sprinkler OUTLOOK

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EUROPEAN FIRE SPRINKLER NETWORK

A solution is needed now

There is no doubt that the trend towards the use of synthetic fluorine free foams (SFFF) in fixed fire protection systems is gathering pace. The conversation is no longer if, or even when, it is simply that the market needs a solution now. Unfortunately, these solutions are not coming to market quickly enough to meet legislative and environmental demand and any hope of "drop in replacements" is beyond reality for now. A particular area of concern explains Simon Barratt, Foam Product Manager, Viking, is the availability of suitable SFFF products for use in conventional sprinkler systems.

So what is the problem?

Fire protection sprinklers and sprinkler nozzles are a simple but effective form of active fire protection used in many different applications globally. They are deployed in closed head systems with a fusible element or as sprinkler nozzles in open deluge systems with the fusible element removed. For many years, we have been enhancing these systems with foam to tackle more challenging fire scenarios such as those posed by Class B ignitable liquids. Typical applications are refineries, aircraft hangars, manufacturing and logistics centres with ignitable liquids and other commodities, where water alone is less/ineffective.

Conventional fire sprinklers were not designed with foam use in mind. They are designed to efficiently distribute water in the desired manner depending on the object or risk they are protecting. They are also small, discreet and, due to the high volume used throughout the world, have a sensitive, almost commodity-based price point. Despite this, used with the correct combination of system components and foam concentrate, they can perform very well as foam-enhanced sprinkler systems.

Foam qualities and discharge devices

For foam application on ignitable liquids, it is important to obtain the correct "foam quality". The first of these qualities is the level of Expansion. This is a measurement expressed as a ratio of how much the foam solution expands when applied on a fire through a discharge device. Discharge devices could be monitors, foam chambers or foam branch pipes for example. All these devices, which are designed for use with foam, agitate and/or aspirate air into the foam solution to boost the expansion. It is generally accepted that expansions between 6:1 and 10:1 are optimum for these aspirated devices.

The second important factor is the Drainage rate. This is a measurement of how quickly the expanded foam returns to a solution. Effective performance is a balance of the two, as the expansion is needed to form a blanket over the ignitable liquid and starve the fire of oxygen whilst the drainage is important to provide a continual cooling effect on the fire and surrounding structures.

Foam qualities play an important role in testing and certificating foam discharge devices with foam concentrates. This is because it is unrealistic to fire test foam discharge devices on a 1:1 scale as this would involve large testing infrastructure and cost and would also lead to inconsistency across different products and manufacturers. Therefore, these qualities are obtained by flowing foam through the different discharge devices across the devices' range of operation.
Once the expansion and drainage values are noted, they are replicated later using a specially configured hose nozzle and used to run standard-sized fire tests as prescribed in the appropriate test standard.

These foam qualities are proving to be much more critical in SFFF foams as the additional safety factors given in the past by fluorinated surfactants in AFFF-based foam have been diminished. Independent studies such as the NFPA Research Foundation report on the effectiveness of fluorine-free firefighting foams have confirmed what foam manufacturers have known all along concerning the critical nature of foam qualities with SFFF foam.

Why is a sprinkler different?

A conventional fire sprinkler is considered a non-aspirated foam discharge device and typically gives a low expansion ratio of no more than 4:1, with fast drainage times. It is therefore important to select a foam concentrate that has been developed and independently tested by a third party specifically for use with sprinklers.

Factory Mutual (FM) and Underwriters Laboratories (UL) are considered the most relevant and challenging authorities when it comes to fixed system product testing. Their respective foam test standards, FM5130 and UL162 include material testing, fire performance testing and follow-up manufacturing audits, which gives a higher level of consumer confidence compared to other standards commonly referenced, such as Europe's EN13565-1.

Both these organisations recognise that conventional non-aspirated sprinklers are different in foam performance to other discharge devices and therefore,

Foam Water Sprinkler Discharge Devices

Foam water sprinklers are Approved with the concentrate specified in this listing and at the application rates specified in the table below. The use of foam water sprinklers with other concentrates or at other application rates may result in foam of significantly different fire extinguishing capabilities and burn back (reignition) resistance.

Product	Type of Equipment	Concentrate % in Water	Configuration	Approved Fuel Hazards	Min Solution Application Rate		Max Subsequent Water Application Rate		Min Installation Height		Max Installation Height		Connection	Orientation	K-Factor
					gpm/ft²	(mm/min)	gpm/ft²	(mm/min)	ft	(m)	ft	(m)			
VK100, VK108, VK300, VK301	Automatic Foam Water Sprinkler	3x3%	For use with proportioners specifically tested with this concentrate, pre-mixed solution or Water Motor-Powered Positive Displacement Pumps within acceptable viscosity range only.	Hydrocarbon	0.2	(8)	0.3	(12.22)	5	(1.5)	20	(6.1)	1/2" NPT	Upright	5.6
VK100, VK108, VK300, VK301	Automatic Foam Water Sprinkler	3x3%	For use with proportioners specifically tested with this concentrate, pre-mixed solution or Water Motor-Powered Positive Displacement Pumps within acceptable viscosity range only.	IPA	0.2	(8)	N/A		5	(1.5)	20	(6.1)	1/2" NPT	Upright	5.6
VK100, VK108, VK300, VK301	Automatic Foam Water Sprinkler	3x3%	For use with proportioners specifically tested with this concentrate, pre-mixed solution or Water Motor-Powered Positive Displacement Pumps within acceptable viscosity range only.	Acetone	0.3	(12)	N/A		5	(1.5)	20	(6.1)	1/2" NPT	Upright	5.6

FM Approval Guide – Fixed Extinguishing Systems

the traditional foam quality approach is not applicable. Instead, each sprinkler type is tested under prescribed conditions with variables such as foam concentrate type, K-Factor, application density, fuel type and installation height. The example sprinkler and foam concentrate approval in the Table gives clear design and usage parameters from the fire testing.

Application design standards such as NFPA11, NFPA30 or FMDS 7-29 require the use of Approved / Listed foam concentrates that have been tested on the subject fuels with the intended sprinkler type. This can limit choice because such testing is difficult and expensive but the user does at least have the assurance of proven fire performance.

A difference with the European Standard

EN13565-2 is the European standard for the design of fixed firefighting foam systems. The 2009 version of this standard required that non-aspirated sprinklers be used with foams that have a rating of 1A/B/C for Hydrocarbon-only risks and 1A/B for those also involving polar solvents. This effectively means that the better-quality foams, according to the EN1568 foam concentrate standard, shall be used when utilising non-aspirated sprinklers.

However, there is a flaw in this requirement as foams tested to EN1568 are certificated based on fire pan tests with a standard aspirated hose nozzle that generally gives good foam qualities. This test is very different to the realities of a sprinkler fire test as it does not consider the height of application, the fire updraft effect or the water deluge applied to replicate a period of water only discharge after depletion of the foam reserve.

Another key element is the amount of foam that actually hits the fire pan as opposed to the surrounding area. In the EN1568 tests, all the foam from the test nozzle is discharged into the fire pan. Therefore, it should not be assumed that a 1A product would be able to perform adequately when discharged from a non-aspirated sprinkler.

The 2018 revision of EN13565-2 has probably made the situation worse. Despite the 2009 version giving equivalency of a test hose nozzle to a non-aspirated sprinkler, it did at least push the user to higher quality foams and adequate densities. This requirement has now been removed and users are simply requested to “consult the manufacturer”. There is no caveat or guidance to state what the manufacturer has to demonstrate or prove so this leaves the situation open to interpretation and abuse.

Use of FM-Approved or UL-Listed foam concentrates tested with sprinklers is a sound approach to fire performance. Manufacturers using the freedom allowed under EN13565-2:2018 to justify the use of foams with non-aspirated sprinklers based on foam quality alone are not considering the full picture.

New advances in SFFF

It should be recognised that we are in a phase when demand for Approved/Listed foam systems is moving faster than manufacturers can bring solutions to market. This situation is not due to complacency or lack of effort, it is because replacing fluorinated foam systems with non-fluorinated is challenging, time consuming and expensive. At the time of writing, there is a slow increase in the number of high-quality foams meeting some of the requirement of FM5130 and UL162 entering the market. Choices for foam concentrates with non-aspirated foam concentrates remain very small however.

An exciting new foam to enter the market is Fomtec’s Enviro ARK product, which is developed in conjunction with a selection of Viking sprinklers and hardware. The Enviro ARK foam concentrate becomes the very first SFFF foam concentrate to achieve FM Approval for use on hydrocarbon and polar solvent ignitable liquids. This achievement is the culmination of many years of work with a strict focus on non-aspirated sprinkler performance. For certain applications, particularly warehouse storage, it is important to have a high performing foam working with non-aspirated sprinklers as there can be thousands of these small, cost effective foam discharge devices installed.

Although aspirated sprinklers are available, these tend to be expensive by comparison and some also miss high-level approvals such as FM and UL. They are also larger in size which may be an issue for installation compared to a conventional sprinkler and for sure would increase system material costs.

As part of this FM system approval, there is a proportioning package comprising an extensive line of bladder tanks with wide range proportioners specifically designed and approved for use in closed head sprinkler systems where flow rates can be very low. This special proportioning device is able to manage the higher viscosities found with SFFF foams and comes with the assurance provided by test standards such as FM5130. It is anticipated that additional products, sizes and design parameters will be added to the product line in the coming months.

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