

Watermist system design and review – The Matrix from IWMA

An instrument to assist fire engineers in selecting the suitable systems and the authority having jurisdiction in reviewing them for approval.



Luciano Nigro

Watermist technology can now be considered a mature fire-suppression technology as it has entered the third decade of installation both in marine and in land-based applications. Initiated more than 30 years ago to support the Halon replacement on board ships, the technology grew very rapidly achieving almost 100% of the marine fire-protection market on board passenger ships, protecting hazards from the machinery spaces to the accommodation and public spaces.

By the end of the millennium many applications to land-based occupancies were developed, based on several fire-test protocols published by international organizations including Factory Mutual

▼ Watermist can be used to e.g. protect wooden buildings – inside and outside.



Approvals, UL, VdS, LPCB and others. Nevertheless, in the land-based market the technology has not yet achieved full penetration. This is for various reasons. One of which, in the opinion of the author, being the difficulties that fire engineers, designing and/or reviewing watermist systems for acceptance, find in the process of selecting the system appropriate for each application and in verifying the adequacy of the design parameters that have been used for each system.

To support the fire engineers in this commitment, the International Water Mist Association (IWMA) has developed a descriptive document, 'Project Water Mist – an Alternate Solution to Sprinkler Protection in Building Fire Protection' published in 2014 and a 'working tool' – The Matrix – available on the IWMA website (www.iwma.net), that is the subject of this article.

Documents available from the IWMA website

The first document, referred to as 'the Project', also available from the association website, is a complete list of all the fire-test protocols available on the market at the date of its publication with the description of the occupancies to which they apply and indicating the organizations that developed and published them.

The Matrix was then studied and developed by an IWMA task group, with advice from members, to be a real working tool for fire engineers, having a structure closer to the design and review activity a fire engineer usually does and being updated on a constant basis to be representative of the 'state of the art', which is a key point when designing and installing an advanced technology fire-suppression system.

The complete Matrix is published both for marine and land-based applications. The link to The Matrix is as follows <https://iwma.net/the-matrix/land-based-applications>.

The Matrix

Once the table is opened, it becomes obvious that the first column is easy to interpret: it just refers to the business segment of the case under consideration, divided into residential, commercial and industrial. There is nothing to add to this very simple differentiation.

The second column is the important one for the fire engineers; it is the column dedicated to the applications and it is the key point for the correct interpretation of the Matrix. The selection of the application that most accurately represents the fire hazard related to the 'formal' applications for which a test protocol exists requires a considerable judgement from the fire engineer.

Of course, the real world is not so simple, because the applications listed in the 'application' column of the Matrix are not easily related to the actual application under consideration; paragraph 4.1.3.2 of the EN 14972-1 states:

'Test protocols: one of the greatest challenges to engineering of water mist fire suppression systems lies in determining whether the conditions of a particular and recognized test protocol are representative of the actual conditions in a given application based on an understanding of the dynamics of the interaction of water mist with fire.'



▲ Luciano Nigro to explain The Matrix in Copenhagen during the International Water Mist Conference.

Sometimes the applications are very clear, for example the 'car garages/parking garages', but there are also several applications that are not so well defined, as for example 'residential occupancies' or 'data halls'. In these cases, additional information is needed to relate the applications listed in the Matrix to the real world.

The third and fourth columns of the Matrix are the test protocol columns, which fully identify the test protocol(s) existing for any given application. The list is updated regularly by the association and therefore it can be considered the most updated list of watermist fire-test protocols presently available worldwide.

As mentioned, there are many applications for which more than one protocol is available, and so selecting the protocol that best fits the actual application under consideration remains the responsibility of the fire engineer.

The last column identifies the type approval that can be obtained by 'positively passing' each test protocol mentioned in the previous columns. This is also a very important column to be considered because it distinguishes the test protocols in those that lead to a formal approval (and the organization granting the type approval is listed in column 5) from those protocols that do not lead to

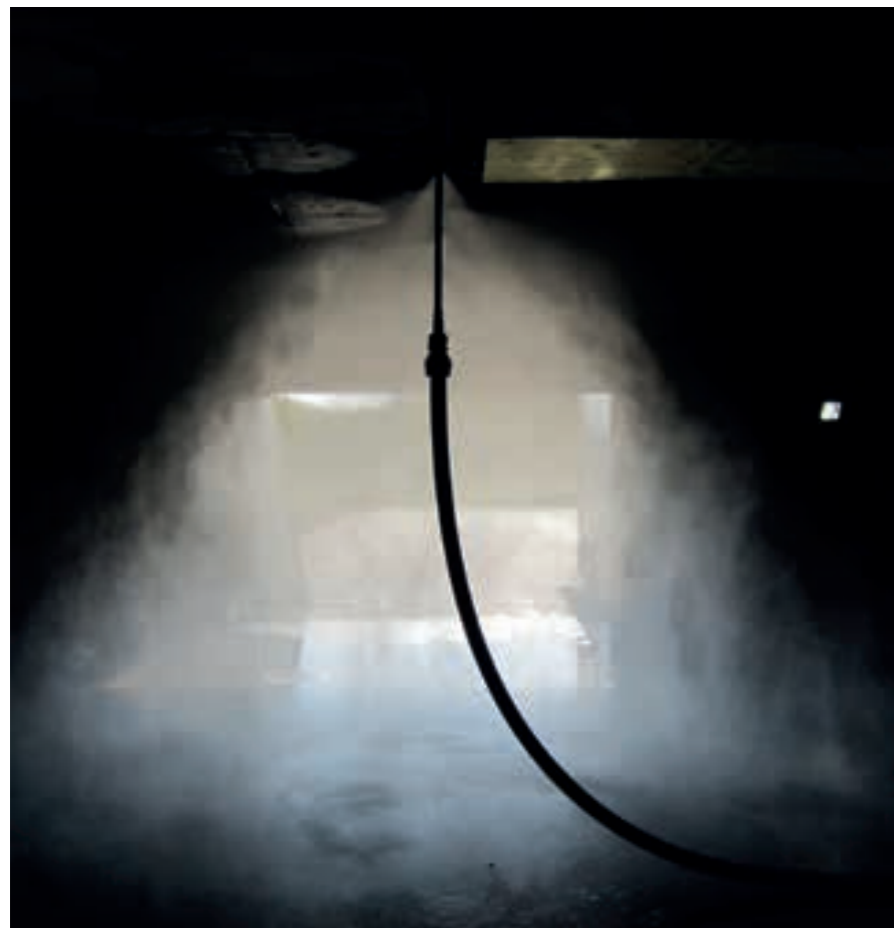
a formal approval but are simply offered to the market as reference protocols to be used by the authorities having jurisdiction, the laboratories, the verification agencies, the manufacturers and so on.

For those that are not familiar with the type-approval process, the fire-test protocols are the procedures issued by the organizations involved in watermist fire-suppression technology to run each of the mentioned test. They list the materials to be used, the procedure to run the tests and the pass-fail criteria to determine the outcome of the tests.

Finally, it should be noticed that the organizations issuing fire-test protocols for watermist applications are not numerous and can be divided in two groups: the approval bodies and the standardization bodies.

Approval bodies for watermist applications include FM Approvals¹, UL², and VdS³. The standardization bodies include the CEN / TC 191 / WG 10⁴ and BSI (British Standards Institution)⁵. As it is possible to see in the Matrix table, the approval bodies always grant a type approval for the system passing the test protocol for the specific application; the

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◀ **Watermist demonstration – CEN demands: 90% of the droplets must be smaller than 1,000 microns in size.**

to one of the test procedures issued by the standardization bodies remains the responsibility of the fire engineer in charge of designing the system.

Future steps

The maintenance and updating of the Matrix are of utmost importance for the tool itself and for the IWMA, in order to provide concrete help to the fire engineers involved in the design, installation or verification of a watermist system in land-based applications.

The addition of a column with a description of the application to which the protocol is applicable, or the implementation of a ‘second page’ in the summary, with each line of the protocols completed with the description of the applicable scenarios given in the protocol itself, could be of help in finding the correct protocol to use for a given application.

Finally, the availability of watermist systems on the market: this is an issue going behind the scope of the IWMA.

In conclusion, the Matrix provides the list of occupancies and protocols, but the demonstration that a company has successfully passed a protocol remains the fire engineer’s responsibility to ascertain because, as stated in the last sentence of the introduction to EN 14972-1: ‘Water mist is a specific application solution which needs to be proven for each individual application and/or occupancy.’

➔ **For more information, go to <https://iwma.net/the-matrix>**

Reference

- 1. SFPE Handbook of Fire Protection Engineering – Chapter 46 – Water Mist Fire Suppression Systems.
- 2. FM Approvals - <https://www.approvalguide.com/search?searchParameters=groupID=ODU>
- 3. UL - <https://www.ul.com/services/water-mist-system-equipment-component-testing>
- 4. VdS - <https://vds.de/en/certification/companies-and-specialist-professionals/fire-protection/installer-company-for-fire-extinguishing-systems>
- 5. CEN – CEN/TC191/WG10 – Water Mist Fire Fighting Systems – EN 14972 series
- 6. BS - <https://www.bsigroup.com/en-GB/search-results/?q=Water%20Mist%20Systems&Page=1&tab=Standards>
- 7. LPCB - <https://www.redbooklive.com/pdfdocs/redbook-vol1part3.pdf?m=47100>
- 8. FM Class Number 5560 – Examination Standard for Water Mist Systems – January 2021 edition

standardization bodies normally don’t, except for the residential applications tested according to BS standard 8458 that are approved by the LPCB⁶.

The approval issued by an approval body is also useful when correlating between the test protocol and the actual application under consideration. An example is chapter 1.2 of the FM standard 5560 where all the 16 applications for which FM Approvals has issued a test protocol are described in detail with all the applicable limitations and/or extensions.

The same does not apply to the test protocols issued by the standardization bodies that also include a paragraph for each protocol describing the scenarios to which the protocol can be applied, because this information is ‘embedded’ in the test protocol text and is not easily available to the fire engineer.

The above is a complete description of the Matrix content. It should be added that all the information included in the table is carefully verified and checked by the IWMA task group, which includes some of the most relevant professionals dealing with watermist technology worldwide.

However, there are some comments and some actions to take into

consideration to make it better and even more useful to the fire engineer mentioned at the beginning.

Comments

As mentioned in the text, the correlation between the fire-test protocol and the actual application under consideration is not easy for the fire engineer. It is possible, when talking about test protocols issued by approval bodies, which are liable for what they indicate and give all the information necessary for the correct use of the protocols, but it is less straightforward for the standardization body protocols.

The second and most important comment is related to the real availability of the system on the market. With the Matrix it is only possible to say that, for a given application, one or more test protocols exist and whether they lead to a type approval or not but no information is given about the availability of one or more manufacturers that can provide a watermist system designed and installed in accordance with the test protocol under consideration. The identification of the manufacturer(s) holding an approval or having carried out a fire test according



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