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# PREVENT SYSTEMS

FIRE SUPPRESSION WITH LOW PRESSURE WATER MIST  
– A REAL ALTERNATIVE

## Testing to the British Water Mist Standards

– Residential and Commercial low hazard

UK water mist seminar

BRE Global, Watford, March 1, 2018

Erling Mengshoel, Prevent Systems

The logo for Prevent Systems features the company name in a bold, white, sans-serif font. To the right of the text is a circular graphic composed of numerous small dots in shades of blue, white, and orange, arranged in a pattern that suggests a globe or a network.

PREVENT  
SYSTEMS

# Short intro

Managing director and co-founder of Prevent Systems AS, est. 2007

First company to successfully pass the test requirements to:

- BS- DD 8458
- BS 8458, including open room tests
- BS 8489-7, category 3

First company with LPCB certified automatic water mist nozzles, listed in the RedBook

Water mist nozzles distributed in the UK by IPS Flow Systems

Prevent Systems researches, develops and distributes its' own patented low pressure water mist technology



# Residential water mist fire tests - BS 8458

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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# Commercial low hazard fire tests – BS 8489 - 7

BS 8489-7:2016



BSI Standards Publication

**Fixed fire protection  
systems – Industrial and  
commercial watermist  
systems**

Part 7: Fire performance tests and  
requirements for watermist systems  
for the protection of low hazard  
occupancies

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# BS 8458:2015

## 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](#)<sup>1)</sup>.

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.

Table 1 Category of system

Category of system	Description of building/occupancy
Domestic occupancy	<p>Single family dwellings such as:</p> <ul style="list-style-type: none"> <li>• Individual dwelling house</li> <li>• Individual flat</li> <li>• Individual maisonette</li> <li>• Transportable home</li> </ul> <p>Houses of multiple occupation (HMOs) <sup>A)</sup></p> <p>Bed and breakfast accommodation <sup>A)</sup></p> <p>Boarding houses <sup>A)</sup></p> <p>Blocks of flats 18 m or less in height and with a maximum total floor area of 2 400 m<sup>2</sup> <sup>B), C)</sup></p>
Residential occupancy	<p>Blocks of flats greater than 18 m in height <sup>C)</sup></p> <p>Sheltered and extra care housing</p> <p>Residential care premises</p> <p>Residential rehabilitation accommodation</p> <p>Dormitories (e.g. attached to educational establishments)</p> <p>Hostels</p>



## 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;*

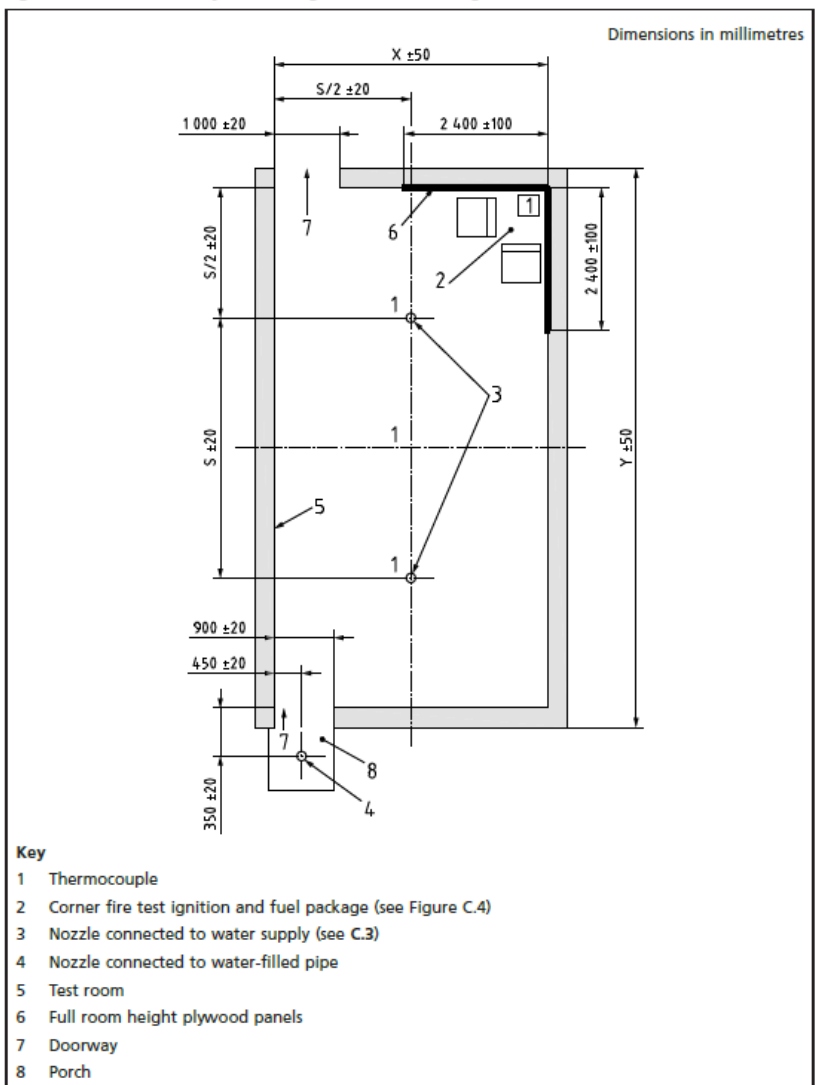
# Residential water mist

## fire tests - BS 8458

4 fire tests in enclosed room;

- Corner
- Under 1
- Between 2
- With forced ventilation

Figure C.1 Corner test layout showing a two-nozzle arrangement



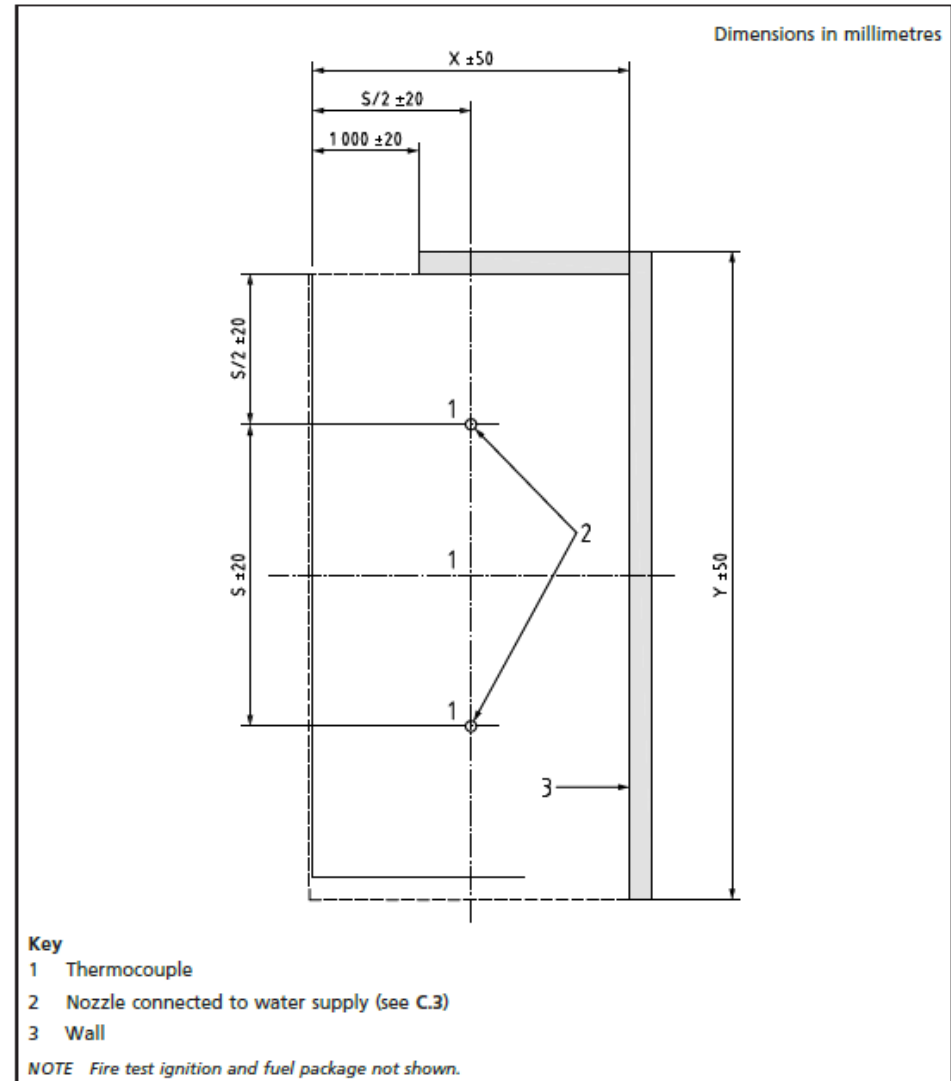


# Residential water mist fire tests - BS 8458

## 2 open room tests

- Two tests repeated

Figure C.7 Open room test layout showing a two-nozzle arrangement



## Residential water mist test fire load



## Residential sprinkler test fire load



# Residential water mist test

BS 8458:2015 –between 2 nozzles open room





# Pass / fail requirements

## 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)

## 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

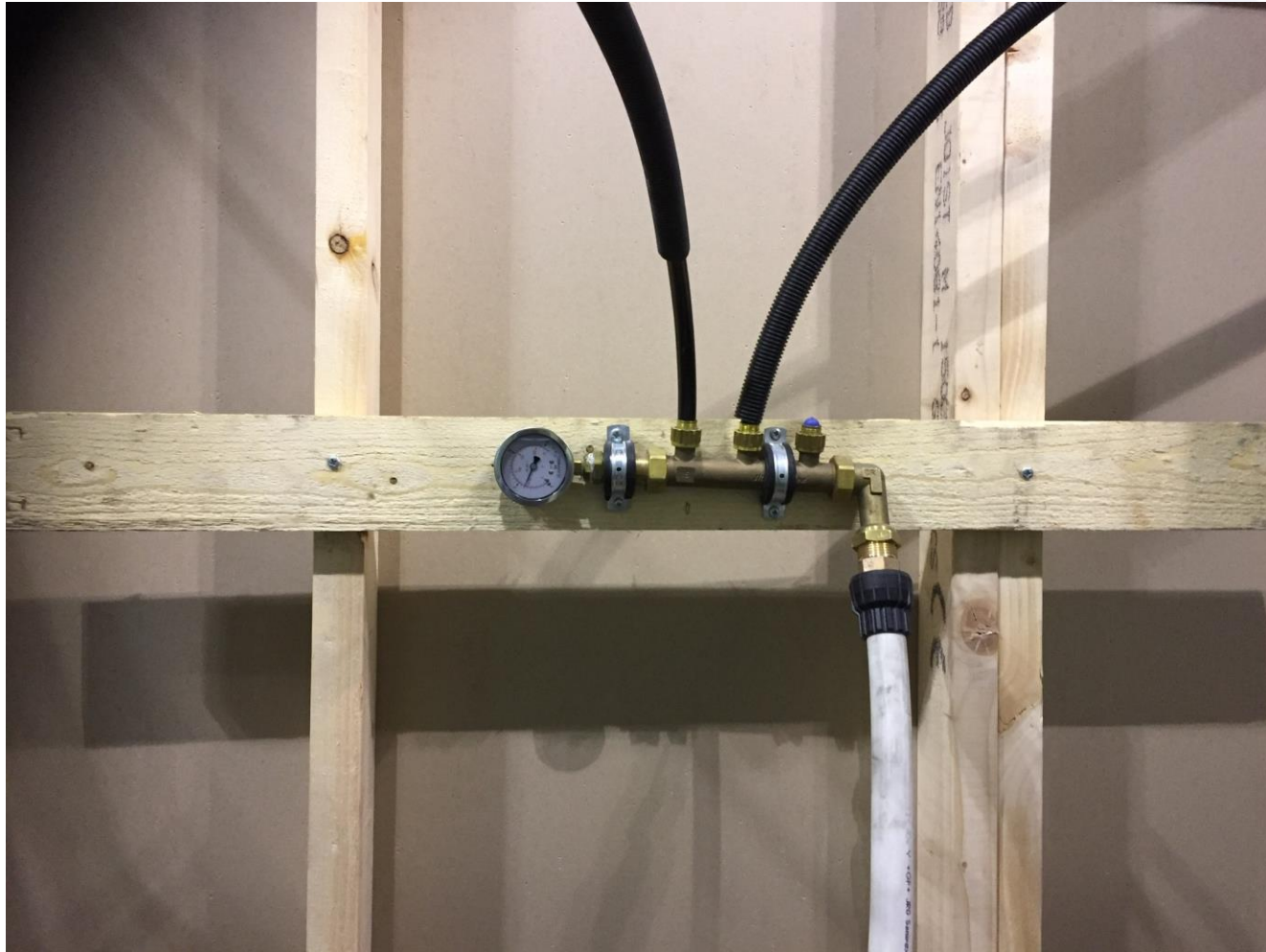
Fire tests	Maximum room size	Maximum ceiling height
a, b, c, d	Fire test room	3.5 m
a, b, c, d, e	80 m <sup>2</sup>	3.5 m
a, b, c, d, f	Fire test room	5.5 m
a, b, c, d, e, f	80 m <sup>2</sup>	5.5 m

## Pump-set for residential fire tests





## Pipe in-tube system for residential fire tests



## BRE Global Test Report

Fire tests to Annex C of BS 8458 with a Prevent low pressure water mist system incorporating Prev5exp20 nozzles

Prepared for: Prevent Systems  
Date: 10 May 2017  
Report Number: P107196-1000 Issue: 1

Fire tests to Annex C of BS 8458: 2015 with Prevent Systems Prev5exp20 nozzles

Report Number: P107196-1000  
Issue: 1

### 4 Conclusion

The Prevent water mist system submitted to BRE Global for testing and as described in section 2.3 of this report met the recommendations of Clause 6.1 of BS 8458: 2015 when tested in accordance with Annex C, Clauses C.1 to C.4.

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## A summary of a research project report comparing residential sprinklers and water mist

Brandförsök med boendesprinkler och vattendimma

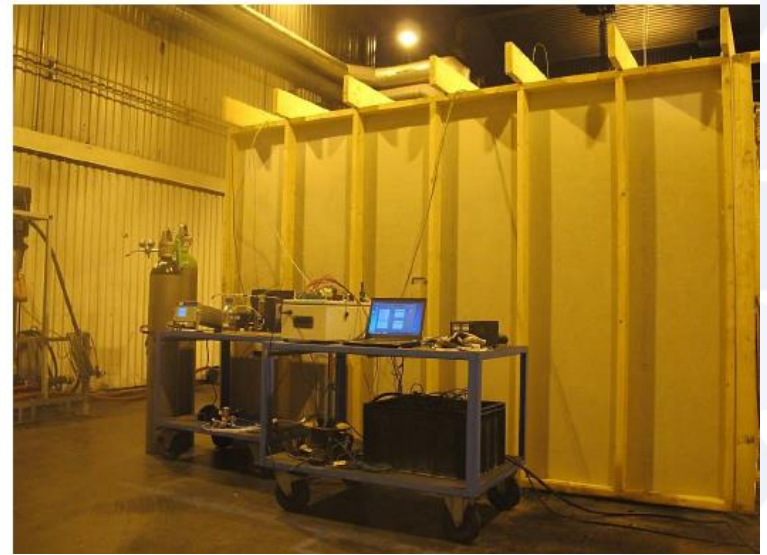
Magnus Arvidson, RISE Safety and Transport  
Sprinklerdagen 2017, 6 april 2017, Sollentuna

Research Institutes of Sweden  
**Safety and Transport**  
Fire Research



# Test room

- Area:  $3.66\text{m} \times 3.66\text{m} = 13.4\text{m}^2$
- Ceiling height: 2.5m
- Door opening:  $0.90\text{m} \times 2.08\text{m}$





## Loss of fire load– in a 13.4m<sup>2</sup> room

Prev3exp compared to Residential sprinkler head using 2.05mm/m<sup>2</sup>/min



Low pressure water mist



Residential sprinkler

## Loss of fire load– in a 13.4m<sup>2</sup> room

Prev3exp compared to Residential sprinkler head using 2.05mm og 4.1mm/m<sup>2</sup>/min



Low pressure water mist

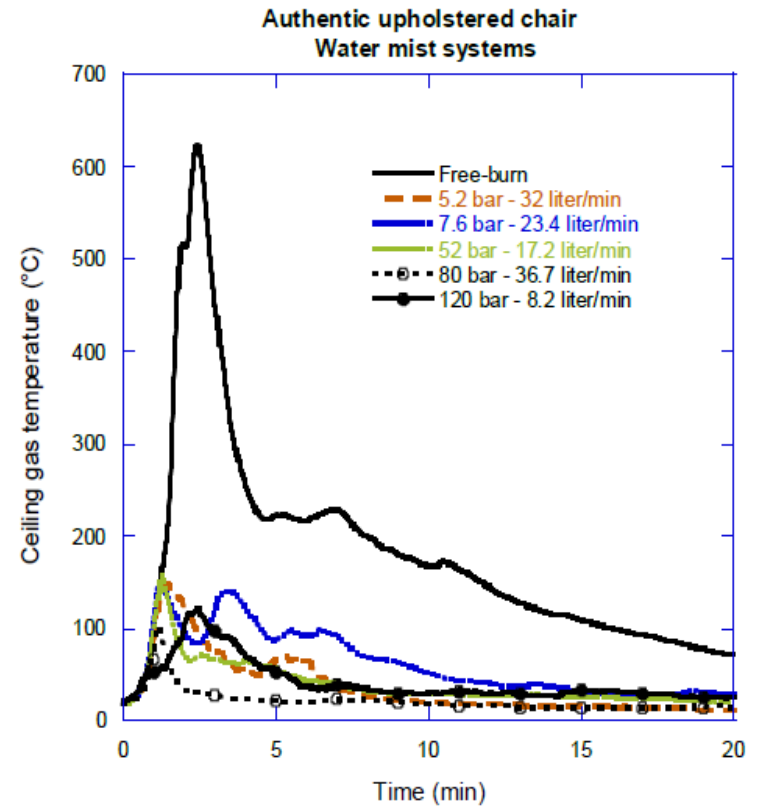
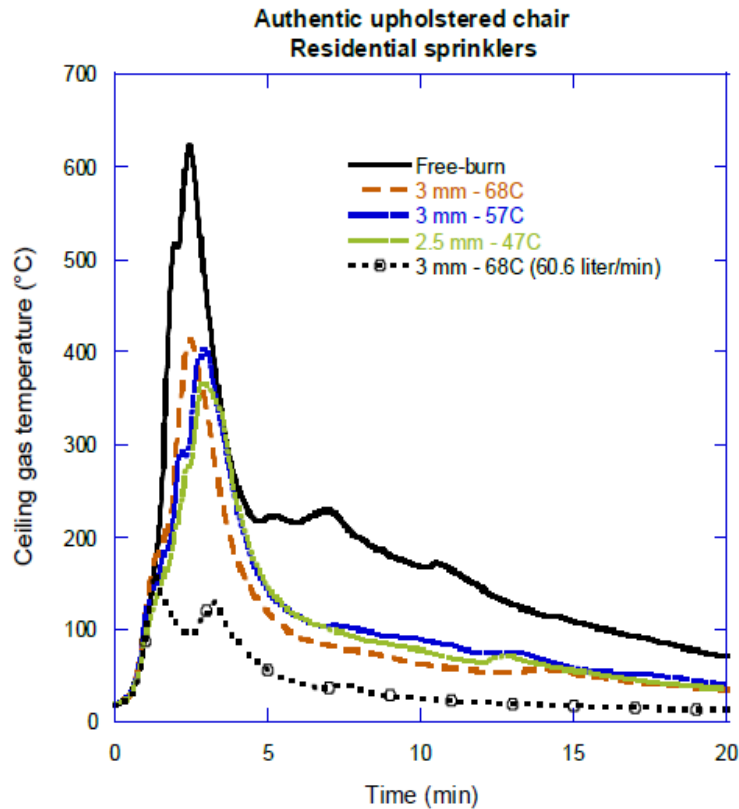


Residential sprinkler -  
2.05mm



Residential sprinkler -  
4.1mm

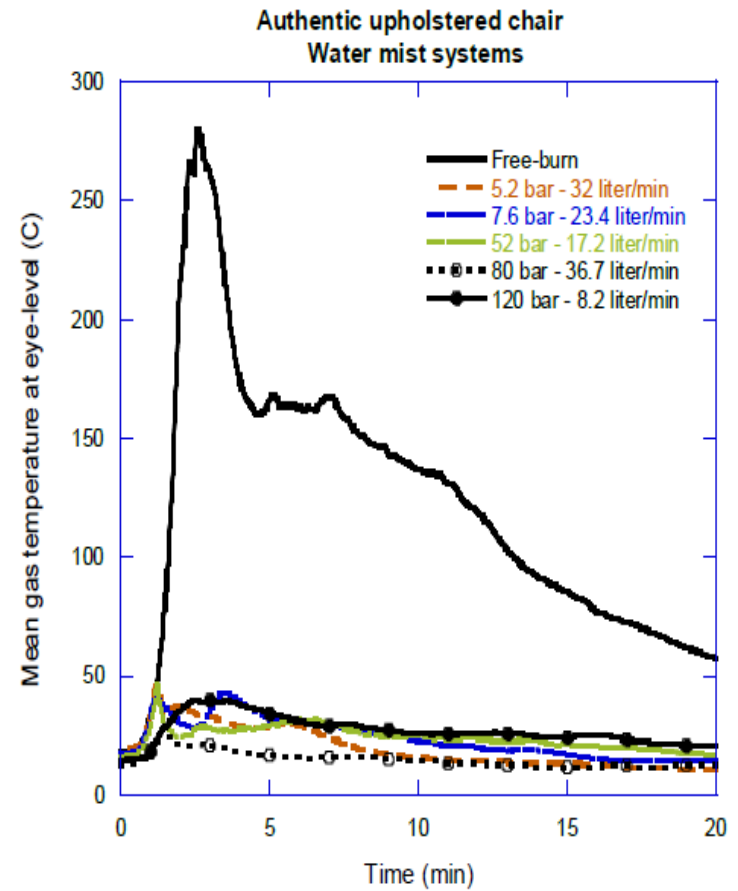
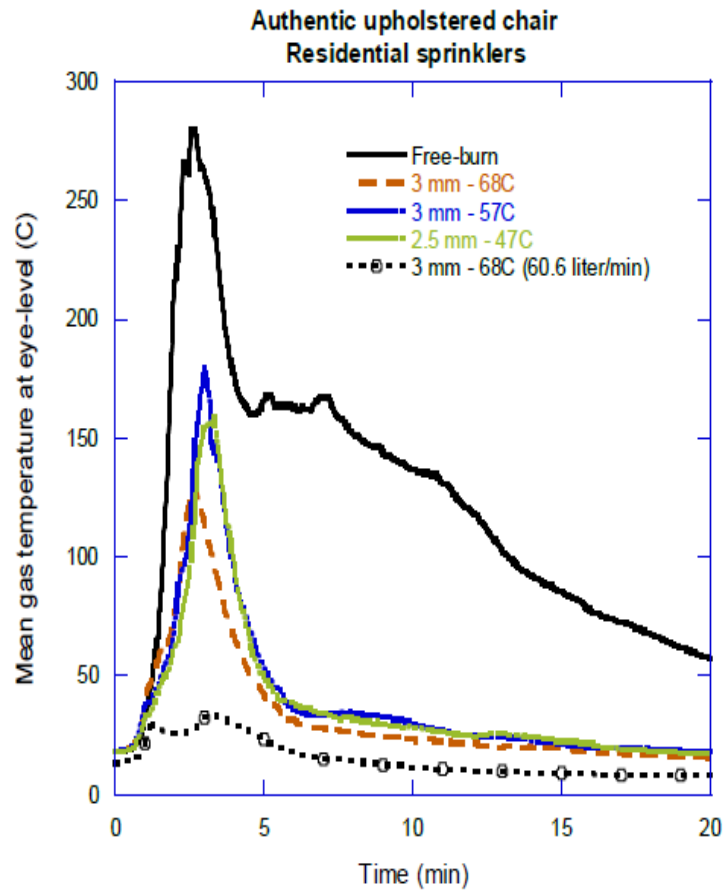
# Gas temperatures at ceiling





# Gas temperatures at eye-height

(3 different measuring points)



# Residential water mist fire tests - BS 8458

BS 8458:2015



BSI Standards Publication

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# Commercial low hazard fire tests – BS 8489 - 7

BS 8489-7:2016



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Part 7: Fire performance tests and  
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# Commercial low hazard fire tests – BS 8489-7, category 3

## 1 Scope

This part of BS 8489 describes tests and specifies requirements for industrial and commercial watermist systems for the protection of low hazard occupancies as defined in BS 8489-1.

This part of BS 8489 is applicable to ceiling heights up to 5 m.

Table 1 Occupancies and acceptable fire test protocols for an automatic watermist system<sup>A)</sup>

Occupancy	Description of occupancy	Exceptions	Fire test protocol
Apartments (where BS 8458 cannot be complied with or is not appropriate) Churches Concealed spaces Gymnasiums Hotel bed rooms and their access (only) Local lending libraries Residential or nursing or convalescent homes where BS 8458 cannot be complied with or is not appropriate Offices Restaurant seating areas Schools and university classrooms Unused attics in low hazard premises containing no combustible contents or stored materials and no electrical or mechanical services other than lighting	Lightly loaded non-storage and non-manufacturing areas with ordinary combustibles  Expect fire with relatively low rates of heat release in these occupancies	Mat stores	BS 8489-7  FM 5560:2016, Appendix G

*NOTE The listed test protocols are applicable with the following limited parameters.*

- BS 8489-7 covers Category 1, 2 and 3 systems for:
  - fire loads  $\leq 500 \text{ MJ/m}^2$  (covered in Category 3 only);
  - ceiling heights  $\leq$  tested height up to 5 m;
  - floor area = restricted and unrestricted;

# Commercial low hazard fire tests – BS 8489-7, category 3



Figure 2 – Fuel package

## 2.1 Test ceiling

The non-combustible ceiling for the test was 6 m by 6 m and was installed at a height of 5 m. A plan view schematic drawing of the test ceiling is shown in Figure 1.

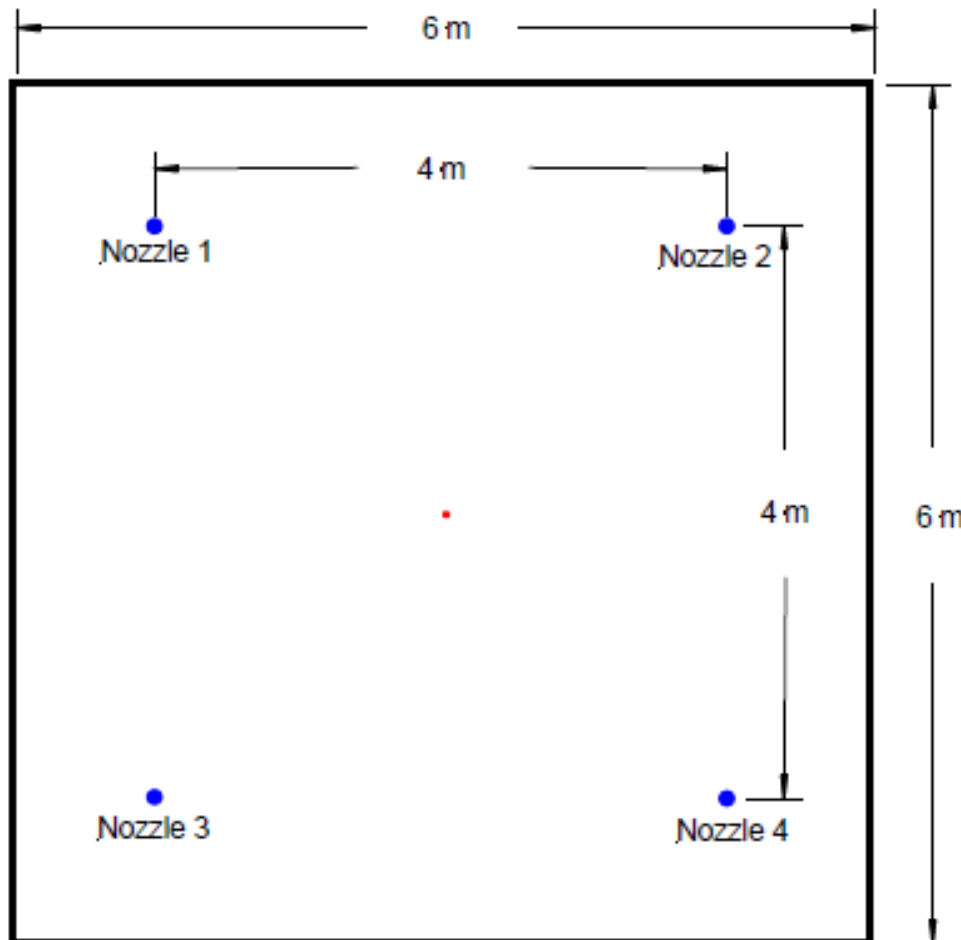


Figure 1 – Schematic plan view drawing of the test ceiling

## 4 fire tests

- Under one nozzle
- Between two nozzles
- Between four nozzles
- Repeat the worst



# Pass / fail requirements

BS 8489-7:2016

BRITISH STANDARD

- g) For tests 7.8 and 7.9:
- damage to the plywood walls does not extend to the full height at the ends of the walls;
  - damage to the foam and box files does not extend to all areas;
  - the maximum gas temperature over ignition 76 mm below the ceiling does not exceed 80 °C, for a duration longer than 3 min for the 30 min system discharge;
  - after 5 min (measured either from the start of system operation or the ignition of both wood cribs, whichever takes the longer), the mean ceiling temperatures (see 7.1.6) remain steady or decrease until the end of the test.



The fire damage to the plywood walls is shown in Figure 19.



Figure 19 – Fire damage to the plywood walls, foam sheets and box files

## BRE Global Assessment Report

Assessment report for a Prevent low pressure water mist system tested to BS 8489-7

Prepared for: Prevent Systems

Date: 19 January 2017

Report Number: P109045-1001 Issue: 1

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## 5 Conclusion

On the basis of the information provided, in our opinion:

1. The Prevent automatic low pressure water mist system tested in 2014 (as reported in BRE Global report 293115) met the fire test requirements of Clauses 8 f) and g) of BS 8489-7: 2016.
2. There was no detrimental impact in the nozzle operation time or the suppression effectiveness of the stainless steel Prev5exp nozzle compared to the brass Prev5exp nozzle.

# Design, Installation, Operation and Maintenance Manual «DIOM»



# prEN 14972

EN 14972, *Fixed firefighting systems — Water mist systems*, consists of the following parts:

- Part 1: *Design, installation, inspection and maintenance*;
- Part 2: *Test protocol for shopping areas for automatic nozzle systems*;
- Part 3: *Test protocol for office, school class rooms and hotel for automatic nozzle systems*;
- Part 4: *Test protocol for non-storage occupancies for automatic nozzle systems*;
- Part 5: *Test protocol for car garages for automatic nozzle systems*;
- Part 6: *Test protocol for false floors and false ceilings for automatic nozzle systems*;
- Part 7: *Test protocol for commercial low hazard occupancies for automatic nozzle systems*;
- Part 8: *Test protocol for machinery in enclosures exceeding 260 m<sup>3</sup> for open nozzle systems*;
- Part 9: *Test protocol for machinery in enclosures not exceeding 260 m<sup>3</sup> for open nozzle systems*;
- Part 10: *Test protocol for atrium protection with sidewall nozzles for open nozzle systems*;
- Part 11: *Test protocol for cable tunnels for open nozzle systems*;
- Part 12: *Test protocol for commercial deep fat cooking fryers for open nozzle systems*;
- Part 13: *Test protocol for wet benches and other similar processing equipment for open nozzle systems*;
- Part 14: *Test protocol for combustion turbines in enclosures exceeding 260 m<sup>3</sup> for open nozzle systems*;
- Part 15: *Test protocol for combustion turbines in enclosures not exceeding 260 m<sup>3</sup> for open nozzle systems*;
- Part 16: *Test protocol for industrial oil cookers for open nozzle systems*.
- Part 17: *Test protocol for residential and domestic areas for automatic nozzle systems*.



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# Summary

- Demanding performance based fire test standards
- Repeatable tests – consistent fire development
- Confidence in performance
- Allows manufacturer the opportunity to compete in the marketplace – similar design criteria to sprinkler
- Room for improvement – ex. BS 8489 -7 ceiling heights

Thank you for your attention!

Questions?