An assessment of performance vs reliability of electronics vs mechanical systems

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Yusuf Muhammad is a director of Plumis, an innovative British engineering company that develops intelligent fire suppression systems that detect fire earlier, activate faster and deliver better outcomes for people and property. An engineer and the original inventor of Automist, Yusuf has won numerous design awards including the James Dyson Award, the Toyota IQ Design Challenge, the prestigious Red Dot and the Transport Design of the Year by the Design Museum. Yusuf is committed to reducing the number of fire deaths and injuries in the home by providing councils and housing associations with an intelligent approach to fire safety.

Abstract

[*Background*] There has been extensive research indicating the need for a residential suppression system that would activate faster than traditional mechanical systems as to ensure the survivability of the occupant in the room of origin. The concern has always been that a system which is more complex than the simple mechanical trigger of a frangible bulb would result in a much lower reliability, and this availability, negating its use: “too many things to go wrong”.
[*Objective*] The aim of this study was to determine how much faster an electronic system could activate compared to a concealed sprinkler and to determine what level of availability the system would require in order to achieve the same “overall life safety outcome” of a traditional system.
[*Method*] A series of fire tests with different fire loads were carried out with sprinklers as well as with electronically controlled nozzles as to characterise their response time. Some of these were standard BS 8458 fires while some were stylised of concealed fridge fires. Their responses were normalised into a B-risk fire engineering model. The model was then used to develop an open plan flat scenario to assess the tenability limits for occupants escaping that open plan flat depending on a wide variety of fires and the suppression systems used. The output of this exercise was a required level of availability for the electronic nozzle for it to have the same life safety capability as the concealed sprinkler. Simultaneously, a reliability study was carried out to show what the expected reliability of the electronic system would be depending on some key variables such as “remote monitoring”, “maintenance frequency” and “electronics reliability”.
[*Results*] The experiments showed that the electronic system activated between 2 to 13 times faster than a traditional mechanical system. For the simulated open plan flat, that resulted in a required availability of only 42% to have the same overall life safety capability of a concealed sprinkler. The electronic system availability, on the other hand, resulted in a range of 33% to 87% depending on some of the key variables.

KEYWORD: electronically operated water mist systems, availability, reliability, residential, concealed sprinklers.