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# Water Mist Protection of High-Rise Buildings

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Ultra Fog Ltd.

Intersec, Dubai - January 2019





# Overview

- Passive and active fire protection in high-rise buildings
- Features and benefits of water mist systems in high-rise buildings
- Enhancing the fire resistance of high-rise buildings



# Tall building construction



London - 510 tall buildings (>20 floors) currently planned or under construction. <sup>1</sup>

Dubai - 55 tall buildings (>200m), and 18 super tall buildings (>300m) completed. <sup>2</sup>

Globally - buildings taller than 200m:

2010 = 614 <sup>3</sup>

2018 = 1,478 <sup>3</sup>

1. NLA London Tall Buildings Survey. Published April 2018.
2. [en.wikipedia.org/wiki/List\\_of\\_tallest\\_buildings\\_in\\_Dubai](https://en.wikipedia.org/wiki/List_of_tallest_buildings_in_Dubai) - 2018
3. Khaleej Times. 16th December 2018.

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# Passive fire protection: Compartmentation

Fire resistant floors, walls, and doors, to prevent the spread of fire to adjacent spaces.

Intended to enable to firefighters suppress a fire without the need to fully evacuate the building.

Reliance upon a system of Building Control during construction, to assure quality and ensure performance.

Risks posed by through-life modifications to the building.



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# Breach of compartmentation: internal fire spread

Lakanal House fire, London. 2009.

*Built: 1959. Height: 42m*





# Outcome of Lakanal House Inquest

1

Failure of compartmentation via inadequate fire stopping, an open window, and cross connection of ventilation ducts.

3

6 fatalities - all advised via phone to stay put to await rescue. Extensive smoke logging of the communal areas prevented rescue.


2

Fire spread rapidly - both vertically and horizontally.

4

Coroner's Section 43 letter issued to the Council.





# Lakanal House

## Section 43 letter

Source: <https://www.lambeth.gov.uk/elections-and-council/lakanal-house-coroner-inquest>

construction of high rise residential buildings and refurbishment work carried out to enable an assessor to consider whether compartmentation is sufficient or might have been breached.

### *Training of staff engaged in maintenance and refurbishment work on existing building*

It is recommended that your authority consider the training needs of personnel who will be involved in procuring or supervising work to existing high rise residential buildings – whether maintenance, refurbishment or rebuilding of parts of buildings - to ensure that materials and products used in such work have appropriate fire protection qualities. Staff should, for example, be trained to understand the significance of the compartmentation principle and to appreciate when Building Control should be notified about work to be undertaken.

### *Access for emergency vehicles*

It is recommended that your authority liaise with emergency services to consider access for emergency vehicles to high rise residential buildings, having particular regard to obstructions such as vehicle parking in locations which emergency services might need to use.

### *Retro fitting of sprinklers*

Evidence adduced at the inquests indicated that retro fitting of sprinkler systems in high rise residential buildings might now be possible at lower cost than had previously been thought to be the case, and with modest disruption to residents.

**It is recommended that your authority consider the question of retro fitting of sprinkler systems in high-rise residential buildings.**

### *Response*

Rule 43A of the Coroners Rules requires that you give a written response within 56 days beginning with the day on which the report is sent. If you are unable to respond within that time, you may apply to me for an extension. The response is to contain details of any action that has been taken or which it is proposed will be taken whether in response to this report or otherwise, or an explanation as to why no action has been taken.

As required by rule 43, I shall send a copy of this report to the Lord Chancellor.

At your request, I am copying this report to Ms Eleanor Kelly, Chief Executive.

Yours sincerely



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# Active protection: Sprinkler systems

- Designed to respond rapidly at the seat of the fire
- Installed according to local requirements / jurisdiction
- Normally limited to the protection of building's interior





# Breach of compartmentation: external fire spread

Marina Torch, Dubai. (2015)

Address Downtown, Dubai. (2015)

Shepherd's Court, London. (2016)

Grenfell Tower, London. (2017) - *Public inquiry ongoing.*

*No fatalities*



# Active protection: Limitations

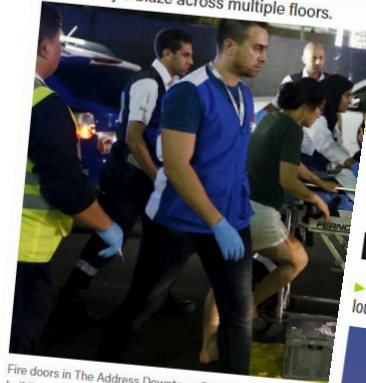
- Active protection is not a panacea - it is not a substitute for the use of materials which prevent the internal and external spread of fire.
- Active protection is designed to mutually support passive protection.

Image source: [www.thenational.ae/international](http://www.thenational.ae/international)



## Dubai hotel's sprinklers ran out of water 15 minutes into fire

► The extent of the fire was beyond the capacity of regular sprinkler systems to cope with a major blaze across multiple floors.



Fire doors in The Address Downtown Dubai Hotel helped to save the building. Ahmed Jadallah / Reuters

## The National LIFESTYLE

Fashion Food Luxury Travel Family Home Wellbeing Motoring Comment

## The Address Downtown hotel reopens two years after fire

► The fire-hit hotel reopens with a fresh interior, a STK steakhouse and a revamped Neo lounge



The Address Hotel Downtown Dubai is now open again for overnight stays. Emaar Hospitality Group

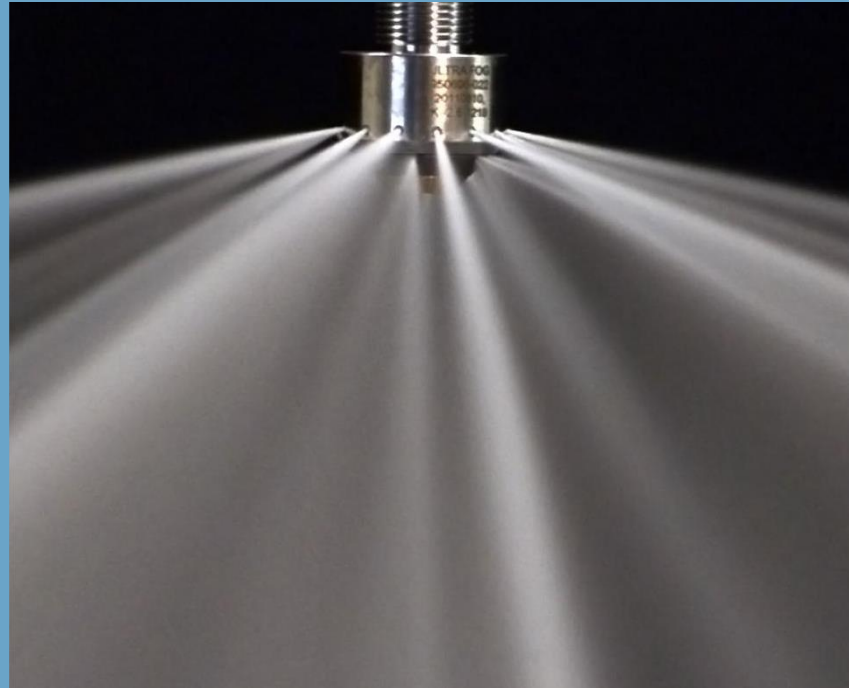
# Water mist as an alternative to sprinklers

Primary feature: water mist uses considerably less water than equivalent sprinkler system.

*How?* By creating a much larger surface area to interact with the heat of the fire.

Fire = fuel • heat • oxygen

The faster the heat is reduced, the faster the fire is suppressed.





## Sprinklers vs Water Mist

|                         | Sprinklers         | Water Mist          | Comparative effect of water mist                             | Benefits of water mist  |
|-------------------------|--------------------|---------------------|--|---|
| Droplet size (diameter) | 1mm                | 0.05mm              | -  | More efficient use of water.<br>Fewer nozzles.<br>Lower water consumption.<br>Smaller diameter pipework, less impact on the building during installation. |
| 1 litre =               | 2 million droplets | 15 million droplets | -  |   |
| Surface area per litre  | 6 m <sup>2</sup>   | 120 m <sup>2</sup>  | Faster heat transfer, faster cooling of the fire.            |   |
| Terminal speed          | 1.4 m/s            | 0.3 m/s             | Increased exposure time within the fire, smoke, and airflow. |   |

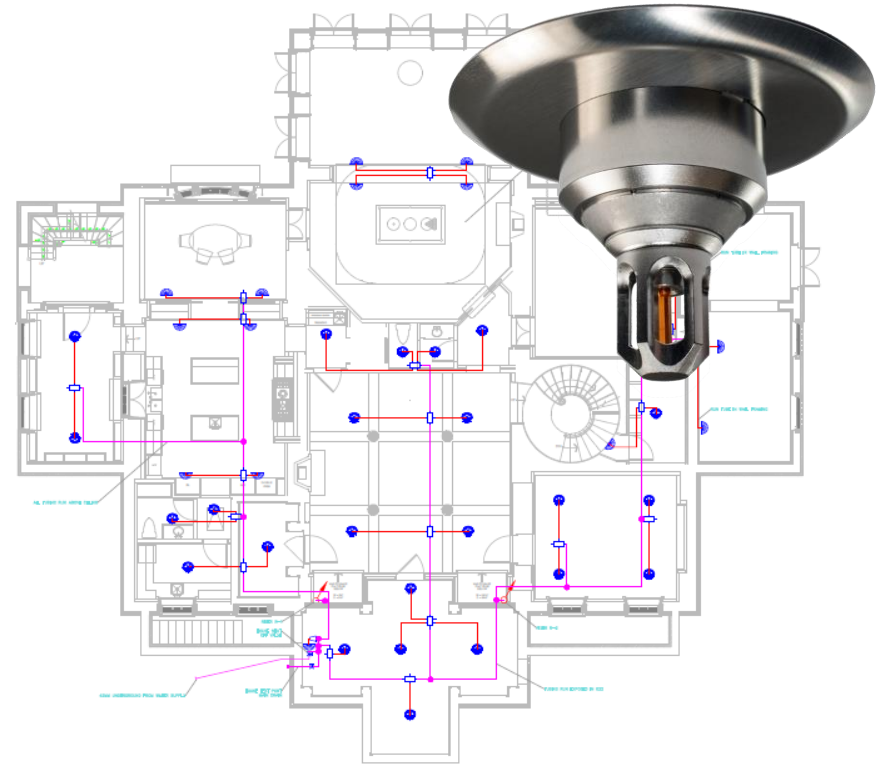
# 5 significant benefits of Water Mist in the context of High Rise Buildings





# Fewer heads

- Less pipework
- Faster installation
- Faster inspection and maintenance

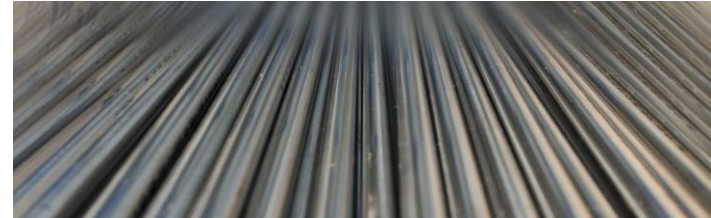




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# Less water. Reduced diameter pipe.

- Compact installation within ceiling voids
- Less mass to support
- Easier to work (cut and bend) onsite, during installation



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# Less water. Smaller water tanks.

- Potential to utilize more space at basement level for other applications - for example: car parking spaces; M&E systems; etc
- Less mass to support
- Less water to “maintain” / treat (e.g., anti-legionella)



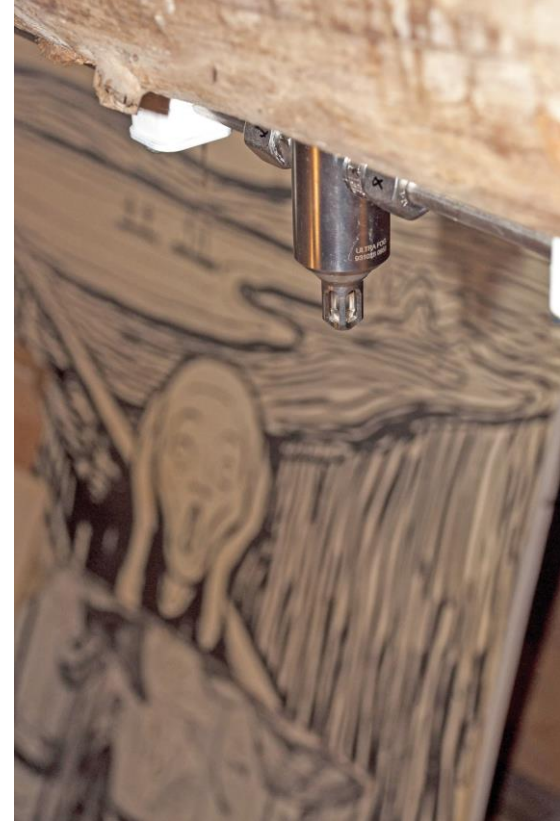
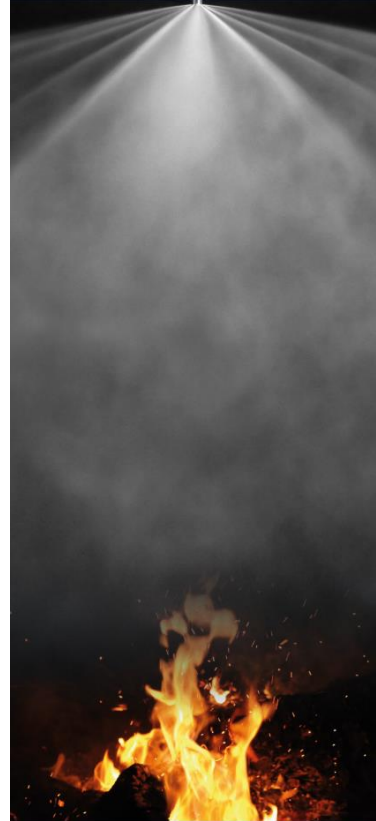
*Sprinkler water tanks*



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# Less water. Less damage.

- Less water damage
- Less smoke damage
- Absorption of radiant heat



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# Higher pressure. Lower pressure losses.

Working pressure at the most remote nozzle to be achieved.

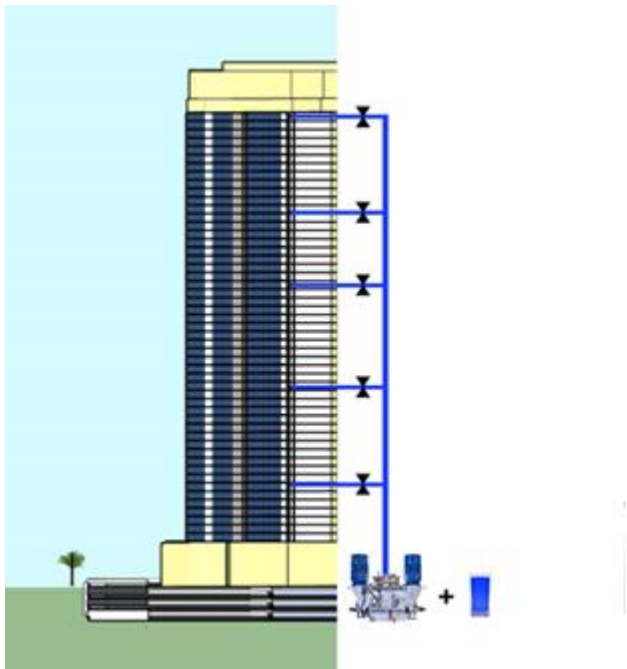
Pump unit compensates for pressure losses between the pump and the furthest nozzles.

Pressure losses due to friction.

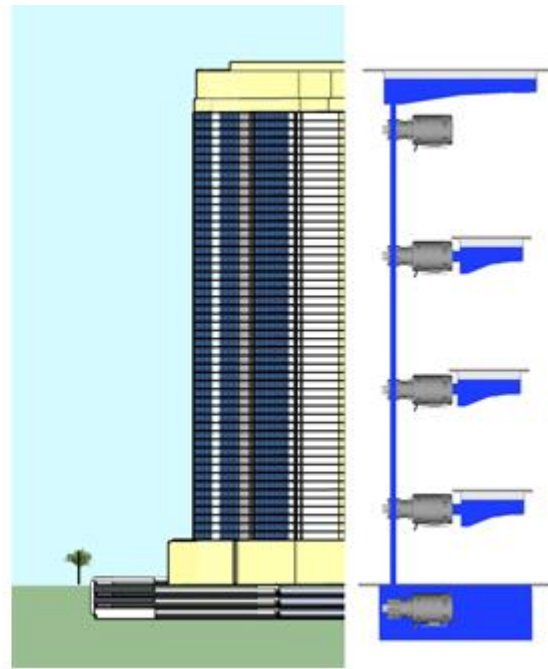
Pressure losses due to static head. 1 bar per 10m.

Advantage of high pressure mist systems: one pump station at ground/basement level. No need for additional pumps and tanks at higher levels throughout the tower. Simplifies the design, installation, and usability of the system.





Water mist system



Traditional sprinkler system

A decorative horizontal line consisting of two segments: a dark blue segment on the left and a lighter blue segment on the right.

# Active suppression of High Rise exterior fires?



# Challenges:

- Prevention of fire spread from interior to exterior
- Fires which originate on the exterior
- Cladding systems - construction and materials
- Variability of balcony fire loads
- Wind loading
- Coanda effect



# Coanda effect

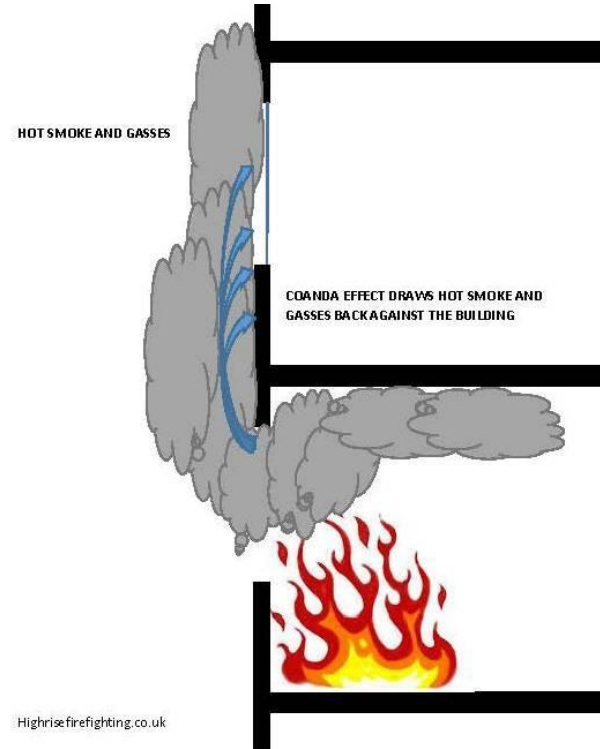


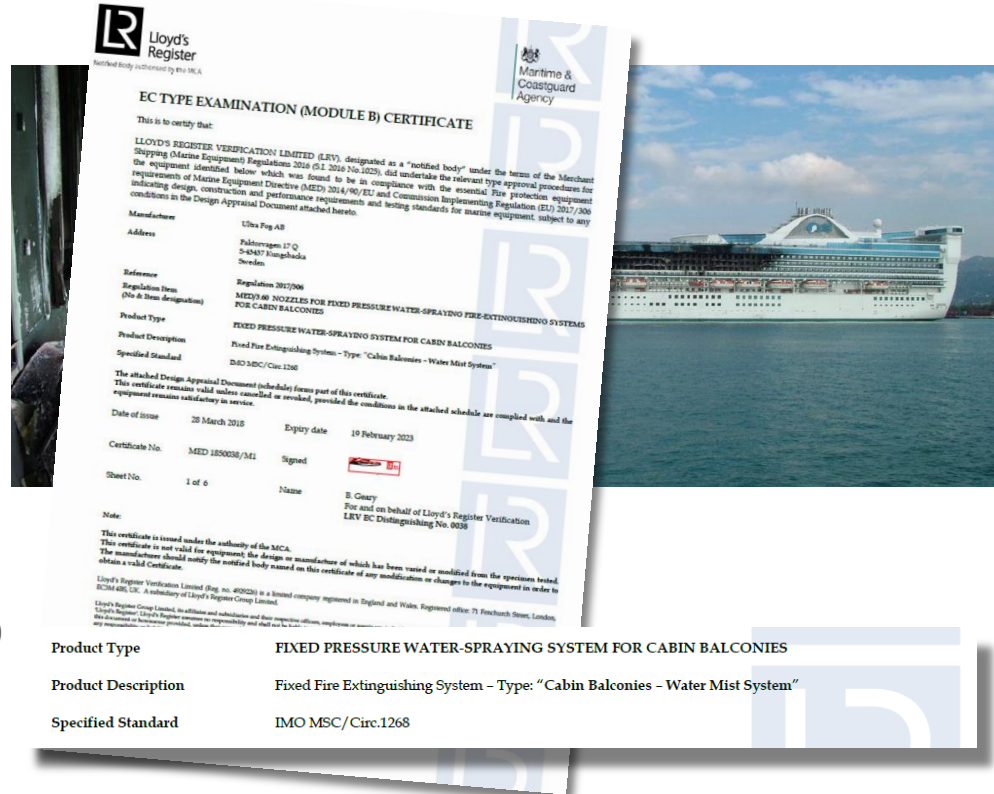
Image source: [www.highrisefirefighting.co.uk](http://www.highrisefirefighting.co.uk)

# Parallels with marine applications

Star Princess cruise ship balcony fire, 2006.

Probable cause: discarded cigarette which ignited combustible material on a balcony. Rapid external spread caused by strong winds, and insufficient passive protection to contain the fire.

- IMO introduced a test standard for water mist protection of cabin balconies. (IMO MSC/Circ.1268)
- Water mist manufacturers develop type-approved balcony protection systems



**Lloyd's Register**  
Technology endorsed by the UKA

**Maritime & Coastguard Agency**


### EC TYPE EXAMINATION (MODULE B) CERTIFICATE

This is to certify that:

LLOYD'S REGISTER VERIFICATION LIMITED (LUV), designated as a "notified body" under the terms of the Merchant Shipping (Marine Equipment) Regulations 2016 (S.I. 2016 No.1022), did undertake the relevant type approval procedures for the equipment identified below which was found to be in compliance with the essential fire protection requirements of the Marine Equipment Directive (MED) 2014/90/EU and Commission Implementing Regulation (EU) 2017/206 indicating design, construction and performance requirements and testing standards for marine equipment subject to any conditions in the Design Appraisal Document attached hereto.

**Manufacturer** Ultra Fog AB  
**Address** Fabrikvägen 17 Q  
S-5447 Singsås  
Sveden.  
**Reference** Regulation 2017/206  
**Regulation Item (No & Description)** MED/40 NOZZLES FOR FIXED PRESSURE WATER-SPRAYING FIRE-EXTINGUISHING SYSTEMS FOR CABIN BALCONIES  
**Product Type** FIXED PRESSURE WATER-SPRAYING SYSTEM FOR CABIN BALCONIES  
**Product Description** Fixed Fire Extinguishing System - Type: "Cabin Balconies - Water Mist System"  
**Specified Standard** MSC/Circ.1268

The attached Design Appraisal Document (schedule) forms part of this certificate.  
This certificate remains valid unless cancelled or revoked, provided the conditions in the attached schedule are complied with and the equipment remains satisfactory in service.

**Date of issue** 28 March 2016      **Expiry date** 19 February 2023  
**Certificate No.** MED 1850036/M1      **Signed**   
**Sheet No.** 1 of 6      **Name** B. Gray  
For and on behalf of Lloyd's Register Verification  
LUV EC Distinguishing No. 0038

**Note:**  
This certificate is issued under the authority of the MCA.  
This certificate is not valid for equipment the design or manufacture of which has been varied or modified from the specimen tested.  
The manufacturer should notify the notified body named on this certificate of any modifications or changes to the equipment in order to obtain a valid Certificate.

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|                            |   |
|----------------------------|---|
| <b>Product Type</b>        | FIXED PRESSURE WATER-SPRAYING SYSTEM FOR CABIN BALCONIES                      |
| <b>Product Description</b> | Fixed Fire Extinguishing System - Type: "Cabin Balconies - Water Mist System" |
| <b>Specified Standard</b>  | IMO MSC/Circ.1268   |

# Exterior protection systems



Edvard Munch's house, Åsgårdstrand, Norway.  
*Wooden heritage building, protected internally and externally with an Ultra Fog water mist system.*

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# Exterior protection systems



Älgårds church, Sweden.  
*A rare, medieval wooden church (C15), protected internally and externally with an Ultra Fog water mist system.*





# Summary

- Active fire suppression is not a substitute for effective passive protection.
- Passive protection can be enhanced with active fire suppression.
- Water mist consumes significantly less water than conventional sprinkler systems, thereby delivering many practical advantages within the context of protection of high rise building.
- Water mist protection is not restricted to the protection of interiors. Exterior protection is also possible.
- Parallels exist between large scale ships and large scale buildings - scope for cross-pollination of ideas and solutions between both sectors.





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# Thank you.

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