

. . . Fire Protection by Computer Design

HAMPSHIRE FIRE PROTECTION
8 N. WENTWORTH AVE.
LONDONDERRY, NH 03053
603-432-8221

Job Name : PARK DANFORTH - PARKING GARAGE
Building : 2016 ADDITION, PARKING GARAGE
Location : PORTLAND, ME
System : 1
Contract : 4737CME
Data File : PDPG.wxf

Hydraulic Design Information Sheet

Name - PARK DANFORTH, PARKING GARAGE Date - 2-12-16
 Location - PORTLAND, ME
 Building - 2016 ADDITION, PARKING GARAGE System No. - 1
 Contractor - PC CONSTRUCTION Contract No. - 4737CME
 Calculated By - BENOIT Drawing No. - 2
 Construction: () Combustible (X) Non-Combustible Ceiling Height - 9-0
 Occupancy - PARKING GARAGE

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

S Other

T Specific Ruling Made By Date

M	Area of Sprinkler Operation - 1950	System Type	Sprinkler/Nozzle
	Density - .15	(X) Wet	Make RELIABLE
D	Area Per Sprinkler - 105	() Dry	Model F1FR
E	Elevation at Highest Outlet - 9	() Deluge	Size 1/2
S	Hose Allowance - Inside - 0	() Preaction	K-Factor 5.6
I	Rack Sprinkler Allowance - 0	() Other	Temp.Rat.155
G	Hose Allowance - Outside - 250		

N Note 30% DRY INCREASE IN REMOTE AREA

Calculation Flow Required - 863.6 Press Required - 40.3 AT TEST
 Summary C-Factor Used: 120 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 10-25-14		Cap. -
T	Time of Test - 10 AM	Rated Cap.- 1000	Elev.-
E	Static Press - 62	@ Press - 70	
R	Residual Press - 60	Elev. - 0	Well
S	Flow - 992		Proof Flow
U	Elevation - 0		

P Location - SEE SITE PLAN

L Source of Information - PORTLAND WATER DEPT., MEANS DIVISION

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

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

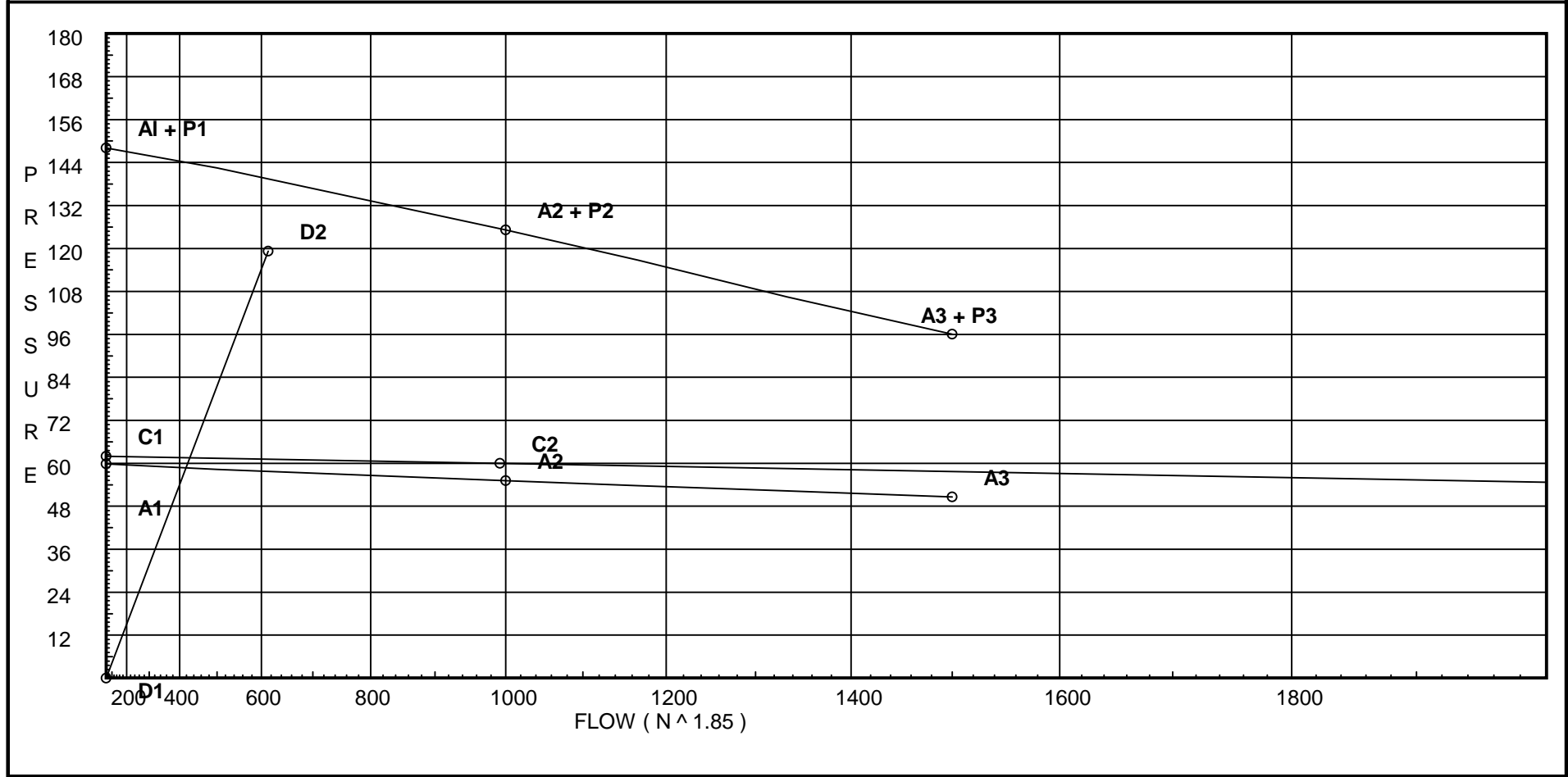
E Horizontal Barriers Provided:

Water Supply Curve C

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City Water Supply: C1 - Static Pressure : 62 C2 - Residual Pressure: 60 C2 - Residual Flow : 992 City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow A1 - Adjusted Static: 59.848 A2 - Adj Resid : 55.14 @ 1000 A3 - Adj Resid : 50.59 @ 1500	Pump Data: P1 - Pump Churn Pressure : 88.2 P2 - Pump Rated Pressure : 70 P2 - Pump Rated Flow : 1000 P3 - Pump Pressure @ Max Flow : 45.5 P3 - Pump Max Flow : 1500 City Residual Flow @ 0 = 6348.24 City Residual Flow @ 20 = 5143.10 City Water @ 150% of Pump = 57.70	Demand: D1 - Elevation : -0.650 D2 - System Flow : 613.614 D2 - System Pressure : 119.215 Hose (Demand) : _____ D3 - System Demand : 613.614 Hose (Adj City) : 250 Safety Margin : 20.192
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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
B	NFPA 13 Butterfly Valve	0	0	2.25	2	2.5	6	7	10	0	12	9	10	12	19	21	0	0	0	0	0
D	Dry Rel D						9.8	9.8			28		47								
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
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
I	90' Grvd-Vic Elbow #10	0	0	2	3	4	3.5	6	5	8	7	8.5	10	13	17	20	23	25	33	36	40
J	90'Tee-Branch Grv Vic #20	0	0	4.5	6	8	8.5	10.8	13	17	16	21	25	33	41	50	65	78	88	98	120
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.

Pressure / Flow Summary - STANDARD

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Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
40	7.5	5.6	7.03	na	14.85	0.15	99	7.0
41	7.5	5.6	7.87	na	15.71	0.15	99	7.0
42	7.5	5.6	9.08	na	16.88	0.15	105	8.0
42T	7.5		9.22	na				
43	7.5	5.6	11.23	na	18.77	0.15	105	8.0
44	7.5	5.6	13.1	na	20.27	0.15	105	8.0
45	7.5	5.6	16.15	na	22.51	0.15	105	8.0
46	7.5	5.6	19.0	na	24.41	0.15	105	8.0
47	7.5	5.6	21.37	na	25.89	0.15	105	8.0
48	9.0	5.6	18.63	na	24.17	0.15	99	7.0
49	9.0	5.6	21.47	na	25.95	0.15	99	7.0
50	9.0	5.6	22.92	na	26.81	0.15	99	7.0
ST	9.0		24.83	na				
51	9.0	5.6	19.37	na	24.65	0.15	105	8.0
52	9.0	5.6	22.33	na	26.46	0.15	105	8.0
53	9.0	5.6	23.83	na	27.34	0.15	105	8.0
TT	9.0		25.8	na				
54	9.0	5.6	21.57	na	26.01	0.15	105	8.0
55	9.0	5.6	24.83	na	27.91	0.15	105	8.0
56	9.0	5.6	26.5	na	28.83	0.15	105	8.0
UT	9.0		28.67	na				
57	9.0	5.6	25.15	na	28.08	0.15	105	8.0
58	9.0	5.6	28.9	na	30.11	0.15	105	8.0
59	9.0	5.6	30.82	na	31.09	0.15	105	8.0
VT	9.0		33.32	na				
60	9.0	5.6	51.12	na	40.04	0.15	105	8.0
61	9.0	5.6	58.36	na	42.78	0.15	105	8.0
62	9.0	5.6	62.07	na	44.12	0.15	105	8.0
XT	9.0		66.85	na				
R	7.5		23.82	na				
S	9.0		27.89	na				
T	9.0		28.98	na				
U	9.0		32.17	na				
V	9.0		37.36	na				
W	9.0		46.09	na				
X	9.0		74.59	na				
Y	9.0		78.19	na				
Z	9.0		97.74	na				
DTR	9.0		108.86	na				
BOR	2.0		118.55	na				
DISC	2.0		119.22	na				
SUCT	2.0		57.69	na				
BF1	2.0		57.74	na				
BF2	2.0		62.74	na				
FLG	1.0		63.29	na				
HOSE	5.0		61.91	na	250.0			
TEST	9.0		60.45	na				

The maximum velocity is 28.63 and it occurs in the pipe between nodes V and W

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	*****
40	14.85	1.049		0.0	8.000	7.032				
to		100.0		0.0	0.0	0.0				K Factor = 5.60
41	14.85	0.1051		0.0	8.000	0.841				Vel = 5.51
41	15.71	1.38	T	4.282	8.500	7.873				K Factor = 5.60
to		100.0		0.0	4.282	0.0				
42T	30.56	0.1051		0.0	12.782	1.343				Vel = 6.56
	0.0									
	30.56					9.216				K Factor = 10.07
42	16.88	1.049		0.0	1.000	9.083				K Factor = 5.60
to		100.0		0.0	0.0	0.0				
42T	16.88	0.1330		0.0	1.000	0.133				Vel = 6.27
42T	30.56	1.38		0.0	8.500	9.216				
to		100.0		0.0	0.0	0.0				
43	47.44	0.2371		0.0	8.500	2.015				Vel = 10.18
43	18.77	1.61		0.0	9.000	11.231				K Factor = 5.60
to		100.0		0.0	0.0	0.0				
44	66.21	0.2072		0.0	9.000	1.865				Vel = 10.43
44	20.26	1.61		0.0	9.000	13.096				K Factor = 5.60
to		100.0		0.0	0.0	0.0				
45	86.47	0.3398		0.0	9.000	3.058				Vel = 13.63
45	22.51	1.61	T	5.71	9.000	16.154				K Factor = 5.60
to		100.0		0.0	5.710	0.0				
R	108.98	0.5211		0.0	14.710	7.666				Vel = 17.17
	0.0									
	108.98					23.820				K Factor = 22.33
46	24.41	1.049		0.0	9.000	18.997				K Factor = 5.60
to		100.0		0.0	0.0	0.0				
47	24.41	0.2636		0.0	9.000	2.372				Vel = 9.06
47	25.89	1.38	T	4.282	5.000	21.369				K Factor = 5.60
to		100.0		0.0	4.282	0.0				
R	50.3	0.2641		0.0	9.282	2.451				Vel = 10.79
	0.0									
	50.30					23.820				K Factor = 10.31
48	24.17	1.049		0.0	11.000	18.627				K Factor = 5.60
to		100.0		0.0	0.0	0.0				
49	24.17	0.2588		0.0	11.000	2.847				Vel = 8.97
49	25.95	1.38	T	4.282	8.500	21.474				K Factor = 5.60
to		100.0		0.0	4.282	0.0				
ST	50.12	0.2624		0.0	12.782	3.354				Vel = 10.75
	0.0									
	50.12					24.828				K Factor = 10.06
50	26.81	1.049	T	3.568	2.500	22.925				K Factor = 5.60
to		100.0		0.0	3.568	0.0				
ST	26.81	0.3136		0.0	6.068	1.903				Vel = 9.95
ST	50.12	1.38	T	4.282	1.000	24.828				
to		100.0		0.0	4.282	0.0				
S	76.93	0.5797		0.0	5.282	3.062				Vel = 16.50
	0.0									

Final Calculations - Hazen-Williams

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	76.93						27.890		K Factor = 14.57	
51 to 52	24.65	1.049 100.0		0.0	11.000	19.374 0.0			K Factor = 5.60	
52 to TT	24.65	0.2685		0.0	11.000	2.953			Vel = 9.15	
52 to TT	26.46	1.38 100.0	T	4.282	8.500	22.327 0.0			K Factor = 5.60	
	51.11	0.2720		0.0	12.782	3.477			Vel = 10.96	
	0.0 51.11						25.804		K Factor = 10.06	
53 to TT	27.34	1.049 100.0	T	3.568	2.500	23.832 0.0			K Factor = 5.60	
TT to T	27.34	0.3250		0.0	6.068	1.972			Vel = 10.15	
TT to T	51.11	1.38 100.0	T	4.282	1.000	25.804 0.0				
	78.45	0.6011		0.0	5.282	3.175			Vel = 16.83	
	0.0 78.45						28.979		K Factor = 14.57	
54 to 55	26.01	1.049 100.0		0.0	11.000	21.572 0.0			K Factor = 5.60	
55 to UT	26.01	0.2965		0.0	11.000	3.261			Vel = 9.66	
55 to UT	27.91	1.38 100.0	T	4.282	8.500	24.833 0.0			K Factor = 5.60	
	53.92	0.3003		0.0	12.782	3.839			Vel = 11.57	
	0.0 53.92						28.672		K Factor = 10.07	
56 to UT	28.83	1.049 100.0	T	3.568	2.500	26.496 0.0			K Factor = 5.60	
UT to U	28.83	0.3586		0.0	6.068	2.176			Vel = 10.70	
UT to U	53.91	1.38 100.0	T	4.282	1.000	28.672 0.0				
	82.74	0.6632		0.0	5.282	3.503			Vel = 17.75	
	0.0 82.74						32.175		K Factor = 14.59	
57 to 58	28.08	1.049 100.0		0.0	11.000	25.146 0.0			K Factor = 5.60	
58 to VT	28.08	0.3416		0.0	11.000	3.758			Vel = 10.42	
58 to VT	30.11	1.38 100.0	T	4.282	8.500	28.904 0.0			K Factor = 5.60	
	58.19	0.3458		0.0	12.782	4.420			Vel = 12.48	
	0.0 58.19						33.324		K Factor = 10.08	
59 to VT	31.09	1.049 100.0	T	3.568	2.500	30.822 0.0			K Factor = 5.60	
VT to V	31.09	0.4123		0.0	6.068	2.502			Vel = 11.54	
VT to V	58.19	1.38 100.0	T	4.282	1.000	33.324 0.0				
	89.28	0.7635		0.0	5.282	4.033			Vel = 19.15	

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Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftg's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0 89.28					37.357		K Factor = 14.61	
60 to 61	40.04	1.049 100.0		0.0 0.0	11.000 0.0	51.118 0.0		K Factor = 5.60	
61 to XT	40.04	0.6585		0.0	11.000	7.243		Vel = 14.86	
61 to XT	42.78	1.38 100.0	T	4.282 0.0	8.500 4.282	58.361 0.0		K Factor = 5.60	
	82.82	0.6645		0.0	12.782	8.493		Vel = 17.77	
	0.0 82.82					66.854		K Factor = 10.13	
62 to XT	44.12	1.049 100.0	T	3.568 0.0	2.500 3.568	62.072 0.0		K Factor = 5.60	
XT to X	44.12	0.7881		0.0	6.068	4.782		Vel = 16.38	
XT to X	82.82	1.38 100.0	T	4.282 0.0	1.000 4.282	66.854 0.0			
	126.94	1.4642		0.0	5.282	7.734		Vel = 27.23	
	0.0 126.94					74.588		K Factor = 14.70	
R to S	159.28	2.157 100.0	2I	6.148 0.0	12.500 6.148	23.820 -0.650			
S to T	159.28	0.2531		0.0	18.648	4.720		Vel = 13.98	
S to T	76.93	2.635 100.0		0.0 0.0	5.500 0.0	27.890 0.0			
T to U	236.21	0.1980		0.0	5.500	1.089		Vel = 13.90	
T to U	78.44	2.635 100.0		0.0 0.0	9.500 0.0	28.979 0.0			
U to V	314.65	0.3364		0.0	9.500	3.196		Vel = 18.51	
U to V	82.75	2.635 100.0		0.0 0.0	10.000 0.0	32.175 0.0			
V to W	397.4	0.5182		0.0	10.000	5.182		Vel = 23.38	
V to W	89.28	2.635 100.0	J	10.582 0.0	1.000 10.582	37.357 0.0			
W to Y	486.68	0.7539		0.0	11.582	8.732		Vel = 28.63	
W to Y	0.0	2.635 100.0	J	10.582 0.0	32.000 10.582	46.089 0.0			
	486.68	0.7539		0.0	42.582	32.104		Vel = 28.63	
	0.0 486.68					78.193		K Factor = 55.04	
X to Y	126.94	2.635 100.0	I J	5.879 10.582	41.000 16.461	74.588 0.0			
Y to Z	126.94	0.0627		0.0	57.461	3.605		Vel = 7.47	
Y to Z	486.67	4.26 100.0	2I J	13.156 15.036	147.000 28.192	78.193 0.0			
Z to DTR	613.61	0.1116		0.0	175.192	19.545		Vel = 13.81	
Z to DTR	0.0	4.26 100.0	3I	19.734 0.0	80.000 19.735	97.738 0.0			
DTR to BOR	613.61	0.1116		0.0	99.735	11.127		Vel = 13.81	
DTR to BOR	0.0	4.26 100.0	J D	15.036 26.313	7.000 52.624	108.865 3.032			
	613.61	0.1115	B	11.277	59.624	6.651		Vel = 13.81	

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BOR to DISC	0.0 613.61	6.357 120.0 0.0113	B S	12.573 40.235 0.0	6.000 52.808 58.808	118.548 0.0 0.667		Vel = 6.20	
	0.0 613.61					119.215		K Factor = 56.20	
System Demand Pressure						119.215			
Safety Margin						20.192			
Continuation Pressure						139.406			
Pressure @ Pump Outlet						139.406			
Pressure From Pump Curve						-81.715			
Pressure @ Pump Inlet						57.692			
SUCT to BF1	0.0 613.61	8.249 120.0 0.0031	G	4.698 0.0 0.0	10.000 4.698 14.698	57.692 0.0 0.046		Vel = 3.68	
BF1 to BF2	0.0 613.61	8.249 120.0 0.0040		0.0 0.0 0.0	1.000 0.0 1.000	57.738 5.000 0.004		** Fixed Loss = 5 Vel = 3.68	
BF2 to FLG	0.0 613.61	8.249 120.0 0.0032	2I	30.537 0.0 0.0	5.000 30.537 35.537	62.742 0.433 0.113		Vel = 3.68	
FLG to HOSE	0.0 613.61	8.27 140.0 0.0024	T G	55.354 6.326 0.0	90.000 61.680 151.680	63.288 -1.732 0.359		Vel = 3.66	
HOSE to TEST	250.00 863.61	12.34 140.0 0.0006	E T G	42.195 93.767 9.377	280.000 145.339 425.339	61.915 -1.732 0.269		Qa = 250 Vel = 2.32	
	0.0 863.61					60.452		K Factor = 111.07	