



BSI Standards Publication

Fixed fire protection systems – Components for watermist systems

Part 1: Specification and test methods for watermist nozzles

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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 31 July 2019. This British Standard 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.

Relationship with other publications

This part of BS 8663 is the first in what is expected to be a series of standards covering watermist system components.

It is intended to be read in conjunction with [BS 8458](#) for residential and domestic watermist systems or BS 8489-1 for industrial and commercial watermist systems.

Information about this document

Watermist nozzles are for use in watermist systems and are designed to provide an additional degree of protection of life and property, above that already achieved by the building design and the installation of smoke and/or fire detectors and systems. This British Standard presumes that the watermist protection will form part of an integrated fire safety system.

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. Appropriate conformity attestation arrangements are described in BS EN ISO 9001. Users seeking assistance in identifying appropriate conformity assessment bodies or schemes may ask BSI to forward their enquiries to the relevant association.

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.

This publication can be withdrawn, revised, partially superseded or superseded. Information regarding the status of this publication can be found in the Standards Catalogue on the BSI website at bsigroup.com/standards, or by contacting the Customer Services team.

Where websites and webpages have been cited, they are provided for ease of reference and are correct at the time of publication. The location of a webpage or website, or its contents, cannot be guaranteed.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is “shall”. Its methods are expressed as a set of instructions, a description, or in sentences in which the principal auxiliary verb is “shall”.

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.

1 Scope

This British Standard specifies requirements and gives test methods for the construction and performance of open and automatic watermist nozzles for use in watermist systems conforming to [BS 8458](#) or BS 8489-1.

This British Standard does not cover the electrical actuation of watermist nozzles.

NOTE 1 Electrical actuation of watermist nozzles is covered in [BS 7273-3](#) and [BS 7273-5](#).

NOTE 2 All pressure data in this standard are given as gauge pressures in bar¹.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this document². For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

[BS 8458](#), *Fixed fire protection systems — Residential and domestic watermist system — Code of practice for design and installation*

BS 8489-1, *Fixed fire protection systems — Industrial and commercial watermist systems — Part 1: Code of practice for design and installation*

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

BS EN 60751, *Industrial platinum resistance thermometers and platinum temperature sensors*

BS EN ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

3 Terms, definitions and abbreviations

For the purposes of this British Standard, the terms, definitions and abbreviations in BS EN 12259-1 and the following apply.

3.1 automatic watermist nozzle

nozzle with a thermally sensitive sealing device which opens to discharge water for firefighting

3.2 coated watermist nozzle

watermist nozzle with a coating, applied for the purpose of reducing the effects of corrosive environments, excluding decorative paint or painted finishes

3.3 concealed watermist nozzle

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

3.4 conductivity factor (*C*)

measure of the conductance between the watermist nozzle's heat responsive element and the water-filled fitting, expressed in m/s^{1/2}

¹ 1 bar = 10⁵ N/m² = 100 kPa.

² Documents that are referred to solely in an informative manner are listed in the Bibliography.

3.5 deflector

plate or other attachment for altering the distribution of the flow of water

3.6 design lower tolerance limit (DLTL)

lowest strength of a glass bulb as specified and assured by the glass bulb supplier

3.7 design upper tolerance limit (DUTL)

highest service load of a watermist nozzle as specified and assured by the watermist nozzle supplier

3.8 dry watermist nozzle

watermist nozzle and dry drop pipe with a valve, at the head of the pipe, held closed by a device maintained in position by the watermist nozzle head valve

3.9 exposed watermist nozzle

watermist nozzle in which all of the thermally sensitive elements are below the plane of the ceiling and mounted perpendicular to the ceiling

NOTE Typical examples of exposed watermist nozzles are pendent and upright nozzles.

3.10 flush pattern watermist nozzle

pendent watermist nozzle for fitting partly above, but with the temperature sensitive element below, the lower plane of the ceiling

3.11 fusible link watermist nozzle

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

3.12 glass bulb watermist nozzle

watermist nozzle which opens when a liquid-filled glass bulb bursts

3.13 in-service nozzle

nozzle that has been installed in an operational watermist system

3.14 horizontal sidewall watermist nozzle

watermist nozzle in which the nozzle directs the water horizontally

3.15 K-factor

co-efficient of flow of a nozzle, expressed in litres per minute per bar^{1/2}

3.16 lower tolerance limit (LTL)

lowest strength of a glass bulb determined by testing and statistical analysis of a batch of 55 or more bulbs

3.17 mean design bulb strength

lowest mean bulb strength, specified and assured by the glass bulb supplier, for any batch of 55 or more bulbs

3.18 mean design service load

highest mean service load, specified and assured by the watermist nozzle supplier, for any batch of 10 or more watermist nozzles

3.19 non-exposed watermist nozzle

watermist nozzle in which any part of the thermal element is level with or above the plane of the ceiling, or the thermal element is not perpendicular to the ceiling

NOTE Typical examples of non-exposed watermist nozzles are concealed, recessed, flush pattern and sidewall nozzles.

3.20 open nozzle

watermist nozzle without an integral valve or sealing element

3.21 operating pressures**3.21.1 operating pressure**

range of pressures between minimum and maximum operating pressures (see [3.21.2](#) and [3.21.3](#))

3.21.2 maximum operating pressure

manufacturer-specified maximum pressure at a nozzle inlet with water flowing

3.21.3 minimum operating pressure

manufacturer-specified minimum pressure at a nozzle inlet with water flowing

3.22 pendent watermist nozzle

watermist nozzle in which the nozzle directs the water downwards

3.23 response time index (RTI)

measure of the thermal sensitivity of the fusible or frangible element in the watermist nozzle

NOTE The response time index is expressed in $m \cdot s^{1/2}$.

3.24 standby pressures**3.24.1 standby pressure**

pressure held in system pipework prior to system operation

NOTE This can be lower or higher than the operating pressure.

3.24.2 maximum standby pressure

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

3.24.3 minimum standby pressure

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

3.25 upper tolerance limit (UTL)

highest service load of a watermist nozzle determined by testing and statistical analysis of a batch of 20 or more watermist nozzles

3.26 upright watermist nozzle

watermist nozzle in which the nozzle directs the water upwards

4 Construction and performance

4.1 Product assembly

Watermist nozzles shall be assembled in such a way that any subsequent adjustment or dismantling will result in destruction of an element of construction.

It shall be possible to remove the cover of a concealed nozzle (e.g. for visual inspection) without having to use special tools.

4.2 Technical literature

A visual and measurement check shall be made to determine whether the test samples correspond to the description in the technical literature (drawings, parts lists, description of functions, operating and installation instructions).

The technical literature shall include at least the following:

- operating temperature;
- spray pattern;
- orientation;
- mounting position;
- *K*-factor;
- nozzle variants (e.g. where inserts are used, to alter the number and/or dimensions of orifices);
- cover plates;
- housings and escutcheons;
- blow-off caps.

NOTE 1 Optionally, manufacturers may declare a service life for each type of nozzle.

NOTE 2 Users of this standard are reminded that each nozzle variant has to be separately fire tested in accordance with BS 8489-1 and/or [BS 8458](#).

4.3 Dimensions and pressure rating

4.3.1 Nominal thread sizes shall be suitable for fittings threaded in accordance with ISO 7-1, BS EN ISO 228-1 or other equivalent standards.

4.3.2 The manufacturer shall declare the minimum and maximum operating pressure and the minimum and maximum standby pressure.

4.4 Nominal operating temperature for automatic nozzles

4.4.1 The nominal operating temperatures of glass bulb watermist nozzles shall be in accordance with [Table 1](#).

4.4.2 The nominal operating temperature ranges of fusible link watermist nozzles shall be in accordance with [Table 1](#).

4.4.3 Glass bulb watermist nozzles and non-plated and non-coated fusible link watermist nozzles shall be colour coded according to the nominal operating temperature as given in [Table 1](#).

Table 1 — *Nominal operating temperatures and colour codes*

Glass bulb watermist nozzles		Fusible link watermist nozzles	
Nominal operating temperature °C	Liquid colour code	Nominal operating temperature within range °C	Yoke arms colour code
57	Orange	57 to 77	Uncoloured
68	Red	80 to 107	White
79	Yellow	121 to 149	Blue
93	Green	163 to 191	Red
100	Green	204 to 246	Green
121	Blue	260 to 302	Orange
141	Blue	320 to 343	Black
163	Mauve		
182	Mauve		
204	Black		
227	Black		
260	Black		
286	Black		
343	Black		

4.5 Operating temperatures for automatic nozzles

When tested in accordance with [Annex A](#), the watermist nozzles shall operate at a temperature within the range:

$$[t \pm (0.035 t + 0.62)] \text{ } ^\circ\text{C}$$

where t is the nominal operating temperature.

4.6 Water flow and distribution

4.6.1 K -factor

The K -factor shall be specified by the manufacturer.

When determined in accordance with [Annex B](#), the K -factor shall be within $\pm 5\%$ of the manufacturer's specified value.

All nozzle variants shall be tested.

4.6.2 Water distribution

4.6.2.1 Watermist nozzles other than sidewall watermist nozzles

For watermist nozzles other than sidewall watermist nozzles, when tested in accordance with [Annex C \(C.1.2\)](#) at the minimum and maximum operating pressure, the watermist nozzles shall distribute water over a horizontal surface in accordance with the manufacturer's specification for total discharge density, with a tolerance of ${}_{+10}^{-5}\%$.

When tested in accordance with [Annex C \(C.1.3\)](#) at the minimum and maximum operating pressure, nozzles shall not wet adjacent target nozzles. There shall be no direct impingement or dripping of water from the adjacent nozzle or target.

All nozzle variants shall be tested.

4.6.2.2 Sidewall watermist nozzles

For sidewall watermist nozzles, when tested in accordance with [Annex C \(C.2\)](#) using the minimum and maximum operating pressure, the watermist nozzles shall distribute water over both a horizontal and a vertical surface such that the discharge density collected, in millimetres per minute (mm/min), is in accordance with the manufacturer's specification for total discharge density, with a tolerance of ${}^{-5}_{+10}$ %.

All nozzle variants shall be tested.

4.7 Function

- 4.7.1** For automatic nozzles, when tested in accordance with [Annex D \(D.1\)](#), the watermist nozzle shall open and within 5 s of release of the thermally sensitive element shall operate as intended. Any lodgement of released parts shall be cleared within 60 s of the release of the thermally sensitive element.
- 4.7.2** For nozzles with deflectors or separate/moving parts for the development of a spray, when tested in accordance with [Annex D \(D.2\)](#), the deflector and its supporting parts shall operate as intended.
- 4.7.3** For open nozzles with blow-off caps, when tested in accordance with [Annex D \(D.3\)](#), the cap shall fully release and not impede the discharge.

4.8 Strength of automatic watermist nozzle body and deflector

4.8.1 Strength of nozzle body

4.8.1.1 Mechanical strength test

For nozzles with the thermal element on the same axis as the water supply, when tested in accordance with [Annex E \(E.1.1\)](#), the watermist nozzle body shall not show permanent elongation of more than 0.2% between the load-bearing parts when subjected to twice the measured service load.

4.8.1.2 Hydrostatic strength test

For nozzles with the thermal element on a different axis to the water supply, when tested in accordance with [Annex E \(E.1.2\)](#), no leakage or permanent visible deformation shall occur.

4.8.2 Strength of nozzle deflector

For nozzles with deflectors (or other protruding parts which impinge upon the water discharge and alter the spray pattern), when tested in accordance with [Annex E \(E.2\)](#), the watermist nozzle deflector and its supporting parts shall withstand an applied force of 70 N without permanent deformation.

4.9 Strength of release element for automatic nozzles

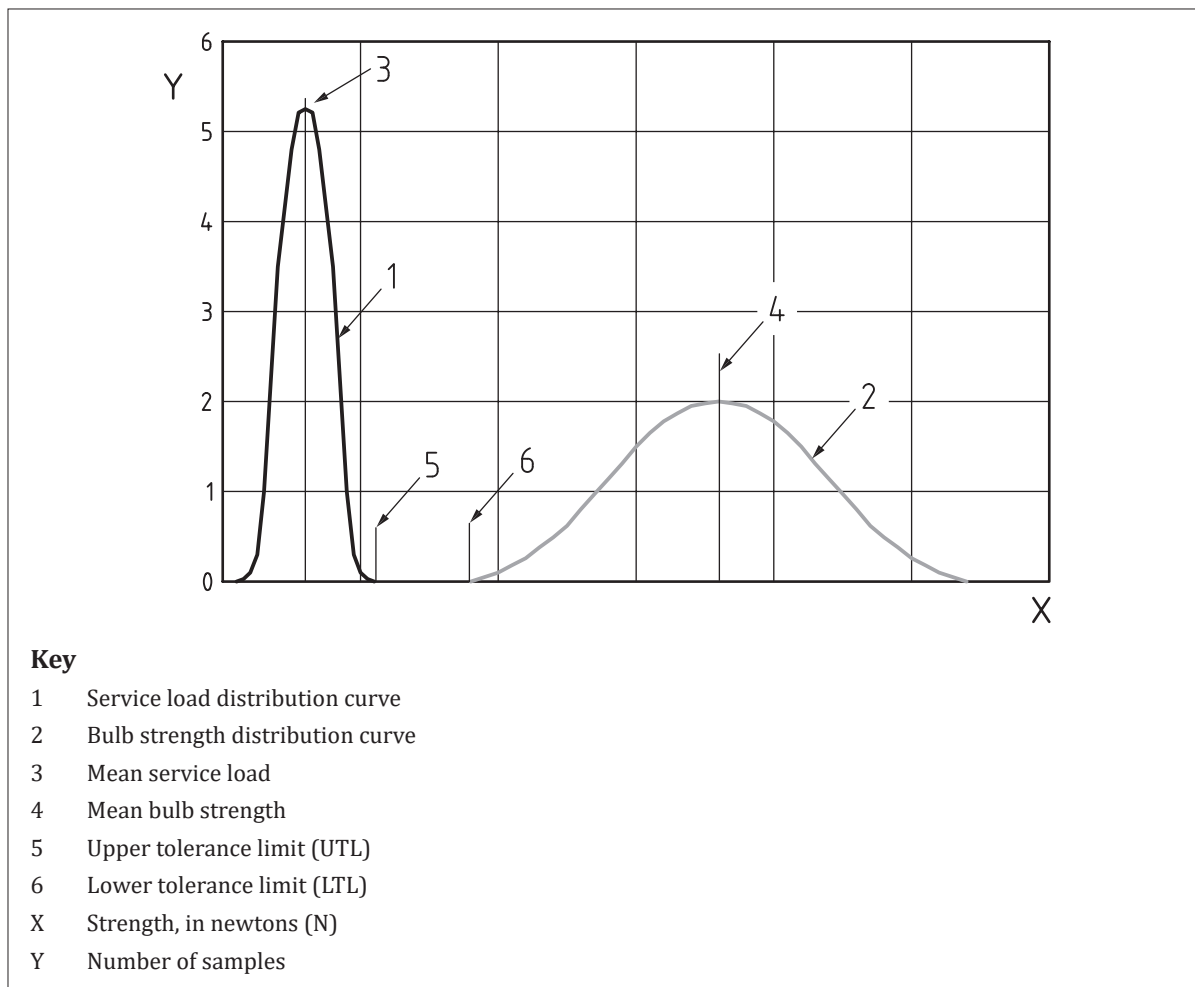
4.9.1 Glass bulb watermist nozzles

For glass bulb watermist nozzles, when tested in accordance with [Annex F \(F.1\)](#), the watermist nozzles shall have:

- a mean design bulb strength of at least six times the mean design service load;
- a mean bulb strength not less than the mean design bulb strength;
- a mean service load not more than the mean design service load;
- a design lower tolerance limit (DLTL) on the distribution curve of at least two times the design upper tolerance limit (DUTL) of the service load distribution curve;
- an upper tolerance limit (UTL) less than or equal to the design upper tolerance limit (DUTL);

- f) a lower tolerance limit (LTL) greater than or equal to the design lower tolerance limit (DLTL) (see [Figure 1](#)).

Figure 1 — Graph of service load and bulb strength distribution curves



4.9.2 Fusible link watermist nozzles

For fusible link watermist nozzles, when tested in accordance with [Annex F \(E2\)](#), the watermist nozzles shall meet one of the following requirements:

- a) the temperature sensitive elements shall withstand a load of 15 times the maximum design load for a period of 100 h, without failure; or
- b) the estimated time to failure of temperature sensitive elements shall be not less than 876 600 h at the design load.

NOTE For further information on the strength test for fusible link elements, see [Annex G](#).

4.10 Leak resistance for automatic nozzles

When tested in accordance with [Annex H](#), automatic watermist nozzles shall not show any sign of leakage.

4.11 Heat exposure (aging) for automatic nozzles

4.11.1 Uncoated watermist nozzles

When tested in accordance with [Annex I \(I.1\)](#), the watermist nozzles shall not operate during the exposure period. When subjected to the additional tests specified in [I.1](#), the watermist nozzles shall meet the following requirements:

- a) when tested in accordance with [D.4](#), the watermist nozzles shall operate such that the waterway is cleared; any lodgements shall be disregarded;
- b) when tested in accordance with [Annex A](#), the watermist nozzles shall conform to the requirements specified in [4.5](#);
- c) when tested in accordance with [Annex H](#), the watermist nozzles shall conform to the requirements specified in [4.10](#).

4.11.2 Glass bulb watermist nozzles

When glass bulb watermist nozzles are tested in accordance with [Annex I \(I.2\)](#), there shall be no damage to the glass bulb.

4.12 Thermal shock for automatic glass bulb nozzles

For automatic glass bulb watermist nozzles, when tested in accordance with [Annex J](#), the glass bulbs shall either:

- a) break correctly on cooling such that the waterway is cleared; or
- b) remain intact, i.e. after immersion, when subjected to a function test in accordance with [D.4](#), they shall operate in such a way that the waterway is cleared; any lodgements shall be disregarded.

4.13 Corrosion

4.13.1 Stress corrosion

Concealed watermist nozzles shall be tested with and without their cover plates assembled.

When watermist nozzles are tested in accordance with [Annex K \(K.1 or K.2\)](#) as appropriate to the material), then those watermist nozzles in which cracks, delamination or failure of an operating part is observed, other than the cover plate, shall show no evidence of leakage in the leak resistance test described in [Annex H](#).

After exposure all watermist nozzles shall be subjected to a function test in accordance with [D.4](#). The watermist nozzles shall operate in such a way that the waterway is cleared; any lodgements shall be disregarded. In the case of concealed watermist nozzles, the three complete assemblies and the three watermist nozzles without cover plates shall be tested.

Those watermist nozzles which show evidence of cracking, delamination or failure of a non-operating part shall show no visible evidence of separation of permanently attached parts when tested in accordance with [Annex B](#), and the *K*-factor shall vary less than $\pm 5\%$.

4.13.2 Sulfur dioxide corrosion

Concealed watermist nozzles shall be tested with and without their cover plates assembled.

When watermist nozzles are tested in accordance with [Annex K \(K.3\)](#), then after exposure, when subjected to a function test in accordance with [D.4](#), the watermist nozzle shall operate in such a way that the waterway is cleared; any lodgements shall be disregarded.

After the sulfur dioxide corrosion test, when the watermist nozzles are tested in accordance with [Annex B](#), the *K*-factor shall vary less than $\pm 5\%$.

4.13.3 Salt mist corrosion

Concealed watermist nozzles shall be tested with and without their cover plates assembled.

When watermist nozzles are tested in accordance with [Annex K \(K.4\)](#), then after exposure, when subjected to a function test in accordance with [D.4](#), the watermist nozzle shall operate in such a way that the waterway is cleared; any lodgements shall be disregarded.

Open nozzles which can incorporate a blow-off cap shall be tested in accordance with [Annex K \(K.4\)](#), then after exposure, when subjected to a function test in accordance with [D.3](#), the watermist nozzle shall operate in such a way that the blow-off cap is fully released.

After the salt mist corrosion test, when the watermist nozzles are tested in accordance with [Annex B](#), the K-factor shall vary less than $\pm 5\%$.

4.13.4 Moist air exposure

When tested in accordance with [Annex K \(K.5\)](#), then after exposure, when subjected to a function test in accordance with [D.4](#), the watermist nozzle shall operate in such a way that the waterway is cleared; any lodgements shall be disregarded.

After the moist air exposure test, when the watermist nozzles are tested in accordance with [Annex B](#), the K-factor shall vary less than $\pm 5\%$.

4.14 Integrity of watermist nozzle coatings (coating resistance to low temperature)

When coated watermist nozzles are tested in accordance with [Annex L](#), any coating (other than decorative coatings) on the watermist nozzle shall not crack or flake.

4.15 Water hammer for automatic nozzles

When tested in accordance with [Annex M](#), watermist nozzles shall not leak. After the test, when subjected to a function test in accordance with [D.4](#), the watermist nozzle shall operate in such a way that the waterway is cleared; any lodgements shall be disregarded.

4.16 Thermal response

NOTE The orientations used for the thermal response tests are:

- *favourable orientation, such that the heat responsive element is fully exposed to the airflow;*
- *unfavourable orientation, with the influence of any yoke arm shadow effect limited to a nominal angle of 25° each side of the yoke arm.*

4.16.1 Response in the favourable orientation

For exposed watermist nozzles, when tested in accordance with [Annex N \(N.1\)](#) in the favourable orientation, the nozzles shall fall within the response time index (RTI) and conductivity factor (C) limits as shown in [Figure 2](#).

For non-exposed watermist nozzles, when tested in accordance with [Annex N \(N.2\)](#) in the favourable orientation, watermist nozzles shall have a wind tunnel response time within $\pm 10\%$ of the manufacturer's declared range.