

**CALCULATION SHEET FOR FIRE SPRINKLER AND HYDRANT SYSTEM PUMP**  
**LOCATION : BASEMENT 1**

**I - Flow rate calculation:**

- + According TCVN 7336 :2003 use category Ordinary Hazard Group III
- + Area of sprinkler operation shall be: 360 m<sup>2</sup>
- + Density design: 0.3 l/s.m2
- + Water flow requirement for sprinkler: 108 l/s
- + No. of sprinkler calculated: 30 nos
- + Minimum Sprinkler head Flow: 3.6 l/s
- + K factor Sprinkler head: 8.0 [G/min(psi)<sup>1/2</sup>] = 6.078 [L/s.(MPa)<sup>1/2</sup>]
- + Minimum pressure Sprinkler head Pt: 0.35077 Mpa  $P_t = (Q/K)^2$

**II. Presure drop calculation (Follow TCVN7336-2021):**

1. The calculated water expense Q, going through sprinkler shall be calculated as following formula:

$$Q = K \cdot \sqrt{P_t} \quad (\text{l/s}) \quad (\text{flow item B.2.2 TCVN 7336-2021})$$

Where:

- + K-is water expense coefficient through sprinkler [l/s.(MPa)<sup>1/2</sup>]
- + Pt-is free pressure before sprinkler (MPa)

2. Friction loss formula P<sub>i</sub>:

$$P_i = P_{1-2} = \frac{Q_{1-2}^2 \cdot L_{1-2}}{100 \cdot K_T} \quad (\text{MPa})$$

Where:

- + P<sub>i</sub> - frictional resistance in MPa per meter of pipe.
- + P<sub>e</sub> - elevation pressure (Mpa)
- + Q - flow in l/s
- + L - length pipe (m)
- + K<sub>T</sub> flow talbe B.2 TCVN 7336:2021

**HYDRAULIC CALCULATION - FIRE SPRINKLER AND HYDRANT SYSTEM PUMP - FOLLOW DWG ISOMETRIC OF THE FIRE PUMP**

Node	Flow-(l/s)		Head	Pipe size		Velocity (m/s)	Pipe Length L (m)	K <sub>T</sub>	Required (MPa)		Notes	
				Diameter Nominal (mm)	Internal Diameter (mm)							
1-2	q	3.600	1	25	27.9	5.89	3.5	3.650	Pt	0.3507704	q =	3.60000
									Pe			
	Q								P <sub>i</sub>	0.1242740	P =	0.475044
2-3	q		2	32	36.7	7.37	3.5	16.500	Pt	0.4750443	q =	4.18946
									Pe			
	Q	7.789							P <sub>i</sub>	0.1287060	P =	0.603750
3-4	q		3	32	36.7	11.83	3.5	16.500	Pt	0.6037504	q =	4.72302
									Pe			
	Q	12.512							P <sub>i</sub>	0.3321016	P =	0.935852
4-5	q		4	40	42	13.28	3.5	34.500	Pt	0.9358519	q =	5.88023
									Pe			
	Q	18.393							P <sub>i</sub>	0.3431947	P =	1.279047
5-6	q		5	50	54	11.04	3.5	135.000	Pt	1.2790467	q =	6.87439
									Pe			
	Q	25.267							P <sub>i</sub>	0.1655180	P =	1.444565
6-7	q		6	50	54	14.23	1.3	135.000	Pt	1.4445647	q =	7.30566
									Pe			
	Q	32.573							P <sub>i</sub>	0.1021689	P =	1.546734
7-14	q		6*(1/2)	125	132	1.19	3	16940.000	Pt	1.5467336		
									Pe			
	Q	16.286							P <sub>i</sub>	0.0004697	P =	1.547203
Nhánh xuất phát tại nút 14 có đặc tính giống với nhánh xuất phát tại nút 7:												
Balancing at No14/ Cân bằng tại nút 14												
	No14-7		Q=	16.29								
	No14-13		Q=	32.58								

Mạch  
vòng  
Q=Q/2

		No14	Q=	48.86	I/s @	1.54720	MPa											
14-21	q		6+6*(1/2)	125	132	3.57	3	16940.000	Pt	1.5472034								
									Pe									
	Q	48.864							P <sub>i</sub>	0.0042285								
											P =	1.551432						
Nhánh xuất phát tại nút 21 có đặc tính giống với nhánh xuất phát tại nút 7, 14:																		
Balancing at No21/ Cân bằng tại nút 21																		
		No21-14	Q=	48.86														
		No14-13	Q=	32.62														
		No14	Q=	81.49	I/s @	1.55143	MPa											
21-22	q		12+6*(1/2)	125	132	5.96	27	16940.000	Pt	1.5514319								
									Pe									
	Q	81.486							P <sub>i</sub>	0.1058326								
											P =	1.657264						
22-23	q	5.000	12+6*(1/2) ) + 1HYD	125	132	6.32	184	16940.000	Pt	1.6572645			Tủ vách tường 5l/s					
									Pe	0.1200000	(Chiều cao 12m)							
	Q	86.486							P <sub>i</sub>	0.8124545								
											P =	2.589719						
+Water flow requirement :																		
								172.973	I/s	=	10378.36	l/min						
+Pump head :												2.590	Mpa					
+Safety margin:												1.20						
+Pump head requirement:												3.108	Mpa					
+ Pump capacity:												10,378	I/min	@	3.108	Mpa	31.08	Bar