

HYDRAULIC CALCULATIONS

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Hydraulic Design Information, Remote Area 1, Pages 1 through 8

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FL49347
Consulting Engineering Associates, Inc.
Registry 3962
8365 Gunn Highway
Tampa, FL 33626

Project Name: Orient Road Jail Fire Pump Replacement

Project Address: 1201 Orient Road Tampa, FL 33619

<p><u>CODE APPLICABLE TO THESE CALCULATIONS:</u> Florida Fire Prevention Code, Fifth Edition Calculations produced using SprinkCAD</p>

HYDRAULIC DESIGN INFORMATION SHEET

Job Name: Fire Pump Replacement - Orient Road Jail Building 13
Location: 1201 Orient Road
Tampa, FL. 33619 USA

Drawing Date: 9-8-2020

Remote Area Number: 1

Engineers: Consulting Engineers Associates, Inc. Registry 3962
8365 Gunn Highway
Tampa, FL. 33626
Telephone:(813) 448-0225

Engineer of Record: John W. Wells III, P.E. FL. 49347

Calculated By: SprinkCAD
www.sprinkcad.com
1400 Pennbrook Pkwy.
Lansdale, PA 19446

Construction: Type II
Occupancy: Light
Reviewing Authorities: HBCO

SYSTEM DESIGN

Code:NFPA 14 Hazard:Class I Standpipe System Type:WET

Area of Sprinkler Oper.	sq ft	Sprinkler or Nozzle
Density (gpm/sq ft)	1.000	Make: Tyco
Area per Sprinkler	250.0 sq ft	Model: 2-1/2" FHV
Hose Allowance Inside	0 gpm	K-Factor:25.00
Hose Allowance Outside	0 gpm	Temperature Rating: 350

CALCULATION SUMMARY (4) Flowing Outlets
gpm Required: 1000.2 psi Required: 28.0 @ Source

WATER SUPPLY

Water Flow Test	Pump Data
Date of Test 5-21-2020	Rated Capacity 1000 gpm
Static Pressure 74.0 psi	Rated Pressure 85.0 psi
Residual Pres 62.0 psi	Elevation 0
At a Flow of 1150 gpm	Make: Generic
Elevation 0"	Model:

Location: Site Hydrant No. 5
Source of Information: Florida Fire Services, Inc. (877) 662-3473

SYSTEM VOLUME 3522 Gallons

Notes: Existing Fire Pump Replacement

HYDRAULIC CALCULATION DETAILS

		HYDRAULIC		FLOW	LOSS	
QTY	DESCRIPTION	LENGTH	C ID	gpm	psi	TOTALS
	Hydr Ref W	Required at Hyd Area 1		1000		126.1 psi
1	10" Grvd Butterfly Valve Tyco BfV	12'	120 10.140	1000	0.0	
1	8" Grvd Check Valve Tyco CV-1FR	CHART LOSS		1000	0.5	
1	8" x 5" Flngd Reducer CI, Conc	0'	120 8.071	1000	0.0	
	Hydr Ref R1	Required at PUMP DISCHARGE		1000		126.6 psi
1	85 psi@1000 gpm PUMP Generic	CHART BOOST		1000	100.0	
1	8" Flngd Gate Valve Kennedy Gate	4'	120 8.071	1000	0.0	
1	Pipe 8" 10x21 Allied Domestic	30'	120 8.249	1000	0.2	
3	8" Grvd 90 Ell Firelock	39'	120 8.071	1000	0.4	
1	8" MJ Tee DI	35'	120 8.071	1000	0.3	
1	12" x 8" Flngd Reducer CI, Conc	0'	120 11.938	1000	0.0	
1	Pipe 12" DIx18 America DI 350	125'	140 12.578	1000	0.1	
3	12" MJ 90 Ell DI	81'	120 11.938	1000	0.1	
1	12 Flngd Gate Valve Kennedy Gate	6'	120 11.938	1000	0.0	
1	12" MJ Tee DI	60'	120 11.938	1000	0.1	
1	Pipe 12" DIx18 America DI 350	126'	140 12.578	1000	0.1	
1	12" MJ 45 Ell DI	13'	120 11.938	1000	0.0	
	Hydr Ref R2	Required at Source		1000		28.0 psi
Water Source 74.0 psi static, 62.0 psi residual @ 1150 gpm				1000 gpm		64.7 psi
						=====
SAFETY PRESSURE						36.8 psi

Available Pressure of 64.7 psi Exceeds Required Pressure of 28.0 psi
 This is a safety margin of 36.8 psi or 57 % of Supply

Maximum Water Velocity is 16.9 fps

FITTING NAME TABLE

ABBREV.	NAME
C	Coupling
E	90' Standard Elbow
F	45' Elbow
S	Straight Flow Thru Tee
T	90' Flow Thru Tee
V	Valve

LEGEND

HYD REF	Hydraulic reference. Refer to accompanying flow diagram.
K FACTOR	Flow factor for open head or path where $\text{Flow (gpm)} = K \times \sqrt{P}$
Qa	Flow added or subtracted
Qt	Total flow
DIA	Actual internal diameter of pipe
C	Hazen Williams pipe roughness factor
Pf/ft	Friction loss per foot of pipe
PIPE	Length of pipe
FTNG'S	Number of fittings. See table above.
TOTAL	Total length (PIPE + FTNG'S)
Pt	Total pressure (psi) at fitting
Pe	Pressure due to change in elevation where $P_e = 0.433 \times \text{change in elevation}$
Pf	Friction loss (psi) to fitting where $P_f = 1 \times 4.52 \times (Q/C)^{1.85} / ID^{4.87}$
Pv	Velocity pressure (psi) where $P_v = 0.001123 \times Q^2 / ID^4$
Pn	Normal pressure (psi), where $P_n = P_t - P_v$

NOTES:

- Pressures are balanced to 0.01 psi. Pressures are listed to 0.1 psi. Addition may vary by 0.1 psi due to accumulation of round off.
- Calculations conform to NFPA 13.
- Velocity Pressures are not considered in these Calculations

NODE NUMBER	ELEVATION (FT)	SPRINKLER K-FACTOR (GPM/ (PSI ^{1/2}))	PRESSURE (PSI)	ACTUAL FLOW (GPM)	MINIMUM FLOW (GPM)	ACTUAL DENSITY (GPM/SQ. FT)
1	30.50	25.00	100.1	250.1	250.0	1.00
2	30.50	25.00	100.1	250.1	250.0	1.00
3	30.50	25.00	100.0	250.0	250.0	1.00
4	30.50	25.00	100.0	250.0	250.0	1.00
A1	30.50		102.8			
A2	30.50		103.2			
A3	24.42		108.7			
A4	23.00		109.5			
A5	24.42		114.5			
A6	2.00		126.1			
B1	30.50		102.8			
C1	30.50		102.7			
C2	30.50		103.1			
C3	24.42		108.5			
C4	23.00		109.4			
D1	30.50		102.7			
W	2.00		126.1			

Max velocity of 16.92 occurs in the pipe from A1 TO 1

HYD. REF POINT	Qa Qt	DIA. "C" Pf/ft	FITTING TYPES	PIPE FTNG'S TOTAL	Pt Pe Pf	Pt Pv Pn	***** NOTES *****
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PATH 1 FROM HYDRAULIC REFERENCE 4 TO W (PRIMARY PATH)

4	250.00	2.469	1T	0.67	100.0	100.0	K = 25.00
		C=120		12.00	0.0	0.0	
	250.00	0.215		12.67	2.7	100.0	Vel = 16.92
C1		4.260	1T	1.00	102.7	102.7	
		C=120		26.33	0.0	0.0	
	250.00	0.015		27.33	0.4	102.7	Vel = 5.68
C2	250.00	4.260	2E	23.17	103.1	103.1	
		C=120		26.33	2.6	0.0	See PATH 2
	500.00	0.055		49.50	2.7	103.1	Vel = 11.37
C3		6.357	2E	4.06	108.5	108.5	
		C=120		35.21	0.6	0.0	
	500.00	0.008		39.26	0.3	108.5	Vel = 5.10
C4		8.249	1T	0.67	109.4	109.4	
		C=120		38.92	0.0	0.0	
	500.00	0.002		39.59	0.1	109.4	Vel = 3.03
A4	500.21	8.249	4E	511.32	109.5	109.5	
		C=120	3T	206.85	-0.6	0.0	See PATH 3
	1000.21	0.008	1F	718.17	5.7	109.5	Vel = 6.06
A5		10.370	9E	386.76	114.5	114.5	
		C=120	1T	325.70	9.7	0.0	
	1000.21	0.003	4F	712.47	1.8	114.5	Vel = 3.84
A6		8.249		4.00	126.1	126.1	
		C=120		0.00	0.0	0.0	
	1000.21	0.008		4.00	0.0	126.1	Vel = 6.06
W	1000.21				126.1		K = 89.06

PATH 2 FROM HYDRAULIC REFERENCE 3 TO C2

3	250.00	2.469	1T	0.67	100.0	100.0	K = 25.00
		C=120		12.00	0.0	0.0	
	250.00	0.215		12.67	2.7	100.0	Vel = 16.92

UNITS - DIAMETER (INCH) LENGTH (FOOT) FLOW (GPM) PRESSURE (PSI)

HYD. REF POINT	Qa Qt	DIA. "C" Pf/ft	FITTING TYPES	PIPE FTNG'S TOTAL	Pt Pe Pf	Pt Pv Pn	***** NOTES *****
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PATH 2 FROM HYDRAULIC REFERENCE 3 TO C2 CONTINUED

D1	250.00	4.260 C=120 0.015	1T	1.00 26.33 27.33	102.7 0.0 0.4	102.7 0.0 102.7	Vel = 5.68
C2	250.00				103.1		K = 24.62

PATH 3 FROM HYDRAULIC REFERENCE 1 TO A4

1	250.10	2.469 C=120 0.216	1T	0.67 12.00 12.67	100.1 0.0 2.7	100.1 0.0 100.1	K = 25.00 Vel = 16.92
A1	250.10	4.260 C=120 0.015	1T	1.00 26.33 27.33	102.8 0.0 0.4	102.8 0.0 102.8	Vel = 5.68
A2	250.10 500.21	4.260 C=120 0.055	1E 1T	11.49 39.50 50.99	103.2 2.6 2.8	103.2 0.0 103.2	See PATH 4 Vel = 11.37
A3	500.21	8.249 C=120 0.002	2E 1T	22.33 78.96 101.28	108.7 0.6 0.2	108.7 0.0 108.7	Vel = 3.03
A4	500.21				109.5		K = 47.80

PATH 4 FROM HYDRAULIC REFERENCE 2 TO A2

2	250.10	2.469 C=120 0.216	1T	0.67 12.00 12.67	100.1 0.0 2.7	100.1 0.0 100.1	K = 25.00 Vel = 16.92
B1	250.10	4.260 C=120 0.015	1T	1.00 26.33 27.33	102.8 0.0 0.4	102.8 0.0 102.8	Vel = 5.68

UNITS - DIAMETER (INCH)

LENGTH (FOOT)

FLOW (GPM)

PRESSURE (PSI)

HYD. REF POINT	Qa Qt	DIA. "C" Pf/ft	FITTING TYPES	PIPE FTNG'S TOTAL	Pt Pe Pf	Pt Pv Pn	***** NOTES *****
A2	250.10			103.2		K = 24.62	

Job
Fire Pump Replacement - Orient R
1201 Orient Road
Tampa
Remote Area: 1

Water
Static Pres: 74.0 psi
Resid. Pres: 62.0 psi
Flow: 1150 gpm
Date: 5-21-2020
Loc: Hydrant No. 5

Required
Pressure: 28.0 psi
Sys Flow: 1000 gpm
Sys+Hose: 1000 gpm
Safety Pres: 36.8 psi
Hd Elv Pres: 12.3 psi

Hose Allowance
In: 0 gpm
Out: 0 gpm

Pump Info
Rtd Pres: 85 psi
Rtd Flow: 1000 gpm

Flow(gpm)
0
1000
1500
0
0

Pres(psi)
102.0
100.0
55.3
0.0
0.0

