Test and approval of components - watermist nozzles

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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*

- Standby pressure

\[ P = \text{constant} \]
Watermist nozzle challenge

Charged but unused for years

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

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

P

Operating pressure range

Standby pressure

detector
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
Will a watermist nozzle hold?

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?

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

- Detection within limits
- No accidental detection
Will a watermist nozzle actuate and deliver?

Tests:
- 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
  - 121°C minimum
  - 90 days

- Post aging tests
  - Function (at Pmin)
  - Leak (at Pmax)
  - Operating temperature
K-factor

- Nozzle manufacturing criteria
  - Opening
  - Internal chambers

- Tests
  - Operating pressure range
  - Measured flow
  - Determined k-factor
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

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 Decision
• Review of project

Certification Activities
• Certification report
• Drawings
• Documentation
• FPC

Surveillance
• FPC
• Product Audit

Listing
• Redbook entry
• Certificates
• Document Registers

Application
• Product Details
• Drawings
• ISO 9001

Application
• Product Details
• Drawings
• ISO 9001
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 pendant 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.
Maintenance Testing of Sprinkler Heads: Qualitative Analysis Causes of Failures

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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