

The MATRIX

an essential Tool for Fire Engineers doing
Specifications, Review and Acceptance of
Water Mist Systems

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Presentation organization:

The point of view of the users

- Fire engineers having the role of selecting the most appropriate fire protection system for the hazard under consideration, and to make a basic specification for it.
- Fire Department officials, having the role of approving a fire protection system for the selected application
- Loss Control specialists in Insurance Companies called to review the design and accept the installed water mist fire protection system



The Fire Engineer

The main tasks to accomplish for a “normal system”:

- Hazard analysis and consequent classification - i.e.: Ordinary Hazard, special hazard, flammable liquids, ecc..
- Selection of the most appropriate fire protection system for the hazard under consideration.
- Entering the “applicable design and installation standard to define the main characteristics of the system.

The main tasks to accomplish for a “water mist system”:

- Hazard analysis... mostly the same as for “normal systems”
- Selection of the most appropriate water mist system for the hazard... here the first doubt arises
- Entering the “applicable standard” is now not enough, because the standard does not define it.
- The applicable **“fire test protocol”** need to be identified



The Fire Official

The main tasks to accomplish for a “normal system”:

- Check whether the indicated hazard can be protected by the proposed system – the specified standard usually provide this information (e.g.: NFPA 13 or EN 14972)
- Check whether the proposed design specifications meet the indication that can be derived from the applicable design and installation standard.

The main tasks to accomplish for a “water mist system”:

- Check whether the indicated hazard can be protected by the proposed system ... mostly the same as for “normal systems”
- Entering the “applicable standard” is now not enough, because the standard does not define the design specifications
- The applicable **“fire test protocol”** need to be identified



The Loss Control Specialist

The main tasks to accomplish for a “normal system”:

- Check whether the indicated hazard can be protected by the proposed system – the specified standard usually provide this information (e.g.: NFPA 13 or EN 14972)
- Check whether the proposed design specifications meet the indication that can be derived from the applicable design and installation standard.

The main tasks to accomplish for a “water mist system”:

- Check whether the indicated hazard can be protected by the proposed system ... mostly the same as for “normal systems”
- Entering the “applicable standard” is now not enough, because the standard does not define it
- Check the approval of the system
- The applicable **“fire test protocol”** need to be identified



How to approach the challenge

IN SUMMARY

When approaching a problem of fire protection with water mist technology, there are a few steps to comply with, in terms to achieve an effective protection system

- Classify the Hazard
- Check whether a fire test protocol exists for that hazard
- Check whether there are approvals issued by any recognized fire protection authority according to that protocol
 - **It is then possible to find at least an approved water mist system for the application**
- Consider the available systems.



Fire test protocols for Machinery Spaces

EXAMPLE FOR MACHINERY SPACES

In the specific case of the Machinery Spaces there are several fire test protocols available, not necessarily “equivalent one to the other”.

- Factory Mutual classify the Machinery spaces dividing the Combustion Turbines from the other Machinery Spaces and Special Hazard machinery spaces. They issue the test protocols (FM 5560) and approve several systems, including Hi-Fog
- The German VdS also publish a fire test procedure for Machinery Spaces and issues approvals for water mist systems, including Hi-Fog.
- Other protocols are available from IMO for Machinery Spaces on board of ships.
- And now the EN 14972 also publish protocols...



Test protocols for LH and OH (HC I, II & III)

WHEN APPROACHING THE LH, OH OR HC CLASSIFIED AREAS WITH AUTOMATIC NOZZLES THE PROBLEM IS MORE COMPLEX

The available protocols has been included in the 14972 European Standard” but the choice is not easy.

- Factory Mutual HC I is behind the 14972-4
- The German VdS protocols on offices, false ceiling and raised floors are behind the 14972 part 2, 3 and 6
- A BSI protocol is behind the so called Low Hazard test protocol 14972-7.
- And now there are also the FM protocols on HC-II and HC-III occupancies not in CEN...



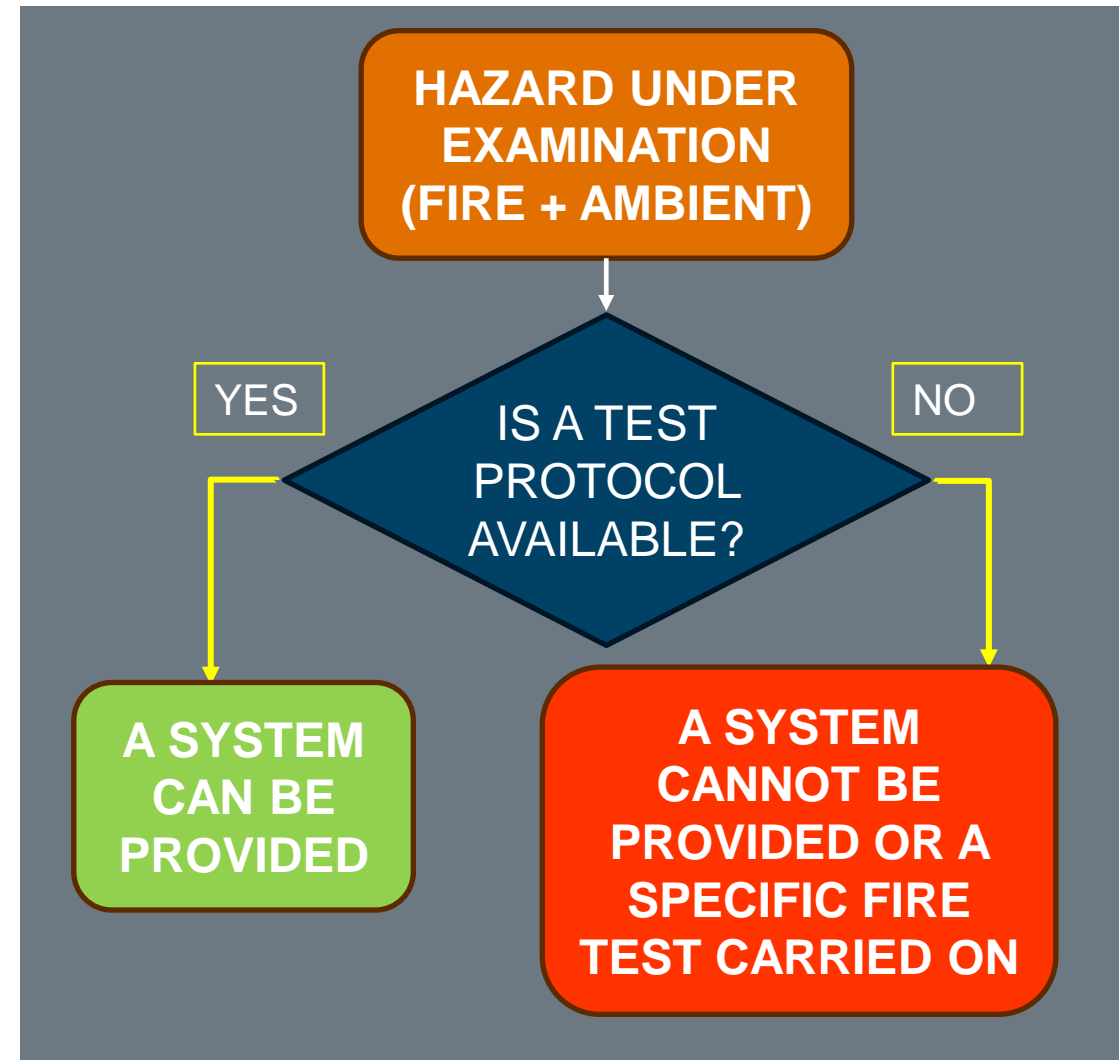
THE DECISION MAKER PROCESS

IN A VERY SIMPLE FLOW DIAGRAM THE PROCESS IS AS SHOWN

Either a fire test protocol exists for the given fire hazard and in the given environment

Or the system cannot be provided unless a specific fire test, for that application only, is arranged

TEST PROTOCOLS NEED TO BE IDENTIFIED



HOW CAN WE HELP THE USERS IN SOLVING THE PROBLEMS SO FAR MENTIONED?

- The role of IWMA in promoting the water mist technology is also to “facilitate” the end user in the application of the water mist systems.
- The Board of the Association, with the help of some of the members, decided a few years ago to develop “THE MATRIX”
- A comprehensive and continuously updated table of the available water mist fire test protocols and their applicability



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THE MATRIX FOR LAND APPLICATIONS



Land Standards

Business Segment	Application	Fire Test Protocols	Type approvals
Residential	Residential occupancies	prEN 14972-17 (no published document available yet)	Test protocol for residential occupancies for automatic nozzle systems
		BS 8458-2015	Fixed fire protection systems – Residential and domestic watermist systems – Code of practice for design and installation
		UL 2167-2021	Water Mist Nozzles for Fire Protection Service Ch.44 - Residential area fire tests
Offices, schools, hotels, recreational areas, etc (EUR OH1, FM HC-1, NFPA LH)	Offices, schools, hotels, recreational areas, etc (EUR OH1, FM HC-1, NFPA LH)	EN 14972-3:2021	Test protocol for office, school class rooms and hotel for automatic nozzle systems
		prEN 14972-4	Test protocol for non-storage occupancies for automatic nozzle systems
		FprEN 14972-7	Test protocol for commercial low hazard occupancies for automatic nozzle systems
		VdS 3883-1en:2020	Fire Test Protocol for Water Mist Systems, Part 1: Protection of office spaces and accommodation areas
		BS 8489-7:2016	Fixed fire protection systems – Industrial and commercial watermist systems Part 7: Fire performance tests and requirements for watermist systems for the protection of low hazard occupancies
		FM 5560:2021	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) [formerly Light Hazard occupancies]

Application	Standard	Description	Type Approvals	
Industrial applications	NFPA OH1	Water Mist Nozzles for Fire Protection Service Ch.46 - Ordinary Hazard Group 1 fire tests	UL	
	Sales, storage & shopping areas NFPA OH2	Test protocol for shopping areas for automatic nozzle systems		
	Sales, storage & shopping areas NFPA OH2	VdS 3883-5en	Fire Test Protocol for Water Mist Systems, Part 5: Protection of selected sales and storage areas and mechanical floors	VdS
		UL 2167-2021	Water Mist Nozzles for Fire Protection Service Ch.47 - Ordinary Hazard Group 2 fire tests	
	FM Global Non-Storage Occupancies, Hazard Category 2 (HC-2)	Approval Standard for Water Mist Systems, APPENDIX P: Fire tests for water mist systems for the protection of non-storage occupancies, Hazard Category 2 (HC-2)	FM Approvals	
	FM Global Non-Storage Occupancies, Hazard Category 3 (HC-3)	Approval Standard for Water Mist Systems, APPENDIX P: Fire tests for water mist systems for the protection of non-storage occupancies, Hazard Category 3 (HC-3)	FM Approvals	
	Data halls	FM 5560:2021	Approval Standard for Water Mist Systems, APPENDIX M: Fire tests for water mist systems for the protection of data processing equipment rooms/halls - above raised floor	FM Approvals
		FM 5560:2021	Approval Standard for Water Mist Systems, APPENDIX N: Fire tests for water mist systems for the protection of data processing equipment rooms/halls - below raised floor	FM Approvals
	Mechanical escalators	VdS Rolltrappentests (Escalator en. V1) Draft: 20.08.09	Test Setup and Requirements - Protection of mechanical escalator	VdS
	Commercial deep fat cooking fryers	prEN 14972-12 (no published document available yet)	Test protocol for commercial deep fat cooking fryers for open nozzle systems	
	Machinery spaces & turbine enclosures < 80 m³	FM 5560:2021	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 m³	FM Approvals
		FM 5560:2021	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 m³	FM Approvals
	Machinery spaces & turbine enclosures < 260 m³	FM 5560:2021	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 m³	VdS, FM Approvals
		FM 5560:2021	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 m³	VdS, FM Approvals
	Machinery spaces & turbine enclosures > 260 m³	EN 14972-9 (2020)	Test protocol for machinery in enclosures not exceeding 260 m³ for open nozzle systems	
EN 14972-15:2021		Test protocol for combustion turbines in enclosures not exceeding 260 m³ for open nozzle systems		
FM 5560:2021		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 m³	VdS, FM Approvals	
FM 5560:2021		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 m³	VdS, FM Approvals	
Local application	EN 14972-8 (2020)	Test protocol for machinery in enclosures exceeding 260 m³ for open nozzle systems		
	EN 14972-14:2021	Test protocol for combustion turbines in enclosures exceeding 260 m³ for open nozzle systems		
	FM 5560:2021	Approval Standard for Water Mist Systems, APPENDIX I: Fire tests for water mist systems for the protection of local applications	FM Approvals	
Wet benches and other similar processing equipment	prEN 14972-13 (no published document available yet)	Test protocol for wet benches and other similar processing equipment for open nozzle systems		
	FM 5560:2021	Approval Standard for Water Mist Systems, APPENDIX H: Fire tests for water mist systems for the protection of wet benches and other similar processing equipment	FM Approvals	
Industrial oil cookers	FM 5560:2021	Approval Standard for Water Mist Systems, APPENDIX L: Fire tests for water mist systems for the protection of chemical fume hoods		
	EN 14972-16 (2020)	Test protocol for industrial oil cookers for open nozzle systems		
Continuous wood board presses	FM 5560:2021	Approval Standard for Water Mist Systems, APPENDIX J: Fire tests for water mist systems for the protection of industrial oil cookers	FM Approvals	
	FM 5560:2021	Approval Standard for Water Mist Systems, APPENDIX K: Fire tests for water mist systems for the protection of continuous wood board presses	FM Approvals	
Cable tunnels / Cable ducts	EN 14972-11:2023	Test protocol for cable tunnels for open nozzle systems		
	VdS 3883-8en	Fire Test Protocol for Water Mist Systems, Part 8: Protection of Cable Ducts	VdS	
Flammable liquid storages and processing	VdS 3883-7en	Fire Test Protocol for Water Mist Systems, Part 7: Protection of Areas with Combustible Liquids	VdS	
	VdS 3883-6en	Fire Test Protocol for Water Mist Systems, Part 6: Protection of Paint Booths	VdS	

Footnote 1: If standards for an application do not yet exist, IWMA recommends full-scale fire tests to prove system performance.



THE MATRIX FOR MARINE APPLICATIONS

Everything is more simple and straightforward defined



Marine Standards



Customer Group / Ship type	Customer Application	Fire Test Protocols		Type Approvals
Ship Type	Application	Document id	Title	Classification Society
Cruise ships, Ferries & Ro-Ro, Yachts, Cargo Ships, Service vessels, Special vessels and, Offshore vessels & Floating Units, Naval vessels	Accommodation, public spaces & service areas	Res.A.800 as amended in Res.MSC.265	Revised guidelines for approval of sprinkler systems equivalent to that referred to in SOLAS II-2/12	ABS, BV, CCS, CRS, DNVGL, IRClass, KRIS, LIR, ClassNK, PRS, RINA, RMRS
	Machinery space / total flooding	MSC/Circ.1165	Revised guidelines for the approval of equivalent water-based fire-extinguishing systems for machinery spaces of Category A and cargo pump rooms	American Bureau of Shipping (ABS) Bureau Veritas (BV) China Classification of Shipping (CCS) Croatian Register of Shipping (CRS) Det Norske Veritas GL (DNVGL) Indian Register of Shipping (IRClass) Korean Register of Shipping (KRS) Lloyd's Register (LR) Nippon Kaiji Kyokai (ClassNK) Polish Register of Shipping (PRS) Registro Italiano Navale (RINA) Russian Maritime Register of Shipping (RMRS)
		MSC.1/Circ.1385	Scientific methods on scaling of test volume for fire test on water-mist fire-extinguishing systems (for systems approved according to MSC/Circ.1165)	
	Machinery space / local protection	MSC.1/Circ.1387	Revised guidelines for the approval of fixed water-based local application fire-fighting systems for use in Category A machinery spaces (MSC/Circ.913)	
	Ro-ro spaces	MSC.1/Circ.1430	Revised guidelines for the design and approval of fixed water-based fire-fighting systems for ro-ro spaces and special category spaces (MSC.1/Circ.1272)	
	Cabin balconies	MSC.1/Circ.1268	Guidelines for the approval of fixed pressure water spraying and water-based fire-extinguishing systems for cabin balconies	
	Deep-fat fryers	ISO 15371:2009	Ships and marine technology - Fire-extinguishing systems for protection of galley cooking equipment	
Galley ducts				



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Standard	
General Design & Installation	
EN 14972-1:2020	Fixed firefighting systems - Water mist systems Design and installation
VdS 3188:2020	Water Mist Sprinkler Systems and Water Mist Extinguishing Systems (High Pressure Systems) - Planning and Installation
NFPA 750:2023	Standard on Water Mist Fire Protection Systems
FM Global Loss Prevention Data Sheet 4-2:2022	Water mist systems

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		BS 8458:2015	Fixed fire protection systems – Residential and domestic watermist systems – Code of practice for design and installation	LPCB
		UL 2167:2021	Water Mist Nozzles for Fire Protection Service Ch.44 - Residential area fire tests	UL
	Offices, schools, hotels, recreational areas, etc (EUR OH1, FM HC-1, NFPA LH)	EN 14972-3:2021	Test protocol for office, school class rooms and hotel for automatic nozzle systems	
		prEN 14972-4	Test protocol for non-storage occupancies for automatic nozzle systems	
		FprEN 14972-7	Test protocol for commercial low hazard occupancies for automatic nozzle systems	
		VdS 3883-1en:2020	Fire Test Protocol for Water Mist Systems, Part 1: Protection of office spaces and accommodation areas	VdS
		BS 8489-7:2016	Fixed fire protection systems – Industrial and commercial watermist systems Part 7: Fire performance tests and requirements for watermist systems for the protection of low hazard occupancies	
		FM 5560:2021	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) [formerly Light Hazard occupancies]	FM Approvals
		UL 2167:2021	Water Mist Nozzles for Fire Protection Service Ch.43 - Shinboard public space fire tests & Ch.45 - Light Hazard area fire tests	

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Let us see in detail the information that are in the matrix and how useful they can be for the end users



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And then, let us see in detail which information is missing and see whether we can try to incorporate it for future developments



CONCLUSION

- Water mist technology is definitely friendly for the planet and for the environment
- We need to make it more friendly for the end users
- THE MATRIX is in our opinion a good tool for the fire engineers involved with the design, review and approval of water mist systems
- Any suggestion on how to make it more useful is more than welcomed.



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