

Building protection

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Sales Director EMEA

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Agenda

- 01 Commercial building protection

- 02 Design topics & standards

- 03 Wood building protection

- 04 Car Park protection

- 05 Reference case histories

- 06 Q&A

How we segment the market

Offices	Hotel	Healthcare	Educational
 <p data-bbox="402 642 800 696">Co-working spaces</p>	 <p data-bbox="817 642 1215 696">Luxury</p>	 <p data-bbox="1233 642 1630 696">Hospitals</p>	 <p data-bbox="1648 642 2046 696">University & School</p>
 <p data-bbox="402 971 800 1025">Multi-tenant offices</p>	 <p data-bbox="817 971 1215 1025">Business & Conference</p>	 <p data-bbox="1233 971 1630 1025">Care homes</p>	 <p data-bbox="1648 971 2046 1025">Conferences</p>
 <p data-bbox="402 1272 800 1272">Company offices</p>	 <p data-bbox="817 1272 1215 1272">Heritage</p>	 <p data-bbox="1233 1272 1630 1272">Laboratory & research</p>	 <p data-bbox="1648 1272 2046 1272">Libraries</p>

How we segment the market

Car parks	Atriums	Shopping centers	Others
 <p data-bbox="402 644 723 696">Standard</p>	 <p data-bbox="817 644 1138 696">Museums</p>	 <p data-bbox="1233 644 1554 696">Shops</p>	 <p data-bbox="1648 644 1969 696">Wood building</p>
 <p data-bbox="402 972 723 1025">Automated</p>	 <p data-bbox="817 972 1138 1025">Large halls</p>	 <p data-bbox="1233 972 1554 1025">Malls</p>	 <p data-bbox="1648 972 1969 1025">Attics</p>
 <p data-bbox="402 1215 723 1270">EV Car</p>	 <p data-bbox="817 1215 1138 1270">Church</p>	 <p data-bbox="1233 1215 1554 1270">F&B</p>	 <p data-bbox="1648 1215 1969 1270">High-rise</p>

Complex buildings have multiple fire risks



Standards and design rules

EN 14972-1 + manufacturer DIOM



NFPA 750



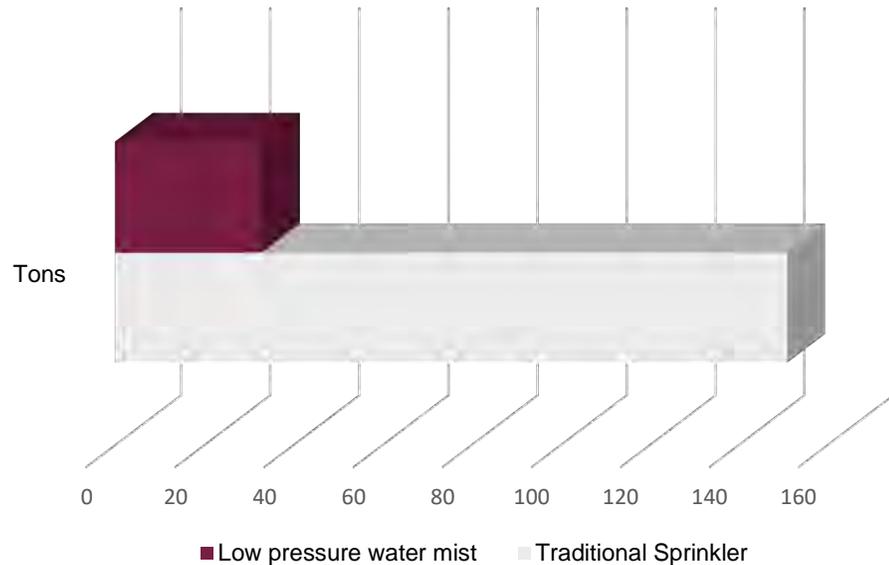
FM DS 4-2

FM DS 3-26



Building protection: Sustainability

Water mist is an eco-friendly and sustainable technology with 70% less CO2-e compared to sprinkler



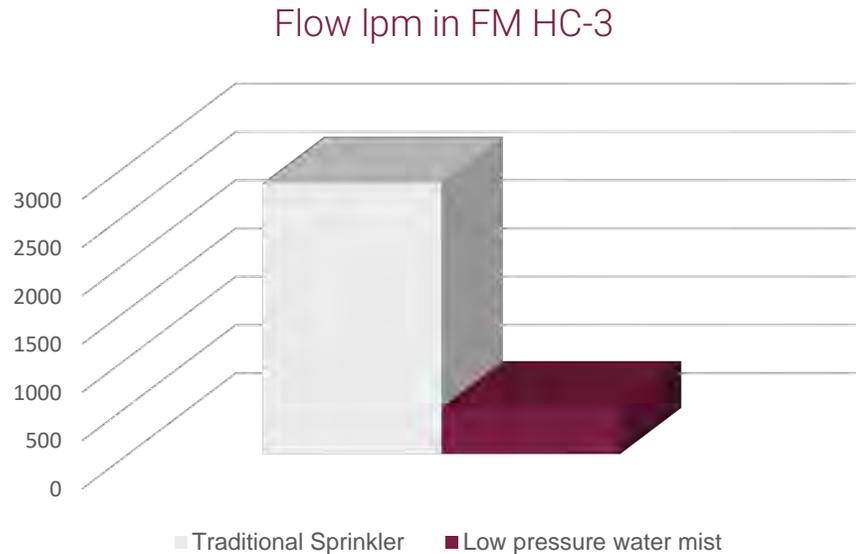
Data from a case study of a Data Center with 4000 nozzles head

Traditional Sprinkler	kg/m	m	kg
DN25	2.41	5456	19723
DN32	3.1	3780	17577
DN40	3.56	765	4085
DN50	5.03	6600	49797
DN80	6.76	153	1551
DN100	9.83	1084	15984
DN150	17.15	1656	42601
			151318

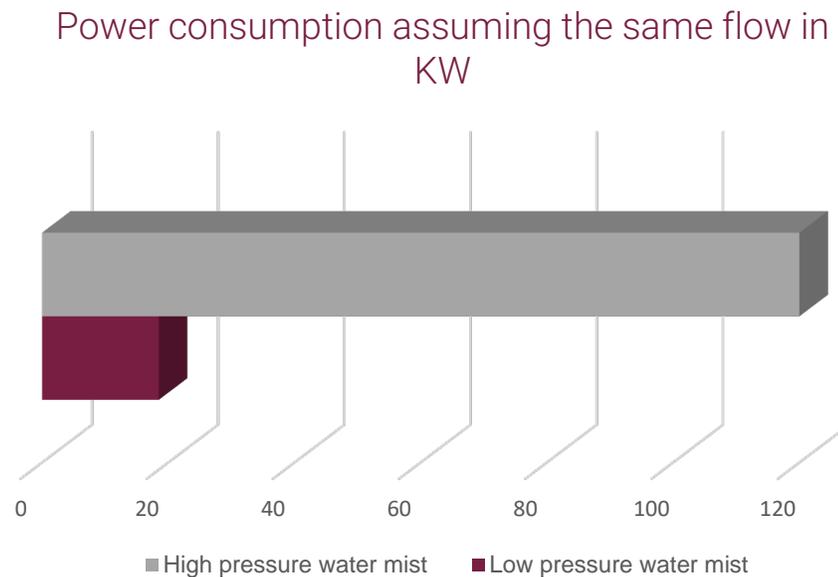
Low pressure water mist	kg/m	m	kg
18x1	0.426	2350	1502
22x1	0.625	5366	5031
28x1	0.805	1419	1713
35x1.5	1.258	3355	6331
42x1.5	1.521	1000	2282
54x1.5	1.972	3932	11631
76.1x2	3.711	900	5010
			33499

Building protection: Sustainability

Low pressure water mist heavily reduces the water consumption compared to sprinkler and the energy demand compared to high pressure water mist



Water saving



Energy saving

Building Protection: Aesthetic need



Building protection: Evacuation & collateral damages



A most efficient system leads to a faster evacuation and less collateral damages



Design approaches

EN 14972

- Ordinary Hazard Group 1 (OH1)**
72 m² – minimum 6 nozzles
- Ordinary Hazard Group 2 (OH2)**
144 m² – wet system
180 m² – dry system
- Ordinary Hazard Group 3 (OH3)**
216 m²
- Ordinary Hazard Group 4 (OH4)**
360 m²

NFPA750

Test protocols developed, carried out and interpreted by international recognized fire testing laboratories

FM DS 3-26

- HC1**
140 m² – minimum 9 nozzles
- HC2: worst case between:**
9 nozzles
The approval listing
- HC3: worst case between:**
9 nozzles
The approval listing

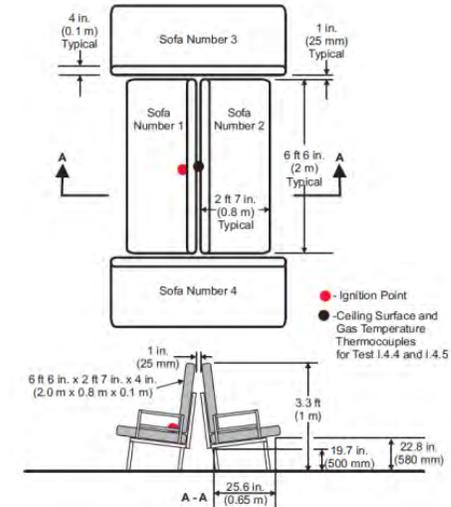
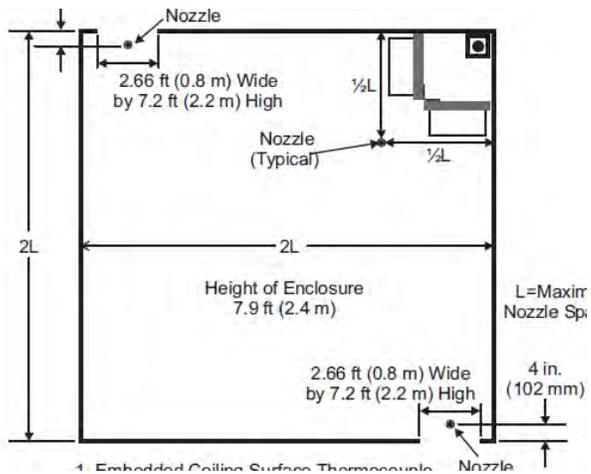
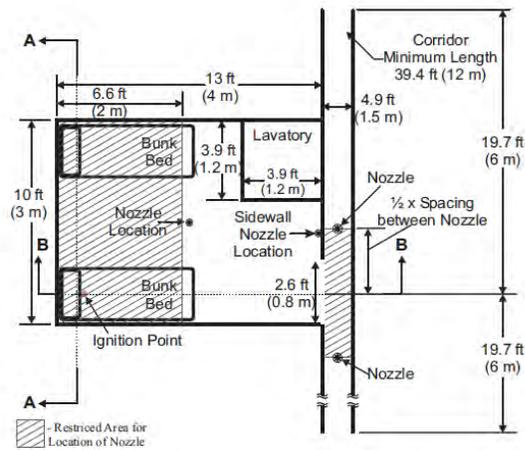
Standards are not specifying flow and pressure as for sprinkler systems



Test results define the design!

Commercial building protection

OHI approval Test EN14972-4 ; EN 14972-7 and FM5560 HC1



General limitations:

$H \leq A$ as tested

Nozzle spacing $\leq A$ as tested

Commercial building protection

Design criteria from EN 14972-1 OH1

Minimum design area (table 1):

- 72 m²

Minimum nozzle quantity (table 1):

- 6

Minimum operation time (table 4):

- 60 minutes

OH-VSO

Nozzle type: Pendent

Mini pressure: 8 bar to 16 bar

K-factor: 16,7

Max Spacing: 4,5 x 4,5 meters

Max height: 5,0 meters for FM; 12 m for DNV

Water density: 2,33 mm/m²

Note: 12 m ceiling height based on annex A fire tests

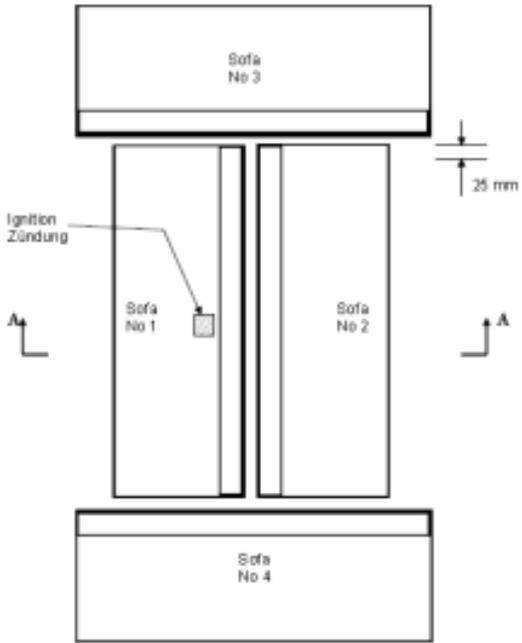
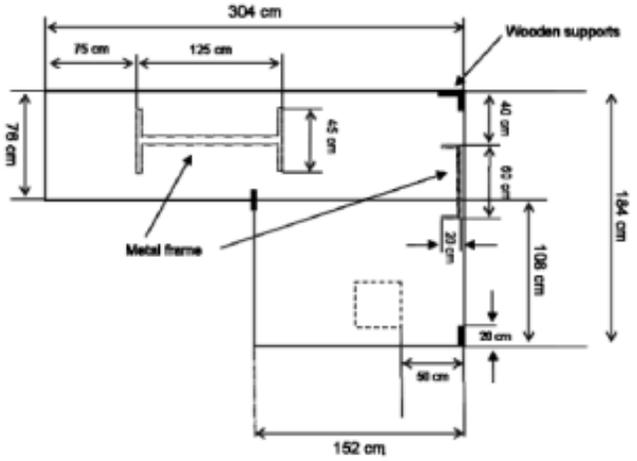


Flow rate@8 bar : $6 \times 47,3 = 283,8$ lpm



Commercial building protection

OH1 approval Test EN14972-1 annex A and protection of Office Spaces and Accommodation Areas with Sidewall



General limitations:
 $H \leq A_s$ tested
 Nozzle spacing $\leq A_s$ tested

Commercial building protection

Design criteria from EN 14972-1 OH1

Minimum design area (table 1):

- 72 m²

Minimum nozzle quantity (table 1):

- 6

Minimum operation time (table 4):

- 60 minutes

OH-SW2

Nozzle type: Sidewall

Mini pressure: 8 bar to 16 bar

K-factor: 25,5

Max Spacing: 6,0 x 6,0 meters

Max height: 5,0 meters

Water density: 2,00 mm/m²

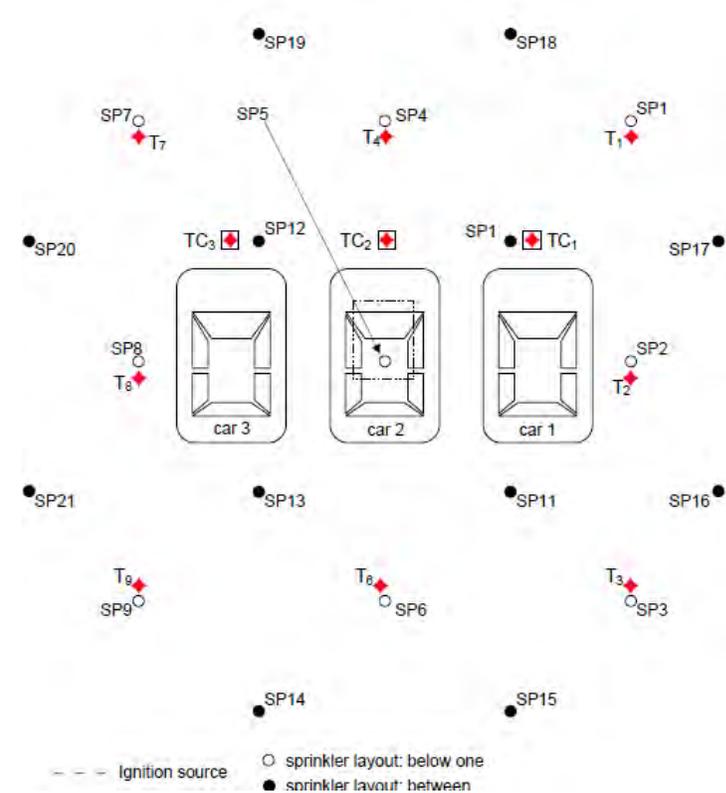
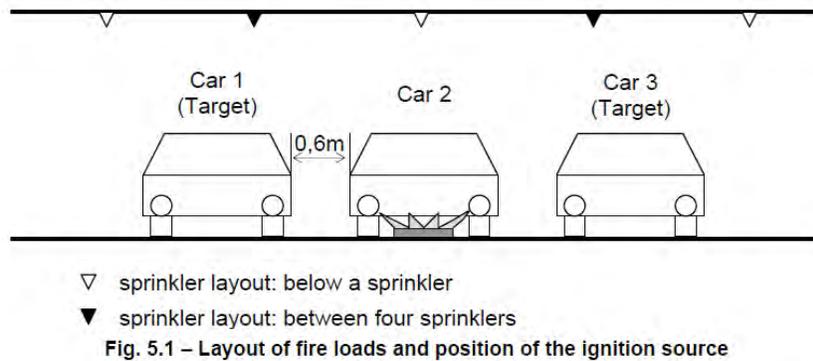


Flow rate@8 bar : $6 \times 72,2 = 433,2 \text{ lpm}$



Commercial building protection

OH2 approval Test EN14972-5 and VDS OH2 Parking Garages



General limitations:

$H \leq A_s$ tested

Nozzle spacing $\leq A_s$ tested

Comparison with sprinklers

6,5 mm/min

12m² (3,5m x 3,5m)

Commercial building protection

Design criteria from EN 14972-1 OH2
Car park

OH-UPR

Minimum design area (table 1):

- 144 m² wet system
- 180 m² dry system

Minimum nozzle quantity:

- N/A

Minimum operation time (table 4):

- 60 minutes

Nozzle type: Upright

Mini pressure: 6 bar to 16 bar

K-factor: 19,4

Max Spacing: 4,0 x 4,0 meters

Max height: 3,0 meters

Water density: 2,97 mm/m²

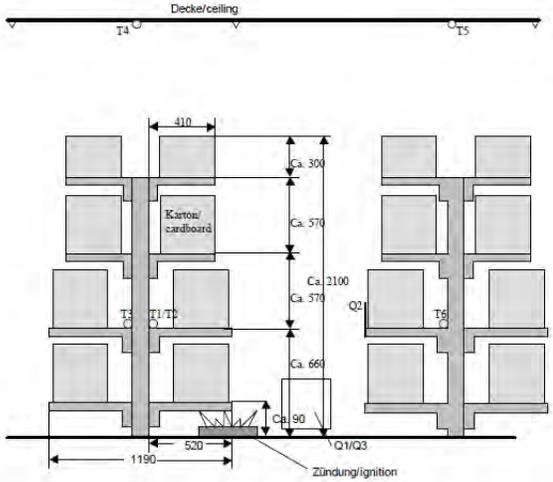
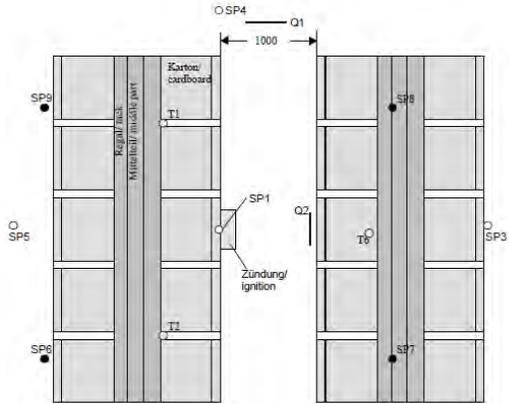
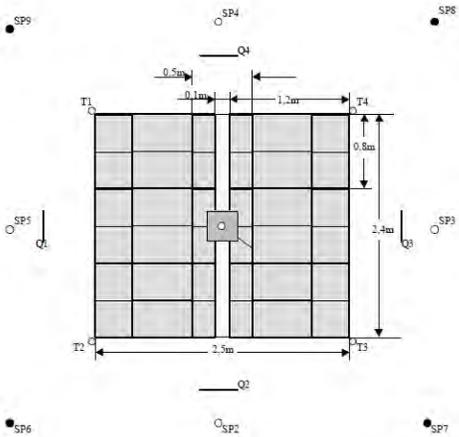
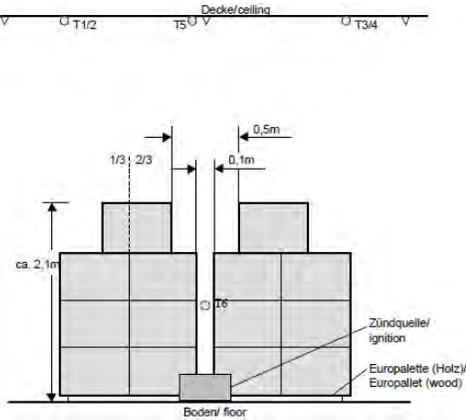


Flow rate@6 bar : $9 \times 47,53 = 427,77$ lpm



Commercial building protection

OH3 approval Test EN14972-2 and VDS and CEN selected OH-3 sales-, storage- and technique areas



General limitations:
 $H \leq A$ as tested
 Nozzle spacing $\leq A$ as tested

Comparison with sprinklers
 8 mm/min
 12m² (3,5m x 3,5m)

Commercial building protection

Design criteria from EN 14972-1 OH3

Minimum design area (table 1):

- 216 m² wet system

Minimum nozzle quantity:

- N/A

Minimum operation time (table4):

- 60 minutes

OH-PX2

Nozzle type: Pendent

Mini pressure: 7 bar to 16 bar

K-factor: 19,0

Max Spacing: 3,5 x 3,5 meters

Max height: 4,0 meters

Water density: 4,1mm/m²



Flow rate@7 bar : 18 x 50,3 = 905,4 lpm



Commercial building protection

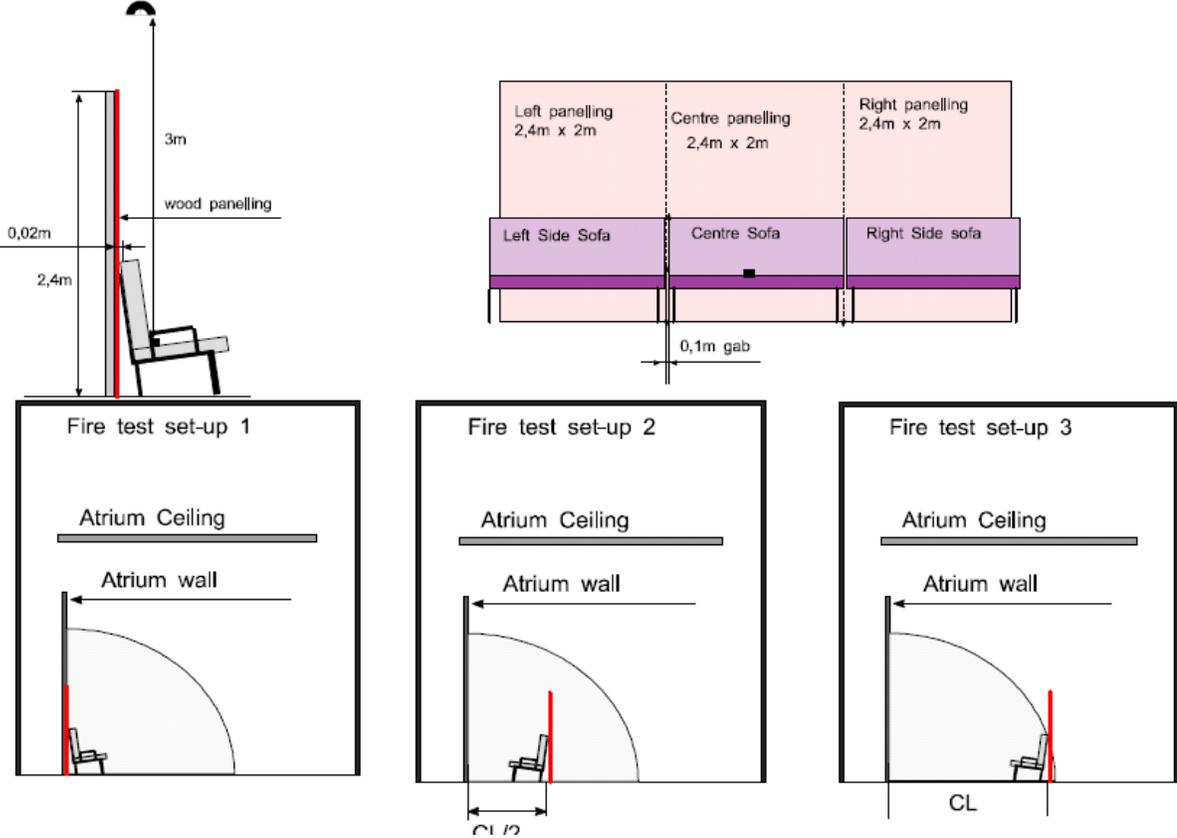
Atrium approval Test EN14972-10 and DFL standard: 80717-004.

General limitations:

- $H \leq A_s$ tested
- Nozzle spacing $\leq A_s$ tested

Tests parameters:

- Fuel loads of 4 – 6MW
- Fuel located on the floor
- Control and suppress fires as well as sidewall sprinklers in 3 different scenarios, in well ventilated areas.



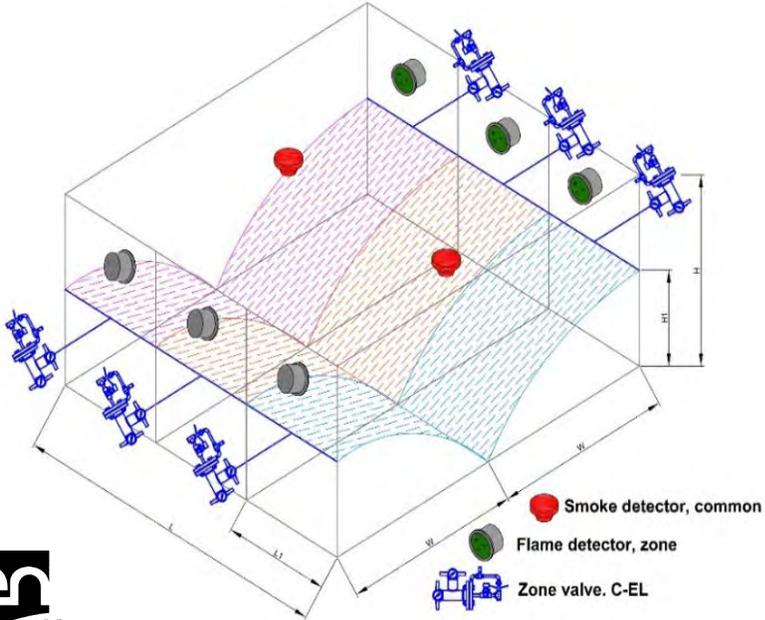
Commercial building protection

Zone Design:



Design for worst case scenario.

Tradeoff between zone cost and zone water consumption



General Description				
Atrium System Type	A	B	C	D
Minimum water pressure (bar)	5	6	10	6
Maximum working pressure (bar)	16	16	16	16
K-factor 6m pipe (metric (l/t/vbar))	37	52	62	26
Flow 6m pipe (L/min)	83	127	196	64
Drop size	DN ₉₀ < 300 μm			

Length (L)	Unlimited	
Height (H)	Unlimited	
Width (W)	Type A	8 meter
	Type B	10 meter
	Type C	13 meter
	Type D	5 meter
Nozzle height (H1)	3 meter to 7 meter	
Zone length (L1)	Unlimited	

Hydraulic System				
Water density (mm/m ²)	2	2,3	2,6	2,3
Design area and system operation time	As for sprinklers installed in similar hazard groups			



Protection of wood building

Performance based design

SCOPE

Offices

Hotels

University

Typical OH1 building with exposed timber ceiling



Heritage Building Fires

There have been many devastating fires in the UK and Ireland that have completely burnt out irreplaceable stately homes and buildings.

Some get rebuilt and some are gone forever.

Clandon Park, Surrey – Destroyed 2015 (source picture BBC)

VID



Parnham House, Dorset (Image: DWFRSCraigBaker/Twitter)

Glasgow School of Art – Fires Mackintosh Building

May 2014 – Fire caused during student preparation for a degree show. Flammable gasses from an expanding foam canister came into contact with a hot surface on a projector.

The fire spread through wooden ducting and took hold in the library and spread further.

It was decided to rebuild, faithfully to the original design with modern protection built in.



Glasgow School of Art – Fires Mackintosh Building

June 2018. Second even more devastating fire during the reconstruction phase.

Fire cause 'undetermined'

Lots of criticism from people with the advantage of hindsight.

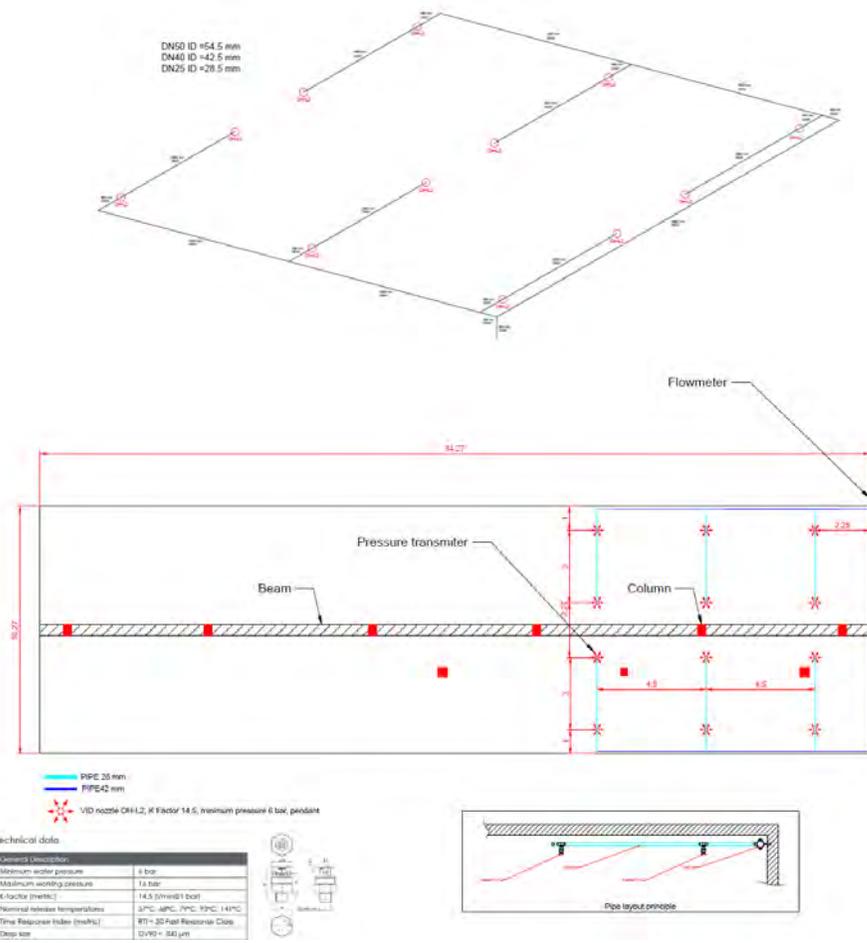
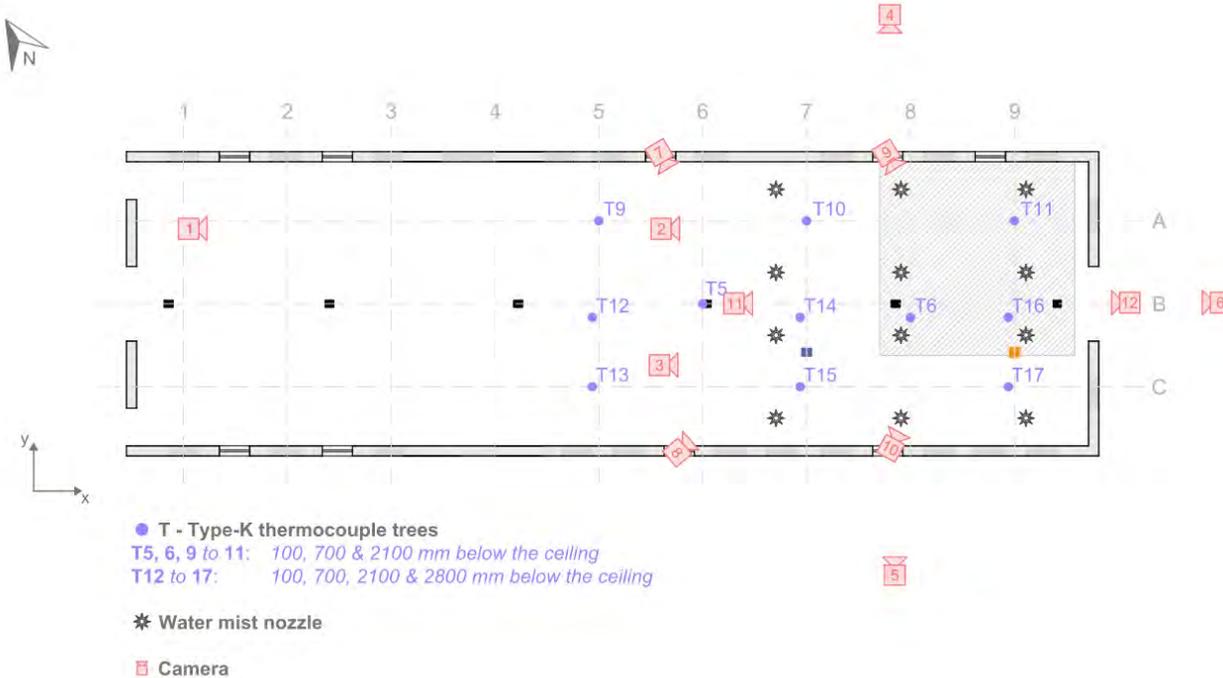
Let us take a step back to the introduction slide mentioning parties involved.



Source unknown



Water mist in an open compartment with an exposed timber ceiling



General limitations:
 H ≤ As tested
 Nozzle spacing ≤ As tested

Water mist in an open compartment with an exposed timber ceiling

CERIB/ARUP Code RED test 3

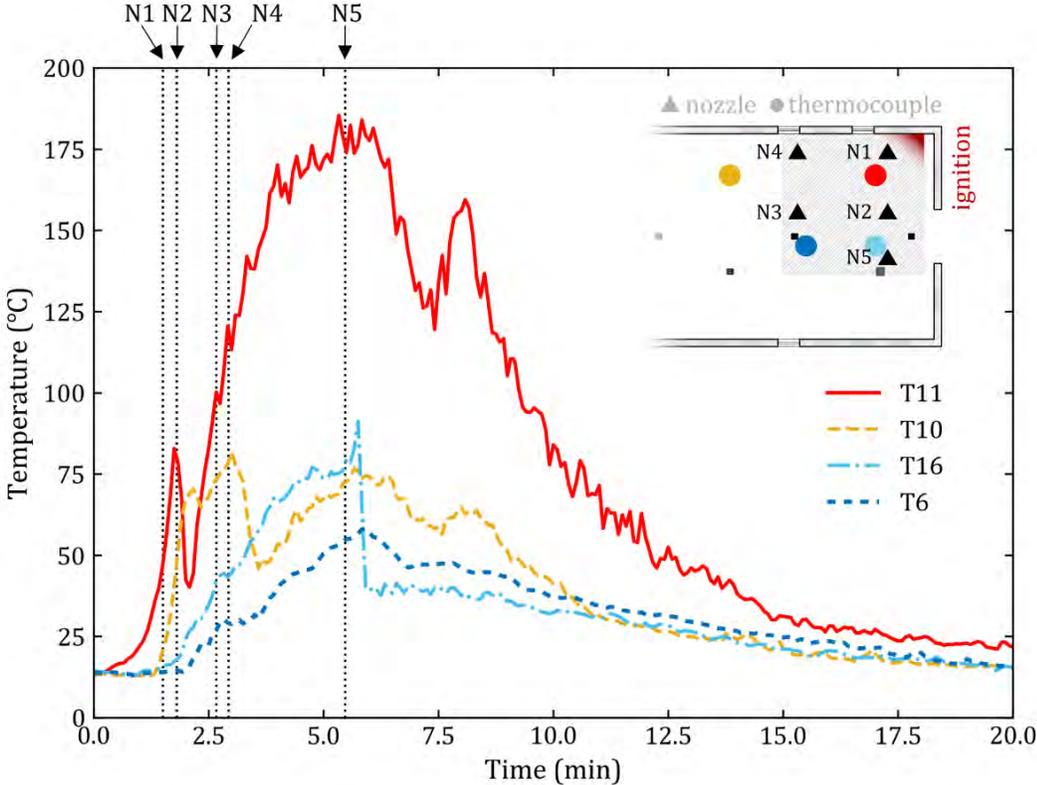


Water mist in an open compartment with an exposed timber ceiling

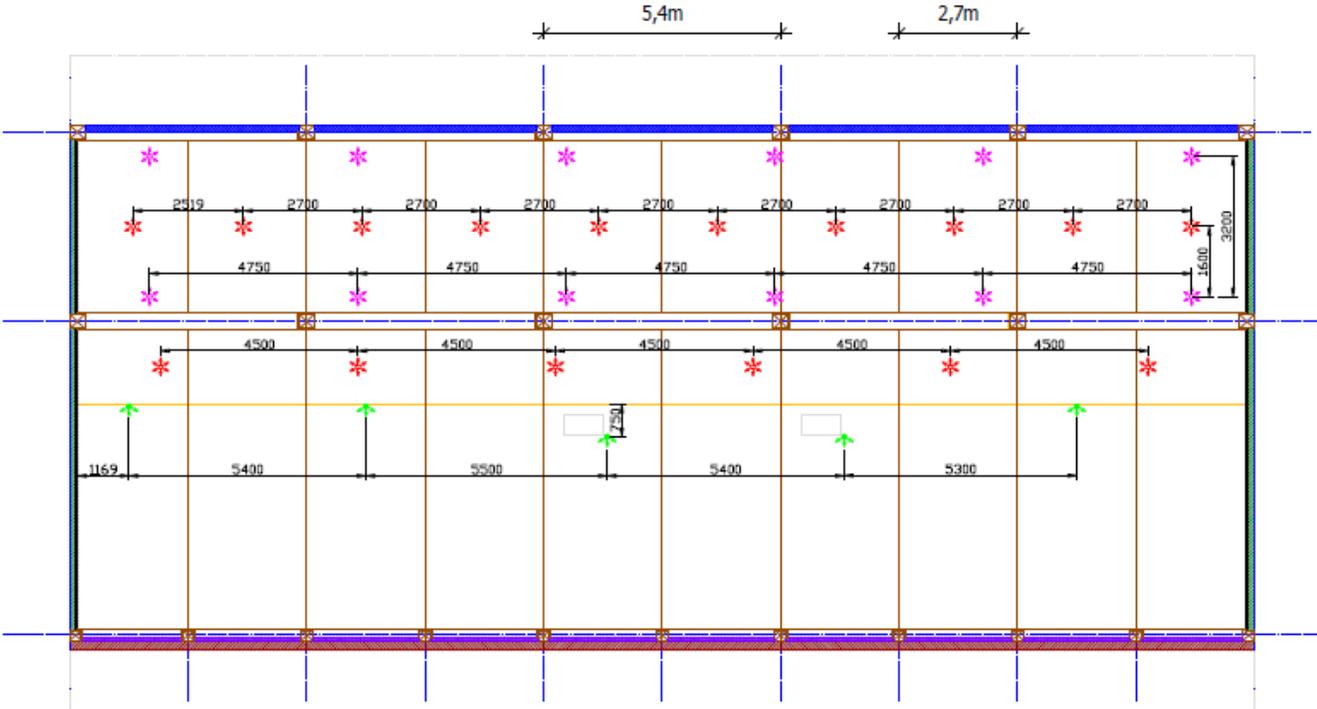
The system successfully controlled the fire such that the maximum compartment temperatures near the ceiling in the immediate vicinity of the ignition **never exceeded 185 °C** after 05.28 min that the 5th nozzle activated, and **85°C elsewhere in the compartment.**

Compartment temperatures started to fall soon after the activation of the 5th nozzle. The average discharge density for the five nozzles was **2.88 ltrs/ m/min at a pressure of 7.36 bar.**

Nozzle	Activation time	Average discharge density
N1	1 min 30 s	3.0 litres/m/min
N2	1 min 48 s	
N3	2 min 40 s	2.93 litres/m/min
N4	2 min 56 s	
N5	5 min 28 s	



Water mist in an open compartment with an exposed timber ceiling



- * Base OH-VSD, facteur K 16,7, pression min 8 bar
- * Base OH-DC2, facteur K 13,85, pression min 8 bar
- * Base OH-SW2, facteur K 29, pression min 8 bar

General limitations:
 $H \leq A$ as tested
 Nozzle spacing $\leq A$ as tested



Water mist in an open compartment with an exposed timber ceiling



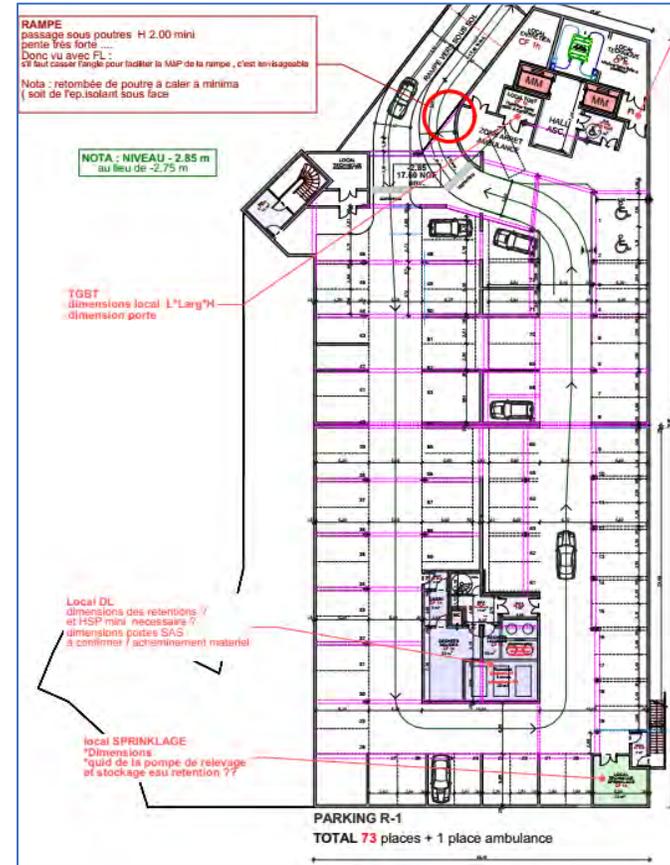
Protection of car parks with EN14972 – annex A



3-26 Fire Protection for Nonstorage Occupancies

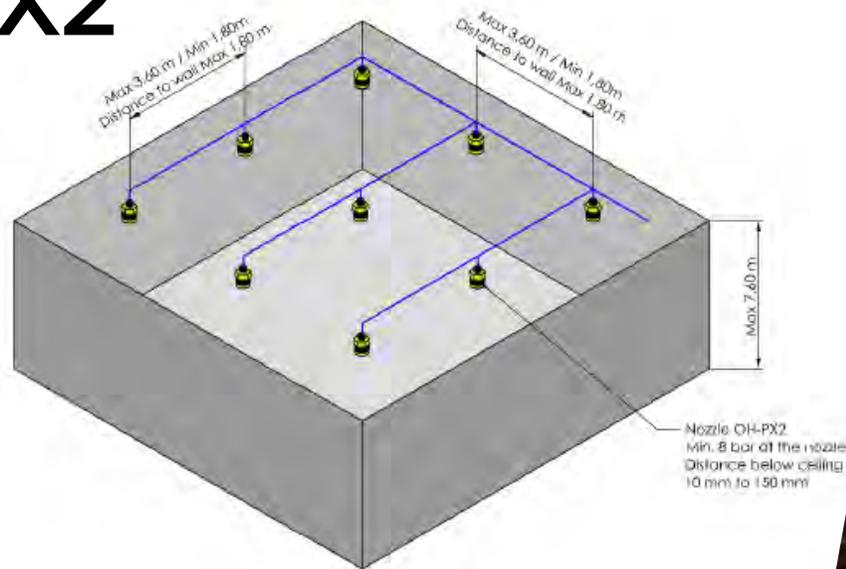
Table C-1. Nonstorage, Non-Manufacturing Occupancies and their Associated Fire Hazard Categories

Occupancy	Description	Hazard Category	Considerations
Healthcare Facilities	- Hospitals and Hospital Laboratories	HC-1	Data sheets to consider: - 1-3, High-Rise Buildings - 1-12, Ceilings and Concealed Spaces - 1-24, Protection Against Liquid Damage - 5-23, Emergency and Standby Power Systems
	- Nursing or Convalescent Homes - Kitchens - Care Homes - Penal Institutions (Jailhouses, etc.)		
	- Hospital Utility Plants - Storage Room/Pharmacies with Storage	HC-2 HC-3	- 6-4, Oil or Gas Fired Single-Burner Boilers - 6-5, Oil or Gas Fired Multiple Burner Boilers - 7-15, Garages
Business Facilities & Apartments	- Offices - Hotels - Flats / Apartments - Residential Buildings	HC-1	Data sheets to consider: - 1-3, High-Rise Buildings - 1-12, Ceilings and Concealed Spaces - 1-24, Protection Against Liquid Damage - 7-15, Garages
	- Utility Rooms	HC-2	
Educational Facilities	- Universities - Schools - Kindergartens - Colleges - Dormitories and Residence Halls - Prisons - Detention centers - Utility Rooms	HC-1	Data sheets to consider: - 1-3, High-Rise Buildings - 1-12, Ceilings and Concealed Spaces - 1-24, Protection Against Liquid Damage - 5-23, Emergency and Standby Power Systems - 7-15, Garages
		HC-2	
		HC-3	
Transport & Logistic	- Airport Terminal - Bus Stations - Train Stations - Ferry Port - Cruise Terminal - Bicycle Parks	HC-1	Data sheets to consider: - 7-11, Conveyors - 7-15, Garages - 7-29, Ignitable Liquid Storage in Portable Containers - 7-32, Ignitable Liquid Operations
	- Parking Garage - Car Parks	HC-3	- 7-93, Aircraft Hangars, Aircraft Manufacturing and Assembly Facilities, and Protection of Aircraft Interiors During Assembly
	- Car-Sized Vehicle Repair Garages and Assembly Operations Where Unfueled Vehicles are Repaired, Tested or Assembled	HC-3	- 8-3, Rubber Tire Storage - 8-9, Storage of Class 1, 2, 3, 4 and Plastic Commodities
	- Truck Loading Docks - loading and unloading canopies - Package Delivery/Distribution Hubs - Cross docking areas - Aircraft Hangar, - Zeppelin Hangar		
Energy Service Providers	- Gas and Oil Stations/Service Provider - Battery Stations - Solar Plant - Wind Turbines - Photo Voltaic Farms	HC-3	Data sheets to consider: - 3-10, Wind Turbines



1.2.3.15 Protection of Non-Storage Occupancies, Hazard Category 2 (HC-2) and Hazard Category 3 (HC-3), Appendix P. Protection of Non-Storage Occupancies, Hazard Category 1 (HC-1) are covered under Section 1.2.3.7. The occupancies are defined as Hazard Category 2 (HC-2) and Hazard Category 3 (HC-3). The water supply shall be capable of supplying 60 minutes of water to the hydraulically most remote **nine automatic nozzles**, or 1.5 times the number of operated nozzles during fire performance testing, whichever is greater. Water mist systems with certification for HC-3 are suitable for HC-3, HC-2, and HC-1. Water mist systems with certification for HC-2 are suitable for HC-2 and HC-1. Water mist systems with certification for HC-1 are only suitable for HC-1 (see Section 1.2.3.7).

OH-PX2



Desing area: 9 Nozzle design for HC-3;

Min pressure: 8 bar;

K-factor: 19.0 metric;

Minimum flow: 53.75;

Max height: 7,6 m – FM; 12 m – IBS;

Max spacing: 3,6 m x 3,6 m;

Total flow: 484 l/min



Automatic nozzles

ID	OH-DR1	OH-VSO	OH-DC1	OH-DC2	OH-PX2	OH-PX2
Hazard type	Residential	OH1/OH4	Data Centre		HC2 HC3	OH3
Type	Pendent	Pendent	Pendent	Upright	Pendent	Pendent
Notified body	BS/DnVGL	FM/ DnVGL/IBS	FM	FM	FM	DnVGL IBS
Spacing	5,00 m	4,50 m	3,60 m	3,60 m	3,60 m	3,50 m
Mex height	5,00 m	5,00 et 12 m	5,00 m	1,00 m	7,6 m	4.00 m
K-factor	19	16.7	13.4	13.85	19	19
Min. pressure	5 bar	8 bar	8 bar	8 bar	8 bar	7 bar

FM Approvals



Automatic nozzles

ID	OH- SW2	OH-SW4	OH-AC100	OH-UPR	OH-OE137	OH-DC1
Hazard type	OH1	OH1 /wood building	OH1	Parking OH2	OH1	Cable tunnel
Type	Sidewall	Sidewall	Pendent	Upright	Pendent	Pendent
Notified body	DnVGL	Efectis		VdS/IBS		VdS/IBS
Spacing	6 m	5.4m	3,50 m	4,00 m	3.5 m	3,00 m
Mex height	2-5 m	3.10m	4,00 m	3,00 m	4.00 m	3,75 m
K-factor	25.5	31.5	10	19.4	13.7	13.4
Min. pressure	8 bar	8 bar	8 bar	6 bar	8 bar	8 bar

FM Approvals



Open nozzles

ID	LA-K7	K6	BM1	APS	KIP	Facade	CT-ODC1
Hazard type	Local application	Total flooding	Total flooding	Atriums/OH4	Comble	rideau	Cable tunnel
Type	Pendent	Pendent	Pendent	Sidewall	Sidewall	Sidewall	Pendent
Notified body	FM	FM	FM	DFL/IBS	DFL	DFL	VDS/IBS
Spacing	2,00 m	4m à 3m	3.65 m	26 m / 1m	6.5 m	0.5 m	3.00 m
Mex height	2.50m above hazard	12,00 m	5,00 m	No limitation	xx m	7.00 m	3.75 m
K-factor	7	5.6	2.8	37 - 62 /6m	51.6 /6m	25.6 /6 m	13.4
Min. pressure	8 - 9 bar	10.5 - 7.7 bar	12.5 bar	5 - 10 bar	7 bar	5 bar	8 bar

FM Approvals



Introduction to the Johnnie Walker Experience

Introduction

This case study follows a commercial LPWM project that consists of challenges with design, installation and approvals.

The property is a landmark building in the heart of Edinburgh which was a former department store dating back to the 1800s.

Diageo's Johnnie Walker Experience is a £185 million financial investment, and a high profile visitor attraction, that provides a journey through the story of the brand's 200-year old history of the Scotch whisky, and includes food and drink experience areas, across eight floors.



Introduction

1890s



Current day



Applications

The project had a full range of applications for water mist, including some that required additional design adjustments and insurer / project consultants and fire engineering input.

- A flexible events space for staging music, theatre, arts and community events.
- A bar academy.
- Maturation and tasting areas.
- Roof-top bars.
- Retail space.
- Plant room areas



Negotiations

This project is a great example of co-operation between the interested parties, that all have different agendas but a common aim.

It is also a good example of a design and installation company standing firm and arguing the position for water mist.

A great example of knowing **“what is in the standard”** and very importantly **“what is not in the standard”** and how to apply that knowledge when negotiating.



Design challenge maturation and tasting area

The main area of concern for the acceptance of the water mist system was the maturation area.

A banded area for storing whisky barrels.

Alternative considerations:

- Sprinkler system, stand alone or using a hybrid zone from the LPWM system.
- Foam enhancement.
- Specific full-scale application test.
- Other Technologies.

Water-based application aim:

Suppression and dilution of Whisky to where it becomes unable to continue the combustion process.



Maturation Area

All options were considered by the fire engineers, and a pure water mist solution was accepted by the decision makers, based on fast detection activating a deluge system, with the capability of high cooling, extinguishing flammable liquids and diluting the polar solvent.



System general specification

- **Pipe System** – Stainless steel press-fit.
- **Nozzles** – OH VSO, OH PX1, OH-SWC, K6. Model APS atrium system.
- **Water Supply** – 60 minutes. 23m³ sectional tank with infill.
- **Pump Set** - Full redundancy pump set. 3 x 600 lpm pumps.
- **Control valves** – WAC, C-EL, C-EL- PA, Sufa.
- **Detection** – Intrinsically safe triple IR flame. (“single knock”)
- **Air Compressor** – Single compressor with 25 liter receiver.



Products	Number
K6	117
OH-VSO	550
OH-PX1	172
OH-SWC	14
OH-RT Rosettes	70
OH R2 T Rosettes	732
OH RNG Nozzle Guard	26
C-EL Deluge valve	6
C-EL-PA Pre-Action valve	8
WAC Valves	9
SUFA valves	2
APS Atrium System	13 x 6m Type B

The width of products and unique specialist systems within the VID FIREKILL range allowed the project to overcome the design challenges, and to go forward as a water mist installation.

- **Wet systems.** Controlled by WAC valves.



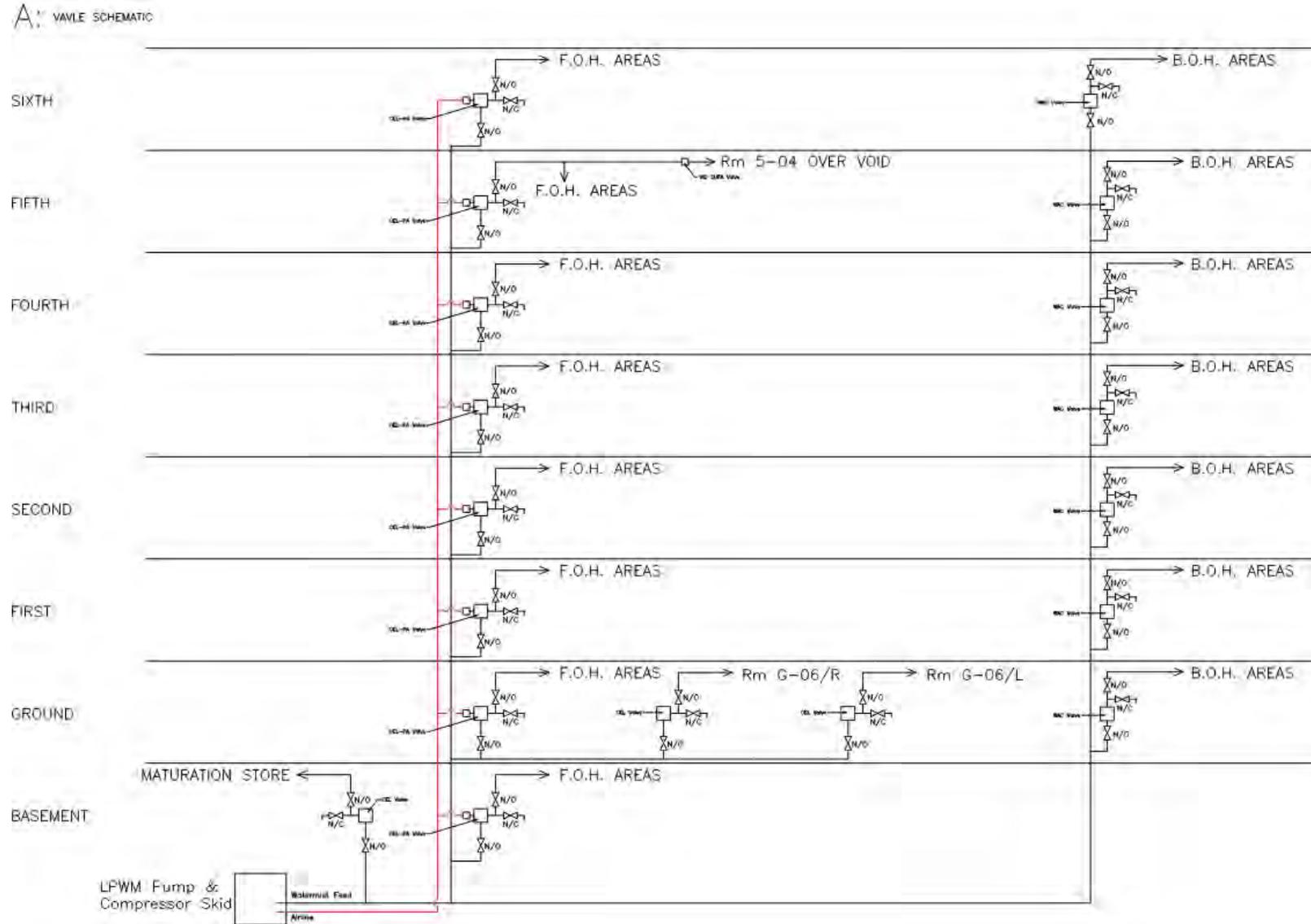
- **Deluge systems.** Controlled by C-EL valves.



- **Pre-action systems.** Controlled by C-EL-PA valves.



Schematic



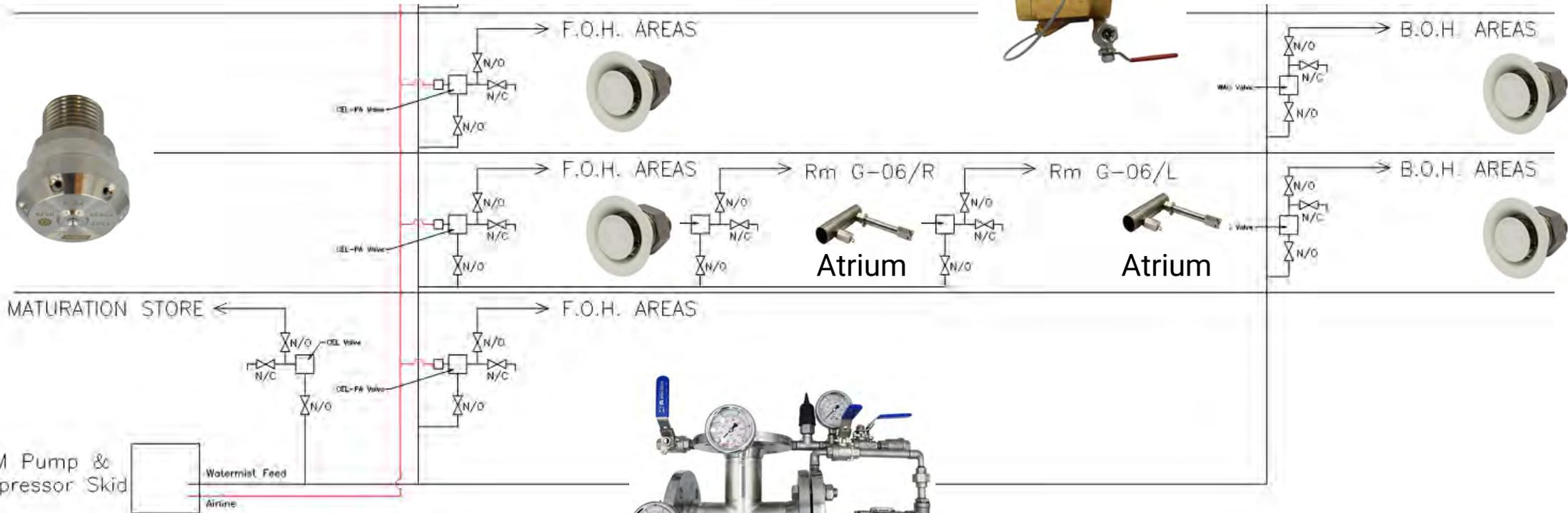
Schematic



C-EL Deluge – Maturation K6 System and Atrium Systems.

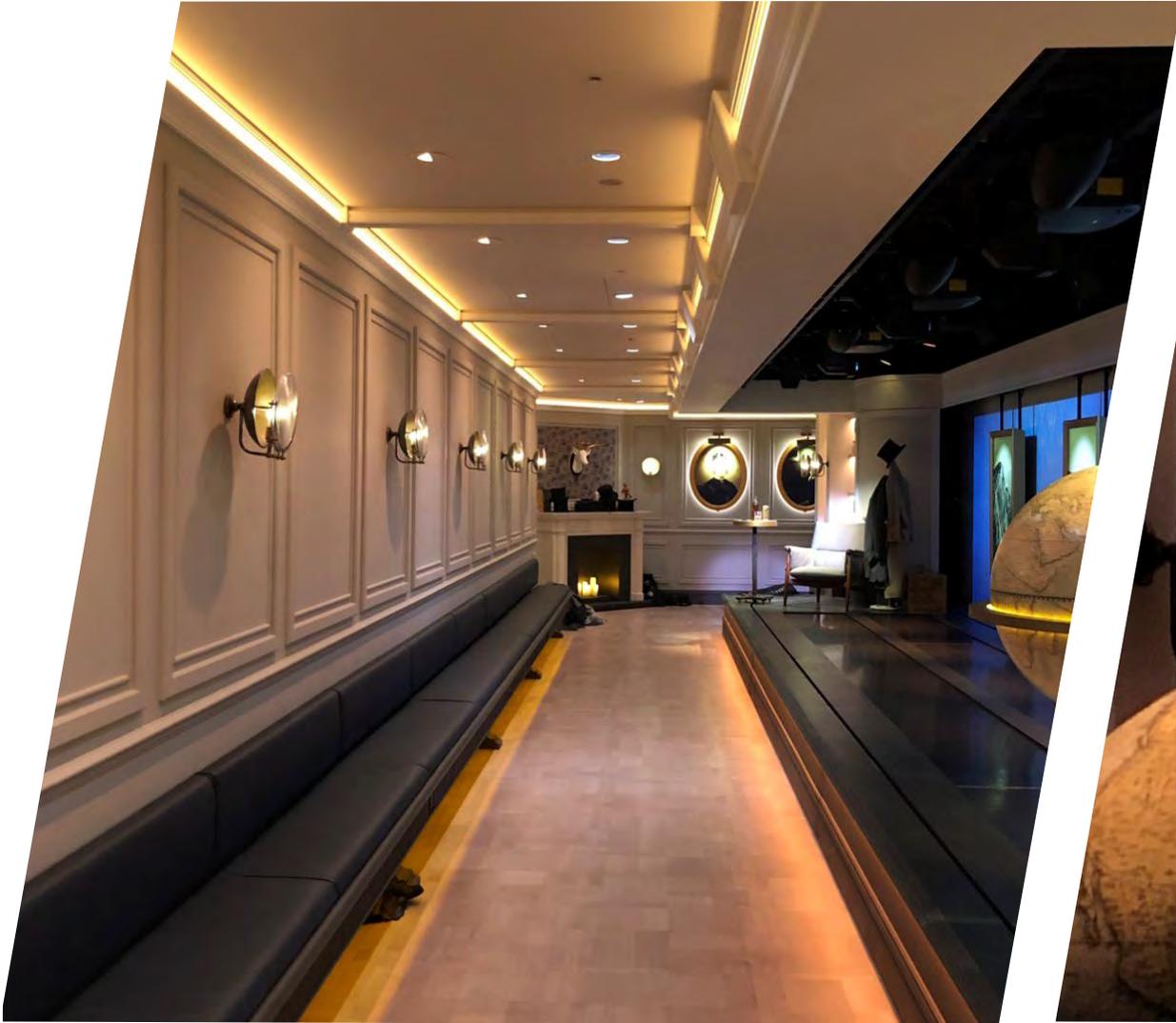


WAC– Wet OH automatic back of house zones.



C-EL-PA – Pre-action front of house zones.

Johnnie Walker Experience



Johnnie Walker Experience



Johnnie Walker Experience



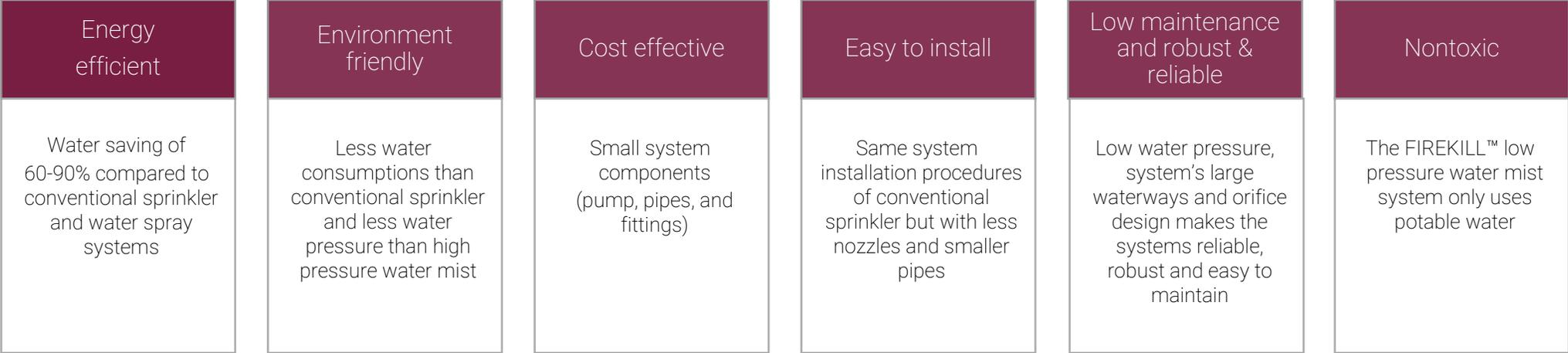
Johnnie Walker Experience



Johnnie Walker Experience



Summary



Thank you

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