



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



NOV 03 2016

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 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

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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

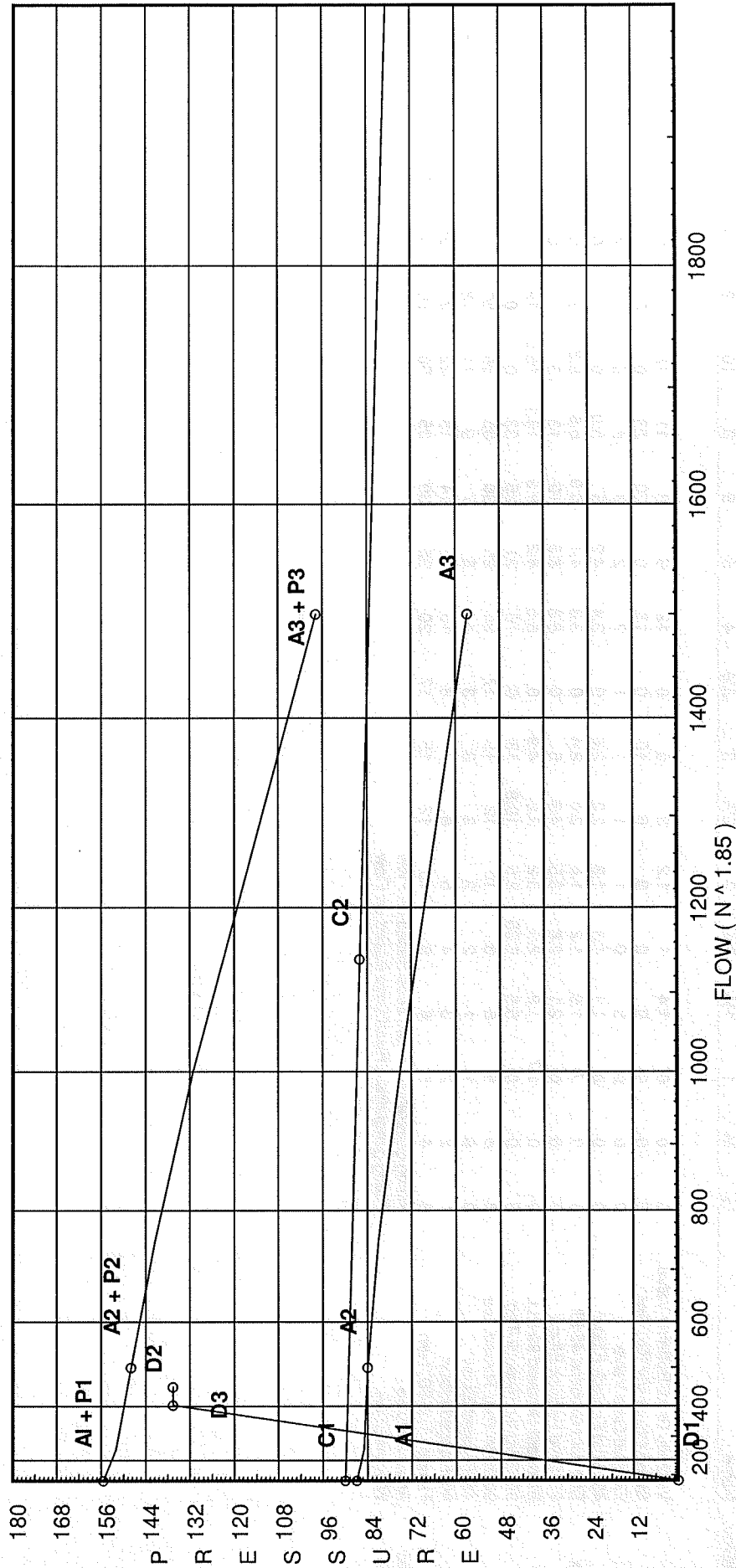
A1 - Adjusted Static: 86.869
A2 - Adj Resid : 83.909 @ 500
A3 - Adj Resid : 56.783 @ 1500

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

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Fitting Legend	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
Abbrev. Name																				
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																			
Zlb Wilkens 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units
Length Units
Flow Units
Pressure Units

Inches
Feet
US Gallons per Minute
Pounds per Square Inch

Fittings Used Summary

1/2"	1/2"	1/2"	1/2"
1/4"	1/4"	1/4"	1/4"
3/8"	3/8"	3/8"	3/8"
1/2"	1/2"	1/2"	1/2"

Pressure / Flow Summary - STANDARD

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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

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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

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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	51.56	1.049	T	5.0	0.001	41.539			K Factor = 8.00	
to		120.0	Eq	35.5	40.500	-0.325				
A1	51.56	0.7504		0.0	40.501	30.390			Vel = 19.14	
	0.0									
	51.56					71.604			K Factor = 6.09	
S2	47.96	1.049	T	5.0	0.001	35.948			K Factor = 8.00	
to		120.0	Eq	20.7	25.700	-0.325				
X2	47.96	0.6564		0.0	25.701	16.871			Vel = 17.80	
	0.0									
	47.96					52.494			K Factor = 6.62	
S3	49.55	1.049	T	5.0	0.001	38.357			K Factor = 8.00	
to		120.0	Eq	20.7	25.700	-0.325				
X3	49.55	0.6971		0.0	25.701	17.915			Vel = 18.39	
	0.0									
	49.55					55.947			K Factor = 6.62	
S4	47.67	1.049	T	5.0	0.001	35.510			K Factor = 8.00	
to		120.0	Eq	20.7	25.700	-0.325				
X4	47.67	0.6490		0.0	25.701	16.681			Vel = 17.70	
	0.0									
	47.67					51.866			K Factor = 6.62	
S5	49.24	1.049	T	5.0	0.001	37.891			K Factor = 8.00	
to		120.0	Eq	20.7	25.700	-0.325				
X5	49.24	0.6892		0.0	25.701	17.714			Vel = 18.28	
	0.0									
	49.24					55.280			K Factor = 6.62	
S6	40.00	1.049	T	5.0	0.001	25.000			K Factor = 8.00	
to		120.0	Eq	35.5	40.500	-0.524				
X6	40.0	0.4691		0.0	40.501	19.000			Vel = 14.85	
	0.0									
	40.00					43.476			K Factor = 6.07	
S7	32.56	1.049	T	5.0	5.420	33.805			K Factor = 5.60	
to		120.0	Eq	23.5	28.500	-0.524				
X7	32.56	0.3206		0.0	33.920	10.874			Vel = 12.09	
	0.0									
	32.56					44.155			K Factor = 4.90	
S8	40.67	1.049	T	5.0	0.001	25.846			K Factor = 8.00	
to		120.0	Eq	35.5	40.500	-0.524				
X8	40.67	0.4838		0.0	40.501	19.594			Vel = 15.10	
	0.0									
	40.67					44.916			K Factor = 6.07	
S9	43.53	1.049	T	5.0	0.001	29.609			K Factor = 8.00	
to		120.0	Eq	35.5	40.500	-0.524				
X9	43.53	0.5486		0.0	40.501	22.219			Vel = 16.16	
	0.0									
	43.53					51.304			K Factor = 6.08	

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	*****
*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	

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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									

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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	0.0	3.26		0.0	1.040	106.328	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	106.328	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	106.328	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	106.328	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	106.328	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	402.75	3.26		0.0	1.340	106.328				
to		120.0		0.0	0.0	0.0				
B7	402.75	0.1343		0.0	1.340	0.180		Vel = 15.48		
B7	0.0	3.26		0.0	8.100	106.508				
to		120.0		0.0	0.0	0.0				
B8	402.75	0.1344		0.0	8.100	1.089		Vel = 15.48		
B8	0.0	3.26		0.0	2.560	107.597				
to		120.0		0.0	0.0	0.0				
B9	402.75	0.1344		0.0	2.560	0.344		Vel = 15.48		
B9	0.0	3.26		0.0	58.497	107.941				
to		120.0		0.0	0.0	0.0				
B10	402.75	0.1345		0.0	58.497	7.866		Vel = 15.48		
B10	0.0	3.26	2I	13.44	37.083	115.807				
to		120.0		0.0	13.440	0.0				
B11	402.75	0.1345		0.0	50.523	6.793		Vel = 15.48		
B11	0.0	3.26	I	6.72	9.390	122.600				
to		120.0	T	20.159	47.039	0.0				
SYS1	402.75	0.1345	B	6.72	56.429	7.588		Vel = 15.48		
			C	13.44						
	0.0							K Factor = 35.30		
	402.75					130.188				
*										
SYS2	0.0	4.26		0.0	7.250	124.949	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	128.089	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		
	0.0									

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	*****
	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 BYPs	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	
BYPs 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

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	*****
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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



Page 5 - Verify velocity of 28.53, between nodes B9 and B10 is acceptable. Also refer to pages 10 and 11.

NOV 03 2016

Hydraulic Design Information Sheet

Name - 46125901 Webster ISB - 1st Lvl - RA2

Date - 10/17/16

Location - 8274 Big Bend Blvd

Building - Webster ISB

Contractor - Ahern Fire Protection

Calculated By - Dana Mitchell

Construction: () Combustible (X) Non-Combustible

Occupancy - HC-2

System No. - SYS1

Contract No. - 461259

Drawing No. - FP-101.A

Ceiling Height - 13-5 1/2

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 R () Double Row () Slave Pallet () Solid Shelf () Non

T A () Mult. Row () Open Shelf

O

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 - RA2

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

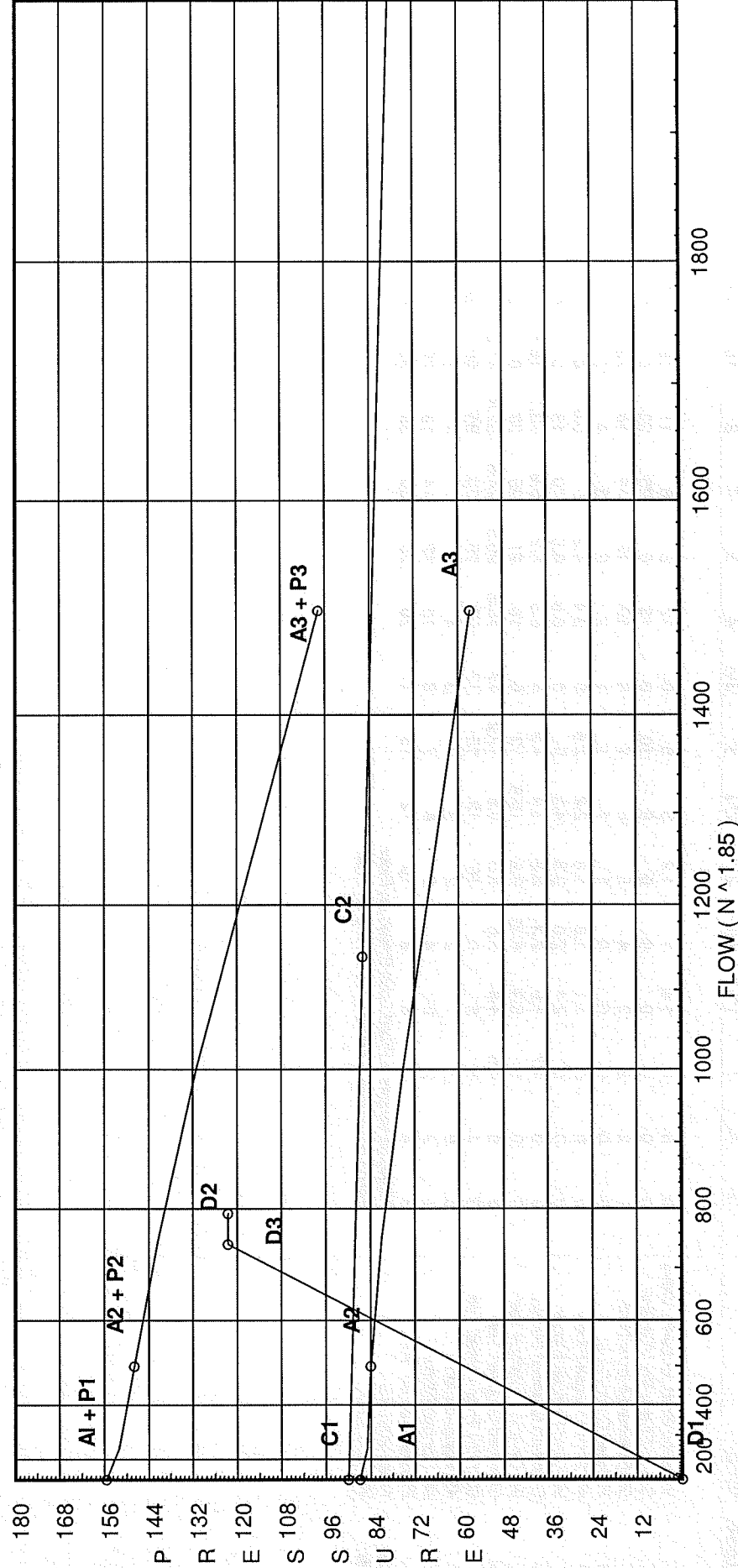
A1 - Adjusted Static: 86.869
A2 - Adj Resid : 83.909 @ 500
A3 - Adj Resid : 56.783 @ 1500

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

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

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Fitting Legend	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
Abbrev. Name																				
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 Wilkens 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

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

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.
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				
BYP5	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 3I	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

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	*****
C6 to C7	0.0	3.26 120.0		0.0	3.240 0.0	38.970 0.0	0.0 0.0			
C7 to C8	0.0	3.26 120.0	I	6.72	28.260 6.720	38.970 0.0	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		Vel = 0	
C9 to C10	0.0	3.26 120.0	2I	13.44	22.280 13.440	37.796 0.974	0.0 0.0		Vel = 0	
C10 to A6	39.10 39.1	3.26 120.0 0.0018	2H J	6.989 17.471	18.800 24.460 43.260	38.770 0.152 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 0.0	37.750 0.0			Vel = 2.84	
B2 to B3	104.35	3.26 120.0		0.0	2.370 0.0	37.756 0.0			Vel = 6.85	
B3 to B4	178.17	3.26 120.0		0.0	2.370 0.0	37.826 0.0			Vel = 8.39	
B4 to B5	40.00	3.26 120.0		0.0	8.130 0.0	37.826 0.0			Vel = 12.42	
B5 to B6	218.17	3.26 120.0		0.0	8.130 0.0	38.178 0.0			Vel = 16.91	
B6 to B7	104.96	3.26 120.0		0.0	6.130 0.0	38.726 0.0			Vel = 20.16	
B7 to B8	323.13	3.26 120.0		0.0	6.130 0.0	39.520 0.0			Vel = 21.75	
B8 to B9	565.98	3.26 120.0		0.0	8.100 0.0	39.520 0.0			Vel = 24.06	
B9 to B10	59.98	3.26 120.0		0.0	2.560 0.0	41.564 0.0			Vel = 28.53	
B10 to B11	625.96	3.26 120.0		0.0	2.560 0.0	41.564 0.0			Vel = 28.53	
B10 to B11	742.16	3.26 120.0	2I	13.44	37.083 13.440	66.712 0.0			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 BYPs	0.0 792.16	8.249 120.0 0.0051	Ix	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 : 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



Page 4 - Verify velocity of 28.16, between nodes X5 and A1 is acceptable. Also refer to page 6

NOV 03 2016

Hydraulic Design Information Sheet

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

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		

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
	() 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

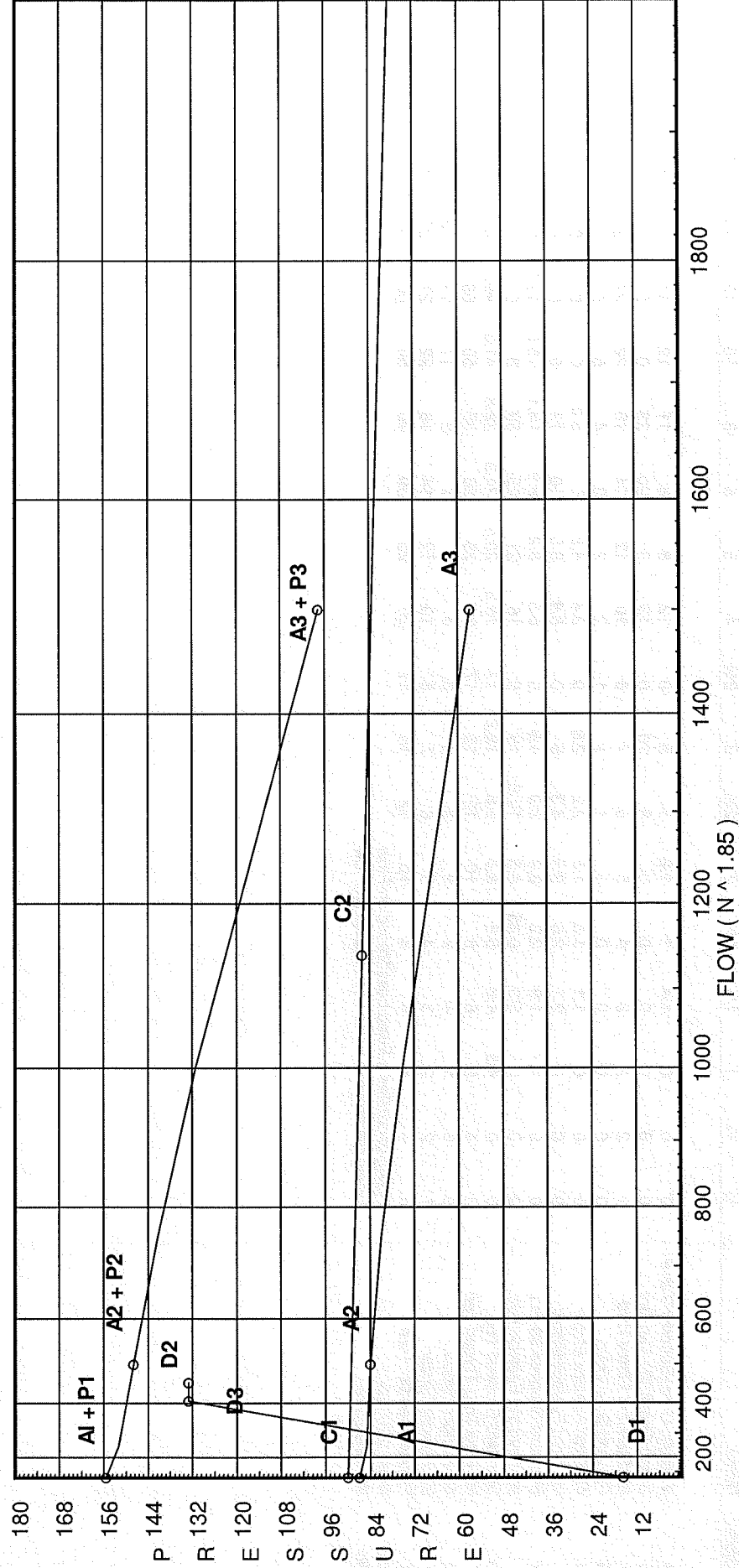
Ahern Fire Protection
46125904 Webster ISB - 4th Lvl - RA1

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

Fitting Legend		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
Abbrev.	Name																				
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
lx	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 Tee 90' Turn	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

Pressure / Flow Summary - STANDARD

Ahern Fire Protection
46125904 Webster ISB - 4th 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	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				
BYP5	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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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	*****
* S1 to X1										
	24.29	1.049	T	5.0	0.001	18.818			K Factor = 5.60	
		120.0	Eq	23.5	28.500	-0.395				
	24.29	0.1864		0.0	28.501	5.314			Vel = 9.02	
	0.0									
	24.29					23.737			K Factor = 4.99	
S2 to X2										
	24.51	1.049	T	5.0	0.001	19.160			K Factor = 5.60	
		120.0	Eq	23.5	28.500	-0.395				
	24.51	0.1896		0.0	28.501	5.403			Vel = 9.10	
	0.0									
	24.51					24.168			K Factor = 4.99	
S3 to X3										
	25.40	1.049	T	5.0	0.001	20.571			K Factor = 5.60	
		120.0	Eq	23.5	28.500	-0.395				
	25.4	0.2025		0.0	28.501	5.771			Vel = 9.43	
	0.0									
	25.40					25.947			K Factor = 4.99	
S4 to X4										
	27.08	1.049	T	5.0	0.001	23.392			K Factor = 5.60	
		120.0	Eq	23.5	28.500	-0.395				
	27.08	0.2280		0.0	28.501	6.499			Vel = 10.05	
	0.0									
	27.08					29.496			K Factor = 4.99	
S5 to X5										
	30.01	1.049	T	5.0	0.001	28.717			K Factor = 5.60	
		120.0	Eq	23.5	28.500	-0.395				
	30.01	0.2756		0.0	28.501	7.856			Vel = 11.14	
	0.0									
	30.01					36.178			K Factor = 4.99	
S6 to X6										
	40.00	1.049	E	2.0	6.667	25.000			K Factor = 8.00	
		120.0	T	5.0	27.700	-0.110				
	40.0	0.4691	Eq	20.7	34.367	16.123			Vel = 14.85	
	0.0									
	40.00					41.013			K Factor = 6.25	
S7 to X7										
	42.41	1.049	T	5.0	0.001	28.108			K Factor = 8.00	
		120.0	Eq	20.7	25.700	-0.110				
	42.41	0.5228		0.0	25.701	13.437			Vel = 15.74	
	0.0									
	42.41					41.435			K Factor = 6.59	
S8 to X8										
	44.68	1.049	T	5.0	0.001	31.188			K Factor = 8.00	
		120.0	Eq	20.7	25.700	-0.110				
	44.68	0.5756		0.0	25.701	14.794			Vel = 16.59	
	0.0									
	44.68					45.872			K Factor = 6.60	
S9 to X9										
	31.92	1.049	T	5.0	0.001	32.480			K Factor = 5.60	
		120.0	Eq	23.5	28.500	-0.395				
	31.92	0.3089		0.0	28.501	8.805			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	
	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	
	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	
	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				
	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				
	0.0 127.09						54.858		K Factor = 17.16	
*										

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	*****
X9 to X10	31.92	1.38 120.0		0.0 0.0	10.000 0.0	40.890 0.0				
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 0.0	10.792 0.0	41.702 0.0				
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 0.0	10.708 13.440	54.164 0.286				
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 0.0	2.500 0.0	54.858 0.0				
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 0.0	7.130 0.0	55.006 0.0				
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 0.0	56.042 13.440	55.588 0.0				
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 0.0	81.958 6.720	65.028 0.0				
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 0.0	42.035 0.0	77.076 0.0				
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 0.0	80.245 6.720	82.787 0.0				
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 0.0	7.250 0.0	104.329 3.141				
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 0.0	10.580 17.907	107.738 3.501		Qa = 50		
	455.01	0.0458		0.0	28.487	1.305		Vel = 10.24		

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	*****
SYS3 to HV13	0.0 455.01	4.26 120.0 0.0458		0.0 0.0 0.0	7.250 0.0 7.250	112.544 3.140 0.332			Vel = 10.24	
HV13 to SYS2	0.0 455.01	4.26 120.0 0.0458		0.0 0.0 0.0	8.083 0.0 8.083	116.016 3.501 0.370			Vel = 10.24	
SYS2 to HV12	0.0 455.01	4.26 120.0 0.0458		0.0 0.0 0.0	7.250 0.0 7.250	119.887 3.140 0.332			Vel = 10.24	
HV12 to BLK1	0.0 455.01	4.26 120.0 0.0458	J	21.067 0.0 0.0	5.375 21.067 26.442	123.359 2.328 1.210			Vel = 10.24	
	0.0 455.01					126.897			K Factor = 40.39	
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	130.633 -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	127.709 -0.812 0.0	0.0 0.0 0.0		Vel = 0	
BLK1 to BLK2	455.01 455.01	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 0.0 0.0	22.083 25.147 47.230	127.439 0.866 0.308			Vel = 4.60	
TOR to BOR	0.0 455.01	6.357 120.0 0.0065	B J	10.059 31.433 0.0	8.792 41.492 50.284	128.613 3.808 0.328			Vel = 4.60	
BOR to PO	0.0 455.01	6.357 120.0 0.0065	B C	10.059 25.147 0.0	5.417 35.206 40.623	132.749 0.0 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 BYPS	0.0 455.01	8.249 120.0 0.0018	lx	15.386 0.0 0.0	8.292 15.386 23.678	84.312 -2.869 0.043			Vel = 2.73	
BYPS 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

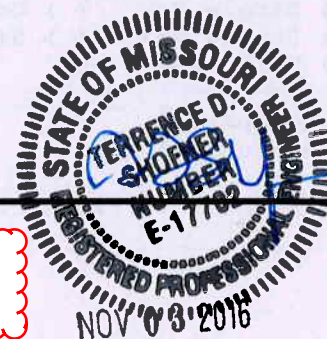
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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
BKFL to SPIG	0.0 455.01	7.981 120.0 0.0021	G lx	4.0 13.1 0.0	85.291 17.100 102.391	88.381 -4.060 0.220			Vel = 2.92	
SPIG to UG1	0.0 455.01	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



Page 4 - Verify velocity of 32.12, between nodes X24 and B1 is acceptable. Also refer to page 6.

Hydraulic Design Information Sheet

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

S () NFPA 13 () Lt. Haz. Ord.Haz.Gp. () 1 () 2 () 3 () Ex.Haz.
Y () NFPA 231 () NFPA 231C () Figure Curve
S Other Factory Mutual - HCl
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	Rated Cap.- 1000	Cap. -
T	Time of Test - 2:30 PM	@ Press - 55	Elev.-
E	Static Press - 90	Elev. - 87.375	Well
R	Residual Press - 86		Proof Flow
	Flow - 1140		
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
46125904 Webster ISB - 4th Lvl - RA2

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

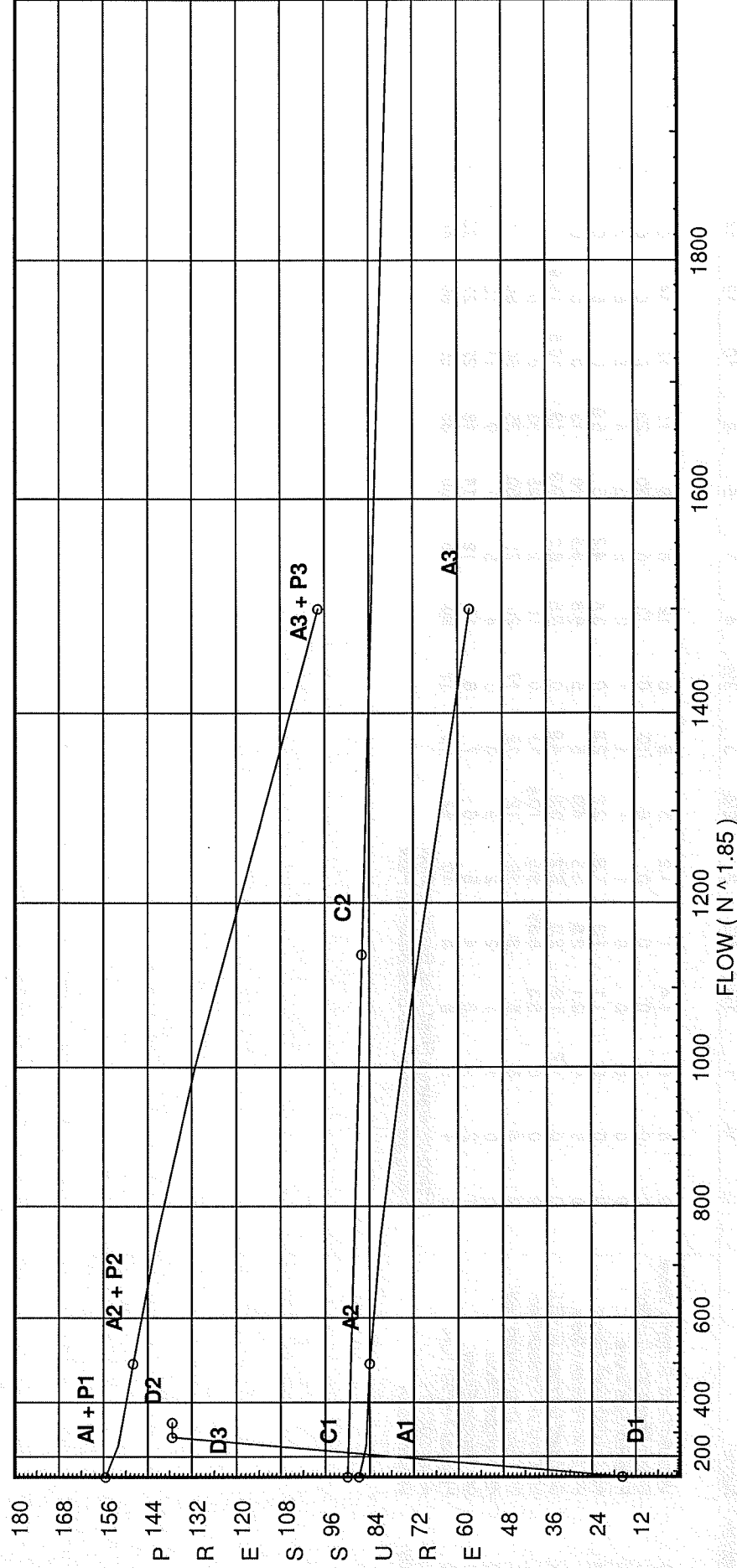
A1 - Adjusted Static: 86.869
A2 - Adj Resid : 83.909 @ 500
A3 - Adj Resid : 56.783 @ 1500

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
J 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
T 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
U 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
V 45' Flanged Elbow	0	0	1	1	2	2	3	3	3	4	5	7	9	11	13	12.5	14	16	18	22
X 90' Flanged Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	25	28	32	36	44
Zac Flanged Tee 90' Turn	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	44	51	58	65	80
Zib Ames 2000SS	Fitting generates a Fixed Loss Based on Flow																			
Wilkins 350A	Fitting generates a Fixed Loss Based on Flow																			

Units Summary

Diameter Units
Length Units
Flow Units
Pressure Units

Inches
Feet
US Gallons per Minute
Pounds per Square Inch

Pressure / Flow Summary - STANDARD

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

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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 43.28	1.38 120.0 0.1428		0.0 0.0 0.0	14.500 0.0 14.500	42.904 0.0 2.070			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 4I	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	285.49 285.49	3.26 120.0 0.0711	I	6.72 0.0 0.0	80.245 6.720 86.965	99.762 0.0 6.187			Vel = 10.97	
A8 to SYS4	0.0 285.49	3.26 120.0 0.0711	2I 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	285.49 285.49	4.26 120.0 0.0193		0.0 0.0 0.0	7.250 0.0 7.250	111.043 3.141 0.140			Vel = 6.43	
HV14 to SYS3	50.00 335.49	4.26 120.0 0.0261	2I	17.907 0.0 0.0	10.580 17.907 28.487	114.324 3.501 0.743			Qa = 50 Vel = 7.55	
SYS3 to HV13	0.0 335.49	4.26 120.0 0.0261		0.0 0.0 0.0	7.250 0.0 7.250	118.568 3.140 0.189			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 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 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 26.442	5.375 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 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 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 0.442	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 47.230	22.083 25.147 0.866 0.175	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 41.492	8.792 41.492 3.808 0.187	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 40.623	5.417 35.206 0.0 0.151	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 BYPS	0.0 335.49	8.249 120.0 0.0011	lx	15.386 0.0 23.678	8.292 15.386 -2.869 0.025	85.210 -2.869 0.025		Vel = 2.01	
BYPS 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 13.1 102.391	85.291 17.100 -4.060 0.126	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 : 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



Page 5 - Verify velocity of 27.92, between nodes D4 and D5 is acceptable. Also refer to page 10.

NOV 03 2016

Hydraulic Design Information Sheet

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

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			
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	() Single Row	() Conven. Pallet	() Auto. Storage () Encap.
R	() Double Row	() Slave Pallet	() Solid Shelf () Non
T	() Mult. Row		() Open Shelf
A			
O			
C			
R	Flue Spacing	Clearance:Storage to Ceiling	
A	Longitudinal	Transverse	
G			
E	Horizontal Barriers Provided:		

Water Supply Curve C

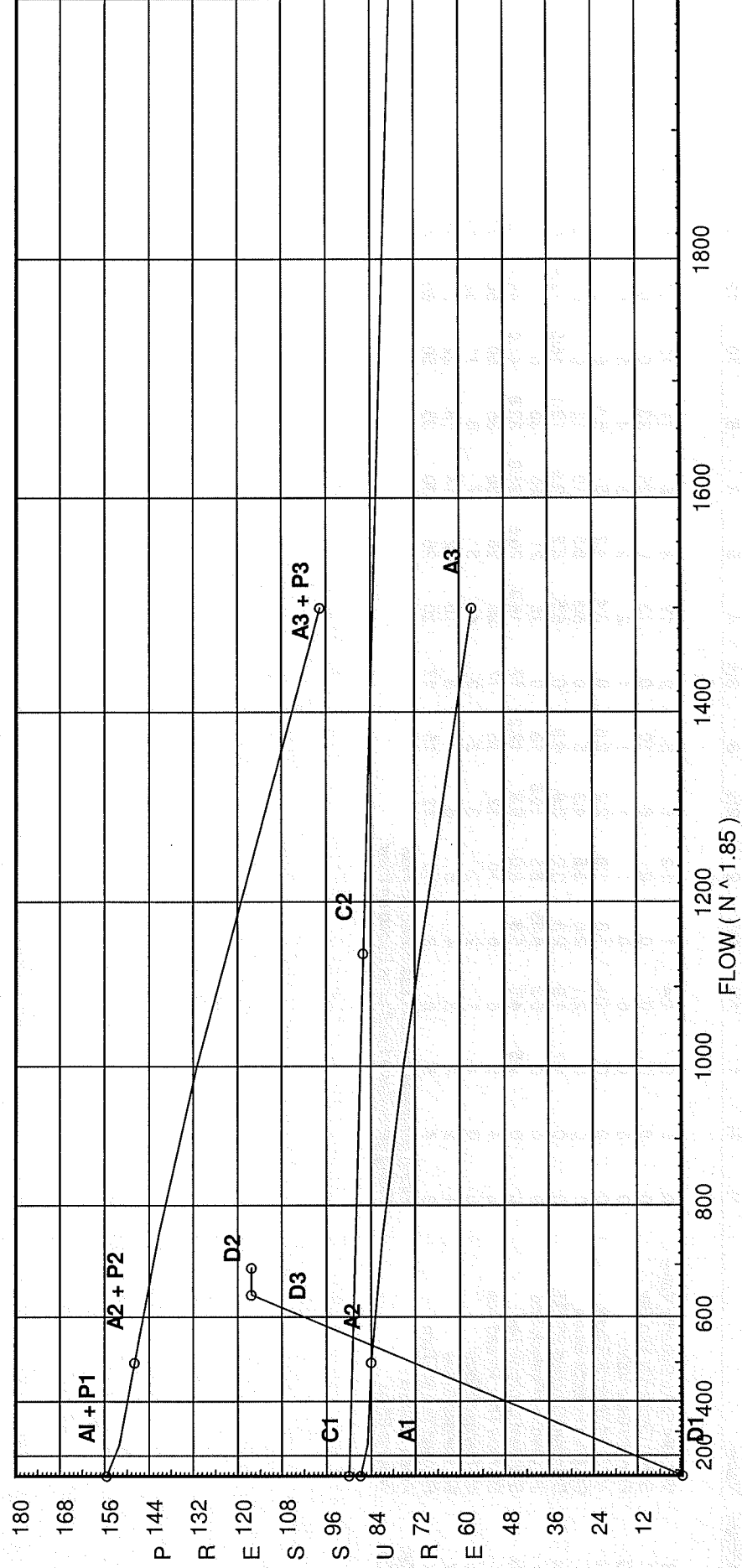
Ahern Fire Protection
46125900 Webster ISB - Basement Lvl - RA3

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

Ahern Fire Protection
46125900 Webster ISB - Basement Lvl - RA3

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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																					
Zib	Wilkins 350A																					

Fitting generates a Fixed Loss Based on Flow
Fitting generates a Fixed Loss Based on Flow

Units Summary

Diameter Units
Length Units
Flow Units
Pressure Units

Inches
Feet
US Gallons per Minute
Pounds per Square Inch

Pressure / Flow Summary - STANDARD

Ahern Fire Protection
46125900 Webster ISB - Basement Lvl - RA3

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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

Ahern Fire Protection
46125900 Webster ISB - Basement Lvl - RA3

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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

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	*****
* 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

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	*****
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	
	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	
	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	
	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	
	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	
	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	
	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	
	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	
	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	
	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	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125900 Webster ISB - Basement Lvl - RA3

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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	*****
	0.0 31.40					17.521			K Factor = 7.50	
*										
X1 to X2	33.64 33.64	1.61 120.0 0.0422		0.0 0.0 0.0	10.000 0.0 10.000	19.771 0.0 0.422			Vel = 5.30	
X2 to S3	34.00 34.00 67.64	1.61 120.0 0.1540		0.0 0.0 0.0	10.000 0.0 10.000	20.193 0.0 1.540			Vel = 10.66	
S3 to D1	37.30 37.30 104.94	1.61 120.0 0.3468	2lx T	4.6 8.0 0.0	7.810 12.600 20.410	21.733 1.641 7.079			K Factor = 8.00 Vel = 16.54	
	0.0 104.94					30.453			K Factor = 19.02	
*										
X4 to X5	26.00 26.00 26.0	1.61 120.0 0.0262		0.0 0.0 0.0	14.840 0.0 14.840	12.159 0.0 0.389			Vel = 4.10	
X5 to X6	26.43 26.43 52.43	1.61 120.0 0.0961	2lx	4.6 0.0 0.0	16.140 4.600 20.740	12.548 0.0 1.993			Vel = 8.26	
X6 to Z1	28.81 28.81 81.24	1.61 120.0 0.2165		0.0 0.0 0.0	1.270 0.0 1.270	14.541 0.0 0.275			Vel = 12.80	
Z1 to D2	58.89 58.89 140.13	1.61 120.0 0.5922	lx Jx T	2.3 5.8 8.0	7.570 16.100 23.670	14.816 1.676 14.017			Vel = 22.08	
	0.0 140.13					30.509			K Factor = 25.37	
*										
S7 to S8	29.26 29.26 29.26	1.61 120.0 0.0327		0.0 0.0 0.0	10.500 0.0 10.500	13.373 0.0 0.343			K Factor = 8.00 Vel = 4.61	
S8 to Z1	29.62 29.62 58.88	1.61 120.0 0.1192		0.0 0.0 0.0	9.230 0.0 9.230	13.716 0.0 1.100			K Factor = 8.00 Vel = 9.28	
	0.0 58.88					14.816			K Factor = 15.30	
*										
X9 to X10	27.61 27.61 27.61	1.61 120.0 0.0293		0.0 0.0 0.0	14.830 0.0 14.830	13.655 0.0 0.435			Vel = 4.35	
X10 to X11	28.07 28.07 55.68	1.61 120.0 0.1074		0.0 0.0 0.0	14.830 0.0 14.830	14.090 0.0 1.593			Vel = 8.77	
X11 to Z2	29.94 29.94 85.62	1.61 120.0 0.2379		0.0 0.0 0.0	1.320 0.0 1.320	15.683 0.0 0.314			Vel = 13.49	

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	*****
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

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	*****
X21 to Z5	29.29 83.73	1.61 120.0 0.2284	Jx 0.0 0.0	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 0.0 0.0	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 0.0 0.0	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 0.0	4.026 120.0 0.0		0.0 0.0 0.0	7.250 0.0 7.250	102.376 3.140 0.0	0.0 0.0 0.0			
HV12 to BLK1	0.0 0.0	4.026 120.0 0.0	J	16.0 0.0 0.0	5.375 16.000 21.375	105.516 2.328 0.0	0.0 0.0 0.0		Vel = 0	
	0.0 0.0					107.844			K Factor = 0	
HV11 to SYS1	50.00 50.0	4.026 120.0 0.0009		0.0 0.0 0.0	6.750 0.0 6.750	109.224 -2.923 0.006			Qa = 50	
SYS1 to BLK1	643.33 693.33	4.026 120.0 0.1314	J	16.0 0.0 0.0	1.875 16.000 17.875	106.307 -0.812 2.349			Vel = 1.26	
BLK1 to BLK2	0.0 693.33	6.065 120.0 0.0179	2I H B J	20.0 5.0 8.0 25.0	46.209 58.000 104.209	107.844 -0.235 1.862			Vel = 17.47	
BLK2 to TOR	0.0 693.33	6.065 120.0 0.0179	2I	20.0 0.0 0.0	22.083 20.000 42.083	109.471 0.866 0.752			Vel = 7.70	
TOR to BOR	0.0 693.33	6.065 120.0 0.0179	B J	8.0 25.0 0.0	8.792 33.000 41.792	111.089 3.808 0.746			Vel = 7.70	
BOR to PO	0.0 693.33	6.065 120.0 0.0179	B C	8.0 20.0 0.0	5.417 28.000 33.417	115.643 0.0 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	0.0 693.33	7.981 120.0 0.0047	Ix	13.1 0.0 0.0	8.292 13.100 21.392	81.682 -2.869 0.100			Vel = 4.45	
BYPs to BKFL	0.0 693.33	6.065 120.0 0.0179	2J I Zib	50.0 10.0 0.0	13.417 60.000 73.417	78.913 6.315 1.312			** Fixed Loss = 3.5	
BKFL to SPIG	0.0 693.33	7.981 120.0 0.0047	G Ix	4.0 13.1 0.0	85.291 17.100 102.391	86.540 -4.060 0.480			Vel = 7.70	
SPIG to UG1	0.0 693.33	8.39 140.0 0.0028	2G Zac 2V	13.572 0.0 61.074	80.000 134.023 214.023	82.960 4.251 0.592			Vel = 4.45	
									** Fixed Loss = 4.251	
									Vel = 4.02	

Final Calculations - Hazen-Williams

Ahern Fire Protection
46125900 Webster ISB - Basement Lvl - RA3

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Fng'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 - Preaction - RA1
Building : Webster ISB
Location : 8274 Big Bend Blvd
System : Preaction
Contract : 461259
Data File : 46125901 Webster ISB - Preaction - RA1.WXF



NOV 03 2016

Hydraulic Design Information Sheet

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

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

	Area of Sprinkler Operation - 583	System Type	Sprinkler/Nozzle
M	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		

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
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	() Single Row () Conven. Pallet	() Auto. Storage	() Encap.
S	() Double Row () Slave Pallet	() Solid Shelf	() Non
T	() Mult. Row	() Open Shelf	
O			
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 - Preaction - RA1

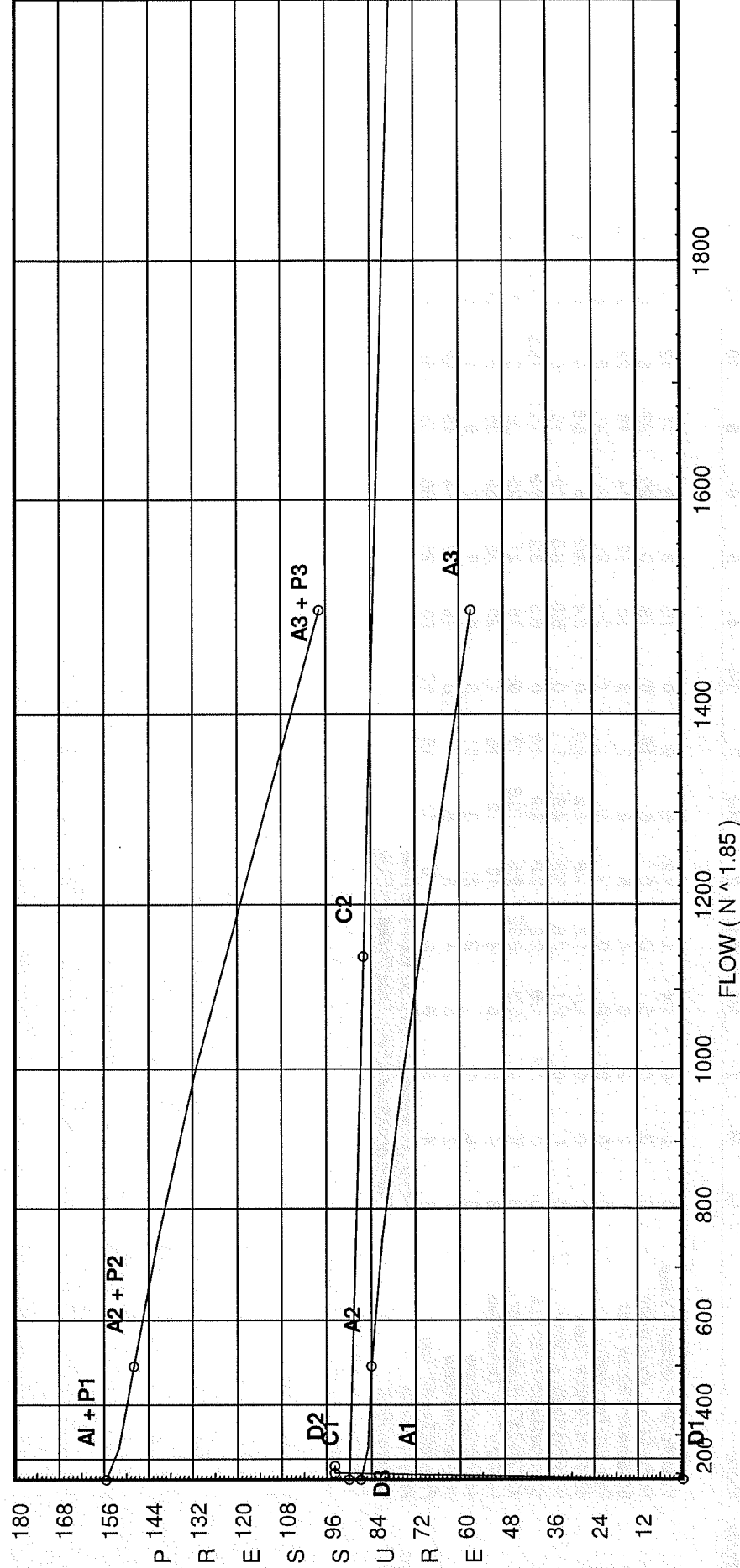
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City Water Supply:
C1 - Static Pressure : 90
C2 - Residual Pressure: 86
C2 - Residual Flow : 1140

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

Fitting Legend	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
Abbrev. Name																				
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																			
Zlb Wilkens 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

1	1/2"	1/2"	1/2"
2	1/2"	1/2"	1/2"
3	1/2"	1/2"	1/2"
4	1/2"	1/2"	1/2"

Pressure / Flow Summary - STANDARD

Ahern Fire Protection
46125901 Webster ISB - Preaction - RA1

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Date 09/22/16

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									
X63	15.97	1.049		10.000	8.092				
to		120.0		0.0	0.0				
X64	15.97	0.0858		10.000	0.858		Vel =	5.93	
X64 to D2									
X64	16.72	1.049	T	5.0	0.750	8.950			
to		120.0		0.0	5.000	0.0			
D2	32.69	0.3230		5.750	1.857		Vel =	12.14	
	0.0								
	32.69				10.807		K Factor =	9.94	
* X65 to X66									
X65	14.95	1.049		4.000	6.956				
to		120.0		0.0	0.0				
X66	14.95	0.0760		4.000	0.304		Vel =	5.55	
X66 to X67									
X66	14.82	1.049		6.000	7.260				
to		120.0		0.0	0.0				
X67	29.77	0.2717		6.000	1.630		Vel =	11.05	
X67 to D3									
X67	16.66	1.049	T	5.0	0.750	8.890			
to		120.0		0.0	5.000	0.0			
D3	46.43	0.6181		5.750	3.554		Vel =	17.24	
	0.0								
	46.43				12.444		K Factor =	13.16	
*MAINS									
D1 to D2									
D1	30.68	1.61		8.500	10.504				
to		120.0		0.0	0.0				
D2	30.68	0.0356		8.500	0.303		Vel =	4.83	
D2 to D3									
D2	32.69	1.61		12.000	10.807				
to		120.0		0.0	0.0				
D3	63.37	0.1364		12.000	1.637		Vel =	9.99	
D3 to PA									
D3	46.43	1.61	5lx	11.5	68.750	12.444			
to		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									
PA	0.0	1.61	4lx	9.2	56.125	57.927			
to		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									
BLK4	0.0	1.682		0.0	8.667	81.686			
to		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									
A1	109.80	3.26		0.790	84.327				
to		120.0		0.0	0.0				
A2	109.8	0.0127		0.790	0.010		Vel =	4.22	
A2 to A3									
A2	0.0	3.26		8.900	84.337				
to		120.0		0.0	0.0				
A3	109.8	0.0121		8.900	0.108		Vel =	4.22	

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	*****
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 3I	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	4I 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	2I	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

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 0.0				86.825			K Factor = 0	
*									
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	87.647 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	87.647 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	87.647 0.0 0.0	0.0 0.0 0.0		Vel = 0	
B4 to B5	0.0 0.0	3.26 120.0 0.0	0.0 0.0 0.0	6.130 0.0 6.130	87.647 0.0 0.0	0.0 0.0 0.0		Vel = 0	
B5 to B6	0.0 0.0	3.26 120.0 0.0	0.0 0.0 0.0	3.160 0.0 3.160	87.647 0.0 0.0	0.0 0.0 0.0		Vel = 0	
B6 to B7	109.80 109.8	3.26 120.0 0.0119	0.0 0.0 0.0	1.340 0.0 1.340	87.647 0.0 0.016			Vel = 4.22	
B7 to B8	0.0 109.8	3.26 120.0 0.0122	0.0 0.0 0.0	8.100 0.0 8.100	87.663 0.0 0.099			Vel = 4.22	
B8 to B9	0.0 109.8	3.26 120.0 0.0121	0.0 0.0 0.0	2.560 0.0 2.560	87.762 0.0 0.031			Vel = 4.22	
B9 to B10	0.0 109.8	3.26 120.0 0.0121	0.0 0.0 0.0	58.497 0.0 58.497	87.793 0.0 0.710			Vel = 4.22	
B10 to B11	0.0 109.8	3.26 120.0 0.0122	2I 13.44 0.0	37.083 13.440 50.523	88.503 0.0 0.614			Vel = 4.22	
B11 to SYS1	0.0 109.8	3.26 120.0 0.0121	I 6.72 T 20.159 B 6.72 C 13.44	9.390 47.039 56.429	89.117 0.0 0.685			Vel = 4.22	
	0.0 109.80				89.802			K Factor = 11.59	
*									
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	83.674 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	86.814 2.328 0.0	0.0 0.0 0.0		Vel = 0	

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 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	25.147 6.287 10.059	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 BYPS	0.0 159.8	8.249 120.0 0.0003	Ix	15.386 0.0 0.0	8.292 15.386 23.678	84.518 -2.869 0.006			Vel = 0.96	
BYPS 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 Ix	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

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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



NOV 03 2016

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

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

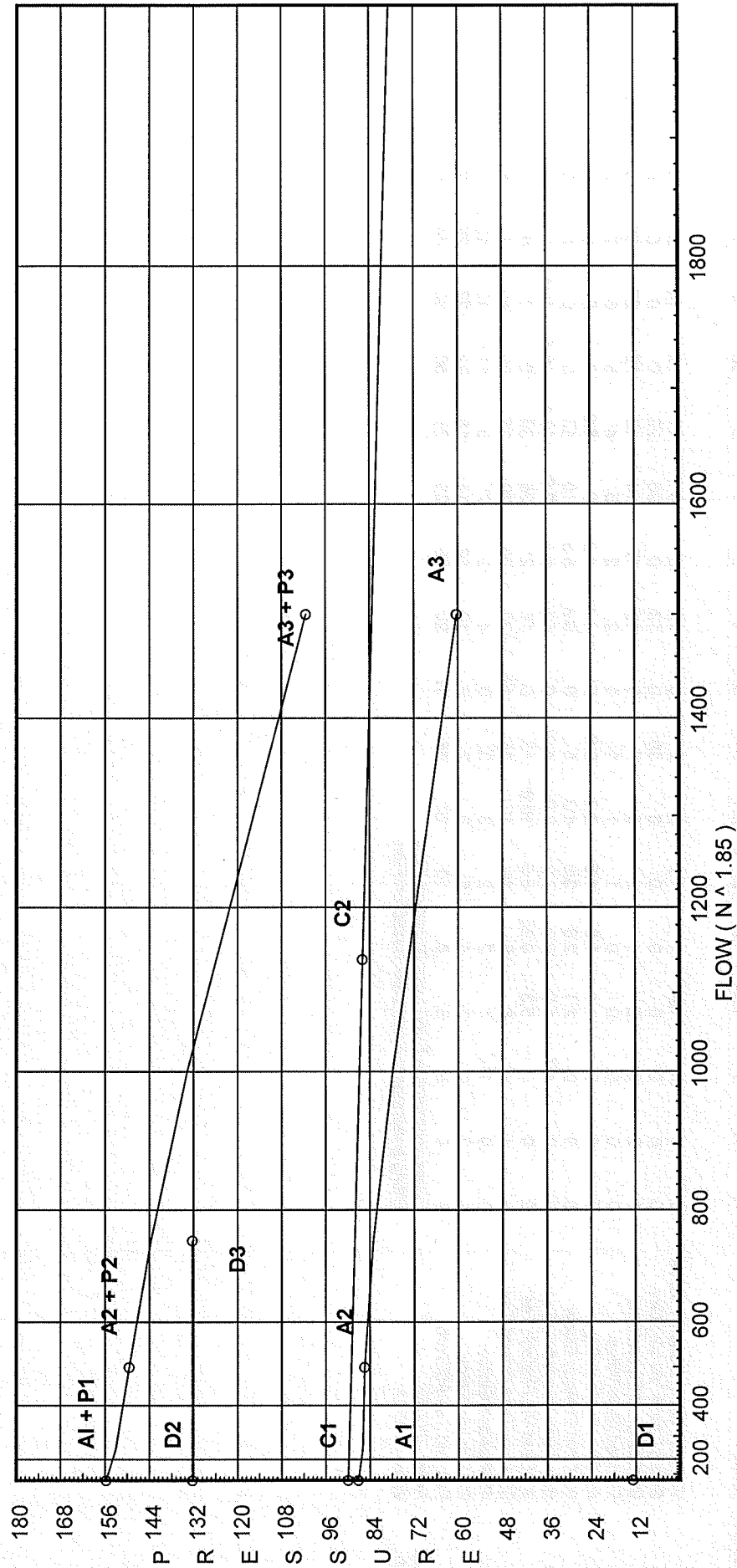
Pump Data:

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 : 132.298
D2 - System Pressure : 750
D3 - System Demand : 750
Safety Margin : 11.270



Fittings Used Summary

Ahern Fire Protection
46125901 Webster ISB - Standpipes

Fitting Legend		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
Abbrev.	Name																				
B	Victaulic Grnd. 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' Grnd 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' Grnd 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' Grnd 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
Length Units
Flow Units
Pressure Units

Inches
Feet
US Gallons per Minute
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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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	*****
*										
HF14	250.00	2.469	T	12.0	0.500	105.858			Qa = 250	
to		120.0		0.0	12.000	0.0				
HV14	250.0	0.2154		0.0	12.500	2.692			Vel = 16.75	
	0.0									
	250.00					108.550			K Factor = 24.00	
HF13	0.0	2.469	T	12.0	0.500	115.732	0.0			
to		120.0		0.0	12.000	0.0	0.0			
HV13	0.0	0.0		0.0	12.500	0.0	0.0		Vel = 0	
	0.0									
	0.0					115.732			K Factor = 0	
*										
HF24	250.00	2.469	E	6.0	1.833	100.000			Qa = 250	
to		120.0	T	12.0	18.000	0.0				
HV24	250.0	0.2154		0.0	19.833	4.272			Vel = 16.75	
	0.0									
	250.00					104.272			K Factor = 24.48	
HF23	250.00	2.469	E	6.0	2.084	107.158			Qa = 250	
to		120.0	T	12.0	18.000	0.0				
HV23	250.0	0.2154		0.0	20.084	4.326			Vel = 16.75	
	0.0									
	250.00					111.484			K Factor = 23.68	
*										
HV24	250.00	4.26	2I	17.907	19.832	104.272				
to		120.0		0.0	17.907	6.641				
HV23	250.0	0.0151		0.0	37.739	0.571			Vel = 5.63	
HV23	250.00	4.26	2I	17.907	19.500	111.484				
to		120.0		0.0	17.907	6.641				
HV22	500.0	0.0545		0.0	37.407	2.039			Vel = 11.25	
HV22	0.0	4.26	I	8.954	7.666	120.164				
to		120.0		0.0	8.954	2.959				
BLK4	500.0	0.0545		0.0	16.620	0.906			Vel = 11.25	
	0.0									
	500.00					124.029			K Factor = 44.90	
HV21	0.0	2.469	T	12.0	7.167	127.134	0.0			
to		120.0	B	5.0	17.000	-3.104	0.0			
BLK4	0.0	0.0		0.0	24.167	0.0	0.0		Vel = 0	
BLK4	500.00	6.357	3I	37.72	22.334	124.029				
to		120.0		0.0	37.720	-0.613				
BLK3	500.0	0.0078		0.0	60.054	0.466			Vel = 5.05	
BLK3	0.0	6.357	J	31.433	171.916	123.882				
to		120.0	H	6.287	50.293	-0.253				
BLK2	500.0	0.0078	I	12.573	222.209	1.725			Vel = 5.05	
	0.0									
	500.00					125.354			K Factor = 44.66	
*										
HV14	250.00	4.26	2I	17.907	10.580	108.550				
to		120.0		0.0	17.907	3.501				
SYS3	250.0	0.0151		0.0	28.487	0.431			Vel = 5.63	

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	*****
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 BYPS	0.0 750.0	8.249 120.0 0.0046	Ix	15.386 0.0 0.0	8.292 15.386 23.678	83.068 -2.869 0.109				
								Vel =	4.50	
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	

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	*****
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	

Shop Drawing Submittal Review

Transmitted To: Cannon Design

Date: November 28, 2016

Attention: stl-cac@cannondesign.com

Contact Person / WTA Field Inspector:
Patrick Garner

Project Name: Webster University-**ISB**

Reviewed by: Mike Whitworth (WES)

Project No. WT 14127.01
WES 607

☐ UPS

☐ Courier

☒ **Email**

Copies	No.	Description
1 PDF	211316F02	(Submittal No.'s)
		(Cannon #211316-002) - (Paric #15051-0311) - (WES #607)
		➤ Fire Protection Calcs

***Remarks: See Submittal Review from Webb Engineering.**

c: **Kelvin Patel**
Kpatel@cannondesign.com

☒ ***Reviewed**

☐ *No Exceptions Taken

☐

☐ *Make Corrections As Noted,
No Resubmittal Required

Corrections or comments made on shop drawings during this review do not relieve contractor from compliance with requirements of drawings and specifications. This check is only for review of general conformance with the design concept of project and general compliance with information given in contract documents. Contractor is responsible for: confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades; and performing his work in a safe and satisfactory manner.



1400 S. 3rd Street, Suite 201
St. Louis, Missouri 63104
Phone: (314) 588-0600
Fax: (314) 588-0604

Letter of Transmittal

To: **wtashop@wmtao.com**

From: **Mike Whitworth**

Date: **November 22, 2016**

Re: **Webster University ISB**

WES No: **607**

☐ For your Files

☐ For Review

☐ Please Comment

☐ Please Reply

Item No.	Description	No. of Copies	Date
1	Shop Drawing Review – (21 1316-002) 211316 Dry-Pipe Pre-Action Sprinkler Systems Hydraulic Calculations for: Level 0 (RA-3), Level 01 (RA-1), Level 01 (RA-2), Level 04 (RA-1), Level 04 (RA-2), Pre-Action Calculations, Standpipe Calculations,	1	11-22-2016

•Signature: Mike Whitworth



**WEBB
ENGINEERING
SERVICES INC.**

www.webb-engineering.com

The review of this submittal is limited to the general conformance with the designated design concept and intent of this project and with the general compliance of the information provided in the contract documents. All comments, remarks and notations made on the submittal(s) as a result of this review do not relieve the contractor from full compliance with requirements of the contract documents. Approval for a specific item shall not include approval of an assembly of which the item is not a component. The contractor is solely responsible for rough-in and installation confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordination of this work with that of other trades on this project; and in a safe and satisfactory manner. All work shall be installed in full compliance with the manufacturer's recommendation, Federal, State and Local rules and regulation and the Authority Having Jurisdiction (AHJ) and applicable adopted codes and standards.

PROJECT NAME: Webster
University ISB
LOCATION: St. Louis
Missouri
CLIENT PROJ. NO.: N/A
WES PROJ. NO.: 607
SPECIFICATION SECTION: 211316
Dry-Pipe Pre-
Action Sprinkler
Systems
SUBMITTAL ITEM: See Below -

CONTRACTOR: J.F. Ahern Co.
CTR. SUBMITTAL #: 21 1316-002
SUBMITTAL DATE: November 09, 2016
DATE RECEIVED: November 11, 2016
RECEIVED VIA: E-Mail
RECEIVED FROM: WTA
DATE RETURNED: NOVEMBER 22, 2016
RETURNED VIA: E-MAIL
RETRURNED TO: WTASHOP@WMTAO.COM

STATUS KEY:

NO EXCEPTION TAKEN						
NEC	MCN	AAR	REJ	REV	MAKE CORRECTIONS NOTED, NO RESUBMITTAL:	
					AMEND AND RESUBMIT	
					REJECTED, SEE REMARKS:	
					REVIEWED ONLY	
					ITEM	REMARKS
Hydraulic Calculations for -						
				X	Level 01 – Remote Area 1	
				X	Level 01 – Remote Area 2	1. Page 5 - Verify velocity of 28.53, between nodes B9 and B10 is acceptable. Also refer to pages 10 and 11.
				X	Level 04 – Remote Area 1	1. Page 4 - Verify velocity of 28.16, between nodes X5 and A1 is acceptable. Also refer to page 6
				X	Level 04 – Remote Area 2	1. Page 4 - Verify velocity of 32.12, between nodes X24 and B1 is acceptable. Also refer to page 6.
				X	Basement – Remote Area 3	1. Page 5 - Verify velocity of 27.92, between nodes D4 and D5 is acceptable. Also refer to page 10.
				X	Pre-Actions Calculations	
				X	Standpipe Calculations	

REVIEWED BY: Michael R. Whitworth DATE: November 22, 2016

THESE COMMENTS ARE TO BE ATTACHED TO ALL COPIES OF THE SHOP DRAWING REFERENCED ABOVE.

SUBMITTAL IDENTIFICATION SHEET

To be completed by Contractor/CM

PROJECT NAME	
ADDRESS	
NUMBER	
OWNER	
ARCHITECT / ENGINEER	
SUBMITTED BY	
CONTRACTOR / CM SUBMITTAL NO.	CANNON DESIGN SUBMITTAL NO.
DRAWING / DETAIL REFERENCE	SPECIFICATION SECTION / PARAGRAPH
MANUFACTURER / SUPPLIER	ITEM / PRODUCT ID
REQUIRED DATE	PRIORITY
CRITICAL	☐

To be completed by Reviewer

CANNON DESIGN SUBMITTAL NUMBER
RECEIVED DATE

- ☐ **A. No Exceptions Taken**
No further review of submittal is required.
- ☐ **B. Make Corrections Noted**
Incorporate corrections in work;
resubmission is not required.
- ☐ **C. Revise and Resubmit**
Revise as noted, and resubmit for review.
- ☐ **D. Rejected**
Submittal is not in compliance with Contract Documents;
provide new submittal.
- ☐ **E. For Record / Information Only**
Submittal was reviewed for Record / Information
purposes only.
- ☐ **F. Not Required for Review**
Submittal is not required by Contract Documents
and has not been reviewed.

Review is for conformance with the design concept of this project and for general compliance with contract documents. Contractor is responsible for quantities, dimensions and compliance with contract documents and for information that pertains to fabrication processes, construction techniques and coordination of this work with all trades which will be affected thereby. This review is null and void if submittal deviates from contract documents and does not indicate or note deviations.

ITEM BEING SUBMITTED (check only one)

- ☐ Shop Drawings ☐ Certification / Qualifications ☐ Coordination Drawing
☐ Samples ☐ Record Documents ☐ Calculations
 (_____ copies) ☐ Product Data ☐ Schedules
☐ LEED Submittal ☐ O&M Manuals
☐ Other _____

ITEM BEING SUBMITTED FOR (check only one)

- ☐ Action ☐ Information Only ☐ Record

REMARKS OR DEVIATIONS

CONTRACTOR / CM CERTIFICATION
(SUBMITTALS NOT CERTIFIED WILL BE RETURNED WITHOUT REVIEW)



PARIC CORPORATION
SUBMITTAL STAMP

THIS SHOP DRAWING HAS BEEN REVIEWED BY PARIC CORPORATION

Subcontractor remains responsible for dimensions, quantities, coordination with other trades and compliance with contract documents.

Ry:

Devin D. Gates

REVIEWED BY	DATE

A/E COMMENTS

- ☐
- See attached sheet(s) for additional comments

REVIEWED BY	DATE



77 Westport Plaza
Suite 250
St. Louis, MO 63146

TRANSMITTAL

No. 15051-0311

Paric Corporation

PROJECT: 15051-Webster University Interdisciplinary Science Building

DATE: 11/09/2016

TO: Cannon Design
1100 Clark Ave
St Louis MO 63102

RE: Fire Protection Calculations

ATTN: Kelvin Patel

JOB: 15051

WE ARE SENDING:		SUBMITTED FOR:	ACTION TAKEN:
☐ Shop Drawings		☒ Approval	☐ Approved as Submitted
☐ Letter		☐ Your Use	☐ Approved as Noted
☐ Prints		☐ As Requested	☐ Returned After Loan
☐ Change Order		☐ Review and Comment	☐ Resubmit
☐ Plans			☐ Submit
☐ Samples		SENT VIA:	☐ Returned
☐ Specifications		☐ Attached	☐ Returned for Corrections
☒ Other: Calculations		☐ Separate Cover Via:	☐ Due Date:

<i>Item</i>	<i>Package</i>	<i>Code</i>	<i>Rev.</i>	<i>Copies</i>	<i>Date</i>	<i>Description</i>	<i>Status</i>
Submittal		211316-002	1		11/09/2016	Fire Protection Calculations	Submitted

NOTES:

CC:

Signed: _____
Devin Gates