

. . . 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 UPPER SUITES LEVEL
Drawing : 2 OF 2
Location : PORTLAND, MAINE
Remote Area : 3
Contract : 4949
Data File : 3-4949.WXF

HYDRAULIC CALCULATIONS
for

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

Design

Remote area number: 3
Remote area location: 3
Occupancy classification: LIGHT HAZARD
Density: .1 - Gpm/SqFt
Area of application: 1000 - SqFt
Coverage per sprinkler: 148/100 - SqFt
Type of sprinklers calculated: 5.6K 200DEG. RECESSED PENDENTS
No. of sprinklers calculated: 14
In-rack demand: - GPM
Hose streams: 100 - GPM
Total water required (including hose streams): 396.5 - GPM @ 127.4 - 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..

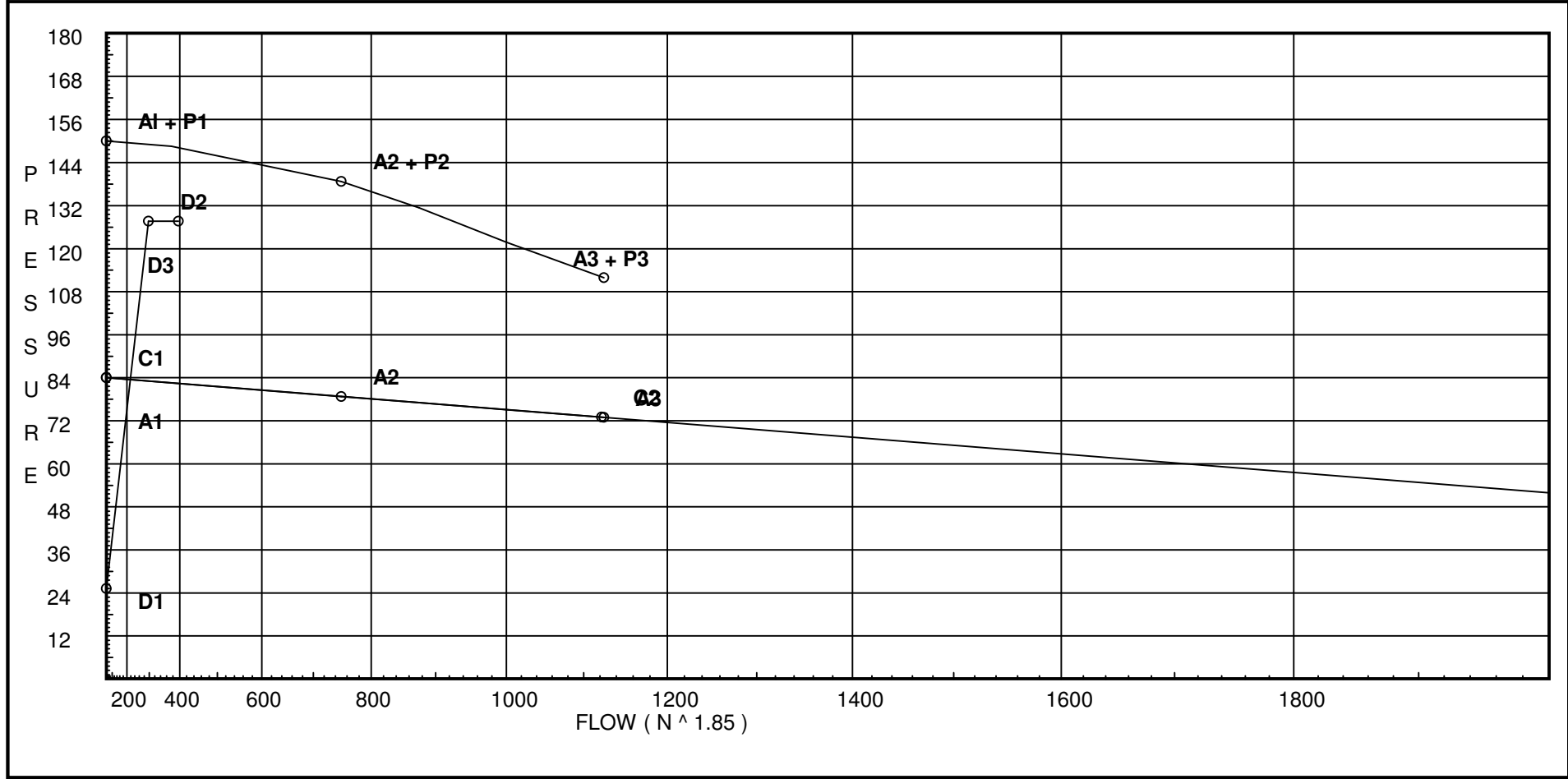
Name of contractor: EASTERN FIRE PROTECTION
Address: 170 KITTY HAWK AVE. / AUBURN/LEWISTON IND. PARK / AUBURN, MA
Phone number: 207-784-1507
Name of designer: JWD
Authority having jurisdiction: SFMO, PORTLAND FIRE DEPT.
Notes: (Include peaking information or gridded systems here.) HYDRAULICALLY REMOTE
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)

EASTERN FIRE PROTECTION
 CUMBERLAND COUNTY CIVIC CENTER UPPER SUITES LEVEL

Page 2
 Date

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: 84.000 A2 - Adj Resid : 78.774 @ 750 A3 - Adj Resid : 72.936 @ 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 : 25.211 D2 - System Flow : 296.551 D2 - System Pressure : 127.668 Hose (Demand) : 100 D3 - System Demand : 396.551 Safety Margin : 20.464
--	--	--



Fittings Used Summary

EASTERN FIRE PROTECTION
CUMBERLAND COUNTY CIVIC CENTER UPPER SUITES LEVEL

Page 3
Date

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	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				396.55	127.668
TEST	84.0	73	1122.0	82.394	396.55	82.394

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	
301	110.04	5.35	13.04	19.32	K=K @ LINE
302	110.375	5.3	13.58	19.52	K=K @ LN2
303	113.04	5.3	15.42	20.8	K=K @ LN2
304	111.04	5.3	16.78	21.7	K=K @ LN3
305	111.04		18.14		
306	113.04	5.3	19.49	23.39	K=K @ LN2
307	113.04	5.3	25.34	26.67	K=K @ LN2
308	110.04	5.35	7.67	14.82	K=K @ LINE
309	110.375	5.3	8.27	15.23	K=K @ LN2
310	113.04	5.3	9.18	16.05	K=K @ LN2
311	113.04	5.3	14.66	20.29	K=K @ LN2
312	113.04	5.3	18.44	22.75	K=K @ LN2
313	111.04	5.3	20.32	23.88	K=K @ LN3
315	111.04	5.3	22.68	25.23	K=K @ LN3
314	113.04		20.87		
316	113.04		23.92		
317	113.04	5.3	25.8	26.91	K=K @ LN2
318	113.04		36.2		
320	113.04		36.8		
319	113.04		37.24		
321	113.04		40.84		
322	113.04		42.48		
123	85.83		58.78		
124	85.83		63.22		
CT	85.83		64.75		
CW	85.83		66.79		
DB	85.83		72.95		
GA	85.83		75.84		
78	85.83		77.27		
DC	85.83		79.0		
GB	85.83		80.05		
GC	85.83		81.12		
GD	85.83		81.2		
88	85.83		84.16		
DD	85.83		87.69		
DE	85.83		101.11		
DF	85.83		104.21		
GG	85.83		105.06		

NODE ANALYSIS (cont.)

Node Tag	Elevation	Node Type	Pressure at Node	Discharge at Node	Notes
DH	85.83		106.41		
K	85.83		107.78		
RT	85.83		112.47		
RB	85.83		112.48		
L	51.83		127.46	100.0	
PO	51.83		127.67		
PI	51.83		82.39		
TEST	51.83		82.39		

Final Calculations - Hazen-Williams - 2007

EASTERN FIRE PROTECTION
 CUMBERLAND COUNTY CIVIC CENTER UPPER SUITES LEVEL

Page 6
 Date

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	
301 to 302	110.040 110.375	5.35	19.32 19.32	1 1.049		0.0 0.0 0.0	5.540 0.0 5.540	120	13.044 -0.145 0.676		K = K @ LINE Vel = 7.17	
302 to 303	110.375 113.040	5.3	19.52 38.84	1 1.049	1F	1.0 0.0	5.750 1.000 6.750	120	13.575 -1.154 2.998		K = K @ LN2 Vel = 14.42	
303 to 305	113.040 111.040	5.3	20.80 59.64	1.25 1.38		0.0 0.0 0.0	7.170 0.0 7.170	120	15.419 0.866 1.853		K = K @ LN2 Vel = 12.79	
305			0.0 59.64						18.138		K Factor = 14.00	
304 to 305	111.040 111.040	5.3	21.70 21.7	1 1.049	1T	5.0 0.0 0.0	4.000 5.000 9.000	120	16.776 0.0 1.362		K = K @ LN3 Vel = 8.06	
305 to 306	111.040 113.040		59.64 81.34	1.25 1.38		0.0 0.0 0.0	4.830 0.0 4.830	120	18.138 -0.866 2.215		Vel = 17.45	
306 to 307	113.040 113.040	5.3	23.38 104.72	1.25 1.38		0.0 0.0 0.0	8.000 0.0 8.000	120	19.487 0.0 5.856		K = K @ LN2 Vel = 22.46	
307 to 320	113.040 113.040	5.3	26.68 131.4	1.5 1.61	2E 1T	8.0 8.0 0.0	5.790 16.000 21.790	120	25.343 0.0 11.457		K = K @ LN2 Vel = 20.71	
320			0.0 131.40						36.800		K Factor = 21.66	
308 to 309	110.040 110.375	5.35	14.82 14.82	1 1.049	1E	2.0 0.0 0.0	7.920 2.000 9.920	120	7.672 -0.145 0.741		K = K @ LINE Vel = 5.50	
309 to 310	110.375 113.040	5.3	15.23 30.05	1 1.049	1F	1.0 0.0	6.460 1.000 7.460	120	8.268 -1.154 2.062		K = K @ LN2 Vel = 11.16	
310 to 311	113.040 113.040	5.3	16.05 46.1	1 1.049		0.0 0.0 0.0	9.000 0.0 9.000	120	9.176 0.0 5.489		K = K @ LN2 Vel = 17.11	

Final Calculations - Hazen-Williams - 2007

EASTERN FIRE PROTECTION
 CUMBERLAND COUNTY CIVIC CENTER UPPER SUITES LEVEL

Page 7
 Date

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	*****
311 to 312	113.040 113.040	5.3	20.28 66.38	1.25 1.38	0.0 0.0	12.000 0.0	120 0.3150	14.665 0.0		K = K @ LN2	
								3.780		Vel = 14.24	
312 to 314	113.040 113.040	5.3	22.76 89.14	1.25 1.38	0.0 0.0	4.460 0.0	120 0.5433	18.445 0.0		K = K @ LN2	
								2.423		Vel = 19.12	
314			0.0 89.14					20.868		K Factor = 19.51	
313 to 314	111.040 113.040	5.3	23.88 23.88	1 1.049	1T 0.0	5.0 5.000	120 0.1807	20.319 -0.866		K = K @ LN3	
								1.415		Vel = 8.86	
314			0.0 23.88					20.868		K Factor = 5.23	
315 to 316	111.040 113.040	5.3	25.23 25.23	1 1.049	1T 0.0	5.0 5.000	120 0.2000	22.681 -0.866		K = K @ LN3	
								2.108		Vel = 9.37	
316			0.0 25.23					23.923		K Factor = 5.16	
314 to 316	113.040 113.040		113.02 113.02	1.25 1.38	0.0 0.0	3.625 0.0	120 0.8428	20.868 0.0			
								3.055		Vel = 24.24	
316 to 317	113.040 113.040		25.23 138.25	1.5 1.61	0.0 0.0	3.250 0.0	120 0.5775	23.923 0.0			
								1.877		Vel = 21.79	
317 to 318	113.040 113.040	5.3	26.91 165.16	1.5 1.61	1T 0.0	8.0 12.960	120 0.8026	25.800 0.0		K = K @ LN2	
								10.402		Vel = 26.03	
318 to 319	113.040 113.040		0.0 165.16	3 3.26	2L 1T	13.44 20.159	120 0.0259	36.202 0.0			
								1.041		Vel = 6.35	
319			0.0 165.16					37.243		K Factor = 27.06	
320 to 319	113.040 113.040		131.40 131.4	3 3.26	1T 0.0	20.159 20.159	120 0.0169	36.800 0.0			
								0.443		Vel = 5.05	
319 to 321	113.040 113.040		165.15 296.55	3 3.26	2L 1T	13.44 20.159	120 0.0763	37.243 0.0			
								3.601		Vel = 11.40	
321 to 322	113.040 113.040		0.0 296.55	3 3.26	2L 0.0	13.44 13.440	120 0.0763	40.844 0.0			
								1.636		Vel = 11.40	
322 to 123	113.040 85.830		0.0 296.55	3 3.26	2L 1T	13.44 20.159	120 0.0763	42.480 11.785			
								4.511		Vel = 11.40	
123 to 124	85.830 85.830		0.0 296.55	3 3.26	3L 0.0	20.159 20.159	120 0.0763	58.776 0.0			
								4.448		Vel = 11.40	

Final Calculations - Hazen-Williams - 2007

EASTERN FIRE PROTECTION
 CUMBERLAND COUNTY CIVIC CENTER UPPER SUITES LEVEL

Page 8
 Date

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	*****
124 to CT	85.830 85.830		0.0 296.55	3 3.26		0.0 0.0 20.000	120 0.0764	63.224 0.0 1.527		Vel = 11.40	
CT to CW	85.830 85.830		0.0 296.55	3 3.26		0.0 0.0 26.670 26.670	120 0.0763	64.751 0.0 2.035		Vel = 11.40	
CW to DB	85.830 85.830		0.0 296.55	3 3.26	5L 1T	33.599 20.159 27.000 53.758 80.758	120 0.0763	66.786 0.0 6.164		Vel = 11.40	
DB to GA	85.830 85.830		0.0 296.55	3 3.26	4L	26.879 0.0 26.879 37.879	120 0.0763	72.950 0.0 2.891		Vel = 11.40	
GA to 78	85.830 85.830		0.0 296.55	3 3.26	2L	13.44 0.0 13.440 18.770	120 0.0763	75.841 0.0 1.433		Vel = 11.40	
78 to DC	85.830 85.830		0.0 296.55	3 3.26	1T	20.159 0.0 20.159 22.659	120 0.0763	77.274 0.0 1.729		Vel = 11.40	
DC to GB	85.830 85.830		0.0 296.55	3 3.26	1L	6.72 0.0 6.720 13.720	120 0.0764	79.003 0.0 1.048		Vel = 11.40	
GB to GC	85.830 85.830		0.0 296.55	3 3.26		0.0 0.0 14.000 14.000	120 0.0763	80.051 0.0 1.068		Vel = 11.40	
GC to GD	85.830 85.830		0.0 296.55	3 3.26		0.0 0.0 1.000 1.000	120 0.0770	81.119 0.0 0.077		Vel = 11.40	
GD to 88	85.830 85.830		0.0 296.55	3 3.26	4L	26.879 0.0 26.879 38.879	120 0.0763	81.196 0.0 2.967		Vel = 11.40	
88 to DD	85.830 85.830		0.0 296.55	3 3.26	2F 2L	8.064 13.44 24.750 21.504 46.254	120 0.0763	84.163 0.0 3.530		Vel = 11.40	
DD to DE	85.830 85.830		0.0 296.55	3 3.26	2L 2T	13.44 40.319 122.000 53.759 175.759	120 0.0763	87.693 0.0 13.415		Vel = 11.40	
DE to DF	85.830 85.830		0.0 296.55	4 4.26	2L 2T	15.8 52.668 81.000 68.468 149.468	120 0.0207	101.108 0.0 3.100		Vel = 6.68	
DF to GG	85.830 85.830		0.0 296.55	4 4.26	1T	26.334 0.0 26.334 41.334	120 0.0207	104.208 0.0 0.857		Vel = 6.68	
GG to DH	85.830 85.830		0.0 296.55	4 4.26	1L 1T	7.9 26.334 30.500 34.234 64.734	120 0.0207	105.065 0.0 1.343		Vel = 6.68	
DH to K	85.830 85.830		0.0 296.55	4 4.26	4L 1T	31.601 26.334 8.250 57.935 66.185	120 0.0207	106.408 0.0 1.373		Vel = 6.68	

Final Calculations - Hazen-Williams - 2007

EASTERN FIRE PROTECTION
 CUMBERLAND COUNTY CIVIC CENTER UPPER SUITES LEVEL

Page 9
 Date

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	*****
K to RT	85.830 85.830		0.0 296.55	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 0.0207	107.781 3.000 1.693		* Fixed loss = 3 Vel = 6.68	
RT to RB	85.830 85.830		0.0 296.55	6 6.357		0.0 0.0 4.000	120 0.0028	112.474 0.0 0.011		Vel = 3.00	
RB to L	85.830 51.830		0.0 296.55	6 6.357	3L 1T 33.948 37.72 0.0	14.000 71.668 85.668	120 0.0030	112.485 14.725 0.254		Vel = 3.00	
L to PO	51.830 51.830	H100	100.00 396.55	8 8.249	3G 1S 2L 1T 14.094 52.853 30.537 41.108	5.000 138.592 143.592	120 0.0014	127.464 0.0 0.204		Vel = 2.38	
PO			0.0 396.55					127.668		K Factor = 35.10	
System Demand Pressure								127.668			
Safety Margin								20.464			
Continuation Pressure								148.132			
Pressure @ Pump Outlet								148.132			
Pressure From Pump Curve								-65.740			
Pressure @ Pump Inlet								82.392			
PI to TEST	51.830 51.830		0.0 396.55	8 8.249		0.0 0.0 1.000	120 0.0020	82.392 0.0 0.002		Vel = 2.38	
TEST			0.0 396.55					82.394		K Factor = 43.69	