

Analysis of Factors Influencing the Response Time of an Aspirating Gaseous Agent Concentration Detection Method

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Abstract : Gas fire extinguishing system is widely used due to its cleanliness and efficiency, and since its spray will be affected by many factors such as convection and obstacles in jetting region, so in order to evaluate its effectiveness, detecting concentration distribution in the jetting area is indispensable, which is commonly achieved by aspirating concentration detection technique. During the concentration measurement, the response time of detector is a very important parameter, especially for those fire-extinguishing systems with rapid gas dispersion. Long response time will not only underestimate its concentration but also prolong the change of concentration with time. Therefore it is necessary to analyze the factors influencing the response time. In the paper, an aspirating concentration detection method was introduced, which is achieved by using a small critical nozzle and a laminar flowmeter, and because of the response time is mainly related to the gas transport process from sampling site to the sensor, the effects of exhaust pipe size, gas flow rate, and gas concentration on its response time were analyzed. During the research, Bromotrifluoromethane (CBrF_3) was used. The effect of the sampling tube was investigated with different length of 1, 2, 3, 4 and 5 m (5mm in pipe diameter) and different pipe diameter of 3, 4, 5, 6 and 8 mm (3m in length). The effect of gas flow rate was analyzed by changing the throat diameter of the critical nozzle with 0.5, 0.682, 0.75, 0.8, 0.84 and 0.88 mm. The effect of gas concentration on response time was studied with the concentration range of 0-25%. The result showed that the response time increased with the increase of both the length and diameter of the sampling pipe, and the effect of length on response time was linear, but for the effect of diameter, it was exponential. It was also found that as the throat diameter of critical nozzle increased, the response time reduced a lot, in other words, gas flow rate has a great influence on response time. For the effect of gas concentration, the response time increased with the increase of the CBrF_3 concentration, and the slope of the curve was reduced.

Keywords : aspirating concentration detection, fire extinguishing, gaseous agent, response time

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