

**... Fire Protection by Computer Design**

HIGH TECH FIRE PROTECTION  
84 HACKETT MILLS ROAD  
P.O. BOX 156  
POLAND, ME 04274  
207-998-2551

Job Name : 660 CONGRESS STREET 1ST FLOOR COMMERCIAL SPACE  
Drawing : FP-01  
Location : 1ST FLOOR COMMERCIAL / RETAIL SPACE 104  
Remote Area : #1  
Contract :  
Data File : 1ST FLOOR COM NEW UNDERGROUND.WXF

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**HYDRAULIC CALCULATIONS**  
*for*

**Project name:** 660 CONGRESS STREET 3RD FLOOR RESIDENTIAL  
**Location:** 1ST FLOOR COMMERCIAL / RETAIL SPACE 104  
**Drawing no:** FP-01  
**Date:** 8-12-14

**Design**

**Remote area number:** #1  
**Remote area location:** 1ST FLOOR COMMERCIAL / RETAIL SPACE 104  
**Occupancy classification:** COMMERCIAL / ORDINARY HAZARD GROUP 2  
**Density:** .2 - Gpm/SqFt  
**Area of application:** 900 - SqFt  
**Coverage per sprinkler:** 120 - SqFt  
**Type of sprinklers calculated:** COMMERCIAL PENDENTS AND HSW  
**No. of sprinklers calculated:** 11  
**In-rack demand:** N/A - GPM  
**Hose streams:** 250 - GPM  
**Total water required (including hose streams):** 551 - GPM @ 58 - Psi  
**Type of system:** WET SYSTEM NFPA 13  
**Volume of dry or preaction system:** N/A - Gal

**Water supply information**

**Date:** 8-8-2014  
**Location:** TEST HYDRANT ACROSS THE STREET FROM SITE  
**Source:** PORTLAND WATER DISTRICT

**Name of contractor:** HIGH TECH FIRE PROTECTION  
**Address:** 84 HACKETT MILLS ROAD / P.O. BOX 156 / POLAND, ME 04274  
**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.)**

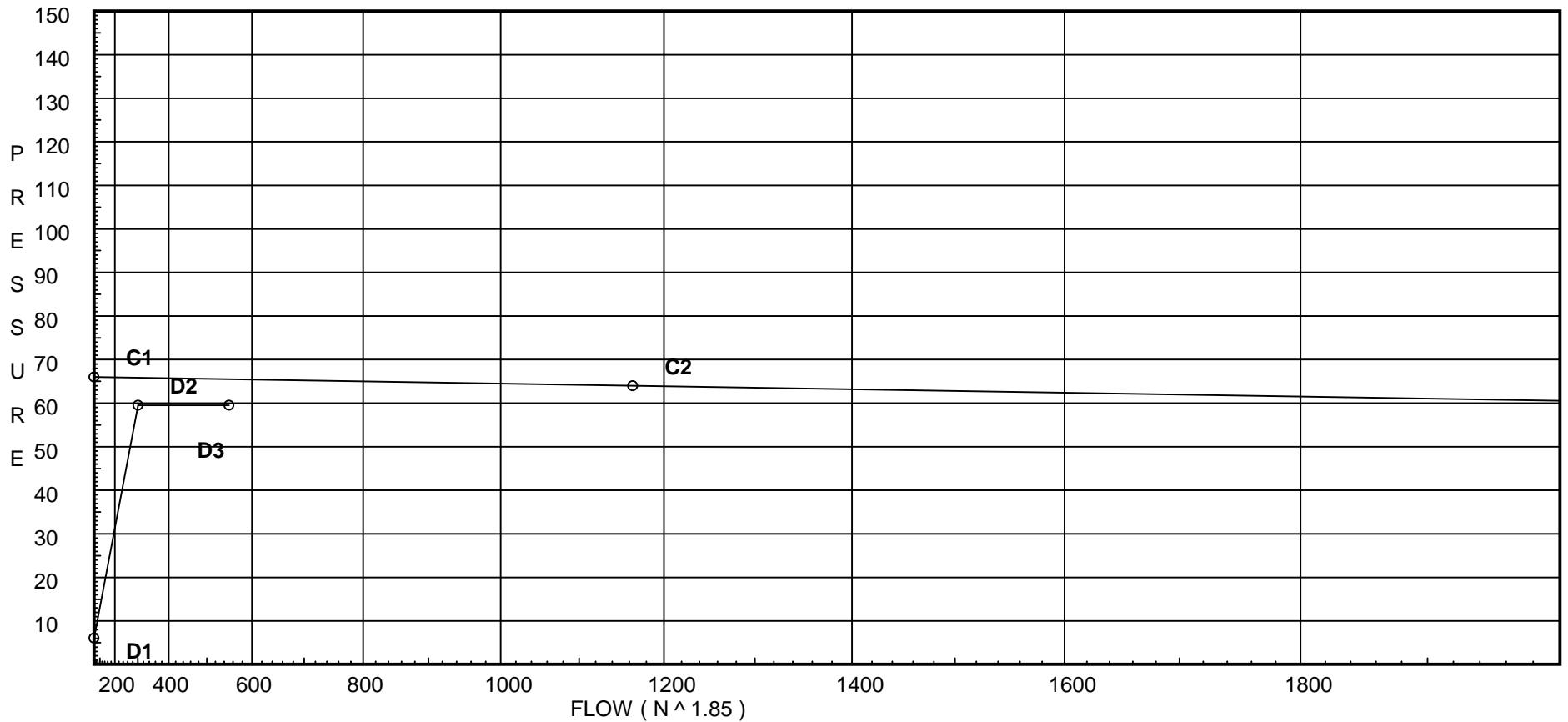
# Water Supply Curve (C)

HIGH TECH FIRE PROTECTION  
660 CONGRESS STREET 1ST FLOOR COMMERCIAL SPACE

Page 2  
Date 8-12-14

City Water Supply:  
C1 - Static Pressure : 66  
C2 - Residual Pressure: 64  
C2 - Residual Flow : 1164

Demand:  
D1 - Elevation : 6.063  
D2 - System Flow : 301.065  
D2 - System Pressure : 59.501  
Hose ( Demand ) : 250  
D3 - System Demand : 551.065  
Safety Margin : 5.998



# Fittings Used Summary

HIGH TECH FIRE PROTECTION  
660 CONGRESS STREET 1ST FLOOR COMMERCIAL SPACE

Page 3  
Date 8-12-14

## 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
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
Fsp	Flow Switch Potter VSR	Fitting generates a Fixed Loss Based on Flow																			
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

HIGH TECH FIRE PROTECTION  
660 CONGRESS STREET 1ST FLOOR COMMERCIAL SPACE

Page 4  
Date 8-12-14

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
DP1	-1.0	5.6	18.37	na	24.0	0.2	120	7.0
DP2	-1.0	5.6	18.37	na	24.0	0.2	120	7.0
100	20.0	5.6	17.3	na	23.29	0.2	100	7.0
101	20.0	K = K @ EQ01	19.03	na	24.0			
102	20.0	K = K @ EQ01	20.31	na	24.79			
105	20.0	K = K @ EQ01	24.28	na	27.11			
106	20.0		24.55	na				
110	20.0	K = K @ EQ02	24.1	na	27.41			
111	20.0		25.68	na				
120	20.0	K = K @ EQ02	20.49	na	25.27			
121	20.0		25.9	na				
125	20.0	K = K @ EQ01	26.31	na	28.22			
126	20.0	K = K @ EQ02	28.78	na	29.95			
131	20.0	K = K @ EQ01	31.05	na	30.66			
132	20.0		32.07	na				
135	20.0	K = K @ EQ02	28.58	na	29.84			
136	20.0		32.12	na				
140	20.0		32.49	na				
141	20.0		32.63	na				
142	20.0		33.14	na				
127	20.0		33.29	na				
150	20.0	K = K @ EQ02	29.89	na	30.52			
151	20.0		33.88	na				
152	20.0		37.22	na				
153	8.0		43.89	na				
TO1	8.0		48.19	na				
BO1	3.0		56.23	na				
BASE	0.0		61.57	na				
H1	0.0		61.8	na				
H2	0.0		61.81	na	250.0			
TEST	6.0		59.5	na				

The maximum velocity is 12.36 and it occurs in the pipe between nodes 126 and 127

# Final Calculations - Hazen-Williams

HIGH TECH FIRE PROTECTION  
660 CONGRESS STREET 1ST FLOOR COMMERCIAL SPACE

Page 5  
Date 8-12-14

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	24.00 24.0	1.049 120.0 0.1823	1T	5.0 0.0 0.0	1.000 5.000 6.000	18.367 -0.433 1.094			K Factor = 5.60 Vel = 8.91	
	0.0 24.00					19.028			K Factor = 5.50	
DP2 to EQ02	24.00 24.0	1.049 120.0 0.1823	1E	2.0 0.0 0.0	1.000 2.000 3.000	18.367 -0.433 0.547			K Factor = 5.60 Vel = 8.91	
	0.0 24.00					18.481			K Factor = 5.58	
100 to 101	23.29 23.29	1.049 120.0 0.1725	3E	6.0 0.0 0.0	4.000 6.000 10.000	17.303 0.0 1.725			K Factor = 5.60 Vel = 8.65	
101 to 102	24.00 47.29	1.38 120.0 0.1683		0.0 0.0 0.0	7.600 0.0 7.600	19.028 0.0 1.279			K Factor @ node EQ01 Vel = 10.14	
102 to 106	24.80 72.09	1.61 120.0 0.1731	1E 1T	4.0 8.0 0.0	12.500 12.000 24.500	20.307 0.0 4.242			K Factor @ node EQ01 Vel = 11.36	
	0.0 72.09					24.549			K Factor = 14.55	
105 to 106	27.11 27.11	1.38 120.0 0.0600		0.0 0.0 0.0	4.500 0.0 4.500	24.279 0.0 0.270			K Factor @ node EQ01 Vel = 5.82	
106 to 111	72.09 99.2	2.067 120.0 0.0925	1T	10.0 0.0 0.0	2.200 10.000 12.200	24.549 0.0 1.129			Vel = 9.48	
	0.0 99.20					25.678			K Factor = 19.58	
110 to 111	27.41 27.41	1.049 120.0 0.2330	1T	5.0 0.0 0.0	1.750 5.000 6.750	24.105 0.0 1.573			K Factor @ node EQ02 Vel = 10.18	
111 to 121	99.20 126.61	2.635 120.0 0.0446		0.0 0.0 0.0	5.000 0.0 5.000	25.678 0.0 0.223			Vel = 7.45	
	0.0 126.61					25.901			K Factor = 24.88	
120 to 121	25.27 25.27	1.049 120.0 0.2006	3E 1T	6.0 5.0 0.0	16.000 11.000 27.000	20.486 0.0 5.415			K Factor @ node EQ02 Vel = 9.38	
121 to 125	126.60 151.87	2.635 120.0 0.0625		0.0 0.0 0.0	6.500 0.0 6.500	25.901 0.0 0.406			Vel = 8.94	
125 to 126	28.22 180.09	2.635 120.0 0.0855	1T	16.474 0.0 0.0	12.400 16.474 28.874	26.307 0.0 2.469			K Factor @ node EQ01 Vel = 10.60	
126 to 127	29.95 210.04	2.635 120.0 0.1137	2T	32.948 0.0 0.0	6.750 32.948 39.698	28.776 0.0 4.514			K Factor @ node EQ02 Vel = 12.36	

# Final Calculations - Hazen-Williams

HIGH TECH FIRE PROTECTION  
660 CONGRESS STREET 1ST FLOOR COMMERCIAL SPACE

Page 6  
Date 8-12-14

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
	0.0 210.04									
						33.290			K Factor = 36.40	
131 to 132	30.66	1.38 120.0	2E	6.0 0.0	7.500 6.000	31.049 0.0			K Factor @ node EQ01	
	30.66	0.0754		0.0	13.500	1.018			Vel = 6.58	
132 to 136	0.0	2.157 120.0		0.0 0.0	6.500 0.0	32.067 0.0				
	30.66	0.0086		0.0	6.500	0.056			Vel = 2.69	
	0.0 30.66									
						32.123			K Factor = 5.41	
135 to 136	29.84	1.049 120.0	1T 1E	5.0 2.0	6.000 7.000	28.576 0.0			K Factor @ node EQ02	
	29.84	0.2728		0.0	13.000	3.547			Vel = 11.08	
136 to 140	30.66	2.157 120.0	2V	8.615 0.0	3.500 8.615	32.123 0.0				
	60.5	0.0301		0.0	12.115	0.365			Vel = 5.31	
140 to 141	0.0	2.157 120.0	1V	4.307 0.0	0.500 4.307	32.488 0.0				
	60.5	0.0300		0.0	4.807	0.144			Vel = 5.31	
141 to 142	0.0	2.157 120.0	1V	4.307 0.0	12.500 4.307	32.632 0.0				
	60.5	0.0302		0.0	16.807	0.507			Vel = 5.31	
	0.0 60.50									
						33.139			K Factor = 10.51	
142 to 127	60.50	2.157 120.0		0.0 0.0	5.000 0.0	33.139 0.0				
	60.5	0.0302		0.0	5.000	0.151			Vel = 5.31	
127 to 151	210.04	3.26 120.0		0.0 0.0	9.100 0.0	33.290 0.0				
	270.54	0.0644		0.0	9.100	0.586			Vel = 10.40	
	0.0 270.54									
						33.876			K Factor = 46.48	
150 to 151	30.52	1.049 120.0	1E 1T	2.0 5.0	7.000 7.000	29.893 0.0			K Factor @ node EQ02	
	30.52	0.2845		0.0	14.000	3.983			Vel = 11.33	
151 to 152	270.54	3.26 120.0	2V 1X	13.44 17.471	11.700 30.911	33.876 0.0				
	301.06	0.0785		0.0	42.611	3.344			Vel = 11.57	
152 to 153	0.0	3.26 120.0	1V	6.72 0.0	12.000 6.720	37.220 5.197				
	301.06	0.0785		0.0	18.720	1.470			Vel = 11.57	
153 to TO1	0.0	3.26 120.0	4V	26.879 0.0	28.000 26.879	43.887 0.0				
	301.06	0.0785		0.0	54.879	4.307			Vel = 11.57	
TO1 to BO1	0.0	3.26 120.0	1Fsp 1B	0.0 13.44	3.000 33.599	48.194 5.166			* Fixed loss = 3	
	301.06	0.0785	1T	20.159	36.599	2.872			Vel = 11.57	

# Final Calculations - Hazen-Williams

HIGH TECH FIRE PROTECTION  
660 CONGRESS STREET 1ST FLOOR COMMERCIAL SPACE

Page 7  
Date 8-12-14

Hyd. Ref. Point	Qa  Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
BO1 to BASE	0.0 301.06	4.26 120.0 0.0214	1Zia 1E	0.0 13.167 0.0	2.000 13.167 15.167	56.232 5.012 0.324		* Fixed loss = 3.713 Vel = 6.78	
BASE to H1	0.0 301.06	6.16 140.0 0.0027	2F 1G 1T	20.084 4.304 43.037	20.000 67.425 87.425	61.568 0.0 0.233		Vel = 3.24	
H1 to H2	0.0 301.06	16.32 100.0 0.0	1T	87.173 0.0 0.0	70.000 87.174 157.174	61.801 0.0 0.007		Vel = 0.46	
H2 to TEST	250.01 551.07	6.16 140.0 0.0082	1G 1E 1Eq	4.304 20.084 1.435	10.000 25.823 35.823	61.808 -2.599 0.292		Qa = 250 Vel = 5.93	
	0.0 551.07					59.501		K Factor = 71.44	