水喷雾灭火系统水喷淋现象的原因及防治措施

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提要 水喷雾灭火系统可用于可燃液体火灾和电气火灾,由于其独特的灭火特点,也由于《建规》和《高规》局部修订时,在条文中有具体规定,水喷雾灭火系统日益受到重视并广为应用。但水喷雾灭火系统在运行中普遍存在的水喷淋现象影响了水喷雾灭火系统的应用,就其原因及防治措施论述了个人观点。

关键词 水喷雾灭火系统 水喷淋现象 水雾喷头 稳高压给水系统 紧急开启阀

水喷雾灭火系统和自动喷水灭火系统(以下简称水喷淋)两者灭火机理不同、灭火对象不同、喷头设置位置不同、喷头型式不同,是两种完全不相同的灭火系统。水喷雾灭火系统是利用水雾喷头在一定水压下将水流分解成细小水雾滴进行灭火或防护冷却的一种固定式灭火系统。水雾喷头喷出粒径小于1mm的雾状水,除可用于扑救固体火灾,还可用于扑救闪点高于60 ℃的液体火灾和油浸式电气设备的火灾。水喷雾灭火系统可以应用的场所正是水喷淋的禁区。而现在的问题是水喷雾灭火系统出现了水喷淋现象,从喷头喷出的不是雾化水、雾状水,而是粒径大于1mm的水滴。水喷淋现象导致灭火系统不仅不能扑灭可燃液体火灾和电气火灾,反而造成火势的蔓延,因此对于水喷雾灭火系统的水喷淋现象必须认真对待。

1 水喷淋现象的原因

水喷雾灭火系统的水喷淋现象,究其原因有以下几种情况:

1.1 喷头选用不当

水喷雾灭火系统应采用水雾喷头,按不同场所分别选用:离心雾化型水雾喷头——用于扑救电气火灾;防腐型水雾喷头——用于腐蚀性环境;有防尘罩水雾喷头——在有粉尘场所设置。

水雾喷头的特点是在一定水压下,利用离心或撞击原理,将水分解成细小水滴的喷头。只有采用水雾喷头,才能达到水滴雾化的目的,绝对不能用水喷淋系统的开式喷头。水雾喷头是水喷雾灭火系统的关键部件,按规定产品应经国家消防产品质量监

$$P_{S_1} = P_2 + 0.02 = 0.488(\text{MPa},\text{绝压})$$

则稳压泵启动压力下罐内的空气容积 V_{S_1}:

$$V_{S_1} = \frac{P_2}{P_{S_1}} V_2 = \frac{0.468}{0.488} \times 0.986 = 0.946(\text{m}^3)$$

计算时,气压罐的工况还应满足以下条件:

稳压泵的停泵压力 P_{S_2} 按 $P_{S_2} = P_{S_1} + 0.05\text{MPa}$ 取值,同时应符合稳压水容积 $V_S = V_{S_1} - V_{S_2}$ 不少于 0.05m^3 的规定。

据此继续计算:

$$P_{S_2} = P_{S_1} + 0.05 = 0.538(\text{MPa},\text{绝压})$$

$$V_{S_2} = \frac{P_{S_1}}{P_{S_2}} V_{S_1} = \frac{0.488}{0.538} \times 0.946 = 0.858(\text{m}^3)$$

$$V_S = V_{S_1} - V_{S_2} = 0.946 - 0.858 = 0.088(\text{m}^3) > 0.05(\text{m}^3)$$

如不满足要求,可调整气压罐规格重新计算。

对于气压罐与稳压泵放在低处的情况,系统稳压工作压力较高,为了避免系统工作压力过高或超压,在计算时一般宜将 $P_{S_1} - P_1$ 值控制在0.2MPa以内。

本例气压罐选用「1 000 ×2 180mm是合理的,需要时可算出各种工况下罐内水位 h_1、h_2、h_3、h_4 的值。

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督检测中心检测合格才能使用。因为不符合国家标准的产品,也不能将水雾化,因此喷头选用得当是第一要素,对选用的喷头一定要正确、合格、慎重。

1.2 压力规定

《水喷雾灭火系统设计规范》(GB50219 - 95)第3.1.3条规定:"水雾喷头的工作压力,当用于灭火时不应小于0.35MPa;……"。该压力为最低工作压力,一般来说水雾喷头均须在一定工作压力下才能使出水形成雾化状态。对一种水雾喷头而言,工作压力愈高其出水的雾化效果愈好,而在相同的喷雾强度下,雾化效果好有助于提高灭火效率。因此压力保证至关重要,实践证明我国的水雾喷头当压力大于或等于0.35MPa时,能获得良好的雾化效果,满足灭火的要求。在工程设计时,对水喷雾灭火系统最不利点喷头确定压力后,应详细计算管网水头损失,推及水泵扬程,以确保工作压力值。

1.3 系统启动方式选择

水喷雾灭火系统应设有自动控制、手动控制和应急操作三种控制方式。一般认为控制方式和雨淋系统等同。因为两者性质相近,都为开式喷头,都为开式系统,使用时喷头同时工作。

自动控制:系指水喷雾灭火系统的火灾探测、报警部分与供水设备、雨淋阀组等部件自动联锁操作的控制方式;手动控制:系指人为远距离操纵供水设备、雨淋阀组等系统组件的控制方式;应急操作:系指人为现场操纵供水设备、雨淋阀组等系统组件的控制方式。

三种控制方式以自动控制方式为主。自动控制方式包括火灾探测器或闭式喷头等,我们认为应推荐火灾探测器。原因之一是闭式喷头设置在被保护设备的上方,当感受热气流时,玻璃球破碎,闭式喷头喷出的不是水雾而是水滴,由此而造成水喷淋现象,尽管雨淋阀的传动管管径较小,闭式喷头喷出的水量有限,但还是会造成一些不良后果。因此,优先推荐采用火灾探测器(缆式线型定温火灾探测器、空气管式感温火灾探测器)。

1.4 水泵低速状态运行

水喷雾灭火系统设于室内,一般采用临时高压给水系统,系统所需流量和压力由消防水泵提供并保证,水泵由静止状态至正常工况,有一个转速递增过程,按《消防泵性能要求和试验方法》(GB6245 - 1998)的规定,启动时间为20s,消防泵达到额定工况。即从0至额定转速(2 900 r/min或1 450 r/min),所需的时间为20s。当水泵机组采用变频调速装置时,该运行时间有时会更长,可达2～3min。在额定转速时,供水压力为设计压力;在未达到额定转速时,供水压力必然低于设计压力。喷头出水难以雾化,导致水喷雾灭火系统出现水喷淋现象。

2 防治措施

在以上四个原因中,前三种情况一般会被重视,较易防止。而后一种情况,由于属于运行过程中出现的问题,往往容易忽视。而这种情况,出现频率又高于其他情况,尽管时间很短,但也会造成一定后果,因此更须认真对待。防治措施可采用下列方法之一:

(1)采用稳高压给水系统,稳高压给水系统平时由稳压装置(稳压泵或稳压罐)保持管网所需压力、消防时由消防主泵提供消防所需的流量和压力,只要将消防管网的压力设定值确定在水喷雾灭火系统为保证雾化效果所要求的最低工作压力以上,则无论是稳压泵的启动,还是消防主泵的启动都不会出现因压力值偏低而造成的水喷淋现象。

(2)采用紧急开启阀控制。紧急开启阀为水力控制阀之一。启动方式和性质相近于泄压阀,但两者设置位置、作用和功能不同。泄压阀设置在水泵供水管的旁通管上,用以防止超压,在压力超过设定值时开启、以释放压力,出水可回流至消防水池;而紧急开启阀则装在水泵出水管上,在压力超过设定值时,才开通消防管道,将满足水压要求的消防用水供到喷头处。未达到要求水压时,紧急开启阀处于关闭状态。这种做法虽然与消防阀门在一般情况下要求开通的做法不相一致,但由于水力控制阀的可靠性,还是可行的。

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Abstract: The fire water system design of Shenzhen Convention & Exhibition Center (SZCEC) was discussed and expounded by sixteen well-known Chinese fire experts. The specialists suggested that the water jet nozzle system should be installed in-door with height above l3 meters, the water flowrate should be calculated according simultaneous operation of two jet nozzles at the same time, the fast response automatic sprinkler systems should be adopted in remaining areas, and that the water volume in storage pool should be enlarged accordingly.

Abstract: Pneumatic water system is widely applied in fire water system. The suitable sphere of this system is discussed on the basis of design norm and practices and the common problems of the available integral products are indicated. The selection and calculation of pneumatic containers are presented with practical examples.

Abstract: The water spraying fire system is suitable for fire accidents caused by fluid fuel or by electrical appliances. Due to its special features and the related clauses formatted in the partly revised national norms of building fire system and fire system of high rise building, it is widely used. The often-appeared phenomenon of water sprinkle in operation of water spraying system causes troubles. The causes and prevention of this phenomenon are described in this paper.

Abstract: Cross connection is inevitable in drinking water lines, so the water pollution caused by counter flow must be prevented as possible for the water quality protection. In this paper the function, installation of counter flow preventor and resulted changes in the pipeline layout are described.

Abstract: As the interface of room floor and building sewer system, the quality of the drainers is the key factor to conserve the in-door air environment. The technical attentions to develop new floor drainers are proposed on the basis of investigation on recent status of drainer application. Some new types are recommended.

Abstract: A prepared fold section of river-crossing pipeline in size of *DN*820 ×12 was sunken into the pre-excavated trench integrally for the Nanjiang Waterworks in Guigang city. The execution of this works including the welding, consolidation and anti-corrosion treatment of the pipeline, floating carriage, allocation, water injection and sinking of the integral pipeline into the trench are described in details in this paper.

Abstract: The development of plastic pipes used for building hot and cold water system is introduced and three of them namely PAP pipe, PE-X pipe and PP-R pipe are compared. The applied features of them are summarized.

Abstract: The external factors that interfere the reliability of the automatic control system of WTP and their prevention measures are presented. The effect of the described anti-interference measures has been approved in practices.

Abstract: Database, a software system with functions of data storage, management, treatment and maintenance is the core of modern computing structure. Established hydraulic database for water supply networks incorporated all the network related manipulations including the hydraulic calculation, operation monitoring, dispatching, performance, optimum design and drawing and plotting to a full integrality. It is very beneficial for the modern water distribution networks management.

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