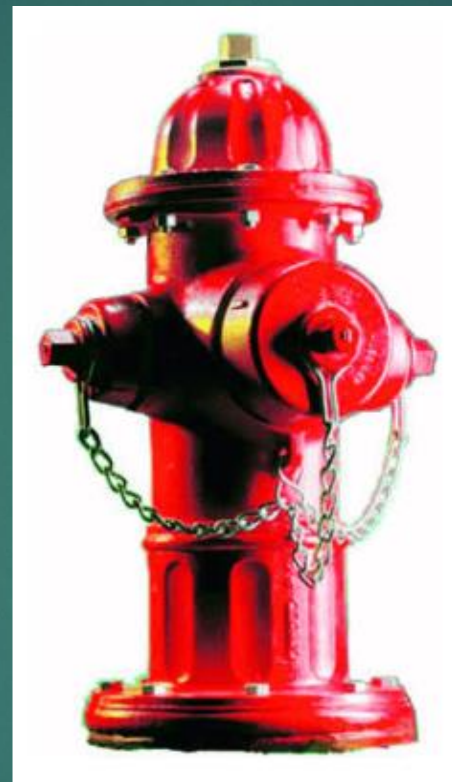
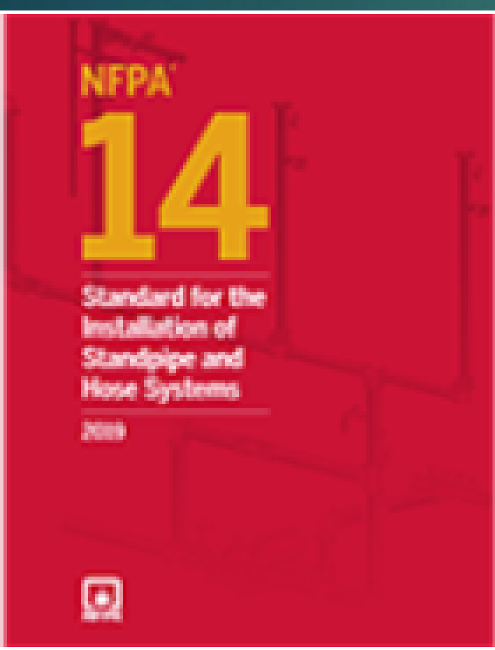
FIRE HYDRANT SYSTEM





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Standards & Codes of Fire Hydrants

The following norms and standards are used as design recommendations for fire hydrant systems:

- NFPA 14
- NFPA 20
- NFPA 25
- AWWA
- BS EN 14384
- BS 750

INTRODUCTION

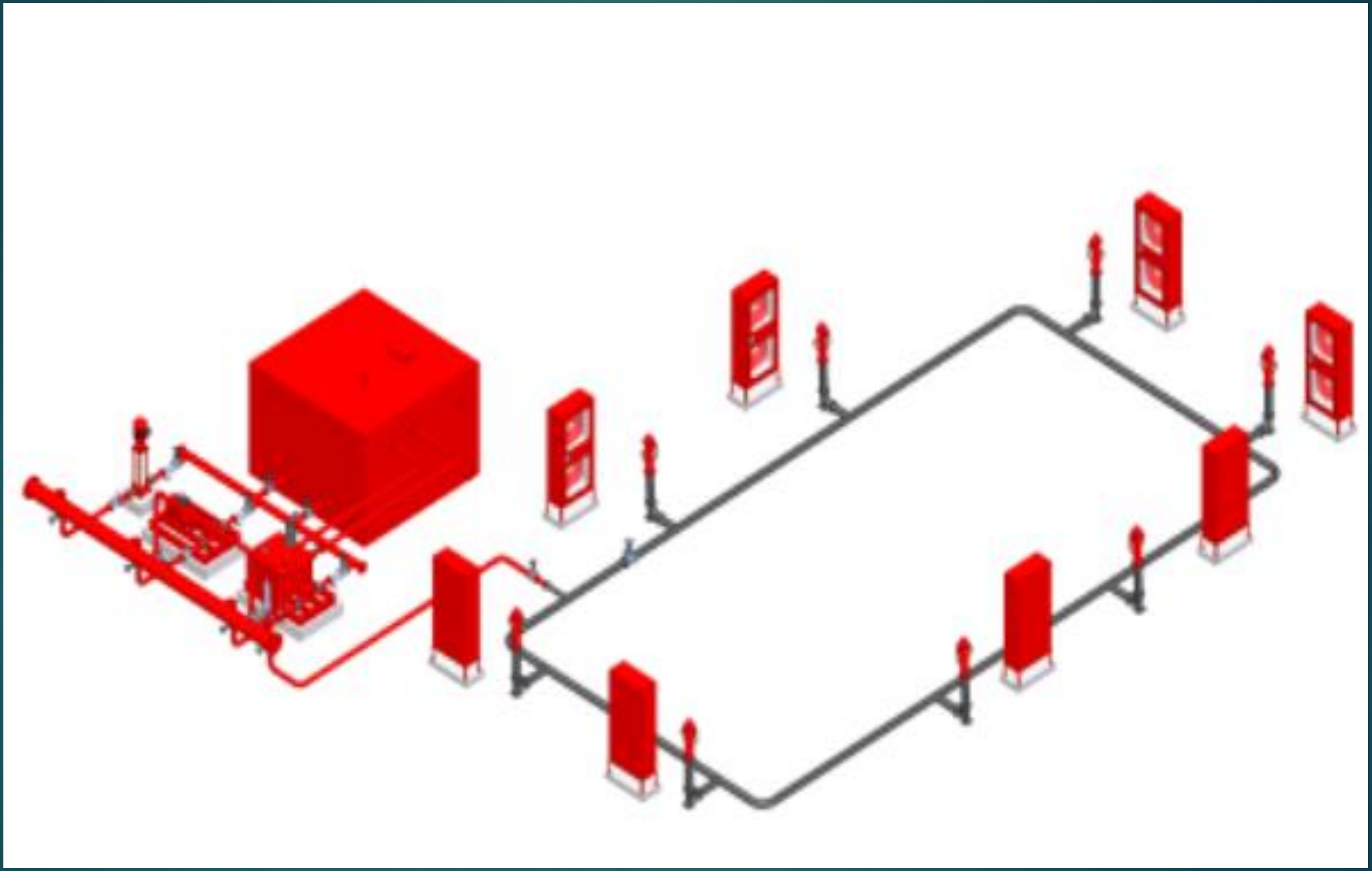
Fire Hydrant System, the oldest and still one of the most effective ones, consists of the following components:

- Sufficiently large water reservoir / Tank.
- Fire pump sets (Main and Standby) UL/FM.
- Jockey pump set.
- Hydrant valves.
- Fire fighting hoses.
- Branch pipe with nozzles.
- Pipe & Fitting (Sch-40).

SYSTEM COMPONENTS

- Landing Valves
- Hoses
- Couplings
- Hose Reels
- Fire Brigade Connectors
- Branch Pipes & Nozzles
- Pump Set
- Water Tank

Fire Hydrant System



Storage Tanks & Water Reservoir

Storage tanks and water reservoir are tanks that supply water for the water based fire protection system.

Types of water tanks.

1- Gravity Tanks
2- Pressure Tanks
3- Suctions tanks

Gravity Tanks.

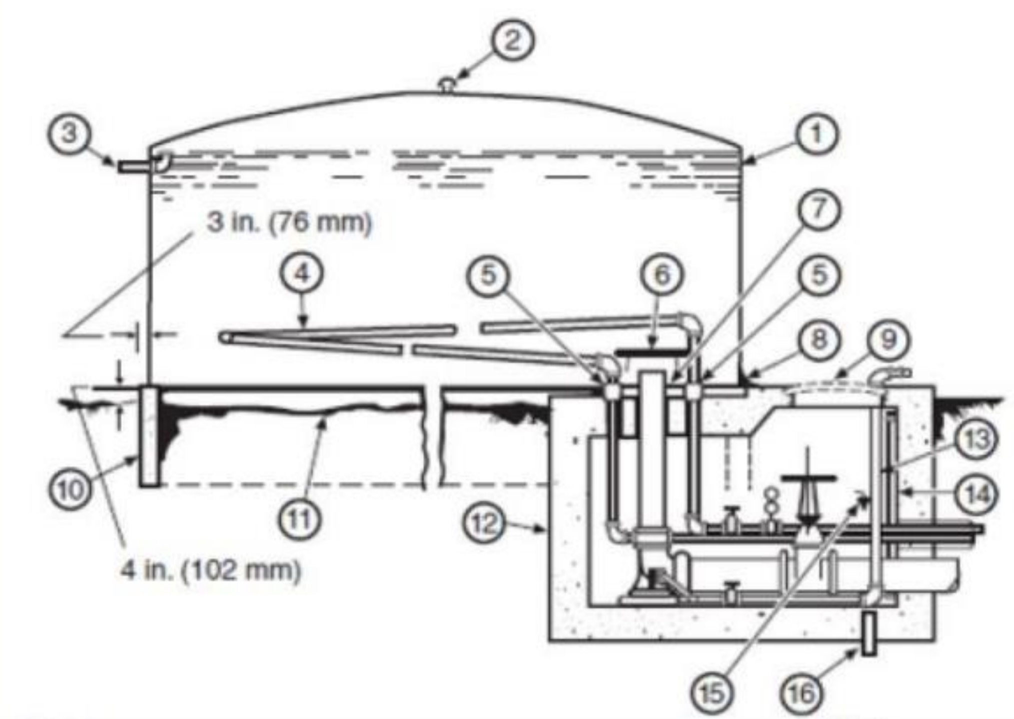
Gravity tanks are **elevated water tanks that utilize gravity to provide pressure**. They might be capable of providing the necessary pressure to operate a fire suppression system on their own, or they can be used to provide water to a fire pump.

Pressure Tanks.

Pressure tanks contain both water and air under pressure. When a system is actuated, the pressurized air pushes the water out of the tank. Because of this, a sufficient capacity of air must be available to discharge the water from the tank at the necessary rate. Pressure tanks are rarely used because they are typically no larger than 10,000 gallons (37,850 liters).

Suction Tanks.

Suction tanks are mounted on the ground or below ground. Because of this they do not utilize elevation as a primary means to increase the pressure. Suction tanks typically provide water to a fire pump, which then boosts the pressure. Special consideration is needed for below grade tanks because they must either have a vertical turbine pump or a pump located below the tank.



Types of Fire Hydrants.

1-Wet Barrel Hydrant

The wet barrel fire hydrant holds a constant water supply.

2-Dry Barrel Hydrant

The dry barrel fire hydrant needs to have a valve release to let water in.

Types of Fire Hydrants

Fire Hydrant Working

Firefighters find fire hydrants, attach their hoses, and then pump a massive amount of pressurized water to extinguish the fire. The hydrant's valve cover is removed using a specific pentagonal wrench. The firefighters then open the valve to allow the water to flow after attaching the hoses.

They normally have a nut or bolt to turn on to start the flow and a connecting point to connect a fire hose to. Every fire hydrant is nothing more than a connection to the main water line. A riser pipe links the hydrant valve to the ground underneath it. Normal hydrants, on the other hand, do not affect the water pressure or flow. They act as valves, allowing firemen to use the existing pressure in the water lines. While all of this may appear to be straightforward, the underlying mechanics of a fire hydrant are more complicated and vary by area..

Fire Hydrant Colors

All fire hydrants are color-coded following NFPA regulations. These hues represent the predicted flow of the procedure.

The meaning of the colors on a fire hydrant's nozzle caps is something that emergency responders and utility personnel are typically familiar with. In general, the color red is reserved for specific tasks such as firefighting. White denotes that the hydrant is on the water utility's service, but not necessarily on the water main, whereas yellow indicates that the hydrant is on the water main with high pressure. Violet is most commonly associated with non-potable water that meets international standards, such as untreated water from a lake or pond.

Standpipes.

Standpipes.

Standpipes are a useful tool for firefighters, even though they work differently than traditional hydrants. Standpipes are a viable alternative to sprinkler systems because they allow firefighters to distribute water to a specific section of a building.

They are typically located in a fixed interior location in a large structure. This permits those who are unable to evacuate the building to self-extinguish a fire. Standpipes are therefore an important tool for firefighters, particularly in big structures where a huge number of hoses would be required to extinguish the fire.

Design of Fire Hydrant.

- How much water is needed for firefighting?
- How many hydrants are required?
- What type of hose connection is required?
- Current and future configuration of the fire apparatus.
- Operating characteristics of a hydrant.
- Pressure available in lines.

Design of Fire Hydrant.

- What are climate conditions?
- Hydrant outlet threads (Coupling) should meet standards.
- Shape and access to the fire hydrant.
- The discharge valve should be specified to open by turning counterclockwise and close by turning clockwise.
- Valves and outlets should be simple, and reliable to connect and operate.

Location of Fire Fire Hydrant.

•Standard practice for fire hydrant is to install at every Minor deviations.

•Appropriate as per the situation.

•A sufficient number of hydrants should be provided for the required fire flow and high-hazard areas.

•The safe minimum distance of fire hydrant should be from the protected/ involved structures.

Location of Fire Fire Hydrant.

•The competent authority of the fire wing/ department must be consulted to ensure the operational and practical issues, involved.

•Hydrants spacing should not create any obstruction.

•Hydrants' proximity to structures is protected.

•Fire hydrants must not be isolated by a fence, gate, or obstruction.

•Fire hydrant parking of vehicles Should be at a safe distance from the hydrant.

•connected must not block critical access Vehicles and hoses way.

Hydrant Installation.

•Comparison and monitoring of Preliminary grading design final grading.

•Coordination among all parties involved at the building site in fire hydrant Installation details.

•Coordination with utility companies for ensuring noninterference of utility poles, vaults, cabinets, sewerage lines, and encroachments, etc.

Inspection and Maintenance of Fire Hydrants.

Inspection of Fire Hydrant.

•Hydrants should be checked physically & operationally.

•Frequently but at least once a year.

•Valves, blanking caps couplings, main stop valves & mainline must be checked periodically.

•Hydrants should not be hidden by tall grass, brush, fences, debris, or any other obstruction.

•Check and ensure that all blank caps are present.

•All the inspection records of every periodical inspection must be documented.

Inspection and Maintenance of Fire Hydrants.

Maintenance of a Hydrant.

•Check the gasket in the caps to make sure they are not cracked, broken, or missed, if broken replace them with a new one.

•Lubricant any part of the hydrant if necessary or rusted.

•All the valves, delivery valve main stem nut valve, and mainline valve must be repaired or replaced if broken cracked, missed, or rusted.

Hydraulic Calculation

Fire Operating Scenario-1		
Operating Scenario	2-Hose Reel operating at 28M and 3-hydrants at ground floor in both new & old CFB area.	
Flow	880-GPM	Installed Capacity is 1000-GPM of which 880-GPM is required for fire scenario and 120 GPM are still available.
Available Pressure	4.74 @ 28M & 7.26 @ 2M	At 28M there are 2 hose reel connection (1”) and at 2M there are 2-hydrants connection (2.5”) are operated.
Required Pressure	4.5 @ 28M & 6.9 @ 2M	According to NFPA 1” connection requires min of 4.5 bar pressure and 2.5” connection requires 6.9 bar pressure.

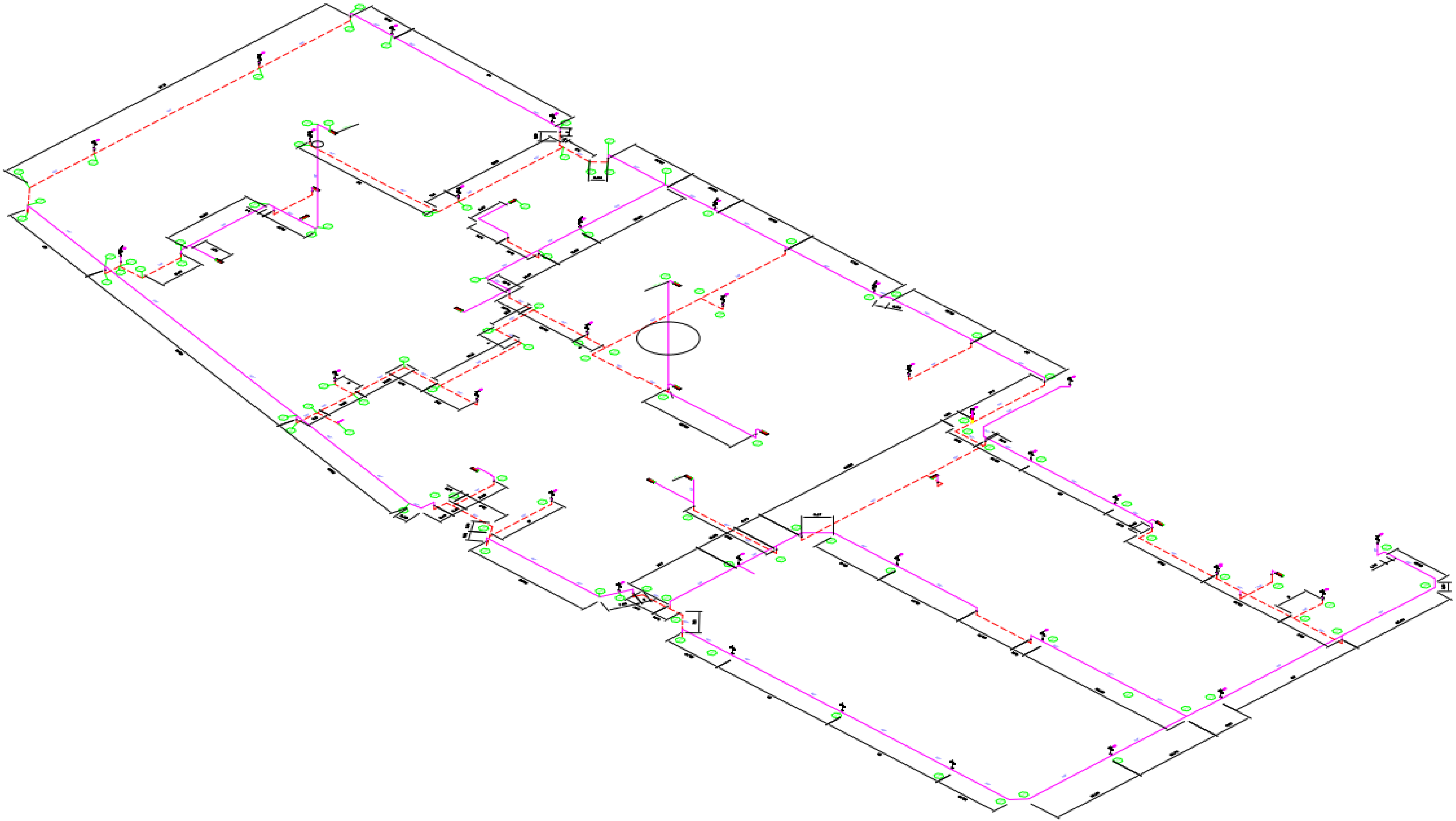
Hydraulic Calculation

Fire Operating Scenario-2		
Operating scenario	2-hydrants operating in new CFB area and 2-hydrants operating in old CFB area.	
Flow	1000-GPM	Installed Capacity is 1000-GPM of which 1000-GPM is required for fire scenario.
Available Pressure	7.23 @ 2M	At 2M there are 4-hydrants connection (2.5”) are operated.
Required Pressure	6.9 @ 2M	According to NFPA 2.5” connection requires 6.9 bar pressure.
Fire Operating Scenario-3	4-hydrants operating in new CFB area. (Results provided in separate hydraulic calculation report)	

Hydraulic Evaluation of Pump Capacity

Pump Specifications				
Pump Type	Flow (GPM)	Head (m)	Quantity (set)	Drive
Motor driven fire pumps	1000	8-Bar	1	120hp-2p Siemens motor
Diesel fire pump	1000	8-Bar	1	Cummins,6BT5.9 G1-Diesel Engine
Jockey pump	45	9-Bar	1	10-hp/2p KSB Motor
Fire Ring Hydraulic Requirements according to calculations				
Operating scenario-1: 880 GPM @ 7.29 bar (2M) and 4.7 bar (28M)				
Operating scenario-2: 1000 GPM @ 7.23 bar (2M)				
Operating scenario-3: 1000 GPM @ 7.06 bar (2M)				
Operating scenario-4: 1000 GPM @ 7.25 bar (2M)				
Operating scenario-5: 730 GPM @ 7.33 bar (2M) and 4.80 bar (28M)				
Conclusion:				
As existing pump specifications i.e., 1000 GPM @ 8 bar fulfills each operating scenario requirement mentioned above in this table hence it is recommended that existing installed pumps will suffice the extension of existing fire water ring and can be operate able for both old and new CFB area.				

Node Diagram of Fire Hydrant System



Software Hydraulic Calculation

FIRE OPERATING SCENARIO

HAZARD AREA:COAL POWER PLANT

DISCHARGE FROM ONE HYDRANT DELIVERY: 250 GPM

TOTAL OPREATED FIRE HYDRANT DELIVERIES: 04 NOS

TOTAL DISCHARGE FROM HYDRANT DELIVERIES: 1000 GPM = 1000 GPM

REQUIRED PUMP CAPACITY : 1000-GPM

INSTALLED PUMP CAPACITY : 1000-GPM

AVAILABLE PRESSURE FOR HYDRANT DELIVERY : 7.3 BAR

REQUIRED PRESSURE FOR HYDRANT DELIVERY : 6.9 BAR

Software Hydraulic Calculation

WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (BAR)	RESID. PRESS. (BAR)	@	FLOW (LPM)	AVAIL. PRESS. (BAR)	@	TOTAL DEMAND (LPM)	REQ'D PRESS. (BAR)
107	8.00	7.90		3785.0	7.900		3784.0	7.900

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	3784.0 LPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	0.0 LPM
OTHER HOSE STREAM ALLOWANCES	3784.0 LPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	0.0 LPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (M)	NODE TYPE	PRESSURE TOTAL (BAR)	PRESSURE NORMAL (BAR)	DISCHARGE (L/MIN)
1	2.00	HOSE STREAM	7.258	7.258	946.0
2	-1.00	- - - -	7.558	7.555	- - -
3	-1.00	- - - -	7.559	7.555	- - -
4	-1.00	- - - -	7.574	7.570	- - -
5	-1.00	- - - -	7.600	7.597	- - -
6	-1.00	- - - -	7.605	7.602	- - -
7	-1.00	- - - -	7.619	7.616	- - -
8	1.00	- - - -	7.424	7.421	- - -
9	-1.00	- - - -	7.630	7.623	- - -
10	-1.00	- - - -	7.630	7.629	- - -
11	2.00	HOSE STREAM	7.335	7.335	946.0
12	-1.00	- - - -	7.629	7.629	- - -
13	-1.00	- - - -	7.630	7.629	- - -
14	-1.00	- - - -	7.632	7.631	- - -
15	-1.00	- - - -	7.632	7.631	- - -
16	-1.00	- - - -	7.634	7.633	- - -
17	-1.00	- - - -	7.637	7.636	- - -
18	28.00	- - - -	4.797	4.791	- - -
19	28.00	- - - -	4.840	4.783	- - -
20	-1.00	- - - -	7.680	7.680	- - -
21	-1.00	- - - -	7.640	7.633	- - -
22	-1.00	- - - -	7.642	7.600	- - -
23	-1.00	- - - -	7.623	7.617	- - -
24	-1.00	- - - -	7.623	7.623	- - -
25	-1.00	- - - -	7.613	7.606	- - -
26	-1.00	- - - -	7.602	7.595	- - -
27	-1.00	- - - -	7.577	7.570	- - -
28	-1.00	- - - -	7.569	7.562	- - -
29	-1.00	- - - -	7.557	7.550	- - -
30	-1.00	- - - -	7.556	7.556	- - -
31	2.00	HOSE STREAM	7.254	7.250	946.0
32	-1.00	- - - -	7.548	7.548	- - -

Software Hydraulic Calculation

NODE ANALYSIS DATA

NODE TAG	ELEVATION (M)	NODE TYPE	PRESSURE TOTAL (BAR)	PRESSURE NORMAL (BAR)	DISCHARGE (L/MIN)
33	-1.00	- - - -	7.548	7.548	- - -
34	28.00	- - - -	4.707	4.707	- - -
35	-1.00	- - - -	7.548	7.548	- - -
36	-1.00	- - - -	7.548	7.548	- - -
37	-1.00	- - - -	7.548	7.548	- - -
38	-1.00	- - - -	7.548	7.548	- - -
39	2.00	HOSE STREAM	7.254	7.254	946.0
40	-1.00	- - - -	7.551	7.550	- - -
41	-1.00	- - - -	7.552	7.552	- - -
42	-1.00	- - - -	7.552	7.552	- - -
43	-1.00	- - - -	7.552	7.552	- - -
44	-1.00	- - - -	7.552	7.552	- - -
45	-1.00	- - - -	7.552	7.552	- - -
46	-1.00	- - - -	7.552	7.552	- - -
47	-1.00	- - - -	7.552	7.552	- - -
48	-1.00	- - - -	7.552	7.552	- - -
49	-1.00	- - - -	7.552	7.552	- - -
50	-1.00	- - - -	7.554	7.554	- - -
51	-1.00	- - - -	7.555	7.555	- - -
52	-1.00	- - - -	7.555	7.555	- - -
53	-1.00	- - - -	7.555	7.555	- - -
54	-1.00	- - - -	7.555	7.555	- - -
55	4.10	- - - -	7.056	7.056	- - -
56	-1.00	- - - -	7.555	7.555	- - -
57	-1.00	- - - -	7.554	7.552	- - -
58	-1.00	- - - -	7.554	7.553	- - -
59	-1.00	- - - -	7.560	7.559	- - -
60	-1.00	- - - -	7.560	7.559	- - -
61	-1.00	- - - -	7.565	7.564	- - -
62	-1.00	- - - -	7.568	7.566	- - -
63	-1.00	- - - -	7.573	7.571	- - -
64	1.00	- - - -	7.383	7.382	- - -
65	1.00	- - - -	7.385	7.384	- - -
66	-1.00	- - - -	7.587	7.586	- - -
67	1.00	- - - -	7.396	7.395	- - -
68	1.00	- - - -	7.396	7.396	- - -
69	-1.00	- - - -	7.592	7.592	- - -
70	4.00	- - - -	7.103	7.103	- - -
71	-1.00	- - - -	7.596	7.594	- - -
72	1.00	- - - -	7.408	7.407	- - -
73	-1.00	- - - -	7.606	7.606	- - -
74	-1.00	- - - -	7.608	7.608	- - -
75	-1.00	- - - -	7.609	7.609	- - -
76	-1.00	- - - -	7.610	7.609	- - -
77	-1.00	- - - -	7.610	7.610	- - -
78	-1.00	- - - -	7.611	7.610	- - -
79	-1.00	- - - -	7.613	7.613	- - -
80	-1.00	- - - -	7.615	7.615	- - -
81	-1.00	- - - -	7.616	7.616	- - -
82	-1.00	- - - -	7.617	7.616	- - -
83	-1.00	- - - -	7.607	7.606	- - -

Software Hydraulic Calculation

NODE ANALYSIS DATA

NODE TAG	ELEVATION (M)	NODE TYPE	PRESSURE TOTAL (BAR)	PRESSURE NORMAL (BAR)	DISCHARGE (L/MIN)
84	1.00	- - - -	7.411	7.411	- - -
85	1.00	- - - -	7.413	7.413	- - -
86	1.00	- - - -	7.413	7.413	- - -
87	1.00	- - - -	7.415	7.414	- - -
88	1.00	- - - -	7.417	7.416	- - -
89	1.00	- - - -	7.418	7.418	- - -
90	1.00	- - - -	7.418	7.418	- - -
91	1.00	- - - -	7.418	7.418	- - -
92	1.00	- - - -	7.419	7.419	- - -
93	1.00	- - - -	7.419	7.419	- - -
94	7.00	- - - -	6.832	6.832	- - -
95	1.00	- - - -	7.421	7.420	- - -
96	-1.00	- - - -	7.619	7.617	- - -
97	7.00	- - - -	6.836	6.835	- - -
98	-1.00	- - - -	7.621	7.619	- - -
99	-1.00	- - - -	7.624	7.623	- - -
100	-1.00	- - - -	7.625	7.624	- - -
101	-1.00	- - - -	7.625	7.625	- - -
102	-1.00	- - - -	7.626	7.625	- - -
103	-1.00	- - - -	7.629	7.628	- - -
104	-1.00	- - - -	7.632	7.631	- - -
105	-1.00	- - - -	7.632	7.631	- - -
106	-1.00	- - - -	7.634	7.632	- - -
107	-3.00	SOURCE	7.900	7.900	3784.0

Software Hydraulic Calculation

PIPE DATA

PIPE TAG END NODES	ELEV. (M)	PT (BAR)	PN (BAR)	DISC. (LPM)	Q(LPM) VEL(MPS)	DIA(MM) HW(C) FL/M		LENGTH (M)	PRESS. SUM. (BAR)
Pipe: 1					-928.1	154.05	PL	10.20	PF 0.006
1	2.00	7.258	7.258	946.0	0.83	120	FTG	----	PE 0.294
2	-1.00	7.558	7.555	0.0		0.0006	TL	10.20	PV 0.003
Pipe: 2					-928.1	154.05	PL	1.49	PF 0.001
2	-1.00	7.558	7.555	0.0	0.83	120	FTG	----	PE 0.000
3	-1.00	7.559	7.555	0.0		0.0006	TL	1.49	PV 0.003
Pipe: 3					-928.1	154.05	PL	24.90	PF 0.015
3	-1.00	7.559	7.555	0.0	0.83	120	FTG	----	PE 0.000
4	-1.00	7.574	7.570	0.0		0.0006	TL	24.90	PV 0.003
Pipe: 4					-928.1	154.05	PL	45.00	PF 0.027
4	-1.00	7.574	7.570	0.0	0.83	120	FTG	----	PE 0.000
5	-1.00	7.600	7.597	0.0		0.0006	TL	45.00	PV 0.003
Pipe: 5					-928.1	154.05	PL	8.89	PF 0.005
5	-1.00	7.600	7.597	0.0	0.83	120	FTG	----	PE 0.000
6	-1.00	7.605	7.602	0.0		0.0006	TL	8.89	PV 0.003
Pipe: 6					-928.1	154.05	PL	23.47	PF 0.014
6	-1.00	7.605	7.602	0.0	0.83	120	FTG	----	PE 0.000
7	-1.00	7.619	7.616	0.0		0.0006	TL	23.47	PV 0.003
Pipe: 7					-928.1	154.05	PL	1.49	PF 0.001
7	-1.00	7.619	7.616	0.0	0.83	120	FTG	----	PE-0.196
8	1.00	7.424	7.421	0.0		0.0006	TL	1.49	PV 0.003
Pipe: 8					-928.1	154.05	PL	16.61	PF 0.010
8	1.00	7.424	7.421	0.0	0.83	120	FTG	----	PE 0.196
9	-1.00	7.630	7.623	0.0		0.0006	TL	16.61	PV 0.003
Pipe: 9					416.7	154.05	PL	1.49	PF 0.000
9	-1.00	7.630	7.623	0.0	0.37	120	FTG	----	PE 0.000
10	-1.00	7.630	7.629	0.0		0.0001	TL	1.49	PV 0.001
Pipe: 10					416.7	154.05	PL	8.58	PF 0.001
10	-1.00	7.630	7.629	0.0	0.37	120	FTG	----	PE-0.294
11	2.00	7.335	7.335	946.0		0.0001	TL	8.58	PV 0.001
Pipe: 11					0.0	154.05	PL	0.30	PF 0.000
11	2.00	7.335	7.335	946.0	0.00	120	FTG	----	PE 0.294
12	-1.00	7.629	7.629	0.0		0.0000	TL	0.30	PV 0.000
Pipe: 12					-529.3	154.05	PL	6.14	PF 0.001
11	2.00	7.335	7.335	946.0	0.47	120	FTG	----	PE 0.294
13	-1.00	7.630	7.629	0.0		0.0002	TL	6.14	PV 0.001

Software Hydraulic Calculation

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PIPE TAG                                     Q(LPM)   DIA(MM)   LENGTH    PRESS.
  END      ELEV.    PT      PN     DISC.   VEL(MPS)  HW(C)      (M)       SUM.
 NODES      (M)   (BAR)   (BAR)   (LPM)              FL/M               (BAR)

     Pipe: 13                                -529.3   154.05 PL     8.86   PF 0.002
13         -1.00  7.630   7.629     0.0        0.47      120 FTG    ----   PE 0.000
14         -1.00  7.632   7.631     0.0              0.0002 TL      8.86   PV 0.001

     Pipe: 14                                -529.3   154.05 PL     1.49   PF 0.000
14         -1.00  7.632   7.631     0.0        0.47      120 FTG    ----   PE 0.000
15         -1.00  7.632   7.631     0.0              0.0002 TL      1.49   PV 0.001

     Pipe: 15                                -529.3   154.05 PL    11.70   PF 0.002
15         -1.00  7.632   7.631     0.0        0.47      120 FTG    ----   PE 0.000
16         -1.00  7.634   7.633     0.0              0.0002 TL     11.70   PV 0.001

     Pipe: 16                                -529.3   154.05 PL    12.70   PF 0.003
16         -1.00  7.634   7.633     0.0        0.47      120 FTG    ----   PE 0.000
17         -1.00  7.637   7.636     0.0              0.0002 TL     12.70   PV 0.001

     Pipe: 17                                -529.3   154.05 PL     0.60   PF 0.000
17         -1.00  7.637   7.636     0.0        0.47      120 FTG    ----   PE-2.840
18         28.00  4.797   4.791     0.0              0.0002 TL      0.60   PV 0.001

     Pipe: 18                                -529.3   102.26 PL    28.00   PF 0.043
18         28.00  4.797   4.791     0.0        1.07      120 FTG    ----   PE 0.000
19         28.00  4.840   4.783     0.0              0.0015 TL     28.00   PV 0.006

     Pipe: 19                                   0.0   102.26 PL     3.30   PF 0.000
19         28.00  4.840   4.783     0.0        0.00      120 FTG    ----   PE 2.840
20         -1.00  7.680   7.680     0.0              0.0000 TL      3.30   PV 0.000

     Pipe: 20                               -1344.8   154.05 PL     8.66   PF 0.010
9          -1.00  7.630   7.623     0.0        1.20      120 FTG    ----   PE 0.000
21         -1.00  7.640   7.633     0.0              0.0012 TL      8.66   PV 0.007

     Pipe: 21                               -1344.8   154.05 PL     1.49   PF 0.002
21         -1.00  7.640   7.633     0.0        1.20      120 FTG    ----   PE 0.000
22         -1.00  7.642   7.600     0.0              0.0012 TL      1.49   PV 0.007

     Pipe: 22                                1319.8   154.05 PL    16.22   PF 0.018
22         -1.00  7.642   7.600     0.0        1.18      120 FTG    ----   PE 0.000
23         -1.00  7.623   7.617     0.0              0.0011 TL     16.22   PV 0.007

     Pipe: 23                                   0.0   154.05 PL     8.00   PF 0.000
23         -1.00  7.623   7.617     0.0        0.00      120 FTG    ----   PE 0.000
24         -1.00  7.623   7.623     0.0              0.0000 TL      8.00   PV 0.000

     Pipe: 24                                1319.8   154.05 PL     9.43   PF 0.011
23         -1.00  7.623   7.617     0.0        1.18      120 FTG    ----   PE 0.000
25         -1.00  7.613   7.606     0.0              0.0011 TL      9.43   PV 0.007

     Pipe: 25                                1319.8   154.05 PL     9.60   PF 0.011
25         -1.00  7.613   7.606     0.0        1.18      120 FTG    ----   PE 0.000
26         -1.00  7.602   7.595     0.0              0.0011 TL      9.60   PV 0.007
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Software Hydraulic Calculation

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PIPE TAG                                          Q(LPM)   DIA(MM)   LENGTH     PRESS.
   END      ELEV.    PT       PN      DISC.   VEL(MPS)  HW(C)       (M)         SUM.
  NODES      (M)    (BAR)    (BAR)    (LPM)              FL/M                  (BAR)

     Pipe: 104                                  -590.1   154.05 PL     3.73    PF 0.001
100         -1.00   7.625    7.624     0.0    0.53       120 FTG    ----     PE 0.000
102         -1.00   7.626    7.625     0.0               0.0003 TL     3.73    PV 0.001

     Pipe: 105                                  -590.1   154.05 PL    11.48    PF 0.003
102         -1.00   7.626    7.625     0.0    0.53       120 FTG    ----     PE 0.000
103         -1.00   7.629    7.628     0.0               0.0003 TL    11.48    PV 0.001

     Pipe: 106                                  -590.1   154.05 PL    11.29    PF 0.003
103         -1.00   7.629    7.628     0.0    0.53       120 FTG    ----     PE 0.000
104         -1.00   7.632    7.631     0.0               0.0003 TL    11.29    PV 0.001

     Pipe: 107                                  -590.1   154.05 PL     0.30    PF 0.000
104         -1.00   7.632    7.631     0.0    0.53       120 FTG    ----     PE 0.000
105         -1.00   7.632    7.631     0.0               0.0003 TL     0.30    PV 0.001

     Pipe: 108                                  -590.1   154.05 PL     6.88    PF 0.002
105         -1.00   7.632    7.631     0.0    0.53       120 FTG    ----     PE 0.000
106         -1.00   7.634    7.632     0.0               0.0003 TL     6.88    PV 0.001

     Pipe: 109                                  -590.1   154.05 PL    31.25    PF 0.008
106         -1.00   7.634    7.632     0.0    0.53       120 FTG    ----     PE 0.000
22          -1.00   7.642    7.600     0.0               0.0003 TL    31.25    PV 0.001

     Pipe: 110                                 -3254.7   154.05 PL     6.39    PF 0.038
22          -1.00   7.642    7.600     0.0    2.91       120 FTG    ----     PE-2.840
19          28.00   4.840    4.783     0.0               0.0060 TL     6.39    PV 0.042

     Pipe: 111                                 -3784.0   154.05 PL     3.00    PF 0.024
19          28.00   4.840    4.783     0.0    3.38       120 FTG    ----     PE 3.036
107         -3.00   7.900    7.900    (N/A)              0.0079 TL     3.00    PV 0.057

NOTES (HASS):

  (1) Calculations were performed by the HASS 8.4 computer program
      under license no. 50031730   granted by
                     HRS Systems, Inc.
                     208 Southside Square
                     Petersburg, TN  37144
                        (931) 659-9760

  (2) The system has been calculated to provide an average
      imbalance at each node of 0.0010 lpm and a maximum
      imbalance at any node of 0.0035 lpm.

  (3) Velocity pressures have been included in the calculation
      of the system pressures and flows.  Maximum water velocity
      is 3.38 m/sec at pipe 111.

  (4) Items listed in bold print on the cover sheet
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Software Hydraulic Calculation

```
WATER SUPPLY CURVE

    8.4+
       |
       *\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
       |                                     7.90 bar @ 3785 l/min-> O
    7.7+                                      Flow Test Point
       |
       |
       |
    7.0+
       |
       |
       |
    6.3+
       |
       |
       |
  P5.6+
  R    |
  E    |
  S    |
  S4.9+
  U    |
  R    |
  E    |
   4.2+
  (    |
  B    |
  A    |
  R3.5+
  )    |
       |
       |
   2.8+
       |
       |
       |
   2.1+
       |
       |
       |-------------------------------
   1.4+             LEGEND            -
       |                              -
       | X - Required Water Supply    -
       |    7.90 bar @ 3784 l/min     -
   0.7+                               -
       | O - Available Water Supply   -
       |    7.90 bar @ 3784 l/min     -
       |                              -
   0.0++-+---+-----+------+-------+---------+---------+----------+-----------+
        8001200 1600   2000    2400     2800      3200       3600        4000
                                     FLOW (LPM)
```

TAHNK YOU

Naqash Kazmi (CFPS®) NFPA

CERTIFIED FIRE PROTECTION SPECIALIST(CFPS®)