Ann Micheli

Managing Director

Ultra Fog

Ann Micheli has been Managing Director at Ultra Fog since 2012. Her background in assisting Small & Medium Sized firms to diversify and to internationalize brought her into the fire suppression industry some 15 years ago, where she has been enjoying the challenge of developing a small, Italian marine fire company into the international group that it is today.

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ULTRA FOG®
FIRE EXTINGUISHING SYSTEM

Watermist Protection for Turbine Enclosures

Ann Micheli

IWMA WEBINAR 29 APRIL 2021

Traditional Solutions for Turbine Enclosures

Facility managers have long toiled over deciding on the safest and most effective way to protect these vital systems. Low-pressure and high-pressure carbon dioxide (CO2) systems are currently the most common systems used, but the industry is now leaning towards a safer solution; water mist suppression.

- Halon Fire Suppression Systems

  For many years, Halon 1301 was the holy grail of fire suppressants for high-value assets that would be damaged by traditional sprinkler systems. But, in 1989, when the Montreal Protocol determined that halon depleted the ozone layer, and the U.S. Environmental Protection Agency subsequently banned its manufacture in 1994, the search was on for halon replacement options.

- Clean Agent Fire Suppression Systems

  Clean Agent (eg FM-200 or NOVEC) has been used as an alternative to the Halon option, but this too is recently subjected to a phase out. Effective in extinguishing fire, Clean Agent Systems can be costly to refill.

- Aerosol

  Aerosol suppression systems have the advantage of being easy to maintain, but can be expensive to clean up after discharge. The NFPA defines aerosols as a finely-divided solid, and they remain in the air for a long time and are total flooding agents. Stat-X Aerosol is currently used for small packaged generator enclosures.

Traditional Solutions for Turbine Enclosures

- CO_2 Fire Suppression Systems
  - Carbon dioxide has many positive attributes as a fire suppressant. Often known as the "original" clean agent, it does not leave behind residue that damages equipment, it is plentiful and non-corrosive, and is highly effective. CO_2 suppresses fires through oxygen dilution, unlike other clean agents (ex: halon).
  - However, the concentration range of CO_2 needed to suppress most fuel fires ranges between 34% and 72% volume/volume percent (v/v). CO_2 levels above 7.5% v/v **are extremely dangerous to humans. Fainting, convulsion, or death can occur within seconds of exposure** (Skaggs 1998).
  - The knowledge of the hazards related to CO_2 systems has been a main factor in the push for more safety guidance and regulation with the systems. NFPA 12 Section 4.3 now requires all CO_2 Systems to have proper safety procedures and life safety equipment in place, e.g.
    - •Consideration of hazards to personnel
    - •Warning signs placed in conspicuous areas
    - •Evacuation procedures in place
    - •Electrical clearances between CO_2 systems and live parts
    - •Lockout valves
    - •Wintergreen odorizer to warn of CO_2 release
    - •Pneumatic time delay (NFPA 2015)

Although CO_2 has many great firefighting attributes, its inherent danger to worker safety has many looking to alternative methods that offer equal suppression and minimal life safety threats.

HIGH-PRESSURE WATER MIST SUPPRESSION IS THE FUTURE

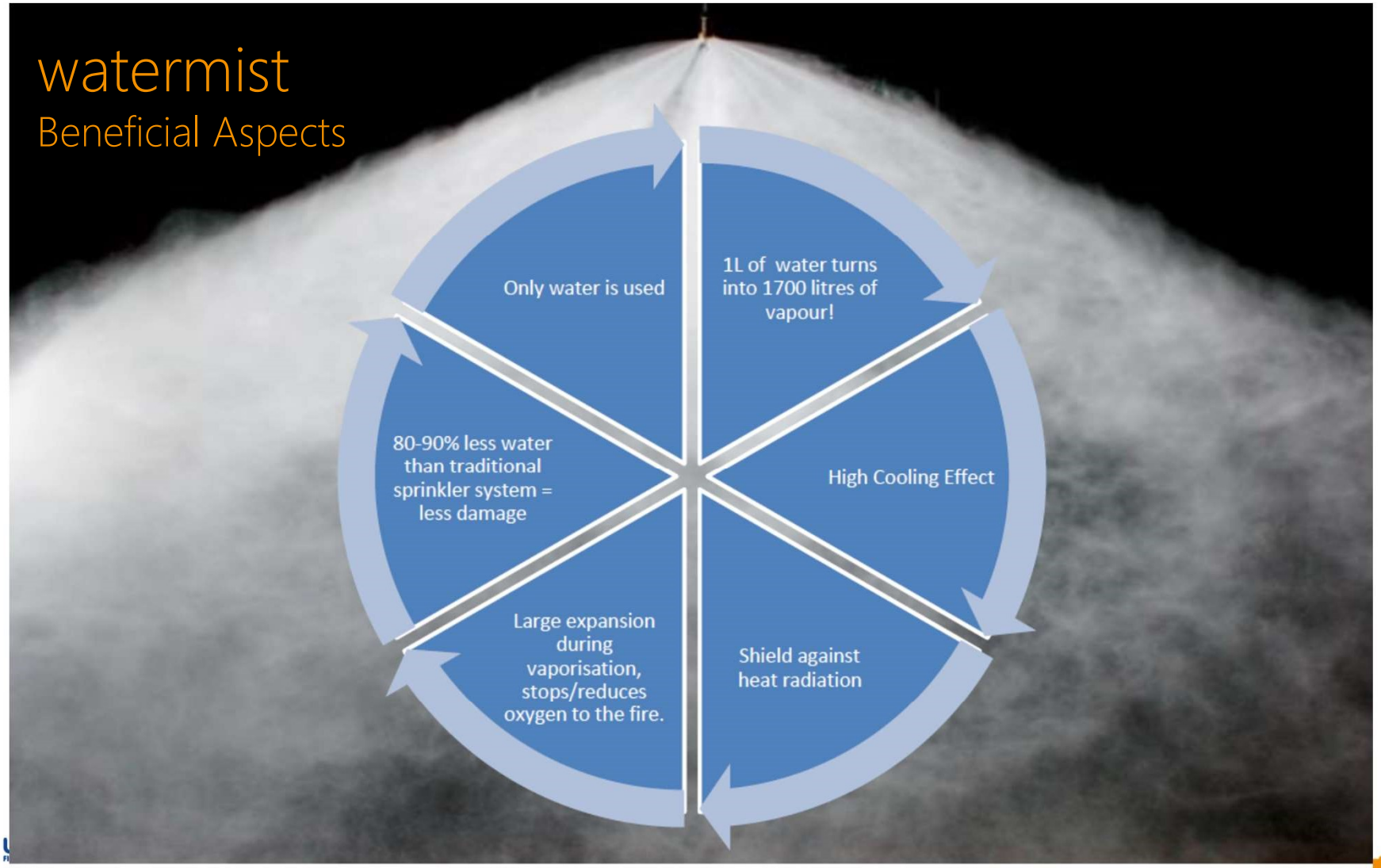
- Contrary to carbon dioxide, high-pressure water mist systems are non-hazardous to personnel. Water mist has many benefits that gaseous agents do not have. These include
  - no toxicity issues,
  - minimal damage and reset times, and
  - no requirement for an "air tight" enclosure

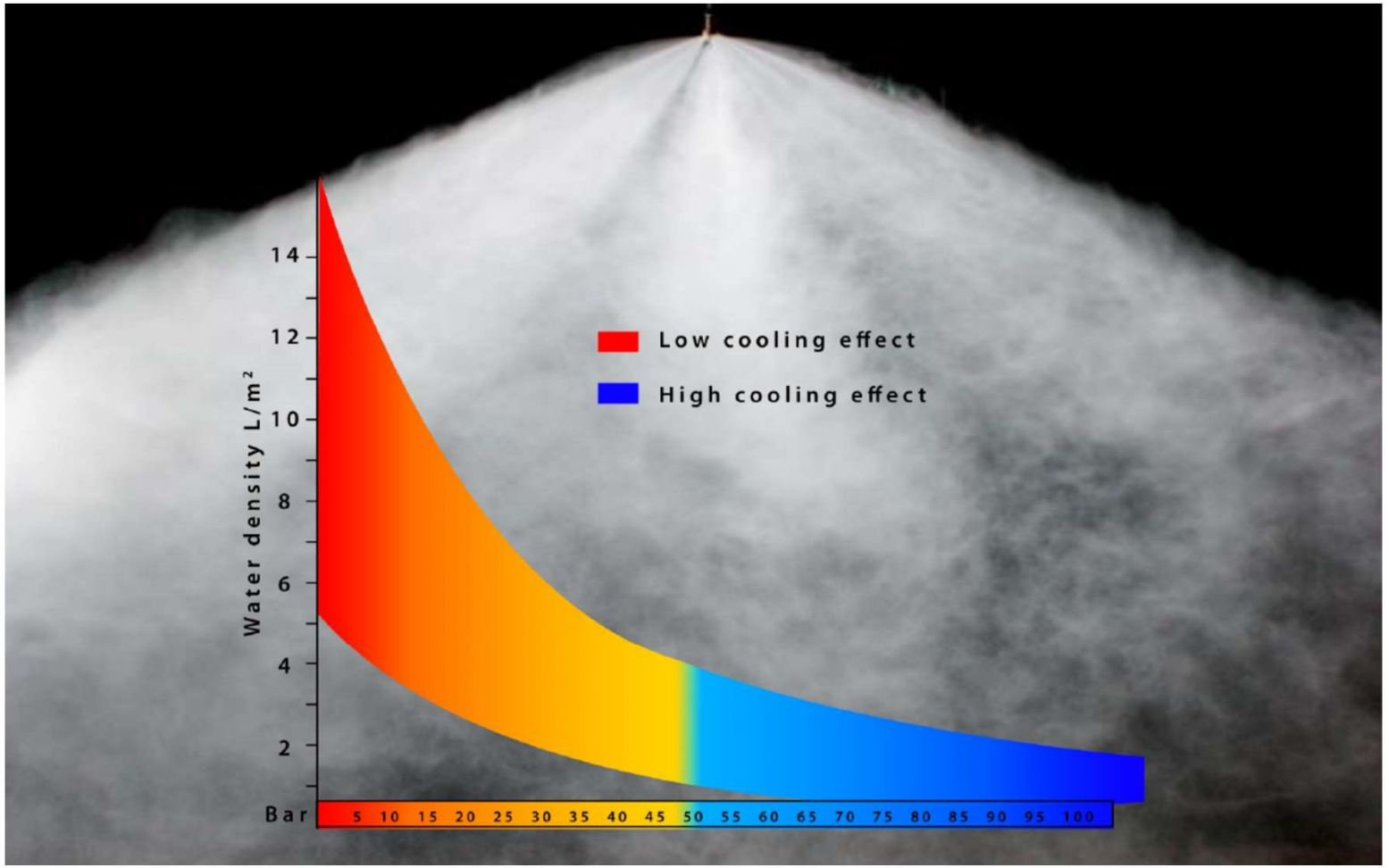
- In power generation, water mist systems are typically used for combustion turbines and diesel generators. These are usually total flooding systems, each adjusted for the size of the equipment they are protecting.

- The three mechanisms of water mist systems that suppress fires are:
  - Local oxygen displacement by evaporation
  - Radiant heat blocking of flames
  - Rapid evaporative cooling of flame and surrounding gasses

watermist

Beneficial Aspects





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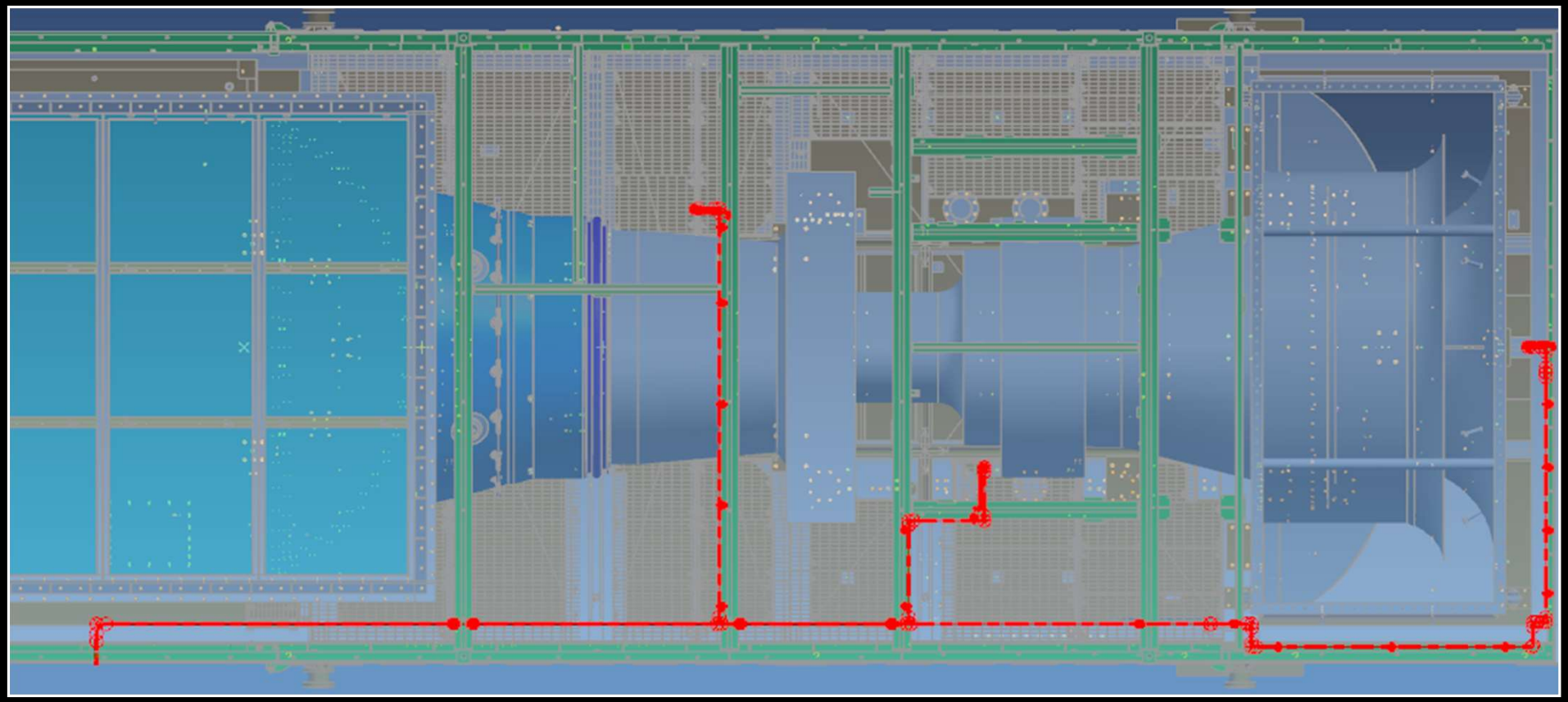
APPROVAL STANDARDS FOR WATERMIST : TURBINE ENCLOSURE

Machinery spaces & turbine enclosures < 80 m^3	FM 5560: 2016	Approval Standard for Water Mist Systems, APPENDIX A: Fire tests for water mist systems for the protection of machinery in enclosures with volumes not exceeding 80 m^3	FM Approvals
	FM 5560: 2016	Approval Standard for Water Mist Systems, APPENDIX B: Fire tests for water mist systems for the protection of combustion turbines in enclosures with volumes not exceeding 80 m^3	FM Approvals
Machinery spaces & turbine enclosures < 260 m^3	FM 5560: 2016	Approval Standard for Water Mist Systems, APPENDIX C: Fire tests for water mist systems for the protection of machinery in enclosures with volumes not exceeding 260 m^3	VdS, FM Approvals
	FM 5560: 2016	Approval Standard for Water Mist Systems, APPENDIX D: Fire tests for water mist systems for the protection of combustion turbines in enclosures with volumes not exceeding 260 m^3	VdS, FM Approvals
	EN 14972-9 (2020)	Test protocol for machinery in enclosures not exceeding 260 m^3 for open nozzle systems	
	prEN 14972-15: 2020	Test protocol for combusiton turbines in enclosures not exceeding 260 m^3 for open nozzle systems	
Machinery spaces & turbine enclosures > 260 m^3	FM 5560: 2016	Approval Standard for Water Mist Systems, APPENDIX E: Fire tests for water mist systems for the protection of machinery in enclosures with volumes exceeding 260 m^3	VdS, FM Approvals
	FM 5560: 2016	Approval Standard for Water Mist Systems, APPENDIX F: Fire tests for water mist systems for the protection of combustion turbines in enclosures with volumes exceeding 260 m^3	VdS, FM Approvals
	EN 14972-8 (2020)	Test protocol for machinery in enclosures exceeding 260 m^3 for open nozzle systems	
	prEN 14972-14: 2020	Test protocol for combusiton turbines in enclosures exceeding 260 m^3 for open nozzle systems	



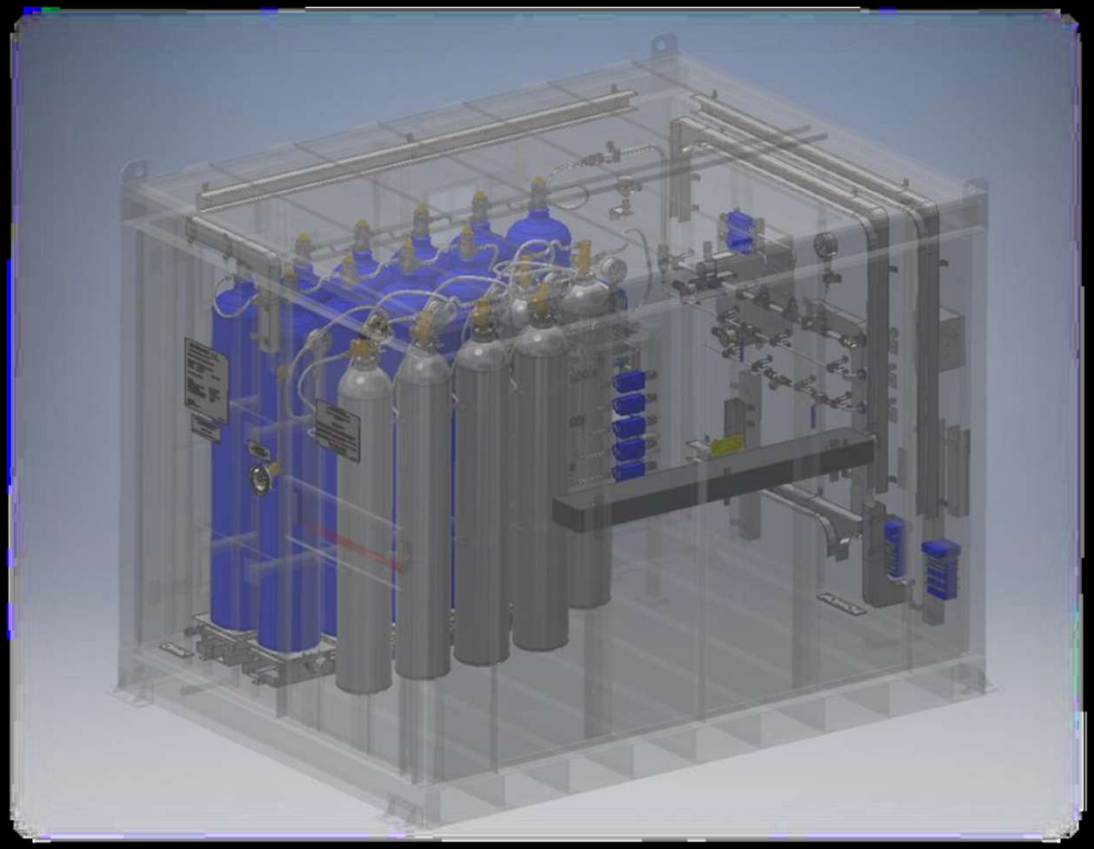
TYPICAL EXAMPLE OF WATERMIST NOZZLE DISTRIBUTION IN A TURBINE ENCLOSURE

ULTRA FOG®
FIRE EXTINGUISHING SYSTEM

Offshore

FM 5560 TESTED WATERMIST NOZZLE FOR TURBINE ENCLOSURE

- The Nozzle used in the ULTRA FOG system is an open-type, 202-073-O-F nozzle. This is part of a deluge system and used in total flooding applications. It is designed to discharge water at a pressure of 100 bar at 7.3 L/min. It can cover an area of 4m x 4m with a maximum ceiling height of 5m. It has a K-Factor of 0.73
- ULTRA FOG nozzle components are precision-manufactured of stainless steel and other corrosion resistive materials. Nozzles have been tested in accordance with IMO Resolution and FM Approvals in order to achieve the best and most reliable function. They are easily constructed and consist of only four non-moving parts. This ensures a safe and uniform quality when assembling the nozzle components.
- Each nozzle is equipped with a 120 µm filter to prevent clogging.
- It has been tested according to FM 5560 Appendix C and meets the intent of NFPA 750 for the best and most reliable functions



TYPICAL EXAMPLE OF WATERMIST FIRE FIGHTING SKID

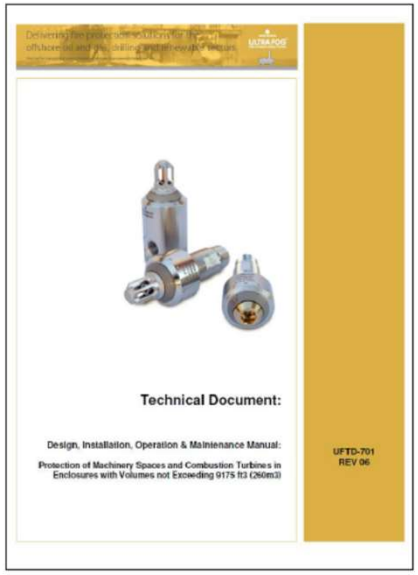
ULTRA FOG®
FIRE EXTINGUISHING SYSTEM

Offshore

SYSTEM OPERATION

- The accumulator unit is driven by compressed nitrogen, which is stored in cylinders at a pressure of ~200 bar. A pressure switch and pressure gauge is used to monitor the pressure to ensure there are no leaks in the system; and there is sufficient amount of Nitrogen to protect GT enclosure for the correct time.
- Upon activation, the pilot cylinder within the accumulator system is activated, releasing the nitrogen which in turn activates the slave cylinder(s), therefore pressurizes the water cylinders.
- The number of cylinders supplied with the accumulator system is determined by the water requirement for the hazard area and a pressure calculation. One Nitrogen cylinder (Pilot) is fitted with a solenoid actuated valve. All other gas or nitrogen cylinder (Slave) valves are fitted with pneumatic actuators.
- When the system is activated, then the master valve opens first and in turn distributes the nitrogen to the pneumatic actuators. This allows all the cylinders in the system to open simultaneously, therefore causing water to discharge evenly. This sequence is repeated for all accumulator units.
- Activation of the system takes place in sections, manually or automatically. This is either done by using the manual override switch on the solenoid valve or by activating the system electrically via a control panel situated outside the enclosure.
- Reserve accumulator units can be furnished if a reserve or back up system is required. These require check valves to separate water flow between the main and reserve systems.
- All nozzles in the activated section generate water fog. The system shall be designed to protect the hazard area for a minimum of ten minutes.
- The system is designed for the Protection of Machinery Spaces and Combustion Turbines in Enclosures with Volumes not Exceeding 9175 ft3 (260 m3) where a manual or an automatic activation is desired.

Testing & Documentation – projects.



AG1002-FT-001	Functional (Discharge) Test & Cert
AG1002-FI-001	Final Inspection (Final & Visual) & Cert
AG1002-TE-001	TEST - Pneumatic & Cert
AG1002-TE-002	TEST - Hydrostatic & Cert
AG1002-TE-003	TEST - Dimensional & Cert
AG1002-TE-004	TEST - Completeness & 3 Way & Cert
AG1002-TE-005	TEST - Paint Inspection & Cert
AG1002-TE-006	TEST - Sealing Test & Cert
AG1002-TE-007	TEST - Electrical Insulation
AG1002-TE-008	TEST – Electrical Earth Test
By cylinder manufacturer	Hydraulic Test on cylinders as per listing
AG1002-CB-002	TEST - Bottles/Tanks material Certs

Certificate of Compliance

This certificate is issued for the following:

Water Mist System

System Designation:	Ultra Fog® Water Mist System for the Protection of Machinery and Combustion Turbines in Enclosures with Volumes up to, and including, 46,615 ft³ (1,320 m³) and a maximum ceiling height of 39.4 ft (12.0 m)
Design, Installation, Operation and Maintenance Manual:	Design, Installation, Operation & Maintenance Manual: Protection of Machinery Spaces and Combustion Turbines in Enclosures with Volumes not Exceeding 46,615 ft³ (1,320 m³), Document Number: UFTD-702, Rev. 03

Prepared for:
ULTRAFOG R&D SRL
VIA GRECALE 33
55049 – VIAREGGIO (LU)
ITALY

Manufactured at:
ULTRA FOG SP. Z.O.O
DLUGA STREET 12
TUCHOM 80-209
POLAND

FM Approval Standard Class: 5560 Dated: March 2009

Approval Identification: 3042691 Approval Granted: February 13, 2017
Superseded by: RR224501 Date Approved: July 22, 2020

To verify the availability of the Approved product, please refer to www.approvalguide.com

Said Approval is subject to satisfactory field performance, continuing Surveillance Audits, and strict conformity to the constructions as shown in the Approval Guide, an online resource of FM Approvals.

David B. Fuller
VP, Manager – Fire Protection Group
FM Approvals
1151 Boston-Providence Turnpike
Norwood, MA 02062

FM Approvals
Member of the FM Global Group

Certificate of Compliance

This certificate is issued for the following:

Water Mist System

System Designation:	Ultra Fog® Water Mist System for the Protection of Machinery and Combustion Turbines in Enclosures with Volumes not Exceeding 9175 ft³ (260 m³) and a maximum ceiling height of 16.4 ft (5 m)
Design, Installation, Operation and Maintenance Manual:	Design, Installation, Operation & Maintenance Manual: Protection of Machinery Spaces and Combustion Turbines in Enclosures with Volumes not Exceeding 9175 ft³ (260 m³) – Decaying Pressure, Document Number: UFTD-703, Rev. 01

Prepared for:
ULTRAFOG R&D SRL
VIA GRECALE 33
55049 – VIAREGGIO (LU
ITALY

Manufactured at:

FM Approval

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1151 Boston-Providence
Norwood, MA 02062

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Member of the FM Global Group

Certificate of Compliance

This certificate is issued for the following:

Water Mist System

System Designation:	Ultra Fog® Water Mist System for the Protection of Machinery and Combustion Turbines in Enclosures with Volumes up to, and including, 17,657 ft³ (500 m³) and a maximum ceiling height of 16.4 ft (5 m)
Design, Installation, Operation and Maintenance Manual:	Design, Installation, Operation & Maintenance Manual: Protection of Machinery Spaces and Combustion Turbines in Enclosures with Volumes not Exceeding 17,657 ft³ (500 m³), Document Number: UFTD-704, Rev. 04

Prepared for:
ULTRAFOG R&D SRL
VIA GRECALE 33
55049 – VIAREGGIO (LU)
ITALY

Manufactured at:
ULTRA FOG SP. Z.O.O
DLUGA STREET 12
TUCHOM 80-209
POLAND

FM Approval Standard Class: 5560 Dated: November 2012

Approval Identification: 3054163 Approval Granted: August 1, 2017
Superseded by: RR224501 Date Approved: July 22, 2020

To verify the availability of the Approved product, please refer to www.approvalguide.com

Said Approval is subject to satisfactory field performance, continuing Surveillance Audits, and strict conformity to the constructions as shown in the Approval Guide, an online resource of FM Approvals.

David B. Fuller
VP, Manager – Fire Protection Group
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1151 Boston-Providence Turnpike
Norwood, MA 02062

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Member of the FM Global Group

Lloyd's Register

Current issue date: 5 May 2020
Expiry date: 18 March 2022
Certificate identity number: 10266130

Original approval(s):
ISO 9001 - 19 March 2013

Certificate of Approval

This is to certify that the Management System of:

Ultrafog S.r.l.

Via Grecale 33, 55049 Viareggio - LU, Italy

has been approved by Lloyd's Register to the following standards:

ISO 9001:2015

Approval number(s): ISO 9001 – 0028537

This certificate is valid only in association with the certificate schedule bearing the same number on which the locations applicable to this approval are listed.

The scope of this approval is applicable to:
Provision to the maritime industry of approved fire dampers.

rcilio de Souza
anager - South Europe
Register Quality Assurance Italy Srl
: Lloyd's Register Quality Assurance Limited

UKAS
001

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ULTRA FOG®
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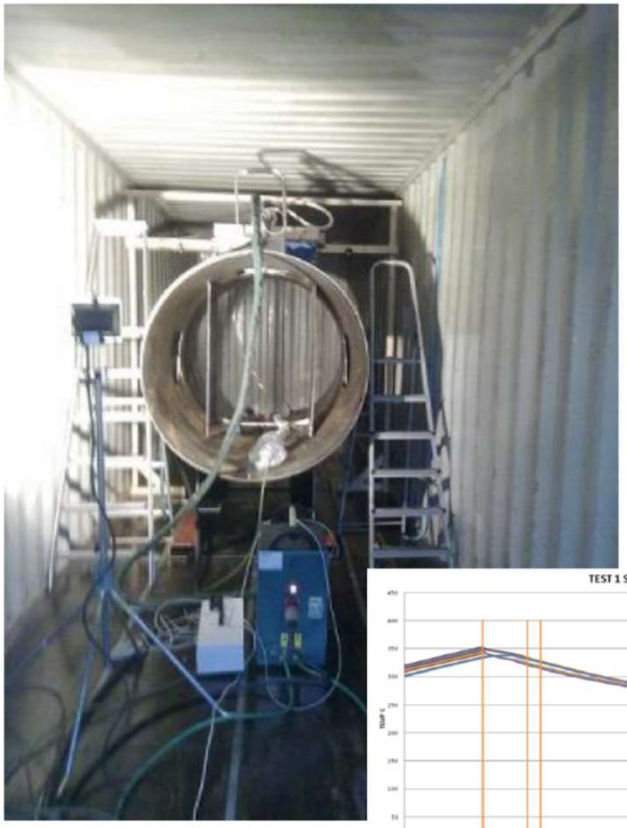
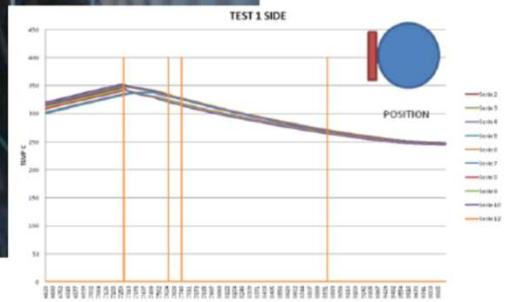
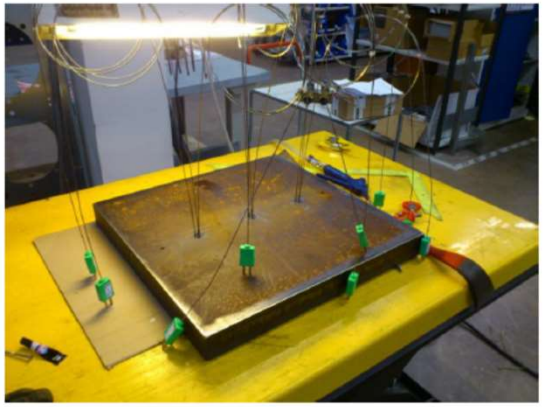
Offshore

Testing – client specific (cooling).







The Manufacturing Process

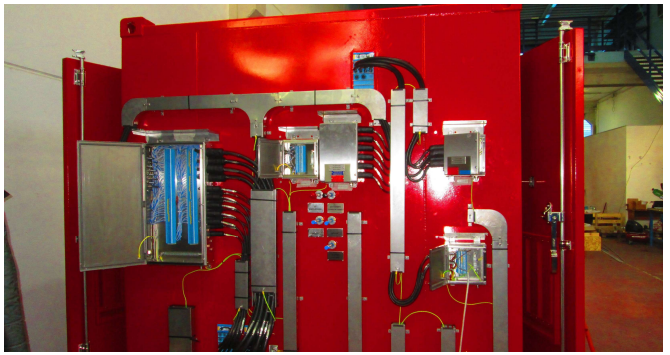


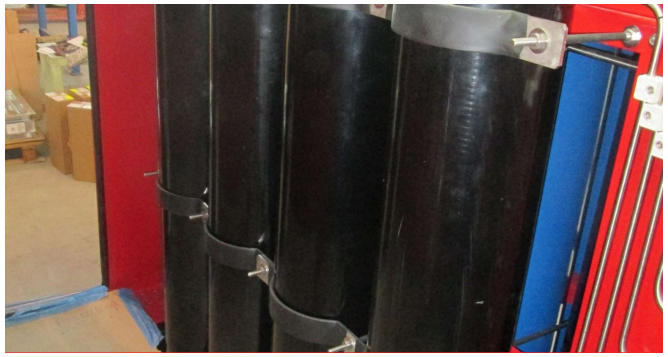




WEIGHING DEVICE

- Each 67.5L bottle is located on top of a weighing device that is fixed in place inside the Fire Fighting Skid.
- They are intended to support the weight and the balance of the cylinders and send signals to the control station advising if nominal water weight is lower than required.
- The weighing device will send signals to the control panel as the weight changes, with an alarm sounding once 10% of the total weight of the cylinder has been lost. This is used on Water Cylinders only.
- Each device has a rubber isolation mat to segregate the two different materials.
- The weighing devices are fixed to the floor of the FFS Enclosure.





FIRE FIGHTING SKID

Thank you !