

BS 8458:2015



BSI Standards Publication

Fixed fire protection systems – Residential and domestic watermist systems – Code of practice for design and installation

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 30 November 2015. It was prepared by Subcommittee FSH/18/5, *Watermist systems*, under the authority of Technical Committee FSH/18, *Fixed fire fighting systems*. A list of organizations represented on these committees can be obtained on request to their secretary.

Supersession

This British Standard supersedes DD 8458-1:2010, which is withdrawn.

Relationship with other publications

Attention is drawn to the requirements of BS EN 806, with particular regard to backflow prevention, and to BS 1710 for guidance on identification and marking of pipework.

Guidance on the application of automatic fire suppression systems is given in BS 9991, BS 9999, the Building Regulations 2010, Approved Document B for use in England [1], [2], Wales [3], [4] and its equivalents in Scotland [5] and Northern Ireland [6].

Information about this document

Watermist fire suppression systems for residential and domestic applications are designed to provide an additional degree of protection of life and property, above that to be achieved by the installation of smoke and/or fire detectors and systems.

This British Standard presumes that the watermist fire suppression system will form part of an integrated fire safety system as part of the building design.

This document converts DD 8458-1 into a full British Standard. It is a full revision of the Draft for Development, and incorporates the following principal changes:

- clarification of the application of residential and domestic building categorizations based on occupancy and risk;
- change to building height limit (from 20 m to 45 m);
- changes to fire test protocols:
 - removal of one ventilation fire test;
 - addition of two optional “open room” fire tests;
- changes to the limits of application dependent on fire tests successfully completed;
- increase in maximum nozzle spacing;
- expanded guidance on water supplies;
- additional measures for vulnerable people;
- additional recommendations for components.

Product certification/inspection/testing. Users of this British Standard are advised to consider the desirability of third-party certification/inspection/testing of product conformity with this British Standard. Users seeking assistance in identifying appropriate conformity assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

Use of this document

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.

This British Standard is intended for the use of designers, engineers, architects, surveyors, contractors, installers and authorities having jurisdiction.

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions in this British Standard are presented in roman (i.e. upright) type. Its recommendations are expressed in sentences in which the principal auxiliary verb is "should".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. "organization" rather than "organisation").

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Particular attention is drawn to the Water Supply (Water Fittings) Regulations 1999 [7], the Water Supply (Water Fittings) (Scotland) Byelaws 2014 [8] and the Water Supply (Water Fittings) Regulations (Northern Ireland) 2009 [9] in respect of requirements for any fire suppression system which conveys, or is likely to convey, water supplied by a water undertaker or licensed water supplier.

Introduction

Watermist fire suppression systems have demonstrated their value in assisting the protection of life and property in industrial and commercial applications for many years. The advent of watermist nozzles that operate at an earlier stage in the development of a fire, together with the recognition that the largest numbers of deaths from fire occur in the home, have led to the introduction of watermist fire suppression systems specifically designed for residential and domestic occupancies.

A correctly designed, installed and properly maintained watermist fire suppression system can detect, suppress and control a fire at an early stage of development, and activate an alarm. Operation of the system rapidly reduces the rate of production of heat and smoke, allowing more time for the occupants to escape to safety or be rescued.

This British Standard accordingly covers design, installation, water supplies, maintenance and testing of residential and domestic watermist fire suppression systems installed to reduce the risk to life.

However, fire-fighting and life protection encompasses a wide field of endeavour and as such it is impracticable to cover every possible factor or circumstance that might affect implementation of this British Standard.

Residential and domestic watermist systems are seen as emerging technology in the market and their performance can be more sensitive than traditional sprinkler systems to small design changes, which can compromise their effectiveness. They can have features such as smaller bore waterways and they generally operate at higher pressures, which poses a number of design and maintenance challenges. They produce smaller droplets of water, which can be prone to being adversely affected by compartment geometry and fire plumes.

Smaller bore waterways and small orifice size in nozzles can be prone to being blocked by particles and debris. Attention to good quality installation and commissioning practices coupled with adequately maintained filtration by means of strainers is therefore essential. Subsequent contamination or deterioration of water supply quality, through ingress of matter, corrosion or microbial activity, could compromise system effectiveness.

The use of components that have been tested and approved in accordance with appropriate component specifications for fire protection applications is also important for system performance and reliability. At the time of writing of this British Standard, the testing and approval of watermist system components for residential and domestic applications is a developing area. In some cases it might be appropriate to select components that have been approved for use in sprinkler or commercial watermist systems.

The fire tests detailed in this British Standard are an important method of demonstrating that the water spray pattern and smaller droplet sizes produced by each specific system are capable of suppressing the test fires and reducing temperatures in the fire test room. The ventilation fire test also provides an assessment of the effect of air flows on the watermist droplets. However, it needs to be recognized that these tests represent a limited range of fire scenarios and there are limits to their applicability to all scenarios that might be encountered in application. The scope of application of this British Standard is therefore limited, as detailed in 6.2. Attention is also drawn to 4.5 which contains guidance about circumstances when enhanced performance, reliability and resilience measures are to be provided.

Residential and domestic watermist fire suppression systems consist of a water supply, filter, non-return valve, stop valve, priority demand valve (where required), automatic alarm system and pipework to automatic watermist nozzles.

The watermist nozzles are fitted at specified locations, the appropriate watermist nozzle type being used for each location.

The main elements of a typical watermist fire suppression system are shown in Annex A. Automatic watermist nozzles operate at a pre-determined temperature to discharge water over a known area below. The flow of water thus initiated causes the sounding of an alarm. Only those watermist nozzles operate which are individually heated above their operating temperature by the heat from the fire.

The provision of a watermist fire suppression system does not negate the need for other fire precautions or practical measures, which can include structural fire resistance, escape routes, smoke or fire detectors and safe housekeeping practices. Even with the installation of a watermist fire suppression system, normal actions on the discovery of a fire need to be taken, such as immediate evacuation and the calling of the fire and rescue service.

Watermist fire suppression system maintenance is not complex but is essential (see Clause 8). It is important that owners and occupiers pay particular attention to precautions issued by the watermist system supplier, such as the avoidance of obstructions to the watermist nozzle, or not painting the watermist nozzle or its mounting.

1 Scope

This British Standard gives recommendations for the design, installation, water supplies, commissioning, maintenance and testing of watermist systems with automatic nozzles installed in residential and domestic occupancies up to a maximum ceiling height of 5.5 m. It primarily covers watermist systems used for life safety, but might also provide property protection.

The recommendations of this British Standard are also applicable to any addition, extension, repair or other modification to a residential or domestic watermist system.

The British Standard does not cover watermist systems in industrial and commercial buildings. Recommendations for these systems are given in DD 8489-1 ¹⁾.

2 Normative references

Standards publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM A269-10, *Standard specification for seamless and welded austenitic stainless steel tubing for general service*

ASTM A312, *Standard specification for seamless, welded, and heavily cold worked austenitic stainless steel pipes*

ASTM F442, *Standard specification for chlorinated poly(vinyl chloride) (CPVC) plastic pipe (SDR-PR)*

BS 5839 (all parts), *Fire detection and fire alarm systems for buildings*

BS 7671, *Requirements for electrical installations – IET Wiring Regulations*

¹⁾ At the time of publication of BS 8458, DD 8489-1 is undergoing conversion to a full British Standard as BS 8489-1.

BS 8558, *Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages – Complementary guidance to BS EN 806*

BS EN 520:2004, *Gypsum plasterboards – Definitions, requirements and test methods*

BS EN 805, *Water supply – Requirements for systems and components outside buildings*

BS EN 806 (all parts)²⁾, *Specifications for installations inside buildings conveying water for human consumption*

BS EN 1057:2006+A1:2010, *Copper and copper alloys – Seamless, round copper tubes for water and gas in sanitary and heating applications*

BS EN 10226-1, *Pipe threads where pressure tight joints are made on the threads – Part 1: Taper external threads and parallel internal threads – Dimensions, tolerances and designation*

BS EN 10226-2, *Pipe threads where pressure tight joints are made on the threads – Part 2: Taper external threads and taper internal threads – Dimensions, tolerances and designation*

BS EN 10255, *Non-alloy steel tubes suitable for welding and threading – Technical delivery conditions*

BS EN 12259-1, *Fixed firefighting systems – Components for sprinkler and water spray systems – Part 1: Sprinklers*

BS EN 13238, *Reaction to fire tests for building products – Conditioning procedures and general rules for selection of substrates*

BS EN 15004-1, *Fixed firefighting systems – Gas extinguishing systems – Part 1: Design, installation and maintenance*

BS EN ISO 9453, *Soft solder alloys – Chemical compositions and forms*

BS EN ISO/IEC 17025:2005, *General requirements for the competence of testing and calibration laboratories*

FM 5560, *Water mist systems*

Other publications

[N1] BUILDING RESEARCH ESTABLISHMENT. *Requirements and test methods for the approval of watermist systems for use in commercial low hazard occupancies*. LPS 1283. Issue 1.1. Watford: BRE Global Ltd, 2014.

3 Terms and definitions

For the purposes of this British Standard, the following terms and definitions apply.

3.1 additive

chemical or mixture of chemicals or gases, intentionally introduced into a watermist system for one or more of the following purposes:

- a) enhancement of, or compliance with, fire protection requirements;
- b) corrosion protection;
- c) frost protection

²⁾ This standard also gives an informative reference to BS EN 806-2:2005.

3.2 alarm device

device for detecting water flow in or through a watermist system and initiating an alarm signal

3.3 alarm receiving centre

continuously manned premises, remote from those in which a fire detection and fire alarm system is fitted, where the information concerning the state of the fire alarm system is displayed and/or recorded, so that the fire and rescue service can be summoned

3.4 alarm test valve

valve through which water can flow to test the operation of an alarm device

3.5 assumed maximum area of operation (AMAO)

maximum area over which it is assumed, for design purposes, that watermist will operate in a fire

3.6 authority having jurisdiction (AHJ)

organization, office, or individual responsible for enforcing the requirements of legislation or standards, or for approving equipment, materials, an installation, or a procedure

3.7 authorized supplier

company that is fully trained and authorized by a manufacturer for the design, installation, commissioning and maintenance of its fixed watermist systems and has documentation providing evidence of this

Assessed capability. Users of this British Standard are advised to consider the desirability of using a contractor who has quality system assessment and registration by an accredited third-party certification body. Appropriate conformity attestation arrangements are described in BS EN ISO 9001.

3.8 backflow

movement of the fluid from downstream to upstream within an installation

[SOURCE: BS EN 1717:2000, 3.5]

3.9 backflow prevention device

device that is intended to prevent contamination of wholesome water by backflow in a water supply system

[SOURCE: BS EN 1717:2000, 3.6, modified – additional words included]

3.10 compartment

area completely enclosed by walls and a ceiling, where any single internal opening is not more than 2 500 mm in width, and has either:

- a) a lintel depth of not less than 200 mm; or
- b) a single opening of not more than 900 mm in width without a lintel, with no other openings

NOTE This is not the same as a compartment as defined by building regulations.

3.11 competent person

person, suitably trained and qualified by knowledge, understanding and practical experience, and provided with the necessary instructions, to enable the required task(s) to be carried out correctly

3.12 control

<of fire> prevention of fire spread beyond a defined fire zone

- 3.13 crawl space**
area not used for storage, under a floor or roof, giving access to building services
- 3.14 discharge duration**
time that watermist discharges throughout one fire-fighting event measured from the operation of the first nozzle
- 3.15 effective capacity**
volume of stored water available to a pump, taking into account the air gap at the top and the unusable water at the base of the tank, which is affected by a vortex letting air into the pump suction
- 3.16 fire pump**
pump that is automatically operated in the event of a fire and that supplies water to a watermist system from a water storage facility or from a mains supply
- 3.17 mains water supply**
permanent network of pipes that convey wholesome water from a public or private water supply system to a customer service connection or user draw-off point
- 3.18 maintenance**
combination of all technical and administrative actions, including supervision actions, intended to retain an item in, or restore it to, a state in which it can perform a required function
- 3.19 manufacturer**
organization responsible for manufacturing watermist systems, including nozzles, and for producing the watermist system design manual and the fire test programmes to which it is linked
- 3.20 manufacturer's design and installation manual**
document containing design and installation instructions for all details of a watermist system
- 3.21 priority demand valve**
valve for isolating the water supply to the domestic service in the event of watermist operation
- 3.22 responsible person**
person(s) responsible for or having effective control over fire safety provisions adopted in or appropriate to the occupancy
- 3.23 service pipe**
pipe supplying water from a water supply to any premises that are subject to water pressure and flow from that water supply
- 3.24 stop valve**
manually operated valve for controlling the flow of water into the system pipework which is normally kept in the open position
- 3.25 suppression**
<of fire> reduction in the heat release rate and prevention of re-growth of a fire over the discharge duration

3.26 vulnerable people

people who are at greater risk from fire because they are unable to easily evacuate without assistance, or who have a higher than average likelihood of experiencing a fire, or a combination of the two

3.27 water undertaker

company licensed to provide a public water supply

3.28 watermist

water spray for which the $D_{v0,90}$ is less than 1 mm measured in a plane 1 m from the nozzle at its minimum operating pressure

NOTE $D_{v0,90}$ is the drop diameter such that the cumulative volume, from zero diameter to the respective diameter, is nine tenths of the corresponding sum of the total distribution.

3.29 watermist nozzles**3.29.1 watermist nozzle**

component, with one or more orifices, which is designed to produce and discharge watermist automatically, held closed by an integral quick-response thermal release element

3.29.2 concealed watermist nozzle

watermist nozzle with a cover plate that disengages when heat is applied

3.29.3 fusible link watermist nozzle

watermist nozzle which opens when an element provided for that purpose melts

3.29.4 glass bulb watermist nozzle

watermist nozzle which opens when a liquid filled glass bulb bursts

3.29.5 recessed watermist nozzle

watermist nozzle in which all or part of the heat sensing element is above the lower plane of the ceiling

3.30 watermist system

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

NOTE Watermist systems can discharge water or a mixture of water and some other agent or agents, e.g. inert gases or additives.

3.31 wet pipe system

watermist system using watermist nozzles in which the pipework is always charged with water

3.32 wholesome water

water suitable for human consumption

NOTE Attention is drawn to the definitions given in the Water Supply (Water Fittings) Regulations 1999 [7] and equivalents in Scotland [8] and Northern Ireland [9].

4 Preliminary work and consultation

4.1 Initial considerations

Before undertaking the design of a domestic or residential watermist system for a specific property, the designer should evaluate at least the following factors before starting work on the project:

- a) the risk to be protected;
- b) the type of occupancy of the property (i.e. domestic or residential);
- c) the water supply requirements and availability;
- d) any special circumstances (see 4.6).

NOTE In buildings where there is a mix of residential and commercial use (e.g. where flats are above shops), it is generally appropriate to protect the residential parts using BS 8458, and the commercial parts using DD 8489-1 ³⁾ or BS EN 12845.

4.2 Consultation

COMMENTARY ON 4.2

Some premises might have multiple authorities having jurisdiction (AHJs), who might be concerned with life safety, property protection, business continuity, heritage preservation, and environmental protection. Some AHJs might impose additional requirements beyond those of this British Standard.

Where a watermist system or an extension or alteration to a watermist system is being considered within new or existing buildings, the designer should at an early stage contact any AHJs or others who might have a direct interest in the installation, including but not limited to:

- a) the water undertaker or licensed water supplier;
NOTE Attention is drawn to the requirement to gain consent under water regulations [7–9] ⁴⁾. Further guidance is given in the WRAS Water Regulations guide [10].
- b) the fire authority;
- c) the licensing authority;
- d) the building control body;
- e) the insurer(s) of the dwelling and its contents;
- f) the client, to take into account further considerations of vulnerability (see Annex B).

4.3 Category of system

The designer should at an early stage determine which category of system is applicable, as this affects various design considerations, such as the water requirements for the system. The category of system should be determined by the type of building as shown in Table 1, up to a maximum height of 45 m. If the type of building is not listed in Table 1, or for buildings over 45 m, then the AHJs should be consulted to agree which type of occupancy should apply, whether additional measures are needed (see 4.6) or whether an alternative system (e.g. DD 8489-1 ³⁾ or BS EN 12845) is more appropriate.

³⁾ At the time of publication of BS 8458, DD 8489-1 is undergoing conversion to a full British Standard as BS 8489-1.

⁴⁾ The Water Supply (Water Fittings) Regulations 1999 [7], the Water Supply (Water Fittings) (Scotland) Byelaws 2014 [8] and the Water Supply (Water Fittings) Regulations (Northern Ireland) 2009 [9].

Table 1 Category of system

Category of system	Description of building/occupancy
Domestic occupancy	Single family dwellings such as: • Individual dwelling house • Individual flat • Individual maisonette • Transportable home Houses of multiple occupation (HMOs) ^{A)} Bed and breakfast accommodation ^{A)} Boarding houses ^{A)} Blocks of flats 18 m or less in height and with a maximum total floor area of 2 400 m² ^{B), C)}
Residential occupancy	Blocks of flats greater than 18 m in height ^{C)} Sheltered and extra care housing Residential care premises Residential rehabilitation accommodation Dormitories (e.g. attached to educational establishments) Hostels

^{A)} Buildings with more than two floors and five or more lettable bedrooms should be treated as a residential occupancy.

^{B)} Where the fire strategy requires the communal rooms and corridors to be protected by a watermist system, then the building should be treated as a residential occupancy.

^{C)} This height is the height of the floor of the top storey above ground.

4.4 Cylinder-based systems

Systems using pressurized gas as a form of propellant for the watermist should conform to the safety requirements specified in BS EN 15004-1.

4.5 Use of watermist systems as a compensatory feature

COMMENTARY ON 4.5

There are occasions when a suppression system is used as a means of demonstrating compliance with building regulations or to compensate for, or overcome, circumstances where a building is unable to achieve compliance with guidance issued in support of building regulations. For example:

- *an older building where the existing construction cannot achieve the required fire resistance appropriate to the use of the premises;*
- *a new build that cannot meet the necessary access requirements for fire appliances;*
- *loft conversions where it is either not practical or not possible to secure adequate means of escape.*

It would be impractical for this standard to cover all circumstances. It is therefore essential that consultation take place, and where deemed appropriate to the circumstances there might be a need to increase the discharge duration, the design density and/or the resilience of the system. It is not implied that in all cases that there is necessarily a need to upgrade the category or increase resilience.

It would be beneficial to justify any proposals by means of a fire safety strategy in such cases to support the proposals for the specific case.

Where a watermist system is proposed as a compensatory feature, the following recommendations should be met.

- a) There should be consultation between the designer and any necessary or relevant AHJs, and the category of system (see Table 1) and design discharge duration (see 6.6) should be agreed and recorded on the compliance certificate (see 7.2.5).
- b) Where necessary, proposals should be supported by a fire safety strategy. This should set out how the watermist system and any appropriate resilience measures (see Note 1 to 4.6) would provide equivalence to guidance in support of building regulations.
- c) System resilience measures, where deemed necessary, should be appropriate to the risk and be agreed and recorded on the compliance certificate (see 7.2.5).

4.6 Special circumstances

In some circumstances, enhanced performance, reliability and resilience arrangements should be provided, if an assessment shows them to be necessary. Where appropriate, the designer should consult the relevant AHJ(s).

NOTE 1 Examples of such arrangements include:

- *extended duration of water supply;*
- *making water supplies more robust, such as by the provision of redundancy in the pumping arrangements, back-up electrical supplies, or a fire service infill connection to a stored water tank;*
- *increasing the design discharge density or design assumed maximum area of operation (AMAO).*

NOTE 2 Situations where this might be necessary include:

- *dwellings with a fire load greater than that which would normally be found in a residential or domestic living room, kitchen or bedroom, or if the fire hazard is greater than that of a conventional residential or domestic occupancy;*
- *buildings where the time for fire-fighters to commence fire-fighting in the fire compartment might exceed the duration of water supply of the expected category of system, e.g. buildings over 45 m in height or complex buildings;*
- *older buildings with hidden voids and/or where compartmentation might not meet current standards;*
- *buildings with atria or where a risk assessment shows that the spread of fire could involve two or more enclosed volumetric spaces;*
- *buildings with adjacent areas not protected by an automatic fire suppression system;*
- *buildings housing vulnerable people (see Annex B);*
- *buildings with fire engineered design solutions;*
- *mixed use buildings (see Note to 4.1);*
- *premises providing secure accommodation, asylum centres or similar premises (specialist nozzles are available for institutional situations where ligature or malicious tampering are a concern).*

5 System actuation

System actuation should be automatic by glass bulb or fusible link, initiated by heat generated from the fire.

6 Design

COMMENTARY ON CLAUSE 6

Watermist systems for residential and domestic premises are designed to suppress and control fires. The watermist system design parameters are established by carrying out fire tests as recommended in Annex C. The tests are used to establish for each manufacturer's equipment the necessary number of nozzles and their flows, operating pressures and spacing, together with other required design characteristics. The recommended minimum discharge durations are given in 6.7.

6.1 Fire tests

To determine the system design and component characteristics, tests should be carried out in accordance with Annex C, and the following recommendations should be met.

System testing. *Users of this British Standard are advised to use a test facility that operates a quality system. General requirements for the competence of testing and calibration laboratories are described in BS EN ISO/IEC 17025:2005.*

- a) When tested in accordance with C.1 to C.4:
 - 1) automatic watermist nozzles should be capable of suppressing the test fires for a discharge duration of 10 min for domestic premises or 30 min for residential premises, measured from nozzle operation;
 - 2) within 2 min from the operation of the first nozzle, the mean recorded temperatures 75 mm below the underside of the ceiling should remain steady or decrease.
- b) From the start of the test, the recorded temperatures should not exceed the values indicated in Table 2.
- c) The third nozzle, external to the room, should not operate.

Table 2 Fire test maximum temperatures

Thermocouple location	Maximum allowable temperature °C
75 mm below the underside of the ceiling	320
1.6 m above the floor	95
1.6 m above the floor	55 (for not more than any 120 s interval)

When a successful set of test results is obtained [see a) to c) above], those results should be used to determine the design parameters for the systems to be installed. The system should then be designed using those parameters and in accordance with this British Standard.

All design and installation parameters determined by the fire tests and any other system constraints crucial to the required performance of the system should be specified in the manufacturer's design and installation manual.

Sufficient and relevant design and installation information should be provided to enable the replication of the system as tested.

The manufacturer should describe and/or specify the procedure for the installation of the system.

6.2 Limits of application

The limits of application should be determined according to the fire test protocols against which the system has been successfully tested.

The limits of application for the fire test programmes are shown in Table 3. Tests should be carried out as follows.

- a) Fire tests a, b, c and d should be carried out for all systems.
- b) Fire tests e (open room test) and f (increased ceiling height test) are optional and should be carried out only if requested by the manufacturer.

Table 3 Limits of application based on fire tests

Fire tests	Maximum room size	Maximum ceiling height
a, b, c, d	Fire test room	3.5 m
a, b, c, d, e	80 m ²	3.5 m
a, b, c, d, f	Fire test room	5.5 m
a, b, c, d, e, f	80 m ²	5.5 m

6.3 System design

The system should be designed by an authorized supplier.

Watermist systems should meet the following criteria.

- a) Nozzles should be positioned and oriented in accordance with the manufacturer's design and installation manual, and should meet at least the established design parameters [see 6.1a) to 6.1c)]. The system design should address at least the following:
 - 1) minimum and maximum heights. For systems tested in the standard height test room detailed in C.1.1 or C.1.2 (i.e. 2.5 m) the maximum design height for an installation is 3.5 m. For installations at design heights between 3.5 m and 5.5 m the procedure in C.4f) should be followed;
 - 2) minimum and maximum distances between nozzles;
 - 3) minimum and maximum distances from nozzles to walls;
 - 4) location of nozzles with regard to obstructions;
 - 5) positioning of nozzles with regard to ceiling (flat, sloping or curved);
 - 6) nozzle protection;
 - 7) nozzle ceiling plates used with flush, recessed or concealed watermist nozzles;
 - 8) minimum and maximum water flow rates and water pressures at the nozzles;
 - 9) additive requirements, where applicable.
- b) The watermist system should be a wet pipe system (i.e. one that is permanently charged with water).

NOTE Attention is drawn to the requirements of the Pressure Equipment Directive [11].

- c) Thermally activated nozzles should have quick-response thermal elements in accordance with BS EN 12259-1 in terms of temperature ratings and selection of the temperature rating for installed maximum ambient conditions.

6.4 Extent of watermist system protection

Watermist system protection should be provided in all parts of the dwelling, with the exception of the following areas, which may be excluded unless required by a fire strategy or risk assessment:

- a) bathrooms fitted with a door and with a floor area of less than 5 m²;
- b) cupboards and pantries fitted with doors and with a floor area of less than 2 m², and rooms in which the smallest dimension does not exceed 1 m, where the walls and ceilings are covered with non-combustible or limited-combustible materials;
- c) non-communicating, attached buildings such as garages, boiler houses, etc.;

NOTE 1 "Non-communicating" means separated from the protected premises by not less than 30 min fire resisting construction in accordance with the relevant part of BS 476 or the equivalent European Standard, for example:

- BS 476-21/BS EN 1365-1 for load-bearing walls;
- BS 476-22/BS EN 1364-1 for non-load-bearing walls and partitions;
- BS 476-21/BS EN 1365-2 for floors;
- BS 476-23/BS EN 13381-1 for suspended ceilings;
- ad hoc BS 476-20/BS EN 1366-3 for penetrations of walls and floors by services.

The parts of the BS 476 fire resistance test standards are to be read in conjunction with BS 476-20. The European fire resistance test standards are to be read in conjunction with BS EN 1363-1.

Depending on the design of the building, there might occasionally be a need to refer to other fire resistance test standards. Certain authorities might require 60 min fire-resisting construction.

- d) crawl spaces;
- e) uninhabited loft/roof voids;
- f) ceiling voids;
- g) external balconies permanently open to the outside.

NOTE 2 A fire strategy or risk assessment might demonstrate that extensive spread of fire or smoke, particularly between rooms and compartments, is likely to take place and therefore that the fire risk in the area is such that watermist coverage is necessary.

6.5 Hydraulic calculations

Hydraulic calculations should be based upon recognized methods (see Notes).

NOTE 1 NFPA 750 [12] provides useful information and guidance on appropriate methods including the Hazen–Williams and Darcy–Weisbach calculation methods.

NOTE 2 Calculations may be carried out using computer software provided that the results can be shown to be accurate.

System piping should be hydraulically designed to deliver the required water flow and pressures as determined by the fire tests in Annex C.

Hydraulic calculations should be carried out to determine the hydraulically most unfavourable area for the system based on the maximum number of heads assumed operating, the pipe configuration, head selection and classification of risk.

For systems with no additives and working pressures not exceeding 12 bar ⁵⁾, hydraulic calculations may be carried out using the Hazen–Williams calculation. If this method is used it should be carried out in accordance with Annex D.

6.6 Discharge performance

6.6.1 Domestic occupancies

For domestic occupancies, the system should be capable of providing pressures and flow rates to permit all the watermist nozzles in the fire test room or largest compartment, whichever is the greater, up to a maximum area of operation (AMAO) of 64 m², to operate simultaneously at not less than the greater of:

- a) the nozzle pressure given by the pass criteria determined by the test in Annex C; or
- b) the approval listed discharge performance.

Any flow for alarm purposes should be added to the system flow.

6.6.2 Residential occupancies

For residential occupancies, the system should be capable of providing pressures and flow rates to permit all the watermist nozzles in an assumed maximum area of operation (AMAO) of 64 m² to operate simultaneously at not less than the nozzle pressure given by the pass criteria determined by the test in Annex C, or their approval listed discharge performance, whichever is the greater. Any flow for alarm purposes should be added to the system flow.

6.7 Discharge duration

The water discharge rates and duration should be as follows.

- a) For systems in domestic occupancies, the duration should be at least 10 min from the operation of the first nozzle, and the system should meet the recommendations in 6.1 for the total time of the discharge duration in the most hydraulically demanding area.
- b) For systems in residential occupancies, the duration should be at least 30 min from the operation of the first nozzle, and the system should meet the recommendations in 6.1 for the total time of the discharge duration in the most hydraulically demanding area.

6.8 Water supplies

6.8.1 General

The design should identify water supply requirements (pressure, flow and duration) for the watermist system.

NOTE 1 Where water is drawn from a public mains supply, attention is drawn to the legal requirement for water undertaker approval to be sought.

A suitable water supply should be identified at an early stage to avoid unnecessary work at a later stage. The water supply should be sufficient for the system design parameters identified in 6.5, 6.6 and 6.7.

NOTE 2 For information on Legionella and fire-fighting systems, see Legionella and fire-fighting systems – A technical briefing note [13].

⁵⁾ 1 bar = 10⁵ N/m² = 100 kPa.