the main British Standard covering water mist design, installation, water supplies, maintenance and testing for domestic and residential premises.

BS 8458 'primarily covers water mist systems used for life safety but might also provide property protection'. It contains recommendations for water mist systems installed in domestic and residential occupancies concerning their design, installation, water supplies, commissioning, maintenance and fire performance testing of installed systems.

In BS 8458, the system is categorised as either 'domestic occupancy' or 'residential occupancy'.

'Domestic' includes individual dwelling houses, individual flats, individual maisonettes, transportable homes, house of multiple occupation, bed and breakfast accommodation, boarding houses and blocks of flats 18m or less in height with a maximum total floor area of 2,400 m^2.

'Residential' includes blocks of flats greater than 18 m in height, sheltered and extra care housing, residential care premises, residential rehabilitation accommodation, dormitories and hostels.

This standard primarily covers buildings up to 45 m in height.

BS 8458 can be applied to maximum room sizes of 8 m by 4 m (or 32 m^2), 10 m by 5 m (or 50 m^2) or 80 m^2 (depending on nozzle spacing and relevant successful fire performance test results) and a maximum room height of 3.5 m or 5.5 m (depending on relevant successful fire performance test results).

Because of the bespoke nature of water mist systems, this British Standard contains 'generic rules' rather than 'prescriptive design rules'. Therefore, successful results in all of the BS 8458 specified fire performance tests are critical and necessary to determine the systems design and components characteristics.

Components standards

Water mist nozzles standard BS 8663 Part 1

BS 8663 Part 1: 2019 (*Fixed fire protection systems - Components for watermist systems Part 1: Specification and test methods for watermist nozzles*) specifies requirements and gives test methods for the construction and performance of water mist nozzles for use in water mist systems. This includes automatic water mist nozzles for systems conforming to BS 8458.

Other water mist components standards

Draft BS EN 17450-1 (*Fixed firefighting systems - Water mist components – Part 1: Product characteristics and test methods for strainer and filter components*) specifies product characteristics and test methods for strainer and filter components for water supply connections and pipework in water mist systems. This has been prepared and is due to be published.

It is anticipated that other Parts of BS 8663 or BS EN 17450 for other water mist components such as valves and pumps will be prepared and published in due course.

Some of the components may not be specifically tested and approved for water mist applications; sprinkler and gas approvals for some components can be considered, e.g. valves, flow switches.

System fire performance tests

General

For a proposed water mist system for domestic or residential buildings, it is essential that fire performance tests to BS 8458 are carried out by a United Kingdom Accreditation Service (UKAS)-accredited test laboratory or equivalent.

The purpose of the tests is to assess the performance of the water mist system. These fire tests are representative of the domestic or residential premises and likely realistic fire scenarios.

The system tested should be the same as that proposed for an intended real application.

Additional ad hoc fire performance tests may be required for specific building applications. General fire demonstrations are not generally acceptable as technical evidence to demonstrate the performance of a water mist system. The relevant authority/authorities having jurisdiction should be consulted at all stages of any building application-specific fire test.

Results of fire performance tests are critical and necessary to determine the system's design and components characteristics as well as the permissible scope of application. For each manufacturer's equipment, fire tests are used to establish:

- the necessary number of nozzles
- nozzle locations
- nozzle spacing
- system flows
- system operating pressures
- other necessary design characteristics.

Fire performance tests are expected to include the following elements:

- objectives and assumptions
- agreed acceptance criteria
- water mist system design and components similar to proposed real installation (e.g. nozzle placement, system pressures, pressure at the nozzle, water application rates, concentration of any additive, nozzle type and water discharge duration)
- test enclosure(s) similar to the actual domestic or residential building including structure, appropriate room size(s) and appropriate ventilation conditions
- test fire(s) using appropriate and/or realistic fuel load arrangements(s) in different locations
- relevant measurements/instrumentation to measure parameters for acceptance criteria
- test results, analysis and conclusions

- thorough test programmes that include sensitivity analysis to check the robustness of the design.

Complete test reports from a UKAS-accredited laboratory or equivalent should be supplied to the relevant authority/authorities having jurisdiction.

BS 8458 fire tests

BS 8458 includes a baseline series of stylised simulated room fire tests against which the performance of water mist systems can be assessed. The size of the test room depends on the nozzle spacing (32 m^2 up to 50 m^2) and the ceiling height is 2.5 m. The tests cover different fire load positions and ventilation conditions.

BS 8458 includes an option for an additional series of fire tests for taller rooms with a maximum ceiling height of 5.5 m. BS 8458 includes an option for two additional open sided fire tests for larger rooms up to 80 m^2. Additives, if used, are taken into account in the tests.

The test fires last 10 minutes for domestic premises and 30 minutes for residential premises, measured from the operation of the first nozzle.

To pass each test the system shall suppress the fire for the duration of the test. The acceptance criteria involve recorded temperatures at specific locations not exceeding specified values, and non-operation of a nozzle external to the test room, in accordance with all clauses BS 8458 (e.g. 6.1 and Annex C).

The series of BS 8458: 2015 fire tests is summarised in Table 1 with their associated application limits.

Table 1 – Fire tests for a domestic and residential water mist system and associated application limits

	Fire test room	Fire tests	Application limits
Baseline series	Fire test room size dependent on nozzle spacing (8 m x 4 m or 10 m x 5 m) Ceiling height = 2.5 m	• Corner test (1) + • Fuel package between two nozzles test (1) + • Fuel beneath a nozzle test (1) + • Ventilation test (1) **Total of 4 tests**	Maximum ceiling height = 3.5 m Maximum room area = fire test room area
Series for larger rooms	Fire test room size dependent on nozzle spacing (8 m x 4 m or 10 m x 5 m) with two open sides Ceiling height = 2.5 m	• Open room tests (2) + • Baseline series (4) **Total of 6 tests**	Maximum ceiling height = 3.5 m Maximum room area = 80 m^2
Series for taller rooms	Fire test room size dependent on nozzle spacing (8 m x 4 m or 10 m x 5 m) Ceiling height = 5.5 m	• Corner test (1) + • Fuel package between two nozzles test (1) + • Fuel beneath a nozzle test (1) + • Ventilation test (1) + • Baseline series (4) **Total of 8 tests**	Maximum ceiling height = 5.5 m Maximum room area = fire test room area
Series for taller and larger rooms	Fire test room size dependent on nozzle spacing (8 m x 4 m or 10 m x 5 m) with two open sides Ceiling height = 5.5 m	• Open room tests (2) • Series for taller rooms (including baseline series) (8) **Total of 10 tests**	Maximum ceiling height = 5.5 m Maximum room area = 80 m^2

Third party approval of products and suppliers

Use of independent third-party approved products and suppliers

It is important that water mist systems for domestic and residential buildings are designed, installed, commissioned and maintained by specialist water mist suppliers who are suitably qualified and experienced. The components of domestic and residential water mist systems should be fit for purpose to ensure the effective performance of the system in the event of a fire and to satisfy the authorities having jurisdiction. The best way to ensure this is to use independent third-party certification schemes.

Components and systems approval

Water mist systems and components for use in domestic and residential buildings should have been successfully tested in accordance with appropriate, fully implemented technical standards, where available, and are third-party approved in accordance with these standards by certification bodies.

Building Control Bodies should require the components of water mist systems for domestic and residential premises to be third-party approved as evidence of compliance with the relevant British standards for the purpose of life safety approval.

Water mist components and systems not yet included in standards may be suitable for use. However, robust technical evidence produced by an accredited laboratory with relevant experience in the field of suppression technologies should be required as the minimum baseline against which to compare performance to prove they are appropriate for their intended purpose. This should be brought to the attention of the Building Control Body and confirmed at the earliest possible opportunity.

LPCB operates various approval schemes for fire suppression components and systems. These all require the approval and surveillance of the manufacturer's quality management system to BS EN ISO 9001 (*Quality management systems. Requirements*). They also require the assessment and surveillance of the manufacturer's factory production control system to ensure that components are consistently manufactured to an appropriate quality, regular audit testing of the components, and a system design review. Approved products are marked with the LPCB logo and listed in the LPCB Red Book Live.

Systems approval

Unlike sprinkler systems, where the key requirements are addressed in the design and installation standard, water mist systems have key requirements embedded in the manufacturer's design and installation manual which are determined from manufacturer owned test data. Therefore, additional work is required to confirm compliance. A complete system approval requires:

1) an assessment of all components (e.g. drawings, datasheet, material)
2) an assessment of the manufacturer's design and installation manual (identifying components, bespoke design criteria not detailed in BS 8458 but needed to comply with the standard, i.e. system arrangements for the successful completion of all full-scale fire tests)
3) an assessment of a design/installation against the requirements of BS 8458

4) an assessment of full-scale fire tests, as detailed in the relevant fire test report/s

5) system design methodology, including use of hydraulic calculations.

Confirmation of the limits of the application for the water mist system. The LPCB approval of water mist systems employs all the above list items, e.g. individual component approval and complete system fire performance to be assessed.

LPS 1283 (*Requirements and test methods for the certification of watermist systems for use in commercial low hazard occupancies*) is the LPCB scheme for commercial low-hazard occupancies.

LPS 1285 (*Requirements and test methods for the approval of watermist systems for use in domestic and residential occupancies*) is the draft LPCB scheme for residential and domestic water mist systems which is available on demand.

Installer approval

Building Control Bodies should require installers of water mist systems for domestic and residential premises to be third-party approved. Third-party certification schemes for fire protection products and related services are an effective means of providing the fullest possible assurances, offering a level of quality, reliability and safety.

For example, the LPCB operates certification schemes for installers of fire suppression systems in buildings that require the random inspection of examples of work carried out by the installers. Approved installers are listed in the LPCB List of Approved Fire and Security Products and Services known as the Red Book. The LPCB is developing a UK third-party certification scheme for water mist installers for use with LPCB-approved water mist products. This will be launched once a manufacturer has successfully completed a system approval to LPS 1285. Under these installer certification schemes, a third-party Certificate of Conformity is issued for each system installed. This certificate states that the system meets the requirements of a particular standard, BS 8458 in this case, along with any deviations agreed with the authority having jurisdiction and justification for the deviation.

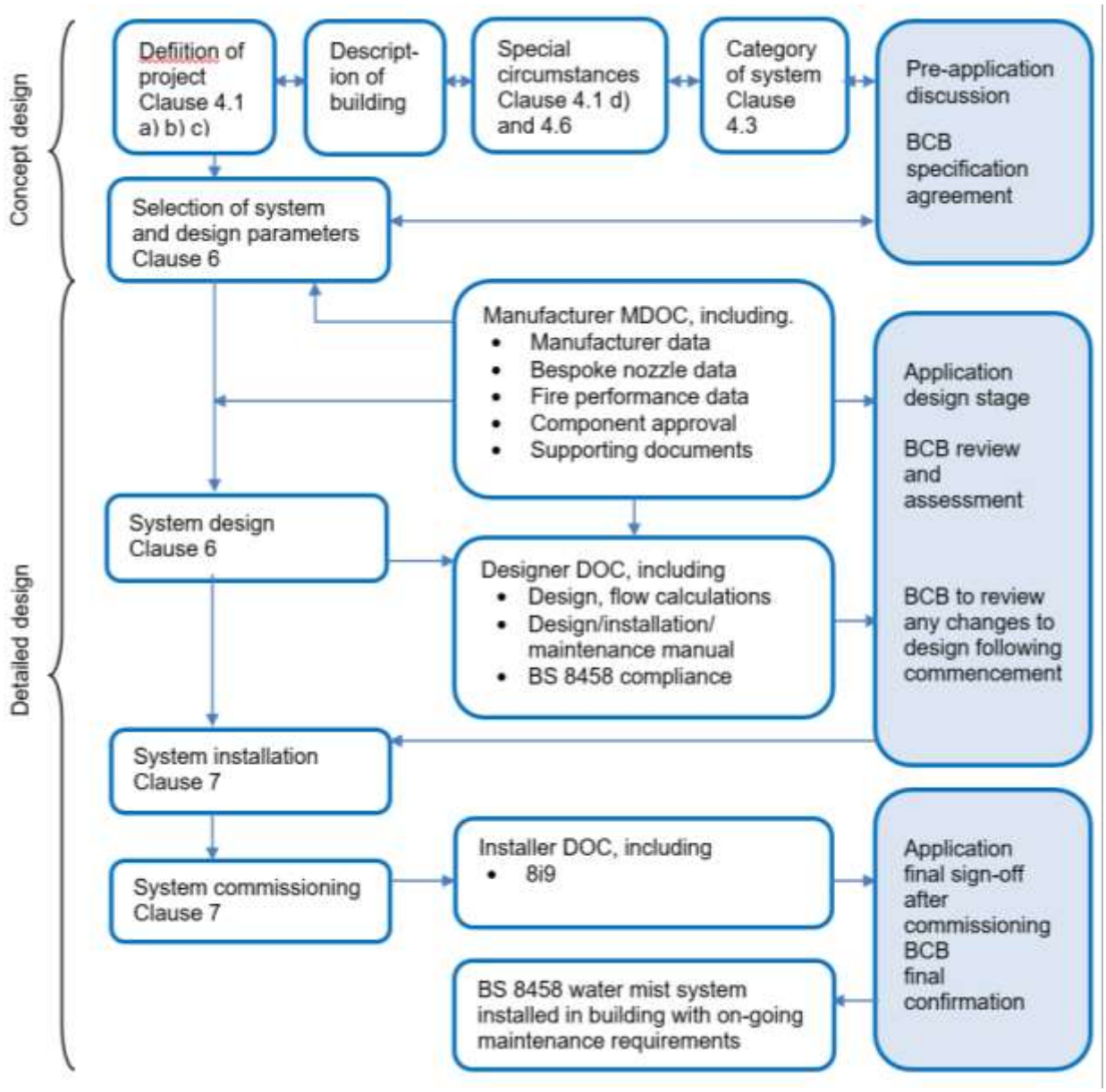
Project process for BS 8458 water mist systems

The flow chart in Figure 1 shows key stages in the design, installation and commissioning of a BS 8458 water mist system, the necessary communications with the Building Control Body (BCB) and the key documents that the designer and installer will need to submit to the Building Control Body for the purposes of evaluating the water mist system design for the building.

Building Control Bodies will need to assess and verify the information submitted in relation to the designing, installing and commissioning of the water mist system to assess its suitability for compliance.

If the selection of the water mist system or key components change in the course of the project, it is essential that Building Control Bodies revisit the specification and design parameters of the water mist system and be provided with new or updated documentation for review and assessment, prior to the installation of the water mist system. Building Control Bodies may need to seek independent specialist advice to assess changes to the water mist system or key components.

Figure 1: Project process flowchart



Note that the Clause references are from BS 8458.

Design, installation and commissioning

BS 8458 is a complete standard and details all the design, installation and commissioning details. However, the following aspects are worth making Building Control Bodies aware of, in more detail.

Hydraulic calculations

- The water supply system shall be confirmed as delivering specified pressure and flow requirements at both the most remote areas and least remote areas in a system for at least the minimum design duration .
- In some designs the specification shall be for greater than the minimum number of operating nozzles.
- Water mist nozzles function in a specified range of operating pressure and flow; any departure from these values in an installed system can make a significant difference in suppression performance.
- Any differences should be identified and rectified; if compensation activities are proposed, these should be evaluated by an independent specialist with supporting data.

Nozzle placement

- Small differences in an installation arrangement compared to those evaluated in the fire test protocols can make a significant difference in suppression performance (e.g. a 0.5 m increase in spacing may be the difference between suppressing a remote fire load or not).
- Any difference should be identified and rectified; if compensation activities are proposed, these should be evaluated with supporting data.

All components

- Some of the components may not be specifically tested and approved for water mist applications; therefore, sprinkler and gas approvals for some components can be considered, e.g. valves, flow switches.
- All of the components require checking to ensure they meet systems performance requirements, e.g. maximum working pressure, assessment with appropriate media.

Commissioning

Commissioning tests and inspection (visual inspection, leakage test, functional test and alarm test) need to be satisfactorily completed prior to handover (See clauses 7.2 and 7.3 and 7.4) and verified by Building Control Bodies. The compliance certificate should be issued.

In addition, a confirmation test for full system operation using a remote test valve is considered desirable (as specified in BS 8489-1 clause 10.1.1b).

Third party innovative water mist systems

There are a number of different types of water mist systems available that have been developed and applied to domestic and residential premises. However, not all of these are suitable alternatives to satisfy Approved Document B (Fire safety) (Wales) section 2.

Some of these water mist systems may have limited third party approval but may not fully be in accordance with BS 8458.

This guidance does not cover local application water mist systems or personal protection water mist systems. Water mist systems should provide full building protection as detailed in BS 8458 clause 6.4.

It may be difficult for Building Control Bodies to assess the different bespoke types of innovative water mist systems. If there is any doubt, it is recommended for Building Control Bodies to seek independent specialist advice.

Checklist questions for the designer, installer and commissioner of the system to provide to Building Control Bodies confirming compliance with the installation standard

Declarations of Conformity (MDOC and CDOC) for the manufacturer, designer, installer and commissioner of the system should be provided to Building Control Bodies to enable them to come to a judgement on the suitability of a water mist system use for specific residential building applications and to confirm or otherwise compliance with BS 8458.

This information will be required at the application design stage and at the final sign-off (completion) stage following commissioning of the system. This will enable Building Control Bodies to be made aware of any changes in the design or installation following the commencement of the work. Designers and installers should ensure that Building Control Bodies are notified of any changes to the agreed design at the time of the change and not leave it to the completion stage.

Checklist questions are included below, for consideration by Building Control Bodies when reviewing the project and Declarations of Conformity.

Introductory information

- *Scheme details (name and address of building)*

Project description

- *Is this a BS 8458 automatic water mist system?*
- *Is the main purpose of this system to meet the regulatory life safety requirement for automatic fire suppression in new or converted residential premises in Wales, as an alternative to a residential sprinkler system?*
- *Is this proposed water mist system being installed in residential building types covered in Approved Document B (Wales) section 2?*
- *Is the proposed water mist system being installed in a home for children under the age of 18 covered by the Domestic Fire Safety (Wales) Measure 2011?*
- *Are all areas protected apart from permitted exceptions?(see BS 8458 clause 6.4)*
- *Are there any special hazards or any special circumstances?*
- *Is the designer, installer suitably trained and qualified?*
- *Are all areas of the building within the application limits of the system?*

Assessment of system details

- *Has BS 8458 been used for the system design and installation?*
- *What are the design assumptions and are they acceptable?*

- *Has all the relevant documentation been provided and does it contain all the relevant information?*

- *Is the system design, installation and maintenance acceptable?*

- *Have all the system components been assessed and are all the system components acceptable?*

- *Are the proposed system details acceptable?*

Assessment of system performance

- *What standards have been used for the system components? Is this/are these appropriate standard(s)?*

- *What other appropriate evidence has been presented?*

- *Have <u>all</u> the relevant specified fire tests in BS 8458 applicable to the real building scenario been undertaken? Have all the fire test details been provided? Were all the fire test results successful?*

- *Has any additional evidence of suitability of water mist system been supplied?*

- *Is the proposed system performance acceptable?*

Example CDOC declaration of conformity form for design, installation and commissioning of water mist systems

An example CDOC declaration of conformity form is included below. This should be completed by the contractor(s) i.e. designer, followed by the installer, at the appropriate stages.

Title: ……. Issue: ……. Date: …….

WATER MIST SYSTEM DESIGN, INSTALLATION AND COMMISSIONING CONTRACTORS' DECLARATION OF CONFORMITY (CDOC)

For new installations for new buildings/For conversions for existing buildings (change of use)/

For extensions of an existing building already having a water mist system

Address of premises

.....

.....

Declaration of Conformity

I/we* hereby declare that the water mist system installation at the above premises, or part thereof, conforms to the appropriate recommendations given in BS 8458: 2015, *Fixed fire protection systems – Residential and domestic watermist systems – Code of practice for design and installation*, as set out in the accompanying declarations, except as stated below/overleaf.

* Delete as appropriate.

Company name and address of designer

…….....

.....

Signed, on behalf of designer …….....

Name (please print) .....

Job title/ Qualification …….

Date ……

Company name and address of installer

…….....

.....

Signed, on behalf of installer…….....

Name (please print) .....

Job title/Qualification ……...

Date ……

Deviations from standards

Declaration (Design, installation or verification)	**BS 8458 Clause number**	**Details of deviation**

This document is only valid when accompanied by the current documents:

Current documents

Type	**Title, Issue date**	**For official use**	
		Received	**Notes**
Installation layout/drawings			
System hydraulic calculations			
Manufacturer system design manual and operating manual			
Manufacturer's MDOC form			
Compliance Certificate (Commissioning test report)			
Any of the following (if available): Fire strategy reports Log books Documents listed in BS 8458: 2015 clause 7.3.2			
Design life/service life specification			

CDOC Table 1 – Declaration of water mist system specification for the building

Project specification	Details to be completed by designer	Details to be completed by installer	For official use Notes
Design standard used			
Manufacturer's design installation, operation and maintenance manual(s) used			
Reason for system installation			
Building type and occupancy			
Building height and number of storeys			
Maximum room area			
Maximum room height			
Special circumstances (e.g. BS 8458: 2015 clause 4.6 and 4.5)			
Enhanced performance, reliability and resilience arrangements (e.g. BS 8458: 2015 B3)			
Details of BCB agreement for special circumstances and enhanced performance, reliability and resilience arrangements (e.g. BS 8458: 2015 clause 4.2)			
Category of system (e.g. BS 8458: 2015 clause 4.3)			
Discharge duration agreed (e.g. BS 8458: 2015 clause 4.3 with regard to any special circumstances)			
Full or partial protection (list all areas of exception e.g. BS 8458: 2015 clause 6.4)			
Component approvals, list all components and corresponding approvals, with supporting MDOC for nozzles (include document number, issue and date)			
System approvals, list all elements of system approvals, with supporting documentation, including supporting MDOC for fire testing (include document number, issue and date)			
Installer approvals, see BS 8458: 2015 clause 7.1.1			

CDOC Table 2 – Declaration of design, installation and commissioning in conformance to BS 8458: 2015

Information required	**To be completed by designer** **Any BS 8458: 2015 non-compliances shall be supported by data**	**To be completed by installer** **Any BS 8458: 2015 non-compliances shall be supported by data**	**For official use**
Electrical supply arrangements e.g. fuse location, supply/demand			
Alarm and control panel arrangements e.g. transmission to receiving centre, triggers/actions etc.			
Are the electrical arrangements in accordance with relevant clauses of BS 8458: 2015, e.g. 6.11.3, 6.11.4, 6.11.5, 6.11.6, 6.12 and 6.13?			
Water supply arrangements e.g. Pump, tank, assumed maximum area of operation (AMAO), pressure (standby and operating), minimum and maximum flow rate, stored volume, effective capacity, proven infill, additives			
Do the hydraulic calculations deliver against the project specification (e.g. with accurate input data such as k-factors and final deliverables such as flow rate range) and comply with clause 6.5?			
Is the water supply arrangement in accordance with clauses: 6.8, 6.9,			

Information required	To be completed by designer Any BS 8458: 2015 non-compliances shall be supported by data	To be completed by installer Any BS 8458: 2015 non-compliances shall be supported by data	For official use
Annex D, 6.11 and 7.1.3?			
Valves, pipe and fitting arrangements e.g. type, material, support, testing			
Are the valves in accordance with clause 6.11.3?			
Are the pipe and fittings in accordance with BS 8458: 2015 clauses 6.11.2.3, 6.11.2.4, 7.1.2 and 7.1.3?			
Nozzle arrangements e.g. type, model(s), maximum spacing			
Are the selected nozzles appropriate for the scope of the application, as defined in the manufacturer's MDOC for nozzles and MDOC for fire testing?			
Are the selected nozzles identical to the manufacturer's MDOC nozzles/fire testing nozzles?			
Is the design and installation arrangements of the selected nozzles (e.g. spacing, height, depth, standby pressure, operating pressure, flow) used within the manufacturer's MDOC limits? Is the design and installation arrangements of the selected nozzles in accordance with BS 8458: 2015 requirements (e.g. clauses 6.1, 6.3,			

Information required	To be completed by designer Any BS 8458: 2015 non-compliances shall be supported by data	To be completed by installer Any BS 8458: 2015 non-compliances shall be supported by data	For official use
6.10 and 6.11)?			

CDOC Table 3 – Declaration of commissioning in conformance to BS 8458: 2015

Information required	**To be completed by installer** **Any BS 8458: 2015 non-compliances shall be supported by data**	**For official use**
I**nstallation** Is compliance confirmed and documented (e.g. by certificates, operation and maintenance manual and logbook, data label), see BS 8458: 2015 clauses 7.2.5, 7.3, 7.4 and 8.3?		
Commissioning tests Specify pressure and flows used in tests. Have the commissioning tests been successfully completed for the final installation (e.g. leak, function and alarm tests), see BS 8458: 2015 clause 7.2?		
Installing company Qualifications (see BS 8458: 2015 clause 7.7.7)		
Ongoing maintenance Are the maintenance activities and occupant/owner responsibilities clear, see BS 8458: 2015 clause 8?		
Project outcome Is the delivered system within the design limits of the application (BS 8458: clauses 6.2, 6.4, 6.5, 6.6 and 6.7)?		

Example MDOC declaration of conformity form for manufacturer's water mist nozzles and fire testing results

An example MDOC declaration of conformity form is included below. These tables should be populated by the water mist component manufacturer. All required data fields should be completed with the applicable technical details. This information should be supplied to the client and/or their representatives.

Title: ……. Issue: ……. Date: …….

Page 1 of 4

WATER MIST COMPONENTS
MANUFACTURER'S DECLARATION OF CONFORMITY (MDOC)
For manufacturer supplied nozzles and fire testing results

Address of manufacturer
.....
.....

Component: (including description, model)
Nozzle.....
Other.....

Declaration of Conformity

I/we* hereby declare that the water mist components detailed above conforms to the appropriate recommendations given in BS 8458: 2015, *Fixed fire protection systems – Residential and domestic watermist systems – Code of practice for design and installation*, and BS 8663-1:2019, *Fixed fire protection systems – Components for watermist systems Part 1: Specification and test methods for watermist nozzles* as set out in the accompanying declarations, except as stated below/overleaf.

* Delete as appropriate.

Signed, on behalf of manufacturer (as appropriate)

.....

Name (please print)..... Company name ……..

Job title/ Qualification…… Date……

Deviations from standards

Declaration	BS 8458 & BS 8663-1 Clause number	Details of deviation

This document is only valid when accompanied by current documents:

Type	Title, issue, date	For official use	
		Received	Notes
Manufacturer's component data sheet			
Manufacturer's component data drawings (on request)			
Manufacturer's system design manual and installation manual			
Manufacturer's fire performance test report (on request)			
Manufacturer's MDOC Table 1			
Manufacturer's MDOC Table 2			

MDOC Table 1 – Declaration of nozzle details and system design parameters

Parameter	Nozzle specification and limits	Details to be completed by manufacturer	For official use Notes
Nozzle	Manufacturer		
	Nozzle designation (model and unique identifier)		
	Datasheet (name, issue, date)		
	Type (upright/pendent/concealed/sidewall)		
	Temperature rating (degC)		
	K-factor (LPM/bar^{½})		
	Nozzle orifice diameter(s)		
	Form of construction: • Nozzle body material • Pipework fitting requirements • Valve type		
	Strainer and filter requirements and minimum strainer area(s).		
	Water quality requirements (e.g. statement that potable water may be used or specific limits in terms of total dissolved solids and/or ppm of dissolved substances)		
	Additives dependency, requirements to ensure enhance fire protection requirements (e.g. concentration and rate of application,), if required		
	Product approval, certificate number and date (confirmation of compliance to BS 8663-1 or LPCB LPS 1283 scheme of requirements) Note: Compliance with these requirements		

Parameter	Nozzle specification and limits	Details to be completed by manufacturer	For official use Notes
	includes: • Tests for nozzle function at minimum standby pressure • Tests for nozzle ageing (heat exposure tested at 121 degC for 90 days at maximum standby pressure), • Test for sulphur dioxide exposure of dynamic o'rings		
Flow	Supply type (pump or cylinder) Note: If the system relies upon propellant gas cylinder(s), full details shall be provided.		
	Minimum operating pressure (bar) and flowrate (l/min)		
	Maximum operating pressure (bar) and flowrate (l/min)		
	Standby pressure, minimum (bar)		
	Standby pressure, maximum (bar)		
Installation design	Maximum nozzle spacing (m)		
	Minimum nozzle spacing (m)		
	Maximum depth below ceiling (mm) Note: Nozzle depth > 300 mm is outside the intended scope of BS 8458: 2015		
	Maximum room area (m^2) Note: either fire test room area or 80 m^2		
	Maximum ceiling height (m), for standard rooms		
	Maximum ceiling height (m), for taller spaces		
Dimensioning of water supply	Minimum design area (m^2)		
	Minimum number of nozzles		
	Minimum design duration (min)		
	Wet system only (dry and pre-action not allowed)		
	Flat ceilings and limited slopes		
	Deviations from standard/ extensions to scope	**Details and additional supporting information**	
	Obstructions		
	Other		

MDOC Table 2 – Declaration of conformance to BS 8458: 2015 fire test protocol for the nozzle in MDOC Table 1

Information required	**Details to be completed by manufacturer**	**For official use**
BS 8458 fire test report (report number, number of pages, date, issue number)		
Name and address of test laboratory		
Nozzle arrangement: designation (model, material, unique identifier), type, orientation, k-factor, temperature rating, spacing, operating pressure		
Details of any additives used in the test programme		
Details of the water supply method used in the test programme (pump/cylinder specification as well as pressure/flow and duration)		
Fire test series arrangements completed (see Table 1 in guide) from the following: • Baseline series (4 tests), give room area and ceiling height • Series for larger rooms (2 tests plus baseline 4 tests), give room area and ceiling height • Series for taller rooms (4 tests plus baseline 4 tests), give room area and ceiling height • Series for taller and larger room (6 tests plus baseline 4 tests), give room area and ceiling height		
Any other supporting data		
Questions	**Answer (yes/no)** **If no, detail non-compliances and provide supporting data**	
Is the test report by an independent third-party, UKAS accredited test laboratory or equivalent?		
Is the nozzle in MDOC Table 1 identical to that used for all fire tests?		
Is the nozzle arrangement (e.g. spacing, pressure, flow, height, depth) in MDOC Table 1 identical to that used for all fire tests?		
Is the maximum room area of 32 m^2 or 50 m^2 in MDOC Table 1 confirmed by successful completion		

Information required	Details to be completed by manufacturer	For official use
of all tests (baseline series) and against all clauses (as given in BS 8458 clause 6.1)? Note: If no, the nozzle model cannot be applied to room areas greater than the fire test room area (i.e. 32 m^2 or 50 m^2 as tested).		
Is the maximum ceiling height of 3.5 m in MDOC Table 1 confirmed by successful completion of all tests (baseline series) and against all clauses (as given in BS 8458 clause 6.1)? Note: If no, the nozzle model cannot be applied to room heights from zero to 3.5 m or above.		
Is the larger room area (maximum area of 80 m^2 for maximum ceiling heights of 3.5 m) in MDOC Table 1 confirmed by successful completion of the all tests (series for larger rooms) and against all clauses (as given in BS 8458 clause 6.1)? Note: If no, the nozzle model cannot be applied to room areas of 80 m^2.		
Is the taller room (maximum ceiling height of 5.5 m and standard test room area) in MDOC Table 1 confirmed by successful completion of the all tests (series for taller rooms) and against all clauses (as given in BS 8458 clause 6.1)? Note: If no, the nozzle model cannot be applied to room heights from 3.5 m to 5.5 m for maximum room areas = area of fire test room.		
Is the taller and larger room (maximum ceiling height of 5.5 m and maximum area of 80 m^2) in MDOC Table 1 confirmed by successful completion of all tests (series for taller and larger rooms) and against all clauses (as given in BS 8458 clause 6.1)? Note: If no, the nozzle model cannot be applied to room heights from 3.5 m to 5.5 m and room areas of 80 m^2.		
Does the water mist system and test report show full compliance with all clauses BS 8458 (e.g. clause 6.1 and Annex C)?		

Future maintenance details for the building owner/occupier (informative)

For an automatic water mist system to remain effective it is essential that it is maintained in line with the manufacturer's recommendations and also the relevant technical standard.

Failure to maintain a water mist system could result in leakage, seizure, blockage, reduction in effectiveness, delay and even failure to operate in the event of a fire.

Suitable information regarding the water mist system should be passed to the building owner/occupier.

BS 8458: 2015 recommends that maintenance involving inspecting and testing of the system should be carried out annually by a suitably qualified and experienced water mist contractor.

BS 8458 recommends that a visual inspection should be carried out to ensure that:

a) The water mist nozzle heat sensing capacity and spray pattern is not impeded.

b) The hazard has not been changed.

c) The system has not been modified out of the scope of BS 8458.

d) System strainers are not impeded; they should be cleaned or replaced if necessary.

e) If a material alteration has been undertaken an assessment of whether the category of system is still appropriate.

BS 8458 recommends that maintenance should involve the following testing:

a) A visual inspection for leaks. If a leak is suspected the pipework should be pressure tested at the highest pressure to be experienced in the system, for a period of one hour.

b) Test valve operated to determine whether the system's design flow rate is achieved.

c) Alarm/s tested to determine whether they function as designed.

d) Stop valves exercised to ensure free movement.

e) Remote monitoring arrangements tested to determine whether they are being transmitted and received correctly.

f) Check trace heating operation, if present.

The signed maintenance records should be contained in the log book, including details of the regular maintenance programme.

BS 8663-1 provides guidance for the selection of in service nozzles and a procedure for their evaluation.

Note: It is not generally possible to replace or exchange the components from one manufacturer into an installation that has been designed for another manufacturer's components. For example, nozzles, nozzle spacings and water flow rates would be specific to that supplied system.

References

Approved Document B (Fire safety) Wales Volumes 1 and 2.

BS 8458: 2015 Fixed fire protection systems. Residential and domestic watermist systems. Code of practice for design and installation, British Standards Institution, 2015.

BS 8489 Part 1: 2016 Fixed fire protection systems. Industrial and commercial watermist systems. Code of practice for design and installation, British Standards Institution, 2016.

BS 8663 Part 1: 2019 Fixed fire protection systems - Components for watermist systems Part 1: Specification and test methods for watermist nozzles, British Standards Institution, 2019.

BS EN ISO 9001: 2015 Quality management systems. Requirements, British Standards Institution, 2015.

Loss Prevention Standard LPS 1283 Requirements and test methods for the certification of watermist systems for use in commercial low hazard occupancies.

Loss Prevention Standard LPS 1285 Requirements and test methods for the approval of watermist systems for use in domestic and residential occupancies (draft).

Draft BS EN 17450 Part 1 Fixed firefighting systems - Water mist components – Part 1: Product characteristics and test methods for strainer and filter components, to be published.

The Construction (Design and Management) Regulations 2015.

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