

论民用建筑中标准喷头的布置

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摘 要 本文对民用建筑中常用的标准喷头的布置形式、间距等问题进行探讨,提出宜按喷头实际工作压力并结合结构柱网确定喷头间距和布置形式。

关键词 喷水灭火系统 工作压力 标准喷头

自动喷水灭火系统(以下简称自喷系统)自喷系统设计的重要内容之一就是合理布置喷头。本文就此问题进行探讨。

1 喷头布置形式

喷头布置形式在设计中除正方形布置外常用的还有长方形、菱形等,究竟采用那种形式好呢?笔者认为宜按喷头实际工作压力并结合结构柱网布置形式确定。这样布置的优点是:既能满足规范要求的喷水强度又能灵活适应建筑分隔的变化,对地下车库及一些不设吊顶的房间又可将喷头布置在主梁分格中,从而提高了建筑的使用空间。

2 喷头布置间距及间距范围

《自动喷水灭火系统设计规范(GBJ84-85)》以下简称“喷规”第 4.1.1 条规定,中危险级建筑喷头布置的最大水平间距为 3.6 m,条文中没有注明这是在最不利点喷头的工作压力为 9.8×10^4 Pa,作用面积内平均喷水强度为 $6 \text{ L/min} \cdot \text{m}^2$ 的条件下定出的间距,因而造成民用建筑中出现不少喷头靠柱布置,并在柱周围形成不被喷水覆盖的空白,对灭火十分不利。产生这种现象的原因就是设计(或施工)忽视了规范规定 3.6 m 间距的特定条件,没有考虑到结构柱距对喷头布置的影响,这种作法应用在仅布一排喷头的走道就更值得研究。

2.1 喷头间距与系统工作压力的关系

“喷规”第 5.1.4 条给出喷头喷水量计算公式:

$$Q = K \sqrt{P/9.8 \times 10^4} \quad \dots\dots(1)$$

式中:Q —— 喷头出水量, L/min;

K —— 喷头特性系数(当喷头公称直径为 15 mm 时, $K=80$);

P —— 喷头工作压力, Pa。

当喷水量确定以后根据规范给出的中危险级建筑的设计喷水强度为 $6 \text{ L/min} \cdot \text{m}^2$,即可算出一个喷头的保护面积为:

$$F = Q/6(\text{m}^2) \quad \dots\dots(2)$$

由公式(1)、(2)可知,喷头前作用水头越大,喷水量越大,保护面积越大,喷头的喷水半径亦大,喷头的布置间距即可随之加大。

2.2 正方形布置的喷头间距与系统的压力关系

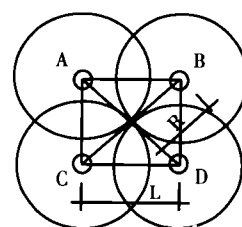


图 1 喷头的正方形布置

如图 1,在喷头 ABCD 组成的正方形中,喷头的间距为(R 为喷头喷水覆盖半径):

$$L = \sqrt{2} R \quad \dots\dots(3)$$

根据式(1)、(2)、(3)可计算不同工作压力的喷头布置间距。

当喷头的计算水压为 9.8×10^4 Pa 时,喷头的出水量 $Q = K \sqrt{P/9.8 \times 10^4} = 80 \text{ L/min}$ 。

按“喷规”要求,民用建筑的设计喷水强度为 $6 \text{ L/min} \cdot \text{m}^2$,则一个喷头的保护面积 $F = Q/6 = 80/6 = 13.33(\text{m}^2)$,喷头间距 $L = \sqrt{F} = 3.65(\text{m})$ 取 3.6 m。由(3)式可知,喷水半径 $R = L/\sqrt{2} = 2.5(\text{m})$ 。

依次类推得出表 1 的结果。

表 1 系统压力与喷头间距的关系

喷头工作压力	MPa	0.05	0.10	0.15	0.20	0.25
喷头出水量	L/min · 只	56	80	97	113	126
喷头保护面积	$\text{m}^2/\text{只}$	9	13	16	18	21
喷头间距	m	3.0	3.6	4.0	4.3	4.6
计算喷水半径	m	2.1	2.5	2.8	3.0	3.2

从上表看出,喷头布置间距可视系统的设计压力定。实际上,除最不利点喷头外,其余喷头的实际工作压力、流量及喷水半径都超过计算值。因此,在满足规范喷水强度要求下,可以根据实际工作压力适当调整喷头布置间距,既安全又经济。

2.3 正方形布置喷头的间距范围

在自喷系统的设计中,喷头的布置既要适应建筑分隔与结构柱距的变化,又必须确保保护面积内的喷

设置自动喷水灭火系统保护防火卷帘的探讨

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摘 要 作者根据国家现行规范的要求,对防火卷帘设置自动喷水灭火系统的喷头类型、间距、喷头与卷帘的距离及管网连接方式、管网工作压力、用水量计算等问题进行了讨论。

关键词 防火卷帘 喷头 工作压力

在现代许多公共建筑中,较多地使用防火卷帘代替防火墙,比如大型商场、展览楼、综合楼等。由于防火卷帘耐火性能较低,用自动喷水灭火系统对其进行降温保护,可以使防火卷帘耐火性能明显提高,确保阻火的可靠性。现就用于防火卷帘保护的自动喷水灭火系统的设置作一些探讨。

1 国家规范对系统设置的规定

a) 《建筑设计防火规范》(GBJ 16—87)第 8.7.2 条,“下列部位应设水幕设备:……;三、防火卷帘或防火幕的上部。”

b) 《高层民用建筑设计防火规范》(GB 50045—95)第 5.4.4 条,“采用防火卷帘代替防火墙时,其防火卷帘应符合防火墙耐火极限的判定条件或在其两侧应设闭式自动喷水灭火系

统,其喷头间距不应小于 2.0 m。”

c) 《自动喷水灭火系统设计规范》(GBJ 84—85)第 2.0.3 条,“水幕系统的用水量应符合下列要求:一、当水幕作为保护作用或配合防火幕和防火卷帘进行防火隔断时,其用水量不应小于 0.5 L/s·m……”

从国家规范关于用于保护防火卷帘的自动喷水灭火系统设置的立意来看,主要有以下五层意思:

a) 采用复合型防火卷帘代替防火墙,其耐火极限符合防火墙耐火极限的判定条件,可以不设置用于保护防火卷帘的自动喷水灭火系统。

b) 当防火卷帘的耐火极限小于防火墙耐火极

水量和喷水强度。而喷水强度是衡量系统能否满足控火灭火的重要尺度,因此“喷规”第 7.1.1 条(二)明确规定:对轻、中危险级建筑在进行系统水力计算时,应保证作用面积内平均喷水强度不小于表 2.0.2 的规定(对民用建筑喷水强度为 6 L/min·m²),但其中任意四个喷头组成的保护面积内的平均喷水强度不应大于也不应小于规定值的 20%,我们可以由此推算出喷头布置的间距范围。

从图 1 可知:A、B、C、D 四个喷头组成的正方形中的喷水强度为:

$$q=Q/L^2 \quad \dots\dots(4)$$

式中:Q——正方形 ABCD 面积的喷水量(前已述及相当于一个喷头的喷水量);

L——正方形边长(即喷头间距)。

按“喷规”上述条文规定有下列不等式成立(民用建筑 $q=6$ L/min·m²):

$$6 \times (1-20\%) \leq q \leq 6 \times (1+20\%) \quad \dots\dots(5)$$

将(4)代入(5)得

$$6 \times 80\% \leq Q/L^2 \leq 6 \times 120\% \quad \dots\dots(6)$$

$$\text{解(6)得 } 4.8 \leq Q/L^2 \leq 7.2 \quad \dots\dots(7)$$

$$\text{解(7)得 } \sqrt{Q/7.2} \leq L \leq \sqrt{Q/4.8} \quad \dots\dots(8)$$

现将几种常用水压作用下喷头的喷水量分别代入(8),即可求出喷头布置间距的范围,结果如表 2:

表 2 系统压力与喷头间距范围的关系

喷头工作压力 MPa	0.05	0.10	0.15	0.20	0.25
喷头喷水量 L/min	56	80	98	113	126
喷头布置间距 m	$2.8 \leq L \leq 3.4$	$3.2 \leq L \leq 4.0$	$3.6 \leq L \leq 4.5$	$3.9 \leq L \leq 4.8$	$4.1 \leq L \leq 5.1$

3 结 论

合理布置喷头是自动喷水灭火系统设计安全与经济的关键。在民用建筑中,影响喷头布置的因素很多,设计时,必须根据工程实际情况,在满足规范要求的喷水强度的条件下,按喷头的实际工作压力,结合建筑分隔与结构柱网布置,确定喷头布置形式与间距,以期安全、实用与经济。

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Fire theory study

Study on the Heat Release Rate of Underground Mall fire Lan Bin etc. (4)

Abstract: By studying the fuel mass release rate and the flow rate of the smoke at the vent, the paper gives the relationship between the heat release rate and smoke amount in the small fire test, so that the heat release rate of the underground mall fire in the full-scale fire test is attained.

Key words: heat release rate, fire, underground mall, smoke

Study on Flash Point Calculation Huang Chao etc. (10)

Abstract: The regularity about the flash point of inflammables is studied in this paper. Based on the law that the vapor combustion heat at flash point varies with carbon quantity, we get the calculating equations about the flash point of alkane, alcohol, aldehyde and alkene. The average error of such calculating is only 0.176, which is respectively 1/8 and 1/104.4 of the original formula average error.

Key words: flash point, calculation, flammables

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Abstract: The properties and technical process for producing the light incombustible wallboard is introduced, and an equation of the relation between fire resistant limit and the thickness of wallboard is obtained by the experiment.

Key words: light incombustible wallboard, non-combustibility, fire resistant limit

The Principles of Drafting the Standard of Foam Fire Extinguishing Agent Zhao Dejun etc. (14)

Abstract: The authors have been engaged in the studying of the foam fire extinguishing agent and the drafting of the standard for many years. The paper puts forward the six principles which must be followed in the drafting of the standard of foam fire extinguishing agent.

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Abstract: The paper puts forward a viewpoint, i.e. how to further define the personnel amount and evacuation time, synthetically calculate the amount and width of the emergency exit in the fireproof design of the safety evacuation system, and make the safe evacuation design more flexible and rational.

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Discussion on Design Method for Smoke Control and Ventilation in Atrium Building Zhu Ming (24)

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Key words: garage, underground garage, smoke ventilation.

Fire Protection Design in the Department Stores with Open Atrium Chen Dongming etc. (30)

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Discussion on the Application of Dry Powder Fire Extinguishing System Song Xudong etc. (36)

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Key words: dry powder fire extinguishing system, fire extinguishing equipment, design application amount.

The Configuration of the Normal Sprinkler heads in Civil Buildings Huang Ziqin etc. (41)

Abstract: The paper discusses the configuration and spacing of the normal sprinkler heads in the civil buildings, and puts forward that the spacing and configuration of the heads should be determined by the actual work pressure and structure net.

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Key words: fire shutter, sprinkler head, fire hydrant system

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Study and Application of Wrapped up Phosphorus Fire Retardant Wu Yong etc. (47)

Abstract: The paper introduces the developing properties and fire retardant mechanism of the red phosphorus fire retardant. It also points out the necessity of capsulation of the red phosphorus. The treatment method and application range of the wrapped up red phosphorus are summarized.

Key words: red phosphorus, fire retardant, surface treatment

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