Welcome

Technical Services Team
APAC - ME

2016-2017

AquaMist

tyco
Fire Protection Products

Trainer Introduction

Student Introductions



Aquamist Systems



Agenda

Introduction

Water Mist: How it works

- Design Standards & Fire Test Protocols
- Case Study
- AquaMist: Tyco's Water Mist Solution

Break

- Protecting Class B Fire Risks – Machinery Spaces
- Protecting Archives (OH3) – Performance Based Design
- Protecting Data Centres – ventilated, pre-action, cable fires
- Protecting Class K (F) Fire Risks – Industrial Oil Cookers
- Protecting Cable Tunnels

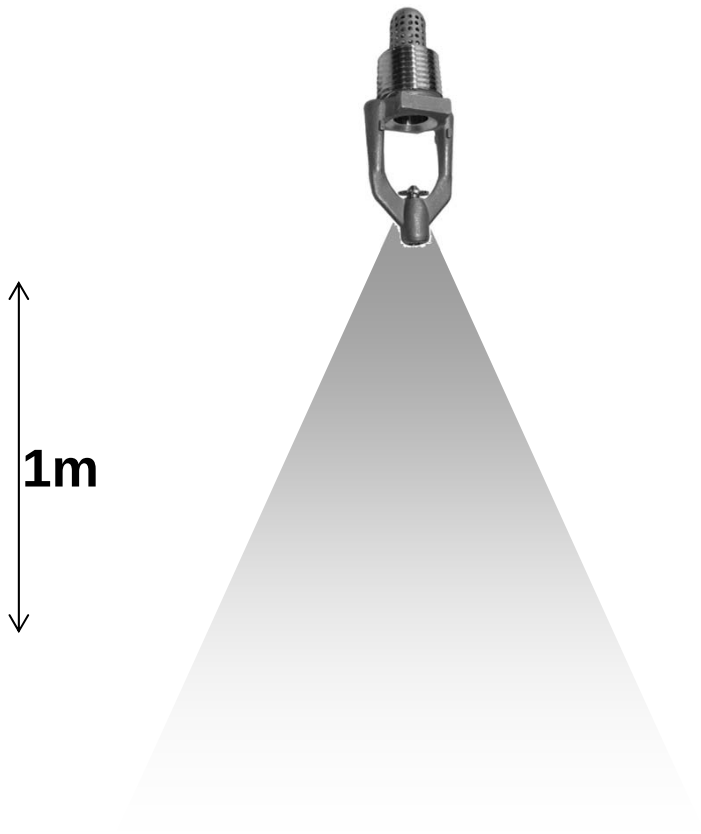

AquaMist
The broadest range of
Solutions in the Indust
tyco
Fire Protection Products
AquaMist



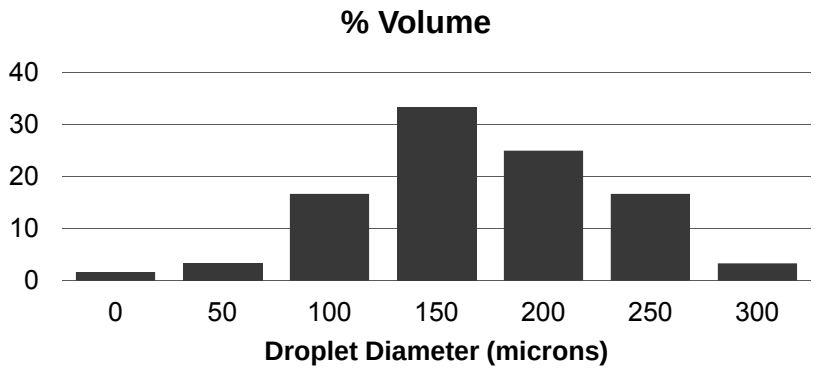
How Water Mist works

How to Measure Droplet Size

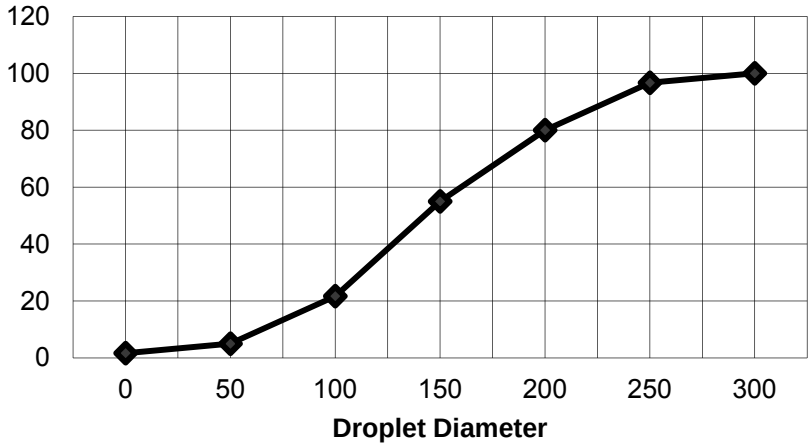
Spray drop size measurement
(usually at 1m from nozzle)



Count the number of drops for each size



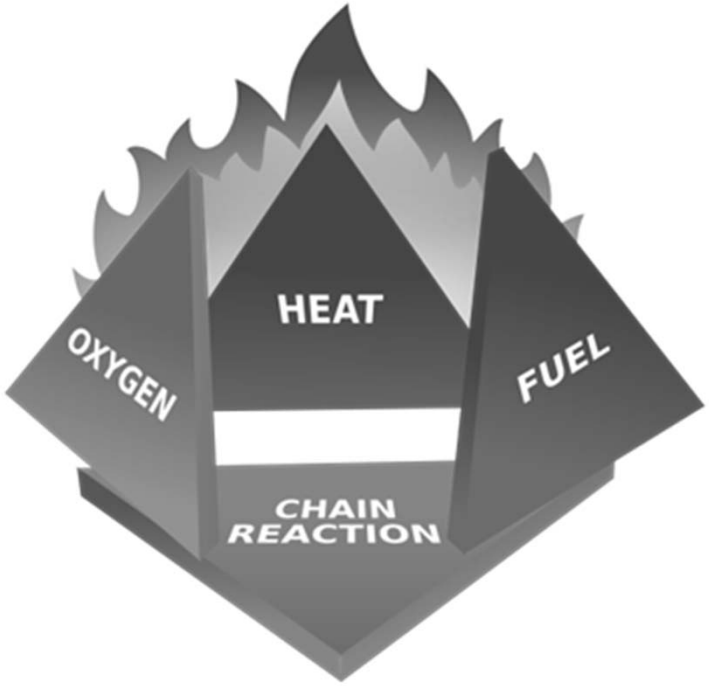
Calculate Dv for each drop size group



Fire Triangle

Fuel Types (NFPA 750)

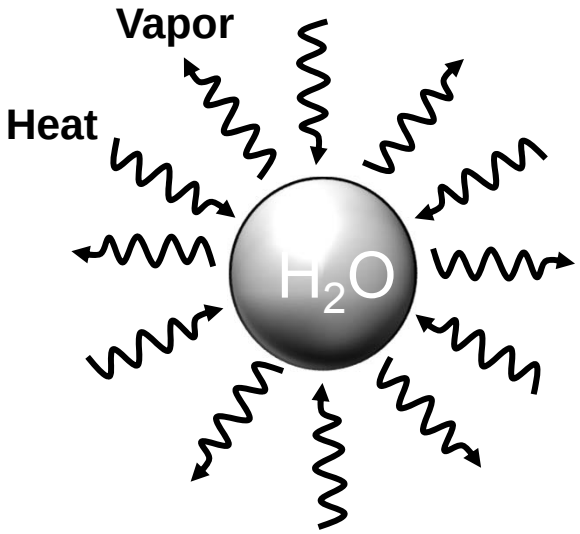
- Class A
  - I.e. wood, paper
- Low Flashpoint class B
  - I.e. Gasoline
- High Flashpoint class B
  - I.e. Diesel
- Class C
  - Cables
  - European standard (EN-2): Class E
- Class K
  - Cooking Oil
  - European standard (EN-2): Class F



Small Water Droplets

Small droplets absorb heat faster, using water at much higher efficiency.

Diameter (mm)	Number of Drops	Surface Area (m2)	Example
10	1	0.000314	ESFR
1	1,000	0.314	Residential
.01	1,000,000	314	Water Mist



Water Mist Fire Fighting

Extinguishing

- Class B & K (F)
- Hydro-Carbon, high heat release
- Global/local oxygen displacement
- Flame cooling
- Radiant heat blocking
- Alternative to deluge and gaseous extinguishing

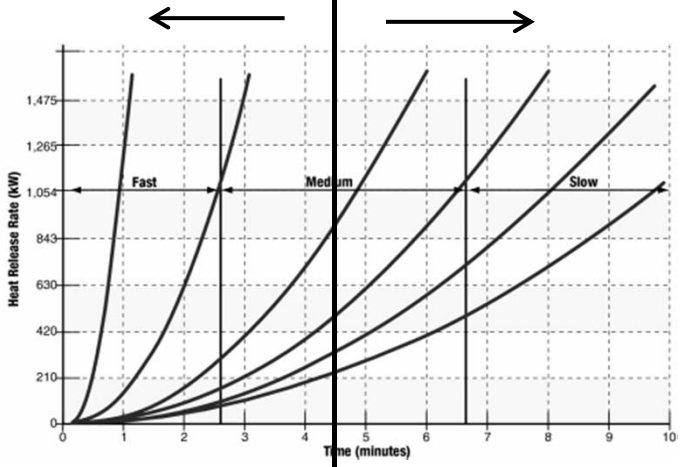
- All nozzles discharge simultaneously (total flooding)
- Enclosure design volume



Control

- Class A
- Ordinary combustibles, low heat release
- Flame / smoke cooling
- Radiant heat blocking
- Pre-wetting combustibles
- 2.5 Dimensional wetting
- Alternative to traditional sprinklers

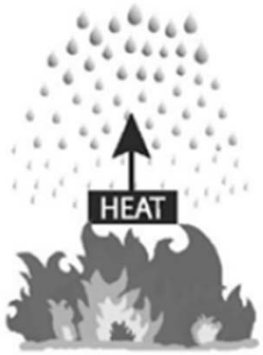
- Operation by frangible bulb
- Design area





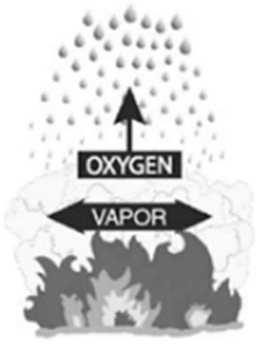
Water Mist Fire Fighting

A.



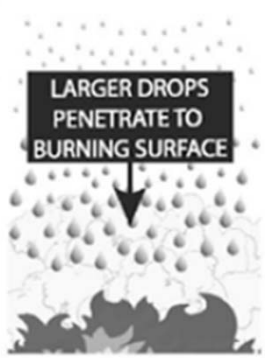
- Evaporation (Heat extraction) is a function of the surface area of the droplets
- Reducing droplet size increases the surface area
- Increasing the surface area allows for larger cooling effect for a given flow

B.



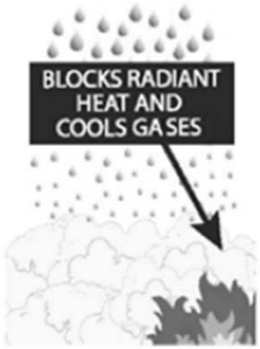
- Water converts to vapor, expanding by a factor of 1650
- Oxygen is displaced and diluted thereby blocking it from the fuel source
- Higher heat levels cause faster vaporization

C.



- Fire extinguishment is improved with direct contact of water droplets
- This type of extinguishment is normally associated with standard sprinklers

D.



- Small droplets tend to remain suspended
- The expanding mist will expand and cool the gasses and other fuel in the area
- Blocks the transfer of radiant heat to the adjacent combustibles and pre-wets them



Design Standards & Fire Testing

Design Standards & Protocols

Design/ Installation Standard

- BS8489 – 1:2016(March publication)
- CEN/TS 14972
- FM 4-2
- NFPA750

✓ Installation and maintenance criteria
✓ Duration
✓ Design Area
✓ No Nozzle design Criteria

Fire & Component Test Protocol

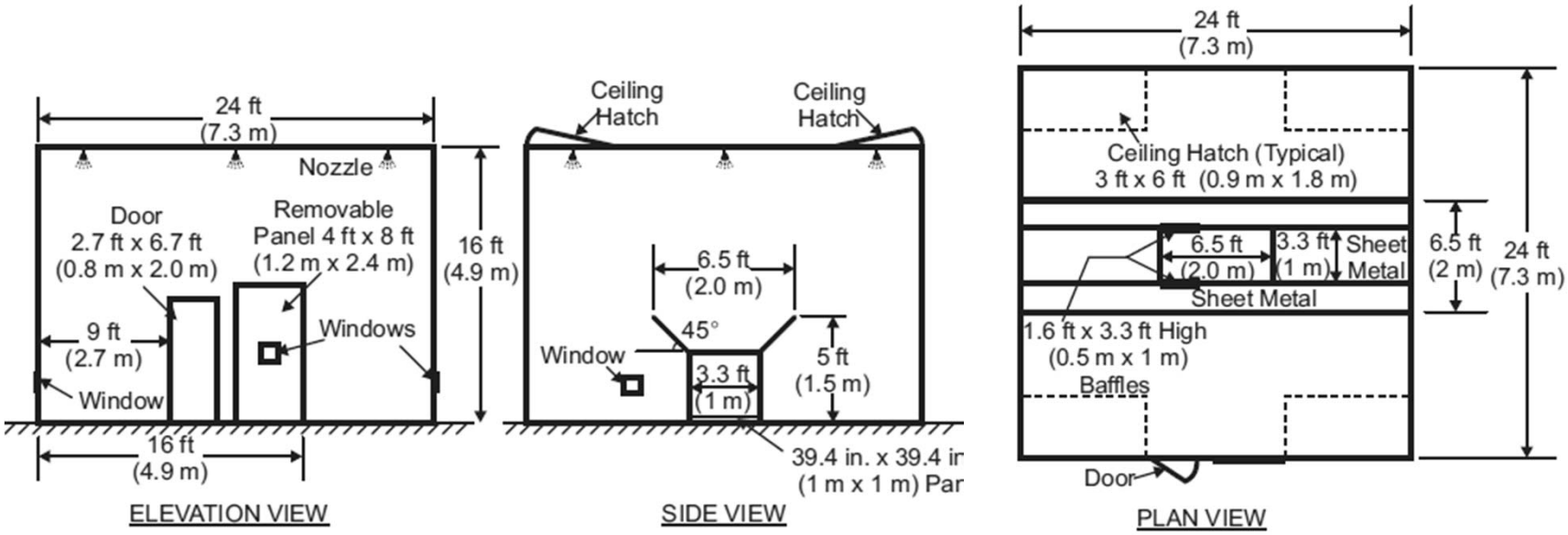
- Land
  - FM5560
  - FM5580
  - VdS ad hoc
  - UL2167
  - TS14972 (no component testing)
- Marine
  - IMO Circ 265 (old Res A.800)
  - IMO 1165
  - IMO 1387 (old IMO 913)

✓ Fire test performance
✓ Component performance

Product not tested or approved should not be specified or installed

Machinery Spaces – FM5560/5580 (Class B)

- At least 5m ceiling height
- Personel Access door without locking mechanism
- Twelve test configurations
- Approval Criteria
  - Extinguishment



Machinery Spaces - IMO1165/UL2167 (Class B)

- Volume Protection
- Enclosure at least 100m^2
- At least 5m ceiling height
- Thirteen test configurations (natural ventilation 2m x 2m)
- Approval Criteria
  - Extinguishment

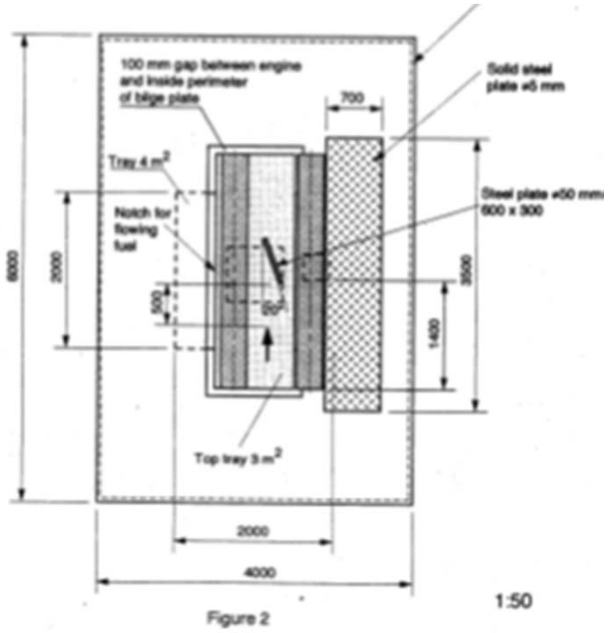
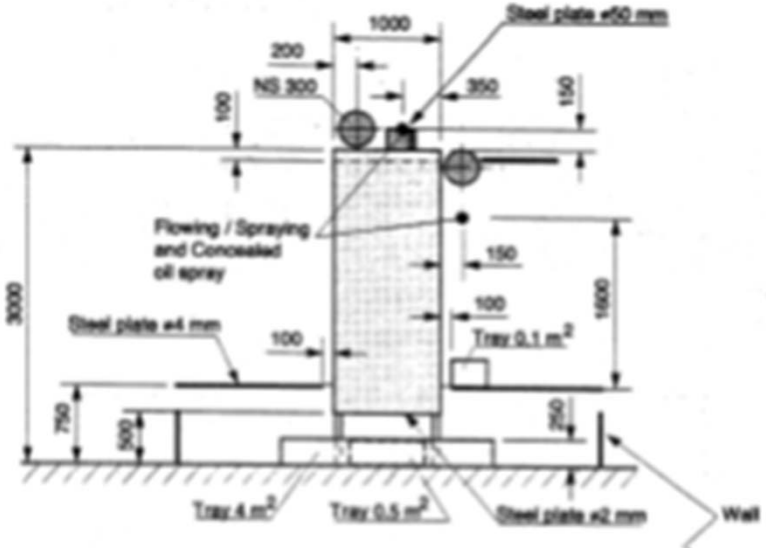


Figure 2



Light Hazard HC-1 – FM5560

- FM5560 Approval Standard for water mist systems
- Appendix G : Fire tests for water mist systems for the protection of non-storage occupancies, hazard category 1 (HC-1)
- Test configurations
  - Small Compartment Fire Test
  - Large Compartment Fire Test
  - Open Space Fire Test
- Approval Criteria
  - Limit to qty of nozzles operating
  - Temperature limits
  - Damage limits

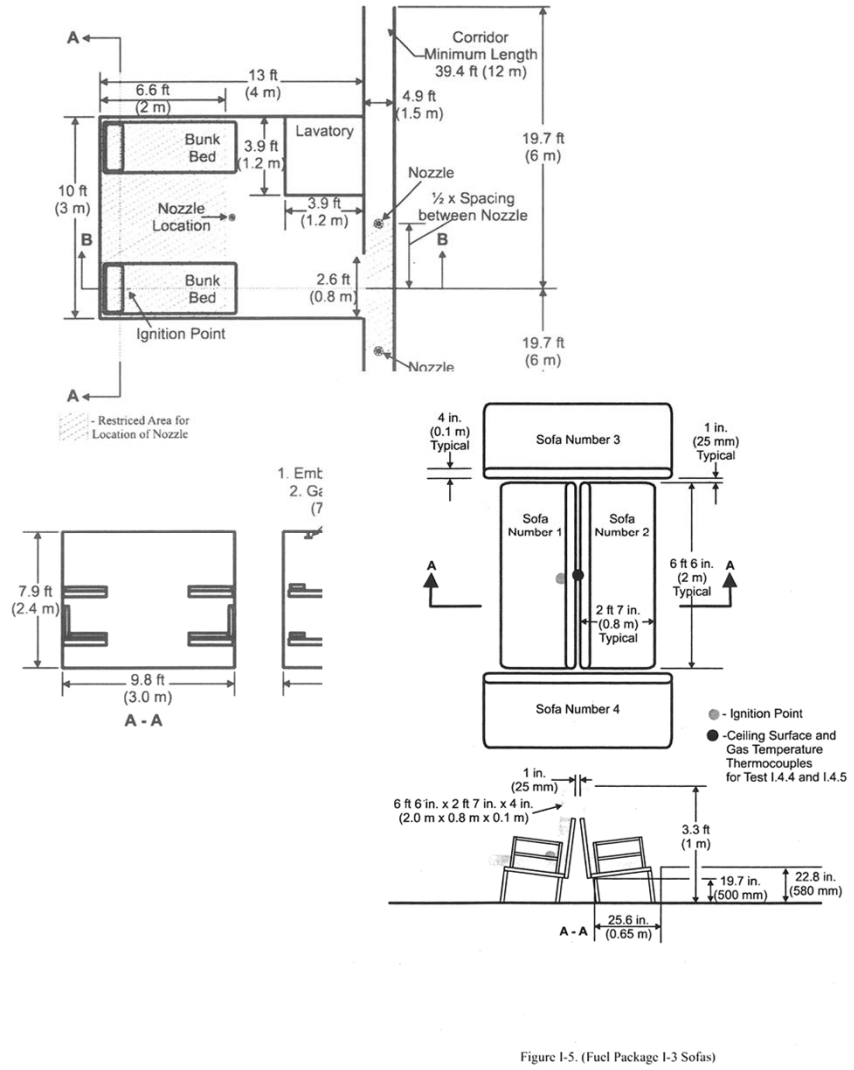
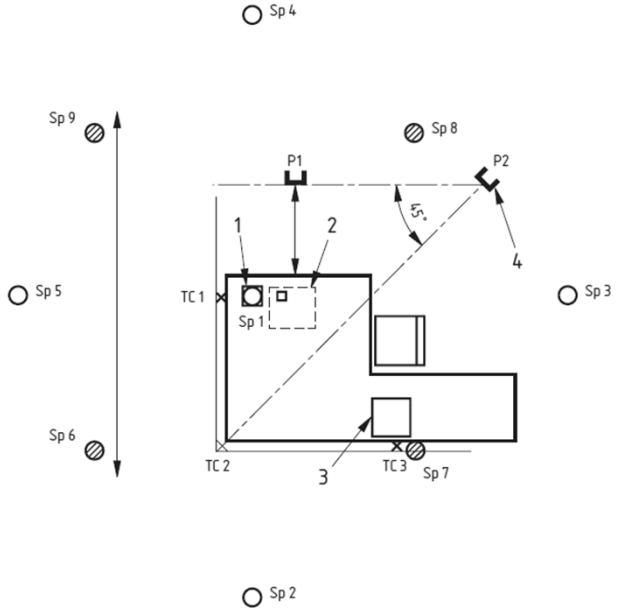


Figure I-5. (Fuel Package I-3 Sofas)

TS14972 – Office Test

- Rooms shall be at least 80m^2
- 2m+ ceiling height
- Reference tested against sprinklers
  - Damage shall not >50%
  - Damage to water mist less than sprinklers
  - The average ceiling gas temperature for water mist shall be less than sprinklers

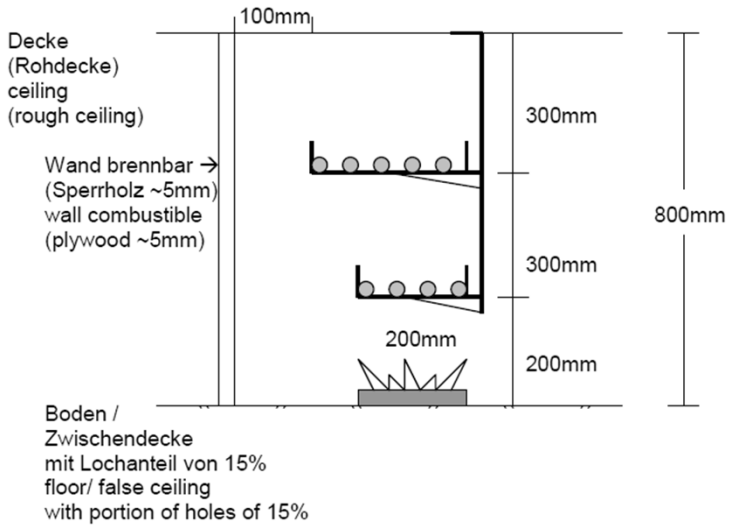




- Two test configurations
  - Under one nozzle
  - Between four nozzles
- Not easily repeatable

VdS – Concealed Space

- VdS test protocol “Fire tests for false floors and false ceilings as a completion of the fire tests ‘Office, OH1’ and similar” dated Dec. 6, 2007.
- 0.8m ceiling height
- Fuel package 120ml Heptane (200*200*20mm)
- Ignition location between two nozzles





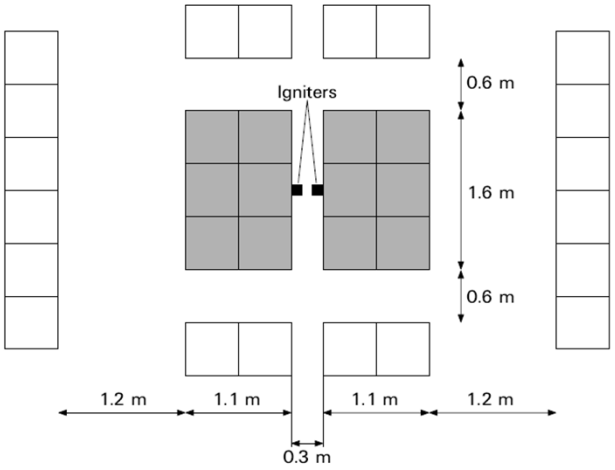


Ordinary Hazard 1 & 2 - UL2167

IMO Circ RES A.800- Shopping and Storage Area Fire Test

80m^2 enclosure – no dimension less than 8m

2.5m ceiling height



Plan view

Ignition location

- Test 1: Centred under one nozzle
- Test 2: Between two nozzles
- Test 3: Between four nozzles



Approval Criteria

- No damage to target cartons
- No more than 50% of target damage

What is Performance Based Design (PBD)?

"An engineering approach to fire protection that allows for the implementation of alternative designs, methods and technologies to meet the functional and operational needs of a facility"

- An application that falls outside of fire test protocol
- Extension of already approved & listed system
  - Fire Tests to greater heights, volumes
  - Combining other technology (e.g. sprinklers)
- Relaxation of building code through employment of solutions that compensate

Four Major Steps for Fire Testing outside of listed protocols

- Consensus establishment of performance goals
- Development of solutions believed to meet performance goals
- Analysis of the solution to determine compliance with performance goals
- Implementation and documentation of the solution



AquaMist
Tyco's Water Mist Solution

Types of Water Mist Systems

High Pressure Water Mist System

A water mist system where the distribution **system piping** is exposed to pressures of **34.5bar or greater (500psi).**

Intermediate Pressure System

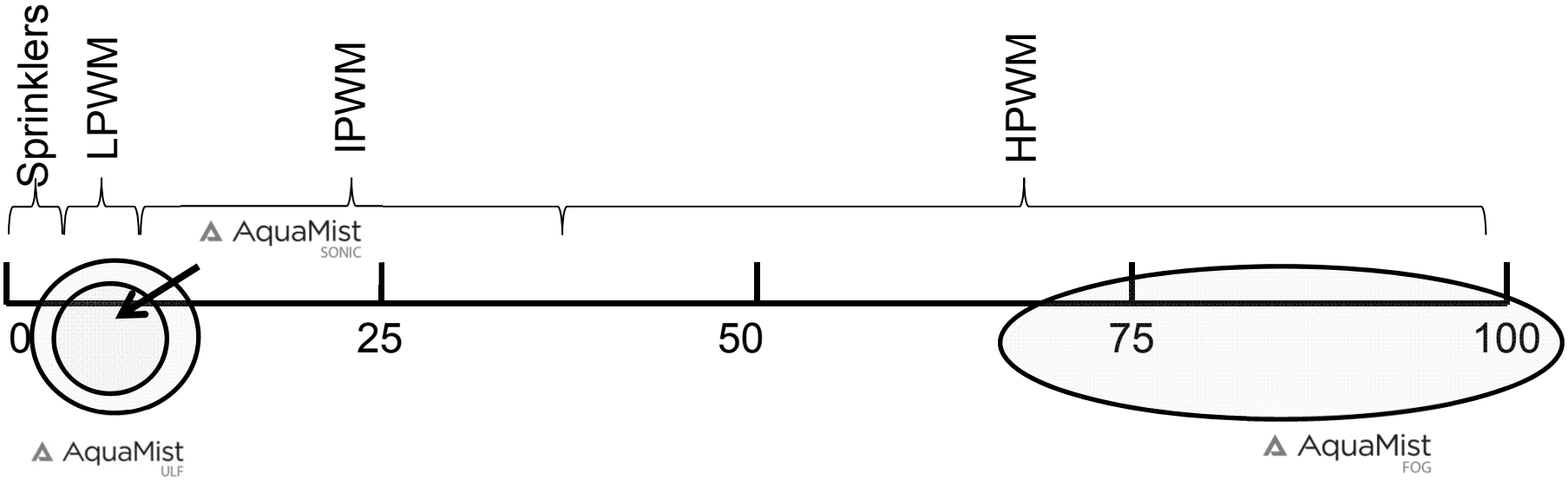
A water mist system where the distribution **system piping** is exposed to pressures of greater than 12.1 bar (175psi) but **less than 34.5 bar (500psi).**

Low Pressure Water Mist System

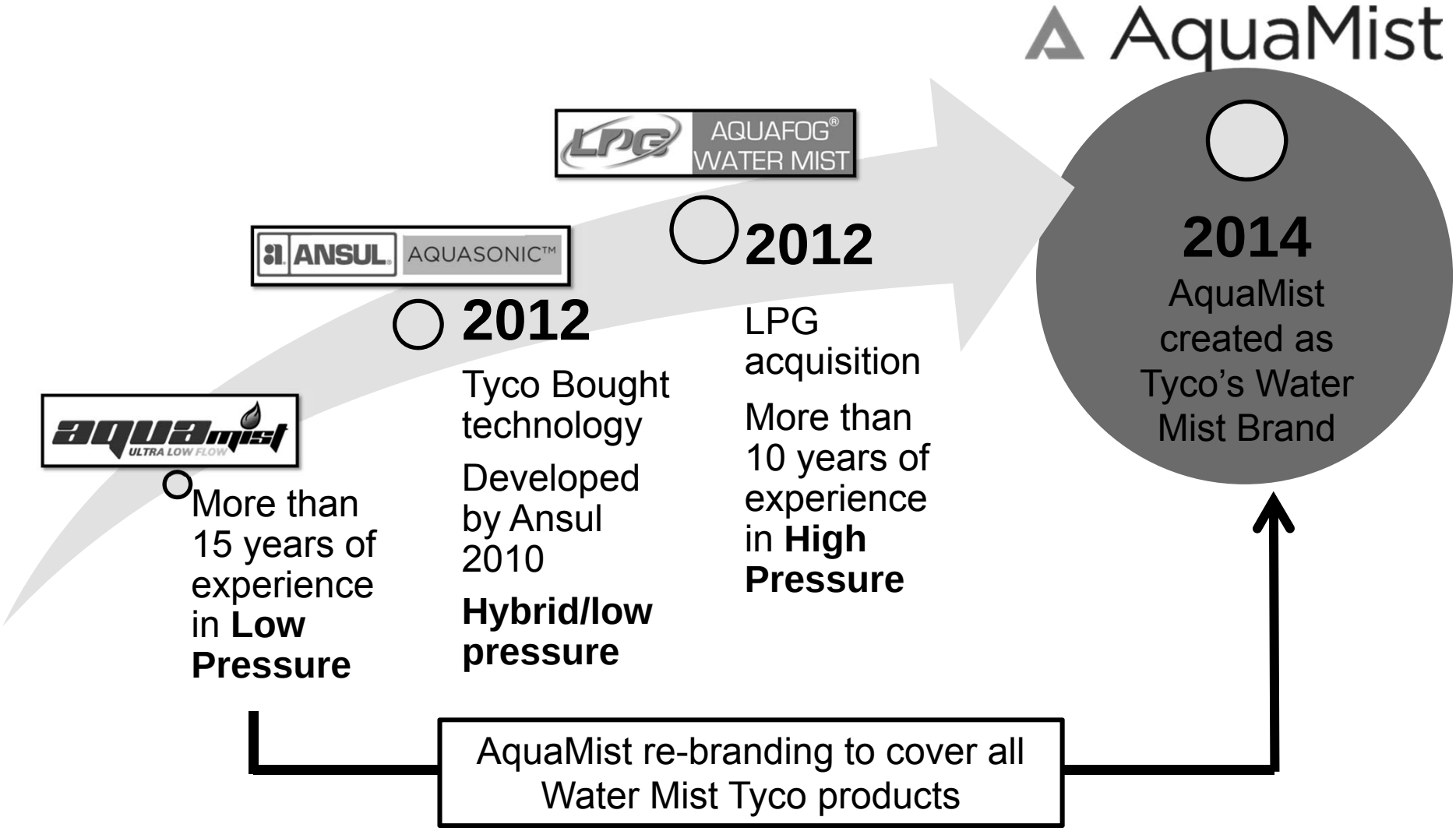
A water mist system where the distribution **system piping** is exposed to pressures of **12.1bar or less (175psi).**

Does Pressure Matter?

- NFPA 750 introduced pressure definitions – high, intermediate & low
- But, identical applications proven by technologies based on all pressure – third party approval critical
- New draft CEN and BS standards remove pressure definition
- If it is MIST, it is MIST, independent on how it is generated

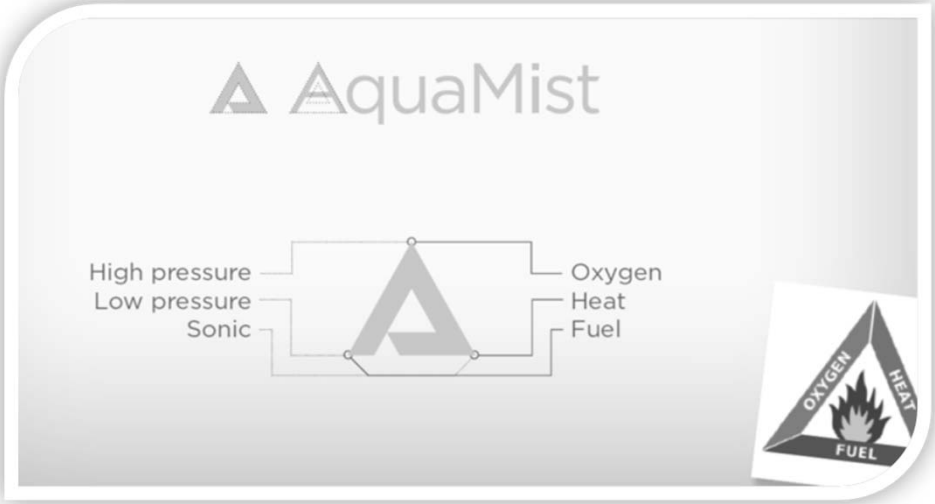


AquaMist's Origins



AquaMist Tecnologies

AquaMist



- AquaMist ULF
- AquaMist FOG
- AquaMist SONIC

The Broadest Range of Water Mist Solutions in the Industry

AquaMist Video



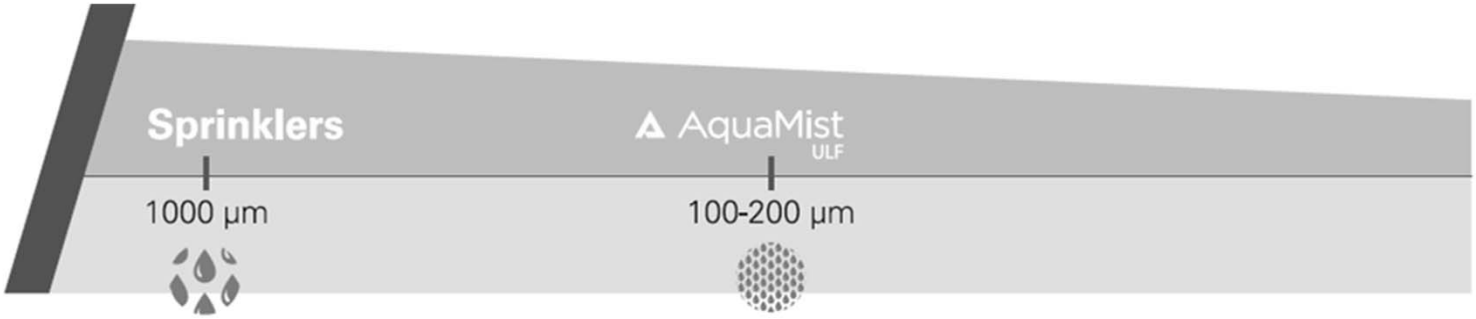
Applications

	AquaMist ULF		AquaMist FOG			AquaMist SONIC
Approval	FM APPROVED	Performance based Design	FM APPROVED	TS14972	Performance based Design	FM APPROVED
Hotels	■					
Data Centers	■			■		
Heritatge Buildings	■			■		
Hospitals	■					
Machinery Spaces	■		■		■	■
Turbine Enclosures	■		■		■	■
Cable tunnel		■				
Library / Archives					■	
Industrial Fryer Protection	■					

AquaMist ULF (Low Pressure)

A reliable and cost effective Water Mist solution for a broad range of applications

- Droplets sizes between 100 and 200 microns.
- As effective as High Pressure and additional advantages as lower electrical requirements and no High Pressure piping and fittings
- Standalone solutions available for installations with supply electricity limitations.



AquaMist ULF (Low Pressure)



Electrical pump units



Cylinder arrangements

AquaMist ULF (Deluge)

AquaMist ULF







Reference	AM-15	AM4	AM-11	AM-10	AM-31
Applications	IMO913 Local Application	Machinery Space	TD2 Local Application	IFP – Fines Box	IFP - Hood
Approval	DNV	FM APPROVED UL		FM APPROVED	FM APPROVED

AquaMist ULF (Automatic)

Tyco
Water
Mist

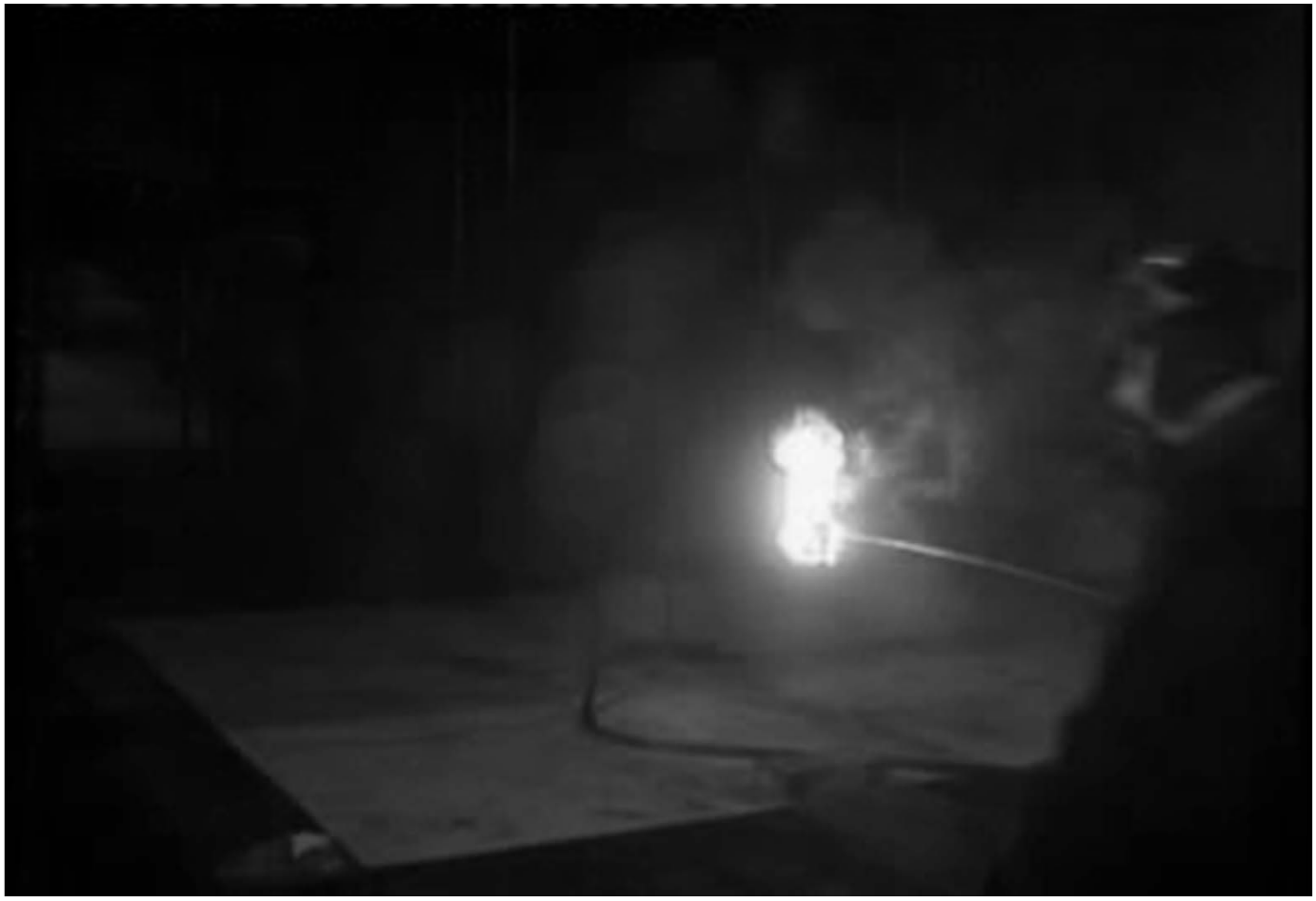





Reference	AM-27	AM-29	AM-24	AM-30
Applications	HC-1	HC-1/HC-2	OH2	Voids/HC-2
Approval	FM APPROVED	FM APPROVED	UL	FM APPROVED VdS

Approval - Machinery Space

AquaMist ULF – Low Pressure



Approval – Machinery Space

AquaMist ULF – Low Pressure

- FM5560 Total Flood
- Pool Fire
- 0.78 litres/min/m^2
- 12 Bar

Approval – Ordinary Hazard

AquaMist ULF – Low Pressure



Approval – Ordinary Hazard

AquaMist ULF – Low Pressure

- FM5560 HC-1 & HC-2
- Class A
- 1.7 litres/min/m^2
- 7.6 Bar
- Water density 20% less than the best High Pressure System.

Ordinary Hazard Protection – Comparison

Approval Comparison – Ordinary Hazard

Normalised to same height	High Pressure Leading Competitor	Low Pressure Tyco
K-factor ($l/min/bar^{1/2}$)	4.1	8.5
Pressure (bar)	80	7.6
Spacing (m)	4.25	3.7
Area (m^2)	18	13.7
Flow (l/min)	36.7	23.4
Flux density ($l/min/m^2$)	2.1	1.7

// Low Pressure Water density ~ 20% LESS than High Pressure

Performance Summary

- Droplet Size - dependent on nozzle and pressure
  - Low pressure single fluid = orifice & deflector design (100-200 µm)
- Class B Fires
  - Smallest droplet sizes best performance
  - Marginal difference between high pressure and low pressure
- Class A Fires
  - Range of droplet sizes gives best performance (low pressure ~20% better)
  - Heavier droplets required for deep-seated cooling
  - Very small droplets (hybrid) have limited effectiveness

Limitations of Water Mist Systems

- Height (automatic nozzles)
- Volume (deluge systems)
- Openings (deluge systems)
- Fire Load – each listed approval states maximum fire load
- Fire risk within application, e.g. atrium – what is being protected ?
- Obstructions
- Nozzle location and orientation
- Validated PBD applicable to the risk?


Thank You