

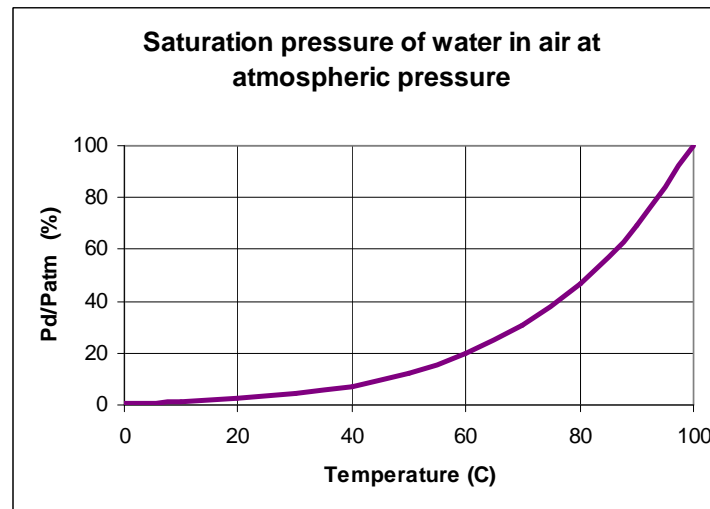
Advances in water mist technology

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Auto-magic systems? (1)

- Some have claimed that water mist is a sort of magic system, that can replace all other types of fire-fighting means
- The magic is often described by the effect of evaporated water, inerting the air of the room, obtained by small enough droplets
- This inerting effect can be obtained by all water based systems, but will be most effective in enclosed spaces, where the water vapour (steam) can be kept at gas phase without leaving through cracks and openings. The temperature inside the enclosure is of importance, since the maximum concentration of water vapour is decided by the saturation pressure of water in air



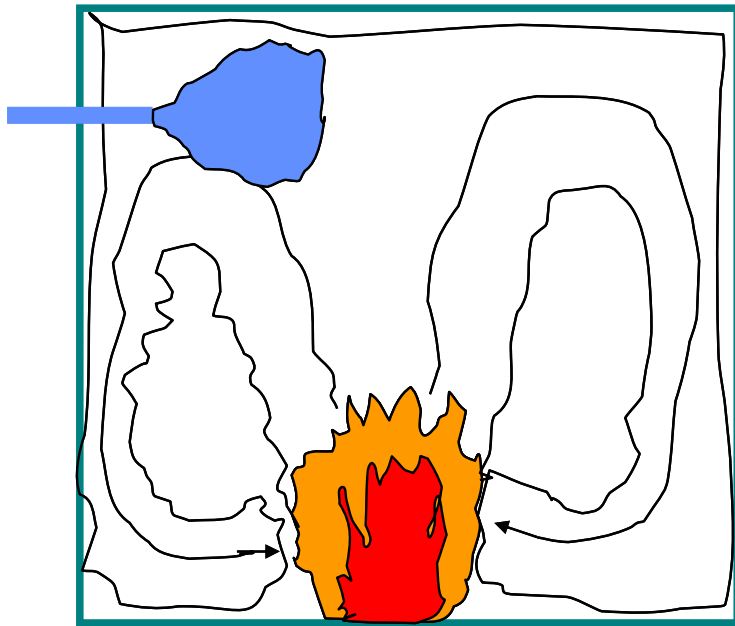
Auto-magic systems? (2)

- In many applications, it is possible to utilize the inerting effect of water vapour, either by total flooding room systems, or by “local flooding” systems. The smaller droplets tend to evaporate faster than larger droplets, and is efficient in contact with smoke and flames
- The major difference between conventional sprinkler systems and water mist systems is the concept of wetting surfaces to prevent fire spread. The larger droplets of conventional sprinkler systems has a better ability to penetrate flow of smoke and to survive transport through hot gases than water mist droplets
- The fast evaporation and the lesser ability to penetrate hot smoke and flames leads to necessity to activate the systems as fast as possible and to disperse the water in the vicinity of the fire source

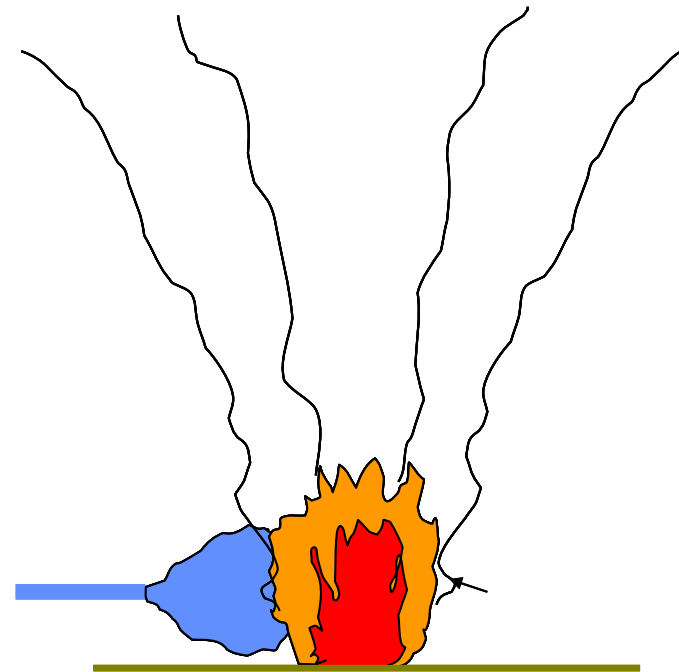
Room size 12 m². Water mist application: 1,7 litres/m² min
Test 13: 1 min before activation



Water mist application



Enclosed fire



Local application

Most efficient in enclosures, most efficient with direct application at base of fire

Recent history (1):



- The disaster at sea: Scandinavian Star passenger ship fire 1990 resulted in updated requirements of fire-fighting systems onboard passenger ships. The water mist manufacturers introduced water mist systems for cabins, corridors public spaces and storage areas (sprinkler systems)
- The ban on Halon (Montreal Protocol 1997) also led to development of new water mist systems for protection of machinery spaces (deluge systems). Water mist manufacturers introduced specially developed and tested systems
- The 1st International Conference on Fire suppression Research, arranged by SP, Stockholm, Sweden, in 1992 focused on water mist technology.
- This was followed by an International Water Mist Conference in Borås, Sweden, in 1993

Corridor of Scandinavian Star: Fire development with ignition of bedclothes, spreading in surface made of Melamine (Fulfilled the present requirements of IMO)



Resent history (2):



- IMO (International Maritime Organization) introduced several applications for water mist systems
 - MSC/Circ.668 Guidelines for the approval of equivalent water-based fire-extinguishing systems for machinery spaces and cargo pump rooms (1994), later revised, now MSC/Cirk.1165 (2005)
 - MSC/913 Guidelines for the approval of fixed local application fire-fighting systems for use in category A machinery spaces (1999)
 - Guidelines for the approval of sprinkler systems equivalent to that referred to in SOLAS REGULATION II-2/12 (Resolution A.800(19), amended and revised to RESOLUTION MSC.265(84) (2008)
 - Scaling to twice the tested size of a machinery space allowed from 2010

- Naval Research Laboratory and Huges Associates (USA) presented a comprehensive review of water mist technology for fire suppression in 1994

Resent history (3):



- NFPA released the first standard for water mist, NFPA 750, in 1996. Revised latest 2010
- CEN TC 191/WG5 appointed Task Group 3: Water Mist systems in 1998, CEN TS 14972 Fixed firefighting systems - Watermist Systems – Design and installation, published 2008. To be revised within 2011.
- UL Standard 2167 Water Mist Nozzles for Fire Protection Service, published 2004
- FM Approval released Approval Standard for Water Mist Systems Class Number 5560 in 2005, with performance test protocols for various applications

Resent history (4):



- Standards for design, testing, installation, inspection and maintenance are released in many countries, for instance in UK, France, New Zealand and Australia
- VdS (Germany) has released a number of test standards for water mist systems

International Water Mist Association

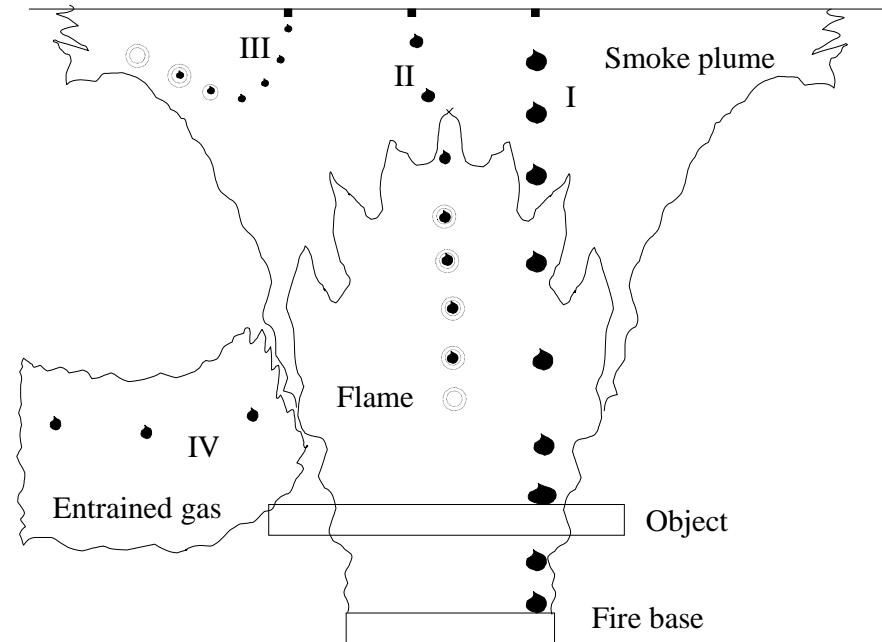
- IWMA was founded in 1998 dedicated exclusively to water mist fire fighting and related technology.
 - IWMA arose from the necessity to establish an international platform for companies, scientists and interested people dealing with Water Mist. For potential users of Water Mist systems IWMA is an independent body which can be addressed for questions related to the technology like e.g. the suitability of Water Mist for certain applications, the limits of such systems, minimum requirements, suitability of test protocols, contacts to insurance companies promoting the technology, understanding and interpretation of guidelines, suitability of test institutes. This will help to give potential users the necessary background for the installation of Water Mist systems.

International Water Mist Association

- IWMA has approximately 50 corporate members, and organizes the manufacturers, test institutes, approval bodies and certification societies as well as academic organizations
- IWMA organize annually the International Water Mist Conference, and the 10th conference is held here in Prague, 3-4 November 2010
- A number of regional educational seminars is held every year, since last IWMC: in Denmark, the Netherlands, USA (NFPA-World Conference), + later 2010: Germany, France and Italy
- IWMA is lead by the Board of Directors and comprises the Scientific Council and the Manufacturers Council
- An annual Member Meeting is held in connection with the IWMC

Typical water mist applications

- Water mist in new applications, where low water application rate is favourable
 - Deep fat fryers
 - Turbine enclosures
 - Heritage protection
- Water mist as an alternative to existing systems
 - Domestic sprinklers
 - OH sprinklers
- Water mist as deluge systems
 - Machinery spaces
 - Process industry



Applications:

- Machinery spaces
- Turbine enclosures
- Cable tunnels
- Flammable liquid storage
- Heritage buildings
- Archives
- Museums
- Industrial wet benches
- Computer rooms
- Industrial deep fat fryers, kitchens
- Road and rail tunnels, underground facilities
- Aircraft hangars, airplane baggage compartments
- Offices, hotel rooms, hospitals, prisons (OH1)
- Atria
- Storage area (OH3)



Test setup for OH3 test with plastic commodity



Water mist/sprinklers

EN 12845:2003 for sprinklers

Prescriptive requirements

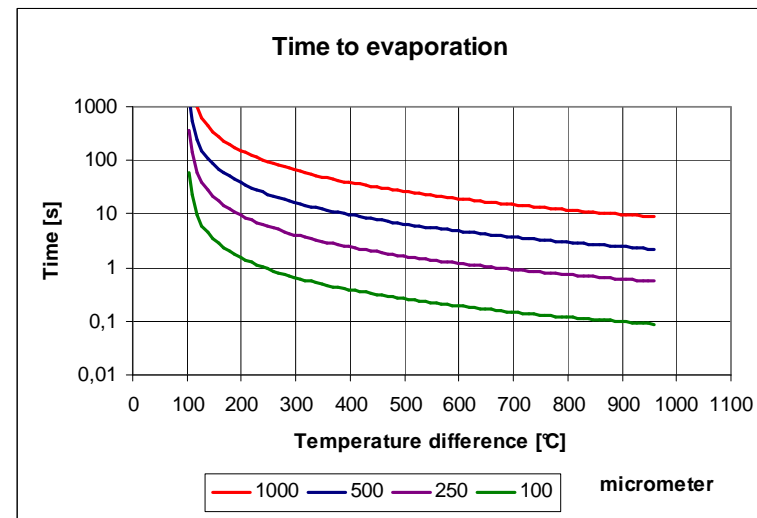
	OH1	OH2	OH3	OH4
Design density (mm/min)	5	5	5	5
Area of operation (m ²)	72	144	216	360
Nominal number of sprinklers	6	12	18	30

- The requirement for sprinklers is the design density, litres/m² min
- The sprinkler standards from the early 1990 included a minimum size of all waterways, including the sprinkler nozzle, of 8mm
- This led to quite large droplets (0,5-1,5 mm?)
- The double requirements on water application rate and dimension of waterways made the introduction of water mist difficult in traditional applications

- The statistics presented for sprinkler systems tells that 98% of all sprinkled fires are controlled, and 60% by 4 sprinkler or less (Numbers from 1990)
- The sprinkler systems are designed to deliver water to a minimum area of 72 – 360 m², reflecting a nominal number of sprinklers from 6 – 30
- This discrepancy between experience and design has not been used to optimize systems

Water mist/sprinklers

- + Utilizes better the heat absorption capacity of water and the inerting effect of water vapour
- + Less water – smaller pipes, reservoirs, pumps, valves
- + Often desirable from an esthetical point of view
- ÷ Smaller dimensions – higher possibility of blockage of waterways
- ÷ More demanding design to fulfill the criteria for reaching all parts of the protected space



CEN TS 14972 Fixed Firefighting Systems – Water Mist Systems - Design and Installation (2008)

- Task Group under CEN TS 191 Fixed Firefighting Systems, WG 5 Sprinklers and water spraying systems, Chairman Dr. Joakim Böke
- Worked since 1998, the TS 14972 was published in 2008. At present, the Task Group works on revision of the TS and inclusion of more test protocols (Atria, Deep fat fryers, storage area (OH3))
- Many of the manufacturers have carried out tests designed by the protocols of CEN TS 14972



Trends

- Marine water-based firefighting systems are now mostly based water mist technology
- IMO regulations paves the way for such systems by harmonizing the performance standards
- Focus on residential sprinkler rules and regulations will open for the use of water mist systems equivalent to residential sprinkler systems (Scandinavia, UK)
- Land-based water mist applications is a growing field

- A trend is that every AHJ makes adjustments to test protocols, or writes their own. This leads to a great number of test methods for water mist systems, with unnecessary costs for the manufacturers
- A non-standardized market may evolve if AHJ's and manufacturers do not work together
 - (AHJ : Authorities Having Jurisdiction)

What is needed to fully include water mist into the palette of firefighting systems?

- More fundamental research on the interaction of water droplets and fire is needed, with the aim to make computer models reliable and verified
- A CEN standard for water mist systems including component tests and a comprehensive set of fire tests for relevant applications should be the mutual aim for the sprinkler industry
- Important to include the quality assurance schemes for water mist as for sprinklers
- Important to cooperate on the installation requirements (CEN) to obtain real optimization of systems
- Manufacturers of sprinkler- and water mist systems should work together to introduce water-based systems in more applications world-wide

Acknowledgements

■ I want to thank:

- Dr. Gunnar Heskestad for education and inspiration during his stay at SINTEF NBL in the 1980s
- Dr. Joakim Böke for his continuous leadership and patient guidance of the Task Group writing CEN TS 14972
- Mr. Randall Eberly for chairing the work of IMO Fire Protection sessions, Performance testing and approval standards
- Colleagues at fire laboratories around the world
- Authorities in Norway for financing fundamental research and studies of water mist
- Members of IWMA