



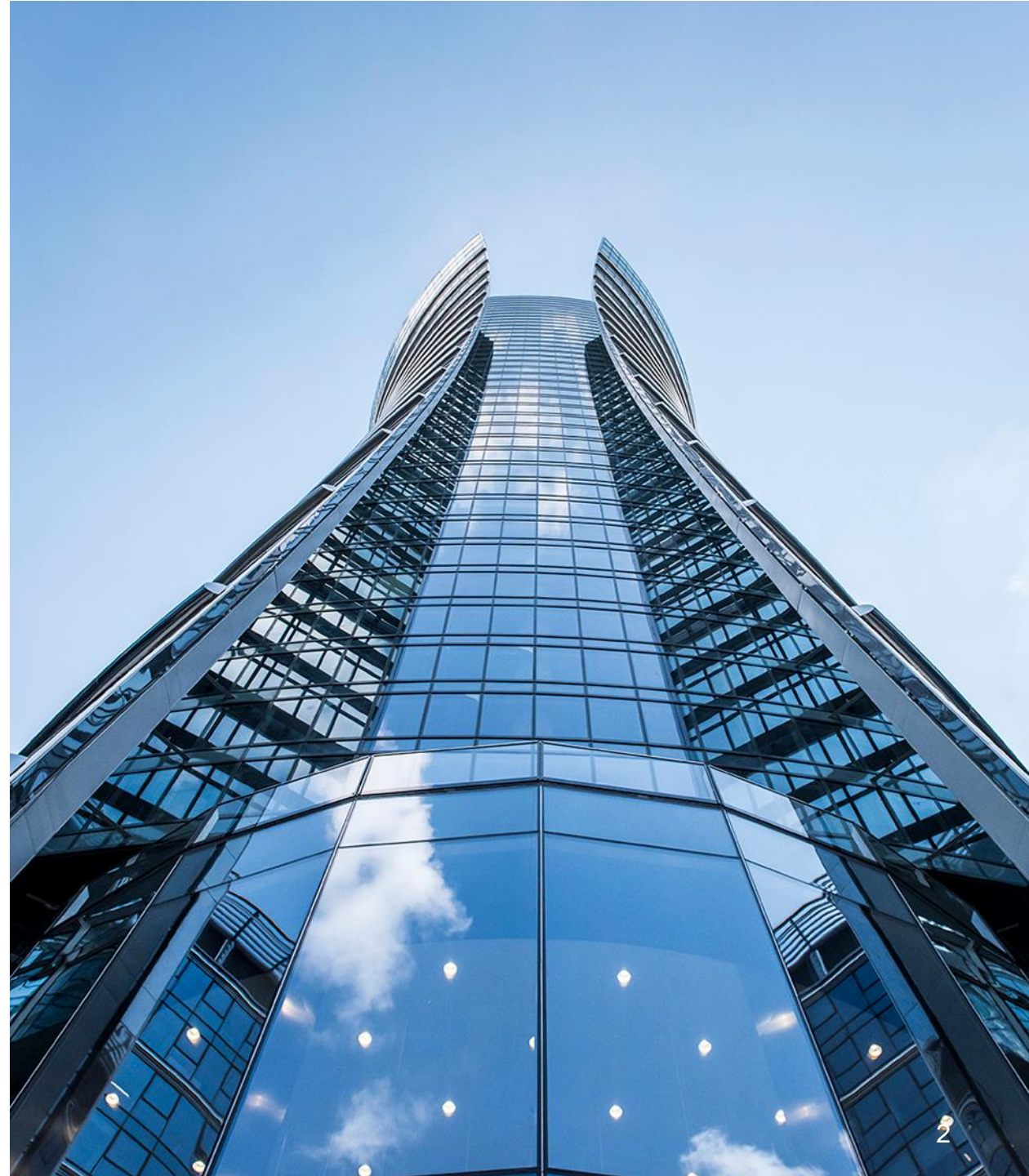
Water mist in high-rise buildings

HOW TO MEET THE INTERNATIONAL CODES AND STANDARDS REQUIREMENTS

Francisco Garcia, Global Market Manager, Marioff Corporation Oy
IWMC 2022, Madrid

Agenda

- Why water mist for high-rise buildings?
 - Definition & Fire risks
 - How water mist fights fire
 - Main benefits
- How to ensure that the water mist system fits for purpose throughout the building lifecycle?
 - International codes and standards
 - Lifetime service



High-rise building definition

Continuously habitable

Mostly designed for office, commercial and/or residential use

High-rise building

45 m - 150 m (164 ft – 492 ft)

Tall building

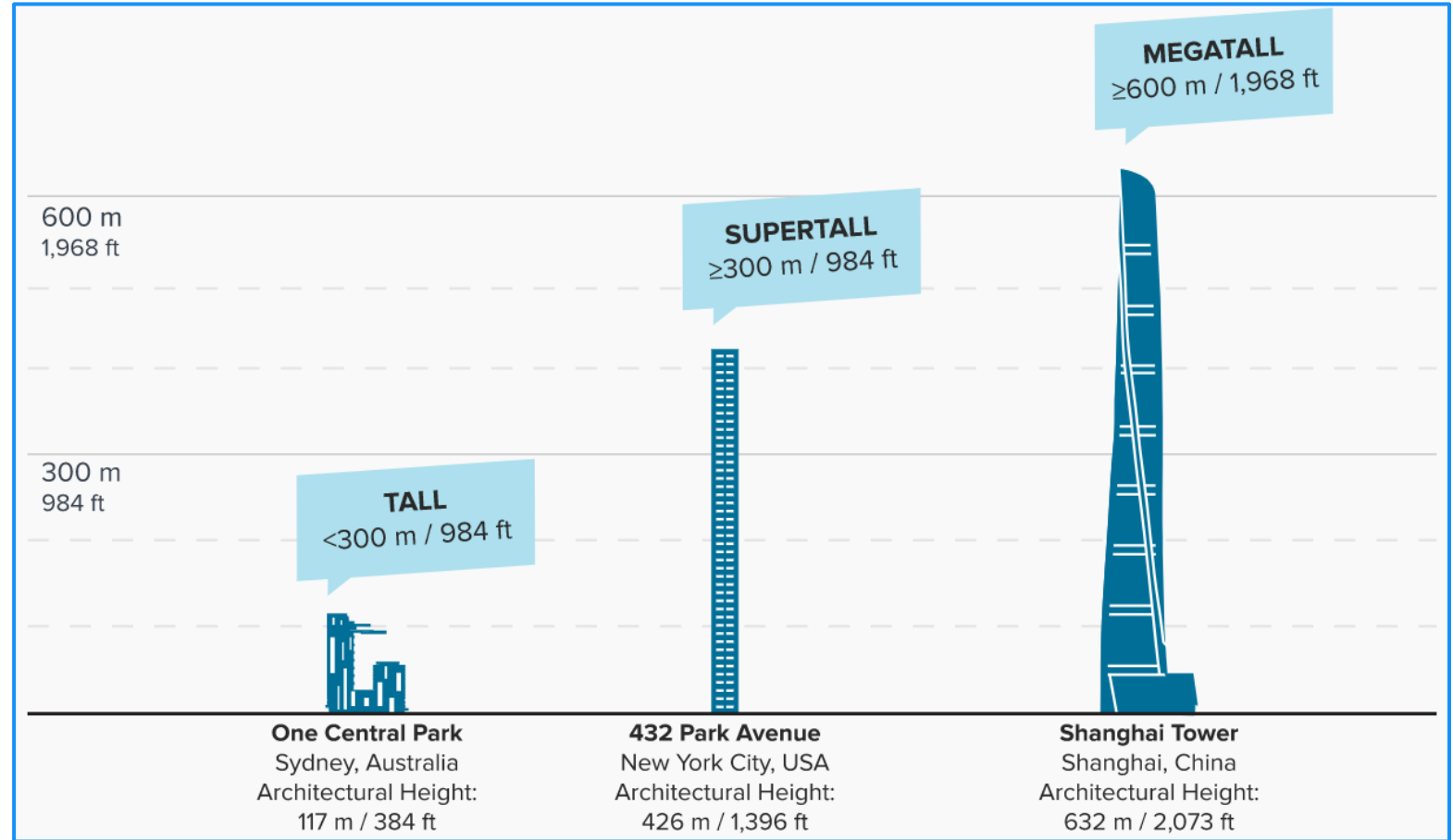
150 m – 300 m (492 ft – 984 ft)

Super tall building

300 m - 600 m (984 ft – 1.969ft)

Mega tall building

> 600 m (> 1.969 ft)



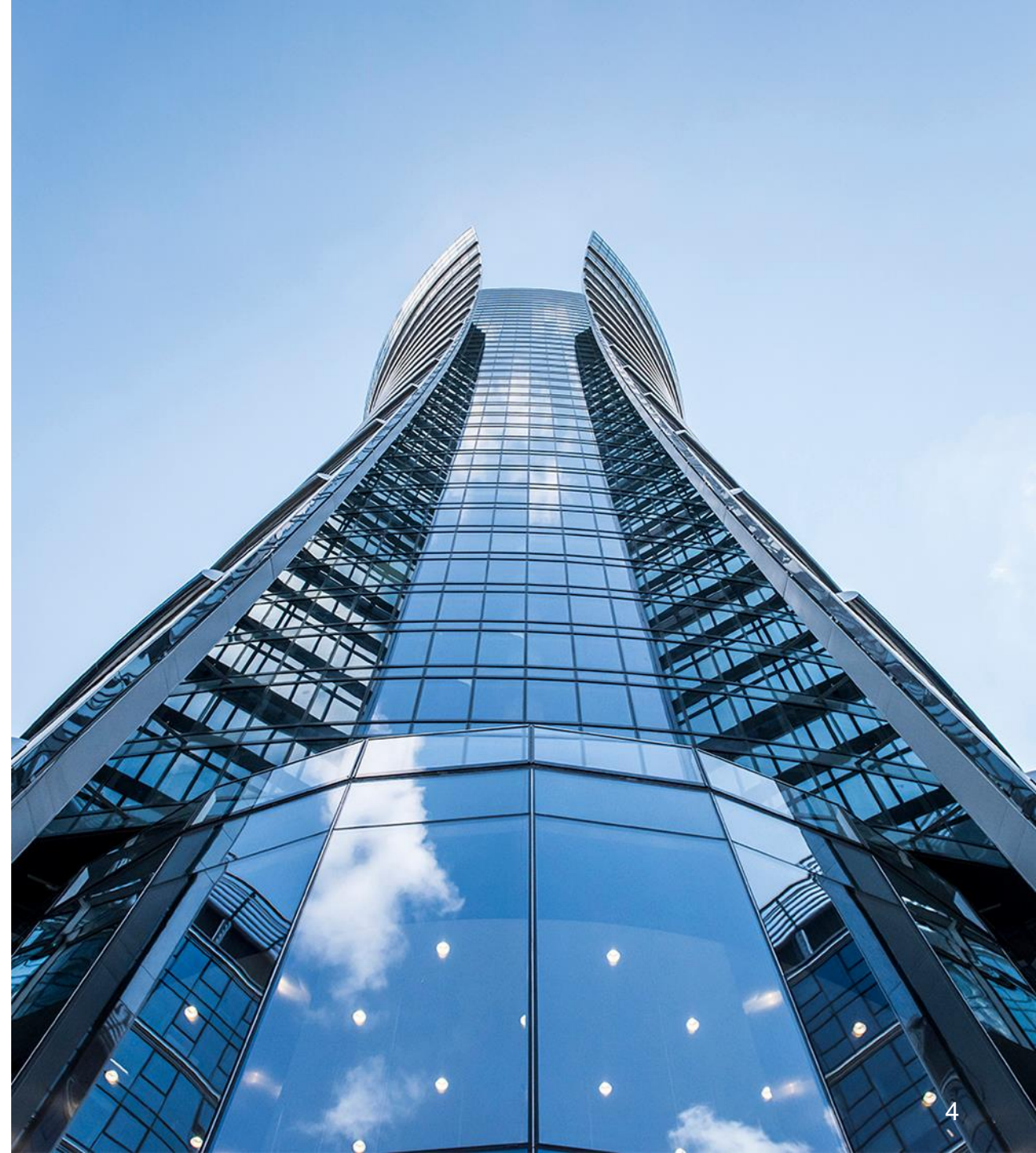
Source: Council on Tall Buildings and Urban Habitat (CTBUH)

Main fire risks

High-rise building is typically a multipurpose building with several fire hazard categories involved

Factors impacting the fire challenge:

- Higher occupancy loads
- Limited means of escape
- Vertical shafts
- Smoke spreading inside
- Greater potential for external fire spread
- Limitations to firefighting/brigade operations



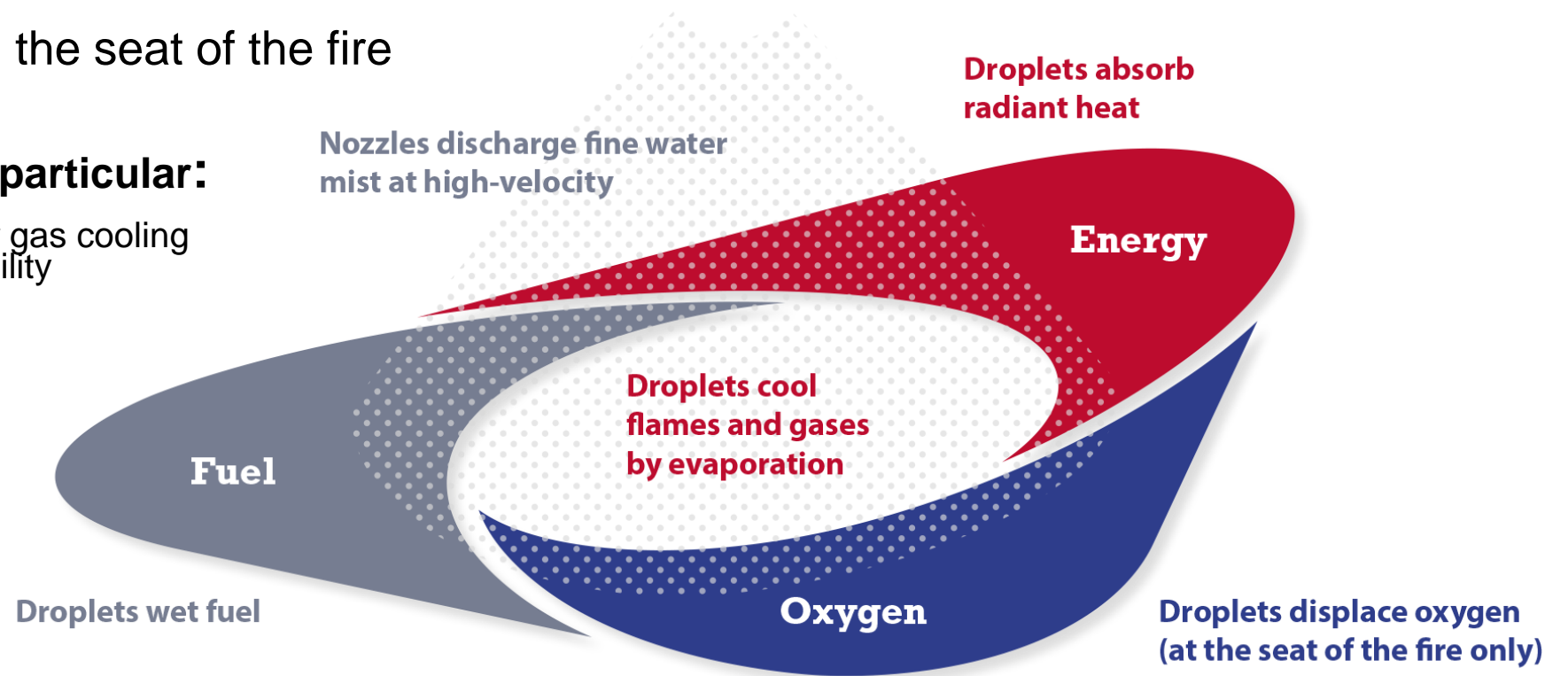
How water mist fights fire?

Water mist in general:

- **cools** the fire flame and the surroundings
- blocks **radiant heat**
- displaces **oxygen** from the seat of the fire

Marioff HI-FOG® system in particular:

- Structural protection by superior gas cooling and radiant heat blocking capability



Main benefits of water mist for HRBs



Multi-hazard protection

Most of the spaces can be protected by a single technology
Streamlined maintenance
OpEx savings

Savings on space, structural loads and passive fire protection

Water tank, risers and compact pump room
Fire rating on construction materials and glass façade

High-pressure outlet

One single pump room
No need for intermediate / booster pump units + water tanks
Extension to adjacent buildings / risks

Scalability

Centralized pump room
Modular pump unit concept
Only tubing, sprinklers and section valves are required for future extension

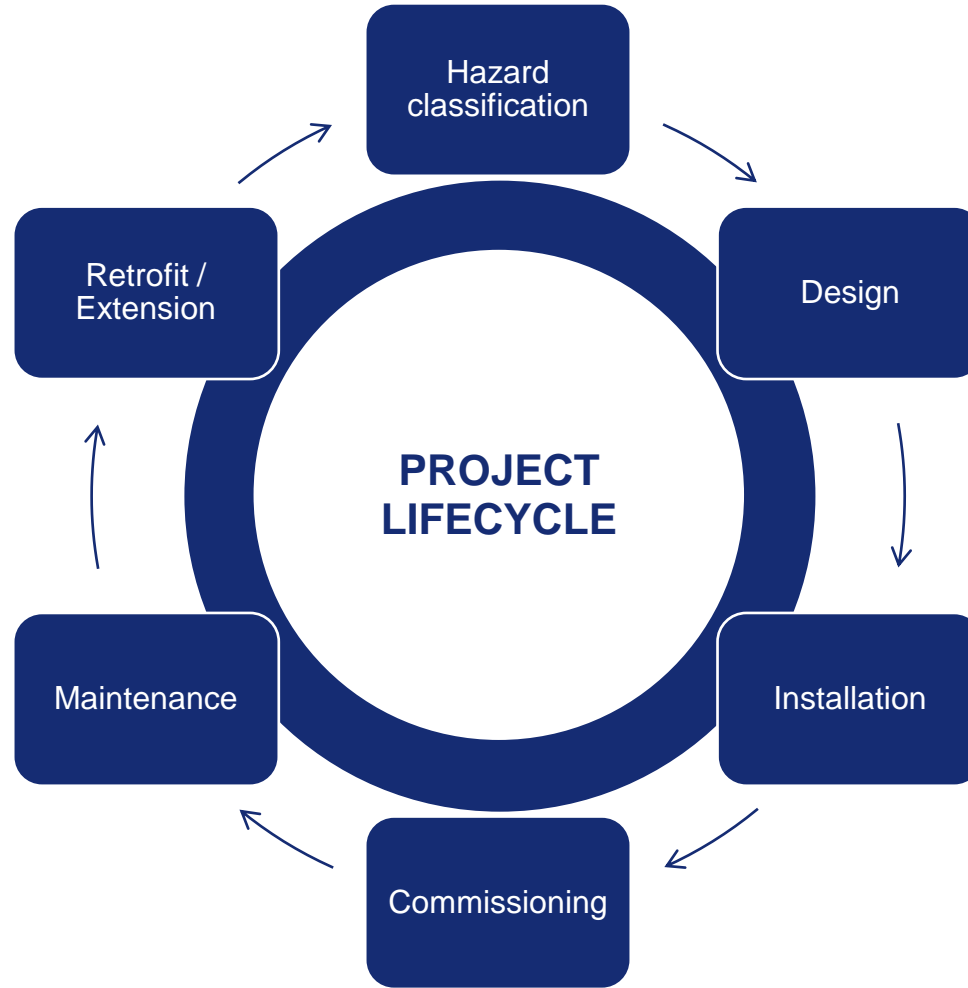
Minimized business disruption

Small water amount used
Localized discharge
Minimum water damaged
Clean water discharged

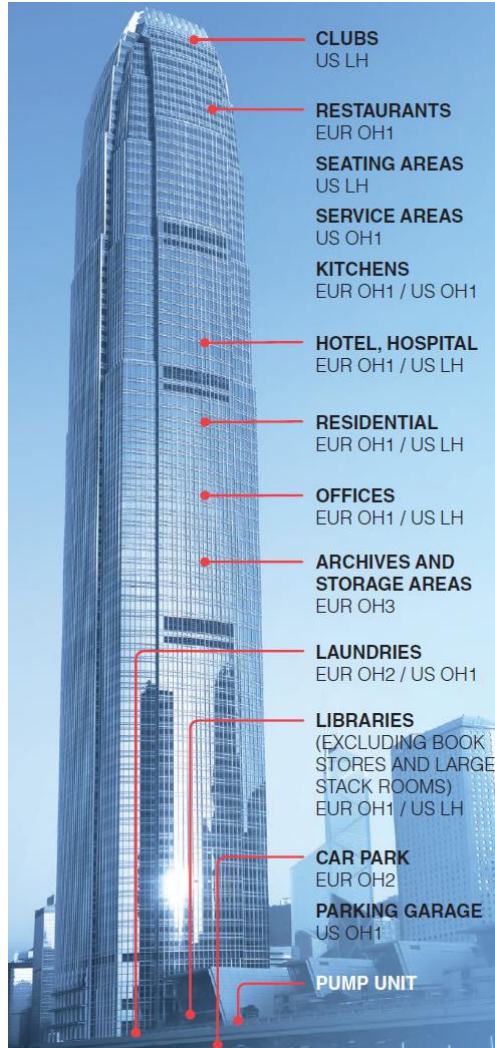
Durable and flexible installation

Small tubing branches
No need for welding, only mechanical/threaded joints
Easy to adapt to complex layouts, benefit for tenants
Pipework longevity

Does the water mist system fit for purpose throughout the lifecycle? **MARIGFF**



Hazard classification



- Typically, a multipurpose building with several fire hazard categories
- Water mist system design based on **actual occupancies** rather than hazard categories, that define the dimensioning
- A water mist system must be **type approved for the occupancies** (when possible) or evaluated in representative **full-scale fire and component tests** by competent third-party organizations
- The design basis is different than with traditional sprinklers, other key elements remaining the same e.g. dimensioning areas, discharge duration and redundancy criteria

International codes and standards*



International standards act as a legal frame for the system design

	Design and Installation Guidelines	Fire Test Protocols	Component Test Protocols	Type Approvals
NFPA	NFPA 750	(Refers to FM, UL)	(Refers to FM, UL)	(Refers to FM, UL)
CEN	EN 14972:1	EN 14972-2...17 In process	EN 17450-1 (filters and strainers) In process	✗
BS	BS 8489-1 BS 8458	BS8489-2...7 BS 8458 In process	BS 8663-1 (nozzles) In process	LPCB (BRE Group)
FM	FMDS 4-2	FM 5560 Appendix A...P	FM5560	✓
UL	(NFPA 750)	UL 2167	UL 2167 (nozzles)	Design & nozzles
VdS	VdS 3188	VdS 3883-1...8	VdS 3100 In process	✓

System design: Type approvals

Type approvals issued by the approval bodies, such as FM Approvals or VdS

A type approval consists of:

1. **Evaluating the system performance in representative full-scale fire tests** by a qualified third-party fire test laboratory

Fire tests have been standardized already for many different **applications**, for example

- hotels
- offices
- data centers
- turbine enclosures

		Fire Test Summary #061/RES/AUG11 Page 1 of 4 HI-FOG systems for protection of residential occupancies Product EPU, MSPU & SPU 21 November 2017													
Test standard	UL 2167 Standard for Safety, Water Mist Nozzles for Fire Protection Service, Chapter 44 Residential Area Fire Tests, November 30, 2011														
Summary	Close to ninety full scale fire tests in two different residential area fire scenarios were conducted during 2010 – 2011 at SP, Technical Research Institute of Sweden, and at UL, Underwriters Laboratories in the US. The extensive test series was run to get the HI-FOG system UL Listed for residential applications, but it served also as the basis for modifications to the 2002 edition of UL 2167, Chapter 44 to better reflect the performance based design and installation parameters of water mist systems. The two scenarios were <ol style="list-style-type: none"> a realistic kitchen scenario and the simulated furniture scenario of UL 1626 Standard for Safety, Residential Sprinklers for Fire Protection Service. The standard simulated furniture scenario was concluded to be the more challenging one and was adopted also to the revised UL 2167, Chapter 44 as the basis for UL Listing. The final approval test series consisted of eight tests in total, at the ceiling heights of 2.4 m and 6.4 m. The standard simulated furniture scenario was applied in all the tests. The HI-FOG system met all the acceptance criteria: temperatures were limited <i>clearly</i> below the acceptance limits with only one HI-FOG sprinkler activating.														
Conclusions	The HI-FOG fire protection system – powered by an electric pump unit and with the installation criteria given below - was shown to meet the performance requirements of UL 2167, Chapter 44, for the protection of residential areas.														
	<table border="1"> <tr> <td>Type</td> <td colspan="2">C40 - 68C /3</td> </tr> <tr> <td rowspan="2">Sprinkler</td> <td>K-factor</td> <td>2.4 lpm/bar^{1/2} [0.17 gpm/psi^{1/2}]</td> </tr> <tr> <td>Operating pressure</td> <td>52 ... 72 bar [755 ... 1045 psi]</td> </tr> <tr> <td rowspan="2">Installation</td> <td>Max ceiling height</td> <td>6.4 m [21 ft]</td> </tr> <tr> <td>Spacing</td> <td>0.61 ... 4.27 m [2 ... 14 ft]</td> </tr> </table>	Type	C40 - 68C /3		Sprinkler	K-factor	2.4 lpm/bar ^{1/2} [0.17 gpm/psi ^{1/2}]	Operating pressure	52 ... 72 bar [755 ... 1045 psi]	Installation	Max ceiling height	6.4 m [21 ft]	Spacing	0.61 ... 4.27 m [2 ... 14 ft]	
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Type approvals issued by the approval bodies, such as FM Approvals or VdS

A type approval consists of:

1. Evaluating the system performance in representative full-scale fire tests by a qualified third-party fire test laboratory
2. Evaluating all the critical components of the system by the approval body

Component tests are used to determine the system's **robustness** and **reliability**



System design: Type approvals

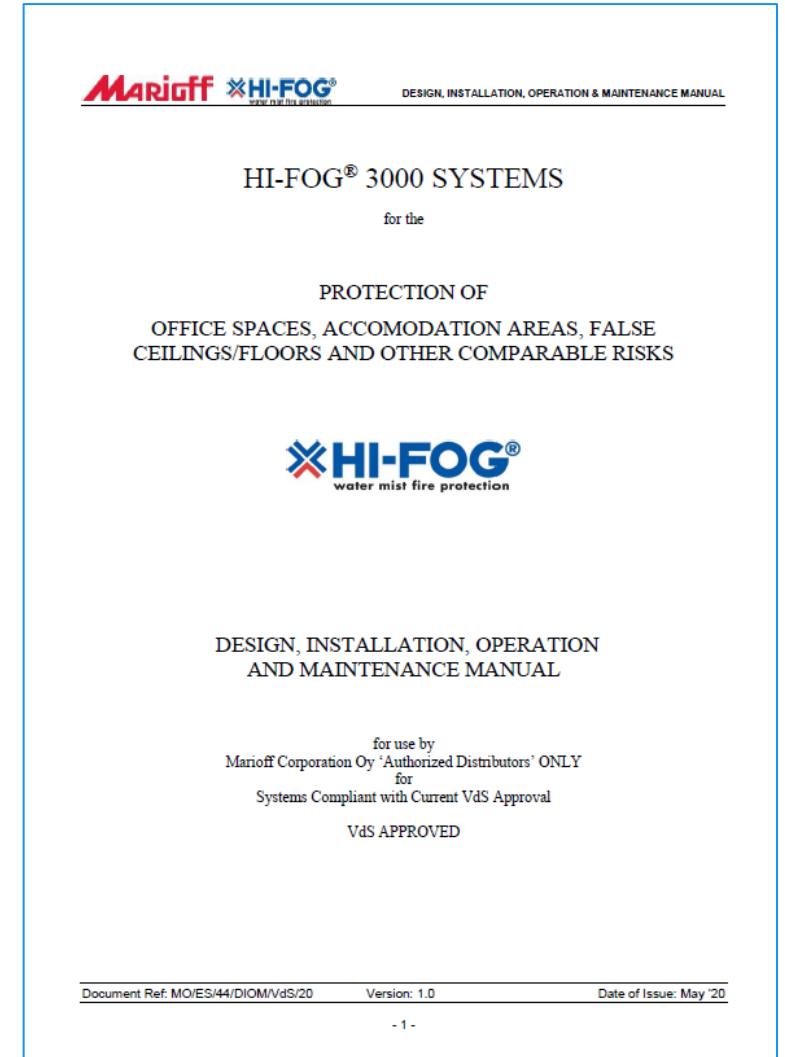


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1. Evaluating the system performance in representative full-scale fire tests by a qualified third-party fire test laboratory
2. Evaluating all the critical components of the system by the approval body
3. A system **DIOM*** manual reviewed and approved by the approval body

*Design, Installation, Operation and Maintenance



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1. Evaluating the system performance in representative full-scale fire tests by a qualified third-party fire test laboratory
2. Evaluating all the critical components of the system by the approval body
3. A system DIOM manual reviewed and approved by the approval body
4. **Continuous and regular follow-up / Audit program** by the approval body

HI-FOG® Sprinkler 3000
Type GASX-nnC

Technical Data Sheet
Document number / Revision
0000078277 / C
4 June 2020

Dimensions in mm

58.4
34.2
Ø19.8

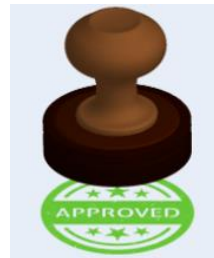
1. Strainer
2. Threads for assembly body connection
3. O-ring seal
4. Area for sprinkler type code and batch number
5. Micro-nozzles
6. Heat-sensitive bulb (super fast response, extra strong)

Products	Product code	Heat-sensitive bulb
	2000502548	57 °C (orange color)
	2000502549	68 °C (red color)
	2000502550	79 °C (yellow color)
	2000502551	93 °C (green color)
2000502552	141 °C (blue color)	
K-factor	1,74	
Body material	Brass	
Finish	Nickel	
Mass	0.056 kg	
Operating pressure	50 bar	
Installation		
Location	Projection	Thread size
Ceiling	Pendent	M18x1.5

Public Contains no Technical Data subject to the EAR or the ITAR

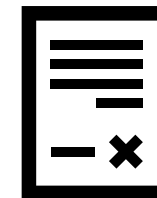
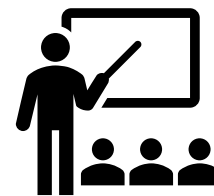
AHJ (required)

- In most of the countries, any generic fire protection company may be certified to install and service a water mist system
- In most of the countries no specific training / experience is required



Manufacturer (additional)

- Specific trainings are available for different system types and pump unit types
- *Proof of Participation* is submitted after the training (name of the attendant and date)



Commissioning and maintenance

It is strongly recommended that the commissioning of a water mist system is made by the manufacturer's trained and qualified field service personnel

As for installation, and according to most of local regulations, a water mist system can be maintained by a generic fire protection company and the local AHJ is the only body that is able to grant a certification.

Trainings on commissioning and maintenance should be available, preferably both F2F and remotely and given by the manufacturer.

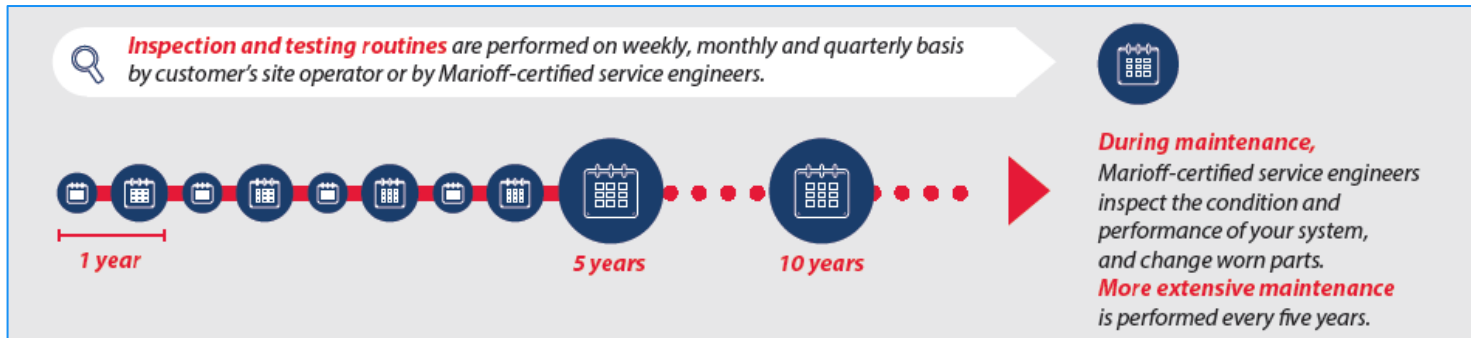
A water mist manufacturer may train employees of a partnering company. After the training attendees can be certified by the manufacturer.



System maintenance



- Manufacturers should develop service manuals for the different water mist systems available
- Manuals define the service tasks required during the lifecycle of a water mist system
- Manuals should include check list with the tasks required



EPU
Operating and Maintenance Manual

Document code / revision: K0008813 / K
Publishing date: 7 October 2021

Preventive maintenance for Land based Marioff HI-FOG Electric Pump Unit (EPU) system

EPU SYSTEM	Semi-annual / Annual	5 year - service	10 year - service
Pump unit			
Stand-by pressure system	Inspection, Test	X	X
High-pressure pumps	Oil change	2 year interval	
Inhalation damper	Inspection and refill	X	X
Pressure relief valve	Test	X	X
	Replacement	X	X
Inhalation valve	Test	X	X
	Overhaul	X	X
Filters	Inspection & cleaning	X	X
	Replacement	X	X
Rubber hoses & flexible connectors	Inspection	X	X
	Replacement	X	X
System operation	Critical operation tests	X	X
Control cabinet	Test	X	X
	Batteries replacement	X	X
System event log	Analysis	X	X
Water supply			
Tank inspection & water supply test	X		
Water quality test	X		
Tank cleaning & water replacement	2 year interval		
Section valves			
Test	X	X	X
Overhaul	X	X	X
Other system components			
Piping	Inspection	X	X
	System flush	X	X
Speakers and spray heads	Inspection	X	X
	Test	X	X
Release/Alarm panel	Test	X	X
	Batteries replacement	X	X

*included in annual maintenance only

1 and 10 year services include all tasks from the annual maintenance. Customer's site operator should inspect the system weekly according to Operation and Maintenance Manual. Preventive maintenance is performed according to manufacturer recommendations, applicable approval and standards. Local authority regulations are taken into account when a customer specific inspection and maintenance program is created.

Read more the right technical support is provided and recommended safety configuration in these manuals without liabilities. The content cannot be used to describe the use of the HI-FOG system without the responsibility of the user. HI-FOG and HI-FOG are registered trademarks of Marioff Corporation by Marioff's parent Carrier. The leading global provider of heating, ventilation and air conditioning solutions.

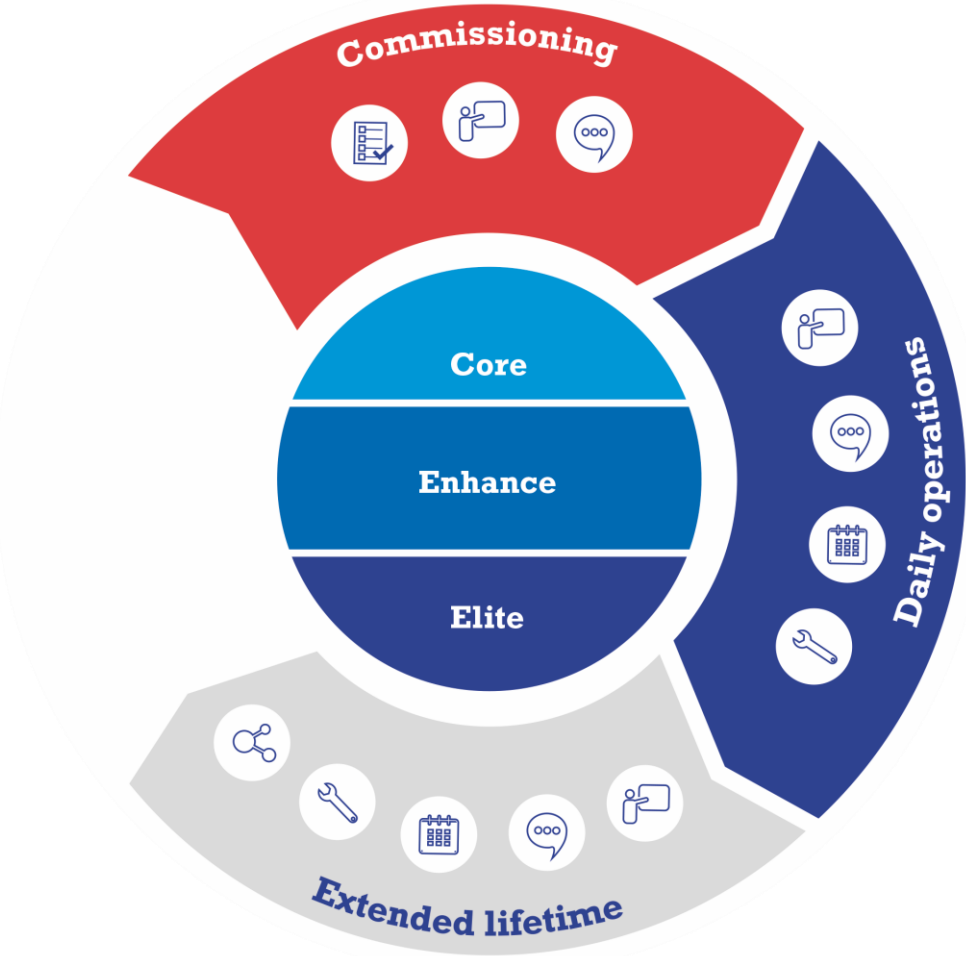
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Your safety is our expertise.

Lifetime service



-  System commissioning
-  Training
-  Technical support
-  Preventive maintenance
-  Repairs and spare parts
-  System upgrades and extensions



Summary

- **Cost-effectiveness and flexibility** are the main benefits of water mist systems compared with traditional sprinkler systems for high-rise buildings
- **Expertise in compliance** with international water mist standards in high-rise building applications is critical
- **A comprehensive training and documentation** for installation and service technicians ensure the quality and reliability of the water mist system
- **A global service network** helps to maintain the water mist system so that it performs as it was designed throughout its lifetime



Marioff



THANK YOU



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