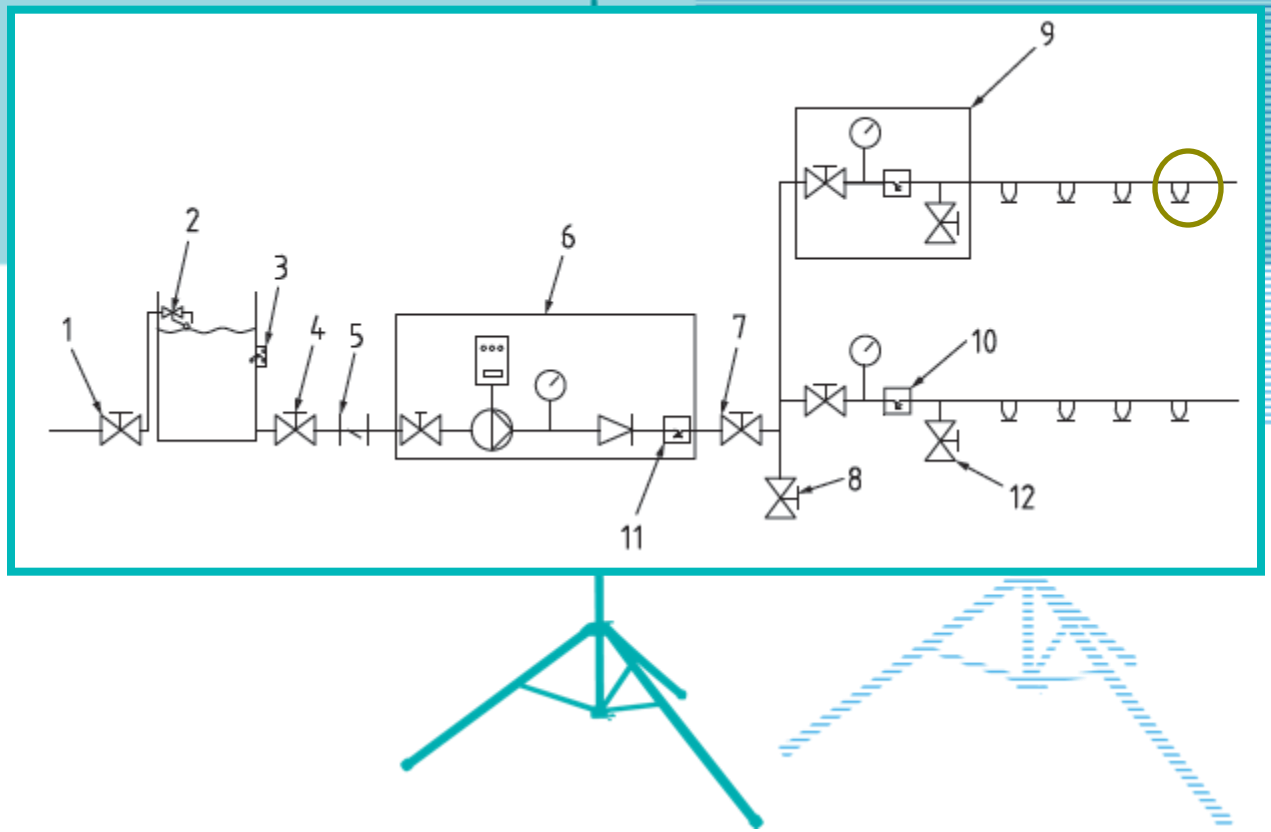
Test and approval of components - watermist nozzles

Louise Jackman

IWMA 2nd UK Water Mist Seminar

22nd March 2017

Components



Watermist nozzle

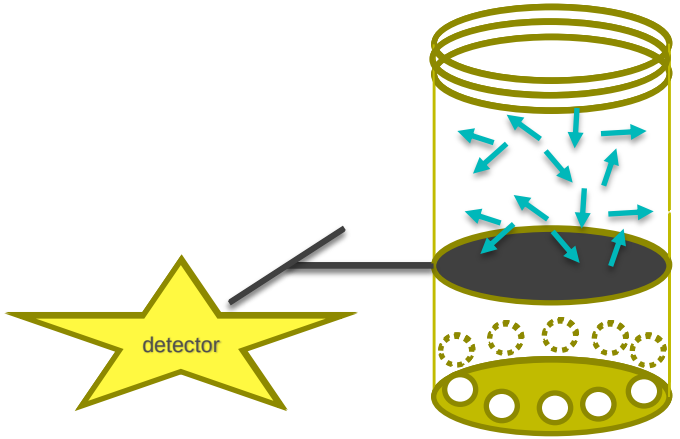
Watermist nozzle

Automatic nozzle

- Body, fittings and openings

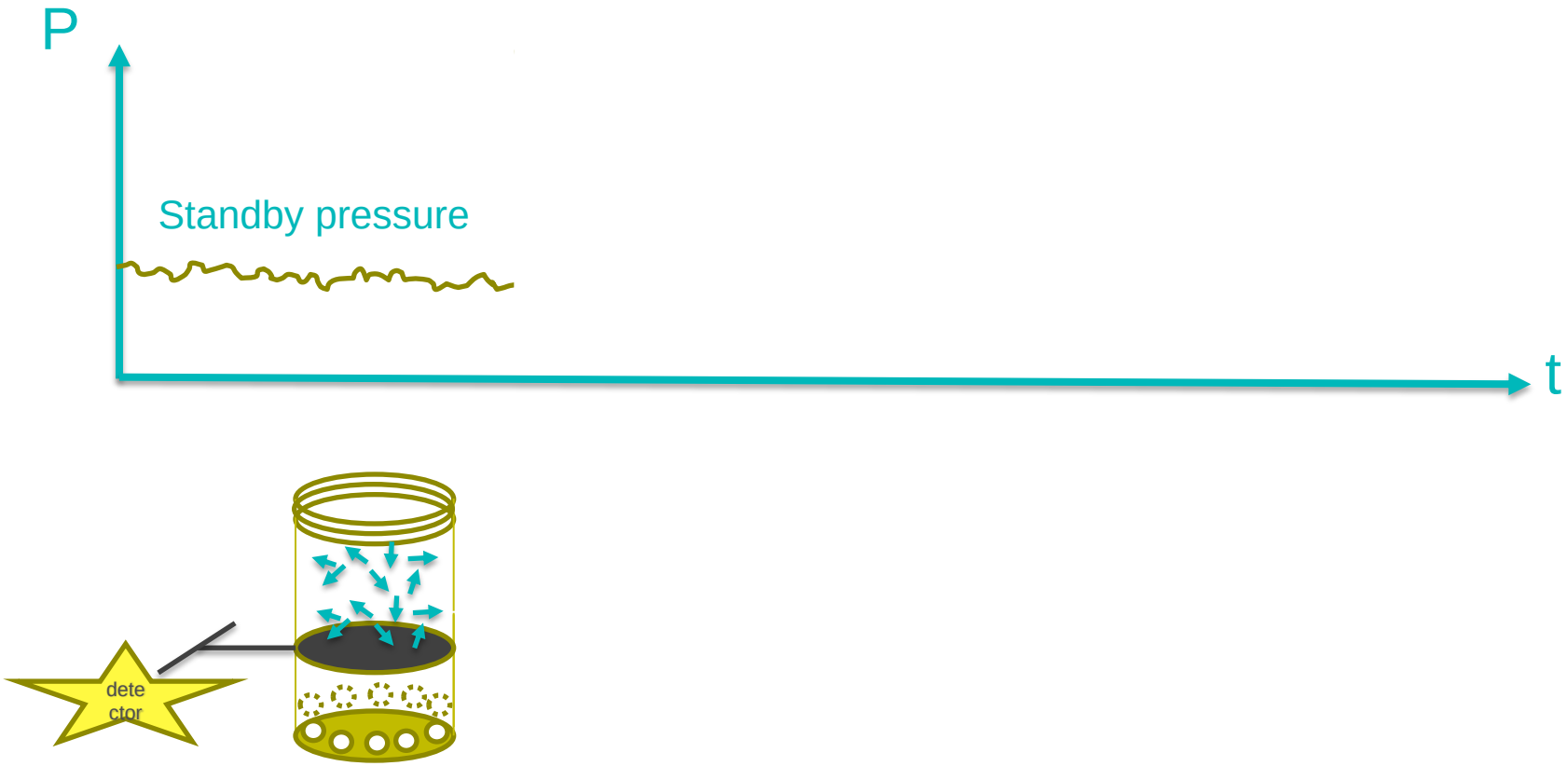
- Valve
- Detector

- Water filled
- Under pressure
- Openings exposed to atmosphere



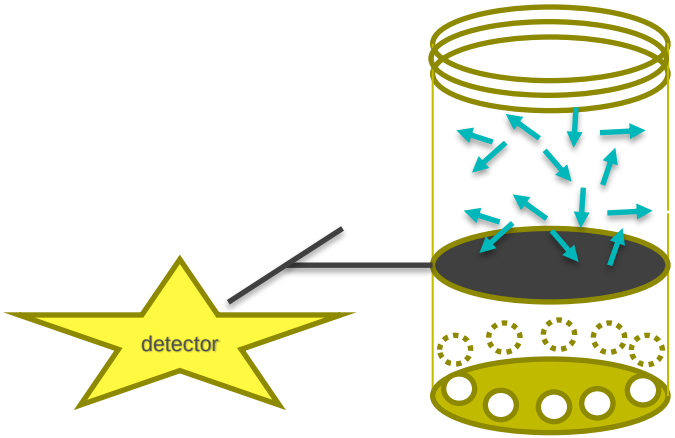
Watermist nozzle pressure

Pressure at a remote nozzle



Watermist nozzle challenge

Charged but unused for years



- Detection 100% available
- No accidental detection
- Pressure maintained
- No leaks

Years of:

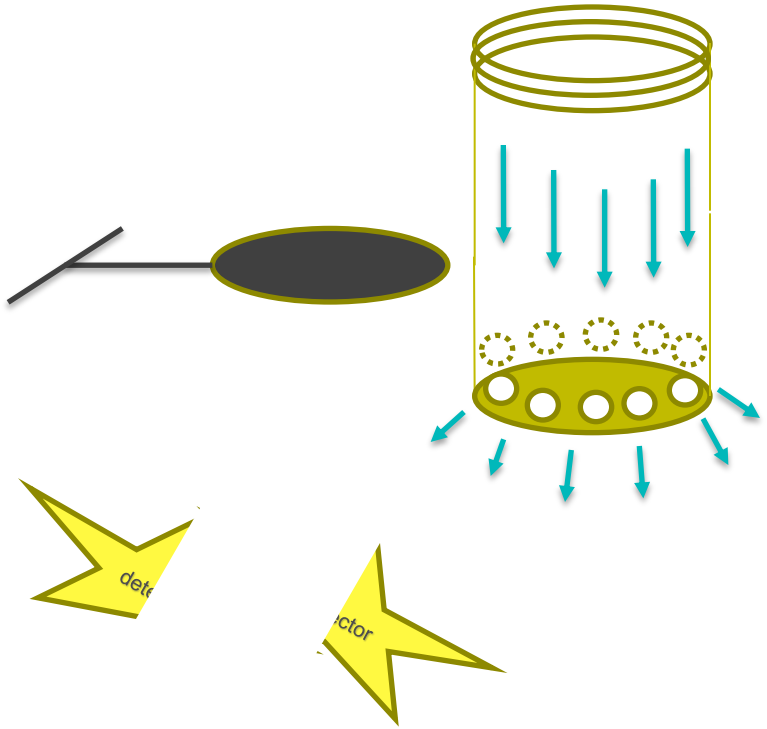
- Temperature cycling
- Pressure changes
- Movement
- Mass concentration changes
- Environmental pollutants (paint, cleaning products…)

Resulting in:

- Corrosion (stress, material build-up)
- Valve seat shift (leak, lock)
- Elastomer migration, adhesion to metal parts

Watermist nozzle challenge

Charged but unused for years, then expected to work immediately

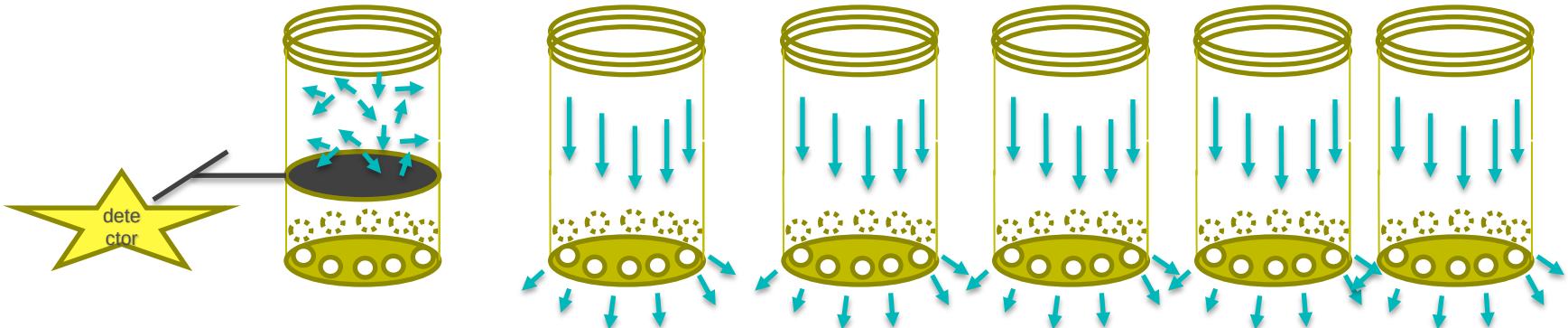


Action:
- Detection
- Open valve
- Water flow through openings

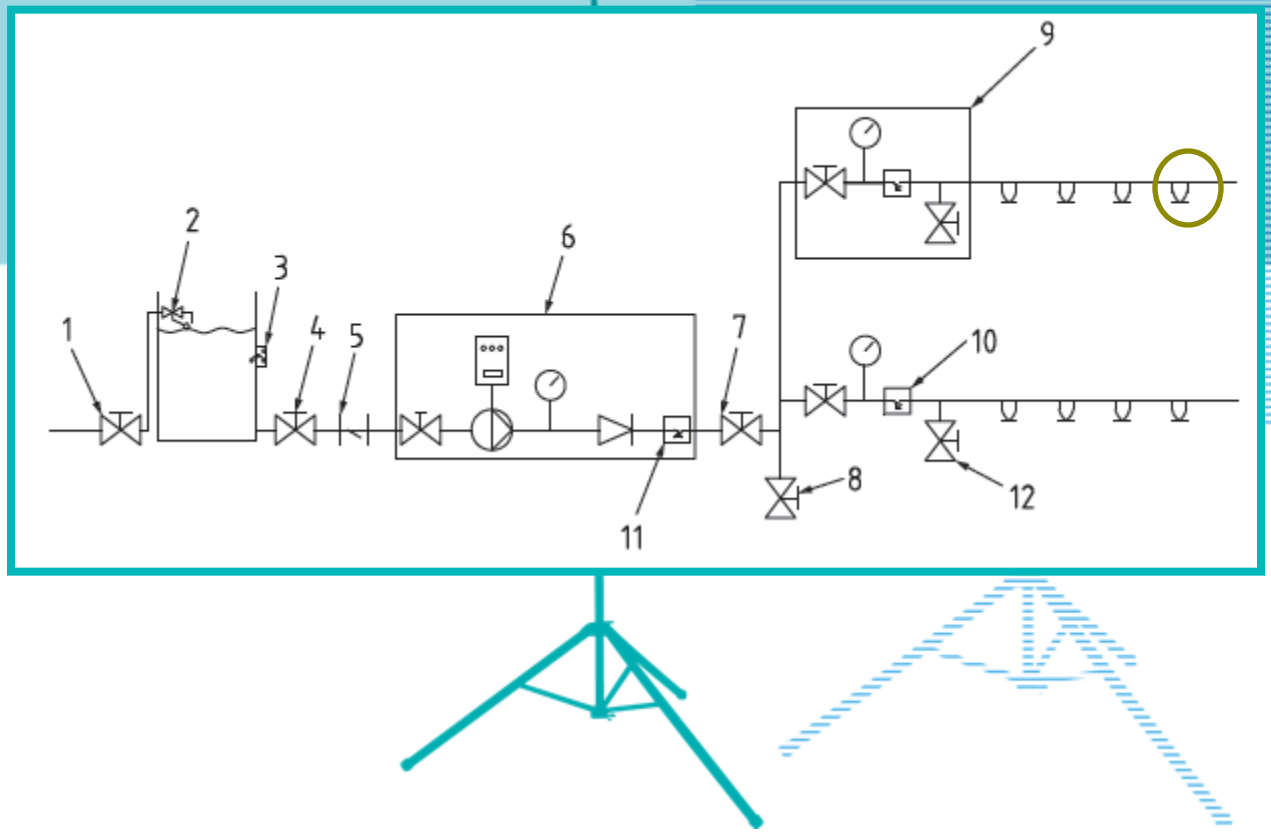
Need:
- Enough force to open valve, i.e. no stuck valves
- No obstruction to small orifices, i.e. pressure/flow regime for spray achieved

Watermist nozzle pressure

Pressure at a remote nozzle



Assurance by Design



Watermist nozzle

Bespoke nozzles – manufacturer's activities

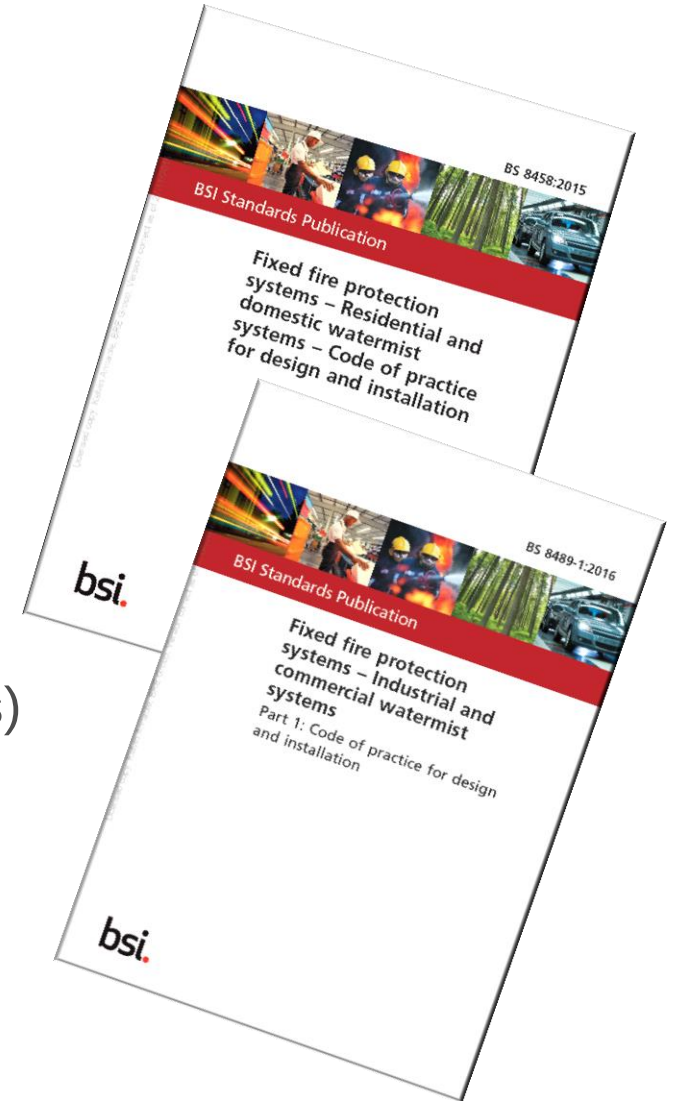
- Engineering precision
- Material selection (e.g stainless steel, PTFE)
- Dynamic forces (e.g. valve function)
- Integral detection (e.g. bulb)
- Flow paths (K-factor)
- Availability (e.g. strainers)

- Manufacturing
- Assembly

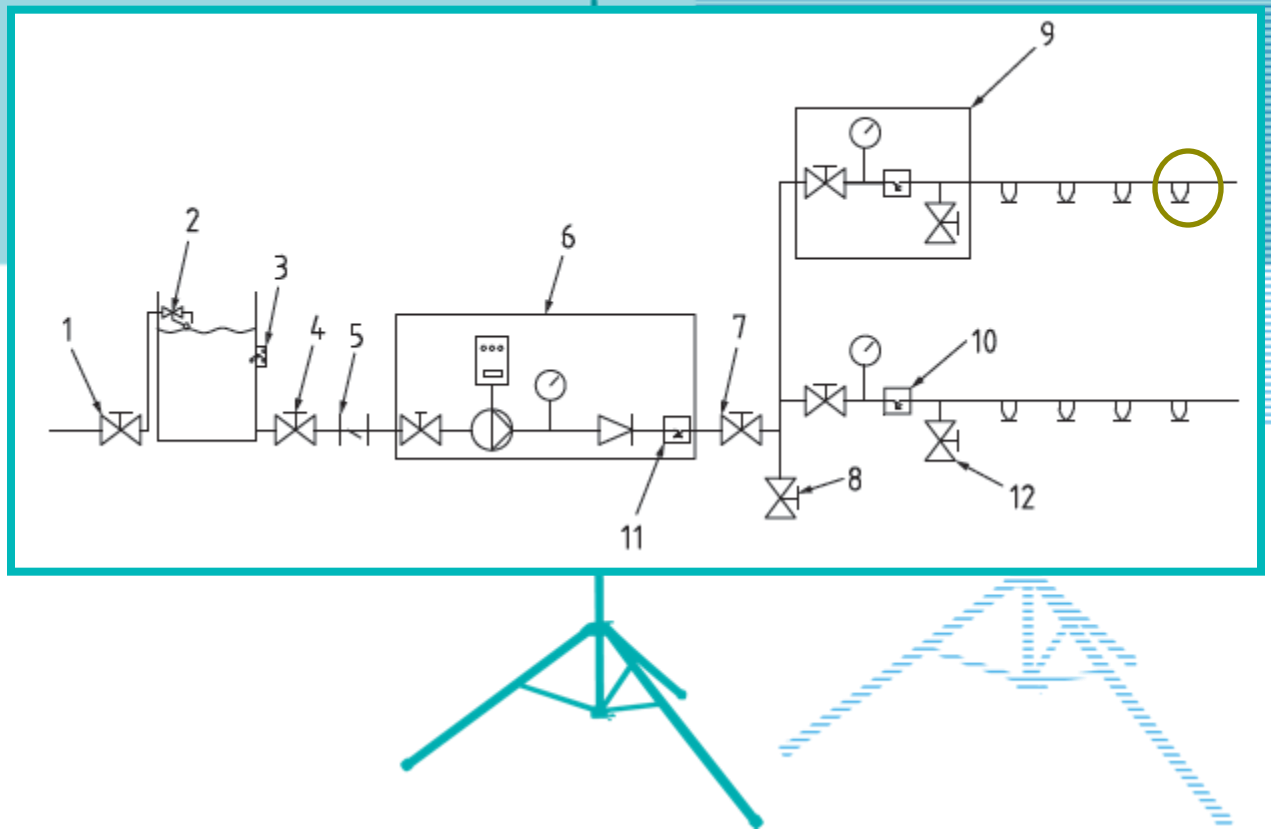
Installations

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

- Manufacturer's datasheets and manuals
- Standards (e.g. BS 8458, BS 8489 series)



Assurance by Testing



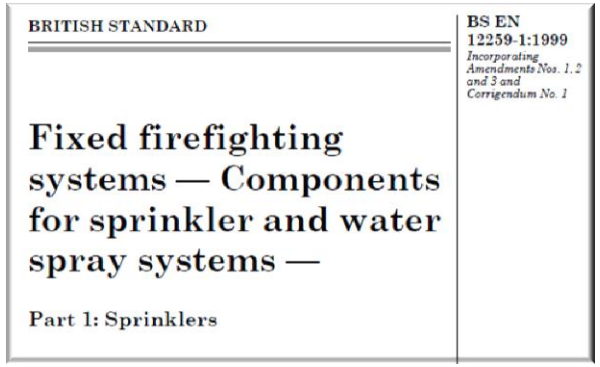
Watermist nozzle

Component tests

- Assessment of performance requirements against standardised methodologies
- Testing to address: robustness, continuous availability ….
- Ensure a consistent approach with a standard baseline

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

- 100 + samples
- Minimum 3 months testing
- BRE test report


BRITISH STANDARD

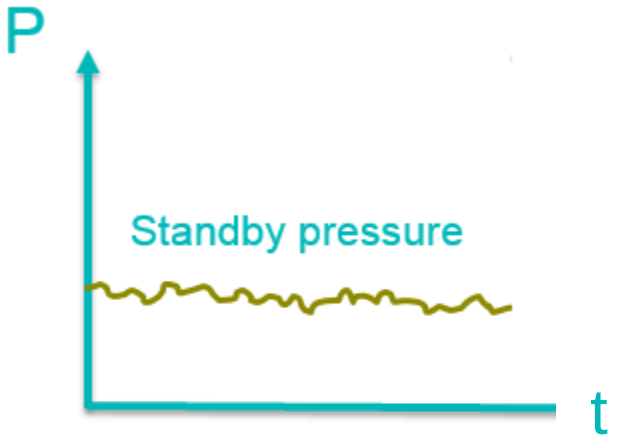
BS EN 12259-1:1999
Incorporating Amendments Nos. 1, 2 and 3 and Corrigendum No. 1

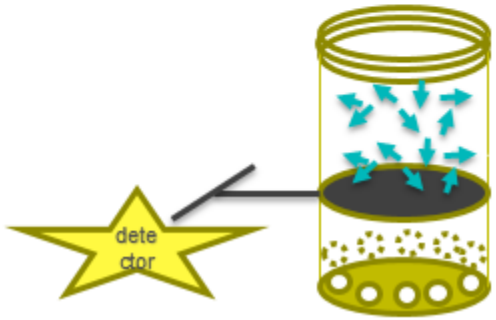
Fixed firefighting systems — Components for sprinkler and water spray systems —

Part 1: Sprinklers

Will a watermist nozzle hold?

- No accidental detection
- No leaks
- Pressure maintained



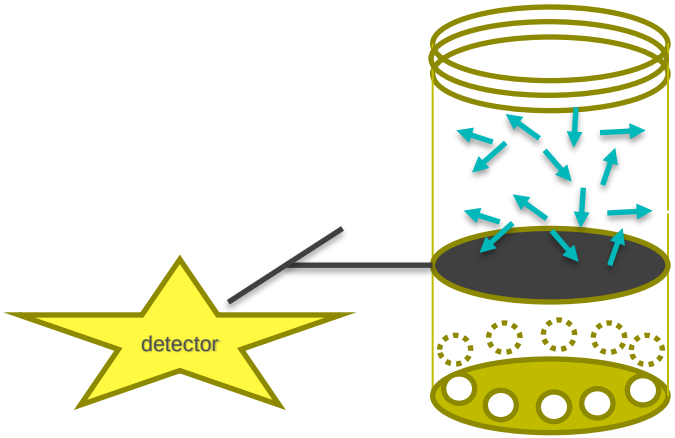


Tests:

- Leakage
- Water hammer
- Vibration
- Impact resistance
- Corrosion (with parts exposed)
  - Stress (brass/stainless steel)
  - Sulphur dioxide
  - Salt mist
  - Moist air
- Long term aging test

Will a watermist nozzle detect?

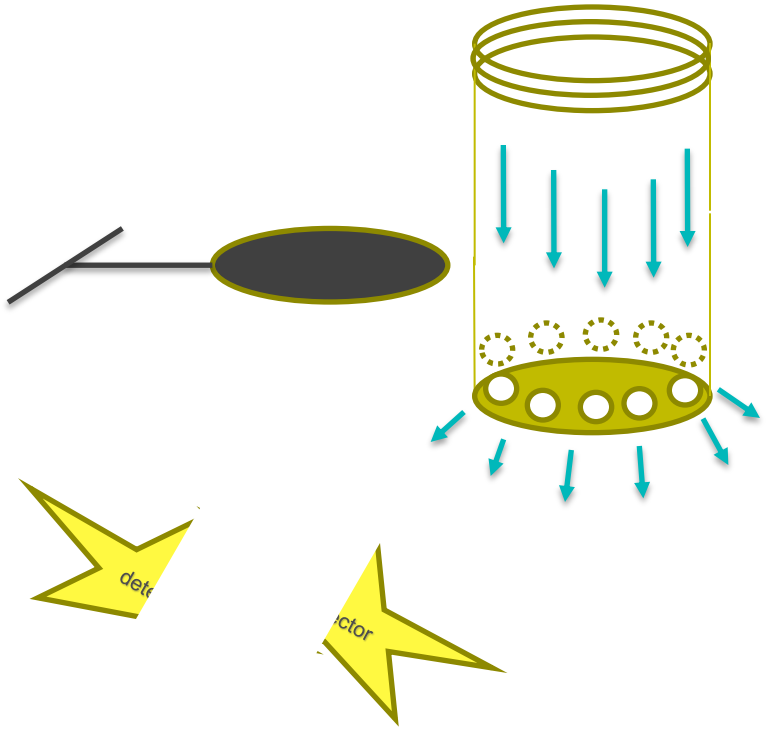
- Detection within limits
- No accidental detection



Tests:

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

Will a watermist nozzle actuate and deliver?



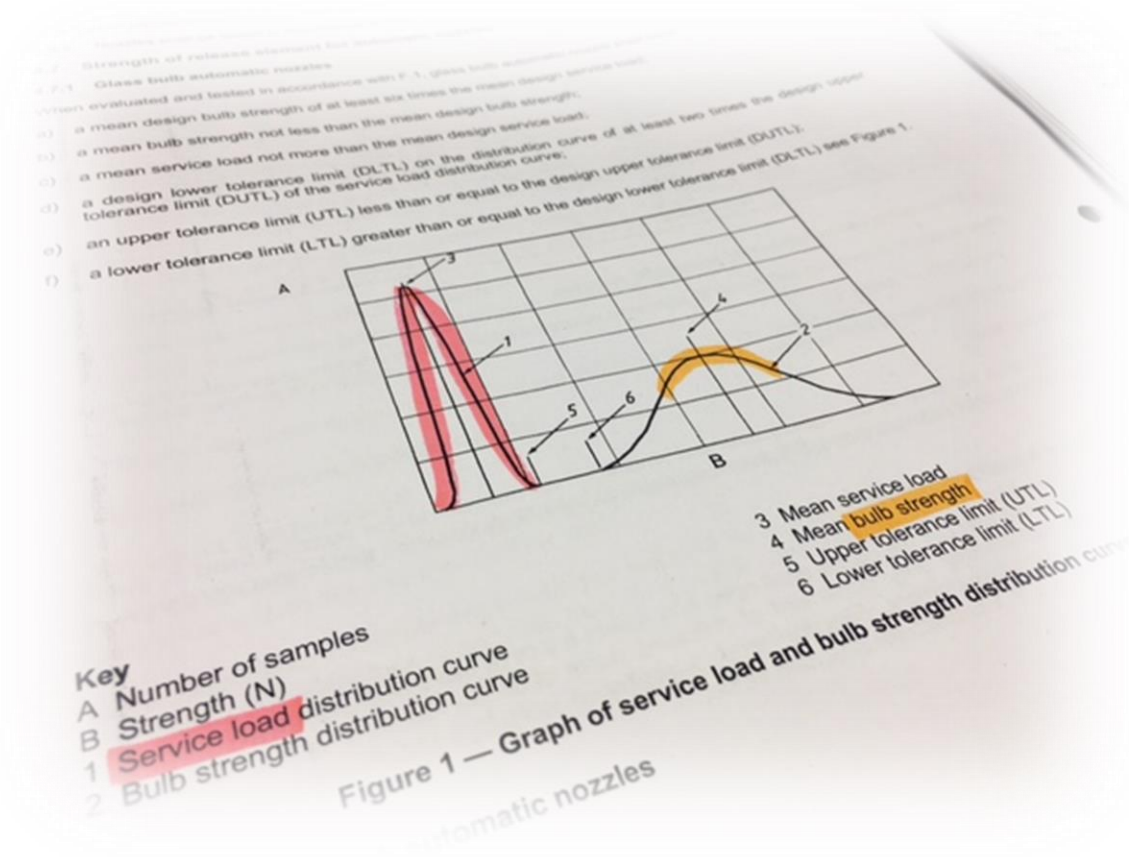
- Detector responds
- No stuck valves
- No obstructions

Tests:

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

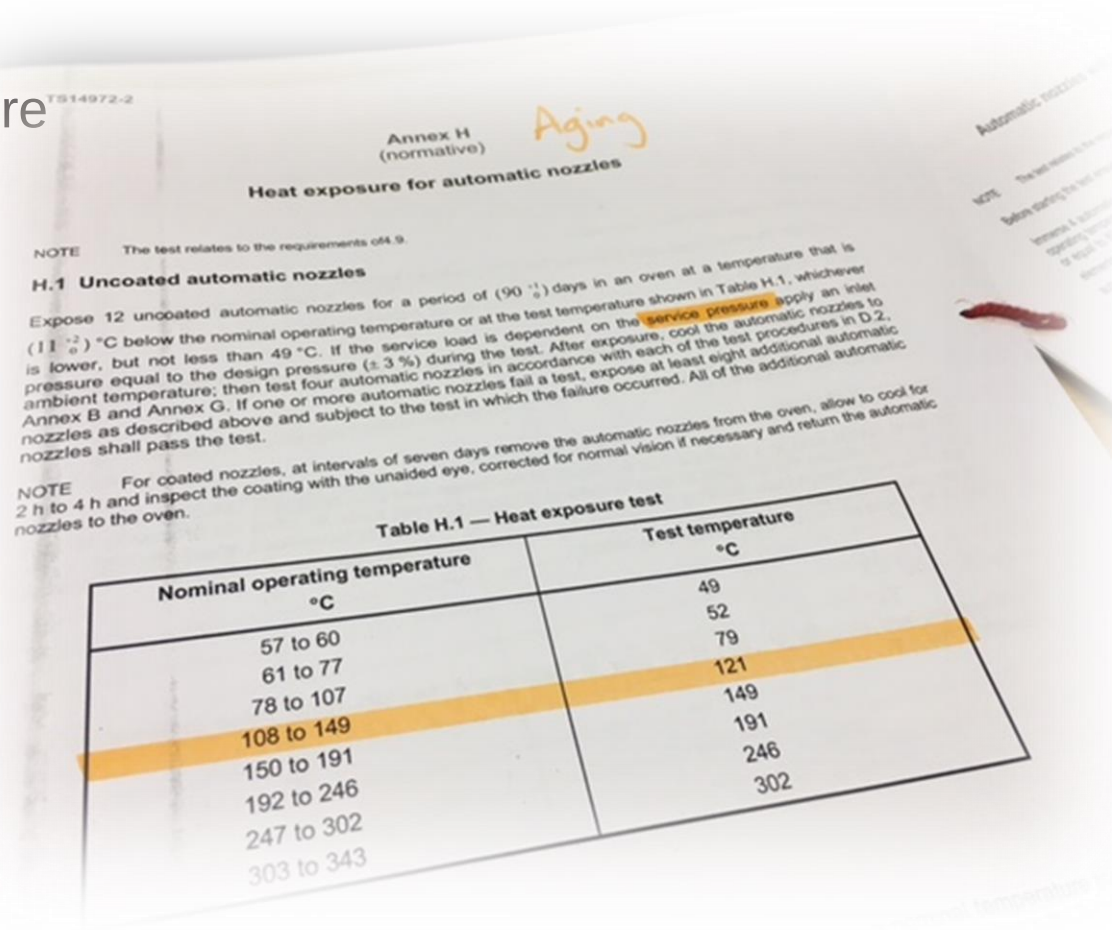
Service load

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



Aging

- Sprinkler baseline criteria
  - Standby/service pressure
  - 121ºC 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.

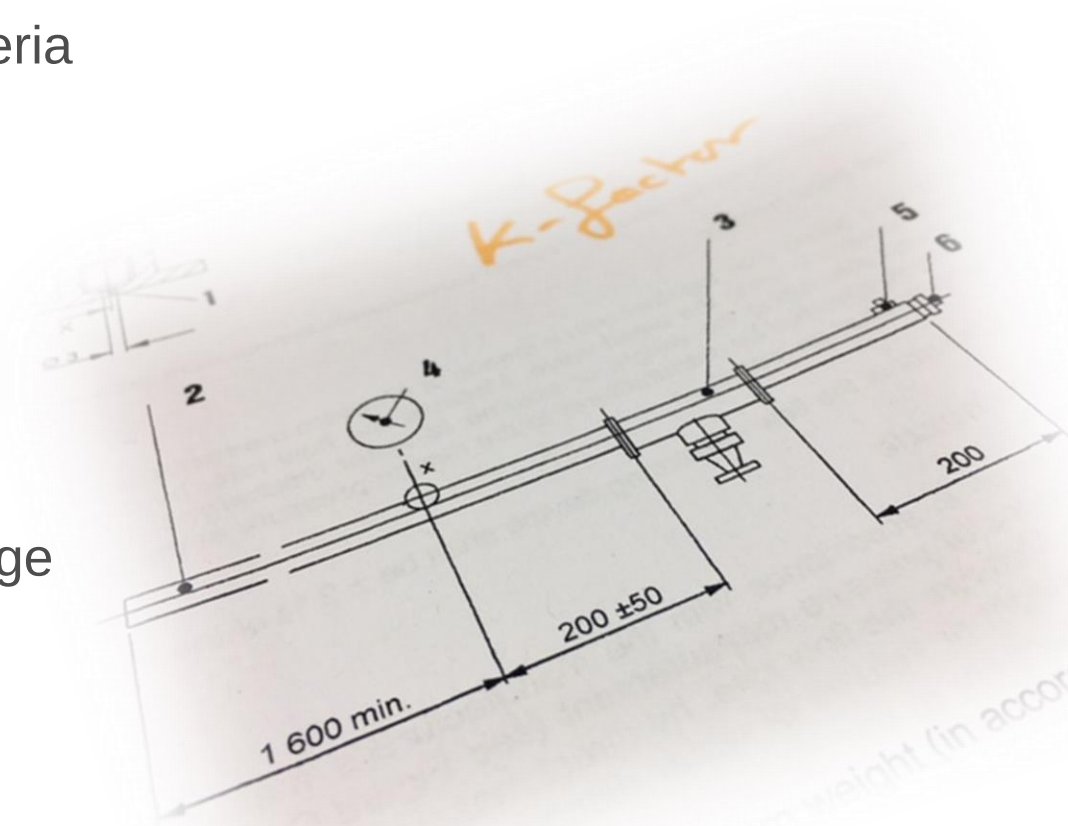
NOTE For coated nozzles, at intervals of seven days remove the automatic nozzles from the oven, allow to cool for 2 h to 4 h and inspect the coating with the unaided eye, corrected for normal vision if necessary and return the automatic nozzles to the oven.

Table H.1 — Heat exposure test

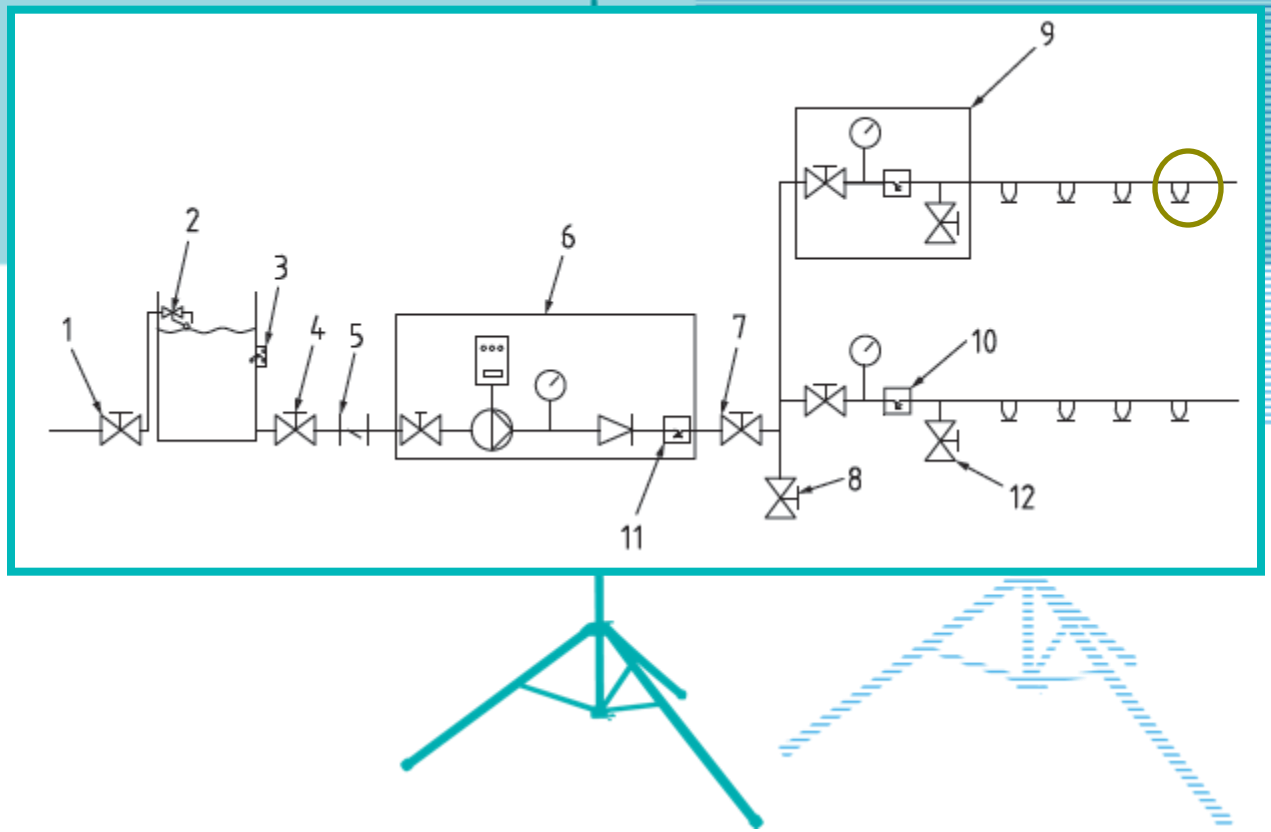
Nominal operating temperature °C	Test temperature °C
57 to 60	49
61 to 77	52
78 to 107	79
108 to 149	121
150 to 191	149
192 to 246	191
247 to 302	246
303 to 343	302

K-factor

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



Assurance by approvals



Watermist nozzle

Buyer beware

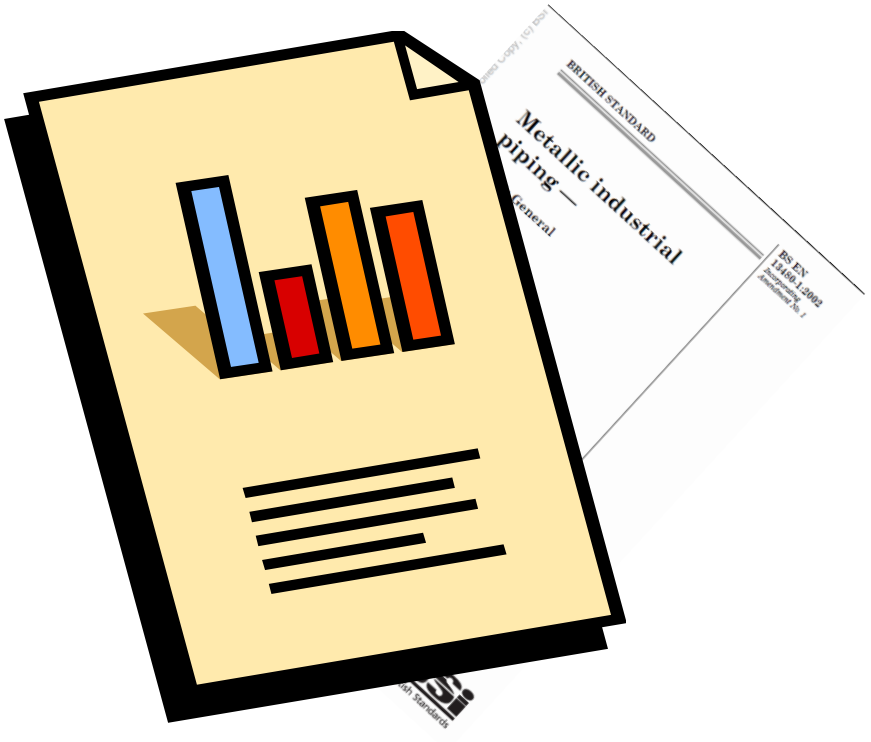
- Was the sample representative?
  - ‘Golden’ sample
- Fully compliant with the standard?
- Was the testing independent?
  - UKAS or ILAC recognised (*International Laboratory Accreditation Cooperation)*
- Will future products be the same?
  - What if materials, designs or processes change?
- No surveillance audits

Test reports

A test report is a statement of fact –

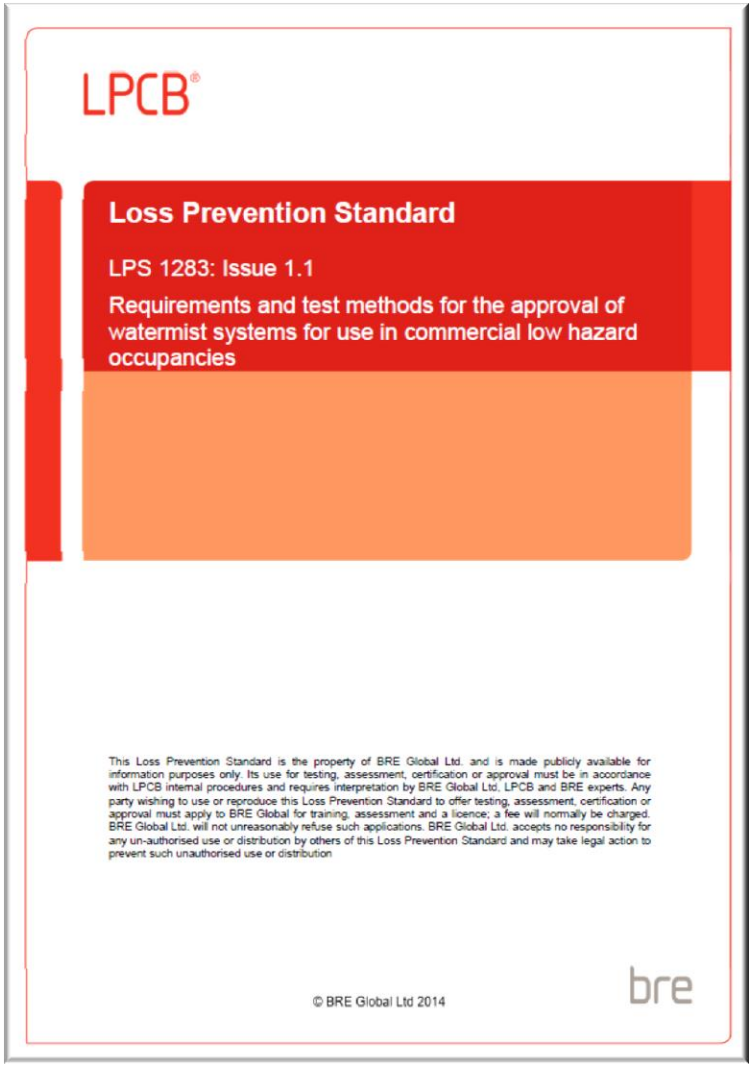
a snapshot in time

related solely to the product presented at the time of testing and reports only the information detailed in the Standard



Loss Prevention Standards

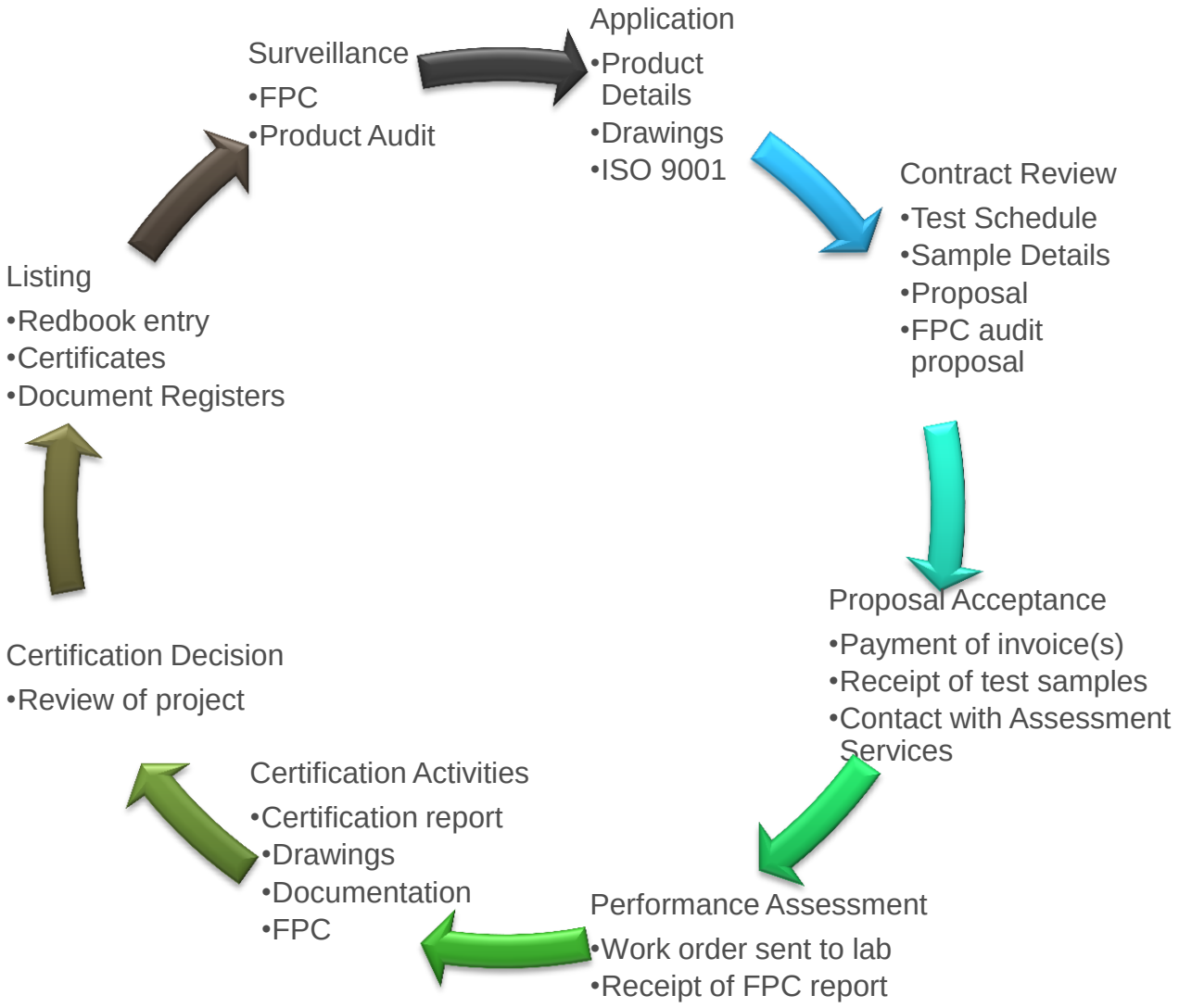
- Loss Prevention Standards (LPS) developed in collaboration with industry, clients, insurers, regulators and other stakeholders
  - Consensus documents developed by stakeholders
- Based on National, European or International standards



Third Party Certification

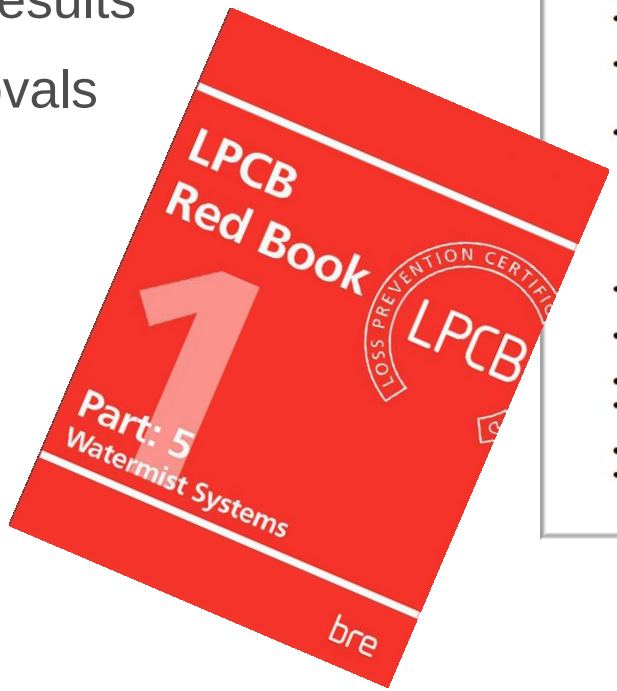
- Is a conformity assessment process,
  - carried out by a body that is independent of both supplier and customer organisations.
- It provides confirmation that
  - products and services have met and will continue to meet the requirements of specified standards.
- The approval process is governed and 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 our case UKAS

On-going processes



Watermist nozzle specifications

- Drawings
- Marking
- Datasheets
- Test results
- Approvals



PART 5: SECTION 1.2
WATERMIST NOZZLES

This section lists products approved in accordance with:

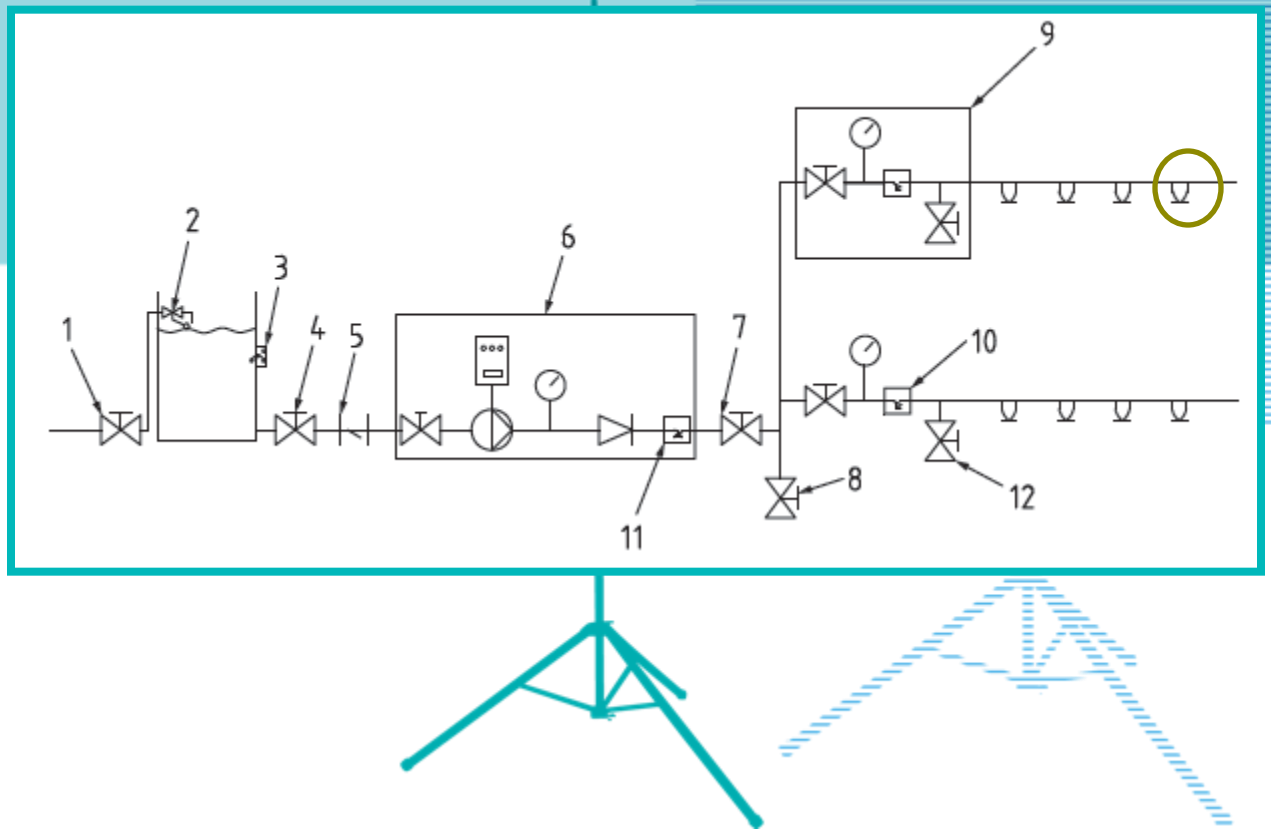
LPCB Schedule of requirements, SD0231 Appendix 4.

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.

Assurance by Commissioning and Maintenance



Watermist nozzle

Maintenance Testing of 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.

Commissioning and maintenance

- BS 8489-1:2016 clause 10.1.1

- b) 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.

- BS 8489-1:2016 clause 11.2

- c) **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.

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 testing of installed watermist nozzles

- BS 8489-1 Clause 11.4.5.4 recommends:
  - 20 or 1% of nozzle are removed from each installation for testing as part of the three yearly maintenance cycle.

- Building owners, system installers and maintainers, inspection authorities and insurers
- Test programme includes function, water flow (K factor), operating temperature and thermal response
- Test report to assist in deciding whether installed nozzles are still fit for service or if any need to be replaced.

BS EN 12845 *"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.

Summary

- Watermist nozzle challenge
- Assurance by
  - Design
  - Testing
  - Approval
  - Commissioning
  - Maintenance

Thank you

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Redbook listing for:

Watermist components, e.g. nozzle

Watermist systems – LPS 1283 and LPS 1285

Third party approvals - increase confidence in product and system performance