



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name : 46125900 Webster ISB - Basement Lvl - RA3
Building : Webster ISB
Location : 8274 Big Bend Blvd
System : SYS1
Contract : 461259
Data File : 46125900 Webster ISB - Basement Lvl - RA3.WXF

Hydraulic Design Information Sheet

Name - 46125900 Webster ISB - Basement Lvl - RA3 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS1
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-100.A
Construction: () Combustible (X) Non-Combustible Ceiling Height - 9-6
Occupancy - HC-2

S () NFPA 13 () Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
Y () NFPA 231 () NFPA 231C () Figure Curve
S Other Factory Mutual - HC-2
T Specific Ruling Made By Date
E

M	Area of Sprinkler Operation - 2506	System Type	Sprinkler/Nozzle
	Density - .20	(X) Wet	Make Viking
D	Area Per Sprinkler - 130	() Dry	Model VK350
E	Elevation at Highest Outlet - 84.458	() Deluge	Size 3/4"
S	Hose Allowance - Inside - 50	() Preaction	K-Factor 8.0
I	Rack Sprinkler Allowance - n/a	() Other	Temp.Rat.200
G	Hose Allowance - Outside - 200		

N Note

Calculation Flow Required - 643.33 Press Required - 106.307 SYS1
Summary C-Factor Used: 120 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 05/23/16		Cap. -
T	Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
E	Static Press - 90	@ Press - 55	
R	Residual Press - 86	Elev. - 87.375	Well
	Flow - 1140		Proof Flow
S	Elevation - 104		

U Location - 8274 Big Bend Blvd

P Source of Information - Ahern Fire Protection

C	Commodity	Class	Location
O	Storage Ht.	Area	Aisle W.
M	Storage Method:	Solid Piled %	Palletized % Rack
M	() Single Row	() Conven. Pallet	() Auto. Storage () Encap.
S	() Double Row	() Slave Pallet	() Solid Shelf () Non
T	() Mult. Row		() Open Shelf

R	K	Flue Spacing	Clearance:Storage to Ceiling
A		Longitudinal	Transverse

G Horizontal Barriers Provided:

Water Supply Curve C

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City Water Supply:

C1 - Static Pressure : 90
C2 - Residual Pressure: 86
C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow

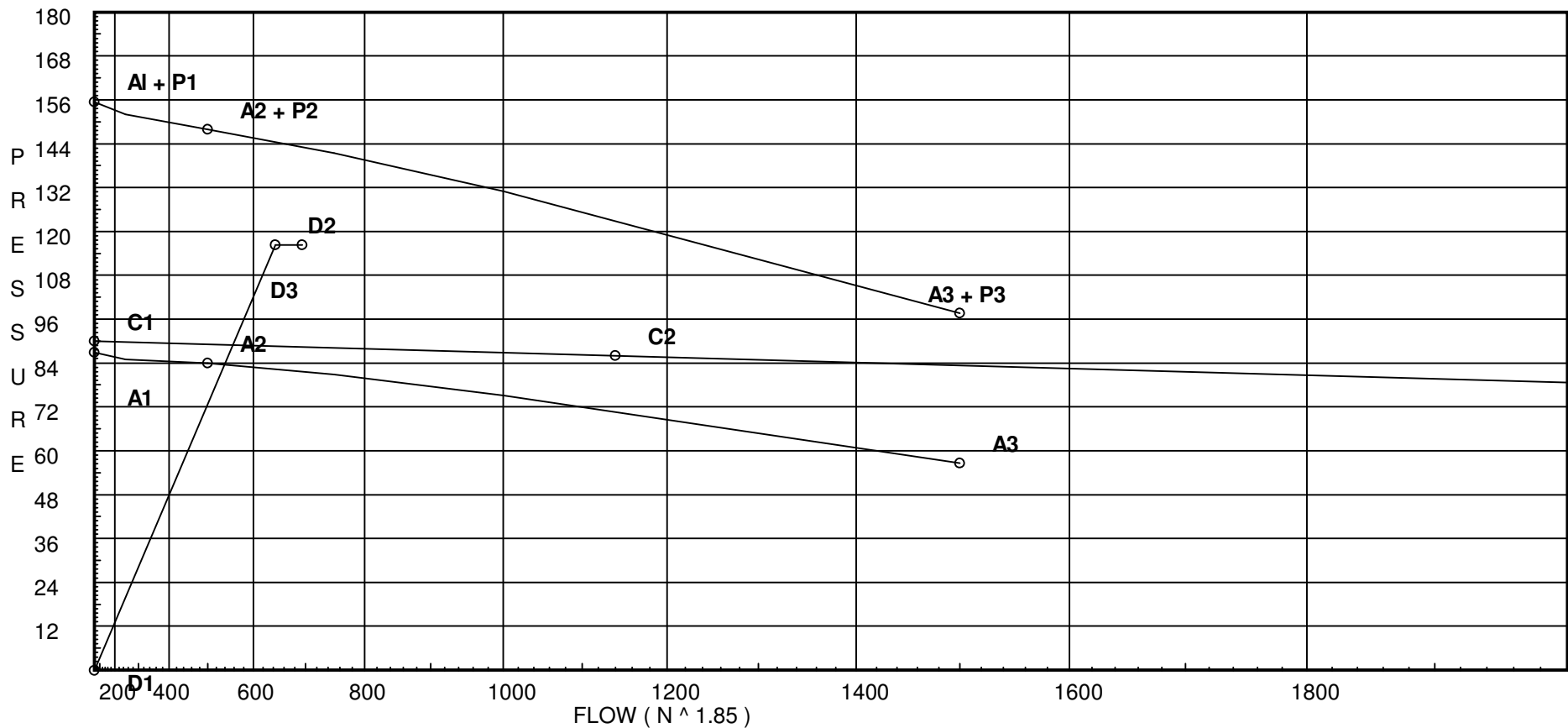
A1 - Adjusted Static: 86.869
A2 - Adj Resid : 83.879 @ 500
A3 - Adj Resid : 56.554 @ 1500

Pump Data:

P1 - Pump Churn Pressure : 68.5
P2 - Pump Rated Pressure : 64
P2 - Pump Rated Flow : 500
P3 - Pump Pressure @ Max Flow : 41
P3 - Pump Max Flow : 1500
City Residual Flow @ 0 = 6135.00
City Residual Flow @ 20 = 5355.71
City Water @ 150% of Pump = 83.35

Demand:

D1 - Elevation : -8.463
D2 - System Flow : 643.329
D2 - System Pressure : 116.240
Hose (Demand) : 50
D3 - System Demand : 693.329
Hose (Adj City) : 200
Safety Margin : 26.839



Fittings Used Summary

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Fitting Legend

Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
Jx	Standard Grooved Tee	0	0	4.5	4.8	5.8	8.0	9.8	12.2	17	16.3	20.5	24.8	32.8	41.3	49.7	65	78	88	98	120
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkins 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units Inches
Length Units Feet
Flow Units US Gallons per Minute
Pressure Units Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S1	84.04	8	17.68	na	33.64	0.2	110	7.0
S2	84.04	8	18.07	na	34.0	0.2	110	7.0
S4	84.46	8	10.56	na	26.0	0.2	130	7.0
S5	84.46	8	10.91	na	26.43	0.2	130	7.0
S6	84.04	8	12.97	na	28.81	0.2	130	7.0
S9	84.46	8	11.91	na	27.61	0.2	130	7.0
S10	84.46	8	12.31	na	28.07	0.2	130	7.0
S11	84.04	8	14.01	na	29.95	0.2	130	7.0
S12	84.46	8	12.28	na	28.03	0.2	130	7.0
S13	84.46	8	12.68	na	28.49	0.2	130	7.0
S14	84.46	8	10.93	na	26.45	0.2	130	7.0
S15	84.46	8	11.29	na	26.88	0.2	130	7.0
S16	84.04	8	12.88	na	28.71	0.2	130	7.0
S17	84.46	8	13.35	na	29.23	0.2	130	7.0
S18	84.46	8	13.79	na	29.71	0.2	130	7.0
S19	84.46	8	11.39	na	27.0	0.2	130	7.0
S20	84.46	8	11.77	na	27.44	0.2	130	7.0
S21	84.04	8	13.41	na	29.29	0.2	130	7.0
S22	84.46	8	15.41	na	31.4	0.2	130	7.0
X1	83.54		19.77	na				
X2	83.54		20.19	na				
S3	83.54	8	21.73	na	37.29	0.2	130	7.0
X4	83.62		12.16	na				
X5	83.62		12.55	na				
X6	83.62		14.54	na				
Z1	83.62		14.82	na				
S7	83.62	8	13.37	na	29.26	0.2	130	7.0
S8	83.62	8	13.72	na	29.63	0.2	130	7.0
X9	83.62		13.66	na				
X10	83.62		14.09	na				
X11	83.62		15.68	na				
Z2	83.62		16.0	na				
X12	83.62		14.06	na				
X13	83.62		14.51	na				
X14	83.62		12.56	na				
X15	83.62		12.96	na				
X16	83.62		14.44	na				
Z3	83.62		17.32	na				
Z4	83.62		19.53	na				
X17	83.62		15.25	na				
X18	83.62		15.73	na				
X19	83.62		13.08	na				
X20	83.62		13.49	na				
X21	83.62		15.02	na				
Z5	83.62		18.02	na				
X22	83.62		17.52	na				
D1	79.75		30.45	na				
D2	79.75		30.51	na				
D3	79.75		31.32	na				
D4	79.75		33.72	na				
D5	79.75		40.9	na				
D6	79.75		56.45	na				
D7	94.0		58.55	na				
B10	95.75		79.07	na				
B11	95.75		99.3	na				
SYS2	110.25		102.38	na				
HV12	103.0		105.52	na				
HV11	89.0		109.22	na	50.0			
SYS1	95.75		106.31	na				
BLK1	97.625		107.84	na				
BLK2	98.167		109.47	na				

Flow Summary - Standard

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
TOR	96.167		111.09	na				
BOR	87.375		115.64	na				
PO	87.375		116.24	na				
PI	87.375		81.68	na				
BYPS	94.0		78.91	na				
BKFL	87.5		86.54	na				
SPIG	96.875		82.96	na				
UG1	96.875		87.8	na	200.0			
TEST	104.0		87.45	na				

The maximum velocity is 27.92 and it occurs in the pipe between nodes D4 and D5

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
* S1 to X1										
	33.64	1.049	T	5.0	0.500	17.681			K Factor = 8.00	
		120.0		0.0	5.000	0.217				
	33.64	0.3405		0.0	5.500	1.873			Vel = 12.49	
	0.0									
	33.64					19.771			K Factor = 7.57	
S2 to X2										
	34.00	1.049	T	5.0	0.500	18.066			K Factor = 8.00	
		120.0		0.0	5.000	0.217				
	34.0	0.3473		0.0	5.500	1.910			Vel = 12.62	
	0.0									
	34.00					20.193			K Factor = 7.57	
S4 to X4										
	26.00	1.049	T	5.0	0.830	10.562			K Factor = 8.00	
		120.0		0.0	5.000	0.364				
	26.0	0.2115		0.0	5.830	1.233			Vel = 9.65	
	0.0									
	26.00					12.159			K Factor = 7.46	
S5 to X5										
	26.43	1.049	T	5.0	0.830	10.914			K Factor = 8.00	
		120.0		0.0	5.000	0.364				
	26.43	0.2178		0.0	5.830	1.270			Vel = 9.81	
	0.0									
	26.43					12.548			K Factor = 7.46	
S6 to X6										
	28.82	1.049	T	5.0	0.420	12.973			K Factor = 8.00	
		120.0		0.0	5.000	0.182				
	28.82	0.2557		0.0	5.420	1.386			Vel = 10.70	
	0.0									
	28.82					14.541			K Factor = 7.56	
S9 to X9										
	27.61	1.049	T	5.0	0.830	11.914			K Factor = 8.00	
		120.0		0.0	5.000	0.364				
	27.61	0.2362		0.0	5.830	1.377			Vel = 10.25	
	0.0									
	27.61					13.655			K Factor = 7.47	
S10 to X10										
	28.06	1.049	T	5.0	0.830	12.307			K Factor = 8.00	
		120.0		0.0	5.000	0.364				
	28.06	0.2434		0.0	5.830	1.419			Vel = 10.42	
	0.0									
	28.06					14.090			K Factor = 7.48	
S11 to X11										
	29.95	1.049	T	5.0	0.420	14.013			K Factor = 8.00	
		120.0		0.0	5.000	0.182				
	29.95	0.2745		0.0	5.420	1.488			Vel = 11.12	
	0.0									
	29.95					15.683			K Factor = 7.56	
S12 to X12										
	28.03	1.049	T	5.0	0.830	12.278			K Factor = 8.00	
		120.0		0.0	5.000	0.364				
	28.03	0.2429		0.0	5.830	1.416			Vel = 10.41	
	0.0									
	28.03					14.058			K Factor = 7.48	

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
S13 to X13	28.49 28.49	1.049 120.0 0.2504	T	5.0 0.0 0.0	0.830 5.000 5.830	12.682 0.364 1.460			K Factor = 8.00 Vel = 10.58	
	0.0 28.49						14.506		K Factor = 7.48	
S14 to X14	26.45 26.45	1.049 120.0 0.2182	T	5.0 0.0 0.0	0.830 5.000 5.830	10.928 0.364 1.272			K Factor = 8.00 Vel = 9.82	
	0.0 26.45						12.564		K Factor = 7.46	
S15 to X15	26.88 26.88	1.049 120.0 0.2247	T	5.0 0.0 0.0	0.830 5.000 5.830	11.291 0.364 1.310			K Factor = 8.00 Vel = 9.98	
	0.0 26.88						12.965		K Factor = 7.47	
S16 to X16	28.71 28.71	1.049 120.0 0.2541	T	5.0 0.0 0.0	0.420 5.000 5.420	12.877 0.182 1.377			K Factor = 8.00 Vel = 10.66	
	0.0 28.71						14.436		K Factor = 7.56	
S17 to X17	29.24 29.24	1.049 120.0 0.2628	T	5.0 0.0 0.0	0.830 5.000 5.830	13.354 0.364 1.532			K Factor = 8.00 Vel = 10.85	
	0.0 29.24						15.250		K Factor = 7.49	
S18 to X18	29.71 29.71	1.049 120.0 0.2705	T	5.0 0.0 0.0	0.830 5.000 5.830	13.792 0.364 1.577			K Factor = 8.00 Vel = 11.03	
	0.0 29.71						15.733		K Factor = 7.49	
S19 to X19	27.00 27.0	1.049 120.0 0.2268	T	5.0 0.0 0.0	0.830 5.000 5.830	11.389 0.364 1.322			K Factor = 8.00 Vel = 10.02	
	0.0 27.00						13.075		K Factor = 7.47	
S20 to X20	27.44 27.44	1.049 120.0 0.2336	T	5.0 0.0 0.0	0.830 5.000 5.830	11.766 0.364 1.362			K Factor = 8.00 Vel = 10.19	
	0.0 27.44						13.492		K Factor = 7.47	
S21 to X21	29.29 29.29	1.049 120.0 0.2637	T	5.0 0.0 0.0	0.420 5.000 5.420	13.409 0.182 1.429			K Factor = 8.00 Vel = 10.87	
	0.0 29.29						15.020		K Factor = 7.56	
S22 to X22	31.40 31.4	1.049 120.0 0.2998	T	5.0 0.0 0.0	0.830 5.000 5.830	15.409 0.364 1.748			K Factor = 8.00 Vel = 11.66	

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0 31.40					17.521			K Factor = 7.50	
*										
X1	33.64	1.61		0.0	10.000	19.771				
to		120.0		0.0	0.0	0.0				
X2	33.64	0.0422		0.0	10.000	0.422			Vel = 5.30	
X2	34.00	1.61		0.0	10.000	20.193				
to		120.0		0.0	0.0	0.0				
S3	67.64	0.1540		0.0	10.000	1.540			Vel = 10.66	
S3	37.30	1.61	2lx	4.6	7.810	21.733			K Factor = 8.00	
to		120.0	T	8.0	12.600	1.641				
D1	104.94	0.3468		0.0	20.410	7.079			Vel = 16.54	
	0.0 104.94					30.453			K Factor = 19.02	
*										
X4	26.00	1.61		0.0	14.840	12.159				
to		120.0		0.0	0.0	0.0				
X5	26.0	0.0262		0.0	14.840	0.389			Vel = 4.10	
X5	26.43	1.61	2lx	4.6	16.140	12.548				
to		120.0		0.0	4.600	0.0				
X6	52.43	0.0961		0.0	20.740	1.993			Vel = 8.26	
X6	28.81	1.61		0.0	1.270	14.541				
to		120.0		0.0	0.0	0.0				
Z1	81.24	0.2165		0.0	1.270	0.275			Vel = 12.80	
Z1	58.89	1.61	lx	2.3	7.570	14.816				
to		120.0	Jx	5.8	16.100	1.676				
D2	140.13	0.5922	T	8.0	23.670	14.017			Vel = 22.08	
	0.0 140.13					30.509			K Factor = 25.37	
*										
S7	29.26	1.61		0.0	10.500	13.373			K Factor = 8.00	
to		120.0		0.0	0.0	0.0				
S8	29.26	0.0327		0.0	10.500	0.343			Vel = 4.61	
S8	29.62	1.61		0.0	9.230	13.716			K Factor = 8.00	
to		120.0		0.0	0.0	0.0				
Z1	58.88	0.1192		0.0	9.230	1.100			Vel = 9.28	
	0.0 58.88					14.816			K Factor = 15.30	
*										
X9	27.61	1.61		0.0	14.830	13.655				
to		120.0		0.0	0.0	0.0				
X10	27.61	0.0293		0.0	14.830	0.435			Vel = 4.35	
X10	28.07	1.61		0.0	14.830	14.090				
to		120.0		0.0	0.0	0.0				
X11	55.68	0.1074		0.0	14.830	1.593			Vel = 8.77	
X11	29.94	1.61		0.0	1.320	15.683				
to		120.0		0.0	0.0	0.0				
Z2	85.62	0.2379		0.0	1.320	0.314			Vel = 13.49	

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
Z2 to D3	56.53 142.15	1.61 120.0 0.6081	Ix Jx T	2.3 5.8 8.0	6.340 16.100 22.440	15.997 1.676 13.646			Vel = 22.40	
	0.0 142.15					31.319			K Factor = 25.40	
*										
X12 to X13	28.03 28.03	1.61 120.0 0.0302		0.0 0.0 0.0	14.830 0.0 14.830	14.058 0.0 0.448			Vel = 4.42	
X13 to Z2	28.49 56.52	1.61 120.0 0.1104		0.0 0.0 0.0	13.510 0.0 13.510	14.506 0.0 1.491			Vel = 8.91	
	0.0 56.52					15.997			K Factor = 14.13	
*										
X14 to X15	26.45 26.45	1.61 120.0 0.0270		0.0 0.0 0.0	14.830 0.0 14.830	12.564 0.0 0.401			Vel = 4.17	
X15 to X16	26.88 53.33	1.61 120.0 0.0992		0.0 0.0 0.0	14.830 0.0 14.830	12.965 0.0 1.471			Vel = 8.40	
X16 to Z3	28.71 82.04	1.61 120.0 0.2199	Jx	5.8 0.0 0.0	7.320 5.800 13.120	14.436 0.0 2.885			Vel = 12.93	
Z3 to Z4	58.94 140.98	2.067 120.0 0.1774	J	8.5 0.0 0.0	3.960 8.500 12.460	17.321 0.0 2.210			Vel = 13.48	
Z4 to D4	115.14 256.12	2.067 120.0 0.5353	I T	3.5 10.0 0.0	9.880 13.500 23.380	19.531 1.676 12.515			Vel = 24.49	
	0.0 256.12					33.722			K Factor = 44.10	
*										
X17 to X18	29.24 29.24	1.61 120.0 0.0326		0.0 0.0 0.0	14.830 0.0 14.830	15.250 0.0 0.483			Vel = 4.61	
X18 to Z3	29.70 58.94	1.61 120.0 0.1193	Jx	5.8 0.0 0.0	7.510 5.800 13.310	15.733 0.0 1.588			Vel = 9.29	
	0.0 58.94					17.321			K Factor = 14.16	
*										
X19 to X20	27.00 27.0	1.61 120.0 0.0281		0.0 0.0 0.0	14.830 0.0 14.830	13.075 0.0 0.417			Vel = 4.26	
X20 to X21	27.44 54.44	1.61 120.0 0.1030		0.0 0.0 0.0	14.830 0.0 14.830	13.492 0.0 1.528			Vel = 8.58	

Final Calculations - Hazen-Williams

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46125900 Webster ISB - Basement Lvl - RA3

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
X21 to Z5	29.29 83.73	1.61 120.0 0.2284	Jx	5.8 0.0 0.0	7.320 5.800 13.120	15.020 0.0 2.997			Vel = 13.20	
Z5 to Z4	31.41 115.14	2.067 120.0 0.1219	J	8.5 0.0 0.0	3.920 8.500 12.420	18.017 0.0 1.514			Vel = 11.01	
	0.0 115.14					19.531			K Factor = 26.05	
*										
X22 to Z5	31.40 31.4	1.61 120.0 0.0373	Jx	5.8 0.0 0.0	7.510 5.800 13.310	17.521 0.0 0.496			Vel = 4.95	
	0.0 31.40					18.017			K Factor = 7.40	
*										
D1 to D2	104.94 104.94	3.068 120.0 0.0149		0.0 0.0 0.0	3.750 0.0 3.750	30.453 0.0 0.056			Vel = 4.55	
D2 to D3	140.12 245.06	3.068 120.0 0.0721		0.0 0.0 0.0	11.230 0.0 11.230	30.509 0.0 0.810			Vel = 10.64	
D3 to D4	142.15 387.21	3.068 120.0 0.1680		0.0 0.0 0.0	14.300 0.0 14.300	31.319 0.0 2.403			Vel = 16.80	
D4 to D5	256.12 643.33	3.068 120.0 0.4298		0.0 0.0 0.0	16.710 0.0 16.710	33.722 0.0 7.182			Vel = 27.92	
D5 to D6	0.0 643.33	3.068 120.0 0.4298	I J	5.0 13.0 0.0	18.170 18.000 36.170	40.904 0.0 15.546			Vel = 27.92	
D6 to D7	0.0 643.33	3.068 120.0 0.4298	I	5.0 0.0 0.0	14.250 5.000 19.250	56.450 -6.172 8.274			Vel = 27.92	
D7 to B10	0.0 643.33	3.068 120.0 0.4298	2I J	10.0 13.0 0.0	26.500 23.000 49.500	58.552 -0.758 21.275			Vel = 27.92	
B10 to B11	0.0 643.33	3.068 120.0 0.4298	2I	10.0 0.0 0.0	37.083 10.000 47.083	79.069 0.0 20.236			Vel = 27.92	
B11 to SYS1	0.0 643.33	4.026 120.0 0.1144	I T B C	6.8 20.0 12.0 13.0	9.390 51.800 61.190	99.305 0.0 7.002			Vel = 16.21	
	0.0 643.33					106.307			K Factor = 62.40	
*										

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125900 Webster ISB - Basement Lvl - RA3

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
SYS2 to HV12	0.0	4.026 120.0		0.0	7.250 0.0	102.376 3.140	0.0 0.0			
HV12 to BLK1	0.0	4.026 120.0	J	16.0	5.375 16.000	105.516 2.328	0.0 0.0	Vel = 0		
	0.0	0.0		0.0	21.375	0.0	0.0	Vel = 0		
	0.0					107.844		K Factor = 0		
HV11 to SYS1	50.00	4.026 120.0		0.0	6.750 0.0	109.224 -2.923		Qa = 50		
	50.0	0.0009		0.0	6.750	0.006		Vel = 1.26		
SYS1 to BLK1	643.33	4.026 120.0	J	16.0	1.875 16.000	106.307 -0.812				
	693.33	0.1314		0.0	17.875	2.349		Vel = 17.47		
BLK1 to BLK2	0.0	6.065 120.0	2I H	20.0 5.0	46.209 58.000	107.844 -0.235				
	693.33	0.0179	B J	8.0 25.0	104.209	1.862		Vel = 7.70		
BLK2 to TOR	0.0	6.065 120.0	2I	20.0	22.083 20.000	109.471 0.866				
	693.33	0.0179		0.0	42.083	0.752		Vel = 7.70		
TOR to BOR	0.0	6.065 120.0	B J	8.0 25.0	8.792 33.000	111.089 3.808				
	693.33	0.0179		0.0	41.792	0.746		Vel = 7.70		
BOR to PO	0.0	6.065 120.0	B C	8.0 20.0	5.417 28.000	115.643 0.0				
	693.33	0.0179		0.0	33.417	0.597		Vel = 7.70		
	0.0									
	693.33					116.240		K Factor = 64.31		
System Demand Pressure						116.240				
Safety Margin						26.839				
Continuation Pressure						143.079				
Pressure @ Pump Outlet						143.079				
Pressure From Pump Curve						-61.397				
Pressure @ Pump Inlet						81.682				
*										
PI to BYPs	0.0	7.981 120.0	lx	13.1	8.292 13.100	81.682 -2.869				
	693.33	0.0047		0.0	21.392	0.100		Vel = 4.45		
BYPs to BKFL	0.0	6.065 120.0	2J I	50.0 10.0	13.417 60.000	78.913 6.315		** Fixed Loss = 3.5		
	693.33	0.0179	Zib	0.0	73.417	1.312		Vel = 7.70		
BKFL to SPIG	0.0	7.981 120.0	G lx	4.0 13.1	85.291 17.100	86.540 -4.060				
	693.33	0.0047		0.0	102.391	0.480		Vel = 4.45		
SPIG to UG1	0.0	8.39 140.0	2G Zac	13.572 0.0	80.000 134.023	82.960 4.251		** Fixed Loss = 4.251		
	693.33	0.0028	2V	61.074	214.023	0.592		Vel = 4.02		

Final Calculations - Hazen-Williams

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46125900 Webster ISB - Basement Lvl - RA3

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Hyd. Ref. Point	Qa	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
			X	59.377						
UG1	200.00	8.39	2G	13.572	500.000	87.803			Qa = 200	
to		140.0	3U	45.805	118.754	-3.086				
TEST	893.33	0.0044	X	59.377	618.754	2.735			Vel = 5.18	
	0.0									
	893.33					87.452			K Factor = 95.53	



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name : 46125901 Webster ISB - 1st Lvl - RA1
Building : Webster ISB
Location : 8274 Big Bend Blvd
System : SYS1
Contract : 461259
Data File : 46125901 Webster ISB - 1st Lvl - RA1.WXF

Hydraulic Design Information Sheet

Name - 46125901 Webster ISB - 1st Lvl - RA1 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS1
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-101.B
Construction: () Combustible (X) Non-Combustible Ceiling Height - 9-6
Occupancy - HC-1

S () NFPA 13 () Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
Y () NFPA 231 () NFPA 231C () Figure Curve
S Other Factory Mutual - HC-1
T Specific Ruling Made By Date
E

M	Area of Sprinkler Operation - 1542	System Type	Sprinkler/Nozzle
	Density - .10	(X) Wet	Make Viking
D	Area Per Sprinkler - 400	() Dry	Model VK632
E	Elevation at Highest Outlet - 95	() Deluge	Size 3/4"
S	Hose Allowance - Inside - 50	() Preaction	K-Factor 8.0
I	Rack Sprinkler Allowance - n/a	() Other	Temp.Rat.155
G	Hose Allowance - Outside - 200		

N
Note

Calculation Flow Required - 402.75 Press Required - 130.188 SYS1
Summary C-Factor Used: 120 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 05/23/16		Cap. -
T	Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
E	Static Press - 90	@ Press - 55	
R	Residual Press - 86	Elev. - 87.375	Well
	Flow - 1140		Proof Flow
S	Elevation - 104		

U
P Location - 8274 Big Bend Blvd
P
L Source of Information - Ahern Fire Protection
Y

C	Commodity	Class	Location
O	Storage Ht.	Area	Aisle W.
M	Storage Method:	Solid Piled %	Palletized % Rack
M			
	() Single Row	() Conven. Pallet	() Auto. Storage () Encap.
S	() Double Row	() Slave Pallet	() Solid Shelf () Non
T	() Mult. Row		() Open Shelf
O			
C			
R	Flue Spacing	Clearance:Storage to Ceiling	
A	Longitudinal	Transverse	
G			
E	Horizontal Barriers Provided:		

Water Supply Curve C

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA1

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City Water Supply:

C1 - Static Pressure : 90
C2 - Residual Pressure: 86
C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow

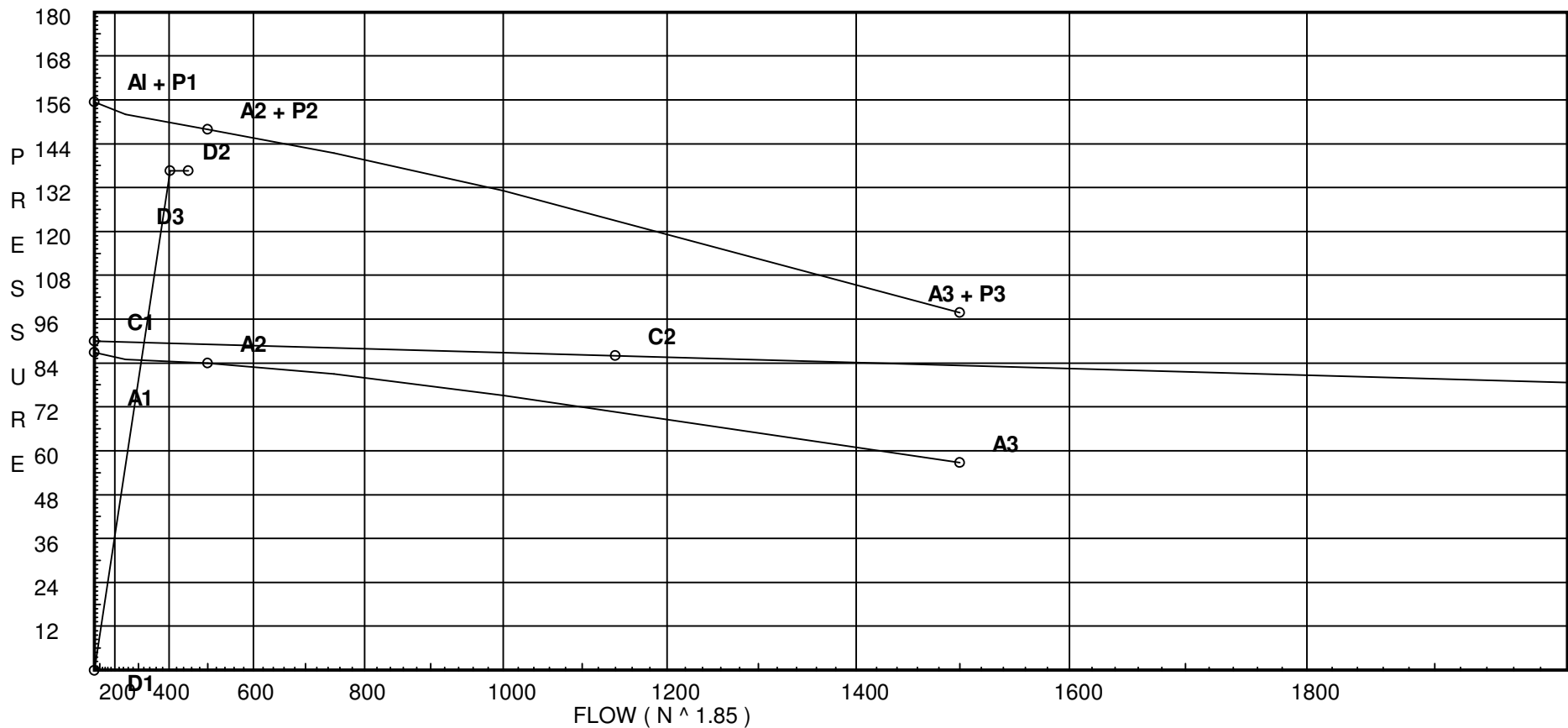
A1 - Adjusted Static: 86.869
A2 - Adj Resid : 83.909 @ 500
A3 - Adj Resid : 56.783 @ 1500

Pump Data:

P1 - Pump Churn Pressure : 68.5
P2 - Pump Rated Pressure : 64
P2 - Pump Rated Flow : 500
P3 - Pump Pressure @ Max Flow : 41
P3 - Pump Max Flow : 1500
City Residual Flow @ 0 = 6135.00
City Residual Flow @ 20 = 5355.71
City Water @ 150% of Pump = 83.35

Demand:

D1 - Elevation : -3.898
D2 - System Flow : 402.751
D2 - System Pressure : 136.518
Hose (Demand) : 50
D3 - System Demand : 452.751
Hose (Adj City) : 200
Safety Margin : 12.512



Fittings Used Summary

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA1

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Fitting Legend

Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
Hx	Standard Grooved 45 Ell	0	0	.8	1.0	1.2	1.6	2.0	2.4	0	3.3	4.1	5.0	6.6	8.3	9.9	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkins 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units Inches
Length Units Feet
Flow Units US Gallons per Minute
Pressure Units Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA1

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S1	95.0	8	41.54	na	51.56	0.1	400	25.0
S2	95.0	8	35.95	na	47.97	0.1	400	25.0
S3	95.0	8	38.36	na	49.55	0.1	400	25.0
S4	95.0	8	35.51	na	47.67	0.1	400	25.0
S5	95.0	8	37.89	na	49.24	0.1	400	25.0
S6	95.0	8	25.0	na	40.0	0.1	400	25.0
S7	95.0	5.6	33.8	na	32.56	0.1	82	7.0
S8	95.0	8	25.85	na	40.67	0.1	256	10.6
S9	95.0	8	29.61	na	43.53	0.1	256	10.6
X2	95.75		52.49	na				
X3	95.75		55.95	na				
X4	95.75		51.87	na				
X5	95.75		55.28	na				
X6	96.21		43.48	na				
X7	96.21		44.16	na				
X8	96.21		44.92	na				
X9	96.21		51.3	na				
Z1	96.21		57.58	na				
A1	95.75		71.6	na				
A2	95.75		71.61	na				
A3	95.75		71.8	na				
A4	95.75		72.41	na				
A5	95.75		78.1	na				
A6	95.4		95.7	na				
A7	95.4		100.92	na				
C1	95.29		95.75	na				
C2	95.29		95.75	na				
C3	95.29		95.75	na				
C4	95.29		95.75	na				
C5	95.29		95.75	na				
C6	95.29		95.75	na				
C7	95.29		95.75	na				
C8	95.29		95.75	na				
C9	98.0		94.57	na				
C10	95.75		95.55	na				
B1	95.75		106.33	na				
B2	95.75		106.33	na				
B3	95.75		106.33	na				
B4	95.75		106.33	na				
B5	95.75		106.33	na				
B6	95.75		106.33	na				
B7	95.75		106.51	na				
B8	95.75		107.6	na				
B9	95.75		107.94	na				
B10	95.75		115.81	na				
B11	95.75		122.6	na				
SYS2	110.25		124.95	na				
HV12	103.0		128.09	na				
HV11	89.0		133.11	na	50.0			
SYS1	95.75		130.19	na				
BLK1	97.625		130.42	na				
BLK2	98.167		130.95	na				
TOR	96.167		132.12	na				
BOR	87.375		136.26	na				
PO	87.375		136.52	na				
PI	87.375		84.33	na				
BYPS	94.0		81.51	na				
BKFL	87.5		88.4	na				
SPIG	96.875		84.55	na				
UG1	96.875		90.13	na	200.0			
TEST	104.0		88.57	na				

Flow Summary - Standard

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA1

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
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The maximum velocity is 24.7 and it occurs in the pipe between nodes X9 and Z1

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
*DROPS										
S1 to A1	51.56 51.56	1.049 120.0 0.7504	T Eq	5.0 35.5 0.0	0.001 40.500 40.501	41.539 -0.325 30.390			K Factor = 8.00 Vel = 19.14	
	0.0 51.56						71.604		K Factor = 6.09	
S2 to X2	47.96 47.96	1.049 120.0 0.6564	T Eq	5.0 20.7 0.0	0.001 25.700 25.701	35.948 -0.325 16.871			K Factor = 8.00 Vel = 17.80	
	0.0 47.96						52.494		K Factor = 6.62	
S3 to X3	49.55 49.55	1.049 120.0 0.6971	T Eq	5.0 20.7 0.0	0.001 25.700 25.701	38.357 -0.325 17.915			K Factor = 8.00 Vel = 18.39	
	0.0 49.55						55.947		K Factor = 6.62	
S4 to X4	47.67 47.67	1.049 120.0 0.6490	T Eq	5.0 20.7 0.0	0.001 25.700 25.701	35.510 -0.325 16.681			K Factor = 8.00 Vel = 17.70	
	0.0 47.67						51.866		K Factor = 6.62	
S5 to X5	49.24 49.24	1.049 120.0 0.6892	T Eq	5.0 20.7 0.0	0.001 25.700 25.701	37.891 -0.325 17.714			K Factor = 8.00 Vel = 18.28	
	0.0 49.24						55.280		K Factor = 6.62	
S6 to X6	40.00 40.0	1.049 120.0 0.4691	T Eq	5.0 35.5 0.0	0.001 40.500 40.501	25.000 -0.524 19.000			K Factor = 8.00 Vel = 14.85	
	0.0 40.00						43.476		K Factor = 6.07	
S7 to X7	32.56 32.56	1.049 120.0 0.3206	T Eq	5.0 23.5 0.0	5.420 28.500 33.920	33.805 -0.524 10.874			K Factor = 5.60 Vel = 12.09	
	0.0 32.56						44.155		K Factor = 4.90	
S8 to X8	40.67 40.67	1.049 120.0 0.4838	T Eq	5.0 35.5 0.0	0.001 40.500 40.501	25.846 -0.524 19.594			K Factor = 8.00 Vel = 15.10	
	0.0 40.67						44.916		K Factor = 6.07	
S9 to X9	43.53 43.53	1.049 120.0 0.5486	T Eq	5.0 35.5 0.0	0.001 40.500 40.501	29.609 -0.524 22.219			K Factor = 8.00 Vel = 16.16	
	0.0 43.53						51.304		K Factor = 6.08	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA1

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Date 09/22/16

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
*BRANCHLINES										
*										
X2	47.96	1.38		0.0	20.000	52.494				
to		120.0		0.0	0.0	0.0				
X3	47.96	0.1726		0.0	20.000	3.453			Vel = 10.29	
X3	49.55	1.38	lx	1.9	15.510	55.947				
to		120.0	Hx	1.0	8.900	0.0				
A2	97.51	0.6415	T	6.0	24.410	15.659			Vel = 20.92	
	0.0									
	97.51					71.606			K Factor = 11.52	
*										
X4	47.67	1.38		0.0	20.000	51.866				
to		120.0		0.0	0.0	0.0				
X5	47.67	0.1707		0.0	20.000	3.414			Vel = 10.23	
X5	49.25	1.38	lx	1.9	17.140	55.280				
to		120.0	Hx	1.0	8.900	0.0				
A3	96.92	0.6343	T	6.0	26.040	16.516			Vel = 20.79	
	0.0									
	96.92					71.796			K Factor = 11.44	
*										
X6	40.00	1.61		0.0	11.660	43.476				
to		120.0		0.0	0.0	0.0				
X7	40.0	0.0582		0.0	11.660	0.679			Vel = 6.30	
X7	32.56	1.61		0.0	4.340	44.155				
to		120.0		0.0	0.0	0.0				
X8	72.56	0.1753		0.0	4.340	0.761			Vel = 11.43	
X8	40.67	1.61		0.0	16.000	44.916				
to		120.0		0.0	0.0	0.0				
X9	113.23	0.3992		0.0	16.000	6.388			Vel = 17.84	
X9	43.53	1.61		0.0	8.608	51.304				
to		120.0		0.0	0.0	0.0				
Z1	156.76	0.7287		0.0	8.608	6.273			Vel = 24.70	
Z1	0.0	1.61	2lx	4.6	7.482	57.577				
to		120.0	T	8.0	12.600	0.199				
A4	156.76	0.7288		0.0	20.082	14.636			Vel = 24.70	
	0.0									
	156.76					72.412			K Factor = 18.42	
*MAINS										
A1	51.56	3.26		0.0	0.790	71.604				
to		120.0		0.0	0.0	0.0				
A2	51.56	0.0025		0.0	0.790	0.002			Vel = 1.98	
A2	97.51	3.26		0.0	8.900	71.606				
to		120.0		0.0	0.0	0.0				
A3	149.07	0.0213		0.0	8.900	0.190			Vel = 5.73	
A3	96.92	3.26		0.0	11.400	71.796				
to		120.0		0.0	0.0	0.0				
A4	245.99	0.0540		0.0	11.400	0.616			Vel = 9.46	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
A4 to A5	156.76 402.75	3.26 120.0 0.1345		0.0 0.0 0.0	42.330 0.0 42.330	72.412 0.0 5.692			Vel = 15.48	
A5 to A6	0.0 402.75	3.26 120.0 0.1345	J 3I	17.471 20.159 0.0	92.110 37.630 129.740	78.104 0.152 17.445			Vel = 15.48	
A6 to A7	0.0 402.75	3.26 120.0 0.1344	J	17.471 0.0 0.0	21.370 17.471 38.841	95.701 0.0 5.222			Vel = 15.48	
A7 to B6	0.0 402.75	3.26 120.0 0.1345	2H J	6.989 17.471 0.0	16.860 24.460 41.320	100.923 -0.152 5.557			Vel = 15.48	
	0.0 402.75					106.328			K Factor = 39.06	
*										
C1 to C2	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	4.740 0.0 4.740	95.748 0.0 0.0	0.0 0.0 0.0		Vel = 0	
C2 to C3	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	0.810 0.0 0.810	95.748 0.0 0.0	0.0 0.0 0.0		Vel = 0	
C3 to C4	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	11.690 0.0 11.690	95.748 0.0 0.0	0.0 0.0 0.0		Vel = 0	
C4 to C5	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	2.910 0.0 2.910	95.748 0.0 0.0	0.0 0.0 0.0		Vel = 0	
C5 to C6	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	12.090 0.0 12.090	95.748 0.0 0.0	0.0 0.0 0.0		Vel = 0	
C6 to C7	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	3.240 0.0 3.240	95.748 0.0 0.0	0.0 0.0 0.0		Vel = 0	
C7 to C8	0.0 0.0	3.26 120.0 0.0	I	6.72 0.0 0.0	28.260 6.720 34.980	95.748 0.0 0.0	0.0 0.0 0.0		Vel = 0	
C8 to C9	0.0 0.0	3.26 120.0 0.0	4I 2H	26.879 6.989 0.0	57.440 33.868 91.308	95.748 -1.174 0.0	0.0 0.0 0.0		Vel = 0	
C9 to C10	0.0 0.0	3.26 120.0 0.0	2I	13.44 0.0 0.0	22.280 13.440 35.720	94.574 0.974 0.0	0.0 0.0 0.0		Vel = 0	
C10 to A6	0.0 0.0	3.26 120.0 0.0	2H J	6.989 17.471 0.0	18.800 24.460 43.260	95.549 0.152 0.0	0.0 0.0 0.0		Vel = 0	
	0.0									

Final Calculations - Hazen-Williams

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46125901 Webster ISB - 1st Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.		Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0					95.701		K Factor = 0		
* 										
B1 to B2	0.0	3.26 120.0		0.0 0.0	1.040 0.0	106.328 0.0	0.0 0.0			
B2 to B3	0.0	0.0		0.0	1.040	0.0	0.0		Vel = 0	
B2 to B3	0.0	3.26 120.0		0.0 0.0	2.370 0.0	106.328 0.0	0.0 0.0			
B3 to B4	0.0	0.0		0.0	2.370	0.0	0.0		Vel = 0	
B3 to B4	0.0	3.26 120.0		0.0 0.0	8.130 0.0	106.328 0.0	0.0 0.0			
B4 to B5	0.0	0.0		0.0	8.130	0.0	0.0		Vel = 0	
B4 to B5	0.0	3.26 120.0		0.0 0.0	6.130 0.0	106.328 0.0	0.0 0.0			
B5 to B6	0.0	0.0		0.0	6.130	0.0	0.0		Vel = 0	
B5 to B6	0.0	3.26 120.0		0.0 0.0	3.160 0.0	106.328 0.0	0.0 0.0			
B6 to B7	402.75	3.26 120.0		0.0 0.0	1.340 0.0	106.328 0.0				
B7 to B8	402.75	0.1343		0.0	1.340	0.180			Vel = 15.48	
B7 to B8	0.0	3.26 120.0		0.0 0.0	8.100 0.0	106.508 0.0				
B8 to B9	402.75	0.1344		0.0	8.100	1.089			Vel = 15.48	
B8 to B9	0.0	3.26 120.0		0.0 0.0	2.560 0.0	107.597 0.0				
B9 to B10	402.75	0.1344		0.0	2.560	0.344			Vel = 15.48	
B9 to B10	0.0	3.26 120.0		0.0 0.0	58.497 0.0	107.941 0.0				
B10 to B11	402.75	0.1345		0.0	58.497	7.866			Vel = 15.48	
B10 to B11	0.0	3.26 120.0	2I	13.44 0.0	37.083 13.440	115.807 0.0				
B11 to SYS1	402.75	0.1345		0.0	50.523	6.793			Vel = 15.48	
B11 to SYS1	0.0	3.26 120.0	I T	6.72 20.159	9.390 47.039	122.600 0.0				
	402.75	0.1345	B C	6.72 13.44	56.429	7.588			Vel = 15.48	
	0.0 402.75					130.188		K Factor = 35.30		
* 										
SYS2 to HV12	0.0	4.26 120.0		0.0 0.0	7.250 0.0	124.949 3.140	0.0 0.0			
HV12 to BLK1	0.0	0.0		0.0	7.250	0.0	0.0		Vel = 0	
HV12 to BLK1	0.0	4.26 120.0	J	21.067 0.0	5.375 21.067	128.089 2.328	0.0 0.0			
	0.0	0.0		0.0	26.442	0.0	0.0		Vel = 0	
	0.0									

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0					130.417			K Factor = 0	
HV11 to SYS1	50.00 50.0	4.26 120.0 0.0007		0.0 0.0 0.0	6.750 0.0 6.750	133.106 -2.923 0.005			Qa = 50 Vel = 1.13	
SYS1 to BLK1	402.75 452.75	4.26 120.0 0.0454	J	21.067 0.0 0.0	1.875 21.067 22.942	130.188 -0.812 1.041			Vel = 10.19	
BLK1 to BLK2	0.0 452.75	6.357 120.0 0.0065	2I H B J	25.147 6.287 10.059 31.433	46.209 72.926 119.135	130.417 -0.235 0.769			Vel = 4.58	
BLK2 to TOR	0.0 452.75	6.357 120.0 0.0065	2I	25.147 0.0 0.0	22.083 25.147 47.230	130.951 0.866 0.306			Vel = 4.58	
TOR to BOR	0.0 452.75	6.357 120.0 0.0064	B J	10.059 31.433 0.0	8.792 41.492 50.284	132.123 3.808 0.324			Vel = 4.58	
BOR to PO	0.0 452.75	6.357 120.0 0.0065	B C	10.059 25.147 0.0	5.417 35.206 40.623	136.255 0.0 0.263			Vel = 4.58	
	0.0 452.75					136.518			K Factor = 38.75	
System Demand Pressure						136.518				
Safety Margin						12.512				
Continuation Pressure						149.030				
Pressure @ Pump Outlet						149.030				
Pressure From Pump Curve						-64.697				
Pressure @ Pump Inlet						84.332				
*										
PI to BYP	0.0 452.75	8.249 120.0 0.0018	lx	15.386 0.0 0.0	8.292 15.386 23.678	84.332 -2.869 0.043			Vel = 2.72	
BYP to BKFL	0.0 452.75	6.357 120.0 0.0065	2J I Zib	62.867 12.573 0.0	13.417 75.440 88.857	81.506 6.315 0.575			** Fixed Loss = 3.5 Vel = 4.58	
BKFL to SPIG	0.0 452.75	7.981 120.0 0.0021	G lx	4.0 13.1 0.0	85.291 17.100 102.391	88.396 -4.060 0.218			Vel = 2.90	
SPIG to UG1	0.0 452.75	8.39 140.0 0.0013	2G Zac 2V X	13.572 0.0 61.074 59.377	80.000 134.023 214.023	84.554 5.307 0.269			** Fixed Loss = 5.307 Vel = 2.63	
UG1 to TEST	200.00 652.75	8.39 140.0 0.0025	2G 3U X	13.572 45.805 59.377	500.000 118.754 618.754	90.130 -3.086 1.530			Qa = 200 Vel = 3.79	
	0.0 652.75					88.574			K Factor = 69.36	

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
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Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name : 46125901 Webster ISB - 1st Lvl - RA2
Building : Webster ISB
Location : 8274 Big Bend Blvd
System : SYS1
Contract : 461259
Data File : 46125901 Webster ISB - 1st Lvl - RA2.WXF

Hydraulic Design Information Sheet

Name - 46125901 Webster ISB - 1st Lvl - RA2 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS1
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-101.A
Construction: () Combustible (X) Non-Combustible Ceiling Height - 13-5 1/2
Occupancy - HC-2

S () NFPA 13 () Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
Y () NFPA 231 () NFPA 231C () Figure Curve
S Other Factory Mutual - HC-2
T Specific Ruling Made By Date
E

M	Area of Sprinkler Operation - 2506	System Type	Sprinkler/Nozzle
	Density - .20	(X) Wet	Make Viking
D	Area Per Sprinkler - 130	() Dry	Model VK350
E	Elevation at Highest Outlet - 98.458	() Deluge	Size 3/4"
S	Hose Allowance - Inside - 50	() Preaction	K-Factor 8.0
I	Rack Sprinkler Allowance - n/a	() Other	Temp.Rat.200
G	Hose Allowance - Outside - 200		

N
Note

Calculation Flow Required - 742.16 Press Required - 111.267 SYS1
Summary C-Factor Used: 120 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 05/23/16		Cap. -
T	Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
E	Static Press - 90	@ Press - 55	
R	Residual Press - 86	Elev. - 87.375	Well
	Flow - 1140		Proof Flow
S	Elevation - 104		

U
P Location - 8274 Big Bend Blvd
P
L Source of Information - Ahern Fire Protection
Y

C	Commodity	Class	Location
O	Storage Ht.	Area	Aisle W.
M	Storage Method:	Solid Piled %	Palletized % Rack
M			
	() Single Row	() Conven. Pallet	() Auto. Storage () Encap.
S	() Double Row	() Slave Pallet	() Solid Shelf () Non
T	() Mult. Row		() Open Shelf
O			
C			
R	Flue Spacing	Clearance:Storage to Ceiling	
A	Longitudinal	Transverse	
G			
E	Horizontal Barriers Provided:		

Water Supply Curve C

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA2

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City Water Supply:

C1 - Static Pressure : 90
C2 - Residual Pressure: 86
C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow

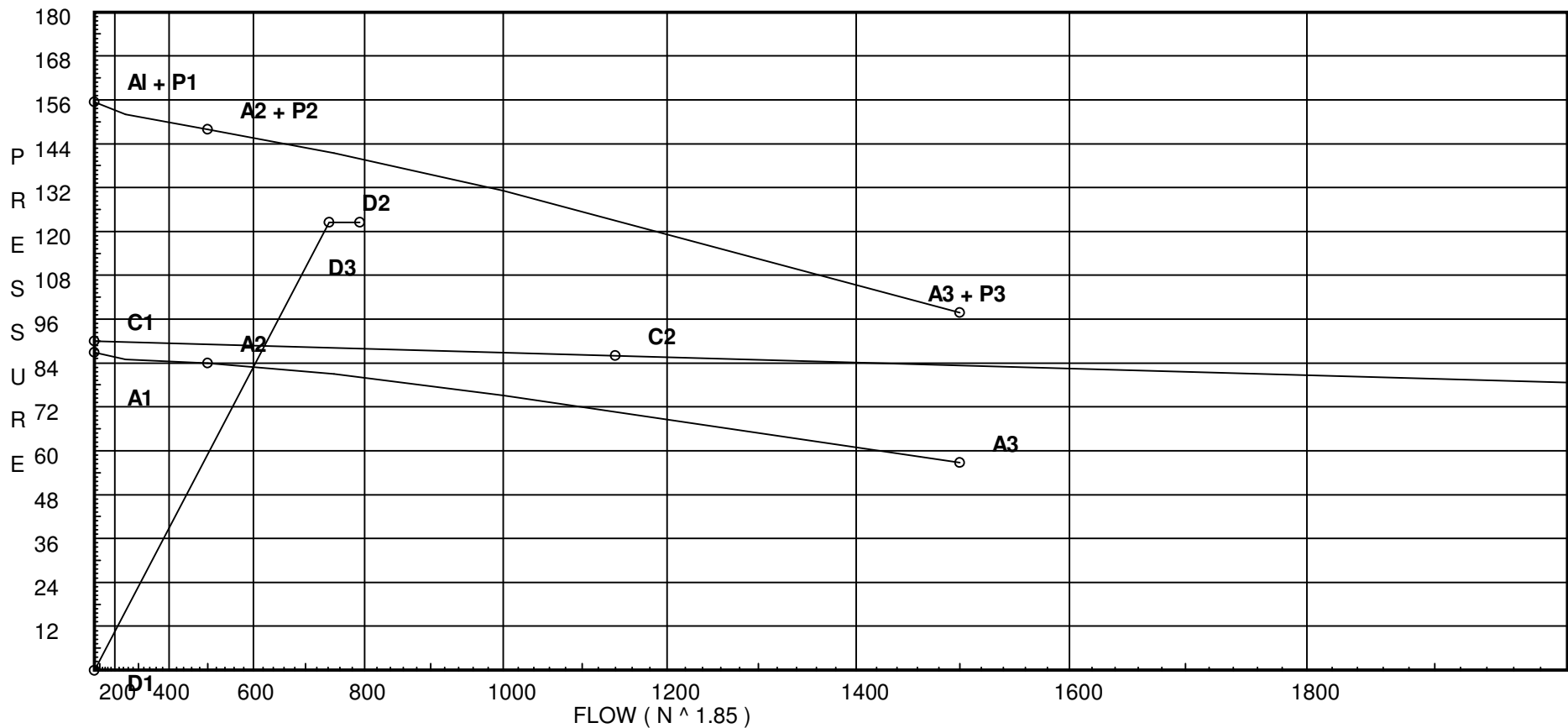
A1 - Adjusted Static: 86.869
A2 - Adj Resid : 83.909 @ 500
A3 - Adj Resid : 56.783 @ 1500

Pump Data:

P1 - Pump Churn Pressure : 68.5
P2 - Pump Rated Pressure : 64
P2 - Pump Rated Flow : 500
P3 - Pump Pressure @ Max Flow : 41
P3 - Pump Max Flow : 1500
City Residual Flow @ 0 = 6135.00
City Residual Flow @ 20 = 5355.71
City Water @ 150% of Pump = 83.35

Demand:

D1 - Elevation : -3.898
D2 - System Flow : 742.163
D2 - System Pressure : 122.501
Hose (Demand) : 50
D3 - System Demand : 792.163
Hose (Adj City) : 200
Safety Margin : 17.561



Fittings Used Summary

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA2

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Fitting Legend

Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
E	90' Standard Elbow Thrd	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
Jx	Standard Grooved Tee	0	0	4.5	4.8	5.8	8.0	9.8	12.2	17	16.3	20.5	24.8	32.8	41.3	49.7	65	78	88	98	120
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkins 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units Inches
Length Units Feet
Flow Units US Gallons per Minute
Pressure Units Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA2

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S11	95.0	8	23.89	na	39.1	0.1	324	17.0
S17	95.0	8	25.0	na	40.0	0.1	400	25.0
S21	95.5	8	11.91	na	27.61	0.2	102	7.0
S22	95.5	8	12.23	na	27.98	0.2	96	7.0
S23	95.5	8	13.41	na	29.3	0.2	96	7.0
S24	95.5	8	16.0	na	32.0	0.2	96	7.0
S25	97.5	8	32.14	na	45.35	0.2	107	7.0
S26	95.0	8	26.93	na	41.52	0.1	400	25.0
S27	94.33	5.6	26.91	na	29.05	0.1	139	7.0
S28	94.33	5.6	30.5	na	30.93	0.1	118	7.0
S29	95.5	8	11.92	na	27.62	0.2	102	7.0
S30	95.5	8	12.2	na	27.95	0.2	96	7.0
S31	95.5	8	13.25	na	29.12	0.2	96	7.0
S32	95.5	8	15.53	na	31.52	0.2	96	7.0
X11	97.5		34.36	na				
S12	97.5	8	20.66	na	36.36	0.2	122	7.0
S13	97.5	8	21.92	na	37.46	0.2	122	7.0
S14	97.5	8	17.11	na	33.09	0.2	117	7.0
S15	97.5	8	18.08	na	34.02	0.2	117	7.0
S16	97.5	8	21.67	na	37.24	0.2	117	7.0
S18	97.5	8	17.31	na	33.29	0.2	117	7.0
S19	97.5	8	18.3	na	34.22	0.2	117	7.0
S20	97.5	8	21.92	na	37.46	0.2	117	7.0
X21	96.75		18.37	na				
X22	96.75		18.86	na				
X23	96.75		20.68	na				
X24	96.75		24.65	na				
X27	95.75		37.51	na				
X28	95.75		38.19	na				
X29	96.21		21.18	na				
X30	96.21		21.68	na				
X31	96.21		23.5	na				
X32	96.21		27.45	na				
A1	95.75		38.85	na				
A2	95.75		38.85	na				
A3	95.75		38.85	na				
A4	95.75		38.85	na				
A5	95.75		38.85	na				
A6	95.4		39.0	na				
A7	95.4		39.07	na				
C1	95.29		38.97	na				
C2	95.29		38.97	na				
C3	95.29		38.97	na				
C4	95.29		38.97	na				
C5	95.29		38.97	na				
C6	95.29		38.97	na				
C7	95.29		38.97	na				
C8	95.29		38.97	na				
C9	98.0		37.8	na				
C10	95.75		38.77	na				
B1	95.75		37.75	na				
B2	95.75		37.76	na				
B3	95.75		37.83	na				
B4	95.75		38.18	na				
B5	95.75		38.73	na				
B6	95.75		39.23	na				
B7	95.75		39.52	na				
B8	95.75		41.56	na				
B9	95.75		42.34	na				
B10	95.75		66.71	na				
B11	95.75		87.76	na				

Flow Summary - Standard

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
SYS2	110.25		107.92	na				
HV12	103.0		111.06	na				
HV11	89.0		114.18	na	50.0			
SYS1	95.75		111.27	na				
BLK1	97.625		113.38	na				
BLK2	98.167		115.32	na				
TOR	96.167		117.04	na				
BOR	87.375		121.76	na				
PO	87.375		122.5	na				
PI	87.375		80.24	na				
BYPS	94.0		77.5	na				
BKFL	87.5		85.43	na				
SPIG	96.875		81.98	na				
UG1	96.875		86.67	na	200.0			
TEST	104.0		86.91	na				

The maximum velocity is 28.53 and it occurs in the pipe between nodes B9 and B10

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
*DROPS										
S11	39.10	1.049	T	5.0	0.001	23.886			K Factor = 8.00	
to		120.0	Eq	20.7	25.700	-1.083				
X11	39.1	0.4498		0.0	25.701	11.560			Vel = 14.51	
	0.0									
	39.10					34.363			K Factor = 6.67	
S17	40.00	1.049	T	5.0	2.333	25.000			K Factor = 8.00	
to		120.0	Eq	20.7	25.700	-0.325				
B3	40.0	0.4691		0.0	28.033	13.151			Vel = 14.85	
	0.0									
	40.00					37.826			K Factor = 6.50	
S21	27.61	1.049	E	2.0	1.917	11.911			K Factor = 8.00	
to		120.0	T	5.0	27.700	-0.541				
X21	27.61	0.2362	Eq	20.7	29.617	6.997			Vel = 10.25	
	0.0									
	27.61					18.367			K Factor = 6.44	
S22	27.98	1.049	E	2.0	1.917	12.233			K Factor = 8.00	
to		120.0	T	5.0	27.700	-0.541				
X22	27.98	0.2422	Eq	20.7	29.617	7.172			Vel = 10.39	
	0.0									
	27.98					18.864			K Factor = 6.44	
S23	29.30	1.049	E	2.0	1.917	13.411			K Factor = 8.00	
to		120.0	T	5.0	27.700	-0.541				
X23	29.3	0.2637	Eq	20.7	29.617	7.809			Vel = 10.88	
	0.0									
	29.30					20.679			K Factor = 6.44	
S24	32.00	1.049	E	2.0	1.917	15.998			K Factor = 8.00	
to		120.0	T	5.0	27.700	-0.541				
X24	32.0	0.3104	Eq	20.7	29.617	9.193			Vel = 11.88	
	0.0									
	32.00					24.650			K Factor = 6.45	
S25	45.35	1.049	E	2.0	3.170	32.141			K Factor = 8.00	
to		120.0	T	5.0	7.000	0.910				
A7	45.35	0.5917		0.0	10.170	6.018			Vel = 16.84	
	0.0									
	45.35					39.069			K Factor = 7.26	
S26	41.52	1.049	T	5.0	0.001	26.930			K Factor = 8.00	
to		120.0	Eq	20.7	25.700	-0.325				
B7	41.52	0.5025		0.0	25.701	12.915			Vel = 15.41	
	0.0									
	41.52					39.520			K Factor = 6.60	
S27	29.05	1.049	T	5.0	0.001	26.911			K Factor = 5.60	
to		120.0	Eq	38.2	43.200	-0.615				
X27	29.05	0.2596		0.0	43.201	11.215			Vel = 10.78	
	0.0									
	29.05					37.511			K Factor = 4.74	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
S28 to X28	30.93 30.93	1.049 120.0 0.2915	T Eq	5.0 23.5 0.0	0.001 28.500 28.501	30.501 -0.615 8.308			K Factor = 5.60 Vel = 11.48	
	0.0 30.93						38.194		K Factor = 5.00	
S29 to X29	27.62 27.62	1.049 120.0 0.2364	T Eq	5.0 35.5 0.0	0.001 40.500 40.501	11.918 -0.308 9.575			K Factor = 8.00 Vel = 10.25	
	0.0 27.62						21.185		K Factor = 6.00	
S30 to X30	27.95 27.95	1.049 120.0 0.2417	T Eq	5.0 35.5 0.0	0.001 40.500 40.501	12.203 -0.308 9.788			K Factor = 8.00 Vel = 10.38	
	0.0 27.95						21.683		K Factor = 6.00	
S31 to X31	29.12 29.12	1.049 120.0 0.2607	T Eq	5.0 35.5 0.0	0.001 40.500 40.501	13.246 -0.308 10.558			K Factor = 8.00 Vel = 10.81	
	0.0 29.12						23.496		K Factor = 6.01	
S32 to X32	31.52 31.52	1.049 120.0 0.3020	T Eq	5.0 35.5 0.0	0.001 40.500 40.501	15.527 -0.308 12.230			K Factor = 8.00 Vel = 11.70	
	0.0 31.52						27.449		K Factor = 6.02	
*BRANCHLINES										
X11 to C10	39.10 39.1	1.38 120.0 0.1183	2Jx	9.6 0.0 0.0	21.250 9.600 30.850	34.363 0.758 3.649			Vel = 8.39	
	0.0 39.10						38.770		K Factor = 6.28	
*										
S12 to S13	36.36 36.36	1.38 120.0 0.1035		0.0 0.0 0.0	12.170 0.0 12.170	20.661 0.0 1.259			K Factor = 8.00 Vel = 7.80	
S13 to B1	37.46 73.82	1.38 120.0 0.3833	3lx T	5.7 6.0 0.0	27.620 11.700 39.320	21.920 0.758 15.072			K Factor = 8.00 Vel = 15.83	
	0.0 73.82						37.750		K Factor = 12.01	
*										
S14 to S15	33.09 33.09	1.38 120.0 0.0869		0.0 0.0 0.0	11.170 0.0 11.170	17.109 0.0 0.971			K Factor = 8.00 Vel = 7.10	
S15 to S16	34.02 67.11	1.38 120.0 0.3213		0.0 0.0 0.0	11.170 0.0 11.170	18.080 0.0 3.589			K Factor = 8.00 Vel = 14.40	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
S16 to B2	37.24 104.35	1.38 120.0 0.7272	2lx T	3.8 6.0 0.0	11.280 9.800 21.080	21.669 0.758 15.329			K Factor = 8.00 Vel = 22.38	
	0.0 104.35					37.756			K Factor = 16.98	
*										
S18 to S19	33.29 33.29	1.38 120.0 0.0878		0.0 0.0 0.0	11.170 0.0 11.170	17.314 0.0 0.981			K Factor = 8.00 Vel = 7.14	
S19 to S20	34.21 67.5	1.38 120.0 0.3248		0.0 0.0 0.0	11.170 0.0 11.170	18.295 0.0 3.628			K Factor = 8.00 Vel = 14.48	
S20 to B4	37.46 104.96	1.38 120.0 0.7352	2lx T	3.8 6.0 0.0	11.280 9.800 21.080	21.923 0.758 15.497			K Factor = 8.00 Vel = 22.51	
	0.0 104.96					38.178			K Factor = 16.99	
*										
X21 to X22	27.61 27.61	1.38 120.0 0.0621		0.0 0.0 0.0	8.000 0.0 8.000	18.367 0.0 0.497			Vel = 5.92	
X22 to X23	27.98 55.59	1.38 120.0 0.2269		0.0 0.0 0.0	8.000 0.0 8.000	18.864 0.0 1.815			Vel = 11.92	
X23 to X24	29.30 84.89	1.38 120.0 0.4964		0.0 0.0 0.0	8.000 0.0 8.000	20.679 0.0 3.971			Vel = 18.21	
X24 to B5	31.99 116.88	1.38 120.0 0.8970	lx T	1.9 6.0 0.0	7.310 7.900 15.210	24.650 0.433 13.643			Vel = 25.07	
	0.0 116.88					38.726			K Factor = 18.78	
*										
X27 to X28	29.05 29.05	1.38 120.0 0.0683		0.0 0.0 0.0	10.000 0.0 10.000	37.511 0.0 0.683			Vel = 6.23	
X28 to B8	30.93 59.98	1.38 120.0 0.2610	T	6.0 0.0 0.0	6.910 6.000 12.910	38.194 0.0 3.370			Vel = 12.87	
	0.0 59.98					41.564			K Factor = 9.30	
*										
X29 to X30	27.62 27.62	1.38 120.0 0.0622		0.0 0.0 0.0	8.000 0.0 8.000	21.185 0.0 0.498			Vel = 5.92	
X30 to X31	27.94 55.56	1.38 120.0 0.2266		0.0 0.0 0.0	8.000 0.0 8.000	21.683 0.0 1.813			Vel = 11.92	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
X31 to X32	29.12 84.68	1.38 120.0 0.4941		0.0 0.0 0.0	8.000 0.0 8.000	23.496 0.0 3.953				
								Vel =	18.16	
X32 to B9	31.52 116.2	1.38 120.0 0.8873	2lx T	3.8 6.0 0.0	6.760 9.800 16.560	27.449 0.199 14.694				
								Vel =	24.93	
	0.0 116.20					42.342		K Factor =	17.86	
*MAINS										
A1 to A2	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	0.790 0.0 0.790	38.848 0.0 0.0	0.0 0.0 0.0			Vel = 0
A2 to A3	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	8.900 0.0 8.900	38.848 0.0 0.0	0.0 0.0 0.0			Vel = 0
A3 to A4	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	11.400 0.0 11.400	38.848 0.0 0.0	0.0 0.0 0.0			Vel = 0
A4 to A5	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	42.330 0.0 42.330	38.848 0.0 0.0	0.0 0.0 0.0			Vel = 0
A5 to A6	0.0 0.0	3.26 120.0 0.0	J 3l	17.471 20.159 0.0	92.110 37.630 129.740	38.848 0.152 0.0	0.0 0.0 0.0			Vel = 0
A6 to A7	39.10 39.1	3.26 120.0 0.0018	J	17.471 0.0 0.0	21.370 17.471 38.841	39.000 0.0 0.069				Vel = 1.50
A7 to B6	45.35 84.45	3.26 120.0 0.0075	2H J	6.989 17.471 0.0	16.860 24.460 41.320	39.069 -0.152 0.310				Vel = 3.25
	0.0 84.45					39.227		K Factor =	13.48	
*										
C1 to C2	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	4.740 0.0 4.740	38.970 0.0 0.0	0.0 0.0 0.0			Vel = 0
C2 to C3	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	0.810 0.0 0.810	38.970 0.0 0.0	0.0 0.0 0.0			Vel = 0
C3 to C4	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	11.690 0.0 11.690	38.970 0.0 0.0	0.0 0.0 0.0			Vel = 0
C4 to C5	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	2.910 0.0 2.910	38.970 0.0 0.0	0.0 0.0 0.0			Vel = 0
C5 to C6	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	12.090 0.0 12.090	38.970 0.0 0.0	0.0 0.0 0.0			Vel = 0

Final Calculations - Hazen-Williams

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46125901 Webster ISB - 1st Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
C6 to C7	0.0	3.26 120.0		0.0	3.240	38.970	0.0			
	0.0	0.0		0.0	3.240	0.0	0.0	Vel = 0		
C7 to C8	0.0	3.26 120.0	I	6.72	28.260	38.970	0.0			
	0.0	0.0		0.0	6.720	0.0	0.0	Vel = 0		
C8 to C9	0.0	3.26 120.0	4I 2H	26.879 6.989	57.440 33.868	38.970 -1.174	0.0			
	0.0	0.0		0.0	91.308	0.0	0.0	Vel = 0		
C9 to C10	0.0	3.26 120.0	2I	13.44	22.280	37.796	0.0			
	0.0	0.0		0.0	13.440	0.974	0.0	Vel = 0		
C10 to A6	39.10	3.26 120.0	2H J	6.989 17.471	18.800 24.460	38.770 0.152				
	39.1	0.0018		0.0	43.260	0.078		Vel = 1.50		
	0.0									
	39.10					39.000		K Factor = 6.26		
*										
B1 to B2	73.82	3.26 120.0		0.0	1.040	37.750				
	73.82	0.0058		0.0	1.040	0.006		Vel = 2.84		
B2 to B3	104.35	3.26 120.0		0.0	2.370	37.756				
	178.17	0.0295		0.0	2.370	0.070		Vel = 6.85		
B3 to B4	40.00	3.26 120.0		0.0	8.130	37.826				
	218.17	0.0433		0.0	8.130	0.352		Vel = 8.39		
B4 to B5	104.96	3.26 120.0		0.0	6.130	38.178				
	323.13	0.0894		0.0	6.130	0.548		Vel = 12.42		
B5 to B6	116.88	3.26 120.0		0.0	3.160	38.726				
	440.01	0.1585		0.0	3.160	0.501		Vel = 16.91		
B6 to B7	84.46	3.26 120.0		0.0	1.340	39.227				
	524.47	0.2187		0.0	1.340	0.293		Vel = 20.16		
B7 to B8	41.51	3.26 120.0		0.0	8.100	39.520				
	565.98	0.2523		0.0	8.100	2.044		Vel = 21.75		
B8 to B9	59.98	3.26 120.0		0.0	2.560	41.564				
	625.96	0.3039		0.0	2.560	0.778		Vel = 24.06		
B9 to B10	116.20	3.26 120.0		0.0	58.497	42.342				
	742.16	0.4166		0.0	58.497	24.370		Vel = 28.53		
B10 to B11	0.0	3.26 120.0	2I	13.44	37.083	66.712				
	742.16	0.4166		0.0	50.523	21.047		Vel = 28.53		

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
B11 to SYS1	0.0 742.16	3.26 120.0 0.4166	I T B C	6.72 20.159 6.72 13.44	9.390 47.039 56.429	87.759 0.0 23.508			Vel = 28.53	
	0.0 742.16					111.267			K Factor = 70.36	
*										
SYS2 to HV12	0.0 0.0	4.26 120.0 0.0		0.0 0.0 0.0	7.250 0.0 7.250	107.917 3.140 0.0	0.0 0.0 0.0		Vel = 0	
HV12 to BLK1	0.0 0.0	4.26 120.0 0.0	J	21.067 0.0 0.0	5.375 21.067 26.442	111.057 2.328 0.0	0.0 0.0 0.0		Vel = 0	
	0.0 0.0					113.385			K Factor = 0	
HV11 to SYS1	50.00 50.0	4.26 120.0 0.0007		0.0 0.0 0.0	6.750 0.0 6.750	114.185 -2.923 0.005			Qa = 50 Vel = 1.13	
SYS1 to BLK1	742.16 792.16	4.26 120.0 0.1277	J	21.067 0.0 0.0	1.875 21.067 22.942	111.267 -0.812 2.929			Vel = 17.83	
BLK1 to BLK2	0.0 792.16	6.357 120.0 0.0182	2I H B J	25.147 6.287 10.059 31.433	46.209 72.926 119.135	113.384 -0.235 2.167			Vel = 8.01	
BLK2 to TOR	0.0 792.16	6.357 120.0 0.0182	2I	25.147 0.0 0.0	22.083 25.147 47.230	115.316 0.866 0.859			Vel = 8.01	
TOR to BOR	0.0 792.16	6.357 120.0 0.0182	B J	10.059 31.433 0.0	8.792 41.492 50.284	117.041 3.808 0.914			Vel = 8.01	
BOR to PO	0.0 792.16	6.357 120.0 0.0182	B C	10.059 25.147 0.0	5.417 35.206 40.623	121.763 0.0 0.738			Vel = 8.01	
	0.0 792.16					122.501			K Factor = 71.57	
System Demand Pressure						122.501				
Safety Margin						17.561				
Continuation Pressure						140.062				
Pressure @ Pump Outlet						140.062				
Pressure From Pump Curve						-59.818				
Pressure @ Pump Inlet						80.244				
*										
PI to BYP	0.0 792.16	8.249 120.0 0.0051	lx	15.386 0.0 0.0	8.292 15.386 23.678	80.244 -2.869 0.121			Vel = 4.76	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
BYPS to BKFL	0.0 792.16	6.357 120.0 0.0182	2J I Zib	62.867 12.573 0.0	13.417 75.440 88.857	77.496 6.315 1.616			* * Fixed Loss = 3.5 Vel = 8.01	
BKFL to SPIG	0.0 792.16	7.981 120.0 0.0060	G lx	4.0 13.1 0.0	85.291 17.100 102.391	85.427 -4.060 0.614			Vel = 5.08	
SPIG to UG1	0.0 792.16	8.39 140.0 0.0035	2G Zac 2V X	13.572 0.0 61.074 59.377	80.000 134.023 214.023	81.981 3.933 0.757			* * Fixed Loss = 3.933 Vel = 4.60	
UG1 to TEST	200.00 992.16	8.39 140.0 0.0054	2G 3U X	13.572 45.805 59.377	500.000 118.754 618.754	86.671 -3.086 3.321			Qa = 200 Vel = 5.76	
	0.0 992.16					86.906			K Factor = 106.43	



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name : 46125901 Webster ISB - 1st Lvl - RA4
Building : Webster ISB
Location : 8274 Big Bend Blvd
System : SYS1
Contract : 461259
Data File : 46125901 Webster ISB - 1st Lvl - RA4.WXF

Hydraulic Design Information Sheet

Name - 46125901 Webster ISB - 1st Lvl - RA4 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS1
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-101.B
Construction: () Combustible (X) Non-Combustible Ceiling Height - 10-2
Occupancy - HC-1,HC-2

S () NFPA 13 () Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
Y () NFPA 231 () NFPA 231C () Figure Curve

S Other Factory Mutual - HC-1,HC-2

T Specific Ruling

Made By

Date

E

M Area of Sprinkler Operation - 1527 System Type Sprinkler/Nozzle
Density - .10\ .20 (X) Wet Make Viking
D Area Per Sprinkler - 400 () Dry Model VK632
E Elevation at Highest Outlet - 96.125 () Deluge Size 3/4"
S Hose Allowance - Inside - 50 () Preaction K-Factor 8.0
I Rack Sprinkler Allowance - n/a () Other Temp.Rat.155
G Hose Allowance - Outside - 200

N

Note

Calculation Flow Required - 374.92 Press Required - 93.937 SYS1
Summary C-Factor Used: 120 Overhead 140 Underground

W Water Flow Test: Pump Data: Tank or Reservoir:
A Date of Test - 05/23/16 Cap. -
T Time of Test - 2:30 PM Rated Cap.- 1000 Elev.-
E Static Press - 90 @ Press - 55
R Residual Press - 86 Elev. - 87.375 Well
Flow - 1140 Proof Flow
S Elevation - 104

U

P Location - 8274 Big Bend Blvd

P

L Source of Information - Ahern Fire Protection

Y

C Commodity Class Location
O Storage Ht. Area Aisle W.
M Storage Method: Solid Piled % Palletized % Rack
M () Single Row () Conven. Pallet () Auto. Storage () Encap.
S R () Double Row () Slave Pallet () Solid Shelf () Non
T A () Mult. Row () Open Shelf
O C

R K Flue Spacing Clearance:Storage to Ceiling
A Longitudinal Transverse

G

E Horizontal Barriers Provided:

Water Supply Curve C

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA4

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Date 09/22/16

City Water Supply:

C1 - Static Pressure : 90
C2 - Residual Pressure: 86
C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow

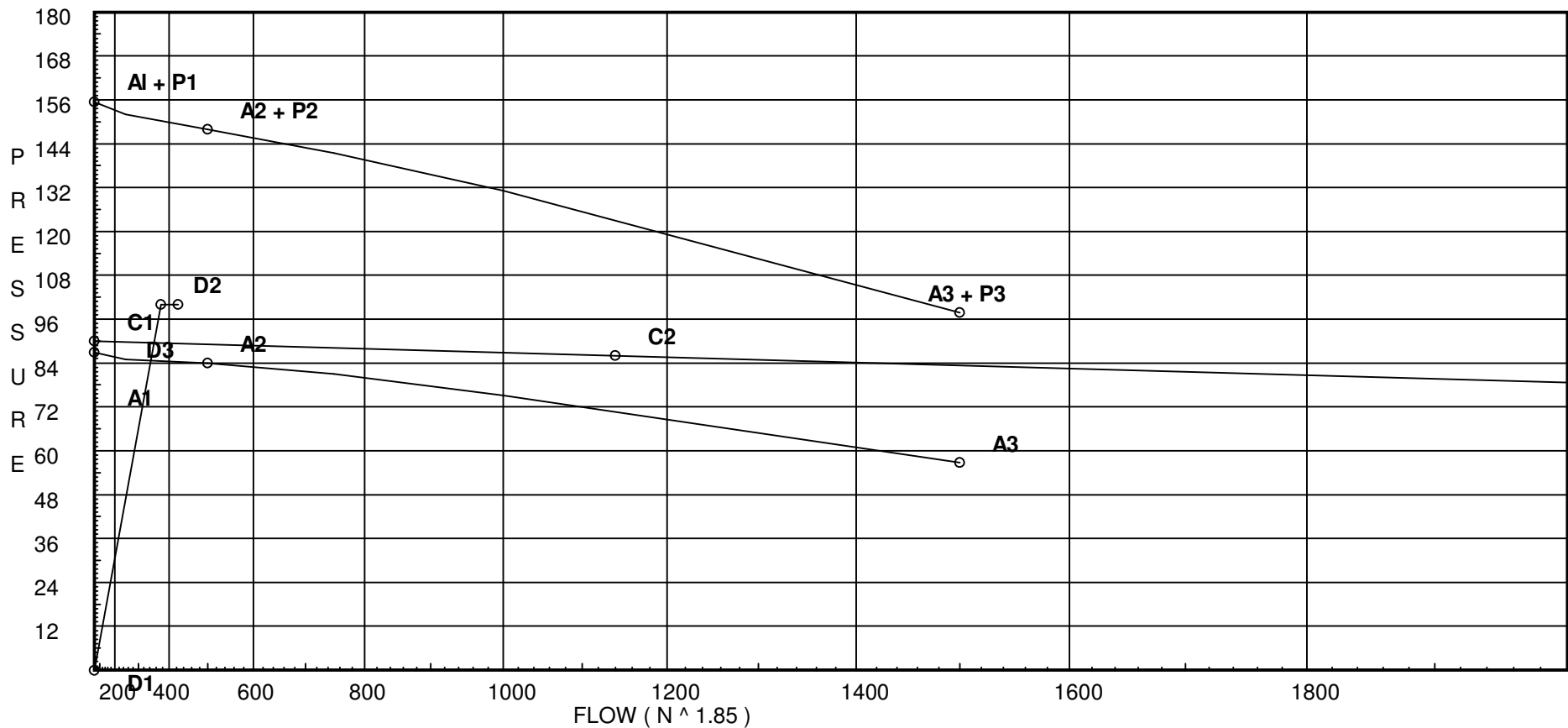
A1 - Adjusted Static: 86.869
A2 - Adj Resid : 83.909 @ 500
A3 - Adj Resid : 56.783 @ 1500

Pump Data:

P1 - Pump Churn Pressure : 68.5
P2 - Pump Rated Pressure : 64
P2 - Pump Rated Flow : 500
P3 - Pump Pressure @ Max Flow : 41
P3 - Pump Max Flow : 1500
City Residual Flow @ 0 = 6135.00
City Residual Flow @ 20 = 5355.71
City Water @ 150% of Pump = 83.35

Demand:

D1 - Elevation : -3.608
D2 - System Flow : 374.917
D2 - System Pressure : 99.968
Hose (Demand) : 50
D3 - System Demand : 424.917
Hose (Adj City) : 200
Safety Margin : 49.672



Fittings Used Summary

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46125901 Webster ISB - 1st Lvl - RA4

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Fitting Legend

Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkins 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units Inches
Length Units Feet
Flow Units US Gallons per Minute
Pressure Units Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA4

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Date 09/22/16

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S44	94.0	5.6	30.06	na	30.7	0.1	75	7.0
S45	95.67	8	17.0	na	32.98	0.1	324	17.0
S46	95.67	8	17.85	na	33.8	0.1	324	17.0
S47	94.0	5.6	30.44	na	30.9	0.1	100	7.0
S48	95.04	8	17.41	na	33.38	0.1	324	17.0
S49	95.04	8	18.28	na	34.21	0.1	324	17.0
S50	94.0	5.6	31.34	na	31.35	0.1	100	7.0
S51	95.04	8	21.36	na	36.97	0.1	324	17.0
S41	96.12	8	19.03	na	34.9	0.2	41	7.0
S42	95.86	8	20.28	na	36.03	0.2	41	7.0
S43	95.62	8	24.62	na	39.7	0.2	41	7.0
X45	96.25		30.05	na				
X46	96.25		31.51	na				
X48	96.68		30.3	na				
X49	96.41		31.91	na				
X51	96.41		37.19	na				
A1	95.75		63.6	na				
A2	95.75		63.6	na				
A3	95.75		63.6	na				
A4	95.75		63.6	na				
A5	95.75		63.6	na				
A6	95.4		63.75	na				
A7	95.4		68.32	na				
C1	95.29		37.64	na				
C2	95.29		37.7	na				
C3	95.29		37.71	na				
C4	95.29		38.17	na				
C5	95.29		38.32	na				
C6	95.29		39.3	na				
C7	95.29		39.62	na				
C8	95.29		43.74	na				
C9	98.0		53.32	na				
C10	95.75		58.5	na				
B1	95.75		73.04	na				
B2	95.75		73.04	na				
B3	95.75		73.04	na				
B4	95.75		73.04	na				
B5	95.75		73.04	na				
B6	95.75		73.04	na				
B7	95.75		73.19	na				
B8	95.75		74.15	na				
B9	95.75		74.45	na				
B10	95.75		81.34	na				
B11	95.75		87.29	na				
SYS2	110.25		88.58	na				
HV12	103.0		91.72	na				
HV11	89.0		96.86	na	50.0			
SYS1	95.75		93.94	na				
BLK1	97.625		94.05	na				
BLK2	98.167		94.5	na				
TOR	96.167		95.64	na				
BOR	87.375		99.73	na				
PO	87.375		99.97	na				
PI	87.375		84.56	na				
BYPS	94.0		81.73	na				
BKFL	87.5		88.56	na				
SPIG	96.875		84.69	na				
UG1	96.875		90.36	na	200.0			
TEST	104.0		88.68	na				

The maximum velocity is 23.73 and it occurs in the pipe between nodes S43 and C1

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA4

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
*DROPS										
S44 to C2	30.70 30.7	1.049 120.0 0.2876	T Eq	5.0 23.5 0.0	0.001 28.500 28.501	30.058 -0.559 8.196			K Factor = 5.60 Vel = 11.40	
	0.0 30.70						37.695		K Factor = 5.00	
S45 to X45	32.98 32.98	1.049 120.0 0.3284	T Eq	5.0 35.5 0.0	0.001 40.500 40.501	17.000 -0.251 13.299			K Factor = 8.00 Vel = 12.24	
	0.0 32.98						30.048		K Factor = 6.02	
S46 to X46	33.80 33.8	1.049 120.0 0.3435	T Eq	5.0 35.5 0.0	0.001 40.500 40.501	17.851 -0.251 13.914			K Factor = 8.00 Vel = 12.55	
	0.0 33.80						31.514		K Factor = 6.02	
S47 to C4	30.90 30.9	1.049 120.0 0.2909	T Eq	5.0 23.5 0.0	0.001 28.500 28.501	30.441 -0.559 8.292			K Factor = 5.60 Vel = 11.47	
	0.0 30.90						38.174		K Factor = 5.00	
S48 to X48	33.38 33.38	1.049 120.0 0.3357	T Eq	5.0 35.5 0.0	0.001 40.500 40.501	17.410 -0.710 13.596			K Factor = 8.00 Vel = 12.39	
	0.0 33.38						30.296		K Factor = 6.06	
S49 to X49	34.21 34.21	1.049 120.0 0.3512	T Eq	5.0 35.5 0.0	0.001 40.500 40.501	18.282 -0.593 14.223			K Factor = 8.00 Vel = 12.70	
	0.0 34.21						31.912		K Factor = 6.06	
S50 to C6	31.35 31.35	1.049 120.0 0.2989	T Eq	5.0 23.5 0.0	0.001 28.500 28.501	31.344 -0.559 8.520			K Factor = 5.60 Vel = 11.64	
	0.0 31.35						39.305		K Factor = 5.00	
S51 to X51	36.97 36.97	1.049 120.0 0.4056	T Eq	5.0 35.5 0.0	0.001 40.500 40.501	21.360 -0.593 16.426			K Factor = 8.00 Vel = 13.72	
	0.0 36.97						37.193		K Factor = 6.06	
*BRANCHLINES										
S41 to S42	34.90 34.9	1.38 120.0 0.0958		0.0 0.0 0.0	11.900 0.0 11.900	19.028 0.113 1.140			K Factor = 8.00 Vel = 7.49	
S42 to S43	36.02 70.92	1.38 120.0 0.3560		0.0 0.0 0.0	11.900 0.0 11.900	20.281 0.104 4.236			K Factor = 8.00 Vel = 15.21	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA4

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
S43 to C1	39.70 110.62 0.0 110.62	1.38 120.0 0.8101	2lx T	3.8 6.0 0.0	6.090 9.800 15.890	24.621 0.143 12.873			K Factor = 8.00 Vel = 23.73	
						37.637			K Factor = 18.03	
*										
X45 to X46	32.98 32.98	1.38 120.0 0.0863		0.0 0.0 0.0	16.980 0.0 16.980	30.048 0.0 1.466			Vel = 7.07	
X46 to C3	33.81 66.79 0.0 66.79	1.38 120.0 0.3185	lx T	1.9 6.0 0.0	10.250 7.900 18.150	31.514 0.416 5.781			Vel = 14.33	
						37.711			K Factor = 10.88	
*										
X48 to X49	33.38 33.38	1.38 120.0 0.0883		0.0 0.0 0.0	16.980 0.0 16.980	30.296 0.117 1.499			Vel = 7.16	
X49 to C5	34.21 67.59 0.0 67.59	1.38 120.0 0.3256	lx T	1.9 6.0 0.0	10.300 7.900 18.200	31.912 0.485 5.926			Vel = 14.50	
						38.323			K Factor = 10.92	
*										
X51 to C7	36.97 36.97 0.0 36.97	1.38 120.0 0.1067	lx T	1.9 6.0 0.0	10.300 7.900 18.200	37.193 0.485 1.942			Vel = 7.93	
						39.620			K Factor = 5.87	
*MAINS										
A1 to A2	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	0.790 0.0 0.790	63.596 0.0 0.0	0.0 0.0 0.0		Vel = 0	
A2 to A3	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	8.900 0.0 8.900	63.596 0.0 0.0	0.0 0.0 0.0		Vel = 0	
A3 to A4	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	11.400 0.0 11.400	63.596 0.0 0.0	0.0 0.0 0.0		Vel = 0	
A4 to A5	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	42.330 0.0 42.330	63.596 0.0 0.0	0.0 0.0 0.0		Vel = 0	
A5 to A6	0.0 0.0	3.26 120.0 0.0	J 3l	17.471 20.159 0.0	92.110 37.630 129.740	63.596 0.152 0.0	0.0 0.0 0.0		Vel = 0	
A6 to A7	374.92 374.92	3.26 120.0 0.1178	J	17.471 0.0 0.0	21.370 17.471 38.841	63.748 0.0 4.575			Vel = 14.41	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA4

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Date 09/22/16

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
A7 to B6	0.0 374.92	3.26 120.0 0.1178	2H J	6.989 17.471 0.0	16.860 24.460 41.320	68.323 -0.152 4.867			Vel = 14.41	
	0.0 374.92					73.038			K Factor = 43.87	
*										
C1 to C2	110.62 110.62	3.26 120.0 0.0122		0.0 0.0 0.0	4.740 0.0 4.740	37.637 0.0 0.058			Vel = 4.25	
C2 to C3	30.70 141.32	3.26 120.0 0.0198		0.0 0.0 0.0	0.810 0.0 0.810	37.695 0.0 0.016			Vel = 5.43	
C3 to C4	66.79 208.11	3.26 120.0 0.0396		0.0 0.0 0.0	11.690 0.0 11.690	37.711 0.0 0.463			Vel = 8.00	
C4 to C5	30.89 239.0	3.26 120.0 0.0512		0.0 0.0 0.0	2.910 0.0 2.910	38.174 0.0 0.149			Vel = 9.19	
C5 to C6	67.59 306.59	3.26 120.0 0.0812		0.0 0.0 0.0	12.090 0.0 12.090	38.323 0.0 0.982			Vel = 11.78	
C6 to C7	31.35 337.94	3.26 120.0 0.0972		0.0 0.0 0.0	3.240 0.0 3.240	39.305 0.0 0.315			Vel = 12.99	
C7 to C8	36.98 374.92	3.26 120.0 0.1178	I	6.72 0.0 0.0	28.260 6.720 34.980	39.620 0.0 4.120			Vel = 14.41	
C8 to C9	0.0 374.92	3.26 120.0 0.1178	4I 2H	26.879 6.989 0.0	57.440 33.868 91.308	43.740 -1.174 10.754			Vel = 14.41	
C9 to C10	0.0 374.92	3.26 120.0 0.1178	2I	13.44 0.0 0.0	22.280 13.440 35.720	53.320 0.974 4.207			Vel = 14.41	
C10 to A6	0.0 374.92	3.26 120.0 0.1178	2H J	6.989 17.471 0.0	18.800 24.460 43.260	58.501 0.152 5.095			Vel = 14.41	
	0.0 374.92					63.748			K Factor = 46.96	
*										
B1 to B2	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	1.040 0.0 1.040	73.038 0.0 0.0	0.0 0.0 0.0		Vel = 0	
B2 to B3	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	2.370 0.0 2.370	73.038 0.0 0.0	0.0 0.0 0.0		Vel = 0	
B3 to B4	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	8.130 0.0 8.130	73.038 0.0 0.0	0.0 0.0 0.0		Vel = 0	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - 1st Lvl - RA4

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
B4 to B5	0.0	3.26 120.0		0.0	6.130	73.038	0.0			
	0.0	0.0		0.0	6.130	0.0	0.0	Vel = 0		
B5 to B6	0.0	3.26 120.0		0.0	3.160	73.038	0.0			
	0.0	0.0		0.0	3.160	0.0	0.0	Vel = 0		
B6 to B7	374.92	3.26 120.0		0.0	1.340	73.038				
	374.92	0.1172		0.0	1.340	0.157		Vel = 14.41		
B7 to B8	0.0	3.26 120.0		0.0	8.100	73.195				
	374.92	0.1178		0.0	8.100	0.954		Vel = 14.41		
B8 to B9	0.0	3.26 120.0		0.0	2.560	74.149				
	374.92	0.1180		0.0	2.560	0.302		Vel = 14.41		
B9 to B10	0.0	3.26 120.0		0.0	58.497	74.451				
	374.92	0.1178		0.0	58.497	6.890		Vel = 14.41		
B10 to B11	0.0	3.26 120.0	2I	13.44	37.083	81.341				
	374.92	0.1178		0.0	13.440	0.0		Vel = 14.41		
B11 to SYS1	0.0	3.26 120.0	I T B C	6.72 20.159 6.72 13.44	9.390 47.039 56.429	87.291 0.0				
	374.92	0.1178				6.646		Vel = 14.41		
	0.0 374.92					93.937		K Factor = 38.68		
*										
SYS2 to HV12	0.0	4.26 120.0		0.0	7.250	88.583	0.0			
	0.0	0.0		0.0	7.250	0.0	0.0	Vel = 0		
HV12 to BLK1	0.0	4.26 120.0	J	21.067	5.375	91.723	0.0			
	0.0	0.0		0.0	21.067	2.328	0.0	Vel = 0		
	0.0 0.0					94.051		K Factor = 0		
HV11 to SYS1	50.00	4.26 120.0		0.0	6.750	96.855		Qa = 50		
	50.0	0.0007		0.0	6.750	-2.923 0.005		Vel = 1.13		
SYS1 to BLK1	374.92	4.26 120.0	J	21.067	1.875	93.937				
	424.92	0.0404		0.0	21.067 22.942	-0.812 0.926		Vel = 9.56		
BLK1 to BLK2	0.0	6.357 120.0	2I H B J	25.147 6.287 10.059 31.433	46.209 72.926 119.135	94.051 -0.235 0.684		Vel = 4.30		

Final Calculations - Hazen-Williams

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46125901 Webster ISB - 1st Lvl - RA4

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
BLK2 to TOR	0.0 424.92	6.357 120.0 0.0058	2I	25.147 0.0 0.0	22.083 25.147 47.230	94.500 0.866 0.272			Vel = 4.30	
TOR to BOR	0.0 424.92	6.357 120.0 0.0057	B J	10.059 31.433 0.0	8.792 41.492 50.284	95.638 3.808 0.288			Vel = 4.30	
BOR to PO	0.0 424.92	6.357 120.0 0.0058	B C	10.059 25.147 0.0	5.417 35.206 40.623	99.734 0.0 0.234			Vel = 4.30	
	0.0 424.92					99.968			K Factor = 42.50	
System Demand Pressure						99.968				
Safety Margin						49.672				
Continuation Pressure						149.640				
Pressure @ Pump Outlet						149.640				
Pressure From Pump Curve						-65.080				
Pressure @ Pump Inlet						84.560				
*										
PI to BYP	0.0 424.92	8.249 120.0 0.0016	lx	15.386 0.0 0.0	8.292 15.386 23.678	84.560 -2.869 0.038			Vel = 2.55	
BYP to BKFL	0.0 424.92	6.357 120.0 0.0058	2J I Zib	62.867 12.573 0.0	13.417 75.440 88.857	81.729 6.315 0.511			** Fixed Loss = 3.5 Vel = 4.30	
BKFL to SPIG	0.0 424.92	7.981 120.0 0.0019	G lx	4.0 13.1 0.0	85.291 17.100 102.391	88.555 -4.060 0.194			Vel = 2.73	
SPIG to UG1	0.0 424.92	8.39 140.0 0.0011	2G Zac 2V X	13.572 0.0 61.074 59.377	80.000 134.023 214.023	84.689 5.430 0.239			** Fixed Loss = 5.43 Vel = 2.47	
UG1 to TEST	200.00 624.92	8.39 140.0 0.0023	2G 3U X	13.572 45.805 59.377	500.000 118.754 618.754	90.358 -3.086 1.412			Qa = 200 Vel = 3.63	
	0.0 624.92					88.684			K Factor = 66.36	



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name : 46125902 Webster ISB - 2nd Lvl - RA1
Building : Webster ISB
Location : 8274 Big Bend Blvd
System : SYS2
Contract : 461259
Data File : 46125902 Webster ISB - 2nd Lvl - RA1.WXF

Hydraulic Design Information Sheet

Name - 46125902 Webster ISB - 2nd Lvl - RA1 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS2
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-102.B
Construction: () Combustible (X) Non-Combustible Ceiling Height - 9-6
Occupancy - HC-1

S () NFPA 13 () Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
Y () NFPA 231 () NFPA 231C () Figure Curve
S Other Factory Mutual - HC1
T Specific Ruling Made By Date
E

M	Area of Sprinkler Operation - 1552	System Type	Sprinkler/Nozzle
	Density - .10	(X) Wet	Make Viking
D	Area Per Sprinkler - 400	() Dry	Model VK634
E	Elevation at Highest Outlet - 109.5	() Deluge	Size 3/4"
S	Hose Allowance - Inside - 50	() Preaction	K-Factor 8.0
I	Rack Sprinkler Allowance - n/a	() Other	Temp.Rat.155
G	Hose Allowance - Outside - 200		

N
Note

Calculation Flow Required - 426.86 Press Required - 118.909 SYS2
Summary C-Factor Used: 120 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 05/23/16		Cap. -
T	Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
E	Static Press - 90	@ Press - 55	
R	Residual Press - 86	Elev. - 87.375	Well
	Flow - 1140		Proof Flow
S	Elevation - 104		

U
P Location - 8274 Big Bend Blvd
P
L Source of Information - Ahern Fire Protection
Y

C	Commodity	Class	Location
O	Storage Ht.	Area	Aisle W.
M	Storage Method:	Solid Piled %	Palletized % Rack
M	() Single Row	() Conven. Pallet	() Auto. Storage () Encap.
S	() Double Row	() Slave Pallet	() Solid Shelf () Non
T	() Mult. Row		() Open Shelf
O			
C			
R	Flue Spacing	Clearance:Storage to Ceiling	
A	Longitudinal	Transverse	
G			
E	Horizontal Barriers Provided:		

Water Supply Curve C

Ahern Fire Protection
46125902 Webster ISB - 2nd Lvl - RA1

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City Water Supply:

C1 - Static Pressure : 90
C2 - Residual Pressure: 86
C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow

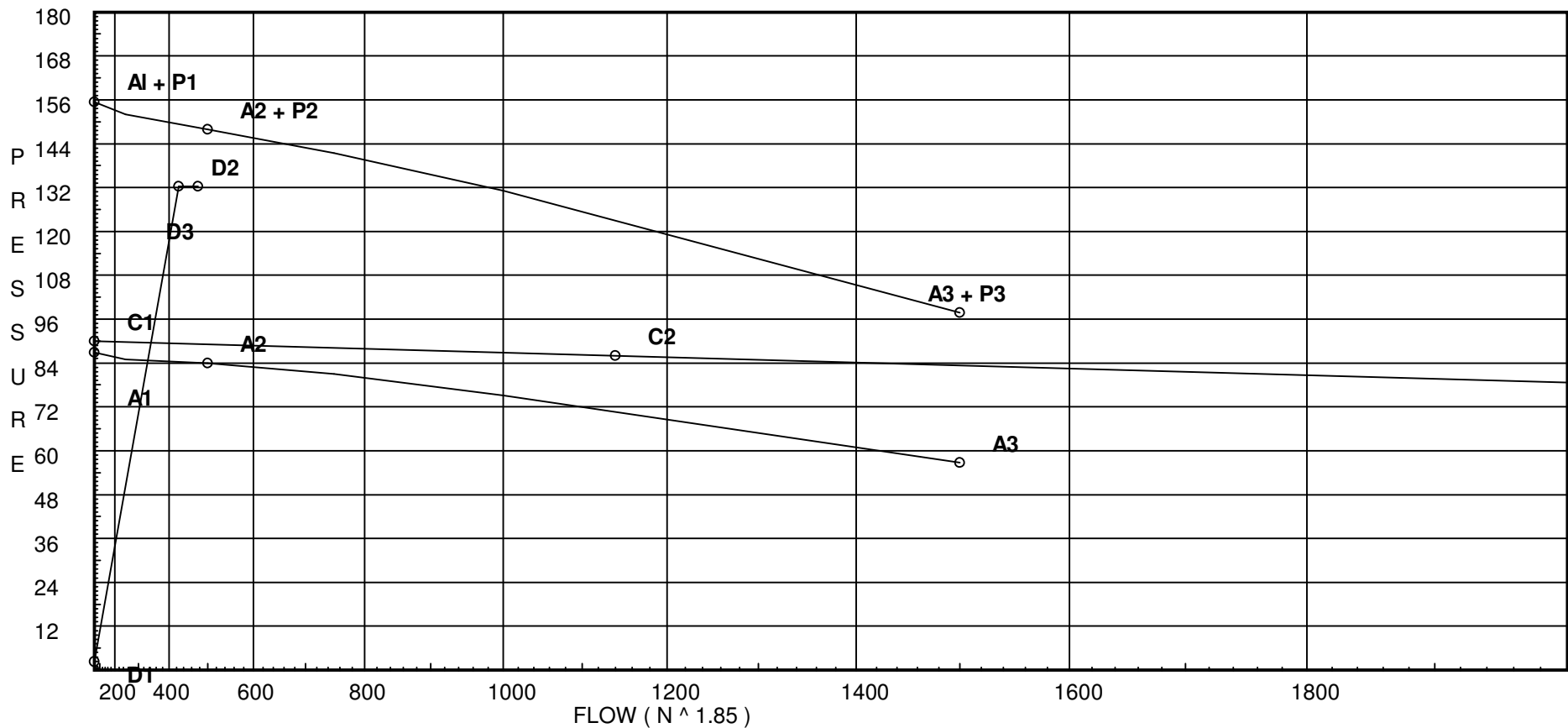
A1 - Adjusted Static: 86.869
A2 - Adj Resid : 83.909 @ 500
A3 - Adj Resid : 56.783 @ 1500

Pump Data:

P1 - Pump Churn Pressure : 68.5
P2 - Pump Rated Pressure : 64
P2 - Pump Rated Flow : 500
P3 - Pump Pressure @ Max Flow : 41
P3 - Pump Max Flow : 1500
City Residual Flow @ 0 = 6135.00
City Residual Flow @ 20 = 5355.71
City Water @ 150% of Pump = 83.35

Demand:

D1 - Elevation : 2.382
D2 - System Flow : 426.86
D2 - System Pressure : 132.261
Hose (Demand) : 50
D3 - System Demand : 476.86
Hose (Adj City) : 200
Safety Margin : 16.209



Fittings Used Summary

Ahern Fire Protection
46125902 Webster ISB - 2nd Lvl - RA1

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Fitting Legend

Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkins 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units Inches
Length Units Feet
Flow Units US Gallons per Minute
Pressure Units Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Ahern Fire Protection
46125902 Webster ISB - 2nd Lvl - RA1

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S1	109.5	8	17.0	na	32.98	0.1	324	17.0
S2	109.5	8	17.28	na	33.26	0.1	324	17.0
S3	109.5	8	18.83	na	34.72	0.1	324	17.0
S4	109.5	8	22.22	na	37.71	0.1	324	17.0
S5	109.5	8	19.62	na	35.43	0.1	256	10.6
S6	109.5	8	19.98	na	35.76	0.1	324	17.0
S7	109.5	8	21.61	na	37.19	0.1	256	10.6
S8	109.5	8	23.69	na	38.94	0.1	324	17.0
S9	109.5	8	33.64	na	46.4	0.1	256	10.6
S10	109.5	8	34.47	na	46.97	0.1	256	10.6
S11	109.5	8	35.26	na	47.5	0.1	256	10.6
X1	110.71		29.81	na				
X2	110.71		30.3	na				
X3	110.71		32.97	na				
X4	110.71		38.78	na				
Z1	110.71		42.26	na				
X5	110.71		34.32	na				
X6	110.71		34.93	na				
X7	110.71		35.16	na				
X8	110.71		41.28	na				
Z2	110.71		50.11	na				
A2	110.25		63.19	na				
A3	110.25		63.23	na				
A4	110.25		63.32	na				
A5	110.25		64.34	na				
A6	110.25		64.82	na				
A7	110.25		66.27	na				
A8	110.25		68.67	na				
A9	110.25		94.31	na				
A10	110.25		107.98	na				
SYS2	110.25		118.91	na				
HV12	103.0		122.34	na	50.0			
HV11	89.0		129.73	na				
SYS1	95.75		126.8	na				
BLK1	97.625		125.99	na				
BLK2	98.167		126.6	na				
TOR	96.167		127.81	na				
BOR	87.375		131.97	na				
PO	87.375		132.26	na				
PI	87.375		84.12	na				
BYPS	94.0		81.3	na				
BKFL	87.5		88.25	na				
SPIG	96.875		84.43	na				
UG1	96.875		89.92	na	200.0			
TEST	104.0		88.48	na				

The maximum velocity is 23.22 and it occurs in the pipe between nodes X8 and Z2

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125902 Webster ISB - 2nd Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
* 										
S1 to X1	32.98 32.98	1.049 120.0 0.3284	T Eq	5.0 35.5 0.0	0.100 40.500 40.600	17.000 -0.524 13.332			K Factor = 8.00 Vel = 12.24	
	0.0 32.98						29.808		K Factor = 6.04	
S2 to X2	33.26 33.26	1.049 120.0 0.3334	T Eq	5.0 35.5 0.0	0.100 40.500 40.600	17.285 -0.524 13.538			K Factor = 8.00 Vel = 12.35	
	0.0 33.26						30.299		K Factor = 6.04	
S3 to X3	34.72 34.72	1.049 120.0 0.3610	T Eq	5.0 35.5 0.0	0.100 40.500 40.600	18.833 -0.524 14.656			K Factor = 8.00 Vel = 12.89	
	0.0 34.72						32.965		K Factor = 6.05	
S4 to X4	37.71 37.71	1.049 120.0 0.4207	T Eq	5.0 35.5 0.0	0.100 40.500 40.600	22.222 -0.524 17.079			K Factor = 8.00 Vel = 14.00	
	0.0 37.71						38.777		K Factor = 6.06	
S5 to X5	35.43 35.43	1.049 120.0 0.3749	T Eq	5.0 35.5 0.0	0.100 40.500 40.600	19.618 -0.524 15.221			K Factor = 8.00 Vel = 13.15	
	0.0 35.43						34.315		K Factor = 6.05	
S6 to X6	35.76 35.76	1.049 120.0 0.3812	T Eq	5.0 35.5 0.0	0.100 40.500 40.600	19.976 -0.524 15.478			K Factor = 8.00 Vel = 13.28	
	0.0 35.76						34.930		K Factor = 6.05	
S7 to X7	37.19 37.19	1.049 120.0 0.4100	T Eq	5.0 20.7 0.0	8.625 25.700 34.325	21.612 -0.524 14.074			K Factor = 8.00 Vel = 13.81	
	0.0 37.19						35.162		K Factor = 6.27	
S8 to X8	38.94 38.94	1.049 120.0 0.4463	T Eq	5.0 35.5 0.0	0.100 40.500 40.600	23.688 -0.524 18.121			K Factor = 8.00 Vel = 14.46	
	0.0 38.94						41.285		K Factor = 6.06	
S9 to A4	46.40 46.4	1.049 120.0 0.6173	T Eq	5.0 43.5 0.0	0.100 48.500 48.600	33.639 -0.325 30.003			K Factor = 8.00 Vel = 17.22	
	0.0 46.40						63.317		K Factor = 5.83	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125902 Webster ISB - 2nd Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
S10 to A6	46.97 46.97	1.049 120.0 0.6314	T Eq	5.0 43.5 0.0	0.100 48.500 48.600	34.466 -0.325 30.684			K Factor = 8.00 Vel = 17.44	
	0.0 46.97					64.825			K Factor = 5.83	
S11 to A7	47.50 47.5	1.049 120.0 0.6448	T Eq	5.0 43.5 0.0	0.100 48.500 48.600	35.258 -0.325 31.337			K Factor = 8.00 Vel = 17.63	
	0.0 47.50					66.270			K Factor = 5.83	
*										
X1 to X2	32.98 32.98	1.61 120.0 0.0407	lx	2.3 0.0 0.0	9.750 2.300 12.050	29.808 0.0 0.491			Vel = 5.20	
X2 to X3	33.26 66.24	1.61 120.0 0.1481		0.0 0.0 0.0	18.000 0.0 18.000	30.299 0.0 2.666			Vel = 10.44	
X3 to X4	34.72 100.96	1.61 120.0 0.3229		0.0 0.0 0.0	18.000 0.0 18.000	32.965 0.0 5.812			Vel = 15.91	
X4 to Z1	37.71 138.67	1.61 120.0 0.5810		0.0 0.0 0.0	6.000 0.0 6.000	38.777 0.0 3.486			Vel = 21.85	
Z1 to A2	0.0 138.67	1.61 120.0 0.5809	4l T	10.4 8.0 0.0	17.280 18.400 35.680	42.263 0.199 20.726			Vel = 21.85	
	0.0 138.67					63.188			K Factor = 17.44	
*										
X5 to X6	35.43 35.43	1.61 120.0 0.0466	lx	2.3 0.0 0.0	10.910 2.300 13.210	34.315 0.0 0.615			Vel = 5.58	
X6 to X7	35.76 71.19	1.61 120.0 0.1693		0.0 0.0 0.0	1.370 0.0 1.370	34.930 0.0 0.232			Vel = 11.22	
X7 to X8	37.19 108.38	1.61 120.0 0.3682		0.0 0.0 0.0	16.630 0.0 16.630	35.162 0.0 6.123			Vel = 17.08	
X8 to Z2	38.94 147.32	1.61 120.0 0.6496		0.0 0.0 0.0	13.590 0.0 13.590	41.285 0.0 8.828			Vel = 23.22	
Z2 to A3	0.0 147.32	1.61 120.0 0.6497	2lx T	4.6 8.0 0.0	7.280 12.600 19.880	50.113 0.199 12.916			Vel = 23.22	
	0.0 147.32					63.228			K Factor = 18.53	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125902 Webster ISB - 2nd Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
* A2 138.67 3.26 0.0 2.110 63.188 to 120.0 0.0 0.0 A3 138.67 0.0190 0.0 2.110 0.040 Vel = 5.33 A3 147.32 3.26 0.0 1.250 63.228 to 120.0 0.0 0.0 A4 285.99 0.0712 0.0 1.250 0.089 Vel = 10.99 A4 46.40 3.26 0.0 10.830 63.317 to 120.0 0.0 0.0 A5 332.39 0.0943 0.0 10.830 1.021 Vel = 12.78 A5 0.0 3.26 0.0 5.170 64.338 to 120.0 0.0 0.0 A6 332.39 0.0942 0.0 5.170 0.487 Vel = 12.78 A6 46.97 3.26 0.0 12.000 64.825 to 120.0 0.0 0.0 A7 379.36 0.1204 0.0 12.000 1.445 Vel = 14.58 A7 47.50 3.26 0.0 16.030 66.270 to 120.0 0.0 0.0 A8 426.86 0.1497 0.0 16.030 2.400 Vel = 16.41 A8 0.0 3.26 4I 26.879 126.920 68.670 to 120.0 J 17.471 44.350 0.0 A9 426.86 0.1497 0.0 171.270 25.644 Vel = 16.41 A9 0.0 3.26 0.0 91.250 94.314 to 120.0 0.0 0.0 A10 426.86 0.1497 0.0 91.250 13.663 Vel = 16.41 A10 0.0 3.26 2I 13.44 19.250 107.977 to 120.0 B 6.72 53.759 0.0 SYS2 426.86 0.1497 C 13.44 73.009 10.932 Vel = 16.41 T 20.159 0.0 426.86 118.909 K Factor = 39.15 * SYS2 426.86 4.26 0.0 7.250 118.909 to 120.0 0.0 3.140 HV12 426.86 0.0407 0.0 7.250 0.295 Vel = 9.61 HV12 50.00 4.26 J 21.067 5.375 122.344 Qa = 50 to 120.0 0.0 21.067 2.328 BLK1 476.86 0.0499 0.0 26.442 1.320 Vel = 10.73 0.0 476.86 125.992 K Factor = 42.48 HV11 0.0 4.26 0.0 6.750 129.728 0.0 to 120.0 0.0 -2.923 0.0 SYS1 0.0 0.0 0.0 6.750 0.0 0.0 Vel = 0 SYS1 0.0 4.26 J 21.067 1.875 126.804 0.0 to 120.0 0.0 21.067 -0.812 0.0 BLK1 0.0 0.0 0.0 22.942 0.0 0.0 Vel = 0										

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125902 Webster ISB - 2nd Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
BLK1 to BLK2	476.86	6.357 120.0	2I H B J	25.147 6.287 10.059 31.433	46.209 72.926 119.135	125.992 -0.235 0.848			Vel = 4.82	
BLK2 to TOR	0.0 476.86	6.357 120.0	2I	25.147 0.0	22.083 25.147	126.605 0.866			Vel = 4.82	
TOR to BOR	0.0 476.86	6.357 120.0	B J	10.059 31.433	8.792 41.492	127.807 3.808			Vel = 4.82	
BOR to PO	0.0 476.86	6.357 120.0	B C	10.059 25.147	5.417 35.206	131.972 0.0			Vel = 4.82	
	0.0 476.86			0.0	40.623	0.289			K Factor = 41.46	
System Demand Pressure						132.261				
Safety Margin						16.209				
Continuation Pressure						148.470				
Pressure @ Pump Outlet						148.470				
Pressure From Pump Curve						-64.349				
Pressure @ Pump Inlet						84.122				
*										
PI to BYP	0.0	8.249 120.0	lx	15.386 0.0	8.292 15.386	84.122 -2.869			Vel = 2.86	
BYP to BKFL	0.0 476.86	6.357 120.0	2J I	62.867 12.573	13.417 75.440	81.300 6.315			** Fixed Loss = 3.5	
BKFL to SPIG	0.0 476.86	7.981 120.0	G lx	4.0 13.1	85.291 17.100	88.246 -4.060			Vel = 4.82	
SPIG to UG1	0.0 476.86	8.39 140.0	2G Zac	13.572 0.0	80.000 134.023	84.426 5.201			** Fixed Loss = 5.201	
UG1 to TEST	200.00 676.86	8.39 140.0	2G 3U X	13.572 45.805 59.377	500.000 118.754 618.754	89.924 -3.086 1.638			Qa = 200	
	0.0 676.86								Vel = 3.93	
	0.0 676.86					88.476			K Factor = 71.96	



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name : 46125902 Webster ISB - 2nd Lvl - RA2
Building : Webster ISB
Location : 8274 Big Bend Blvd
System : SYS2
Contract : 461259
Data File : 46125902 Webster ISB - 2nd Lvl - RA2.WXF

Hydraulic Design Information Sheet

Name - 46125902 Webster ISB - 2nd Lvl - RA2 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS2
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-102.B
Construction: () Combustible (X) Non-Combustible Ceiling Height - 11-2
Occupancy - HC-1

S () NFPA 13 () Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
Y () NFPA 231 () NFPA 231C () Figure Curve
S Other Factory Mutual - HC1
T Specific Ruling Made By Date
E

M Area of Sprinkler Operation - 1542 System Type Sprinkler/Nozzle
Density - .10 (X) Wet Make Viking
D Area Per Sprinkler - 225 () Dry Model VK178
E Elevation at Highest Outlet - 111.167 () Deluge Size 1/2"
S Hose Allowance - Inside - 50 () Preaction K-Factor 5.6
I Rack Sprinkler Allowance - n/a () Other Temp.Rat.155
G Hose Allowance - Outside - 200
N Note

Calculation Flow Required - 212.37 Press Required - 47.074 SYS2
Summary C-Factor Used: 120 Overhead 140 Underground

W Water Flow Test: Pump Data: Tank or Reservoir:
A Date of Test - 05/23/16 Cap. -
T Time of Test - 2:30 PM Rated Cap.- 1000 Elev.-
E Static Press - 90 @ Press - 55
R Residual Press - 86 Elev. - 87.375 Well
Flow - 1140 Proof Flow
S Elevation - 104
U
P Location - 8274 Big Bend Blvd
P
L Source of Information - Ahern Fire Protection
Y

C Commodity Class Location
O Storage Ht. Area Aisle W.
M Storage Method: Solid Piled % Palletized % Rack
M
S R () Single Row () Conven. Pallet () Auto. Storage () Encap.
T A () Double Row () Slave Pallet () Solid Shelf () Non
O C () Mult. Row () Open Shelf
R K Flue Spacing Clearance:Storage to Ceiling
A Longitudinal Transverse
G
E Horizontal Barriers Provided:

Water Supply Curve C

Ahern Fire Protection
46125902 Webster ISB - 2nd Lvl - RA2

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City Water Supply:

C1 - Static Pressure : 90
C2 - Residual Pressure: 86
C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow

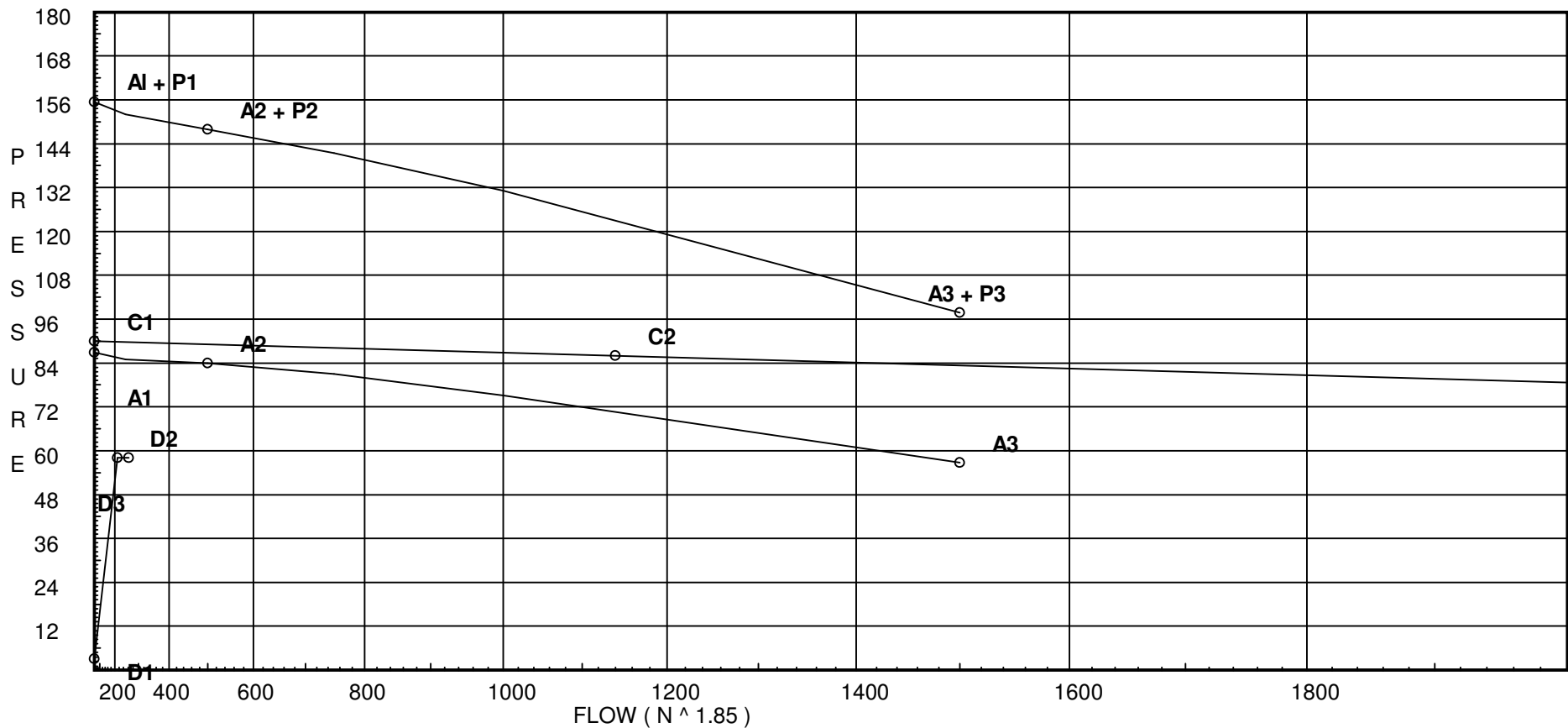
A1 - Adjusted Static: 86.869
A2 - Adj Resid : 83.909 @ 500
A3 - Adj Resid : 56.783 @ 1500

Pump Data:

P1 - Pump Churn Pressure : 68.5
P2 - Pump Rated Pressure : 64
P2 - Pump Rated Flow : 500
P3 - Pump Pressure @ Max Flow : 41
P3 - Pump Max Flow : 1500
City Residual Flow @ 0 = 6135.00
City Residual Flow @ 20 = 5355.71
City Water @ 150% of Pump = 83.35

Demand:

D1 - Elevation : 3.105
D2 - System Flow : 212.371
D2 - System Pressure : 58.105
Hose (Demand) : 50
D3 - System Demand : 262.371
Hose (Adj City) : 200
Safety Margin : 94.106



Fittings Used Summary

Ahern Fire Protection
46125902 Webster ISB - 2nd Lvl - RA2

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Fitting Legend

Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
E	90' Standard Elbow Thrd	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
Jx	Standard Grooved Tee	0	0	4.5	4.8	5.8	8.0	9.8	12.2	17	16.3	20.5	24.8	32.8	41.3	49.7	65	78	88	98	120
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkins 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units Inches
Length Units Feet
Flow Units US Gallons per Minute
Pressure Units Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Ahern Fire Protection
46125902 Webster ISB - 2nd Lvl - RA2

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S21	111.17	5.6	7.01	na	14.82	0.1	104	7.0
S22	111.17	5.6	7.2	na	15.03	0.1	119	7.0
S23	111.17	5.6	8.05	na	15.89	0.1	116	7.0
S24	111.17	5.6	9.91	na	17.63	0.1	117	7.0
S25	111.17	5.6	12.77	na	20.01	0.1	117	7.0
S26	111.17	5.6	7.0	na	14.82	0.1	104	7.0
S27	111.17	5.6	7.41	na	15.24	0.1	146	7.0
S28	111.17	5.6	7.68	na	15.52	0.1	150	7.0
S29	111.17	5.6	8.32	na	16.16	0.1	147	7.0
S30	111.17	5.6	8.63	na	16.45	0.1	147	7.0
S31	111.17	5.6	20.23	na	25.19	0.1	147	7.0
S32	111.17	5.6	20.93	na	25.62	0.1	147	7.0
X21	113.25		7.1	na				
X22	113.25		7.32	na				
X23	113.25		8.28	na				
X24	113.25		10.39	na				
X25	113.25		13.61	na				
Z3	113.25		18.77	na				
X26	113.25		7.87	na				
X27	113.25		8.01	na				
X29	113.25		9.1	na				
Z4	113.25		9.52	na				
Z5	110.25		23.6	na				
X31	113.38		23.08	na				
Z6	113.38		23.31	na				
Z7	113.38		26.47	na				
A1	110.25		31.53	na				
A2	110.25		31.55	na				
A3	110.25		31.6	na				
A4	110.25		31.63	na				
A5	110.25		31.9	na				
A6	110.25		32.11	na				
A7	110.25		32.61	na				
A8	110.25		33.27	na				
A9	110.25		40.31	na				
A10	110.25		44.07	na				
SYS2	110.25		47.07	na				
HV12	103.0		50.3	na	50.0			
HV11	89.0		56.8	na				
SYS1	95.75		53.87	na				
BLK1	97.625		53.06	na				
BLK2	98.167		53.11	na				
TOR	96.167		54.08	na				
BOR	87.375		58.01	na				
PO	87.375		58.1	na				
PI	87.375		85.32	na				
BYPS	94.0		82.46	na				
BKFL	87.5		89.26	na				
SPIG	96.875		85.28	na				
UG1	96.875		91.52	na	200.0			
TEST	104.0		89.25	na				

The maximum velocity is 17.89 and it occurs in the pipe between nodes X25 and Z3

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125902 Webster ISB - 2nd Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
* -----										
S21 to X21	14.82 14.82	1.049 120.0 0.0747	2T	10.0 0.0 0.0	3.380 10.000 13.380	7.006 -0.901 1.000			K Factor = 5.60 Vel = 5.50	
	0.0 14.82						7.105		K Factor = 5.56	
S22 to X22	15.03 15.03	1.049 120.0 0.0767	2T	10.0 0.0 0.0	3.380 10.000 13.380	7.199 -0.901 1.026			K Factor = 5.60 Vel = 5.58	
	0.0 15.03						7.324		K Factor = 5.55	
S23 to X23	15.89 15.89	1.049 120.0 0.0850	2T	10.0 0.0 0.0	3.380 10.000 13.380	8.047 -0.901 1.137			K Factor = 5.60 Vel = 5.90	
	0.0 15.89						8.283		K Factor = 5.52	
S24 to X24	17.63 17.63	1.049 120.0 0.1031	2T	10.0 0.0 0.0	3.380 10.000 13.380	9.915 -0.901 1.380			K Factor = 5.60 Vel = 6.54	
	0.0 17.63						10.394		K Factor = 5.47	
S25 to X25	20.01 20.01	1.049 120.0 0.1303	2T	10.0 0.0 0.0	3.380 10.000 13.380	12.768 -0.901 1.743			K Factor = 5.60 Vel = 7.43	
	0.0 20.01						13.610		K Factor = 5.42	
S26 to X26	14.82 14.82	1.049 120.0 0.0747	E 2T	2.0 10.0 0.0	11.750 12.000 23.750	7.000 -0.901 1.774			K Factor = 5.60 Vel = 5.50	
	0.0 14.82						7.873		K Factor = 5.28	
S27 to X27	15.24 15.24	1.049 120.0 0.0787	2T	10.0 0.0 0.0	9.080 10.000 19.080	7.407 -0.901 1.502			K Factor = 5.60 Vel = 5.66	
	0.0 15.24						8.008		K Factor = 5.39	
S28 to X27	15.52 15.52	1.049 120.0 0.0814	2T	10.0 0.0 0.0	5.080 10.000 15.080	7.681 -0.901 1.228			K Factor = 5.60 Vel = 5.76	
	0.0 15.52						8.008		K Factor = 5.48	
S29 to X29	16.16 16.16	1.049 120.0 0.0877	2T	10.0 0.0 0.0	9.080 10.000 19.080	8.325 -0.901 1.673			K Factor = 5.60 Vel = 6.00	
	0.0 16.16						9.097		K Factor = 5.36	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125902 Webster ISB - 2nd Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
S30 to X29	16.45 16.45	1.049 120.0 0.0906	2T	10.0 0.0 0.0	5.080 10.000 15.080	8.631 -0.901 1.367			K Factor = 5.60 Vel = 6.11	
	0.0 16.45					9.097			K Factor = 5.45	
S31 to X31	25.19 25.19	1.049 120.0 0.1994	2T	10.0 0.0 0.0	9.080 10.000 19.080	20.229 -0.957 3.804			K Factor = 5.60 Vel = 9.35	
	0.0 25.19					23.076			K Factor = 5.24	
S32 to X31	25.62 25.62	1.049 120.0 0.2058	2T	10.0 0.0 0.0	5.080 10.000 15.080	20.930 -0.957 3.103			K Factor = 5.60 Vel = 9.51	
	0.0 25.62					23.076			K Factor = 5.33	
*										
X21 to X22	14.82 14.82	1.38 120.0 0.0197		0.0 0.0 0.0	11.130 0.0 11.130	7.105 0.0 0.219			Vel = 3.18	
X22 to X23	15.03 29.85	1.38 120.0 0.0718		0.0 0.0 0.0	13.360 0.0 13.360	7.324 0.0 0.959			Vel = 6.40	
X23 to X24	15.88 45.73	1.38 120.0 0.1581		0.0 0.0 0.0	13.350 0.0 13.350	8.283 0.0 2.111			Vel = 9.81	
X24 to X25	17.64 63.37	1.38 120.0 0.2889		0.0 0.0 0.0	11.130 0.0 11.130	10.394 0.0 3.216			Vel = 13.59	
X25 to Z3	20.01 83.38	1.38 120.0 0.4802		0.0 0.0 0.0	10.750 0.0 10.750	13.610 0.0 5.162			Vel = 17.89	
Z3 to A1	0.0 83.38	1.38 120.0 0.4802	3lx T	5.7 6.0 0.0	12.160 11.700 23.860	18.772 1.299 11.457			Vel = 17.89	
	0.0 83.38					31.528			K Factor = 14.85	
*										
X26 to X27	14.82 14.82	1.38 120.0 0.0197		0.0 0.0 0.0	6.850 0.0 6.850	7.873 0.0 0.135			Vel = 3.18	
X27 to Z4	30.76 45.58	1.38 120.0 0.1571		0.0 0.0 0.0	9.610 0.0 9.610	8.008 0.0 1.510			Vel = 9.78	
	0.0 45.58					9.518			K Factor = 14.77	
X29 to Z4	32.61 32.61	1.38 120.0 0.0847		0.0 0.0 0.0	4.970 0.0 4.970	9.097 0.0 0.421			Vel = 6.99	

Final Calculations - Hazen-Williams

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46125902 Webster ISB - 2nd Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
Z4 to Z5	45.58 78.19	1.38 120.0 0.4263	2lx Jx	3.8 4.8 0.0	21.390 8.600 29.990	9.518 1.299 12.785			Vel = 16.77	
Z5 to A2	0.0 78.19	1.61 120.0 0.2012	lx T	2.3 8.0 0.0	29.180 10.300 39.480	23.602 0.0 7.945			Vel = 12.32	
	0.0 78.19					31.547			K Factor = 13.92	
*										
X31 to Z6	50.81 50.81	1.38 120.0 0.1918		0.0 0.0 0.0	1.220 0.0 1.220	23.076 0.0 0.234			Vel = 10.90	
Z6 to Z7	0.0 50.81	1.38 120.0 0.1920	Jx	4.8 0.0 0.0	11.667 4.800 16.467	23.310 0.0 3.162			Vel = 10.90	
Z7 to A5	0.0 50.81	1.61 120.0 0.0906	2lx T	4.6 8.0 0.0	32.313 12.600 44.913	26.472 1.356 4.071			Vel = 8.01	
	0.0 50.81					31.899			K Factor = 9.00	
*										
A1 to A2	83.38 83.38	3.26 120.0 0.0072		0.0 0.0 0.0	2.625 0.0 2.625	31.528 0.0 0.019			Vel = 3.20	
A2 to A3	78.18 161.56	3.26 120.0 0.0251		0.0 0.0 0.0	2.110 0.0 2.110	31.547 0.0 0.053			Vel = 6.21	
A3 to A4	0.0 161.56	3.26 120.0 0.0240		0.0 0.0 0.0	1.250 0.0 1.250	31.600 0.0 0.030			Vel = 6.21	
A4 to A5	0.0 161.56	3.26 120.0 0.0248		0.0 0.0 0.0	10.830 0.0 10.830	31.630 0.0 0.269			Vel = 6.21	
A5 to A6	50.81 212.37	3.26 120.0 0.0412		0.0 0.0 0.0	5.170 0.0 5.170	31.899 0.0 0.213			Vel = 8.16	
A6 to A7	0.0 212.37	3.26 120.0 0.0412		0.0 0.0 0.0	12.000 0.0 12.000	32.112 0.0 0.494			Vel = 8.16	
A7 to A8	0.0 212.37	3.26 120.0 0.0412		0.0 0.0 0.0	16.030 0.0 16.030	32.606 0.0 0.660			Vel = 8.16	
A8 to A9	0.0 212.37	3.26 120.0 0.0412	4l J	26.879 17.471 0.0	126.920 44.350 171.270	33.266 0.0 7.048			Vel = 8.16	
A9 to A10	0.0 212.37	3.26 120.0 0.0412		0.0 0.0 0.0	91.250 0.0 91.250	40.314 0.0 3.755			Vel = 8.16	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125902 Webster ISB - 2nd Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.		Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
A10 to SYS2	0.0 212.37	3.26 120.0 0.0412	2I B C T	13.44 6.72 13.44 20.159	19.250 53.759 73.009	44.069 0.0 3.005			Vel = 8.16	
	0.0 212.37					47.074			K Factor = 30.95	
*										
SYS2 to HV12	212.37	4.26 120.0		0.0 0.0 0.0	7.250 0.0 7.250	47.074 3.140 0.081			Vel = 4.78	
HV12 to BLK1	50.00 262.37	4.26 120.0 0.0165	J	21.067 0.0 0.0	5.375 21.067 26.442	50.295 2.328 0.437			Qa = 50 Vel = 5.91	
	0.0 262.37					53.060			K Factor = 36.02	
HV11 to SYS1	0.0	4.26 120.0 0.0		0.0 0.0 0.0	6.750 0.0 6.750	56.796 -2.923 0.0	0.0 0.0 0.0		Vel = 0	
SYS1 to BLK1	0.0	4.26 120.0 0.0	J	21.067 0.0 0.0	1.875 21.067 22.942	53.872 -0.812 0.0	0.0 0.0 0.0		Vel = 0	
BLK1 to BLK2	262.37 262.37	6.357 120.0 0.0024	2I H B J	25.147 6.287 10.059 31.433	46.209 72.926 119.135	53.060 -0.235 0.281			Vel = 2.65	
BLK2 to TOR	0.0 262.37	6.357 120.0 0.0024	2I	25.147 0.0 0.0	22.083 25.147 47.230	53.106 0.866 0.111			Vel = 2.65	
TOR to BOR	0.0 262.37	6.357 120.0 0.0023	B J	10.059 31.433 0.0	8.792 41.492 50.284	54.083 3.808 0.118			Vel = 2.65	
BOR to PO	0.0 262.37	6.357 120.0 0.0024	B C	10.059 25.147 0.0	5.417 35.206 40.623	58.009 0.0 0.096			Vel = 2.65	
	0.0 262.37					58.105			K Factor = 34.42	
System Demand Pressure						58.105				
Safety Margin						94.106				
Continuation Pressure						152.211				
Pressure @ Pump Outlet						152.211				
Pressure From Pump Curve						-66.892				
Pressure @ Pump Inlet						85.319				
*										
PI to BYP	0.0 262.37	8.249 120.0 0.0006	lx	15.386 0.0 0.0	8.292 15.386 23.678	85.319 -2.869 0.015			Vel = 1.58	

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
BYPS to BKFL	0.0 262.37	6.357 120.0 0.0024	2J I Zib	62.867 12.573 0.0	13.417 75.440 88.857	82.465 6.585 0.209			* * Fixed Loss = 3.77 Vel = 2.65	
BKFL to SPIG	0.0 262.37	7.981 120.0 0.0008	G lx	4.0 13.1 0.0	85.291 17.100 102.391	89.259 -4.060 0.079			Vel = 1.68	
SPIG to UG1	0.0 262.37	8.39 140.0 0.0005	2G Zac 2V X	13.572 0.0 61.074 59.377	80.000 134.023 214.023	85.278 6.147 0.099			* * Fixed Loss = 6.147 Vel = 1.52	
UG1 to TEST	200.00 462.37	8.39 140.0 0.0013	2G 3U X	13.572 45.805 59.377	500.000 118.754 618.754	91.524 -3.086 0.809			Qa = 200 Vel = 2.68	
	0.0 462.37					89.247			K Factor = 48.94	



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name : 46125903 Webster ISB - 3rd Lvl - RA1
Building : Webster ISB
Location : 8274 Big Bend Blvd
System : SYS3
Contract : 461259
Data File : 46125903 Webster ISB - 3rd Lvl - RA1.WXF

Hydraulic Design Information Sheet

Name - 46125903 Webster ISB - 3rd Lvl - RA1 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS3
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-103.A
Construction: () Combustible (X) Non-Combustible Ceiling Height - 9-6
Occupancy - HC-1,HC-2,HC-3

S () NFPA 13 () Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
Y () NFPA 231 () NFPA 231C () Figure Curve
S Other Factory Mutual - HC-1,HC-2,HC-3
T Specific Ruling Made By Date
E

M Area of Sprinkler Operation - 1536 System Type Sprinkler/Nozzle
Density - .1/.2/.3 (X) Wet Make Viking
D Area Per Sprinkler - 100 () Dry Model VK534
E Elevation at Highest Outlet - 124.833 () Deluge Size 3/4"
S Hose Allowance - Inside - 100 () Preaction K-Factor 11.2
I Rack Sprinkler Allowance - n/a () Other Temp.Rat.200
G Hose Allowance - Outside - 400
N

Note

Calculation Flow Required - 600.28 Press Required - 85.557 SYS3
Summary C-Factor Used: 120 Overhead 140 Underground

W Water Flow Test: Pump Data: Tank or Reservoir:
A Date of Test - 05/23/16 Cap. -
T Time of Test - 2:30 PM Rated Cap.- 1000 Elev.-
E Static Press - 90 @ Press - 55
R Residual Press - 86 Elev. - 87.375 Well
Flow - 1140 Proof Flow
S Elevation - 104
U

P Location - 8274 Big Bend Blvd
P
L Source of Information - Ahern Fire Protection
Y

C Commodity Class Location
O Storage Ht. Area Aisle W.
M Storage Method: Solid Piled % Palletized % Rack
M
S R () Single Row () Conven. Pallet () Auto. Storage () Encap.
T A () Double Row () Slave Pallet () Solid Shelf () Non
O C () Mult. Row () Open Shelf
R K Flue Spacing Clearance:Storage to Ceiling
A Longitudinal Transverse
G
E Horizontal Barriers Provided:

Water Supply Curve C

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA1

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City Water Supply:

C1 - Static Pressure : 90
C2 - Residual Pressure: 86
C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow

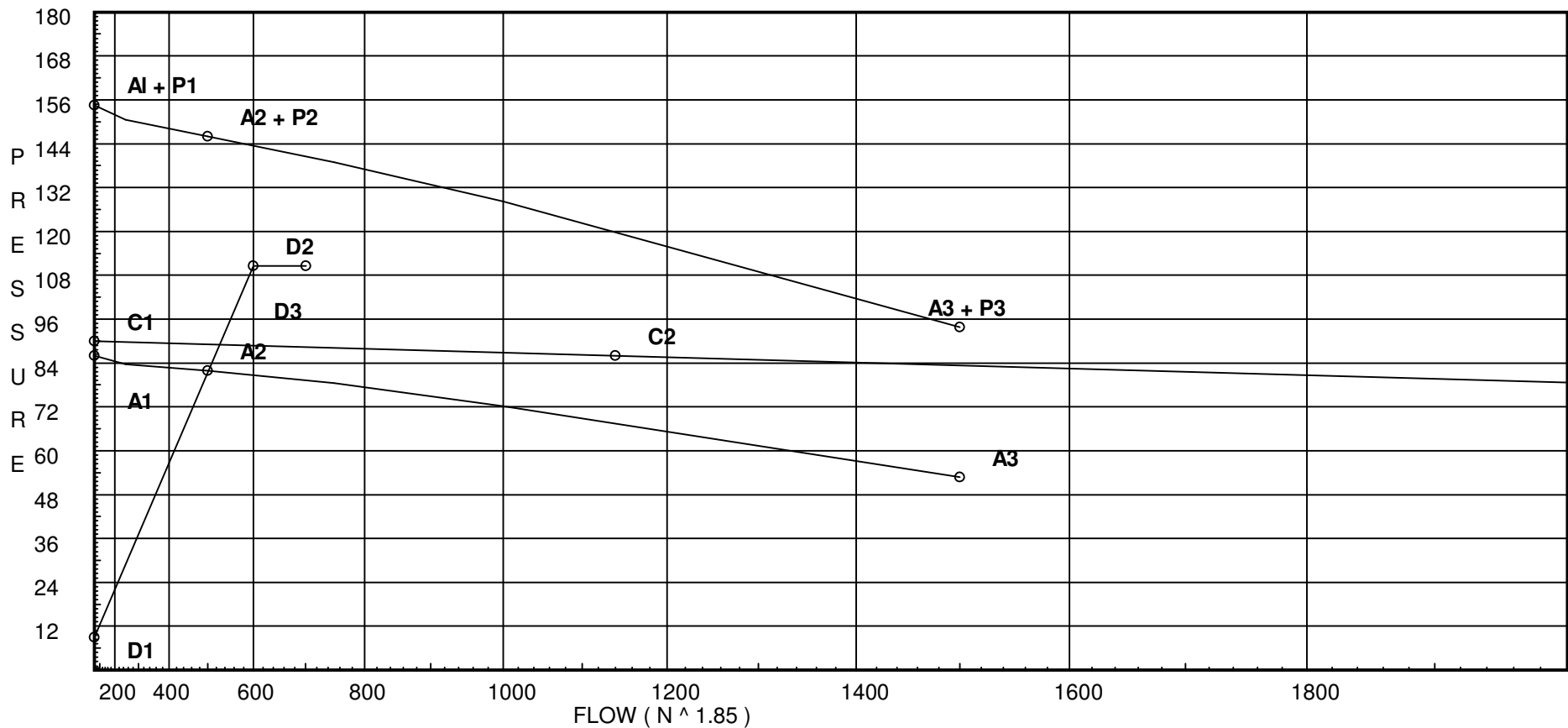
A1 - Adjusted Static: 86.006
A2 - Adj Resid : 81.917 @ 500
A3 - Adj Resid : 52.814 @ 1500

Pump Data:

P1 - Pump Churn Pressure : 68.5
P2 - Pump Rated Pressure : 64
P2 - Pump Rated Flow : 500
P3 - Pump Pressure @ Max Flow : 41
P3 - Pump Max Flow : 1500
City Residual Flow @ 0 = 6135.00
City Residual Flow @ 20 = 5355.71
City Water @ 150% of Pump = 83.35

Demand:

D1 - Elevation : 9.021
D2 - System Flow : 600.28
D2 - System Pressure : 110.629
Hose (Demand) : 100
D3 - System Demand : 700.28
Hose (Adj City) : 400
Safety Margin : 29.899



Fittings Used Summary

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA1

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Fitting Legend

Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkins 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units Inches
Length Units Feet
Flow Units US Gallons per Minute
Pressure Units Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA1

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Date 09/22/16

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S1	124.83	11.2	7.72	na	31.13	0.3	100	7.0
S2	124.83	11.2	8.05	na	31.78	0.3	100	7.0
S3	124.83	11.2	9.36	na	34.26	0.3	100	7.0
S4	124.83	8	25.0	na	40.0	0.1	400	25.0
S5	124.83	5.6	22.18	na	26.37	0.1	151	7.0
S6	124.83	5.6	22.72	na	26.69	0.1	167	7.0
S7	124.83	5.6	24.05	na	27.46	0.1	101	7.0
S8	124.83	8	26.12	na	40.89	0.1	400	25.0
S9	124.83	8	20.18	na	35.94	0.1	324	17.0
S10	124.83	8	21.44	na	37.04	0.1	324	17.0
S11	124.83	8	26.82	na	41.43	0.1	400	25.0
S12	124.33	8	27.54	na	41.99	0.2	104	7.0
S13	124.33	5.6	26.24	na	28.68	0.1	139	7.0
S14	124.33	5.6	29.64	na	30.49	0.1	94	7.0
S15	124.83	5.6	22.61	na	26.63	0.1	196	7.0
S16	124.83	5.6	23.24	na	27.0	0.1	196	7.0
S17	124.83	5.6	27.62	na	29.43	0.1	113	7.0
S18	124.83	8	28.99	na	43.08	0.1	400	25.0
X1	125.58		15.01	na				
X2	125.58		15.63	na				
X3	125.58		18.12	na				
X4	125.58		36.78	na				
X5	125.58		28.06	na				
X6	125.58		28.75	na				
X7	125.58		30.41	na				
X9	125.58		29.79	na				
X10	125.58		31.61	na				
X13	125.58		36.67	na				
X14	125.58		37.22	na				
X15	126.58		28.82	na				
X16	126.58		29.63	na				
X17	126.58		31.69	na				
A6	125.58		40.24	na				
B1	125.58		38.32	na				
B2	125.58		38.33	na				
B3	125.58		38.34	na				
B4	125.58		38.4	na				
B5	125.58		38.97	na				
B6	125.58		39.41	na				
B7	125.58		40.34	na				
B8	125.58		40.99	na				
B9	125.58		41.08	na				
B10	125.58		42.55	na				
B11	125.58		65.96	na				
SYS3	125.583		85.56	na				
HV13	118.333		89.25	na	100.0			
SYS2	110.25		93.57	na				
HV12	103.0		97.45	na				
HV11	89.0		106.2	na				
SYS1	95.75		103.28	na				
BLK1	97.625		102.47	na				
BLK2	98.167		103.96	na				
TOR	96.167		105.51	na				
BOR	87.375		110.04	na				
PO	87.375		110.63	na				
PI	87.375		79.24	na				
BYPS	94.0		76.47	na				
BKFL	87.5		84.07	na				
SPIG	96.875		80.5	na				
UG1	96.875		85.32	na	400.0			
TEST	104.0		86.25	na				

Flow Summary - Standard

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA1

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
----------	-----------	--------	-----------	----	-------------	---------	------	------------

The maximum velocity is 23.07 and it occurs in the pipe between nodes B10 and B11

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
* S1 to X1										
	31.13	1.049	T	5.0	0.100	7.724			K Factor = 11.20	
		120.0	Eq	20.7	25.700	-0.325				
	31.13	0.2950		0.0	25.800	7.611			Vel = 11.56	
	0.0									
	31.13					15.010			K Factor = 8.04	
S2 to X2										
	31.78	1.049	T	5.0	0.100	8.049			K Factor = 11.20	
		120.0	Eq	20.7	25.700	-0.325				
	31.78	0.3065		0.0	25.800	7.907			Vel = 11.80	
	0.0									
	31.78					15.631			K Factor = 8.04	
S3 to X3										
	34.26	1.049	T	5.0	0.100	9.357			K Factor = 11.20	
		120.0	Eq	20.7	25.700	-0.325				
	34.26	0.3522		0.0	25.800	9.088			Vel = 12.72	
	0.0									
	34.26					18.120			K Factor = 8.05	
S4 to X4										
	40.00	1.049	T	5.0	0.100	25.000			K Factor = 8.00	
		120.0	Eq	20.7	25.700	-0.325				
	40.0	0.4691		0.0	25.800	12.104			Vel = 14.85	
	0.0									
	40.00					36.779			K Factor = 6.60	
S5 to X5										
	26.37	1.049	T	5.0	0.100	22.178			K Factor = 5.60	
		120.0	Eq	23.5	28.500	-0.325				
	26.37	0.2171		0.0	28.600	6.209			Vel = 9.79	
	0.0									
	26.37					28.062			K Factor = 4.98	
S6 to X6										
	26.69	1.049	T	5.0	0.100	22.723			K Factor = 5.60	
		120.0	Eq	23.5	28.500	-0.325				
	26.69	0.2220		0.0	28.600	6.349			Vel = 9.91	
	0.0									
	26.69					28.747			K Factor = 4.98	
S7 to X7										
	27.46	1.049	T	5.0	0.100	24.046			K Factor = 5.60	
		120.0	Eq	23.5	28.500	-0.325				
	27.46	0.2340		0.0	28.600	6.691			Vel = 10.19	
	0.0									
	27.46					30.412			K Factor = 4.98	
S8 to B4										
	40.89	1.049	T	5.0	0.100	26.120			K Factor = 8.00	
		120.0	Eq	20.7	25.700	-0.325				
	40.89	0.4885		0.0	25.800	12.604			Vel = 15.18	
	0.0									
	40.89					38.399			K Factor = 6.60	
S9 to X9										
	35.94	1.049	T	5.0	0.100	20.182			K Factor = 8.00	
		120.0	Eq	20.7	25.700	-0.325				
	35.94	0.3849		0.0	25.800	9.930			Vel = 13.34	
	0.0									
	35.94					29.787			K Factor = 6.59	

Final Calculations - Hazen-Williams

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46125903 Webster ISB - 3rd Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
S10 to X10	37.04 37.04	1.049 120.0 0.4069	T Eq	5.0 20.7 0.0	0.100 25.700 25.800	21.435 -0.325 10.499			K Factor = 8.00 Vel = 13.75	
	0.0 37.04						31.609		K Factor = 6.59	
S11 to B6	41.43 41.43	1.049 120.0 0.5007	T Eq	5.0 20.7 0.0	0.100 25.700 25.800	26.822 -0.325 12.917			K Factor = 8.00 Vel = 15.38	
	0.0 41.43						39.414		K Factor = 6.60	
S12 to A6	41.98 41.98	1.049 120.0 0.5131	T Eq	5.0 20.7 0.0	0.100 25.700 25.800	27.543 -0.541 13.238			K Factor = 8.00 Vel = 15.58	
	0.0 41.98						40.240		K Factor = 6.62	
S13 to X13	28.68 28.68	1.049 120.0 0.2535	T Eq	5.0 38.2 0.0	0.100 43.200 43.300	26.235 -0.541 10.978			K Factor = 5.60 Vel = 10.65	
	0.0 28.68						36.672		K Factor = 4.74	
S14 to X14	30.49 30.49	1.049 120.0 0.2838	T Eq	5.0 23.5 0.0	0.100 28.500 28.600	29.640 -0.541 8.118			K Factor = 5.60 Vel = 11.32	
	0.0 30.49						37.217		K Factor = 5.00	
S15 to X15	26.63 26.63	1.049 120.0 0.2210	T Eq	5.0 23.5 0.0	3.000 28.500 31.500	22.612 -0.758 6.961			K Factor = 5.60 Vel = 9.89	
	0.0 26.63						28.815		K Factor = 4.96	
S16 to X16	27.00 27.0	1.049 120.0 0.2267	T Eq	5.0 23.5 0.0	3.000 28.500 31.500	23.245 -0.758 7.142			K Factor = 5.60 Vel = 10.02	
	0.0 27.00						29.629		K Factor = 4.96	
S17 to X17	29.43 29.43	1.049 120.0 0.2659	2T	10.0 0.0 0.0	8.167 10.000 18.167	27.619 -0.758 4.831			K Factor = 5.60 Vel = 10.93	
	0.0 29.43						31.692		K Factor = 5.23	
S18 to B10	43.08 43.08	1.049 120.0 0.5380	T Eq	5.0 20.7 0.0	0.100 25.700 25.800	28.993 -0.325 13.881			K Factor = 8.00 Vel = 15.99	
	0.0 43.08						42.549		K Factor = 6.60	

*

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA1

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Date 09/22/16

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
X1 to X2	31.13	1.38 120.0		0.0 0.0	8.010 0.0	15.010 0.0				
X2 to X3	31.13	0.0775		0.0	8.010	0.621		Vel =	6.68	
X2 to X3	31.77	1.38 120.0		0.0 0.0	8.730 0.0	15.631 0.0				
X3 to B1	62.9	0.2851		0.0	8.730	2.489		Vel =	13.49	
X3 to B1	34.26	1.38 120.0	2I T	4.2 6.0	21.490 10.200	18.120 0.0				
	97.16	0.6373		0.0	31.690	20.195		Vel =	20.84	
	0.0 97.16					38.315		K Factor =	15.70	
*										
X4 to B2	40.00	1.61 120.0	T	8.0 0.0	18.670 8.000	36.779 0.0				
	40.0	0.0582		0.0	26.670	1.553		Vel =	6.30	
	0.0 40.00					38.332		K Factor =	6.46	
*										
X5 to X6	26.37	1.38 120.0		0.0 0.0	12.000 0.0	28.062 0.0				
X6 to X7	26.37	0.0571		0.0	12.000	0.685		Vel =	5.66	
X6 to X7	26.70	1.38 120.0		0.0 0.0	8.000 0.0	28.747 0.0				
X7 to B3	53.07	0.2081		0.0	8.000	1.665		Vel =	11.38	
X7 to B3	27.46	1.38 120.0	T	6.0 0.0	11.610 6.000	30.412 0.0				
	80.53	0.4503		0.0	17.610	7.929		Vel =	17.27	
	0.0 80.53					38.341		K Factor =	13.01	
*										
X9 to X10	35.94	1.38 120.0		0.0 0.0	18.000 0.0	29.787 0.0				
X10 to B5	35.94	0.1012		0.0	18.000	1.822		Vel =	7.71	
X10 to B5	37.04	1.38 120.0	T	6.0 0.0	13.610 6.000	31.609 0.0				
	72.98	0.3753		0.0	19.610	7.359		Vel =	15.65	
	0.0 72.98					38.968		K Factor =	11.69	
*										
X13 to X14	28.68	1.38 120.0		0.0 0.0	8.170 0.0	36.672 0.0				
X14 to B8	28.68	0.0667		0.0	8.170	0.545		Vel =	6.15	
X14 to B8	30.49	1.38 120.0	T	6.0 0.0	8.830 6.000	37.217 0.0				
	59.17	0.2546		0.0	14.830	3.776		Vel =	12.69	
	0.0									

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	59.17					40.993			K Factor = 9.24	
*										
X15	26.63	1.38		0.0	14.000	28.815				
to		120.0		0.0	0.0	0.0				
X16	26.63	0.0581		0.0	14.000	0.814			Vel = 5.71	
X16	27.00	1.38		0.0	9.720	29.629				
to		120.0		0.0	0.0	0.0				
X17	53.63	0.2122		0.0	9.720	2.063			Vel = 11.50	
X17	29.43	1.38	lx	1.9	10.880	31.692				
to		120.0	T	6.0	7.900	0.433				
B9	83.06	0.4767		0.0	18.780	8.953			Vel = 17.82	
	0.0									
	83.06					41.078			K Factor = 12.96	
*										
A6	41.98	3.26	4H	13.977	17.730	40.240				
to		120.0	J	17.471	31.448	0.0				
B7	41.98	0.0021		0.0	49.178	0.101			Vel = 1.61	
	0.0									
	41.98					40.341			K Factor = 6.61	
*										
B1	97.16	3.26		0.0	1.730	38.315				
to		120.0		0.0	0.0	0.0				
B2	97.16	0.0098		0.0	1.730	0.017			Vel = 3.73	
B2	40.00	3.26		0.0	0.500	38.332				
to		120.0		0.0	0.0	0.0				
B3	137.16	0.0180		0.0	0.500	0.009			Vel = 5.27	
B3	80.53	3.26		0.0	1.350	38.341				
to		120.0		0.0	0.0	0.0				
B4	217.69	0.0430		0.0	1.350	0.058			Vel = 8.37	
B4	40.89	3.26		0.0	9.600	38.399				
to		120.0		0.0	0.0	0.0				
B5	258.58	0.0593		0.0	9.600	0.569			Vel = 9.94	
B5	72.98	3.26		0.0	4.760	38.968				
to		120.0		0.0	0.0	0.0				
B6	331.56	0.0937		0.0	4.760	0.446			Vel = 12.74	
B6	41.43	3.26		0.0	7.940	39.414				
to		120.0		0.0	0.0	0.0				
B7	372.99	0.1168		0.0	7.940	0.927			Vel = 14.34	
B7	41.98	3.26		0.0	4.590	40.341				
to		120.0		0.0	0.0	0.0				
B8	414.97	0.1420		0.0	4.590	0.652			Vel = 15.95	
B8	59.17	3.26		0.0	0.470	40.993				
to		120.0		0.0	0.0	0.0				
B9	474.14	0.1809		0.0	0.470	0.085			Vel = 18.22	
B9	83.06	3.26		0.0	6.000	41.078				
to		120.0		0.0	0.0	0.0				
B10	557.2	0.2452		0.0	6.000	1.471			Vel = 21.42	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
B10 to B11	43.08 600.28	3.26 120.0 0.2813		0.0 0.0 0.0	83.200 0.0 83.200	42.549 0.0 23.408			Vel = 23.07	
B11 to SYS3	0.0 600.28	3.26 120.0 0.2813	2I B C T	13.44 6.72 13.44 20.159	15.910 53.759 69.669	65.957 -0.001 19.601			Vel = 23.07	
	0.0 600.28					85.557			K Factor = 64.90	
*										
SYS3 to HV13	600.28 600.28	4.26 120.0 0.0764		0.0 0.0 0.0	7.250 0.0 7.250	85.557 3.140 0.554			Vel = 13.51	
HV13 to SYS2	100.00 700.28	4.26 120.0 0.1016		0.0 0.0 0.0	8.083 0.0 8.083	89.251 3.501 0.821			Qa = 100 Vel = 15.76	
SYS2 to HV12	0.0 700.28	4.26 120.0 0.1017		0.0 0.0 0.0	7.250 0.0 7.250	93.573 3.140 0.737			Vel = 15.76	
HV12 to BLK1	0.0 700.28	4.26 120.0 0.1017	J	21.067 0.0 0.0	5.375 21.067 26.442	97.450 2.328 2.689			Vel = 15.76	
	0.0 700.28					102.467			K Factor = 69.18	
HV11 to SYS1	0.0 0.0	4.26 120.0 0.0		0.0 0.0 0.0	6.750 0.0 6.750	106.202 -2.923 0.0	0.0 0.0 0.0		Vel = 0	
SYS1 to BLK1	0.0 0.0	4.26 120.0 0.0	J	21.067 0.0 0.0	1.875 21.067 22.942	103.279 -0.812 0.0	0.0 0.0 0.0		Vel = 0	
BLK1 to BLK2	700.28 700.28	6.357 120.0 0.0145	2I H B J	25.147 6.287 10.059 31.433	46.209 72.926 119.135	102.467 -0.235 1.724			Vel = 7.08	
BLK2 to TOR	0.0 700.28	6.357 120.0 0.0145	2I	25.147 0.0 0.0	22.083 25.147 47.230	103.956 0.866 0.684			Vel = 7.08	
TOR to BOR	0.0 700.28	6.357 120.0 0.0145	B J	10.059 31.433 0.0	8.792 41.492 50.284	105.506 3.808 0.728			Vel = 7.08	
BOR to PO	0.0 700.28	6.357 120.0 0.0144	B C	10.059 25.147 0.0	5.417 35.206 40.623	110.042 0.0 0.587			Vel = 7.08	
	0.0 700.28					110.629			K Factor = 66.58	
System Demand Pressure						110.629				
Safety Margin						29.899				
Continuation Pressure						140.528				

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.		Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
Pressure @ Pump Outlet						140.528				
Pressure From Pump Curve						-61.290				
Pressure @ Pump Inlet						79.238				
* 										
PI to BYPs	0.0 700.28	8.249 120.0 0.0041	lx	15.386 0.0 0.0	8.292 15.386 23.678	79.238 -2.869 0.096	Vel = 4.20			
BYPS to BKFL	0.0 700.28	6.357 120.0 0.0145	2J I Zib	62.867 12.573 0.0	13.417 75.440 88.857	76.465 6.315 1.286	* * Fixed Loss = 3.5 Vel = 7.08			
BKFL to SPIG	0.0 700.28	7.981 120.0 0.0048	G lx	4.0 13.1 0.0	85.291 17.100 102.391	84.066 -4.060 0.489	Vel = 4.49			
SPIG to UG1	0.0 700.28	8.39 140.0 0.0028	2G Zac 2V X	13.572 0.0 61.074 59.377	80.000 134.023 214.023	80.495 4.220 0.603	* * Fixed Loss = 4.22 Vel = 4.06			
UG1 to TEST	400.00 1100.28	8.39 140.0 0.0065	2G 3U X	13.572 45.805 59.377	500.000 118.754 618.754	85.318 -3.086 4.022	Qa = 400 Vel = 6.39			
0.0 1100.28						86.254	K Factor = 118.47			



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name : 46125903 Webster ISB - 3rd Lvl - RA2
Building : Webster ISB
Location : 8274 Big Bend Blvd
System : SYS3
Contract : 461259
Data File : 46125903 Webster ISB - 3rd Lvl - RA2.WXF

Hydraulic Design Information Sheet

Name - 46125903 Webster ISB - 3rd Lvl - RA2 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS3
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-103.B
Construction: () Combustible (X) Non-Combustible Ceiling Height - 17-7
Occupancy - HC-1

S () NFPA 13 () Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
Y () NFPA 231 () NFPA 231C () Figure Curve

S Other Factory Mutual - HC-1
T Specific Ruling

Made By

Date

M Area of Sprinkler Operation - 1555 System Type Sprinkler/Nozzle
Density - .10 (X) Wet Make Viking
D Area Per Sprinkler - 400 () Dry Model VK634
E Elevation at Highest Outlet - 132.916 () Deluge Size 3/4"
S Hose Allowance - Inside - 50 () Preaction K-Factor 8.0
I Rack Sprinkler Allowance - n/a () Other Temp.Rat.155
G Hose Allowance - Outside - 200

N
Note

Calculation Flow Required - 354.10 Press Required - 106.269 SYS3
Summary C-Factor Used: 120 Overhead 140 Underground

W Water Flow Test: Pump Data: Tank or Reservoir:
A Date of Test - 05/23/16 Cap. -
T Time of Test - 2:30 PM Rated Cap.- 1000 Elev.-
E Static Press - 90 @ Press - 55
R Residual Press - 86 Elev. - 87.375 Well
Flow - 1140 Proof Flow
S Elevation - 104

U
P Location - 8274 Big Bend Blvd

P
L Source of Information - Ahern Fire Protection
Y

C Commodity Class Location
O Storage Ht. Area Aisle W.
M Storage Method: Solid Piled % Palletized % Rack
M
() Single Row () Conven. Pallet () Auto. Storage () Encap.
S R () Double Row () Slave Pallet () Solid Shelf () Non
T A () Mult. Row () Open Shelf
O C

R K Flue Spacing Clearance:Storage to Ceiling
A Longitudinal Transverse

G
E Horizontal Barriers Provided:

Water Supply Curve C

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA2

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City Water Supply:

C1 - Static Pressure : 90
C2 - Residual Pressure: 86
C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow

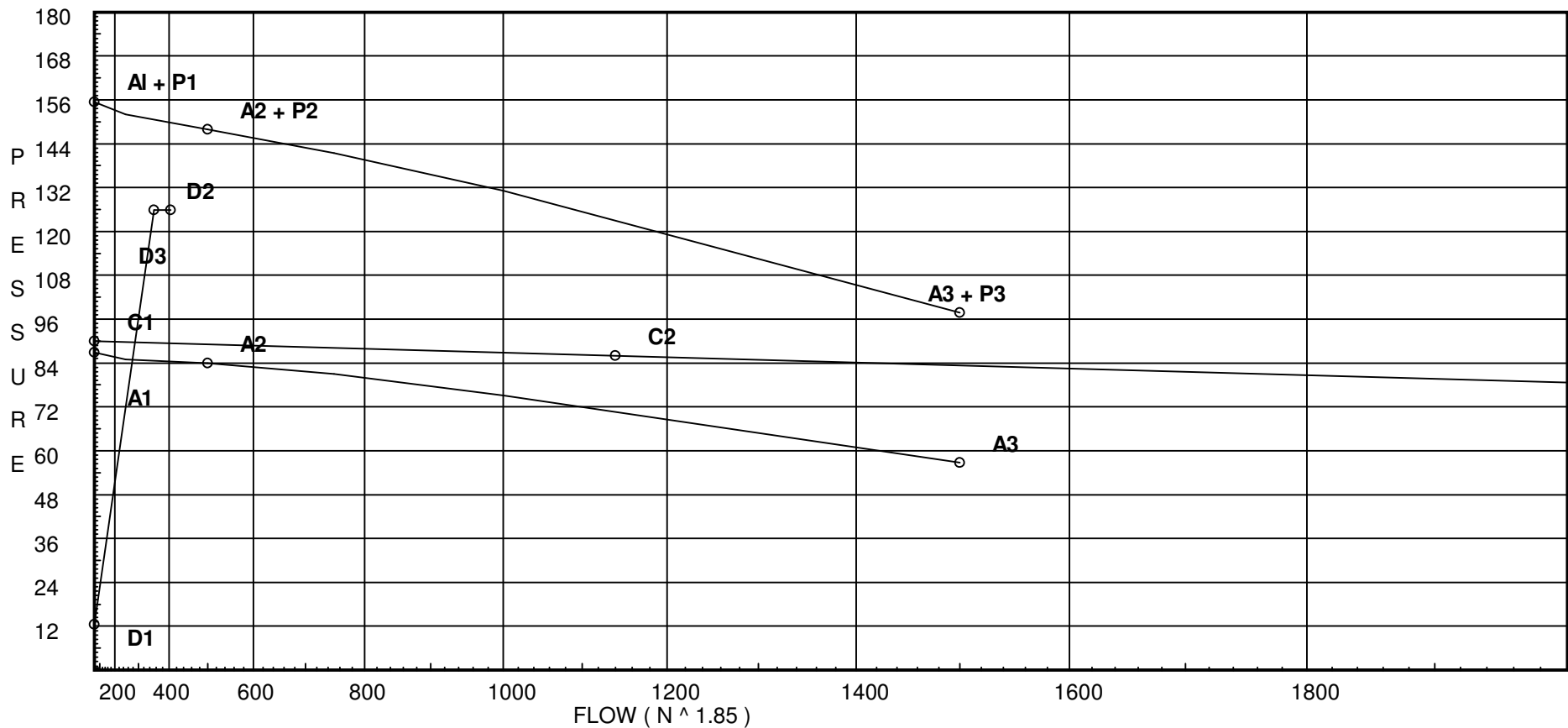
A1 - Adjusted Static: 86.869
A2 - Adj Resid : 83.909 @ 500
A3 - Adj Resid : 56.783 @ 1500

Pump Data:

P1 - Pump Churn Pressure : 68.5
P2 - Pump Rated Pressure : 64
P2 - Pump Rated Flow : 500
P3 - Pump Pressure @ Max Flow : 41
P3 - Pump Max Flow : 1500
City Residual Flow @ 0 = 6135.00
City Residual Flow @ 20 = 5355.71
City Water @ 150% of Pump = 83.35

Demand:

D1 - Elevation : 12.525
D2 - System Flow : 354.097
D2 - System Pressure : 125.908
Hose (Demand) : 50
D3 - System Demand : 404.097
Hose (Adj City) : 200
Safety Margin : 24.165



Fittings Used Summary

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA2

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Fitting Legend

Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
E	90' Standard Elbow Thrd	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkins 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units Inches
Length Units Feet
Flow Units US Gallons per Minute
Pressure Units Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA2

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S21	132.92	8	17.0	na	32.98	0.1	324	17.0
S22	131.46	8	17.79	na	33.75	0.1	256	10.6
S23	130.17	8	19.35	na	35.19	0.1	256	10.6
S24	129.12	5.6	25.86	na	28.48	0.1	121	7.0
S25	124.83	8	25.61	na	40.48	0.1	400	25.0
S26	124.83	8	26.22	na	40.97	0.1	400	25.0
S27	124.83	8	28.59	na	42.77	0.1	400	25.0
S28	124.83	8	38.29	na	49.5	0.1	324	17.0
S29	124.83	8	39.01	na	49.97	0.1	256	10.6
X21	134.83		25.65	na				
X22	133.35		26.86	na				
X23	132.07		29.22	na				
X24	131.01		32.96	na				
Z1	131.01		48.84	na				
X25	128.33		45.8	na				
X26	128.33		46.9	na				
X27	128.33		51.1	na				
X28	125.58		55.92	na				
X29	125.58		56.96	na				
A1	125.58		61.95	na				
A2	125.58		61.98	na				
A3	125.58		63.29	na				
A4	125.58		67.72	na				
A5	125.58		79.05	na				
A6	125.58		85.13	na				
B7	125.58		88.86	na				
B8	125.58		89.35	na				
B9	125.58		89.4	na				
B10	125.58		90.04	na				
B11	125.58		98.85	na				
SYS3	125.583		106.27	na				
HV13	118.333		109.62	na	50.0			
SYS2	110.25		113.42	na				
HV12	103.0		116.82	na				
HV11	89.0		123.86	na				
SYS1	95.75		120.93	na				
BLK1	97.625		120.12	na				
BLK2	98.167		120.51	na				
TOR	96.167		121.62	na				
BOR	87.375		125.7	na				
PO	87.375		125.91	na				
PI	87.375		84.72	na				
BYP5	94.0		81.89	na				
BKFL	87.5		88.67	na				
SPIG	96.875		84.78	na				
UG1	96.875		90.52	na	200.0			
TEST	104.0		88.76	na				

The maximum velocity is 20.55 and it occurs in the pipe between nodes X24 and Z1

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
* 										
S21 to X21	32.98 32.98	1.049 120.0 0.3284	E T Eq	2.0 5.0 20.7	1.167 27.700 28.867	17.000 -0.827 9.479			K Factor = 8.00 Vel = 12.24	
	0.0 32.98						25.652		K Factor = 6.51	
S22 to X22	33.75 33.75	1.049 120.0 0.3425	E T Eq	2.0 5.0 20.7	1.167 27.700 28.867	17.793 -0.819 9.888			K Factor = 8.00 Vel = 12.53	
	0.0 33.75						26.862		K Factor = 6.51	
S23 to X23	35.19 35.19	1.049 120.0 0.3702	E T Eq	2.0 5.0 20.7	1.167 27.700 28.867	19.353 -0.823 10.686			K Factor = 8.00 Vel = 13.06	
	0.0 35.19						29.216		K Factor = 6.51	
S24 to X24	28.48 28.48	1.049 120.0 0.2502	E T Eq	2.0 5.0 23.5	1.167 30.500 31.667	25.858 -0.819 7.923			K Factor = 5.60 Vel = 10.57	
	0.0 28.48						32.962		K Factor = 4.96	
S25 to X25	40.48 40.48	1.049 120.0 0.4796	E T Eq	2.0 5.0 35.5	2.750 42.500 45.250	25.607 -1.516 21.704			K Factor = 8.00 Vel = 15.03	
	0.0 40.48						45.795		K Factor = 5.98	
S26 to X26	40.97 40.97	1.049 120.0 0.4903	E T Eq	2.0 5.0 35.5	2.750 42.500 45.250	26.224 -1.516 22.188			K Factor = 8.00 Vel = 15.21	
	0.0 40.97						46.896		K Factor = 5.98	
S27 to X27	42.77 42.77	1.049 120.0 0.5311	E T Eq	2.0 5.0 35.5	2.750 42.500 45.250	28.588 -1.516 24.031			K Factor = 8.00 Vel = 15.88	
	0.0 42.77						51.103		K Factor = 5.98	
S28 to X28	49.50 49.5	1.049 120.0 0.6959	T Eq	5.0 20.7 0.0	0.100 25.700 25.800	38.291 -0.325 17.955			K Factor = 8.00 Vel = 18.38	
	0.0 49.50						55.921		K Factor = 6.62	
S29 to X29	49.97 49.97	1.049 120.0 0.7081	T Eq	5.0 20.7 0.0	0.100 25.700 25.800	39.014 -0.325 18.268			K Factor = 8.00 Vel = 18.55	
	0.0 49.97						56.957		K Factor = 6.62	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
* X21 32.98 1.61 0.0 13.970 25.652									
to		120.0		0.0	0.641				
X22	32.98	0.0407		13.970	0.569		Vel =	5.20	
X22	33.75	1.61		11.990	26.862				
to		120.0		0.0	0.554				
X23	66.73	0.1501		11.990	1.800		Vel =	10.52	
X23	35.19	1.61		10.000	29.216				
to		120.0		0.0	0.459				
X24	101.92	0.3287		10.000	3.287		Vel =	16.06	
X24	28.48	1.61		30.625	32.962				
to		120.0		0.0	0.0				
Z1	130.4	0.5184		30.625	15.876		Vel =	20.55	
Z1	0.0	2.067	3lx	9.6	50.510	48.838			
to		120.0	T	10.0	19.600	2.352			
A1	130.4	0.1535		70.110	10.764		Vel =	12.47	
	0.0								
	130.40				61.954		K Factor =	16.57	
* X25 40.48 1.61 0.0 18.500 45.795									
to		120.0		0.0	0.0				
X26	40.48	0.0595		18.500	1.101		Vel =	6.38	
X26	40.97	1.61		19.380	46.896				
to		120.0		0.0	0.0				
X27	81.45	0.2171		19.380	4.207		Vel =	12.84	
X27	42.77	1.61	lx	2.3	10.150	51.103			
to		120.0	T	8.0	10.300	1.191			
A2	124.22	0.4739		20.450	9.691		Vel =	19.58	
	0.0								
	124.22				61.985		K Factor =	15.78	
* X28 49.50 1.61 0.0 12.000 55.921									
to		120.0		0.0	0.0				
X29	49.5	0.0863		12.000	1.036		Vel =	7.80	
X29	49.97	1.61	T	8.0	12.160	56.957			
to		120.0		0.0	8.000	0.0			
A3	99.47	0.3142		20.160	6.334		Vel =	15.68	
	0.0								
	99.47				63.291		K Factor =	12.50	
* A1 130.40 3.26 0.0 1.850 61.954									
to		120.0		0.0	0.0				
A2	130.4	0.0168		1.850	0.031		Vel =	5.01	
A2	124.22	3.26		22.680	61.985				
to		120.0		0.0	0.0				
A3	254.62	0.0576		22.680	1.306		Vel =	9.79	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
A3 to A4	99.48 354.1	3.26 120.0 0.1060		0.0 0.0 0.0	41.750 0.0 41.750	63.291 0.0 4.424				
								Vel = 13.61		
A4 to A5	0.0 354.1	3.26 120.0 0.1060	J	17.471 0.0 0.0	89.490 17.471 106.961	67.715 0.0 11.334				
								Vel = 13.61		
A5 to A6	0.0 354.1	3.26 120.0 0.1060		0.0 0.0 0.0	57.420 0.0 57.420	79.049 0.0 6.085				
								Vel = 13.61		
A6 to B7	0.0 354.1	3.26 120.0 0.1060	J	17.471 0.0 0.0	17.730 17.471 35.201	85.134 0.0 3.730				
								Vel = 13.61		
	0.0 354.10					88.864			K Factor = 37.56	
*										
B7 to B8	354.10 354.1	3.26 120.0 0.1059		0.0 0.0 0.0	4.590 0.0 4.590	88.864 0.0 0.486				
								Vel = 13.61		
B8 to B9	0.0 354.1	3.26 120.0 0.1064		0.0 0.0 0.0	0.470 0.0 0.470	89.350 0.0 0.050				
								Vel = 13.61		
B9 to B10	0.0 354.1	3.26 120.0 0.1060		0.0 0.0 0.0	6.000 0.0 6.000	89.400 0.0 0.636				
								Vel = 13.61		
B10 to B11	0.0 354.1	3.26 120.0 0.1060		0.0 0.0 0.0	83.200 0.0 83.200	90.036 0.0 8.816				
								Vel = 13.61		
B11 to SYS3	0.0 354.1	3.26 120.0 0.1060	2I T B C	13.44 20.159 6.72 13.44	16.250 53.759 70.009	98.852 -0.001 7.418				
								Vel = 13.61		
	0.0 354.10					106.269			K Factor = 34.35	
*										
SYS3 to HV13	354.10 354.1	4.26 120.0 0.0288		0.0 0.0 0.0	7.250 0.0 7.250	106.269 3.140 0.209				
								Vel = 7.97		
HV13 to SYS2	50.00 404.1	4.26 120.0 0.0367		0.0 0.0 0.0	8.083 0.0 8.083	109.618 3.501 0.297			Qa = 50	
								Vel = 9.10		
SYS2 to HV12	0.0 404.1	4.26 120.0 0.0367		0.0 0.0 0.0	7.250 0.0 7.250	113.416 3.140 0.266				
								Vel = 9.10		
HV12 to BLK1	0.0 404.1	4.26 120.0 0.0368	J	21.067 0.0 0.0	5.375 21.067 26.442	116.822 2.328 0.972				
								Vel = 9.10		

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0 404.10					120.122			K Factor = 36.87	
HV11 to SYS1	0.0 0.0	4.26 120.0 0.0		0.0 0.0 0.0	6.750 0.0 6.750	123.858 -2.923 0.0	0.0 0.0 0.0			Vel = 0
SYS1 to BLK1	0.0 0.0	4.26 120.0 0.0	J	21.067 0.0 0.0	1.875 21.067 22.942	120.934 -0.812 0.0	0.0 0.0 0.0			Vel = 0
BLK1 to BLK2	404.10 404.1	6.357 120.0 0.0052	2I H B J	25.147 6.287 10.059 31.433	46.209 72.926 119.135	120.122 -0.235 0.624				Vel = 4.08
BLK2 to TOR	0.0 404.1	6.357 120.0 0.0052	2I	25.147 0.0 0.0	22.083 25.147 47.230	120.511 0.866 0.247				Vel = 4.08
TOR to BOR	0.0 404.1	6.357 120.0 0.0052	B J	10.059 31.433 0.0	8.792 41.492 50.284	121.624 3.808 0.263				Vel = 4.08
BOR to PO	0.0 404.1	6.357 120.0 0.0052	B C	10.059 25.147 0.0	5.417 35.206 40.623	125.695 0.0 0.213				Vel = 4.08
	0.0 404.10					125.908			K Factor = 36.01	
System Demand Pressure						125.908				
Safety Margin						24.165				
Continuation Pressure						150.073				
Pressure @ Pump Outlet						150.073				
Pressure From Pump Curve						-65.352				
Pressure @ Pump Inlet						84.721				
*										
PI to BYP	0.0 404.1	8.249 120.0 0.0015	lx	15.386 0.0 0.0	8.292 15.386 23.678	84.721 -2.869 0.035				Vel = 2.43
BYP to BKFL	0.0 404.1	6.357 120.0 0.0052	2J I Zib	62.867 12.573 0.0	13.417 75.440 88.857	81.887 6.315 0.465			** Fixed Loss = 3.5	Vel = 4.08
BKFL to SPIG	0.0 404.1	7.981 120.0 0.0017	G lx	4.0 13.1 0.0	85.291 17.100 102.391	88.667 -4.060 0.177				Vel = 2.59
SPIG to UG1	0.0 404.1	8.39 140.0 0.0010	2G Zac 2V X	13.572 0.0 61.074 59.377	80.000 134.023 214.023	84.784 5.522 0.218			** Fixed Loss = 5.522	Vel = 2.35
UG1 to TEST	200.00 604.1	8.39 140.0 0.0021	2G 3U X	13.572 45.805 59.377	500.000 118.754 618.754	90.524 -3.086 1.327			Qa = 200	Vel = 3.51

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125903 Webster ISB - 3rd Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0 604.10				88.765			K Factor =	64.12



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name : 46125904 Webster ISB - 4th Lvl - RA1
Building : Webster ISB
Location : 8274 Big Bend Blvd
System : SYS4
Contract : 461259
Data File : 46125904 Webster ISB - 4th Lvl - RA1.WXF

Hydraulic Design Information Sheet

Name - 46125904 Webster ISB - 4th Lvl - RA1 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS4
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-104.B
Construction: () Combustible (X) Non-Combustible Ceiling Height - 9-6
Occupancy - HC-1

S () NFPA 13 () Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
Y () NFPA 231 () NFPA 231C () Figure Curve
S Other Factory Mutual - HC1
T Specific Ruling Made By Date
E

M	Area of Sprinkler Operation - 1536	System Type	Sprinkler/Nozzle
	Density - .10	(X) Wet	Make Viking
D	Area Per Sprinkler - 400	() Dry	Model VK634
E	Elevation at Highest Outlet - 140.667	() Deluge	Size 3/4"
S	Hose Allowance - Inside - 50	() Preaction	K-Factor 8.0
I	Rack Sprinkler Allowance - n/a	() Other	Temp.Rat.155
G	Hose Allowance - Outside - 200		

N Note

Calculation Flow Required - 405.01 Press Required - 104.329 SYS4
Summary C-Factor Used: 120 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 05/23/16		Cap. -
T	Time of Test - 2:30 PM	Rated Cap.- 1000	Elev.-
E	Static Press - 90	@ Press - 55	
R	Residual Press - 86	Elev. - 87.375	Well
	Flow - 1140		Proof Flow
S	Elevation - 104		

U Location - 8274 Big Bend Blvd

P Source of Information - Ahern Fire Protection

C	Commodity	Class	Location
O	Storage Ht.	Area	Aisle W.
M	Storage Method: Solid Piled	%	Palletized % Rack
M	() Single Row	() Conven. Pallet	() Auto. Storage () Encap.
S	() Double Row	() Slave Pallet	() Solid Shelf () Non
T	() Mult. Row		() Open Shelf

R	K	Flue Spacing	Clearance:Storage to Ceiling
A		Longitudinal	Transverse

G Horizontal Barriers Provided:

Water Supply Curve C

Ahern Fire Protection
46125904 Webster ISB - 4th Lvl - RA1

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City Water Supply:

C1 - Static Pressure : 90
C2 - Residual Pressure: 86
C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow

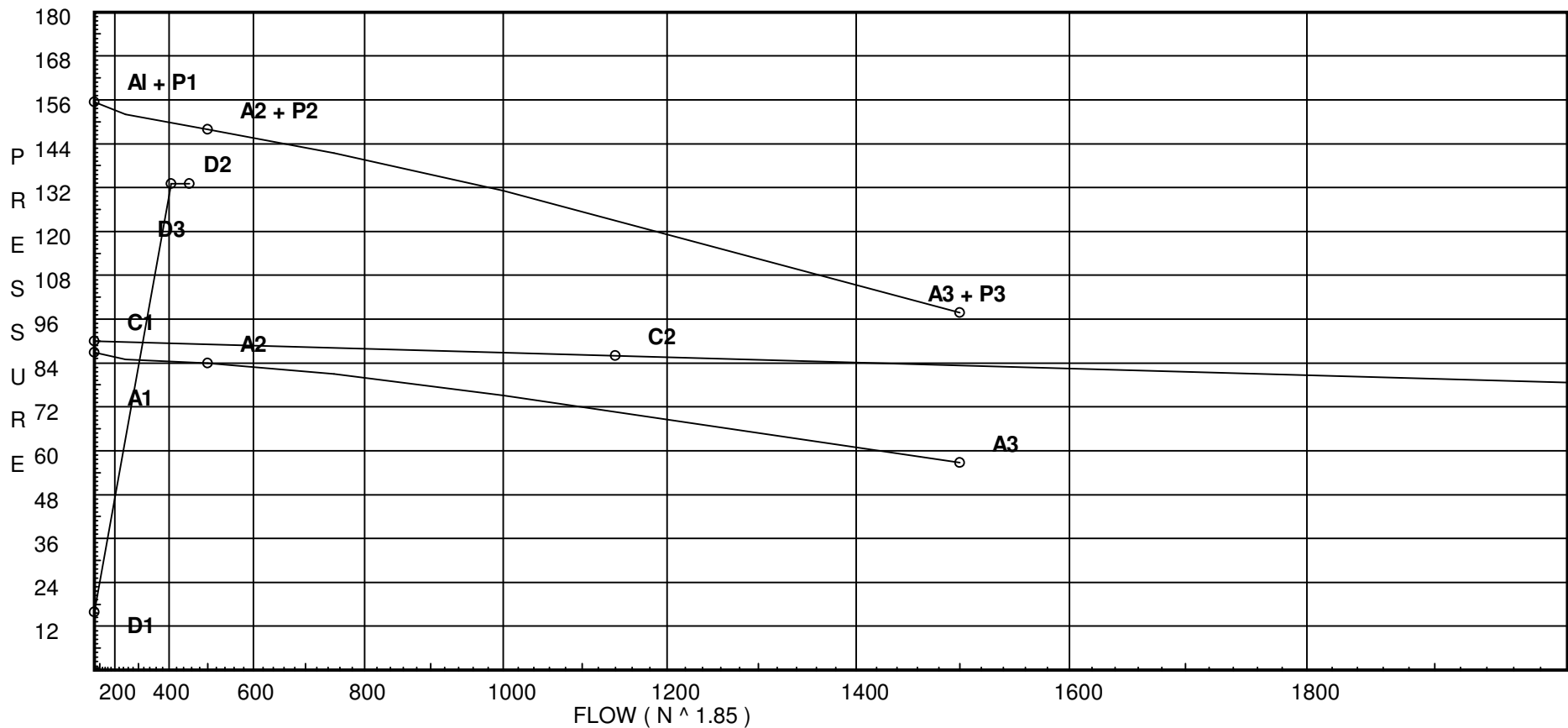
A1 - Adjusted Static: 86.869
A2 - Adj Resid : 83.909 @ 500
A3 - Adj Resid : 56.783 @ 1500

Pump Data:

P1 - Pump Churn Pressure : 68.5
P2 - Pump Rated Pressure : 64
P2 - Pump Rated Flow : 500
P3 - Pump Pressure @ Max Flow : 41
P3 - Pump Max Flow : 1500
City Residual Flow @ 0 = 6135.00
City Residual Flow @ 20 = 5355.71
City Water @ 150% of Pump = 83.35

Demand:

D1 - Elevation : 15.880
D2 - System Flow : 405.01
D2 - System Pressure : 133.014
Hose (Demand) : 50
D3 - System Demand : 455.01
Hose (Adj City) : 200
Safety Margin : 15.963



Fittings Used Summary

Ahern Fire Protection
46125904 Webster ISB - 4th Lvl - RA1

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Fitting Legend

Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
E	90' Standard Elbow Thrd	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
Jx	Standard Grooved Tee	0	0	4.5	4.8	5.8	8.0	9.8	12.2	17	16.3	20.5	24.8	32.8	41.3	49.7	65	78	88	98	120
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkins 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units Inches
Length Units Feet
Flow Units US Gallons per Minute
Pressure Units Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Ahern Fire Protection
46125904 Webster ISB - 4th Lvl - RA1

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S1	140.667	5.6	18.82	na	24.29	0.1	153	7.0
S2	140.667	5.6	19.16	na	24.51	0.1	138	7.0
S3	140.667	5.6	20.57	na	25.4	0.1	126	7.0
S4	140.667	5.6	23.39	na	27.08	0.1	134	7.0
S5	140.667	5.6	28.72	na	30.01	0.1	128	7.0
S6	140.667	8	25.0	na	40.0	0.1	400	25.0
S7	140.667	8	28.11	na	42.41	0.1	400	25.0
S8	140.667	8	31.19	na	44.68	0.1	400	25.0
S9	140.667	5.6	32.48	na	31.92	0.1	137	7.0
S10	140.667	5.6	33.13	na	32.23	0.1	124	7.0
S11	140.667	5.6	35.68	na	33.45	0.1	124	7.0
S12	140.667	8	37.55	na	49.02	0.1	400	25.0
X1	141.58		23.74	na				
X2	141.58		24.17	na				
X3	141.58		25.95	na				
X4	141.58		29.5	na				
X5	141.58		36.18	na				
X6	140.92		41.01	na				
X7	140.92		41.44	na				
X8	140.92		45.87	na				
X9	141.58		40.89	na				
X10	141.58		41.7	na				
X11	141.58		44.89	na				
A1	141.58		54.16	na				
A2	140.92		54.86	na				
A3	140.92		55.01	na				
A4	140.92		55.59	na				
A5	140.92		65.03	na				
A6	140.92		77.08	na				
A7	140.92		82.79	na				
A8	140.92		94.6	na				
SYS4	140.92		104.33	na				
HV14	133.667		107.74	na	50.0			
SYS3	125.583		112.54	na				
HV13	118.333		116.02	na				
SYS2	110.25		119.89	na				
HV12	103.0		123.36	na				
HV11	89.0		130.63	na				
SYS1	95.75		127.71	na				
BLK1	97.625		126.9	na				
BLK2	98.167		127.44	na				
TOR	96.167		128.61	na				
BOR	87.375		132.75	na				
PO	87.375		133.01	na				
PI	87.375		84.31	na				
BYPS	94.0		81.49	na				
BKFL	87.5		88.38	na				
SPIG	96.875		84.54	na				
UG1	96.875		90.11	na	200.0			
TEST	104.0		88.57	na				

The maximum velocity is 28.16 and it occurs in the pipe between nodes X5 and A1

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125904 Webster ISB - 4th Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
* 										
S1 to X1	24.29 24.29	1.049 120.0 0.1864	T EqL	5.0 23.5 0.0	0.001 28.500 28.501	18.818 -0.395 5.314			K Factor = 5.60 Vel = 9.02	
	0.0 24.29						23.737		K Factor = 4.99	
S2 to X2	24.51 24.51	1.049 120.0 0.1896	T EqL	5.0 23.5 0.0	0.001 28.500 28.501	19.160 -0.395 5.403			K Factor = 5.60 Vel = 9.10	
	0.0 24.51						24.168		K Factor = 4.99	
S3 to X3	25.40 25.4	1.049 120.0 0.2025	T EqL	5.0 23.5 0.0	0.001 28.500 28.501	20.571 -0.395 5.771			K Factor = 5.60 Vel = 9.43	
	0.0 25.40						25.947		K Factor = 4.99	
S4 to X4	27.08 27.08	1.049 120.0 0.2280	T EqL	5.0 23.5 0.0	0.001 28.500 28.501	23.392 -0.395 6.499			K Factor = 5.60 Vel = 10.05	
	0.0 27.08						29.496		K Factor = 4.99	
S5 to X5	30.01 30.01	1.049 120.0 0.2756	T EqL	5.0 23.5 0.0	0.001 28.500 28.501	28.717 -0.395 7.856			K Factor = 5.60 Vel = 11.14	
	0.0 30.01						36.178		K Factor = 4.99	
S6 to X6	40.00 40.0	1.049 120.0 0.4691	E T EqL	2.0 5.0 20.7	6.667 27.700 34.367	25.000 -0.110 16.123			K Factor = 8.00 Vel = 14.85	
	0.0 40.00						41.013		K Factor = 6.25	
S7 to X7	42.41 42.41	1.049 120.0 0.5228	T EqL	5.0 20.7 0.0	0.001 25.700 25.701	28.108 -0.110 13.437			K Factor = 8.00 Vel = 15.74	
	0.0 42.41						41.435		K Factor = 6.59	
S8 to X8	44.68 44.68	1.049 120.0 0.5756	T EqL	5.0 20.7 0.0	0.001 25.700 25.701	31.188 -0.110 14.794			K Factor = 8.00 Vel = 16.59	
	0.0 44.68						45.872		K Factor = 6.60	
S9 to X9	31.92 31.92	1.049 120.0 0.3089	T EqL	5.0 23.5 0.0	0.001 28.500 28.501	32.480 -0.395 8.805			K Factor = 5.60 Vel = 11.85	
	0.0 31.92						40.890		K Factor = 4.99	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125904 Webster ISB - 4th Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
S10 to X10	32.23 32.23	1.049 120.0 0.3146	T Eq	5.0 23.5 0.0	0.001 28.500 28.501	33.130 -0.395 8.967			K Factor = 5.60 Vel = 11.96	
	0.0 32.23					41.702			K Factor = 4.99	
S11 to X11	33.45 33.45	1.049 120.0 0.3370	T Eq	5.0 23.5 0.0	0.001 28.500 28.501	35.683 -0.395 9.604			K Factor = 5.60 Vel = 12.42	
	0.0 33.45					44.892			K Factor = 4.99	
S12 to A3	49.02 49.02	1.049 120.0 0.6835	T Eq	5.0 20.7 0.0	0.001 25.700 25.701	37.550 -0.110 17.566			K Factor = 8.00 Vel = 18.20	
	0.0 49.02					55.006			K Factor = 6.61	
*										
X1 to X2	24.29 24.29	1.38 120.0 0.0491		0.0 0.0 0.0	8.780 0.0 8.780	23.737 0.0 0.431			Vel = 5.21	
X2 to X3	24.51 48.8	1.38 120.0 0.1783		0.0 0.0 0.0	9.980 0.0 9.980	24.168 0.0 1.779			Vel = 10.47	
X3 to X4	25.40 74.2	1.38 120.0 0.3870		0.0 0.0 0.0	9.170 0.0 9.170	25.947 0.0 3.549			Vel = 15.92	
X4 to X5	27.09 101.29	1.38 120.0 0.6882		0.0 0.0 0.0	9.710 0.0 9.710	29.496 0.0 6.682			Vel = 21.73	
X5 to A1	30.01 131.3	1.38 120.0 1.1123	T	6.0 0.0 0.0	10.170 6.000 16.170	36.178 0.0 17.986			Vel = 28.16	
	0.0 131.30					54.164			K Factor = 17.84	
*										
X6 to X7	40.00 40.0	1.61 120.0 0.0582		0.0 0.0 0.0	7.250 0.0 7.250	41.013 0.0 0.422			Vel = 6.30	
X7 to X8	42.41 82.41	1.61 120.0 0.2218		0.0 0.0 0.0	20.000 0.0 20.000	41.435 0.0 4.437			Vel = 12.99	
X8 to A2	44.68 127.09	1.61 120.0 0.4943	T	8.0 0.0 0.0	10.180 8.000 18.180	45.872 0.0 8.986			Vel = 20.03	
	0.0 127.09					54.858			K Factor = 17.16	
*										

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
X9 to X10	31.92	1.38 120.0		0.0	10.000	40.890				
X10 to X11	31.92	0.0812		0.0	10.000	0.812		Vel =	6.85	
X10 to X11	32.23	1.38 120.0		0.0	10.792	41.702				
X11 to A4	64.15	0.2956		0.0	10.792	3.190		Vel =	13.76	
X11 to A4	33.45	1.38 120.0	lx Jx	1.9 4.8	9.500 6.700	44.892 0.286				
	97.6	0.6426		0.0	16.200	10.410		Vel =	20.94	
	0.0 97.60					55.588		K Factor =	13.09	
*										
A1 to A2	131.30	3.26 120.0	2l	13.44	10.708	54.164				
A2 to A3	131.3	0.0169		0.0	24.148	0.408		Vel =	5.05	
A2 to A3	127.09	3.26 120.0		0.0	2.500	54.858				
A3 to A4	258.39	0.0592		0.0	2.500	0.148		Vel =	9.93	
A3 to A4	49.02	3.26 120.0		0.0	7.130	55.006				
A4 to A5	307.41	0.0816		0.0	7.130	0.582		Vel =	11.82	
A4 to A5	97.60	3.26 120.0	2l	13.44	56.042	55.588				
A5 to A6	405.01	0.1359		0.0	69.482	9.440		Vel =	15.57	
A5 to A6	0.0	3.26 120.0	l	6.72	81.958	65.028				
A6 to A7	405.01	0.1359		0.0	88.678	12.048		Vel =	15.57	
A6 to A7	0.0	3.26 120.0		0.0	42.035	77.076				
A7 to A8	405.01	0.1359		0.0	42.035	5.711		Vel =	15.57	
A7 to A8	0.0	3.26 120.0	l	6.72	80.245	82.787				
A8 to SYS4	405.01	0.1359		0.0	86.965	11.815		Vel =	15.57	
A8 to SYS4	0.0	3.26 120.0	2l T	13.44 20.159	17.840 53.759	94.602 0.0				
	405.01	0.1359	B C	6.72 13.44	71.599	9.727		Vel =	15.57	
	0.0 405.01					104.329		K Factor =	39.65	
*										
SYS4 to HV14	405.01	4.26 120.0		0.0	7.250	104.329				
HV14 to SYS3	405.01	0.0370		0.0	7.250	0.268		Vel =	9.12	
HV14 to SYS3	50.00	4.26 120.0	2l	17.907	10.580	107.738		Qa =	50	
	455.01	0.0458		0.0	17.907	3.501		Vel =	10.24	

Final Calculations - Hazen-Williams

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46125904 Webster ISB - 4th Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
SYS3 to HV13	0.0 455.01	4.26 120.0 0.0458		0.0	7.250	112.544 3.140				
				0.0	0.0	0.332		Vel = 10.24		
HV13 to SYS2	0.0 455.01	4.26 120.0 0.0458		0.0	8.083	116.016 3.501				
				0.0	0.0	0.370		Vel = 10.24		
SYS2 to HV12	0.0 455.01	4.26 120.0 0.0458		0.0	7.250	119.887 3.140				
				0.0	0.0	0.332		Vel = 10.24		
HV12 to BLK1	0.0 455.01	4.26 120.0 0.0458	J	21.067	5.375	123.359 2.328				
				0.0	21.067	1.210		Vel = 10.24		
	0.0 455.01					126.897		K Factor = 40.39		
HV11 to SYS1	0.0 455.01	4.26 120.0 0.0		0.0	6.750	130.633 -2.923	0.0 0.0			
				0.0	0.0	0.0	0.0	Vel = 0		
SYS1 to BLK1	0.0 455.01	4.26 120.0 0.0	J	21.067	1.875	127.709 -0.812	0.0 0.0			
				0.0	21.067	0.0	0.0	Vel = 0		
BLK1 to BLK2	455.01	6.357 120.0 0.0065	2I H B J	25.147 6.287 10.059 31.433	46.209 72.926 119.135	126.897 -0.235 0.777			Vel = 4.60	
BLK2 to TOR	0.0 455.01	6.357 120.0 0.0065	2I	25.147	22.083	127.439 0.866				
				0.0	25.147	0.308		Vel = 4.60		
TOR to BOR	0.0 455.01	6.357 120.0 0.0065	B J	10.059 31.433	8.792 41.492	128.613 3.808				
				0.0	50.284	0.328		Vel = 4.60		
BOR to PO	0.0 455.01	6.357 120.0 0.0065	B C	10.059 25.147	5.417 35.206	132.749 0.0				
				0.0	40.623	0.265		Vel = 4.60		
	0.0 455.01					133.014		K Factor = 39.45		
System Demand Pressure						133.014				
Safety Margin						15.963				
Continuation Pressure						148.977				
Pressure @ Pump Outlet						148.977				
Pressure From Pump Curve						-64.665				
Pressure @ Pump Inlet						84.312				
*										
PI to BYP	0.0 455.01	8.249 120.0 0.0018	Ix	15.386	8.292	84.312 -2.869				
				0.0	15.386	0.043		Vel = 2.73		
BYP to BKFL	0.0 455.01	6.357 120.0 0.0065	2J I Zib	62.867 12.573 0.0	13.417 75.440 88.857	81.486 6.315 0.580			** Fixed Loss = 3.5 Vel = 4.60	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125904 Webster ISB - 4th Lvl - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
BKFL to SPIG	0.0 455.01	7.981 120.0 0.0021	G lx	4.0 13.1 0.0	85.291 17.100 102.391	88.381 -4.060 0.220			Vel = 2.92	
SPIG to UG1	0.0 455.01	8.39 140.0 0.0013	2G Zac 2V X	13.572 0.0 61.074 59.377	80.000 134.023 214.023	84.541 5.298 0.271			* * Fixed Loss = 5.298 Vel = 2.64	
UG1 to TEST	200.00 655.01	8.39 140.0 0.0025	2G 3U X	13.572 45.805 59.377	500.000 118.754 618.754	90.110 -3.086 1.541			Qa = 200 Vel = 3.80	
	0.0 655.01					88.565			K Factor = 69.60	



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name : 46125904 Webster ISB - 4th Lvl - RA2
Building : Webster ISB
Location : 8274 Big Bend Blvd
System : SYS4
Contract : 461259
Data File : 46125904 Webster ISB - 4th Lvl - RA2.WXF

Hydraulic Design Information Sheet

Name - 46125904 Webster ISB - 4th Lvl - RA2 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - SYS4
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-104.A
Construction: () Combustible (X) Non-Combustible Ceiling Height - 9-6
Occupancy - HC-1

S () NFPA 13 () Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
Y () NFPA 231 () NFPA 231C () Figure Curve
S Other Factory Mutual - HC1
T Specific Ruling Made By Date
E

M Area of Sprinkler Operation - 1629 System Type Sprinkler/Nozzle
Density - .10 (X) Wet Make Viking
D Area Per Sprinkler - 324 () Dry Model VK634
E Elevation at Highest Outlet - 140.17 () Deluge Size 3/4"
S Hose Allowance - Inside - 50 () Preaction K-Factor 8.0
I Rack Sprinkler Allowance - n/a () Other Temp.Rat.155
G Hose Allowance - Outside - 200
N Note

Calculation Flow Required - 285.49 Press Required - 111.043 SYS4
Summary C-Factor Used: 120 Overhead 140 Underground

W Water Flow Test: Pump Data: Tank or Reservoir:
A Date of Test - 05/23/16 Cap. -
T Time of Test - 2:30 PM Rated Cap.- 1000 Elev.-
E Static Press - 90 @ Press - 55
R Residual Press - 86 Elev. - 87.375 Well
S Flow - 1140 Proof Flow
U Elevation - 104
P Location - 8274 Big Bend Blvd
P
L Source of Information - Ahern Fire Protection
Y

C Commodity Class Location
O Storage Ht. Area Aisle W.
M Storage Method: Solid Piled % Palletized % Rack
M
S R () Single Row () Conven. Pallet () Auto. Storage () Encap.
T A () Double Row () Slave Pallet () Solid Shelf () Non
O C () Mult. Row () Open Shelf
R K Flue Spacing Clearance:Storage to Ceiling
A Longitudinal Transverse
G
E Horizontal Barriers Provided:

Water Supply Curve C

Ahern Fire Protection
46125904 Webster ISB - 4th Lvl - RA2

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Date 09/22/16

City Water Supply:

C1 - Static Pressure : 90
C2 - Residual Pressure: 86
C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow

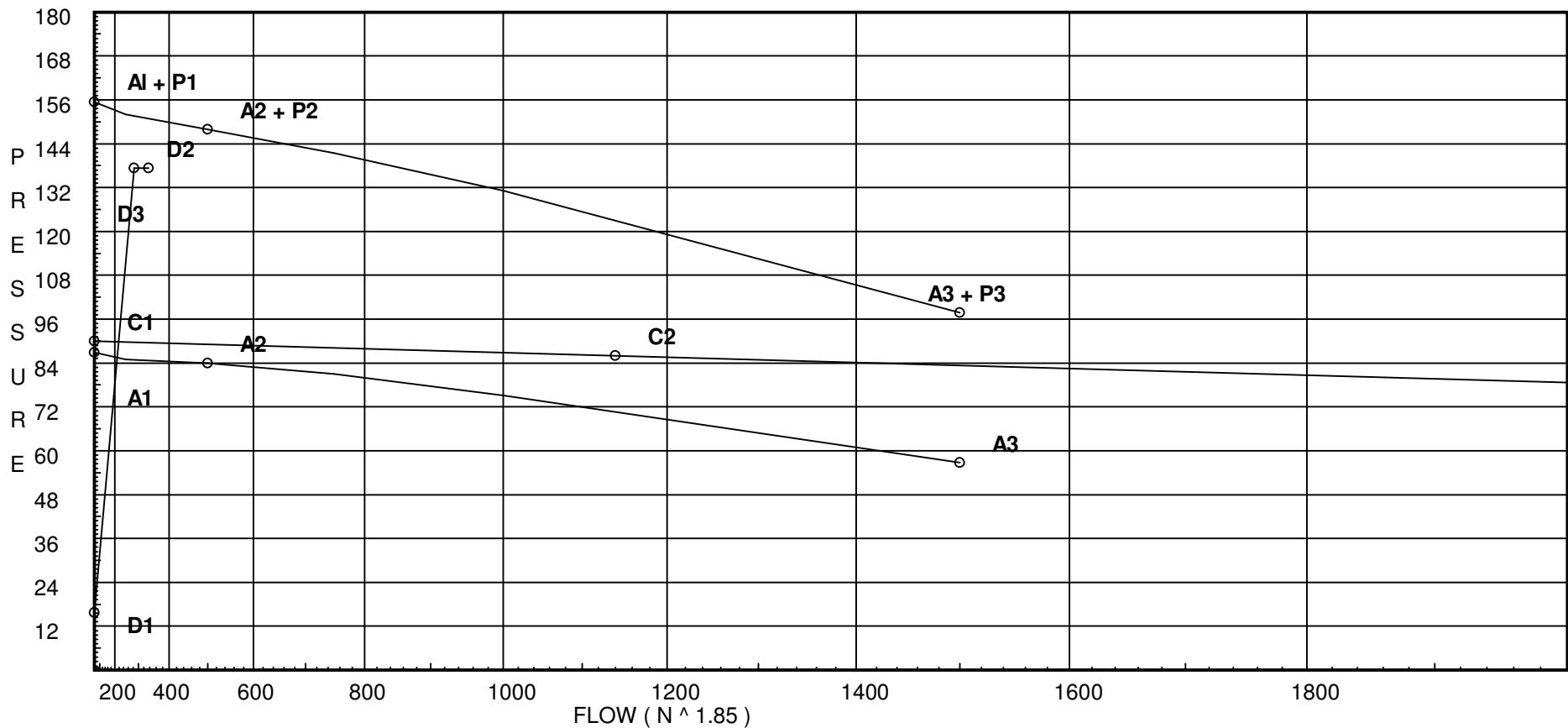
A1 - Adjusted Static: 86.869
A2 - Adj Resid : 83.909 @ 500
A3 - Adj Resid : 56.783 @ 1500

Pump Data:

P1 - Pump Churn Pressure : 68.5
P2 - Pump Rated Pressure : 64
P2 - Pump Rated Flow : 500
P3 - Pump Pressure @ Max Flow : 41
P3 - Pump Max Flow : 1500
City Residual Flow @ 0 = 6135.00
City Residual Flow @ 20 = 5355.71
City Water @ 150% of Pump = 83.35

Demand:

D1 - Elevation : 15.665
D2 - System Flow : 285.489
D2 - System Pressure : 137.348
Hose (Demand) : 50
D3 - System Demand : 335.489
Hose (Adj City) : 200
Safety Margin : 14.030



Fittings Used Summary

Ahern Fire Protection
46125904 Webster ISB - 4th Lvl - RA2

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Fitting Legend

Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkins 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units Inches
Length Units Feet
Flow Units US Gallons per Minute
Pressure Units Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Ahern Fire Protection
46125904 Webster ISB - 4th Lvl - RA2

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Date 09/22/16

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S21	140.17	8	17.0	na	32.98	0.1	324	17.0
S22	140.17	8	18.01	na	33.95	0.1	324	17.0
S23	140.17	8	23.07	na	38.43	0.1	324	17.0
S24	140.17	8	30.77	na	44.38	0.1	324	17.0
S25	140.17	8	29.27	na	43.28	0.1	324	17.0
S26	140.17	8	30.71	na	44.33	0.1	324	17.0
S27	140.17	8	36.21	na	48.14	0.1	324	17.0
X21	140.92		25.12	na				
X22	140.92		26.59	na				
X23	140.92		33.95	na				
X24	140.92		45.06	na				
X25	140.92		42.9	na				
X26	140.92		44.97	na				
X27	140.92		52.87	na				
B1	140.92		73.65	na				
B2	140.92		76.72	na				
A7	140.92		99.76	na				
A8	140.92		105.95	na				
SYS4	140.92		111.04	na				
HV14	133.667		114.32	na	50.0			
SYS3	125.583		118.57	na				
HV13	118.333		121.9	na				
SYS2	110.25		125.61	na				
HV12	103.0		128.94	na				
HV11	89.0		135.69	na				
SYS1	95.75		132.77	na				
BLK1	97.625		131.95	na				
BLK2	98.167		132.16	na				
TOR	96.167		133.2	na				
BOR	87.375		137.2	na				
PO	87.375		137.35	na				
PI	87.375		85.21	na				
BYPS	94.0		82.37	na				
BKFL	87.5		88.99	na				
SPIG	96.875		85.06	na				
UG1	96.875		91.04	na	200.0			
TEST	104.0		89.01	na				

The maximum velocity is 32.12 and it occurs in the pipe between nodes X24 and B1

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125904 Webster ISB - 4th Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
* S21 to X21										
	32.98	1.049	T	5.0	0.010	17.000			K Factor = 8.00	
		120.0	Eq	20.7	25.700	-0.325				
	32.98	0.3284		0.0	25.710	8.443			Vel = 12.24	
	0.0									
	32.98					25.118			K Factor = 6.58	
S22 to X22										
	33.95	1.049	T	5.0	0.010	18.007			K Factor = 8.00	
		120.0	Eq	20.7	25.700	-0.325				
	33.95	0.3463		0.0	25.710	8.904			Vel = 12.60	
	0.0									
	33.95					26.586			K Factor = 6.58	
S23 to X23										
	38.43	1.049	T	5.0	0.010	23.073			K Factor = 8.00	
		120.0	Eq	20.7	25.700	-0.325				
	38.43	0.4356		0.0	25.710	11.198			Vel = 14.27	
	0.0									
	38.43					33.946			K Factor = 6.60	
S24 to X24										
	44.38	1.049	T	5.0	0.010	30.768			K Factor = 8.00	
		120.0	Eq	20.7	25.700	-0.325				
	44.38	0.5685		0.0	25.710	14.615			Vel = 16.48	
	0.0									
	44.38					45.058			K Factor = 6.61	
S25 to X25										
	43.28	1.049	T	5.0	0.010	29.272			K Factor = 8.00	
		120.0	Eq	20.7	25.700	-0.325				
	43.28	0.5429		0.0	25.710	13.957			Vel = 16.07	
	0.0									
	43.28					42.904			K Factor = 6.61	
S26 to X26										
	44.33	1.049	T	5.0	0.010	30.710			K Factor = 8.00	
		120.0	Eq	20.7	25.700	-0.325				
	44.33	0.5674		0.0	25.710	14.589			Vel = 16.46	
	0.0									
	44.33					44.974			K Factor = 6.61	
S27 to X27										
	48.14	1.049	T	5.0	0.010	36.208			K Factor = 8.00	
		120.0	Eq	20.7	25.700	-0.325				
	48.14	0.6608		0.0	25.710	16.990			Vel = 17.87	
	0.0									
	48.14					52.873			K Factor = 6.62	
* X21 to X22										
	32.98	1.38		0.0	17.000	25.118				
		120.0		0.0	0.0	0.0				
	32.98	0.0864		0.0	17.000	1.468			Vel = 7.07	
X22 to X23										
	33.95	1.38	4lx	7.6	15.417	26.586				
		120.0		0.0	7.600	0.0				
	66.93	0.3198		0.0	23.017	7.360			Vel = 14.36	
X23 to X24										
	38.43	1.38		0.0	15.010	33.946				
		120.0		0.0	0.0	0.0				
	105.36	0.7403		0.0	15.010	11.112			Vel = 22.60	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125904 Webster ISB - 4th Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
X24 to B1	44.38 149.74	1.38 120.0 1.4184	T	6.0 0.0 0.0	14.160 6.000 20.160	45.058 0.0 28.594			Vel = 32.12	
	0.0 149.74					73.652			K Factor = 17.45	
*										
X25 to X26	43.28	1.38 120.0		0.0 0.0	14.500 0.0	42.904 0.0			Vel = 9.28	
X26 to X27	44.34 87.62	1.38 120.0 0.5262		0.0 0.0 0.0	15.010 0.0 15.010	44.974 0.0 7.899			Vel = 18.79	
X27 to B2	48.13 135.75	1.38 120.0 1.1831	T	6.0 0.0 0.0	14.160 6.000 20.160	52.873 0.0 23.852			Vel = 29.12	
	0.0 135.75					76.725			K Factor = 15.50	
*										
B1 to B2	149.74 149.74	2.067 120.0 0.1983		0.0 0.0 0.0	15.500 0.0 15.500	73.652 0.0 3.073			Vel = 14.32	
B2 to A7	135.75 285.49	2.067 120.0 0.6543	T 4l	10.0 14.0 0.0	11.208 24.000 35.208	76.725 0.0 23.037			Vel = 27.30	
	0.0 285.49					99.762			K Factor = 28.58	
*										
A7 to A8	285.49	3.26 120.0	I	6.72 0.0	80.245 6.720	99.762 0.0			Vel = 10.97	
A8 to SYS4	0.0 285.49	3.26 120.0 0.0711	2l T B C	13.44 20.159 6.72 13.44	17.840 53.759 71.599	105.949 0.0 5.094			Vel = 10.97	
	0.0 285.49					111.043			K Factor = 27.09	
*										
SYS4 to HV14	285.49	4.26 120.0		0.0 0.0	7.250 0.0	111.043 3.141			Vel = 6.43	
HV14 to SYS3	285.49 50.00	0.0193 4.26 120.0		0.0 0.0	7.250 17.907	0.140 114.324 3.501			Qa = 50 Vel = 7.55	
SYS3 to HV13	335.49 0.0	0.0261 4.26 120.0		0.0 0.0	28.487 7.250	0.743 118.568 3.140			Vel = 7.55	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125904 Webster ISB - 4th Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
HV13 to SYS2	0.0 335.49	4.26 120.0 0.0260		0.0 0.0 0.0	8.083 0.0 8.083	121.897 3.501 0.210			Vel = 7.55	
SYS2 to HV12	0.0 335.49	4.26 120.0 0.0261		0.0 0.0 0.0	7.250 0.0 7.250	125.608 3.140 0.189			Vel = 7.55	
HV12 to BLK1	0.0 335.49	4.26 120.0 0.0261	J	21.067 0.0 0.0	5.375 21.067 26.442	128.937 2.328 0.689			Vel = 7.55	
	0.0 335.49					131.954			K Factor = 29.21	
HV11 to SYS1	0.0 0.0	4.26 120.0 0.0		0.0 0.0 0.0	6.750 0.0 6.750	135.689 -2.923 0.0	0.0 0.0 0.0		Vel = 0	
SYS1 to BLK1	0.0 0.0	4.26 120.0 0.0	J	21.067 0.0 0.0	1.875 21.067 22.942	132.766 -0.812 0.0	0.0 0.0 0.0		Vel = 0	
BLK1 to BLK2	335.49 335.49	6.357 120.0 0.0037	2I H B J	25.147 6.287 10.059 31.433	46.209 72.926 119.135	131.954 -0.235 0.442			Vel = 3.39	
BLK2 to TOR	0.0 335.49	6.357 120.0 0.0037	2I	25.147 0.0 0.0	22.083 25.147 47.230	132.161 0.866 0.175			Vel = 3.39	
TOR to BOR	0.0 335.49	6.357 120.0 0.0037	B J	10.059 31.433 0.0	8.792 41.492 50.284	133.202 3.808 0.187			Vel = 3.39	
BOR to PO	0.0 335.49	6.357 120.0 0.0037	B C	10.059 25.147 0.0	5.417 35.206 40.623	137.197 0.0 0.151			Vel = 3.39	
	0.0 335.49					137.348			K Factor = 28.63	
System Demand Pressure						137.348				
Safety Margin						14.030				
Continuation Pressure						151.378				
Pressure @ Pump Outlet						151.378				
Pressure From Pump Curve						-66.168				
Pressure @ Pump Inlet						85.210				
*										
PI to BYP	0.0 335.49	8.249 120.0 0.0011	lx	15.386 0.0 0.0	8.292 15.386 23.678	85.210 -2.869 0.025			Vel = 2.01	
BYP to BKFL	0.0 335.49	6.357 120.0 0.0037	2J I Zib	62.867 12.573 0.0	13.417 75.440 88.857	82.366 6.295 0.329			** Fixed Loss = 3.48 Vel = 3.39	
BKFL to SPIG	0.0 335.49	7.981 120.0 0.0012	G lx	4.0 13.1 0.0	85.291 17.100 102.391	88.990 -4.060 0.126			Vel = 2.15	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125904 Webster ISB - 4th Lvl - RA2

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
SPIG to UG1	0.0 335.49	8.39 140.0 0.0007	2G Zac 2V X	13.572 0.0 61.074 59.377	80.000 134.023 214.023	85.056 5.826 0.154			* * Fixed Loss = 5.826 Vel = 1.95	
UG1 to TEST	200.00 535.49	8.39 140.0 0.0017	2G 3U X	13.572 45.805 59.377	500.000 118.754 618.754	91.036 -3.086 1.062			Qa = 200 Vel = 3.11	
	0.0 535.49					89.012			K Factor = 56.76	



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name : 46125901 Webster ISB - Preaction - RA1
Building : Webster ISB
Location : 8274 Big Bend Blvd
System : Preaction
Contract : 461259
Data File : 46125901 Webster ISB - Preaction - RA1.WXF

Hydraulic Design Information Sheet

Name - 46125901 Webster ISB - Preaction - RA1 Date - 10/17/16
Location - 8274 Big Bend Blvd
Building - Webster ISB System No. - Preaction
Contractor - Ahern Fire Protection Contract No. - 461259
Calculated By - Dana Mitchell Drawing No. - FP-101.B
Construction: () Combustible (X) Non-Combustible Ceiling Height - 9-6
Occupancy - HC-1

S () NFPA 13 () Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
Y () NFPA 231 () NFPA 231C () Figure Curve

S Other Factory Mutual - HC-1
T Specific Ruling

Made By

Date

M Area of Sprinkler Operation - 583 System Type Sprinkler/Nozzle
Density - .10 (X) Wet Make Viking
D Area Per Sprinkler - 225 () Dry Model VK302
E Elevation at Highest Outlet - 95 () Deluge Size 1/2"
S Hose Allowance - Inside - 50 () Preaction K-Factor 5.6
I Rack Sprinkler Allowance - n/a () Other Temp.Rat.155
G Hose Allowance - Outside - 200

N Note

Calculation Flow Required - 109.80 Press Required - 57.927 PA
Summary C-Factor Used: 120 Overhead 140 Underground

W Water Flow Test: Pump Data: Tank or Reservoir:
A Date of Test - 05/23/16 Cap. -
T Time of Test - 2:30 PM Rated Cap.- 1000 Elev.-
E Static Press - 90 @ Press - 55
R Residual Press - 86 Elev. - 87.375 Well
Flow - 1140 Proof Flow
S Elevation - 104

U Location - 8274 Big Bend Blvd

P Source of Information - Ahern Fire Protection
L
Y

C Commodity Class Location
O Storage Ht. Area Aisle W.
M Storage Method: Solid Piled % Palletized % Rack
M () Single Row () Conven. Pallet () Auto. Storage () Encap.
S R () Double Row () Slave Pallet () Solid Shelf () Non
T A () Mult. Row () Open Shelf
O C

R K Flue Spacing Clearance:Storage to Ceiling
A Longitudinal Transverse

G Horizontal Barriers Provided:
E

Water Supply Curve C

Ahern Fire Protection
46125901 Webster ISB - Preaction - RA1

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City Water Supply:

C1 - Static Pressure : 90
C2 - Residual Pressure: 86
C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow

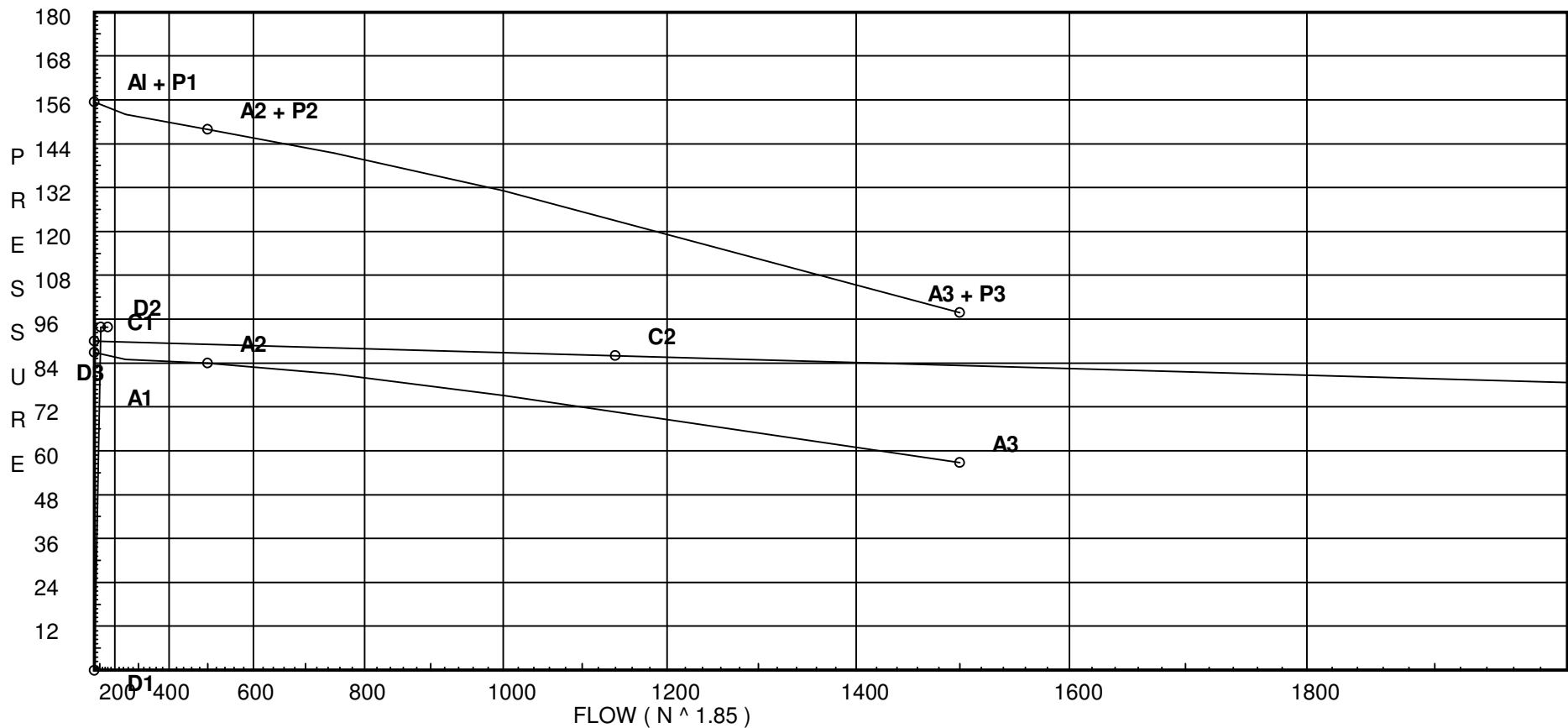
A1 - Adjusted Static: 86.869
A2 - Adj Resid : 83.909 @ 500
A3 - Adj Resid : 56.783 @ 1500

Pump Data:

P1 - Pump Churn Pressure : 68.5
P2 - Pump Rated Pressure : 64
P2 - Pump Rated Flow : 500
P3 - Pump Pressure @ Max Flow : 41
P3 - Pump Max Flow : 1500
City Residual Flow @ 0 = 6135.00
City Residual Flow @ 20 = 5355.71
City Water @ 150% of Pump = 83.35

Demand:

D1 - Elevation : -3.898
D2 - System Flow : 109.802
D2 - System Pressure : 93.823
Hose (Demand) : 50
D3 - System Demand : 159.802
Hose (Adj City) : 200
Safety Margin : 58.540



Fittings Used Summary

Ahern Fire Protection
46125901 Webster ISB - Preaction - RA1

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Fitting Legend

Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
E	90' Standard Elbow Thrd	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkins 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units Inches
Length Units Feet
Flow Units US Gallons per Minute
Pressure Units Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Ahern Fire Protection
46125901 Webster ISB - Preaction - RA1

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
S61	95.0	5.6	7.23	na	15.06	0.1	99	7.0
S62	95.0	5.6	7.78	na	15.62	0.1	100	7.0
S63	95.0	5.6	8.14	na	15.97	0.1	120	7.0
S64	95.0	5.6	8.91	na	16.71	0.1	144	7.0
S65	95.0	5.6	7.13	na	14.95	0.1	120	7.0
S66	95.0	5.6	7.0	na	14.82	0.1	31	7.0
S67	95.0	5.6	8.86	na	16.67	0.1	145	7.0
X61	97.583		7.09	na				
X62	97.583		7.7	na				
X63	97.583		8.09	na				
X64	97.583		8.95	na				
X65	97.583		6.96	na				
X66	97.583		7.26	na				
X67	97.583		8.89	na				
D1	97.583		10.5	na				
D2	97.583		10.81	na				
D3	97.583		12.44	na				
PA	86.75		57.93	na				
BLK4	95.75		81.69	na				
A1	95.75		84.33	na				
A2	95.75		84.34	na				
A3	95.75		84.44	na				
A4	95.75		84.58	na				
A5	95.75		85.1	na				
A6	95.4		86.82	na				
A7	95.4		87.3	na				
C1	95.29		86.87	na				
C2	95.29		86.87	na				
C3	95.29		86.87	na				
C4	95.29		86.87	na				
C5	95.29		86.87	na				
C6	95.29		86.87	na				
C7	95.29		86.87	na				
C8	95.29		86.87	na				
C9	98.0		85.7	na				
C10	95.75		86.67	na				
B1	95.75		87.65	na				
B2	95.75		87.65	na				
B3	95.75		87.65	na				
B4	95.75		87.65	na				
B5	95.75		87.65	na				
B6	95.75		87.65	na				
B7	95.75		87.66	na				
B8	95.75		87.76	na				
B9	95.75		87.79	na				
B10	95.75		88.5	na				
B11	95.75		89.12	na				
SYS2	110.25		83.67	na				
HV12	103.0		86.81	na				
HV11	89.0		92.72	na	50.0			
SYS1	95.75		89.8	na				
BLK1	97.625		89.14	na				
BLK2	98.167		89.02	na				
TOR	96.167		89.93	na				
BOR	87.375		93.78	na				
PO	87.375		93.82	na				
PI	87.375		84.52	na				
BYPS	94.0		81.65	na				
BKFL	87.5		91.22	na				
SPIG	96.875		87.2	na				
UG1	96.875		92.1	na	200.0			

Flow Summary - Standard

Ahern Fire Protection
46125901 Webster ISB - Preaction - RA1

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
TEST	104.0		89.53	na				

The maximum velocity is 17.3 and it occurs in the pipe between nodes D3 and PA

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - Preaction - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
*DROPS										
S61	15.06	1.049	2E	4.0	3.624	7.234			K Factor = 5.60	
to		120.0	T	5.0	9.000	-1.119				
X61	15.06	0.0770		0.0	12.624	0.972			Vel = 5.59	
	0.0									
	15.06					7.087			K Factor = 5.66	
S62	15.62	1.049	2E	4.0	3.624	7.782			K Factor = 5.60	
to		120.0	T	5.0	9.000	-1.119				
X62	15.62	0.0824		0.0	12.624	1.040			Vel = 5.80	
	0.0									
	15.62					7.703			K Factor = 5.63	
S63	15.97	1.049	2E	4.0	3.500	8.137			K Factor = 5.60	
to		120.0	T	5.0	9.000	-1.119				
X63	15.97	0.0859		0.0	12.500	1.074			Vel = 5.93	
	0.0									
	15.97					8.092			K Factor = 5.61	
S64	16.71	1.049	2E	4.0	3.458	8.906			K Factor = 5.60	
to		120.0	T	5.0	9.000	-1.119				
X64	16.71	0.0934		0.0	12.458	1.163			Vel = 6.20	
	0.0									
	16.71					8.950			K Factor = 5.59	
S65	14.95	1.049	2E	4.0	3.458	7.129			K Factor = 5.60	
to		120.0	T	5.0	9.000	-1.119				
X65	14.95	0.0759		0.0	12.458	0.946			Vel = 5.55	
	0.0									
	14.95					6.956			K Factor = 5.67	
S66	14.82	1.049	3E	6.0	7.458	7.000			K Factor = 5.60	
to		120.0	T	5.0	11.000	-1.119				
X66	14.82	0.0747		0.0	18.458	1.379			Vel = 5.50	
	0.0									
	14.82					7.260			K Factor = 5.50	
S67	16.66	1.049	2E	4.0	3.416	8.856			K Factor = 5.60	
to		120.0	T	5.0	9.000	-1.119				
X67	16.66	0.0929		0.0	12.416	1.153			Vel = 6.18	
	0.0									
	16.66					8.890			K Factor = 5.59	
*BRANCHLINES										
*										
X61	15.06	1.049		0.0	8.000	7.087				
to		120.0		0.0	0.0	0.0				
X62	15.06	0.0770		0.0	8.000	0.616			Vel = 5.59	
X62	15.62	1.049	T	5.0	4.750	7.703				
to		120.0		0.0	5.000	0.0				
D1	30.68	0.2873		0.0	9.750	2.801			Vel = 11.39	
	0.0									
	30.68					10.504			K Factor = 9.47	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - Preaction - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
* X63 to X64										
	15.97	1.049		0.0	10.000	8.092				
		120.0		0.0	0.0	0.0				
X64	15.97	0.0858		0.0	10.000	0.858		Vel =	5.93	
X64 to D2										
	16.72	1.049	T	5.0	0.750	8.950				
		120.0		0.0	5.000	0.0				
D2	32.69	0.3230		0.0	5.750	1.857		Vel =	12.14	
	0.0									
	32.69					10.807		K Factor =	9.94	
* X65 to X66										
	14.95	1.049		0.0	4.000	6.956				
		120.0		0.0	0.0	0.0				
X66	14.95	0.0760		0.0	4.000	0.304		Vel =	5.55	
X66 to X67										
	14.82	1.049		0.0	6.000	7.260				
		120.0		0.0	0.0	0.0				
X67	29.77	0.2717		0.0	6.000	1.630		Vel =	11.05	
X67 to D3										
	16.66	1.049	T	5.0	0.750	8.890				
		120.0		0.0	5.000	0.0				
D3	46.43	0.6181		0.0	5.750	3.554		Vel =	17.24	
	0.0									
	46.43					12.444		K Factor =	13.16	
*MAINS										
D1 to D2										
	30.68	1.61		0.0	8.500	10.504				
		120.0		0.0	0.0	0.0				
D2	30.68	0.0356		0.0	8.500	0.303		Vel =	4.83	
D2 to D3										
	32.69	1.61		0.0	12.000	10.807				
		120.0		0.0	0.0	0.0				
D3	63.37	0.1364		0.0	12.000	1.637		Vel =	9.99	
D3 to PA										
	46.43	1.61	5lx	11.5	68.750	12.444				
		120.0	Eq	27.9	39.400	4.692				
PA	109.8	0.3772		0.0	108.150	40.791		Vel =	17.30	
PA to BLK4										
	0.0	1.61	4lx	9.2	56.125	57.927				
		120.0	T	8.0	17.200	-3.898				
BLK4	109.8	0.3772		0.0	73.325	27.657		Vel =	17.30	
BLK4 to A1										
	0.0	1.682		0.0	8.667	81.686				
		120.0		0.0	0.0	0.0				
A1	109.8	0.3047		0.0	8.667	2.641		Vel =	15.85	
	0.0									
	109.80					84.327		K Factor =	11.96	
* A1 to A2										
	109.80	3.26		0.0	0.790	84.327				
		120.0		0.0	0.0	0.0				
A2	109.8	0.0127		0.0	0.790	0.010		Vel =	4.22	
A2 to A3										
	0.0	3.26		0.0	8.900	84.337				
		120.0		0.0	0.0	0.0				
A3	109.8	0.0121		0.0	8.900	0.108		Vel =	4.22	

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
A3 to A4	0.0 109.8	3.26 120.0 0.0122		0.0 0.0 0.0	11.400 0.0 11.400	84.445 0.0 0.139			Vel = 4.22	
A4 to A5	0.0 109.8	3.26 120.0 0.0121		0.0 0.0 0.0	42.330 0.0 42.330	84.584 0.0 0.514			Vel = 4.22	
A5 to A6	0.0 109.8	3.26 120.0 0.0121	J 3l	17.471 20.159 0.0	92.110 37.630 129.740	85.098 0.152 1.575			Vel = 4.22	
A6 to A7	0.0 109.8	3.26 120.0 0.0122	J	17.471 0.0 0.0	21.370 17.471 38.841	86.825 0.0 0.472			Vel = 4.22	
A7 to B6	0.0 109.8	3.26 120.0 0.0121	2H J	6.989 17.471 0.0	16.860 24.460 41.320	87.297 -0.152 0.502			Vel = 4.22	
	0.0 109.80					87.647			K Factor = 11.73	
*										
C1 to C2	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	4.740 0.0 4.740	86.873 0.0 0.0	0.0 0.0 0.0		Vel = 0	
C2 to C3	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	0.810 0.0 0.810	86.873 0.0 0.0	0.0 0.0 0.0		Vel = 0	
C3 to C4	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	11.690 0.0 11.690	86.873 0.0 0.0	0.0 0.0 0.0		Vel = 0	
C4 to C5	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	2.910 0.0 2.910	86.873 0.0 0.0	0.0 0.0 0.0		Vel = 0	
C5 to C6	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	12.090 0.0 12.090	86.873 0.0 0.0	0.0 0.0 0.0		Vel = 0	
C6 to C7	0.0 0.0	3.26 120.0 0.0		0.0 0.0 0.0	3.240 0.0 3.240	86.873 0.0 0.0	0.0 0.0 0.0		Vel = 0	
C7 to C8	0.0 0.0	3.26 120.0 0.0	I	6.72 0.0 0.0	28.260 6.720 34.980	86.873 0.0 0.0	0.0 0.0 0.0		Vel = 0	
C8 to C9	0.0 0.0	3.26 120.0 0.0	4l 2H	26.879 6.989 0.0	57.440 33.868 91.308	86.873 -1.174 0.0	0.0 0.0 0.0		Vel = 0	
C9 to C10	0.0 0.0	3.26 120.0 0.0	2l	13.44 0.0 0.0	22.280 13.440 35.720	85.699 0.974 0.0	0.0 0.0 0.0		Vel = 0	
C10 to A6	0.0 0.0	3.26 120.0 0.0	2H J	6.989 17.471 0.0	18.800 24.460 43.260	86.673 0.152 0.0	0.0 0.0 0.0		Vel = 0	

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0									
	0.0					86.825			K Factor = 0	
*										
B1	0.0	3.26		0.0	1.040	87.647	0.0			
to		120.0		0.0	0.0	0.0	0.0			
B2	0.0	0.0		0.0	1.040	0.0	0.0		Vel = 0	
B2	0.0	3.26		0.0	2.370	87.647	0.0			
to		120.0		0.0	0.0	0.0	0.0			
B3	0.0	0.0		0.0	2.370	0.0	0.0		Vel = 0	
B3	0.0	3.26		0.0	8.130	87.647	0.0			
to		120.0		0.0	0.0	0.0	0.0			
B4	0.0	0.0		0.0	8.130	0.0	0.0		Vel = 0	
B4	0.0	3.26		0.0	6.130	87.647	0.0			
to		120.0		0.0	0.0	0.0	0.0			
B5	0.0	0.0		0.0	6.130	0.0	0.0		Vel = 0	
B5	0.0	3.26		0.0	3.160	87.647	0.0			
to		120.0		0.0	0.0	0.0	0.0			
B6	0.0	0.0		0.0	3.160	0.0	0.0		Vel = 0	
B6	109.80	3.26		0.0	1.340	87.647				
to		120.0		0.0	0.0	0.0				
B7	109.8	0.0119		0.0	1.340	0.016			Vel = 4.22	
B7	0.0	3.26		0.0	8.100	87.663				
to		120.0		0.0	0.0	0.0				
B8	109.8	0.0122		0.0	8.100	0.099			Vel = 4.22	
B8	0.0	3.26		0.0	2.560	87.762				
to		120.0		0.0	0.0	0.0				
B9	109.8	0.0121		0.0	2.560	0.031			Vel = 4.22	
B9	0.0	3.26		0.0	58.497	87.793				
to		120.0		0.0	0.0	0.0				
B10	109.8	0.0121		0.0	58.497	0.710			Vel = 4.22	
B10	0.0	3.26	2I	13.44	37.083	88.503				
to		120.0		0.0	13.440	0.0				
B11	109.8	0.0122		0.0	50.523	0.614			Vel = 4.22	
B11	0.0	3.26	I	6.72	9.390	89.117				
to		120.0	T	20.159	47.039	0.0				
SYS1	109.8	0.0121	B	6.72	56.429	0.685			Vel = 4.22	
			C	13.44						
	0.0									
	109.80					89.802			K Factor = 11.59	
*										
SYS2	0.0	4.26		0.0	7.250	83.674	0.0			
to		120.0		0.0	0.0	3.140	0.0			
HV12	0.0	0.0		0.0	7.250	0.0	0.0		Vel = 0	
HV12	0.0	4.26	J	21.067	5.375	86.814	0.0			
to		120.0		0.0	21.067	2.328	0.0			
BLK1	0.0	0.0		0.0	26.442	0.0	0.0		Vel = 0	

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0 0.0					89.142			K Factor = 0	
HV11 to SYS1	50.00 50.0	4.26 120.0 0.0007		0.0 0.0 0.0	6.750 0.0 6.750	92.720 -2.923 0.005			Qa = 50	Vel = 1.13
SYS1 to BLK1	109.80 159.8	4.26 120.0 0.0066	J	21.067 0.0 0.0	1.875 21.067 22.942	89.802 -0.812 0.152				Vel = 3.60
BLK1 to BLK2	0.0 159.8	6.357 120.0 0.0009	2I H B J	25.147 6.287 10.059 31.433	46.209 72.926 119.135	89.142 -0.235 0.112				Vel = 1.62
BLK2 to TOR	0.0 159.8	6.357 120.0 0.0010	2I	25.147 0.0 0.0	22.083 25.147 47.230	89.019 0.866 0.045				Vel = 1.62
TOR to BOR	0.0 159.8	6.357 120.0 0.0009	B J	10.059 31.433 0.0	8.792 41.492 50.284	89.930 3.808 0.047				Vel = 1.62
BOR to PO	0.0 159.8	6.357 120.0 0.0009	B C	10.059 25.147 0.0	5.417 35.206 40.623	93.785 0.0 0.038				Vel = 1.62
	0.0 159.80					93.823			K Factor = 16.50	
System Demand Pressure						93.823				
Safety Margin						58.540				
Continuation Pressure						152.363				
Pressure @ Pump Outlet						152.363				
Pressure From Pump Curve						-67.845				
Pressure @ Pump Inlet						84.518				
*										
PI to BYP	0.0 159.8	8.249 120.0 0.0003	lx	15.386 0.0 0.0	8.292 15.386 23.678	84.518 -2.869 0.006				Vel = 0.96
BYP to BKFL	0.0 159.8	6.357 120.0 0.0009	2J I Zib	62.867 12.573 0.0	13.417 75.440 88.857	81.655 9.486 0.084			** Fixed Loss = 6.671	Vel = 1.62
BKFL to SPIG	0.0 159.8	7.981 120.0 0.0003	G lx	4.0 13.1 0.0	85.291 17.100 102.391	91.225 -4.060 0.032				Vel = 1.02
SPIG to UG1	0.0 159.8	8.39 140.0 0.0002	2G Zac 2V X	13.572 0.0 61.074 59.377	80.000 134.023 214.023	87.197 4.868 0.039			** Fixed Loss = 4.868	Vel = 0.93
UG1 to TEST	200.00 359.8	8.39 140.0 0.0008	2G 3U X	13.572 45.805 59.377	500.000 118.754 618.754	92.104 -3.086 0.509			Qa = 200	Vel = 2.09

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - Preaction - RA1

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0 359.80				89.527			K Factor =	38.03



Ahern Fire Protection
2675 Scott Ave., Suite C
St. Louis, MO 63103-3047
314-535-4544

Job Name : 46125901 Webster ISB - Standpipes
Building : Webster ISB
Location : 8274 Big Bend Blvd
System : Standpipe
Contract : 461259
Data File : 46125901 Webster ISB - Standpipes.WXF

HYDRAULIC DESIGN INFORMATION SHEET

Name - 46125901 Webster ISB - Standpipes
Location - 8274 Big Bend Blvd
Building - Webster ISB
Contractor - Ahern Fire Protection
Calculated By - Dana Mitchell
Occupancy - n/a

Date - 10/17/16

System No. - Standpipe
Contract No. - 461259
Drawing No. - FP-101.A

S () NFPA 14 Number of Standpipes () 1 (X) 2 () 3 () 4 ()
Y () Other
S () Specific Ruling Made by Date

T
E Flow at Top Most Outlet - 500 Gpm System Type
M Pres. at Top Most Outlet - 100 Psi (X) Wet () Dry
Flow For Ea. Additional Standpipe - 250 Gpm
D Total Additional Flow - 750 Gpm
E Elevation at Highest Outlet - 133-8 Feet
S Hose Valve Connection () 1 1/2" (X) 2 1/2"
I Class Service (X) I () II () III
G Note:
N

Calculation Gpm Required 750 Psi Required 131.630 BOR
Summary C-Factor Used: Overhead 120 Underground 140

W Water Flow Test: Pump Data: Tank or Reservoir:
A Date of Test - 05/23/16 Cap.
T Time of Test - 2:30 PM Rated Cap. 1000 Elev.
E Static (Psi) - 90 @ Psi 55
R Residual (Psi) - 86 Elev. 87.375 Well
Flow (Gpm) - 1140 Proof Flow Gpm
S Elevation - 104

U
P Location: 8274 Big Bend Blvd
P
L Source of Information: Ahern Fire Protection
Y

Water Supply Curve C

Ahern Fire Protection
46125901 Webster ISB - Standpipes

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City Water Supply:

C1 - Static Pressure : 90
C2 - Residual Pressure: 86
C2 - Residual Flow : 1140

City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow

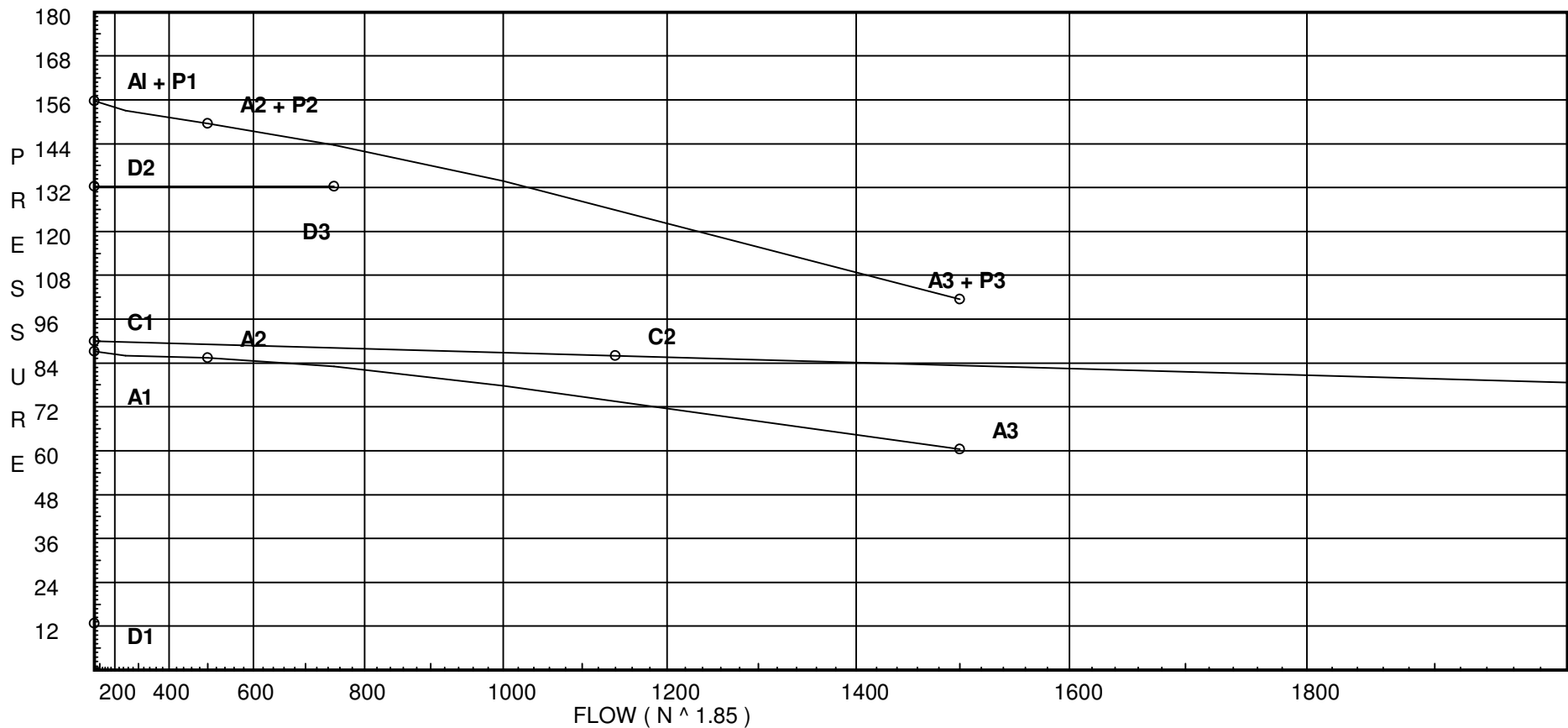
A1 - Adjusted Static: 87.200
A2 - Adj Resid : 85.468 @ 500
A3 - Adj Resid : 60.373 @ 1500

Pump Data:

P1 - Pump Churn Pressure : 68.5
P2 - Pump Rated Pressure : 64
P2 - Pump Rated Flow : 500
P3 - Pump Pressure @ Max Flow : 41
P3 - Pump Max Flow : 1500
City Residual Flow @ 0 = 6135.00
City Residual Flow @ 20 = 5355.71
City Water @ 150% of Pump = 83.35

Demand:

D1 - Elevation : 12.849
D2 - System Flow :
D2 - System Pressure : 132.298
Hose (Demand) : 750
D3 - System Demand : 750
Safety Margin : 11.270



Fittings Used Summary

Ahern Fire Protection
46125901 Webster ISB - Standpipes

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Fitting Legend

Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24
B	Victaulic Grvd. Butterfly Valve	0	0	0	1.4	1	1.2	5	5	0	12	8	8	11	12	14	0	0	0	0	0
C	Swing Check Vlv Vkg Grv	0	0	0	0	0	0	6	10	0	13	0	20	23	0	0	0	0	0	0	0
E	90' Standard Elbow Thrd	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Flanged Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
H	45' Grvd Firelock Elbow	0	0	0	1.1	1.3	1.8	2.2	2.6	0	3.4	4.2	5	5.0	0	0	0	0	0	0	0
I	90' Grvd Firelock Elbow	0	0	0	2.1	2.6	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
Ix	Standard Grooved 90 ELL	0	0	1.7	1.9	2.3	3.2	3.9	4.9	0	6.5	8.2	9.9	13.1	16.5	19.9	0	0	0	0	0
J	90' Grvd Vic Firelock Tee	0	0	0	5.3	6.35	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
T	90' Flow Thru Thread Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121
U	45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
V	90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
X	Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zac	Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Zib	Wilkins 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units Inches
Length Units Feet
Flow Units US Gallons per Minute
Pressure Units Pounds per Square Inch

Fittings Used Summary

Pressure / Flow Summary - STANDARD

Ahern Fire Protection
46125901 Webster ISB - Standpipes

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
HF14	133.667		105.86	na	250.0			
HF13	118.333		115.73	na				
HF24	133.667		100.0	na	250.0			
HF23	118.333		107.16	na	250.0			
HV24	133.667		104.27	na				
HV23	118.333		111.48	na				
HV22	103.0		120.16	na				
HV21	89.0		127.13	na				
BLK4	96.167		124.03	na				
BLK3	97.583		123.88	na				
HV14	133.667		108.55	na				
SYS3	125.583		112.48	na				
HV13	118.333		115.73	na				
SYS2	110.25		119.36	na				
HV12	103.0		122.6	na				
HV11	89.0		129.07	na				
SYS1	95.75		126.14	na				
BLK1	97.625		125.33	na				
BLK2	98.167		125.35	na				
TOR	96.167		127.0	na				
BOR	87.375		131.63	na				
PO	87.375		132.3	na				
PI	87.375		83.07	na				
BYPS	94.0		80.31	na				
BKFL	87.5		88.08	na				
SPIG	96.875		84.58	na				
UG1	96.875		89.26	na				
TEST	104.0		88.16	na				

The maximum velocity is 16.75 and it occurs in the pipe between nodes HF14 and HV14

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - Standpipes

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
* HF14 to HV14										
	250.00	2.469	T	12.0	0.500	105.858			Qa = 250	
		120.0		0.0	12.000	0.0				
	250.0	0.2154		0.0	12.500	2.692			Vel = 16.75	
	0.0									
	250.00					108.550			K Factor = 24.00	
* HF13 to HV13										
	0.0	2.469	T	12.0	0.500	115.732	0.0			
		120.0		0.0	12.000	0.0	0.0			
	0.0	0.0		0.0	12.500	0.0	0.0		Vel = 0	
	0.0									
	0.0					115.732			K Factor = 0	
* HF24 to HV24										
	250.00	2.469	E	6.0	1.833	100.000			Qa = 250	
		120.0	T	12.0	18.000	0.0				
	250.0	0.2154		0.0	19.833	4.272			Vel = 16.75	
	0.0									
	250.00					104.272			K Factor = 24.48	
* HF23 to HV23										
	250.00	2.469	E	6.0	2.084	107.158			Qa = 250	
		120.0	T	12.0	18.000	0.0				
	250.0	0.2154		0.0	20.084	4.326			Vel = 16.75	
	0.0									
	250.00					111.484			K Factor = 23.68	
* HV24 to HV23										
	250.00	4.26	2I	17.907	19.832	104.272				
		120.0		0.0	17.907	6.641				
	250.0	0.0151		0.0	37.739	0.571			Vel = 5.63	
* HV23 to HV22										
	250.00	4.26	2I	17.907	19.500	111.484				
		120.0		0.0	17.907	6.641				
	500.0	0.0545		0.0	37.407	2.039			Vel = 11.25	
* HV22 to BLK4										
	0.0	4.26	I	8.954	7.666	120.164				
		120.0		0.0	8.954	2.959				
	500.0	0.0545		0.0	16.620	0.906			Vel = 11.25	
	0.0									
	500.00					124.029			K Factor = 44.90	
* HV21 to BLK4										
	0.0	2.469	T	12.0	7.167	127.134	0.0			
		120.0	B	5.0	17.000	-3.104	0.0			
	0.0	0.0		0.0	24.167	0.0	0.0		Vel = 0	
* BLK4 to BLK3										
	500.00	6.357	3I	37.72	22.334	124.029				
		120.0		0.0	37.720	-0.613				
	500.0	0.0078		0.0	60.054	0.466			Vel = 5.05	
* BLK3 to BLK2										
	0.0	6.357	J	31.433	171.916	123.882				
		120.0	H	6.287	50.293	-0.253				
	500.0	0.0078	I	12.573	222.209	1.725			Vel = 5.05	
	0.0									
	500.00					125.354			K Factor = 44.66	
* BLK4 to BLK3										
	500.00	6.357	3I	37.72	22.334	124.029				
		120.0		0.0	37.720	-0.613				
	500.0	0.0078		0.0	60.054	0.466			Vel = 5.05	
* BLK3 to BLK2										
	0.0	6.357	J	31.433	171.916	123.882				
		120.0	H	6.287	50.293	-0.253				
	500.0	0.0078	I	12.573	222.209	1.725			Vel = 5.05	
	0.0									
	500.00					125.354			K Factor = 44.66	
* BLK4 to BLK3										
	500.00	6.357	3I	37.72	22.334	124.029				
		120.0		0.0	37.720	-0.613				
	500.0	0.0078		0.0	60.054	0.466			Vel = 5.05	
* BLK3 to BLK2										
	0.0	6.357	J	31.433	171.916	123.882				
		120.0	H	6.287	50.293	-0.253				
	500.0	0.0078	I	12.573	222.209	1.725			Vel = 5.05	
	0.0									
	500.00					125.354			K Factor = 44.66	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125901 Webster ISB - Standpipes

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Date 09/22/16

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
HV14 to SYS3	250.00 250.0	4.26 120.0 0.0151	2I	17.907 0.0 0.0	10.580 17.907 28.487	108.550 3.501 0.431			Vel = 5.63	
SYS3 to HV13	0.0 250.0	4.26 120.0 0.0152		0.0 0.0 0.0	7.250 0.0 7.250	112.482 3.140 0.110			Vel = 5.63	
HV13 to SYS2	0.0 250.0	4.26 120.0 0.0151		0.0 0.0 0.0	8.083 0.0 8.083	115.732 3.501 0.122			Vel = 5.63	
SYS2 to HV12	0.0 250.0	4.26 120.0 0.0150		0.0 0.0 0.0	7.250 0.0 7.250	119.355 3.140 0.109			Vel = 5.63	
HV12 to BLK1	0.0 250.0	4.26 120.0 0.0151	J	21.067 0.0 0.0	5.375 21.067 26.442	122.604 2.328 0.400			Vel = 5.63	
	0.0 250.00					125.332			K Factor = 22.33	
HV11 to SYS1	0.0 0.0	4.26 120.0 0.0		0.0 0.0 0.0	6.750 0.0 6.750	129.068 -2.923 0.0	0.0 0.0 0.0		Vel = 0	
SYS1 to BLK1	0.0 0.0	4.26 120.0 0.0	J B	21.067 15.8 0.0	1.875 36.867 38.742	126.144 -0.812 0.0	0.0 0.0 0.0		Vel = 0	
BLK1 to BLK2	250.00 250.0	6.357 120.0 0.0022	2I H B J	25.147 6.287 10.059 31.433	46.209 72.926 119.135	125.332 -0.235 0.257			Vel = 2.53	
BLK2 to TOR	500.00 750.0	6.357 120.0 0.0164	2I	25.147 0.0 0.0	22.083 25.147 47.230	125.354 0.866 0.776			Vel = 7.58	
TOR to BOR	0.0 750.0	6.357 120.0 0.0164	B J	10.059 31.433 0.0	8.792 41.492 50.284	126.996 3.808 0.826			Vel = 7.58	
BOR to PO	0.0 750.0	6.357 120.0 0.0164	B C	10.059 25.147 0.0	5.417 35.206 40.623	131.630 0.0 0.668			Vel = 7.58	
	0.0 750.00					132.298			K Factor = 65.21	
System Demand Pressure						132.298				
Safety Margin						11.270				
Continuation Pressure						143.568				
Pressure @ Pump Outlet						143.568				
Pressure From Pump Curve						-60.500				
Pressure @ Pump Inlet						83.068				
*										
PI to BYP	0.0 750.0	8.249 120.0 0.0046	lx	15.386 0.0 0.0	8.292 15.386 23.678	83.068 -2.869 0.109			Vel = 4.50	

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
BYPS to BKFL	0.0 750.0	6.357 120.0 0.0164	2J I Zib	62.867 12.573 0.0	13.417 75.440 88.857	80.308 6.315 1.460			** Fixed Loss = 3.5 Vel = 7.58	
BKFL to SPIG	0.0 750.0	7.981 120.0 0.0054	G lx	4.0 13.1 0.0	85.291 17.100 102.391	88.083 -4.060 0.555			Vel = 4.81	
SPIG to UG1	0.0 750.0	8.39 140.0 0.0032	2G Zac 2V X	13.572 0.0 61.074 59.377	80.000 134.023 214.023	84.578 4.000 0.685			** Fixed Loss = 4 Vel = 4.35	
UG1 to TEST	0.0 750.0	8.39 140.0 0.0032	2G 3U X	13.572 45.805 59.377	500.000 118.754 618.754	89.263 -3.086 1.979			Vel = 4.35	
	0.0 750.00					88.156			K Factor = 79.88	