

... Fire Protection by Computer Design

EASTERN FIRE PROTECTION
170 KITTYHAWK AVE
P.O. BOX 1390
AUBURN, ME. 04210
207-784-1507

Job Name : Immucell Sales Calc cleanroom new pipe
Drawing : 1 OF 1
Location : CLEANROOM
Remote Area : #1
Contract : AU-5134-14
Data File : IMMUCELL-CLEANROOM-FIELD.WXF

HYDRAULIC CALCULATIONS
for

Project name: IMMUCELL CLEANROOM RENOVATIONS
Location: CLEANROOM
Drawing no: 1 OF 1
Date: 2/18/14

Design

Remote area number: #1
Remote area location: CLEANROOM
Occupancy classification: ORDINARY GROUP II
Density: .2 - Gpm/SqFt
Area of application: 1517 - SqFt
Coverage per sprinkler: 120 - SqFt
Type of sprinklers calculated: 3/4" VIKING MIRAGE CONCEALED PENDENT
No. of sprinklers calculated: 19
In-rack demand: - GPM
Hose streams: 250 - GPM
Total water required (including hose streams): 714.24 - GPM @ 73.03 - Psi
Type of system: WET
Volume of dry or preaction system: - Gal

Water supply information

Date: 9/25/08
Location: HYDRANTS ARE ON EVERGREEN DRIVE, SEE PLOT PLAN
Source: PORTLAND WATER DIST.

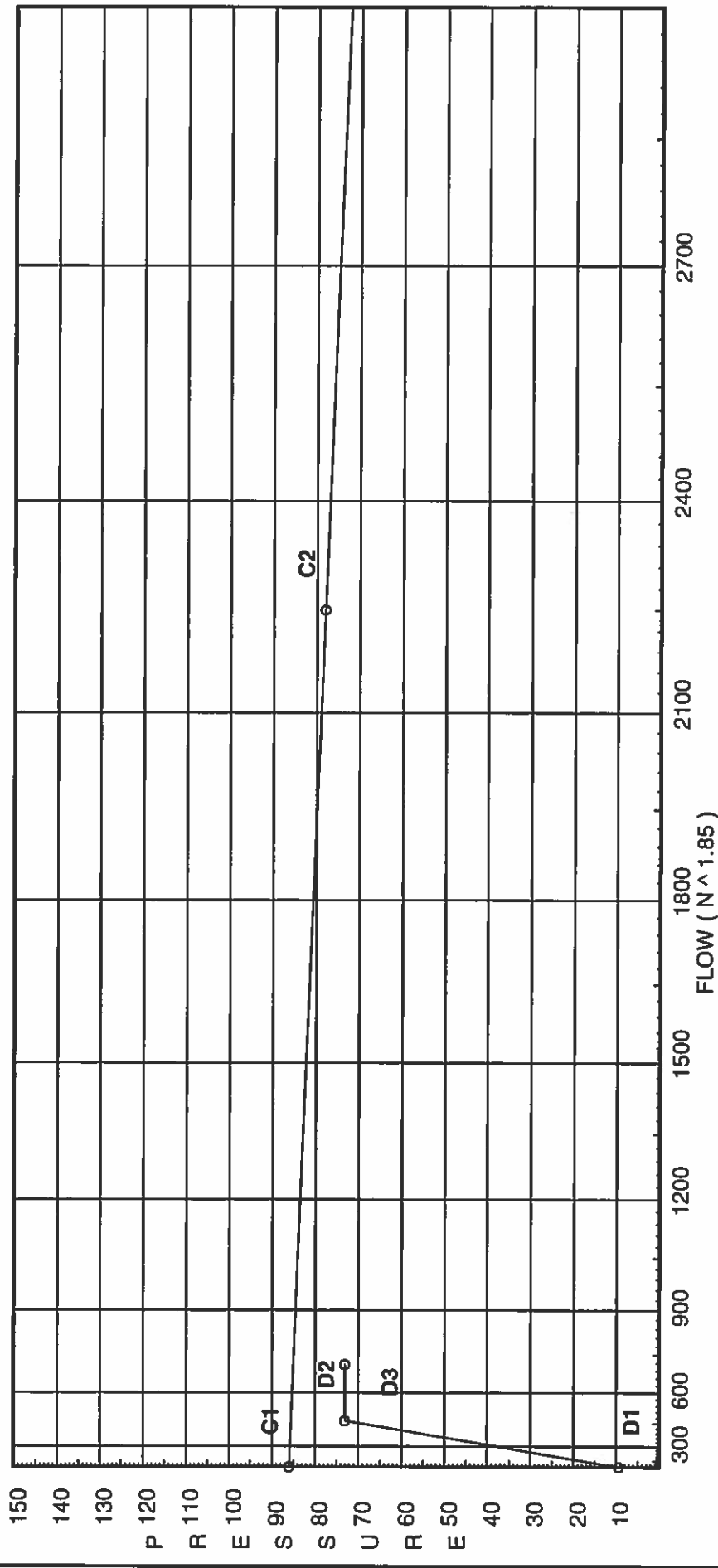
Name of contractor: EASTERN FIRE PROTECTION
Address: 170 KITTYHAWK AVE., AUBURN, ME. 04210
Phone number: 207-784-1507
Name of designer: T. PRAY
Authority having jurisdiction: S.F.M.O.
Notes: (Include peaking information or gridded systems here.)

Water Supply Curve C

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City Water Supply:
 C1 - Static Pressure : 86
 C2 - Residual Pressure: 78
 C2 - Residual Flow : 2250

Demand:
 D1 - Elevation : 9.420
 D2 - System Flow : 464.24
 D2 - System Pressure : 73.032
 Hose (Demand) : 250
 D3 - System Demand : 714.24
 Safety Margin : 12.010



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
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	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
I 90' Grnd-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
S NFPA 13 Swing Check	0	0	5	7	9	11	14	16	19	22	27	32	45	55	65	71	81	91	101	121
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
Y Mechanical Tee	2	4	5	6	8	10.5	12.5	15.5	0	22	0	0	0	0	0	0	0	0	0	0

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

<i>Node at Source</i>	<i>Static Pressure</i>	<i>Residual Pressure</i>	<i>Flow</i>	<i>Available Pressure</i>	<i>Total Demand</i>	<i>Required Pressure</i>
TEST	86.0	78	2250.0	85.042	714.24	73.032

NODE ANALYSIS

<i>Node Tag</i>	<i>Elevation</i>	<i>Node Type</i>	<i>Pressure at Node</i>	<i>Discharge at Node</i>	<i>Notes</i>
D1	0.0	8	7.0	21.17	
D2	0.0	8	7.29	21.6	
D3	0.0	8	7.0	21.17	
D4	0.0	8	7.0	21.17	
D5	0.0	8	7.0	21.17	
D6	0.0	8	9.0	24.0	
D7	0.0	8	7.0	21.17	
D8	0.0	8	9.0	24.0	
D9	0.0	8	9.0	24.0	
D10	0.0	8	7.0	21.17	
1	121.75	6.27	14.15	23.6	K=K @ FH01
2	121.75	6.28	14.2	23.65	K=K @ FH02
3	121.75	6.28	14.48	23.89	K=K @ FH02
4	121.75	6.28	15.08	24.38	K=K @ FH02
50	121.25		16.72		
5	121.25	6.27	16.79	25.71	K=K @ FH03
6	121.75	6.27	13.43	22.99	K=K @ FH04
7	121.75	6.28	13.49	23.06	K=K @ FH02
8	121.75	6.28	13.73	23.26	K=K @ FH02
9	121.75	6.27	14.89	24.21	K=K @ FH05
51	121.25		16.81		
10	121.25	6.27	17.1	25.95	K=K @ FH03
11	121.75	6.27	14.46	23.86	K=K @ FH04
12	121.75	6.3	14.53	24.0	K=K @ FH06
13	121.75	6.27	14.82	24.15	K=K @ FH07
14	121.75	6.33	15.22	24.71	K=K @ FH09
52	121.25		17.25		
16	121.75	6.3	15.5	24.79	K=K @ FH06
17	121.75	6.3	15.58	24.85	K=K @ FH06
18	121.75	6.3	15.89	25.1	K=K @ FH06
19	121.75	6.3	16.55	25.61	K=K @ FH06
15	121.25	6.32	17.57	26.48	K=K @ FH10
53	121.25		18.32		
TOR	109.67		55.93		
BASE	101.0		71.43		
TEST	100.0		73.03	250.0	

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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	*****
D1 to FH01	0 0	8.00	21.17 21.17	1 1.049	1E 1T	2.0 5.0 0.0	23.330 7.000 30.330	120 0.1445	7.000 0.0 4.383		Vel = 7.86	
FH01			0.0 21.17						11.383		K Factor = 6.27	
D2 to FH02	0 0	8.00	21.60 21.6	1 1.049	1E 1T	2.0 5.0 0.0	23.330 7.000 30.330	120 0.1500	7.290 0.0 4.551		Vel = 8.02	
FH02			0.0 21.60						11.841		K Factor = 6.28	
D3 to FH03	0 0	8.00	21.17 21.17	1 1.049	1E 1T	2.0 5.0 0.0	23.330 7.000 30.330	120 0.1445	7.000 0.0 4.383		Vel = 7.86	
FH03			0.0 21.17						11.383		K Factor = 6.27	
D4 to FH04	0 0	8.00	21.17 21.17	1 1.049	1E 1T	2.0 5.0 0.0	23.330 7.000 30.330	120 0.1445	7.000 0.0 4.383		Vel = 7.86	
FH04			0.0 21.17						11.383		K Factor = 6.27	
D5 to FH05	0 0	8.00	21.17 21.17	1 1.049	1E 1T	2.0 5.0 0.0	23.330 7.000 30.330	120 0.1445	7.000 0.0 4.383		Vel = 7.86	
FH05			0.0 21.17						11.383		K Factor = 6.27	
D6 to FH06	0 0	8.00	24.00 24.0	1 1.049	1E 1T	2.0 5.0 0.0	23.330 7.000 30.330	120 0.1823	9.000 0.0 5.530		Vel = 8.91	
FH06			0.0 24.00						14.530		K Factor = 6.30	
D7 to FH07	0 0	8.00	21.17 21.17	1 1.049	1E 1T	2.0 5.0 0.0	23.330 7.000 30.330	120 0.1445	7.000 0.0 4.383		Vel = 7.86	
FH07			0.0 21.17						11.383		K Factor = 6.27	
D8 to FH08	0 0	8.00	24.00 24.0	1 1.049	1E 1T	2.0 5.0 0.0	23.330 7.000 30.330	120 0.1823	9.000 0.0 5.530		Vel = 8.91	
FH08			0.0 24.00						14.530		K Factor = 6.30	
D9 to FH09	0 0	8.00	24.00 24.0	1 1.049	1T	5.0 0.0 0.0	24.420 5.000 29.420	120 0.1823	9.000 0.0 5.364		Vel = 8.91	
FH09			0.0 24.00						14.364		K Factor = 6.33	

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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	*****
D10 to FH10	0 0	8.00	21.17 21.17	1 1.049	1Y	5.0 0.0	24.210 5.000	120	7.000 0.0			
			0.0				29.210	0.1445	4.221	Vel =	7.86	
FH10			21.17						11.221	K Factor =	6.32	
1 to 2	121.75 121.75	6.27	23.60 23.6	2 2.067		0.0 0.0	8.000 0.0	120	14.148 0.0	K = K @ FH01		
							8.000	0.0065	0.052	Vel =	2.26	
2 to 3	121.75 121.75	6.28	23.65 47.25	2 2.067		0.0 0.0	12.000 0.0	120	14.200 0.0	K = K @ FH02		
							12.000	0.0234	0.281	Vel =	4.52	
3 to 4	121.75 121.75	6.28	23.89 71.14	2 2.067		0.0 0.0	12.000 0.0	120	14.481 0.0	K = K @ FH02		
							12.000	0.0501	0.601	Vel =	6.80	
4 to 50	121.75 121.250	6.28	24.38 95.52	2 2.067	1V 1Y	3.5 10.5	2.420 14.000	120	15.082 0.217	K = K @ FH02		
							16.420	0.0863	1.417	Vel =	9.13	
50 to 5	121.250 121.250		0.0 95.52	3 3.26		0.0 0.0	8.170 0.0	120	16.716 0.0			
							8.170	0.0093	0.076	Vel =	3.67	
5 to 51	121.250 121.250	6.27	25.70 121.22	3 3.26		0.0 0.0	0.875 0.0	120	16.792 0.0	K = K @ FH03		
							0.875	0.0149	0.013	Vel =	4.66	
51			0.0 121.22						16.805	K Factor =	29.57	
6 to 7	121.750 121.750	6.27	22.99 22.99	2 2.067		0.0 0.0	10.000 0.0	120	13.433 0.0	K = K @ FH04		
							10.000	0.0061	0.061	Vel =	2.20	
7 to 8	121.750 121.75	6.28	23.06 46.05	2 2.067		0.0 0.0	10.710 0.0	120	13.494 0.0	K = K @ FH02		
							10.710	0.0224	0.240	Vel =	4.40	
8 to 9	121.75 121.75	6.28	23.26 69.31	2 2.067	4V	14.0 0.0	10.170 14.000	120	13.734 0.0	K = K @ FH02		
							24.170	0.0477	1.153	Vel =	6.63	
9 to 51	121.75 121.250	6.27	24.21 93.52	2 2.067	1V 1Y	3.5 10.5	6.500 14.000	120	14.887 0.217	K = K @ FH05		
							20.500	0.0830	1.701	Vel =	8.94	
51 to 10	121.250 121.250		121.22 214.74	3 3.26		0.0 0.0	7.125 0.0	120	16.805 0.0			
							7.125	0.0420	0.299	Vel =	8.25	
10 to 52	121.250 121.250	6.27	25.95 240.69	3 3.26		0.0 0.0	2.830 2.830	120	17.104 0.0	K = K @ FH03		
							2.830	0.0519	0.147	Vel =	9.25	
52			0.0 240.69						17.251	K Factor =	57.95	

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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 *****
11 to 12	121.75 121.750	6.27	23.86	2		0.0	10.000	120	14.464	K = K @ FH04
						0.0	0.0		0.0	Vel = 2.28
12 to 13	121.750 121.75	6.3	24.00	2		0.0	12.000	120	14.530	K = K @ FH06
						0.0	0.0		0.0	Vel = 4.58
13 to 14	121.75 121.75	6.27	24.15	2		0.0	7.920	120	14.819	K = K @ FH07
						0.0	0.0		0.0	Vel = 6.88
14 to 52	121.75 121.250	6.33	24.71	2	1V 1Y	3.5 10.5	6.500 14.000	120	15.224	K = K @ FH09
			96.72	2.067		0.0	20.500	0.0883	1.810	Vel = 9.25
52 to 15	121.250 121.250		240.69	3		0.0	3.250	120	17.251	
						0.0	0.0		0.0	Vel = 12.97
15			0.0 337.41						17.566	K Factor = 80.50
16 to 17	121.75 121.75	6.3	24.79	2		0.0	12.000	120	15.497	K = K @ FH06
						0.0	0.0		0.0	Vel = 2.37
17 to 18	121.75 121.75	6.3	24.85	2		0.0	12.000	120	15.583	K = K @ FH06
						0.0	0.0		0.0	Vel = 4.75
18 to 19	121.75 121.750	6.3	25.10	2		0.0	12.000	120	15.891	K = K @ FH06
						0.0	0.0		0.0	Vel = 7.15
19 to 53	121.750 121.250	6.3	25.61	2	1V 1Y	3.5 10.5	2.420 14.000	120	16.549	K = K @ FH06
			100.35	2.067		0.0	16.420	0.0946	1.553	Vel = 9.59
53			0.0 100.35						18.319	K Factor = 23.45
15 to 53	121.250 121.250	6.32	363.89	3		0.0	6.750	120	17.566	K = K @ FH10
						0.0	0.0		0.0	Vel = 13.99
53 to TOR	121.250 109.670		100.35	3	4T 6I	80.637 40.319	65.410 120.956	120	18.319	
			464.24	3.26		0.0	186.366	0.1749	32.593	Vel = 17.84
TOR to BASE	109.670 101		0.0	3	1B 2F 1S 1T	13.44 8.064 21.503 20.159	4.000 63.166 67.166	120	55.927	
			464.24	3.26				0.1749	11.746	Vel = 17.84
BASE to TEST	101 100		0.0	6	2E 1G 1T	40.168 4.304 43.037	110.000 87.509 197.509	140	71.428	
			464.24	6.16				0.0059	1.171	Vel = 5.00
			250.00							Qa = 250.00

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Node1	Elev1	K	Qa	Nom	Fitting or	Pipe	CFact	Pt			
to						Ftng's		Pe	*****	Notes	*****
Node2	Elev2	Fact	Qt	Act	Eqv.	Ln.	Total	Pf/Ft	Pf		
TEST			714.24						73.032		K Factor = 83.58