

. . . Fire Protection by Computer Design

EASTERN FIRE PROTECTION
170 KITTY HAWK AVE.
AUBURN/LEWISTON IND. PARK
AUBURN, MAINE
207-784-1507

Job Name : CUMBERLAND COUNTY CIVIC CENTER EVENT LEVEL D STORAGE
Drawing : 2 OF52
Location : PORTLAND, MAINE
Remote Area : 2
Contract : 4949
Data File : 3-4949 PHASE II.WXF

HYDRAULIC CALCULATIONS
for

Project name: CUMBERLAND COUNTY CIVIC CENTER EVENT LEVEL D STORAGE

Location: PORTLAND, MAINE

Drawing no: 2 OF52

Date: 4/21/13

Design

Remote area number: 2

Remote area location: 2

Occupancy classification: ORDINARY HAZARD I

Density: .15 - Gpm/SqFt

Area of application: 1100 - SqFt

Coverage per sprinkler: 110/120 - SqFt

Type of sprinklers calculated: 5.6K 200DEG. BRASS UPRIGHTS

No. of sprinklers calculated: 11

In-rack demand: - GPM

Hose streams: 250 - GPM

Total water required (including hose streams): 528.14 - GPM @ 147.22 - Psi

Type of system: WET

Volume of dry or preaction system: - Gal

Water supply information

Date: 9/20/2010

Location: FREE ST PORTLAND, ME

Source: FIRE SPEC. INC.

Name of contractor: EASTERN FIRE PROTECTION

Address: 170 KITTY HAWK AVE. / AUBURN/LEWISTON IND. PARK / AUBURN, MA

Phone number: 207-784-1507

Name of designer: JWD

Authority having jurisdiction: SFMO, PORTLAND FIRE DEPT.

Notes: (Include peaking information or gridded systems here.) HYDRAULICALLY REMOTE

AREA REVISED PER NFPA#13 2010 ED. SEC.11.2.3.2.3.1

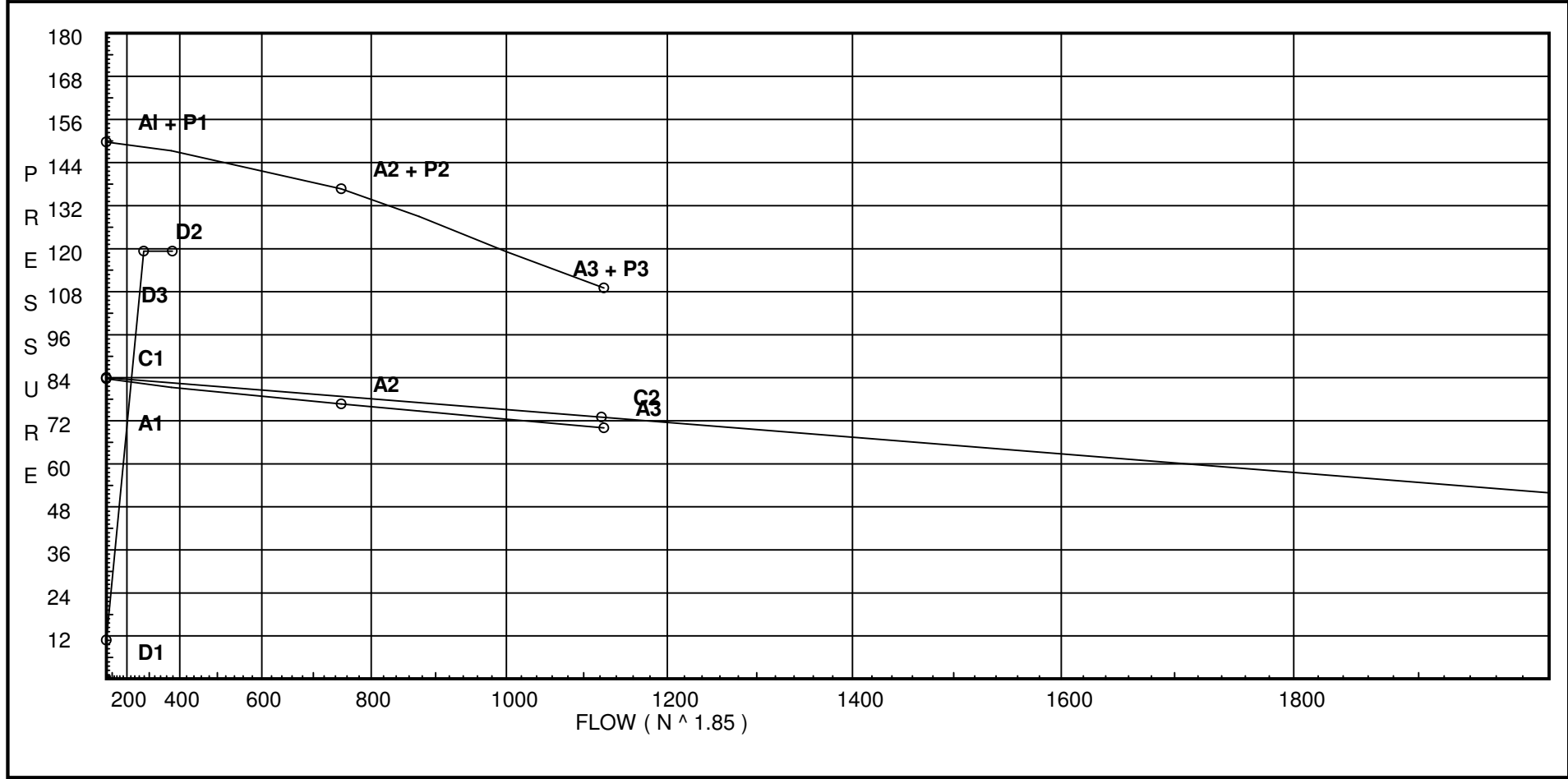
TOTAL SYSTEM DEMAND INDICATED AT PUMP OUTLET (PO)

Water Supply Curve (C)

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City Water Supply: C1 - Static Pressure : 84 C2 - Residual Pressure: 73 C2 - Residual Flow : 1122 City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow A1 - Adjusted Static: 83.734 A2 - Adj Resid : 76.68 @ 750 A3 - Adj Resid : 70.056 @ 1125	Pump Data: P1 - Pump Churn Pressure : 66 P2 - Pump Rated Pressure : 60 P2 - Pump Rated Flow : 750 P3 - Pump Pressure @ Max Flow : 39 P3 - Pump Max Flow : 1125 City Residual Flow @ 0 = 3366.89 City Residual Flow @ 20 = 2906.64 City Water @ 150% of Pump = 72.95	Demand: D1 - Elevation : 10.884 D2 - System Flow : 278.141 D2 - System Pressure : 119.336 Hose (Demand) : 100 D3 - System Demand : 378.141 Hose (Adj City) : 150 Safety Margin : 27.888
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Fittings Used Summary

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Fitting Legend

Abbrev.	Name	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	3 1/2	4	5	6	8	10	12	14	16	18	20	24	
A	Alarm Rel E1 & E3							7.7	21.5		17		27	29								
B	NFPA 13 Butterfly Valve	0	0	0	0	0	6	7	10	0	12	9	10	12	19	21	0	0	0	0	0	0
E	NFPA 13 90' Standard Elbow	1	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61	
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																				
G	NFPA 13 Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13	
L	NFPA 13 Long Turn Elbow	0.5	1	2	2	2	3	4	5	5	6	8	9	13	16	18	24	27	30	34	40	
S	NFPA 13 Swing Check	0	0	5	7	9	11	14	16	19	22	27	32	45	55	65						
T	NFPA 13 90' Flow thru Tee	3	4	5	6	8	10	12	15	17	20	25	30	35	50	60	71	81	91	101	121	

Units Summary

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

Note: Fitting Legend provides equivalent pipe lengths for fittings types of various diameters. Equivalent lengths shown are standard for actual diameters of Sched 40 pipe and CFactors of 120 except as noted with *. The fittings marked with a * show equivalent lengths values supplied by manufacturers based on specific pipe diameters and CFactors and they require no adjustment. All values for fittings not marked with a * will be adjusted in the calculation for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

SUPPLY ANALYSIS

Node at Source	Static Pressure	Residual Pressure	Flow	Available Pressure	Total Demand	Required Pressure
PO	See Information on Pump Curve				378.14	119.336
TEST	84.0	73	1122.0	81.271	528.14	81.271

NODE ANALYSIS

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node	Notes
DROP	0.0	5.6	7.0	14.82	
DR	0.0	5.6	7.0	14.82	
DR3	0.0	5.6	7.0	14.82	
DR4	0.0	5.6	11.21	18.75	
DR5	0.0	5.6	7.18	15.0	
101	76.96	5.6	36.17	33.68	
102	76.96	5.6	36.99	34.06	
104	76.96	5.6	38.43	34.71	
103	76.96		40.78		
105	76.96		54.89		
114	76.96	5.6	15.71	22.2	
108	76.96	5.6	7.18	15.0	
109	76.96	5.6	7.53	15.37	
110	76.96		8.09		
111	76.96	5.6	11.89	19.31	
112	76.96		12.74		
113	76.96	5.6	14.17	21.08	
115	76.96	5.6	17.42	23.37	
116	76.96		17.92		
117	76.96	5.6	25.32	28.18	
118	76.96	5.6	31.02	31.19	
119	74.21		66.4		
120	74.21		67.36		
DD	74.21		81.49		
DE	74.21		98.59		
DF	74.21		101.34		
DG	74.21		102.31		
DH	74.21		103.5		
K	59.83		110.95		
RT	59.83		115.45		
RB	59.83		115.46		
L	51.83		119.15	100.0	
PO	51.83		119.34		
PI	51.83		81.27		
TEST	51.83		81.27	150.0	

Final Calculations - Hazen-Williams - 2007

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv.	Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
DROP to LINE	0 0	5.60	14.82 14.82	1 1.049	1E 1T	2.0 5.0 0.0	2.000 7.000 9.000	120	7.000 0.0		Vel = 5.50	
LINE			0.0 14.82						7.672		K Factor = 5.35	
DR to LN2	0 0	5.60	14.82 14.82	1 1.049	1T	5.0 0.0 0.0	68.000 5.000 73.000	120	7.000 0.0		Vel = 5.50	
LN2			0.0 14.82						12.453		K Factor = 4.20	
DR3 to LN3	0 0	5.60	14.82 14.82	1 1.049	1T	5.0 0.0 0.0	68.000 5.000 73.000	120	7.000 0.0		Vel = 5.50	
LN3			0.0 14.82						12.453		K Factor = 4.20	
DR4 to LN4	0 0	5.60	18.75 18.75	1 1.049	1T	5.0 0.0 0.0	68.000 5.000 73.000	120	11.210 0.0		Vel = 6.96	
LN4			0.0 18.75						19.641		K Factor = 4.23	
DR5 to LN5	0 0	5.60	15.00 15.00	1 1.049	1T	5.0 0.0 0.0	68.000 5.000 73.000	120	7.175 0.0		Vel = 5.57	
LN5			0.0 15.00						12.754		K Factor = 4.20	
101 to 102	76.960 76.960	5.60	33.68 33.68	1.25 1.38		0.0 0.0 0.0	9.170 0.0 9.170	120	36.166 0.0		Vel = 7.22	
102 to 103	76.960 76.960	5.60	34.06 67.74	1.25 1.38	1T	6.0 0.0 0.0	5.580 6.000 11.580	120	36.989 0.0		Vel = 14.53	
103			0.0 67.74						40.775		K Factor = 10.61	
104 to 103	76.960 76.960	5.60	34.72 34.72	1 1.049	1T	5.0 0.0 0.0	1.500 5.000 6.500	120	38.428 0.0		Vel = 12.89	
103 to 105	76.960 76.960		67.73 102.45	1.25 1.38	1E	3.0 0.0 0.0	17.080 3.000 20.080	120	40.775 0.0		Vel = 21.98	
105 to 120	76.960 74.210		0.0 102.45	1.5 1.61	2E 1T	8.0 8.0 0.0	18.000 16.000 34.000	120	54.889 1.191		Vel = 16.15	
120			0.0 102.45						67.361		K Factor = 12.48	
114 to 116	76.960 76.960	5.60	22.20 22.2	1 1.049	1T	5.0 0.0 0.0	9.000 5.000 14.000	120	15.709 0.0		Vel = 8.24	

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv.	Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
116			0.0 22.20						17.918		K Factor = 5.24	
108 to 110	76.960 76.960	5.60	15.00	1	1T	5.0	7.000 5.000	120	7.175 0.0			Vel = 5.57
110			0.0 15.00						8.092		K Factor = 5.27	
109 to 110	76.960 76.960	5.60	15.37	1	1T	5.0	2.040 5.000	120	7.529 0.0			Vel = 5.71
110 to 112	76.960 76.960		15.00	1	1T	5.0	11.500 5.000	120	8.092 0.0			Vel = 11.27
112			0.0 30.37						12.741		K Factor = 8.51	
111 to 112	76.960 76.960	5.60	19.31	1		0.0	7.000 0.0	120	11.888 0.0			Vel = 7.17
112 to 113	76.960 76.960		30.36	1		0.0	2.040 0.0	120	12.741 0.0			Vel = 18.44
113 to 115	76.960 76.960	5.60	21.08	1.25		0.0	9.170 0.0	120	14.170 0.0			Vel = 15.18
115 to 116	76.960 76.960	5.60	23.38	1.25		0.0	0.830 0.0	120	17.420 0.0			Vel = 20.19
116 to 117	76.960 76.960		94.13	1.38		0.0	0.830	0.6000	0.498			Vel = 24.95
116 to 117	76.960 76.960		22.19	1.25		0.0	8.330 0.0	120	17.918 0.0			Vel = 24.95
117 to 118	76.960 76.960	5.60	28.18	1.5		0.0	9.080 0.0	120	25.324 0.0			Vel = 22.77
118 to 119	76.960 74.210	5.60	144.5	1.61		0.0	9.080	0.6269	5.692			Vel = 27.69
118 to 119	76.960 74.210	5.60	31.19	1.5	2E 1T	8.0	22.000 16.000	120	31.016 1.191			Vel = 27.69
119 to 120	74.210 74.210		175.69	1.61		0.0	38.000	0.8999	34.196			Vel = 15.43
119 to 120	74.210 74.210		0.0	2		0.0	4.420 0.0	120	66.403 0.0			Vel = 15.43
120 to DD	74.210 74.210		175.69	2.157		0.0	4.420	0.2167	0.958			Vel = 24.42
120 to DD	74.210 74.210		102.45	2	1T	12.307	15.580 12.307	120	67.361 0.0			Vel = 24.42
DD to DE	74.210 74.210		278.14	2.157		0.0	27.887	0.5066	14.128			Vel = 10.69
DD to DE	74.210 74.210		0.0	3	14L 1T	94.077	138.000 114.236	120	81.489 0.0			Vel = 10.69
DE to DF	74.210 74.210		278.14	3.26		0.0	252.236	0.0678	17.099			Vel = 6.26
DE to DF	74.210 74.210		0.0	4	2L 2T	15.8	81.000 52.668	120	98.588 0.0			Vel = 6.26
DF			278.14	4.26		0.0	149.468	0.0184	2.754			Vel = 6.26

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Node1 to Node2	Elev1 Elev2	K Fact	Qa Qt	Nom Act	Fitting or Eqv. Ln.	Pipe Ftng's Total	CFact Pf/Ft	Pt Pe Pf	*****	Notes	*****
DF to DG	74.210 74.210		0.0 278.14	4 4.26	1T 26.334	26.000 0.0 26.334	120 0.0184	101.342 0.0 0.964		Vel = 6.26	
DG to DH	74.210 74.210		0.0 278.14	4 4.26	1L 1T 7.9 26.334	30.500 34.234 64.734	120 0.0184	102.306 0.0 1.192		Vel = 6.26	
DH to K	74.210 59.830		0.0 278.14	4 4.26	4L 1T 31.601 26.334	8.250 57.935 66.185	120 0.0184	103.498 6.228 1.220		Vel = 6.26	
K to RT	59.830 59.830		0.0 278.14	4 4.26	1A 1G 1B 1L 1T 1Fsp 22.384 2.633 15.8 7.9 26.334 0.0	6.580 75.051 81.631	120 0.0184	110.946 3.000 1.503		* Fixed loss = 3 Vel = 6.26	
RT to RB	59.830 59.830		0.0 278.14	6 6.357		0.0 0.0 4.000	120 0.0028	115.449 0.0 0.011		Vel = 2.81	
RB to L	59.830 51.830		0.0 278.14	6 6.357	3L 1T 33.948 37.72	14.000 71.668 85.668	120 0.0026	115.460 3.465 0.224		Vel = 2.81	
L to PO	51.830 51.830	H100	100.00 378.14	8 8.249	3G 1S 1T 14.094 52.853 41.108	5.000 138.592 143.592	120 0.0013	119.149 0.0 0.187		Vel = 2.27	
PO			0.0 378.14					119.336		K Factor = 34.62	
System Demand Pressure								119.336			
Safety Margin								27.888			
Continuation Pressure								147.224			
Pressure @ Pump Outlet								147.224			
Pressure From Pump Curve								-65.954			
Pressure @ Pump Inlet								81.270			
PI to TEST	51.830 51.830		0.0 378.14	8 8.249		0.0 0.0 1.000	120 0.0010	81.270 0.0 0.001		Vel = 2.27	
TEST			150.00 528.14					81.271		Qa = 150.00 K Factor = 58.58	