



. . . 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 CONCOURSE LEVEL
Drawing : 1 OF 2
Location : PORTLAND, MAINE
Remote Area : 2
Contract : 4949
Data File : 2-4949.WXF

HYDRAULIC CALCULATIONS
for

Project name: CUMBERLAND COUNTY CIVIC CENTER CONCOURSE LEVEL
Location: PORTLAND, MAINE
Drawing no: 1 OF 2
Date: 12/6/12

Design

Remote area number: 2
Remote area location: 2
Occupancy classification: ORDINARY HAZARD
Density: .15 - Gpm/SqFt
Area of application: 1125 - SqFt
Coverage per sprinkler: 130/120 - SqFt
Type of sprinklers calculated: 5.6K 200DEG. RECESSED PENDENTS
No. of sprinklers calculated: 15
In-rack demand: - GPM
Hose streams: 250 - GPM
Total water required (including hose streams): 599.2 - GPM @ 133.9 - 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.

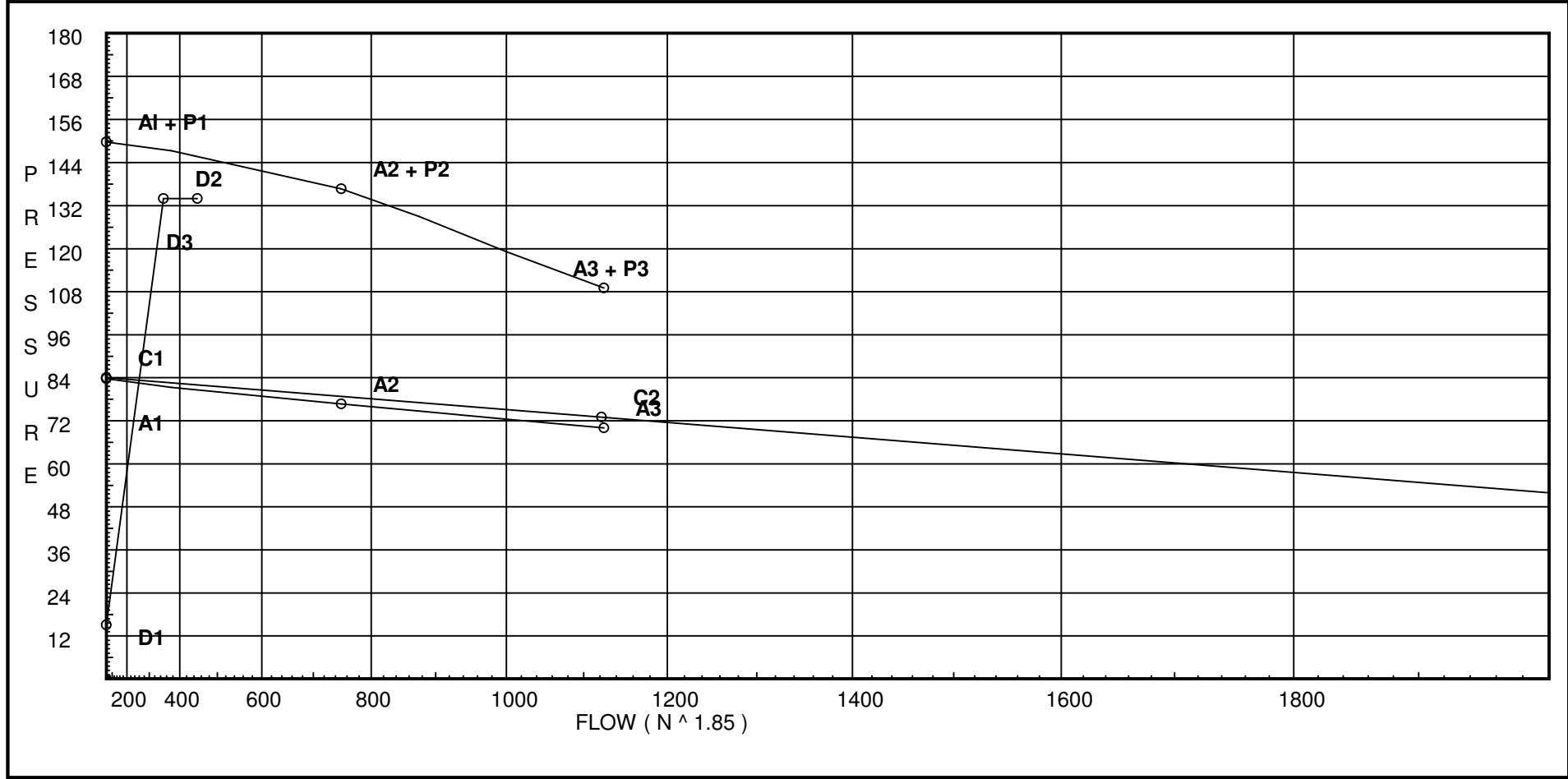
Name of contractor: EASTERN FIRE PROTECTION
Address: 170 KITTY HAWK AVE. / AUBURN/LEWISTON IND. PARK / AUBURN, MA
Phone number: 207-784-1507
Name of designer: JWD
Authority having jurisdiction: SFMO, PORTLAND FIRE DEPT.
Notes: (Include peaking information or gridded systems here.) HYDRAULICALLY REMOTE
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 : 15.089 D2 - System Flow : 349.206 D2 - System Pressure : 133.955 Hose (Demand) : 100 D3 - System Demand : 449.206 Hose (Adj City) : 150 Safety Margin : 11.674
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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	61
F	NFPA 13 45' Elbow	1	1	1	1	2	2	3	3	3	4	5	7	9	11	13	17	19	21	24	28	28
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	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	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	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				449.21	133.955
TEST	84.0	73	1122.0	80.553	599.21	80.553

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	
99	86.67	5.3	27.86	27.96	K=K @ LN2
100	86.67	5.3	27.89	27.98	K=K @ LN2
101	86.67		30.83		
101A	86.67	5.3	30.99	29.49	K=K @ LN2
102	86.67		38.02		
103	86.33	5.31	26.94	27.55	K=K @ LN4
104A	86.33	5.31	26.03	27.08	K=K @ LN4
104	86.33		27.95		
105	86.33		33.83		
106	86.67	5.3	8.48	15.43	K=K @ LN2
107	86.67	5.3	7.82	14.82	K=K @ LN2
108	86.67		8.53		
109	86.67	5.3	10.31	17.01	K=K @ LN2
110	85.0	5.3	14.5	20.17	K=K @ LN2
111	86.33	5.31	16.13	21.32	K=K @ LN4
112	86.33	5.31	20.59	24.08	K=K @ LN4
113	86.33		22.22		
116	85.0	5.3	13.45	19.43	K=K @ LN5
117	85.0	5.3	15.06	20.56	K=K @ LN2
118	85.0	5.3	21.49	24.56	K=K @ LN2
119	85.0		22.63		
114	85.0		35.75		
115	85.0	5.3	35.98	31.78	K=K @ LN2
120	85.83		45.41		
121	85.83		45.88		
122	85.83		46.67		
123	85.83		47.02		
124	85.83		53.04		
CT	85.83		55.1		
CW	85.83		57.86		
DB	85.83		66.2		
GA	85.83		70.11		
78	85.83		72.05		
DC	85.83		74.39		
GB	85.83		75.8		
GC	85.83		77.25		

NODE ANALYSIS (cont.)

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node	Notes
GD	85.83		77.35		
88	85.83		81.37		
DD	85.83		86.14		
DE	85.83		104.3		
DF	85.83		108.49		
GG	85.83		109.65		
DH	85.83		111.47		
K	85.83		113.32		
RT	85.83		118.62		
RB	85.83		118.63		
L	51.83		133.7	100.0	
PO	51.83		133.96		
PI	51.83		80.55		
TEST	51.83		80.55	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 0.672		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	2E 1T	4.0 5.0 0.0	2.000 9.000 11.000	120	7.000 0.0 0.822		Vel = 5.50	
LN2			0.0 14.82						7.822		K Factor = 5.30	
DR3 to LN3	0 0	5.60	14.82 14.82	1 1.049	2E 1T	4.0 5.0 0.0	2.000 9.000 11.000	120	7.000 0.0 0.822		Vel = 5.50	
LN3			0.0 14.82						7.822		K Factor = 5.30	
DR4 to LN4	0 0	5.60	18.75 18.75	1 1.049	2E 1T	4.0 5.0 0.0	2.000 9.000 11.000	120	11.210 0.0 1.271		Vel = 6.96	
LN4			0.0 18.75						12.481		K Factor = 5.31	
DR5 to LN5	0 0	5.60	15.00 15.0	1 1.049	2E 1T	4.0 5.0 0.0	2.000 9.000 11.000	120	7.175 0.0 0.840		Vel = 5.57	
LN5			0.0 15.00						8.015		K Factor = 5.30	
99 to 101	86.670 86.670	5.3	27.96 27.96	1 1.049	1T	5.0 0.0 0.0	7.290 5.000 12.290	120	27.860 0.0 2.973		K = K @ LN2 Vel = 10.38	
101			0.0 27.96						30.833		K Factor = 5.04	
100 to 101	86.670 86.670	5.3	27.98 27.98	1 1.049	1T	5.0 0.0 0.0	7.170 5.000 12.170	120	27.887 0.0 2.946		K = K @ LN2 Vel = 10.39	
101 to 101A	86.670 86.670		27.96 55.94	1.25 1.38		0.0 0.0 0.0	0.670 0.0 0.670	120	30.833 0.0 0.154		Vel = 12.00	
101A to 102	86.670 86.670	5.3	29.49 85.43	1.25 1.38		0.0 0.0 0.0	14.000 0.0 14.000	120	30.987 0.0 7.031		K = K @ LN2 Vel = 18.32	
102 to 122	86.670 85.830		0.0 85.43	1.25 1.38	1E 1T	3.0 6.0 0.0	7.500 9.000 16.500	120	38.018 0.364 8.287		Vel = 18.32	
122			0.0 85.43						46.669		K Factor = 12.51	
103 to 104	86.330 86.330	5.31	27.55 27.55	1 1.049		0.0 0.0 0.0	4.290 0.0 4.290	120	26.940 0.0 1.009		K = K @ LN4 Vel = 10.23	

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	*****
104			0.0 27.55						27.949		K Factor = 5.21	
104A to 104	86.330 86.330	5.31	27.08	1	1T	5.0	3.420 5.000	120	26.030 0.0		K = K @ LN4	
104 to 105	86.330 86.330		27.08	1.049		0.0	8.420	0.2279	1.919		Vel = 10.05	
104 to 105	86.330 86.330		27.54	1		0.0	7.040 0.0	120	27.949 0.0			
105 to 121	86.330 85.830		54.62	1.049		0.0	7.040	0.8349	5.878		Vel = 20.28	
105 to 121	86.330 85.830		0.0	1	1E 1T	2.0 5.0	7.170 7.000	120	33.827 0.217			
121			54.62	1.049		0.0	14.170	0.8349	11.831		Vel = 20.28	
121			0.0 54.62						45.875		K Factor = 8.06	
106 to 108	86.670 86.670	5.3	15.42	1		0.0	0.625 0.0	120	8.478 0.0		K = K @ LN2	
108			15.42	1.049		0.0	0.625	0.0800	0.050		Vel = 5.72	
108			0.0 15.42						8.528		K Factor = 5.28	
107 to 108	86.670 86.670	5.3	14.82	1	1T	5.0	4.460 5.000	120	7.822 0.0		K = K @ LN2	
108 to 109	86.670 86.670		14.82	1.049		0.0	9.460	0.0746	0.706		Vel = 5.50	
108 to 109	86.670 86.670		15.42	1		0.0	6.375 0.0	120	8.528 0.0			
109 to 110	86.670 85		30.24	1.049		0.0	6.375	0.2797	1.783		Vel = 11.23	
109 to 110	86.670 85	5.3	17.01	1		0.0	5.420 0.0	120	10.311 0.723		K = K @ LN2	
110 to 111	85 86.330		47.25	1.049		0.0	5.420	0.6386	3.461		Vel = 17.54	
110 to 111	85 86.330	5.3	20.17	1.25		0.0	6.830 0.0	120	14.495 -0.576		K = K @ LN2	
111 to 113	86.330 86.330		67.42	1.38		0.0	6.830	0.3242	2.214		Vel = 14.46	
111 to 113	86.330 86.330	5.31	21.32	1.25	2E	6.0	5.290 6.000	120	16.133 0.0		K = K @ LN4	
113			88.74	1.38		0.0	11.290	0.5388	6.083		Vel = 19.03	
113			0.0 88.74						22.216		K Factor = 18.83	
112 to 113	86.330 86.330	5.31	24.08	1	1T	5.0	3.875 5.000	120	20.588 0.0		K = K @ LN4	
113 to 114	86.330 85		24.08	1.049		0.0	8.875	0.1834	1.628		Vel = 8.94	
113 to 114	86.330 85		88.74	1.25	2E	6.0	9.420 6.000	120	22.216 0.576			
114			112.82	1.38		0.0	15.420	0.8402	12.956		Vel = 24.20	
114			0.0 112.82						35.748		K Factor = 18.87	
116 to 117	85 85	5.3	19.43	1		0.0	13.080 0.0	120	13.450 0.0		K = K @ LN5	
117 to 119	85 85		19.43	1.049		0.0	13.080	0.1234	1.614		Vel = 7.21	
117 to 119	85 85	5.3	20.56	1	1T	5.0	11.125 5.000	120	15.064 0.0		K = K @ LN2	
119			39.99	1.049		0.0	16.125	0.4690	7.562		Vel = 14.85	

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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	*****
			0.0 39.99					22.626		K Factor = 8.41	
118 to 119	85 85	5.3	24.56	1	1T 5.0	0.960 5.000	120	21.492 0.0		K = K @ LN2	
			24.56	1.049	0.0	5.960	0.1903	1.134		Vel = 9.12	
119 to 114	85 85		39.99	1	1T 5.0	6.540 5.000	120	22.626 0.0			
			64.55	1.049	0.0	11.540	1.1371	13.122		Vel = 23.96	
114 to 115	85 85		112.82	2	0.0	0.875 0.0	120	35.748 0.0			
			177.37	2.067	0.0	0.875	0.2709	0.237		Vel = 16.96	
115 to 120	85 85.830	5.3	31.78	2	1T 10.0	16.580 10.000	120	35.985 -0.359		K = K @ LN2	
			209.15	2.067	0.0	26.580	0.3679	9.780		Vel = 20.00	
120 to 121	85.830 85.830		0.0	3	0.0	11.710 0.0	120	45.406 0.0			
			209.15	3.26	0.0	11.710	0.0401	0.469		Vel = 8.04	
121 to 122	85.830 85.830		54.63	3	0.0	12.920 0.0	120	45.875 0.0			
			263.78	3.26	0.0	12.920	0.0615	0.794		Vel = 10.14	
122 to 123	85.830 85.830		85.43	3	0.0	3.375 0.0	120	46.669 0.0			
			349.21	3.26	0.0	3.375	0.1031	0.348		Vel = 13.42	
123 to 124	85.830 85.830		0.0	3	3L 20.159	38.125 20.159	120	47.017 0.0			
			349.21	3.26	0.0	58.284	0.1033	6.019		Vel = 13.42	
124 to CT	85.830 85.830		0.0	3	0.0	20.000 0.0	120	53.036 0.0			
			349.21	3.26	0.0	20.000	0.1033	2.066		Vel = 13.42	
CT to CW	85.830 85.830		0.0	3	0.0	26.670 0.0	120	55.102 0.0			
			349.21	3.26	0.0	26.670	0.1033	2.754		Vel = 13.42	
CW to DB	85.830 85.830		0.0	3	5L 1T 33.599 20.159	27.000 53.758	120	57.856 0.0			
			349.21	3.26	0.0	80.758	0.1033	8.340		Vel = 13.42	
DB to GA	85.830 85.830		0.0	3	4L 26.879	11.000 26.879	120	66.196 0.0			
			349.21	3.26	0.0	37.879	0.1033	3.912		Vel = 13.42	
GA to 78	85.830 85.830		0.0	3	2L 13.44	5.330 13.440	120	70.108 0.0			
			349.21	3.26	0.0	18.770	0.1033	1.939		Vel = 13.42	
78 to DC	85.830 85.830		0.0	3	1T 20.159	2.500 20.159	120	72.047 0.0			
			349.21	3.26	0.0	22.659	0.1033	2.340		Vel = 13.42	
DC to GB	85.830 85.830		0.0	3	1L 6.72	7.000 6.720	120	74.387 0.0			
			349.21	3.26	0.0	13.720	0.1033	1.417		Vel = 13.42	
GB to GC	85.830 85.830		0.0	3	0.0	14.000 0.0	120	75.804 0.0			
			349.21	3.26	0.0	14.000	0.1032	1.445		Vel = 13.42	

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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	*****
GC to GD	85.830 85.830		0.0 349.21	3 3.26		0.0 0.0 1.000	120 0.1040	77.249 0.0 0.104			Vel = 13.42
GD to 88	85.830 85.830		0.0 349.21	3 3.26	4L 26.879 0.0	12.000 26.879 38.879	120 0.1033	77.353 0.0 4.015			Vel = 13.42
88 to DD	85.830 85.830		0.0 349.21	3 3.26	2F 8.064 2L 13.44	24.750 21.504 46.254	120 0.1033	81.368 0.0 4.777			Vel = 13.42
DD to DE	85.830 85.830		0.0 349.21	3 3.26	2L 13.44 2T 40.319	122.000 53.759 175.759	120 0.1033	86.145 0.0 18.151			Vel = 13.42
DE to DF	85.830 85.830		0.0 349.21	4 4.26	2L 15.8 2T 52.668	81.000 68.468 149.468	120 0.0281	104.296 0.0 4.194			Vel = 7.86
DF to GG	85.830 85.830		0.0 349.21	4 4.26	1T 26.334 0.0	15.000 26.334 41.334	120 0.0281	108.490 0.0 1.160			Vel = 7.86
GG to DH	85.830 85.830		0.0 349.21	4 4.26	1L 7.9 1T 26.334	30.500 34.234 64.734	120 0.0281	109.650 0.0 1.817			Vel = 7.86
DH to K	85.830 85.830		0.0 349.21	4 4.26	4L 31.601 1T 26.334	8.250 57.935 66.185	120 0.0281	111.467 0.0 1.857			Vel = 7.86
K to RT	85.830 85.830		0.0 349.21	4 4.26	1A 22.384 1G 2.633 1B 15.8 1L 7.9 1T 26.334 1Fsp 0.0	6.580 75.051 81.631	120 0.0281	113.324 3.000 2.291		* Fixed loss = 3	Vel = 7.86
RT to RB	85.830 85.830		0.0 349.21	6 6.357		0.0 0.0 4.000	120 0.0040	118.615 0.0 0.016			Vel = 3.53
RB to L	85.830 51.830		0.0 349.21	6 6.357	3L 33.948 1T 37.72	14.000 71.668 85.668	120 0.0040	118.631 14.725 0.342			Vel = 3.53
L to PO	51.830 51.830	H100	100.00 449.21	8 8.249	3G 14.094 1S 52.853 2L 30.537 1T 41.108	5.000 138.592 143.592	120 0.0018	133.698 0.0 0.257			Vel = 2.70
PO			0.0 449.21					133.955		K Factor = 38.81	
System Demand Pressure								133.955			
Safety Margin								11.674			
Continuation Pressure								145.629			
Pressure @ Pump Outlet								145.629			
Pressure From Pump Curve								-65.078			
Pressure @ Pump Inlet								80.551			

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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	*****
PI to TEST	51.830 51.830		0.0 449.21	8 8.249	0.0 0.0	1.000 0.0	120 0.0020	80.551 0.0			
			150.00							Vel = 2.70	
TEST			599.21					80.553		Qa = 150.00 K Factor = 66.76	