



... Fire Protection by Computer Design

High Tech Fire Protection
84 Hackett Mills Road Poland
P.O. Box 154 Minot, ME
Poland, ME 04274
207-998-2551

Job Name : 409 CUMBERLAND AVE APARTMENT COMPLEX PARKING GARAGE 0G
Drawing : FP-01
Location : Parking Garage
Remote Area : 0G
Contract : 101513-1
Data File : Calc #0G Parking garage.WXF

HYDRAULIC CALCULATIONS
for

Project name: 409 CUMBERLAND AVE APARTMENT COMPLEX
Location: Parking Garage
Drawing no: FP-01
Date: 1-23-14

Design

Remote area number: 0G
Remote area location: Parking Garage
Occupancy classification: Ordinary hazard group 1
Density: .15 - Gpm/SqFt
Area of application: 1950 - SqFt
Coverage per sprinkler: 130 - SqFt
Type of sprinklers calculated: quick response uprights
No. of sprinklers calculated: 21
In-rack demand: n/a - GPM
Hose streams: 250 - GPM
Total water required (including hose streams): 709 - GPM @ 64 - Psi
Type of system: Dry system
Volume of dry or preaction system: 146 - Gal

Water supply information

Date: 5-19-05
Location: Corner of Cumberland ave and Mechanic Street
Source: City of Portland

Name of contractor: High Tech Fire Protection
Address: 84 Hackett Mills Road Poland / P.O. Box 154 Minot, ME / Pola
Phone number: 207-998-2551
Name of designer: Ed Poulin
Authority having jurisdiction: State of Maine / City of Portland
Notes: (Include peaking information or gridded systems here.)

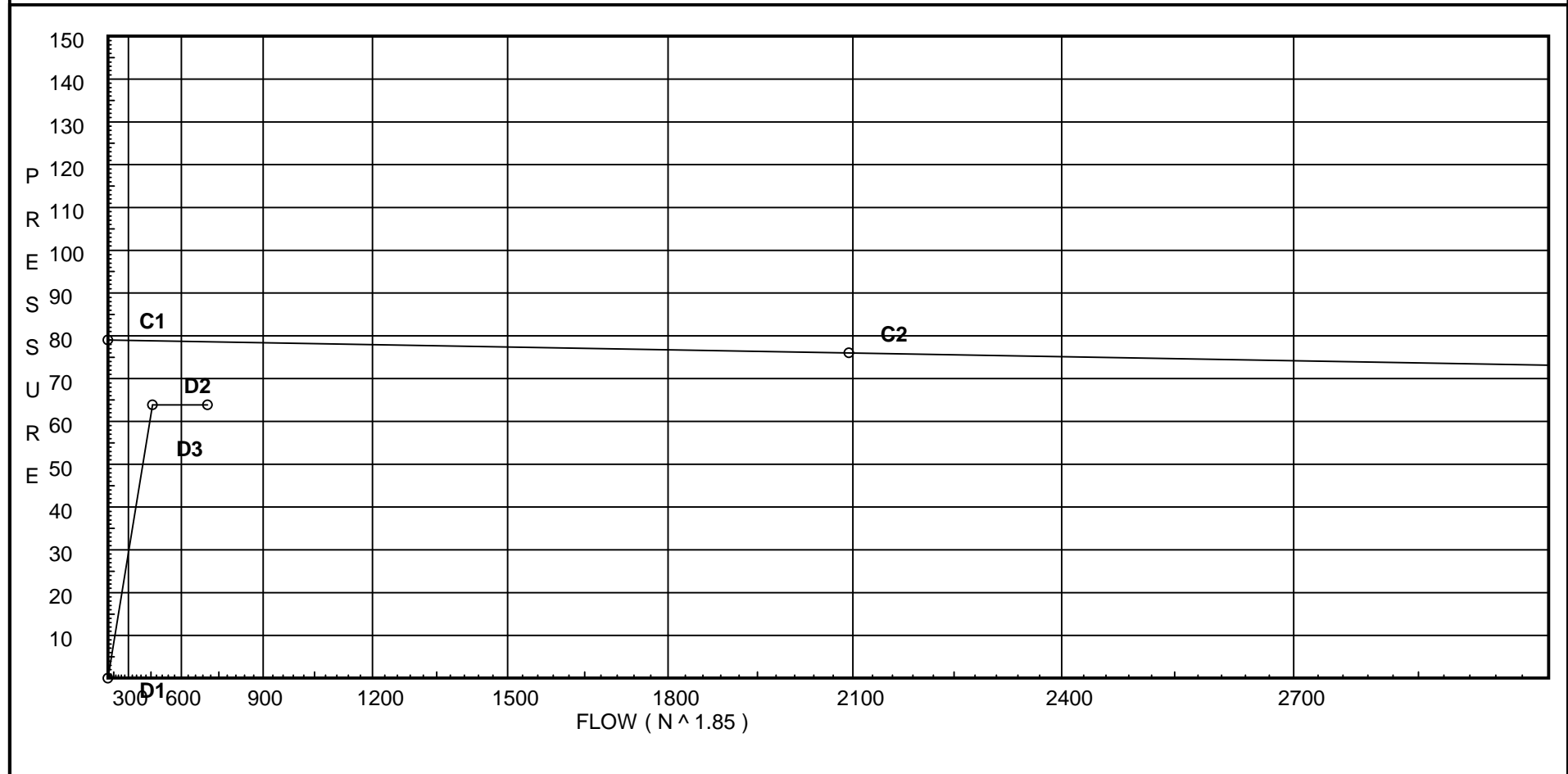
Water Supply Curve (C)

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City Water Supply:
C1 - Static Pressure : 79
C2 - Residual Pressure: 76
C2 - Residual Flow : 2094

Demand:
D1 - Elevation : -2.469
D2 - System Flow : 458.387
D2 - System Pressure : 63.887
Hose (Demand) : 250
D3 - System Demand : 708.387
Safety Margin : 14.709



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	0	0	0	6	7	10	0	12	9	10	12	19	21	0	0	0	0	0
D	Dry Rel D										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
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
G	NFPA 13 Gate Valve	0	0	0	0	1	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
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
V	90' Ell Firelock #001	0	0	0	0	0	3.5	4.3	5	0	6.8	8.5	10	13	0	0	0	0	0	0	0
X	90'Tee-BranchFirelock002	0	0	0	0	0	8.5	10.8	13	0	16	21	25	33	0	0	0	0	0	0	0
Zia	Wilkins 350	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

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.
DP1	9.2	5.6	12.13	na	19.5	0.15	130	7.0
DP2	9.2	5.6	12.13	na	19.5	0.15	130	7.0
10	9.2	5.6	14.75	na	21.51	0.15	130	7.0
11	9.2	5.6	14.02	na	20.97	0.15	130	7.0
12	9.2	5.6	15.61	na	22.13	0.15	130	7.0
13	9.0		16.89	na				
14	9.0		17.08	na				
21	9.0	K = K @ EQ01	17.39	na	19.56			
22	9.0	K = K @ EQ01	17.63	na	19.69			
23	9.0	K = K @ EQ02	17.93	na	19.92			
24	9.0	K = K @ EQ02	18.29	na	20.11			
25	9.0	K = K @ EQ02	18.76	na	20.37			
30	9.3	5.6	12.13	na	19.5	0.15	130	7.0
31	9.3	5.6	13.17	na	20.32	0.15	130	7.0
32	9.3	5.6	14.2	na	21.1	0.15	130	7.0
33	8.9		19.06	na				
40	8.9	K = K @ EQ02	19.78	na	20.92			
41	8.9	K = K @ EQ02	21.49	na	21.8			
42	8.9	K = K @ EQ02	23.49	na	22.8			
43	8.9	K = K @ EQ02	25.81	na	23.9			
50	9.3	5.6	12.94	na	20.15	0.15	130	7.0
51	9.3	5.6	14.42	na	21.27	0.15	130	7.0
52	9.3	5.6	15.9	na	22.33	0.15	130	7.0
53	9.3	5.6	17.44	na	23.39	0.15	130	7.0
54	8.7		26.24	na				
60	9.2	K = K @ EQ02	28.62	na	25.16			
61	9.2		28.92	na				
62	9.2	5.6	31.65	na	31.51	0.15	130	7.0
63	8.6		32.37	na				
64	8.5		41.46	na				
65	8.4		52.17	na				
TOD	8.4		55.56	na				
BOD	3.0		60.73	na				
BASE	0.0		68.66	na				
HS1	10.0		64.87	na				
HS2	12.0		64.72	na				
HS3	12.0		64.74	na	250.0			
TEST	15.0		63.89	na				

The maximum velocity is 18.51 and it occurs in the pipe between nodes 43 and 54

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	*****
DP1 to EQ01	19.50 19.5	1.049 100.0 0.1740	1E 1T	1.427 3.568 0.0	1.800 4.995 6.795	12.125 3.985 1.182			K Factor = 5.60 Vel = 7.24	
	0.0 19.50						17.292		K Factor = 4.69	
DP2 to EQ02	19.50 19.5	1.049 100.0 0.1740	1E 1T	1.427 3.568 0.0	1.200 4.995 6.195	12.125 3.985 1.078			K Factor = 5.60 Vel = 7.24	
	0.0 19.50						17.188		K Factor = 4.70	
10 to 13	21.51 21.51	1.049 100.0 0.2086	1T	3.568 0.0 0.0	6.300 3.568 9.868	14.749 0.087 2.058			K Factor = 5.60 Vel = 7.99	
	0.0 21.51						16.894		K Factor = 5.23	
11 to 12	20.97 20.97	1.049 100.0 0.1990		0.0 0.0 0.0	8.000 0.0 8.000	14.018 0.0 1.592			K Factor = 5.60 Vel = 7.78	
12 to 13	22.12 43.09	1.38 100.0 0.1984	1T	4.282 0.0 0.0	1.750 4.282 6.032	15.610 0.087 1.197			K Factor = 5.60 Vel = 9.24	
	0.0 43.09						16.894		K Factor = 10.48	
13 to 14	64.60 64.6	2.157 100.0 0.0475		0.0 0.0 0.0	4.000 0.0 4.000	16.894 0.0 0.190			Vel = 5.67	
14 to 21	0.0 64.6	2.635 100.0 0.0180	1V	4.213 0.0 0.0	13.000 4.213 17.213	17.084 0.0 0.310			Vel = 3.80	
21 to 22	19.56 84.16	2.635 100.0 0.0292		0.0 0.0 0.0	8.000 0.0 8.000	17.394 0.0 0.234			K Factor @ node EQ01 Vel = 4.95	
22 to 23	19.68 103.84	2.635 100.0 0.0433		0.0 0.0 0.0	6.900 0.0 6.900	17.628 0.0 0.299			K Factor @ node EQ01 Vel = 6.11	
23 to 24	19.92 123.76	2.635 100.0 0.0598		0.0 0.0 0.0	6.000 0.0 6.000	17.927 0.0 0.359			K Factor @ node EQ02 Vel = 7.28	
24 to 25	20.11 143.87	2.635 100.0 0.0792		0.0 0.0 0.0	6.000 0.0 6.000	18.286 0.0 0.475			K Factor @ node EQ02 Vel = 8.46	
25 to 33	20.38 164.25	2.635 100.0 0.1012		0.0 0.0 0.0	2.500 0.0 2.500	18.761 0.043 0.253			K Factor @ node EQ02 Vel = 9.66	
	0.0 164.25						19.057		K Factor = 37.63	
30 to 31	19.50 19.5	1.049 100.0 0.1740		0.0 0.0 0.0	6.000 0.0 6.000	12.125 0.0 1.044			K Factor = 5.60 Vel = 7.24	

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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	*****
31	20.32	1.38		0.0	6.000	13.169				
to		100.0		0.0	0.0	0.0				
32	39.82	0.1715		0.0	6.000	1.029				Vel = 8.54
32	21.10	1.61	1E	2.855	17.800	14.198				K Factor = 5.60
to		100.0	1T	5.71	8.565	0.173				
33	60.92	0.1777		0.0	26.365	4.686				Vel = 9.60
	0.0									
	60.92					19.057				K Factor = 13.96
33	225.17	2.635		0.0	4.000	19.057				
to		100.0		0.0	0.0	0.0				
40	225.17	0.1812		0.0	4.000	0.725				Vel = 13.25
40	20.92	2.635		0.0	8.000	19.782				K Factor @ node EQ02
to		100.0		0.0	0.0	0.0				
41	246.09	0.2135		0.0	8.000	1.708				Vel = 14.48
41	21.80	2.635		0.0	8.000	21.490				K Factor @ node EQ02
to		100.0		0.0	0.0	0.0				
42	267.89	0.2498		0.0	8.000	1.998				Vel = 15.76
42	22.80	2.635		0.0	8.000	23.488				K Factor @ node EQ02
to		100.0		0.0	0.0	0.0				
43	290.69	0.2906		0.0	8.000	2.325				Vel = 17.10
43	23.90	2.635		0.0	1.000	25.813				K Factor @ node EQ02
to		100.0		0.0	0.0	0.087				
54	314.59	0.3360		0.0	1.000	0.336				Vel = 18.51
	0.0									
	314.59					26.236				K Factor = 61.42
50	20.15	1.049		0.0	8.000	12.944				K Factor = 5.60
to		100.0		0.0	0.0	0.0				
51	20.15	0.1849		0.0	8.000	1.479				Vel = 7.48
51	21.27	1.38		0.0	8.000	14.423				K Factor = 5.60
to		100.0		0.0	0.0	0.0				
52	41.42	0.1844		0.0	8.000	1.475				Vel = 8.88
52	22.32	1.61		0.0	8.000	15.898				K Factor = 5.60
to		100.0		0.0	0.0	0.0				
53	63.74	0.1932		0.0	8.000	1.546				Vel = 10.04
53	23.39	1.61	1E	2.855	16.200	17.444				K Factor = 5.60
to		100.0	1T	5.71	8.565	0.260				
54	87.13	0.3445		0.0	24.765	8.532				Vel = 13.73
	0.0									
	87.13					26.236				K Factor = 17.01
54	401.72	3.26	1X	12.469	3.000	26.236				
to		100.0		0.0	12.469	-0.217				
61	401.72	0.1875		0.0	15.469	2.901				Vel = 15.44
	0.0									
	401.72					28.920				K Factor = 74.70
60	25.16	1.61	1T	5.71	3.000	28.619				K Factor @ node EQ02
to		100.0		0.0	5.710	0.0				
61	25.16	0.0346		0.0	8.710	0.301				Vel = 3.97

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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	*****
61	401.72	3.26		0.0	15.200	28.920				
to		100.0		0.0	0.0	0.260				
63	426.88	0.2098		0.0	15.200	3.189		Vel = 16.41		
	0.0									
	426.88					32.369		K Factor = 75.03		
62	31.51	1.61	1T	5.71	3.000	31.652		K Factor = 5.60		
to		100.0		0.0	5.710	0.260				
63	31.51	0.0525		0.0	8.710	0.457		Vel = 4.97		
63	426.88	3.26	1V	4.796	33.000	32.369				
to		100.0		0.0	4.795	0.043				
64	458.39	0.2394		0.0	37.795	9.047		Vel = 17.62		
64	0.0	3.26	2F	5.755	34.000	41.459				
to		100.0	1V	4.796	10.550	0.043				
65	458.39	0.2394		0.0	44.550	10.664		Vel = 17.62		
65	0.0	4.26	3V	19.171	33.000	52.166				
to		100.0		0.0	19.170	0.0				
TOD	458.39	0.0650		0.0	52.170	3.393		Vel = 10.32		
TOD	0.0	4.26	1D	26.313	6.000	55.559				
to		100.0	1B	11.277	37.589	2.339				
BOD	458.39	0.0650		0.0	43.589	2.835		Vel = 10.32		
BOD	0.0	4.26	1T	26.334	2.000	60.733				
to		120.0	1Zia	0.0	39.501	6.005		* Fixed loss = 4.706		
BASE	458.39	0.0464	1E	13.167	41.501	1.926		Vel = 10.32		
BASE	0.0	6.16	1G	4.304	25.000	68.664				
to		140.0	1T	43.037	67.425	-4.331				
HS1	458.39	0.0058	1E	20.084	92.425	0.536		Vel = 4.93		
HS1	0.0	6.16	1T	43.037	80.000	64.869				
to		140.0		0.0	43.037	-0.866				
HS2	458.39	0.0058		0.0	123.037	0.712		Vel = 4.93		
HS2	0.0	12.46	1T	52.745	20.000	64.715				
to		100.0		0.0	52.745	0.0				
HS3	458.39	0.0004		0.0	72.745	0.026		Vel = 1.21		
HS3	250.00	6.16	1G	4.304	10.000	64.741		Qa = 250		
to		140.0	1E	20.084	24.388	-1.299				
TEST	708.39	0.0129		0.0	34.388	0.445		Vel = 7.63		
	0.0									
	708.39					63.887		K Factor = 88.63		