



### WATER SPRAY SYSTEMS

Water remains the predominant fire suppression medium world-wide. By adapting its method of application, water can even be used to extinguish or control fires in situations where it would not normally be considered suitable.

This bulletin deals with fixed water spray installations other than sprinklers, which were dealt with in other bulletins.

#### Definition

A water spray system is connected to the supply through an automatically or manually actuated flow control valve. Water is then piped to specially designed nozzles which distribute it over the protected area.

Automatic valves are actuated by a detection device installed in the protected area.

#### Types of system

The two types of water spray system are:

##### 1. **High velocity system (HV)**

HV systems are mainly used to extinguish fires involving oils or similar combustible liquids. Oil-filled electrical equipment such as transformers, or lubrication systems on steam driven turbines are generally protected by HV systems.

Extinguishment of fires by HVs is achieved by a combination of the following:

- Cooling of the burning oil surface reduces the vaporisation rate
- Steam generated in the fire zone causes a smothering effect through oxygen displacement
- Dilution of the burning product. A water miscible product **eg:** alcohol, can be diluted to a level where it will no longer burn.
- Emulsification through the bombardment of the surface of the product by the high velocity water droplets. The emulsion formed consists either of globules of oil suspended in water or globules of water suspended in oil. The effect is temporary and the mixture will separate again in time.



## 2. **Medium velocity systems (MV)**

MV systems are mainly used to protect structures, plant and storage vessels from radiated heat and direct flame impingement.

Typical applications include: the complete external surface protection of bulk liquefied gas pressure vessels to prevent container failure and the resultant BLEVE (boiling liquid expanding vapour explosion); bulk flammable liquid storage tanks; structures supporting hazardous plant and equipment such as conveyors.

In addition, fire prevention may be achieved particularly where flammable gas leaks are likely to occur. The action of the spray on the leak will help to dissipate the gas more quickly and prevent concentrations from reaching their flammable limits.

### **System actuation**

Most systems can be actuated both automatically and manually.

In small automatic systems, water is held back from the open heads on the distribution piping by an automatic control which incorporates a heat sensing device, such as a frangible glass bulb. Heat from the fire breaks the bulb which allows the valve to open and water to flow to the discharge nozzles.

In large systems a deluge valve is fitted between the mains supply and the distribution piping. In addition, a further pipe system incorporating glass bulb detector heads is installed in the protected area and is also connected to the deluge valve. The latter piping is filled with compressed air at a greater pressure than the system water pressure. This keeps the deluge valve closed.

When the detector head actuates the air escapes and the system water pressure forces open the deluge valve and water flows through the distribution piping to the discharge nozzles.

## **Choosing a system**

When choosing a system for a particular risk, consideration should be given to:

- i) Physical and chemical properties of the materials likely to be involved, **eg:**
  - flash point
  - specific gravity
  - viscosity
  - solubility/miscibility
  - reactivity of water sensitive, or confined high temperature materials
- ii) Possible equipment damage through the thermal shock of water on high temperature equipment.
- iii) Clearances between system components and live electrical equipment. Design clearances are available and ensure complete safety.

## **Design of the system**

Water spray systems should only be designed by specialists. All system designs should include working drawings, specifications and hydraulic calculations which should be forwarded to the manufacturer of the installation components for approval.

Consideration should be given to drainage facilities to handle water discharged from the system and to the likelihood of spilt combustible or flammable liquids which may be present within the protected area.

## **Testing and maintenance schedule**

### ***Acceptance tests***

All newly installed systems should undergo a full acceptance test including:

- Flushing of all systems and supply piping.
- Hydrostatic pressure test of all piping
- A full discharge test, where practicable, to check nozzle positioning, discharge patterns, obstructions to spray patterns and nozzle blockages
- Operating test of all detection systems and moving valve parts for correct operation. It is recommended that a test certificate showing the tests performed and their results be obtained from the testing authority.

Periodic testing and maintenance guide					
Minimum interval System Component	Minimum Interval			Remarks	
	Type of check	Weekly	Annually		5 Yearly
Whole system	Visual check for damaged, broken or missing parts	X			
Control and detection equipment	Check for effective functioning		X		
Manual tripping devices	Check for proper operation		X		
Nozzles	Check for general condition, positioning blockage, corrosion or other damage.		X		Test may be more frequent depending on local conditions
Strainers					
Underground supply pipes	To be flushed		X		
Open discharge nozzles	Full flow test			X	This test can be frequent for flammable liquid/gas storage vessels. For other plant, schedule the test for maintenance shut-down periods.

Some useful information on water spray systems					
Risk	Function of System	Minimum discharge ℓ/min/m <sup>2</sup>	High velocity	Medium velocity	Remarks
General	To extinguish fire	8-20	X		Discharge density dependant on material involved
	Exposure protection	Dependant on situation			Must operate before formation of carbon deposits on surfaces being protected and before failure of storage vessel due to temperature increase.
	Control burning	20		X	Must function at full effectiveness until: i) Flammable materials are consumed ii) Leak has been isolated iii) Repair crews are in attendance
	Fire prevention	Dependant on situation			Must function until hazardous material has been dissolved, diluted and dispersed
Specific Hazards					
Cable trays	To extinguish fire	6			Must apply water directly onto each tray or group of cables being protected.
Transformers	To extinguish fire	10	X		Complete impingement on all exterior surfaces including conservation tank
Storage vessels	Exposure protection	10		X	Water must be applied to entire external surface areas below the vessel equator cannot be wet by run down alone. Additional nozzles are required where projections obstruct spray patterns
Structural steel members	Exposure protection	4		X	Horizontal stressed structural members
		10		X	Vertical structural members

### References:

NFPA Code 15 – 1990 Water Spray Fixed Systems for Fire Protection  
Manual of Firemanship Book 9, HMSO

Published by:  
Fire Protection Association of Southern Africa  
(Incorporated Association not for Gain)  
(Reg. No. 73/00022/08)  
P O Box 15467  
Impala Park  
1472