

11 August 2004

## Process for optimising a water spray extinguishing system

### Description

The present invention relates to a process for optimising a water spray extinguishing system which comprises a water storage device, a line system with nozzles which is  
5 connected to the latter and a propellant for delivering the water to the nozzles.

Conventional water spray extinguishing systems, which are also known as water mist extinguishing systems in the literature, spray drops of water out of the nozzles, and the propellant which is used is either a pressurised gas, preferably nitrogen, or a pump. Both high- and low-pressure systems are prevalent on the market. A gas pressure accumulator  
10 is provided when compressed gas is used.

The manufacturers of extinguishing systems of this kind favour the compressed gas variant, at least where high-pressure systems are concerned, because in this case the intrinsic energy of the pressurised gas is utilised and there is no requirement for any mechanical, susceptible pumps. High-pressure cylinders at a pressure of approximately  
15 200 bar are preferably used for the gas pressure accumulator in order to save space. The disadvantage of this lies in the possibility of a massive water hammer with pressure peaks exceeding 200 bar loading the line system and, in particular, the water tanks upon starting the extinguishing or flooding operation. However the pressure at the nozzles simultaneously drops quickly during flooding, which has an influence on the extinguishing  
20 action.

As shown by practical experience and theoretical knowledge, certain extinguishing parameters, in particular the nozzle pressure and, linked with this, the diameter and speed of the drops, have a substantial influence on the extinguishing action. It is therefore essential, with regard to the extinguishing action, to know the interrelationships between  
25 the extinguishing parameters and then select them accordingly.

In a process described in EP-A-0 661 081 for optimising the extinguishing agent consumption and/or extinguishing time the extinguishing parameters are determined by means of methods relating to thermodynamics and fluid mechanics. Here the development of the fire gas flow and the behaviour of drops of water emerging from a

nozzle in this fire gas flow are firstly established and the properties of the drops of water which are required for the extinguishing operation are calculated from the interrelationships between drop speed, drop size and drop evaporation. Finally, the equipment parameters pressure, water throughput and pipeline dimensions are adapted  
5 so as to produce the desired drops of water.

The object of the invention is to indicate a process of the type initially mentioned which enables the extinguishing action to be optimised through simple regulation of the drop size.

This object is achieved according to the invention in that the pressure propelling the water  
10 is selected such that the nozzle pressure necessary for the required drop size is obtained.

A first preferred embodiment of the process according to the invention is characterised in that a pressurised gas is used as propellant and the nozzle pressure is set by throttling the propelling compressed gas.

A second preferred embodiment of the process according to the invention is characterised  
15 in that the drop size which is to be set at the nozzles is calculated from the size of a given fire and the arrangement of the nozzles in relation to the fire, from which drop size the nozzle pressure is calculated, and that the line diameter and throttling of the propelling compressed gas are calculated from the nozzle pressure.

In the process according to the invention the required nozzle pressure is therefore firstly  
20 calculated and this nozzle pressure is then set by throttling the propelling compressed gas. Because of the phenomenon of the critical flow of compressible media, the action of throttling the propelling compressed gas maintains the delivery pressure constant for as long as possible during extinguishing. According to this phenomenon, the speed in the throttle member cannot be greater than the speed of sound and is therefore independent  
25 of the propelling pressure difference, as long as this does not fall below a certain minimum value.

Further advantages of the process according to the invention lie in the fact that a dangerous water hammer in the line system is prevented, that the water-carrying lines and the water tanks need not exhibit any high-pressure quality, and that the drop  
30 spectrum and the drop speed at the nozzles can be calculated for optimum extinguishing action.

11 August 2004

The invention is explained in detail in the following on the basis of an embodiment which is represented in the single drawing; this embodiment is a schematic representation of an extinguishing system according to the invention, in which the propellant which is used for the extinguishing water is a pressurised gas, for example nitrogen.

As represented, the extinguishing system consists of a line system 1 with nozzles 2, which are provided for discharging extinguishing water in the form of droplets or spray mists.

The extinguishing water is stored in tanks 3 of a water storage device 4, to which the line system 1 is connected. The extinguishing system also comprises a propellant for delivering the water from the storage device 4 to the nozzles 2. As represented, this propellant is a gas pressure accumulator 5.

The gas pressure accumulator 5 consists of a number of high-pressure gas cylinders 6, in which, for example, nitrogen is stored under a pressure of 200 bar. The high-pressure gas cylinders 6 are connected via valves 7 to a pressure line 8 leading to the water storage device 4. The pressure line 8 opens into the individual water tanks 3 and, under the action of high-pressure gas, forces the water out of the tanks 3 into the line system 1 and thus to the nozzles 2. The pressure line 8 is acted upon by high-pressure gas by opening the valves 7, this being initiated in the case of a fire by a corresponding signal from a fire alarm 9 or a central extinguishing unit 10, which is controlled by the fire alarm 9 in the latter case. It is of course also possible to manually initiate the extinguishing operation.

- 10 In the region of the gas pressure accumulator 5 the pressure line 8 contains an orifice plate or throttle 11, through which the delivery pressure in the pressure line 8 and therefore also in the line system 1 is throttled to an optimum nozzle pressure lying, for example, in the range from approximately 10 to 40 bar.

It is possible, through the arrangement of the throttle 11, to utilise the phenomenon of the critical flow of compressible media through nozzles to maintain the delivery pressure as constant as possible during extinguishing. The delivery pressure only changes slowly and guarantees optimum nozzle pressure during the decisive extinguishing or flooding phase. The pressure reduction effected by the throttle 11 prevents any dangerous water hammer from occurring upon opening the valves 7 in the line system 1 and at the nozzles 2. It is also possible to use materials which do not have to exhibit any high-pressure quality for the line system 1 and the water tanks 3.

The throttle 11 is designed when installing the extinguishing system so as to obtain the optimum pressure at the nozzles 2. This design takes place as follows: In a first step the number and arrangement of required nozzles 2 are determined from the dimensions of the space provided for the extinguishing system and from a given fire, after which the development of the fire gas flow, in particular the rate of ascent and temperature of the fire gases, is determined on the basis of a fire model in accordance with the rate of burning, the manner of burning, the area of the fire and the room height. The behaviour of water drops after being discharged from the nozzles 2 is then described by means of these values and the speed and evaporation of the drops established as a function of the room height, from which the drop size and drop speed values which are optimum for extinguishing are determined.

11 August 2004

The dimensions of the lines (line system 1) and the setting of the throttle 11 are then calculated in a second step from the optimum drop size and drop speed values now obtained.

**Claims**

11 August 2004

1. Process for optimising a water spray extinguishing systems which comprises a water storage device (4), a line system (1) with nozzles (2) which is connected to the latter and a propellant for delivering the water to the nozzles (2) characterised in that the pressure propelling the water propellant pressure is selected such that the nozzle pressure necessary for the required drop size is obtained.
2. Process according to Claim 1, characterised in that a pressurised gas is used as propellant and the nozzle pressure is set by throttling the propelling compressed gas.
3. Process according to Claim 2, characterised in that the drop size which is to be set at the nozzles (2) is calculated from the size of a given fire and the arrangement of the nozzles (2) in relation to the fire, from which drop size the nozzle pressure is calculated, and that the line diameter and throttling of the propelling compressed gas are calculated from the nozzle pressure.