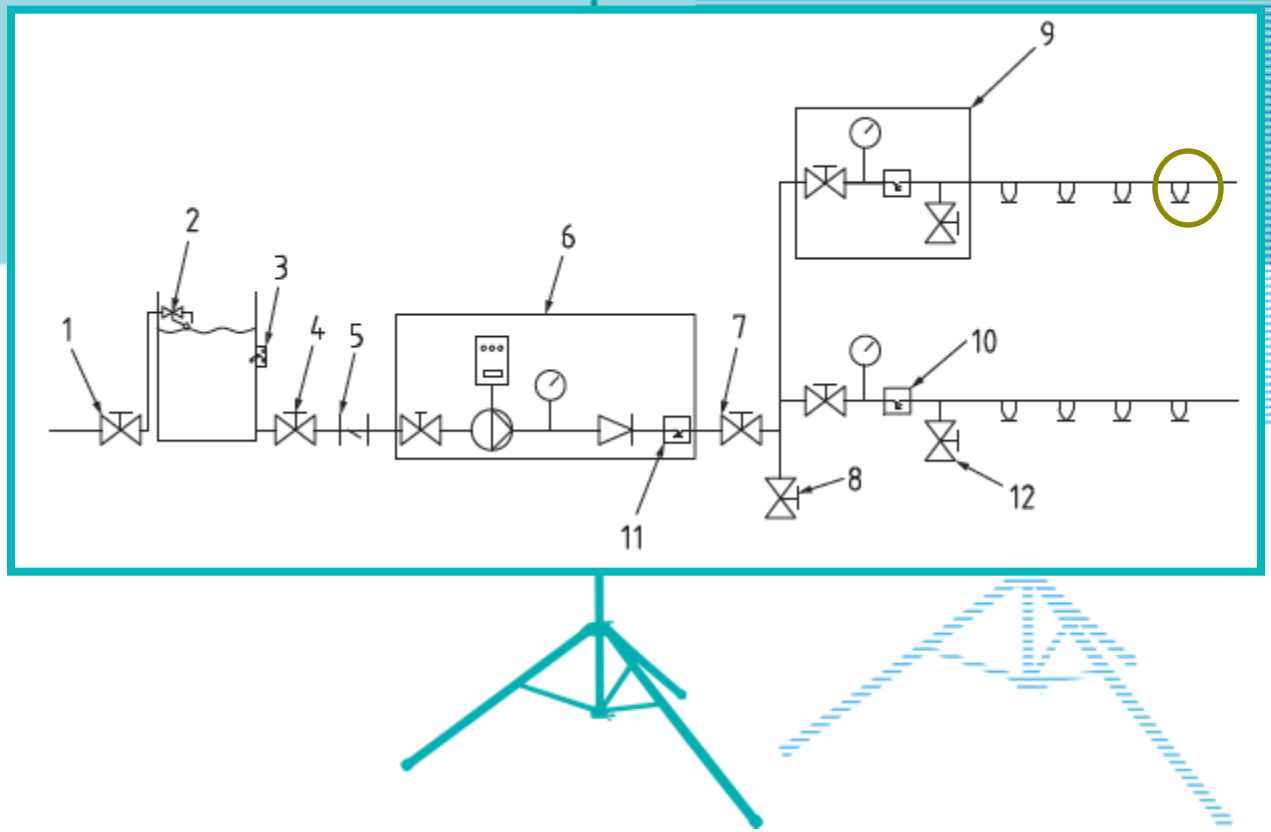
Test and approval of components - watermist nozzles

Louise Jackman
IWMA Water Mist Seminar, Poland
November 2017

Components



Watermist nozzle

Bespoke watermist nozzles

- Engineering precision
- Material selection (e.g stainless steel, Teflon)
- Dynamic forces (e.g. valve function)
- Integral detection (e.g. bulb)
- Flow paths (K-factor)
- Availability (e.g. strainers)

- Manufacturing
- Assembly

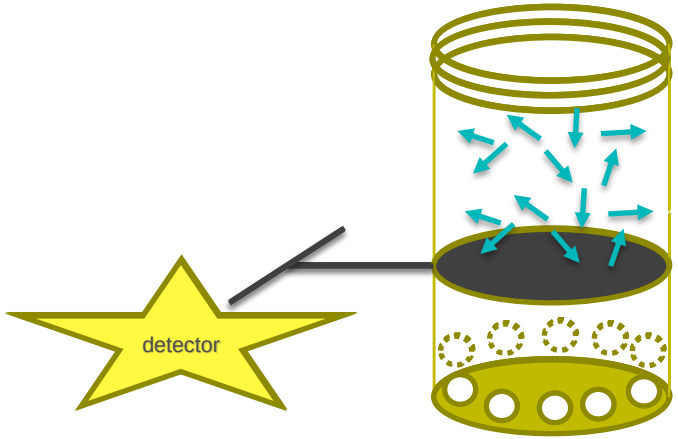
Watermist nozzle

Automatic nozzle

- Body, fittings and openings

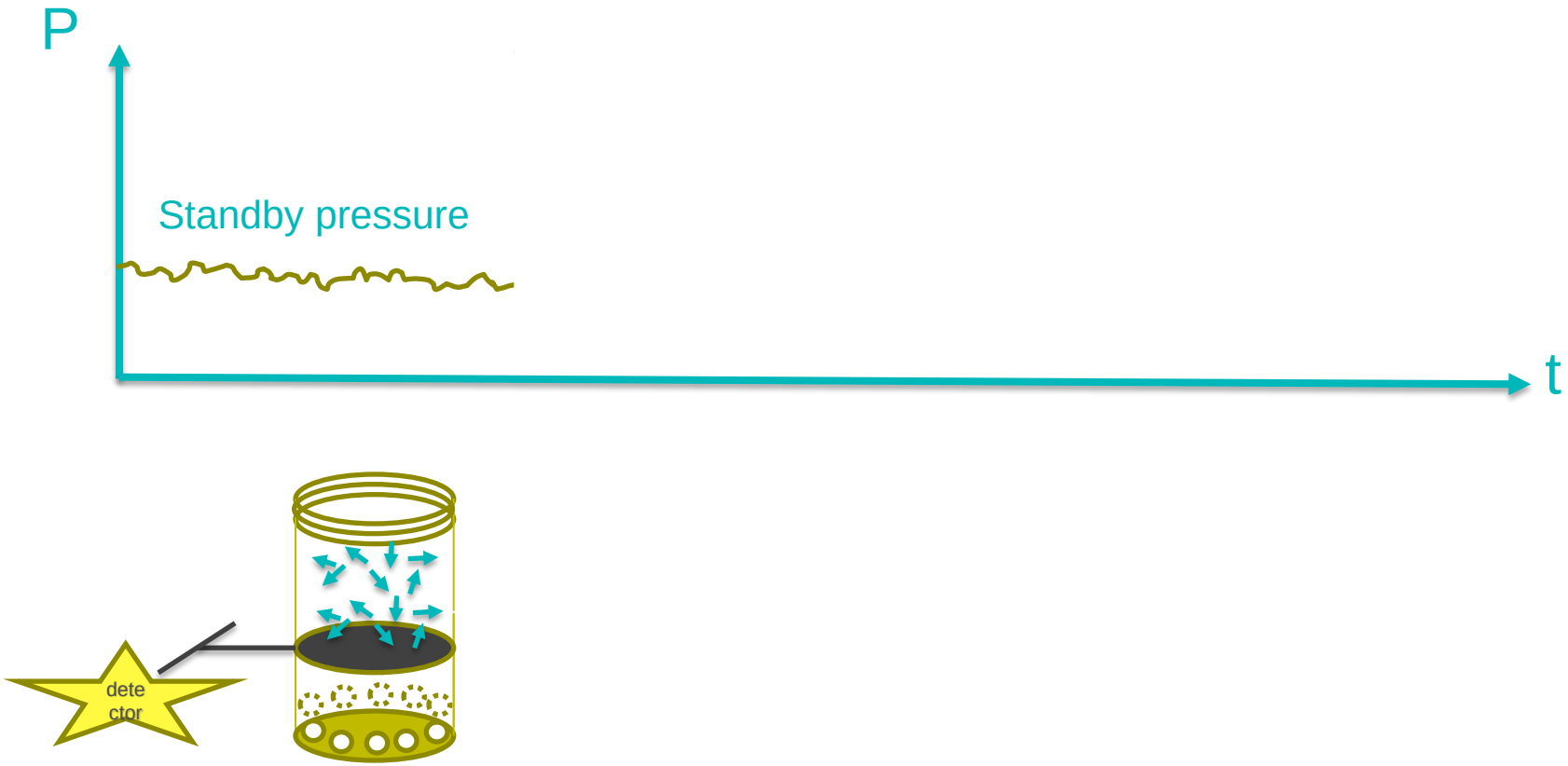
- Valve
- Detector

- Water filled
- Under pressure
- Openings exposed to atmosphere



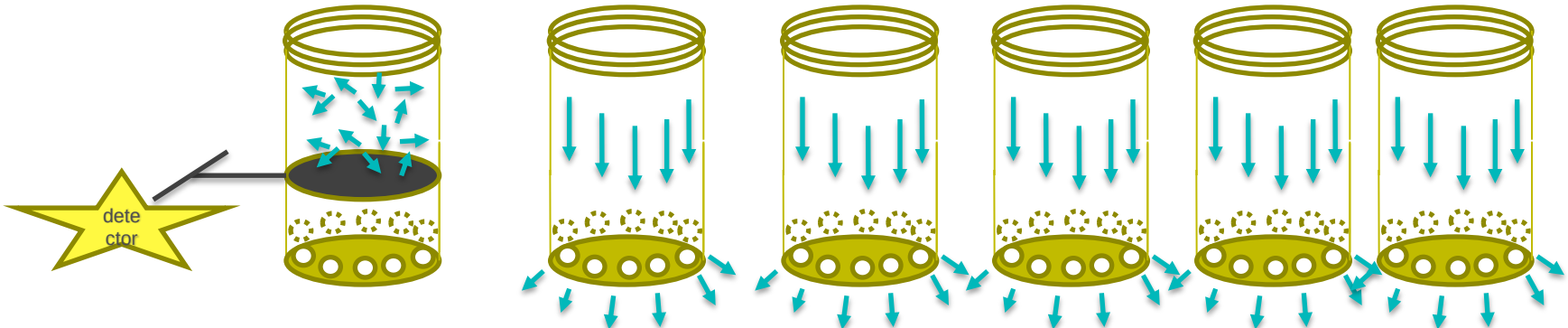
Watermist nozzle pressure

Pressure at a remote nozzle

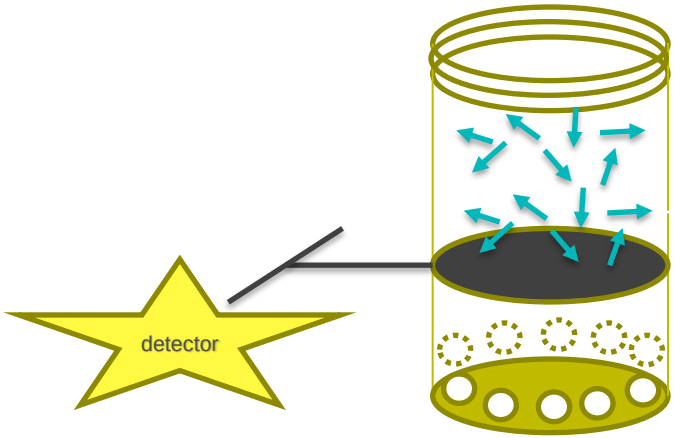


Watermist nozzle pressure

Pressure at a remote nozzle



Watermist nozzle challenge – ambient (no fire)

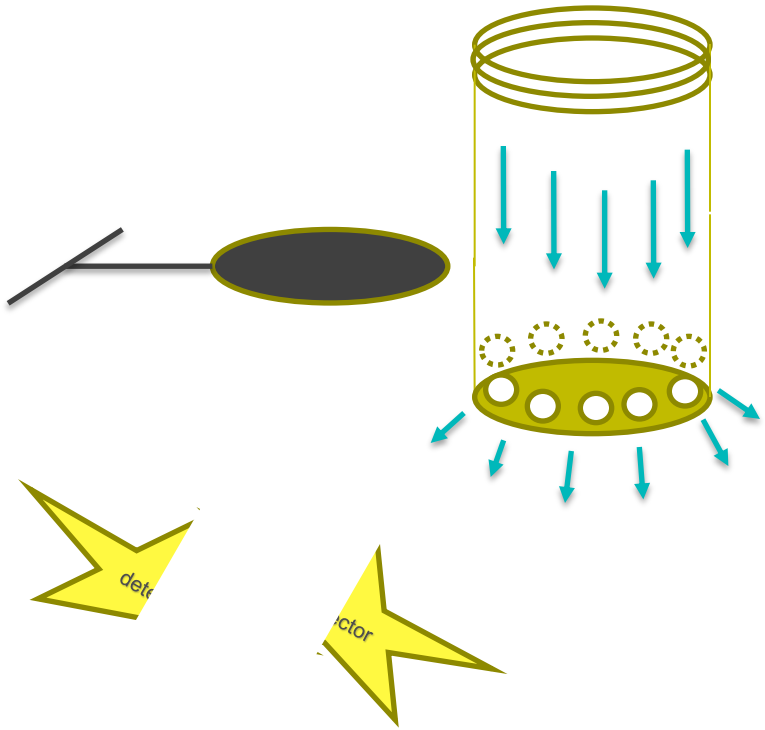


Functions:
- Detection 100% available
- No accidental detection
- Pressure maintained
- No Leaks

Exposure (years):
- Pressure changes
- Temperature cycling
- Movement
- Mass concentration changes
- Environmental pollutants (paint, cleaning products…)

Potential problems:
- Corrosion (cracks, pits, deposits)
- Valve seat (leak, lock)
- Elastomer migration, adhesion
- Detector (cracks, deposits)

Watermist nozzle challenge - fire



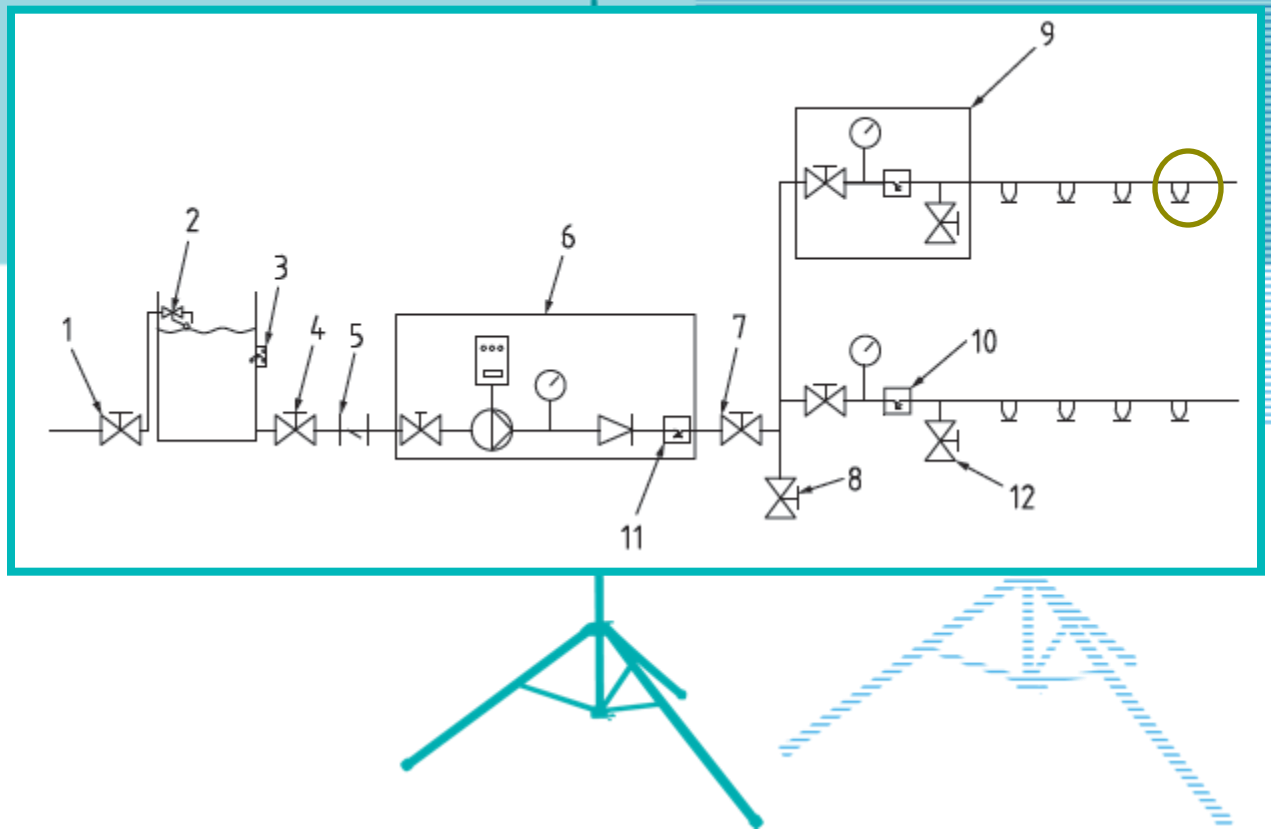
Functions:

- Immediate action
- Detection
- Actuate, open valve
- Water flow through openings

Need:

- Sensitive detector
- Sufficient force to open valve, i.e. no stuck valves
- No obstruction to small orifices, i.e. pressure/flow regime for spray achieved

Assurance by testing



Watermist nozzle

Sprinkler heads: qualitative analysis - causes of failures

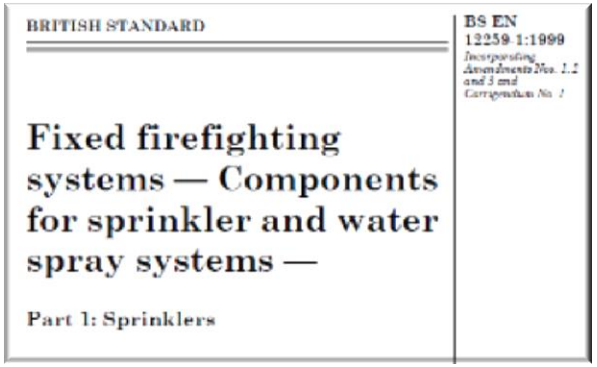
SERGE ZHUIYKOV, Ph.D.* and VINCE DOWLING *Materials Scientist
CSIRO, Manufacturing and Infrastructure Technology, Industrial & Research Services, Australia
FIRE SAFETY SCIENCE–PROCEEDINGS OF THE EIGHTH INTERNATIONAL SYMPOSIUM, 2005

- 3% “O-ring adhesion” of the sprinkler head;
- 4% Undetected rupture of bulb wall;
- 4% Systems “dosed” with sodium silicate in order to overcome small leaks;
- 7 % Heavy deposits of hardened sediment;
- 8% Heavy build-up of dirt and debris on the frame, heat sensitive element and deflector;
- 15% “Intergranular” corrosion of the lead-tin-bismuth “eutectic solder”;
- 29% Unlisted sprinkler heads;
- 30% Extensive deposit of paint on the deflector and the glass bulb or fusible link.

Component tests

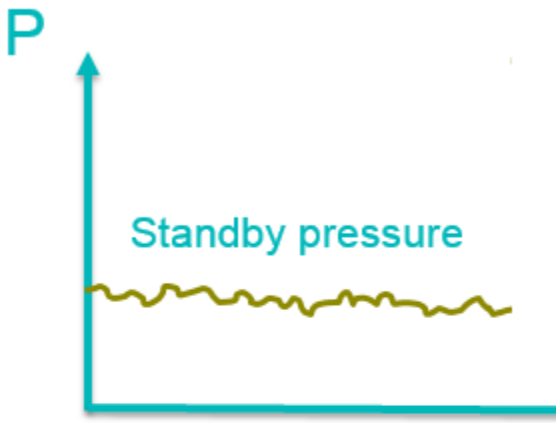
- Assessment of performance against standardised methodologies
- Testing to address: robustness, continuous availability ….
- Ensure a consistent approach with a standard baseline
- 100 + samples, minimum 6 months testing, BREG test report

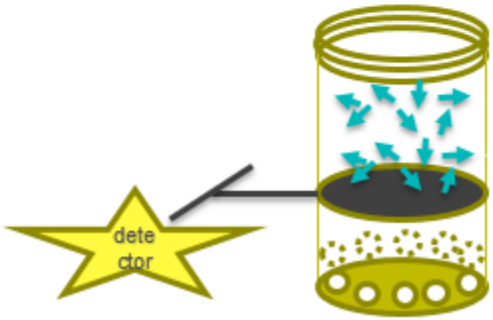
Watermist nozzle test based on sprinkler component tests from EN 12259-1



Nozzle tests – body and valve

- No accidental detection
- No Leaks
- Pressure maintained



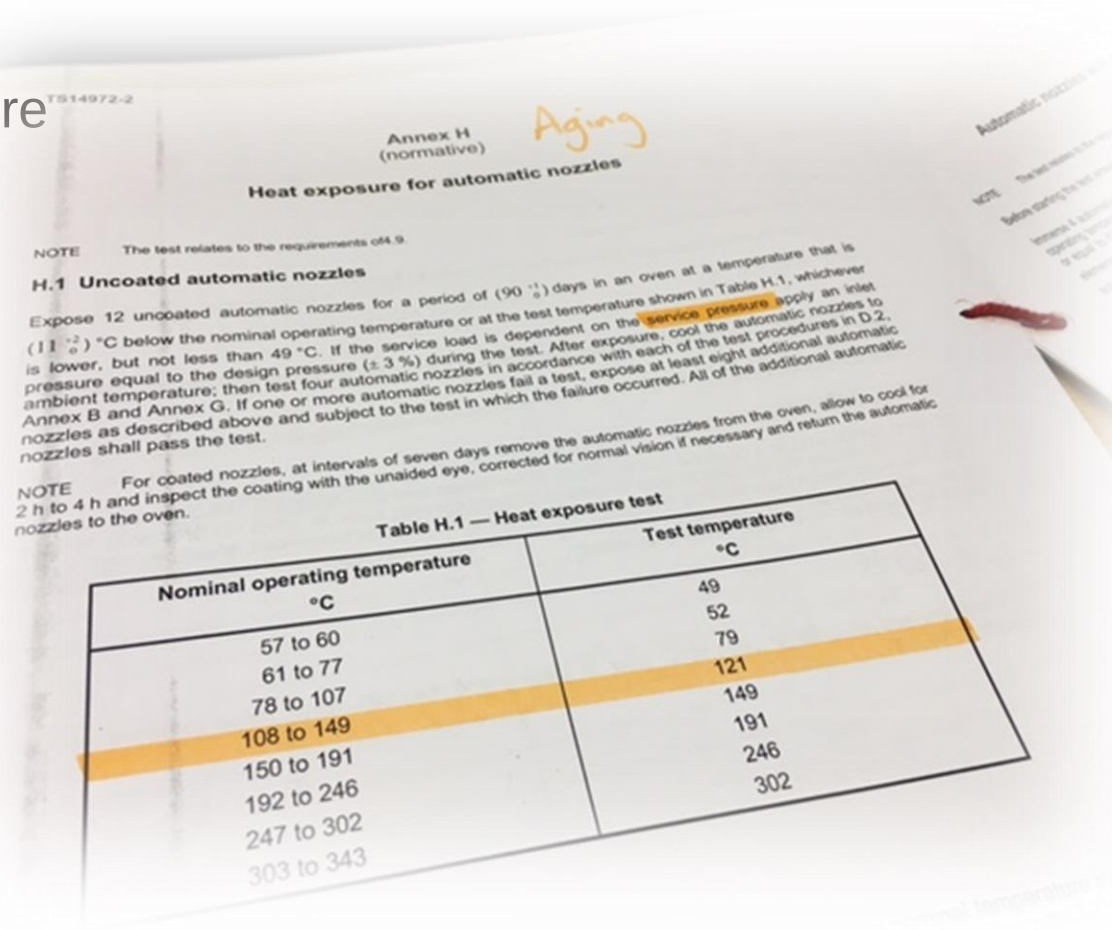


Tests:

- Thermal shock
- Strength of body
- Service load
- Leakage
- Water Hammer
- Vibration
- Impact resistance
- Corrosion (with parts exposed)
  - Stress (brass/SS)
  - Sulphur dioxide
  - Salt mist
  - Moist air
- Long term aging

Long term aging (heat exposure)

- Sprinkler baseline criteria
  - Standby/service pressure
  - 121 degC minimum
  - 90 days
- Post aging tests
  - Function (at Pmin)
  - Leak (at Pmax)
  - Operating temperature



TS14972-2

Annex H
(normative)

Aging

Heat exposure for automatic nozzles

NOTE The test relates to the requirements of 4.9.

H.1 Uncoated automatic nozzles

Expose 12 uncoated automatic nozzles for a period of (90 $^{+1}_{0}$) days in an oven at a temperature that is (11^{+2}_{0}) °C below the nominal operating temperature or at the test temperature shown in Table H.1, whichever is lower, but not less than 49 °C. If the service load is dependent on the service pressure apply an inlet pressure equal to the design pressure (± 3 %) during the test. After exposure, cool the automatic nozzles to ambient temperature; then test four automatic nozzles in accordance with each of the test procedures in D.2, Annex B and Annex G. If one or more automatic nozzles fail a test, expose at least eight additional automatic nozzles as described above and subject to the test in which the failure occurred. All of the additional automatic nozzles shall pass the test.

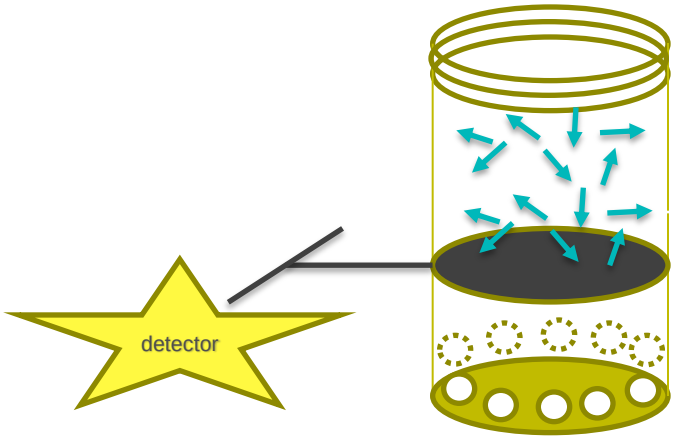
NOTE For coated nozzles, at intervals of seven days remove the automatic nozzles from the oven, allow to cool for 2 h to 4 h and inspect the coating with the unaided eye, corrected for normal vision if necessary and return the automatic nozzles to the oven.

Table H.1 — Heat exposure test

Nominal operating temperature °C	Test temperature °C
57 to 60	49
61 to 77	52
78 to 107	79
108 to 149	121
150 to 191	149
192 to 246	191
247 to 302	246
303 to 343	302

Nozzle tests - detection

- Detection within limits
- No accidental detection

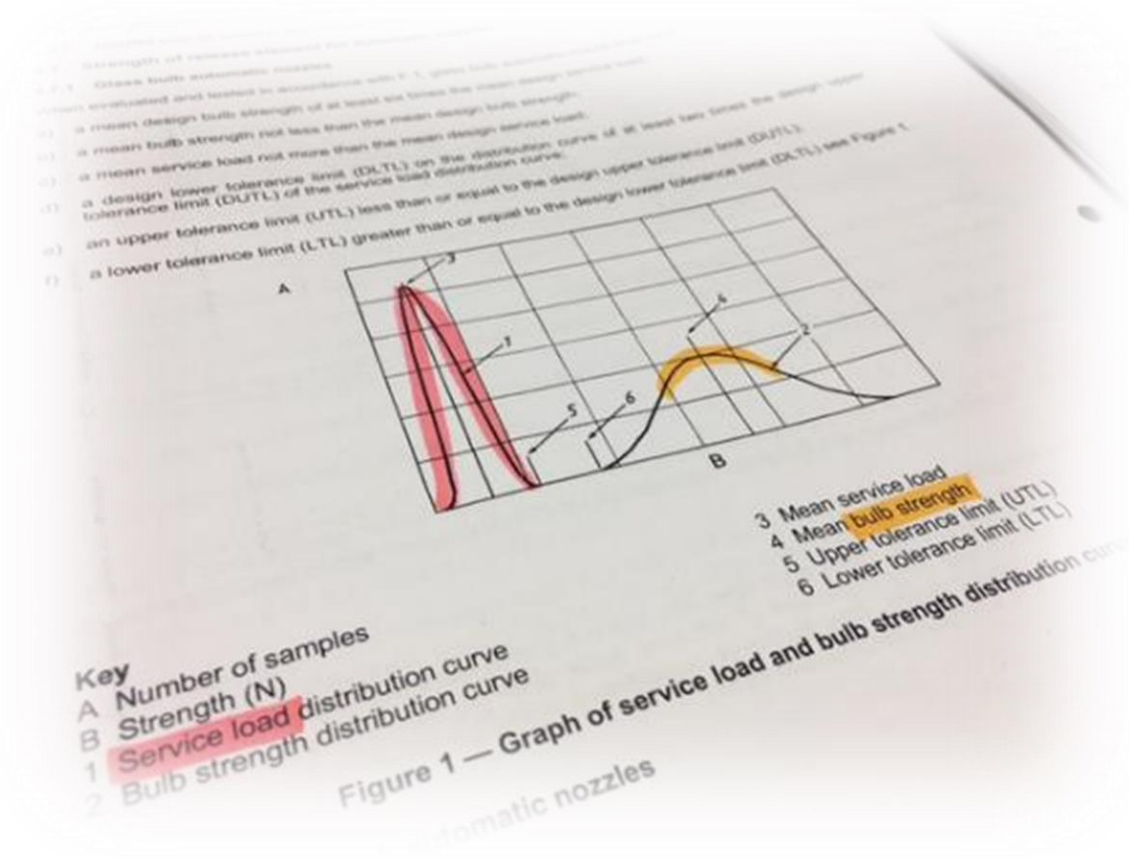


Tests:

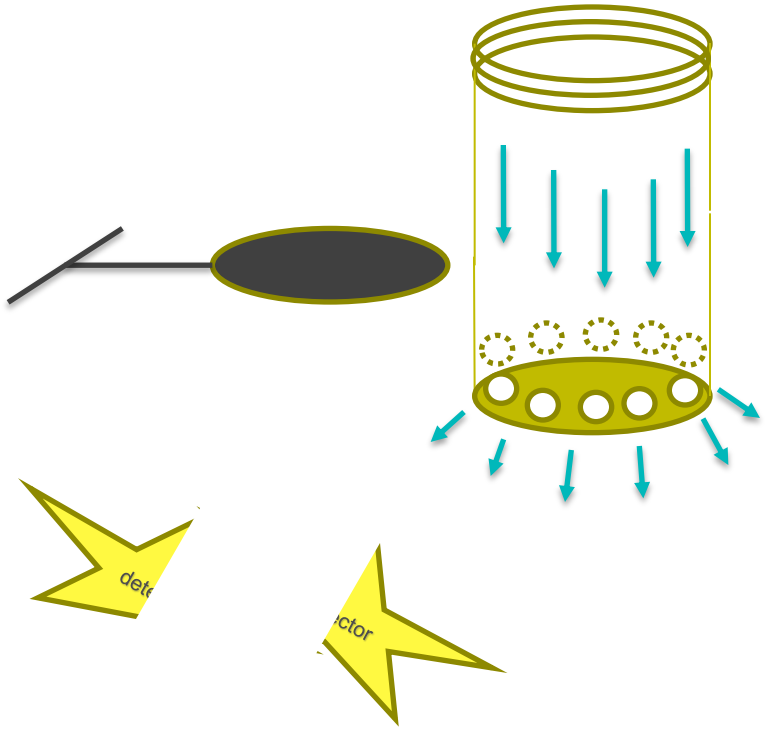
- Operating temperature
- Thermal response
- Thermal shock
- Strength of body
- Service load

Service load

- Nozzle assembly criteria
  - Applied service load
  - Torque precision
- Tests
  - Determine frame load
  - Bulb strength



Nozzle tests - actuate and deliver



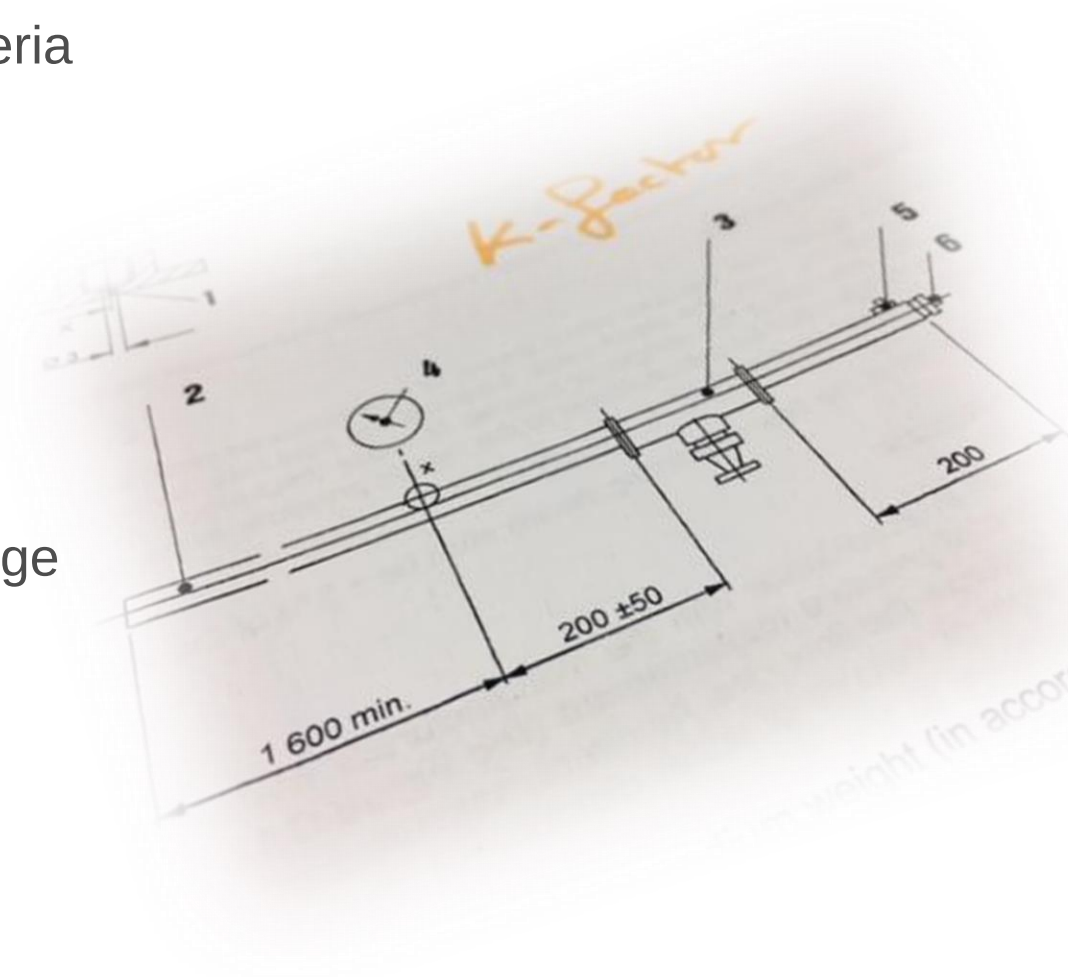
- Detector responds
- No stuck valves
- No obstructions

Tests:

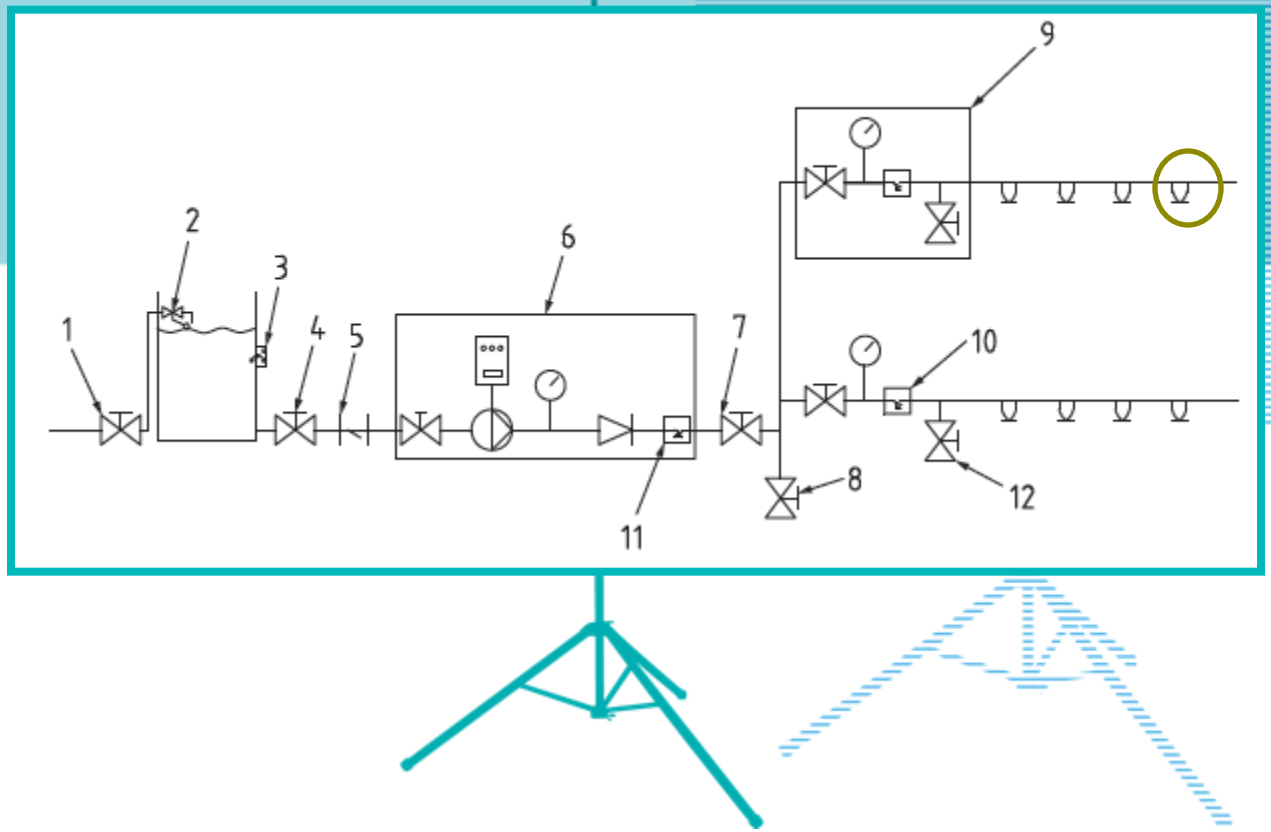
- Function test (at standby pressure)
- Long term aging
- K-factor

K-factor

- Nozzle manufacturing criteria
  - Opening
  - Internal chambers
- Tests
  - Operating Pressure range
  - Measured flow
  - Determined k-factor



Assurance by approvals



Watermist nozzle

Buyer beware

- Was the sample representative?
  - ‘Golden’ Sample
- Fully compliant with the standard?
- Was the testing Independent?
- A test report is a snapshot in time
- Will future products be the same?
  - What if materials, designs or processes change?

Third party certification

- Conformity assessment process
  - carried out by a body that is independent of both supplier and customer organisations
- Provides confirmation that
  - products and services have met and will continue to meet the requirements of specified standards.
- The approval process is controlled through
  - Production testing, audit, ISO standards and Factory Production Control (FPC) audits.
- Certification/approval bodies are overseen by accreditation bodies such as
  - the International Accreditation Forum (IAF) in BRE case UKAS

On-going processes

Application
- Product Details
- Drawings
- ISO 9001

Contract Review
- Test Schedule
- Sample Details
- Proposal
- FPC audit proposal

Proposal Acceptance
- Payment of invoice(s)
- Receipt of test samples
- Contact with Assessment Services

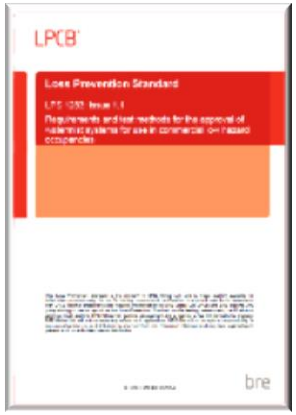
Performance Assessment
- Work order sent to lab
- Receipt of FPC report

Certification Activities
- Certification report
- Drawings
- Documentation
- FPC

Certification Decision
- Review of project

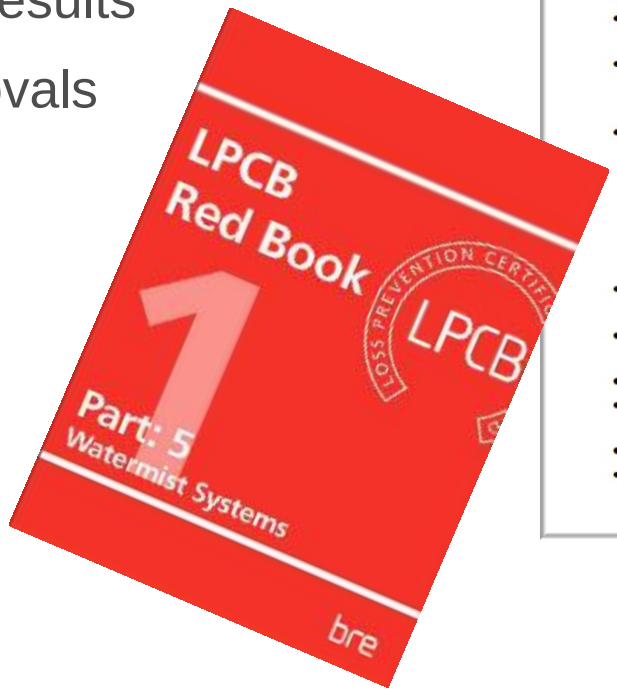
Listing
- Redbook entry
- Certificates
- Document Registers

Surveillance
- FPC
- Product Audit



Watermist nozzle specifications

- Drawings
- Marking
- Datasheets
- Test results
- Approvals



PART 5: SECTION 1.2
WATERMIST NOZZLES

This section lists products approved in accordance with:

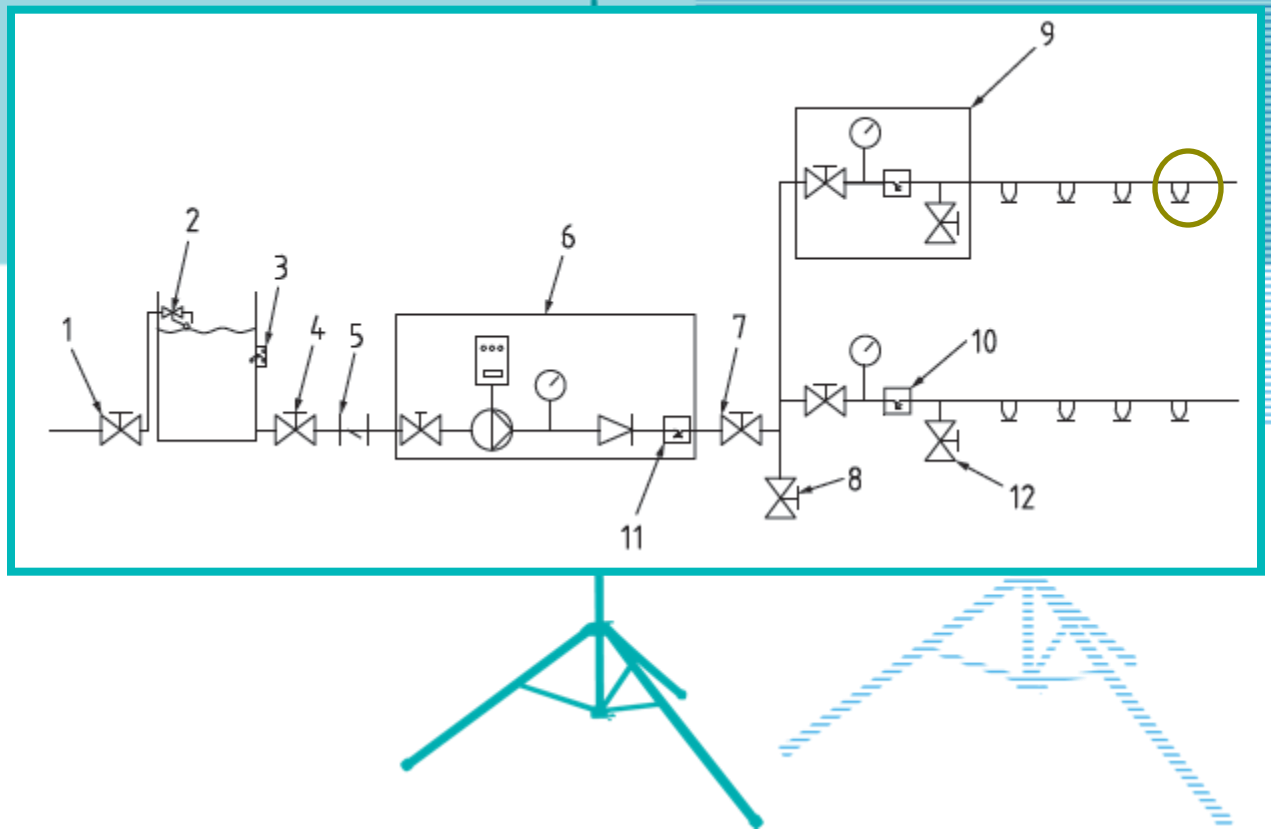
LPCB Schedule of requirements, SD0231 Appendix 4.

As detailed in DPC Draft BS8489-1, 2015-04-24 clause 11.4 and SD0231 Appendix 3 (In service testing protocol) all LPCB approved watermist nozzles should be inspected and samples removed and tested at regular 3 yearly intervals.

Each entry details:

- Nominal orifice size in millimetres
- Temperature ratings in degrees centigrade for automatic nozzles. For open nozzles the temperature rating is listed as N/A.
- The heat sensing element is listed as follows:
  † indicates a glass bulb sensing element. No addition mark is used for other types of sensing element or open heads.
- Nozzle type and orientation:
  1. U indicates that the nozzle should be installed in an upright orientation.
  2. P indicates that the nozzle should be installed in a pendent orientation.
  3. CC indicates that the nozzle is concealed and should be installed in the orientation designated by the manufacturer's approval (U or P).
  4. W indicates that the nozzle should be installed on a sidewall
- K-factor, the discharge coefficient in LPM/bar1/2, where LPM is litres per minute.
- Minimum and maximum design (operating) pressure, i.e. nozzle operating pressure, for a developed spray of water mist, in bar.
- Minimum standby pressure, in bar. The lowest pressure to which a closed automatic nozzle may be exposed prior to activation (either in a closed or flowing system).
- Maximum standby pressure, in bar. The highest pressure to which a closed automatic nozzle may be exposed in a closed system (for the life of the system), e.g. maximum pressure maintained by jockey pump prior to activation.

Finally - assurance within installations

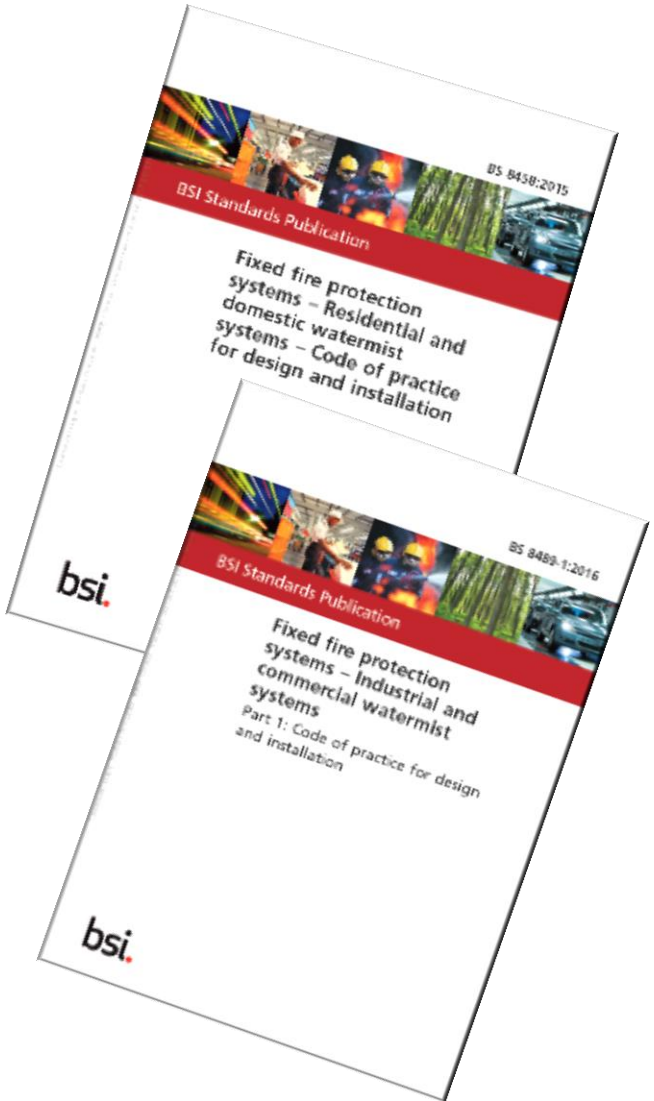


Watermist nozzle

Installation standards

- Water quality (wholesome and strainers)
- Material compatibility and resilience (e.g. pipe, fittings)
- Pressure/flow requirements (e.g. pump)
- Locations

- Manufacturers datasheets and manuals
- Standards (e.g. CEN TS14972, BS8458, BS8489,)



Commissioning and maintenance

– Hydraulically most remote test valve

"The discharge should be checked via the test nozzle. To carry out this check, a test facility should be provided, at the end of the hydraulically most remote range pipe, consisting of a watermist head with the bulb removed and a quick-acting test ball valve. The quick-acting test ball valve should be located in an easily accessible position and should be secured in the closed position with a suitable strap or chain. The end of the test line should normally be capped or plugged. There should also be provision of a permanent drain or means to dispose of waste water." See (BS 8489-1:2016 clause 10.1.1 b)

– Spare nozzles

"Replacement watermist nozzles and additives. A stock of spare watermist nozzles should be kept on the premises as replacements for operated or damaged nozzles. Spare watermist nozzles, together with watermist nozzle spanners as supplied by the system supplier, should be housed in a cabinet or cabinets located in a prominent and easily accessible position where the ambient temperature does not exceed 27 ° C. The number and type of spare watermist nozzles per system should be not less than the number required to reinstate the system to operational status." See (BS 8489-1:2016 clause 11.2 c)

NOTE For automatic nozzles this quantity is based on the largest design area of operation. The stock should be replenished promptly after spares are used.

Periodic inspections of installed watermist nozzles

- **Remove and test**
  - 20 or 1% of nozzles
  - Tests = function, water flow (K factor), operating temperature and thermal response
  - Test report provides information about the fitness for service of the installed nozzles

Frequency

- Watermist - 3 yearly maintenance cycle BS EN 8489-1 Clause 11.4.5.4
- Sprinkler - 25 yearly (some 5 yearly)
- Frequency dependent on site/nozzle.

BS EN 18245 *"Automatic sprinkler systems – design, installation and maintenance",* contains advice for the periodic inspection of pipework and sprinklers. This includes the recommendation that every **25 years** a sample of "in service" sprinklers are removed and tested to ensure that they are fully functional. In some cases individual product approvals requires this to occur at **5 yearly intervals**.

Thank you

Louise Jackman

BRE Global
Bucknalls Lane
Watford
WD25 9XX
GB

+44 (0)1923 664948
Jackmanl@bre.co.uk

www.redbooklive.com
Watermist components - nozzles
Watermist systems – LPS 1283 and LPS 1285
Third party approvals - increase confidence in product and system performance