

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

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

Job Name : Immucell- Freezer Addition  
Drawing : 1 of 1  
Location : New Addition-2nd Lvl  
Remote Area : #1  
Contract : AU-5216-14  
Data File : Immucell Freezer Addition-2nd Lvl Storage.WXF

**HYDRAULIC CALCULATIONS**  
*for*

**Project name:** Immucell Corporation  
**Location:** New Addition-2nd Lvl  
**Drawing no:** 1 of 1  
**Date:** 11/12/14

**Design**

**Remote area number:** #1  
**Remote area location:** Material Storage  
**Occupancy classification:** Ordinary Group II  
**Density:** .2 - Gpm/SqFt  
**Area of application:** 1022 - SqFt  
**Coverage per sprinkler:** 124 - SqFt  
**Type of sprinklers calculated:** 3/4" TY-FRB White Recessed Pendent K=8.0  
**No. of sprinklers calculated:** 10  
**In-rack demand:** - GPM  
**Hose streams:** - GPM  
**Total water required (including hose streams):** 509.22 - GPM @ 60.08 - Psi  
**Type of system:** Wet System  
**Volume of dry or preaction system:** - Gal

**Water supply information**

**Date:** 10/17/14  
**Location:** Hydrants locted on Industrial Drive, See plot plan  
**Source:** Portland Water District

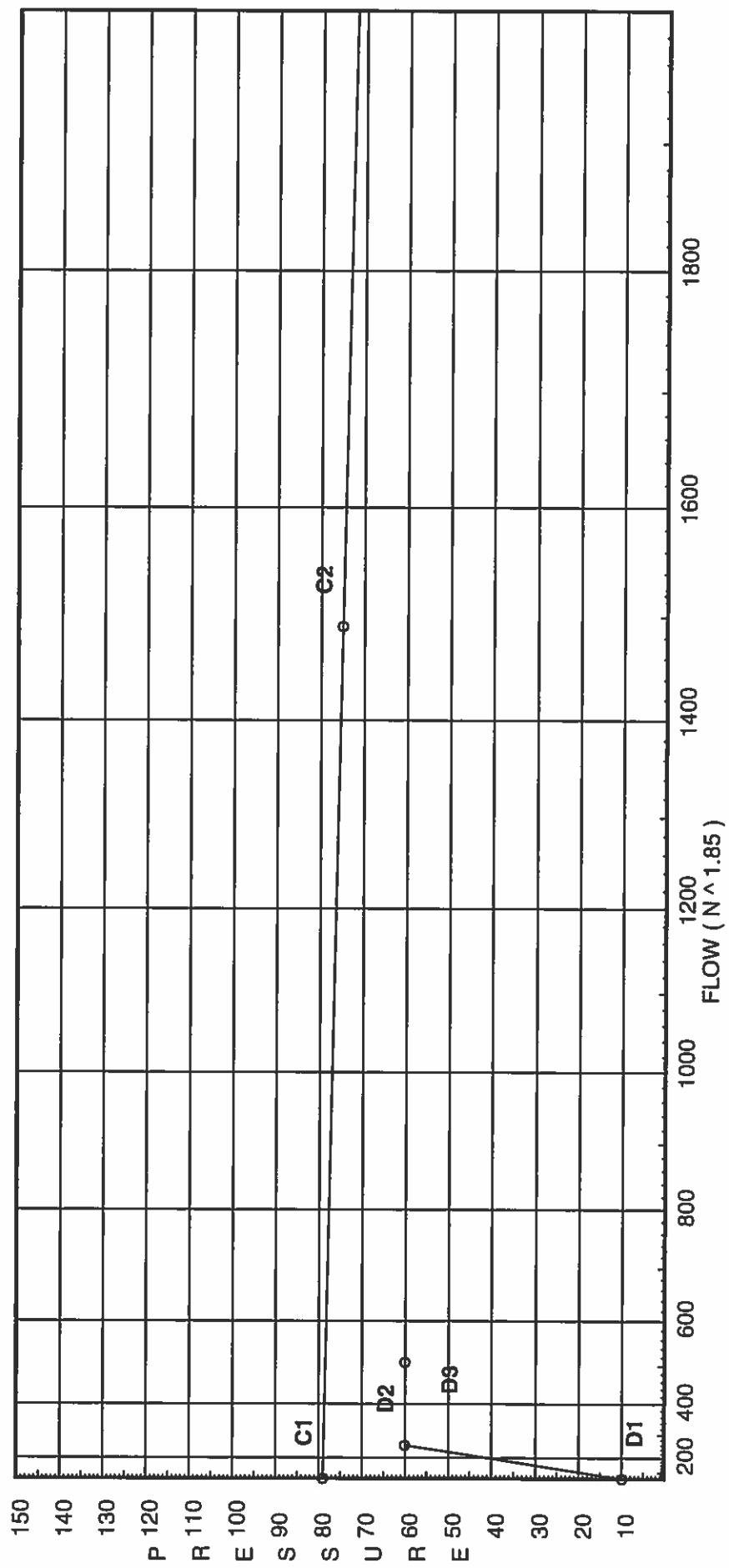
**Name of contractor:** Eastern Fire Protection  
**Address:** 170 Kitty Hawk Ave., Auburn, Me. 04210  
**Phone number:** 207-784-1507  
**Name of designer:** T. Pray  
**Authority having jurisdiction:** S.F.M.O.  
**Notes:** (Include peaking information or gridded systems here.) Remote area reduced per NFPA 13 (2007) SECTION 11.2.3.2.3.1

# Water Supply Curve C

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City Water Supply:  
 C1 - Static Pressure : 79  
 C2 - Residual Pressure: 75  
 C2 - Residual Flow : 1491

Demand:  
 D1 - Elevation : 9.961  
 D2 - System Flow : 259.215  
 D2 - System Pressure : 60.076  
 Hose ( Demand ) : 250  
 D3 - System Demand : 509.215  
 Safety Margin : 18.376



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' 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	81	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
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
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	79.0	75	1491.0	78.452	509.22	60.076

**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>
DO01	0.0	8	9.0	24.0	
DO02	0.0	8	9.61	24.8	
100	123.0	7.58	10.03	24.0	K=K @ EQ01
101	123.0	7.58	10.22	24.22	K=K @ EQ01
102	123.0	7.58	10.86	24.97	K=K @ EQ02
103	123.0	7.58	12.05	26.3	K=K @ EQ02
104	123.0	7.58	10.31	24.33	K=K @ EQ01
105	123.0	7.58	10.5	24.55	K=K @ EQ01
106	123.0	7.58	11.16	25.32	K=K @ EQ02
107	123.0	7.58	12.38	26.66	K=K @ EQ02
108	120.0	7.58	15.03	29.37	K=K @ EQ01
109	120.0	7.58	15.14	29.48	K=K @ EQ01
202A	120.96		15.06		
200	123.0		12.46		
201	123.0		12.8		
202	120.0		16.52		
215	120.0		24.45		
216	121.25		28.71		
217	121.25		31.49		
50	121.25		33.66		
5	121.25		34.15		
51	121.25		34.2		
10	121.25		34.62		
52	121.25		34.79		
15	121.25		34.99		
53	121.25		35.39		
TOR	109.67		51.49		
BASE	101.0		59.24		
TEST	100.0		60.08	250.0	

Final Calculations - Hazen-Williams - 2007

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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	*****
DO01 to EQ01	0 0	8.00	24.00 24.0	1 1.049	1T	5.0 0.0	0.670 5.000	120	9.000 0.0			
			0.0			0.0	5.670	0.1824	1.034	Vel =	8.91	
EQ01			24.00						10.034	K Factor =	7.58	
DO02 to EQ02	0 0	8.00	24.80 24.8	1 1.049	1T	5.0 0.0	0.670 5.000	120	9.610 0.0			
			0.0			0.0	5.670	0.1937	1.098	Vel =	9.21	
EQ02			24.80						10.708	K Factor =	7.58	
100 to 101	123 123	7.58	24.00 24.0	1.5 1.682		0.0 0.0	10.000 0.0	120	10.034 0.0	K = K @ EQ01		
						0.0	10.000	0.0183	0.183	Vel =	3.47	
101 to 102	123 123	7.58	24.22 48.22	1.5 1.682		0.0 0.0	9.670 0.0	120	10.217 0.0	K = K @ EQ01		
						0.0	9.670	0.0665	0.643	Vel =	6.96	
102 to 200	123 123	7.58	24.97 73.19	1.5 1.682	1T	9.9 0.0	1.210 9.900	120	10.860 0.0	K = K @ EQ02		
			0.0			0.0	11.110	0.1439	1.599	Vel =	10.57	
200			73.19						12.459	K Factor =	20.74	
103 to 200	123 123	7.58	26.30 26.3	1.5 1.682	1T	9.9 0.0	9.125 9.900	120	12.046 0.0	K = K @ EQ02		
			0.0			0.0	19.025	0.0217	0.413	Vel =	3.80	
200			26.30						12.459	K Factor =	7.45	
104 to 105	123 123	7.58	24.33 24.33	1.5 1.682		0.0 0.0	10.000 0.0	120	10.314 0.0	K = K @ EQ01		
						0.0	10.000	0.0188	0.188	Vel =	3.51	
105 to 106	123 123	7.58	24.56 48.89	1.5 1.682		0.0 0.0	9.670 0.0	120	10.502 0.0	K = K @ EQ01		
						0.0	9.670	0.0681	0.659	Vel =	7.06	
106 to 201	123 123	7.58	25.31 74.2	1.5 1.682	1T	9.9 0.0	1.210 9.900	120	11.161 0.0	K = K @ EQ02		
			0.0			0.0	11.110	0.1476	1.640	Vel =	10.71	
201			74.20						12.801	K Factor =	20.74	
107 to 201	123 123	7.58	26.66 26.66	1.5 1.682	1T	9.9 0.0	9.125 9.900	120	12.378 0.0	K = K @ EQ02		
			0.0			0.0	19.025	0.0222	0.423	Vel =	3.85	
201			26.66						12.801	K Factor =	7.45	
108 to 202A	120 120.960	7.58	29.37 29.37	1.5 1.682	1J	9.9 0.0	7.125 9.900	120	15.028 -0.416	K = K @ EQ01		
						0.0	17.025	0.0266	0.453	Vel =	4.24	

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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	*****
			0.0 29.37						15.065		K Factor = 7.57	
109 to 202A	120 120.960	7.58	29.48	1.5	1J	9.9 0.0	2.875 9.900	120	15.139 -0.416		K = K @ EQ01	
			29.48	1.682		0.0	12.775	0.0268	0.342		Vel = 4.26	
202A to 202	120.960 120		29.37	1.5	1T	9.9 0.0	0.960 9.900	120	15.065 0.416			Vel = 8.50
			58.85	1.682		0.0	10.860	0.0961	1.044			
			0.0 58.85						16.525		K Factor = 14.48	
200 to 201	123 123		99.50	2.5		0.0 0.0	12.000 0.0	120	12.459 0.0			
			99.5	2.635		0.0	12.000	0.0285	0.342		Vel = 5.85	
201 to 202	123 120		100.86	2.5	2V	11.807 0.0	11.460 11.807	120	12.801 1.299			
			200.36	2.635		0.0	23.267	0.1042	2.425		Vel = 11.79	
202 to 215	120 120		58.85	2.5	1T	16.474 0.0	30.750 16.474	120	16.525 0.0			Vel = 15.25
			259.21	2.635		0.0	47.224	0.1678	7.923			
215 to 216	120 121.250		0.0	2.5	1V 1Y	5.903 17.161	5.540 23.064	120	24.448 -0.541			Vel = 15.25
			259.21	2.635		0.0	28.604	0.1677	4.798			
216 to 217	121.250 121.250		0.0	3	1V 1X	6.72 17.471	22.580 24.191	120	28.705 0.0			Vel = 9.96
			259.21	3.26		0.0	46.771	0.0595	2.783			
217 to 50	121.250 121.250		0.0	3	2V	13.44 0.0	23.080 13.440	120	31.488 0.0			
			259.21	3.26		0.0	36.520	0.0595	2.174		Vel = 9.96	
50 to 5	121.250 121.250		0.0	3		0.0 0.0	8.170 0.0	120	33.662 0.0			
			259.21	3.26		0.0	8.170	0.0595	0.486		Vel = 9.96	
5 to 51	121.250 121.250		0.0	3		0.0 0.0	0.875 0.0	120	34.148 0.0			
			259.21	3.26		0.0	0.875	0.0594	0.052		Vel = 9.96	
51 to 10	121.250 121.250		0.0	3		0.0 0.0	7.125 0.0	120	34.200 0.0			
			259.21	3.26		0.0	7.125	0.0595	0.424		Vel = 9.96	
10 to 52	121.250 121.250		0.0	3		0.0 0.0	2.830 0.0	120	34.624 0.0			
			259.21	3.26		0.0	2.830	0.0594	0.168		Vel = 9.96	
52 to 15	121.250 121.250		0.0	3		0.0 0.0	3.250 0.0	120	34.792 0.0			
			259.21	3.26		0.0	3.250	0.0597	0.194		Vel = 9.96	
15 to 53	121.250 121.250		0.0	3		0.0 0.0	6.750 0.0	120	34.986 0.0			
			259.21	3.26		0.0	6.750	0.0594	0.401		Vel = 9.96	

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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	*****
53 to TOR	121.250 109.670		0.0 259.21	3 3.26	4T 6I	80.637 40.319	65.410 120.956	120	35.387 5.015		Vel = 9.96	
TOR to BASE	109.670 101		0.0 259.21	3 3.26	1B 2F 1S	13.44 8.064 21.503	4.000 63.166 67.166	120	51.492 3.755 3.997		Vel = 9.96	
BASE to TEST	101 100		0.0 259.21	6 6.16	2E 1G 1T	40.168 4.304 43.037	110.000 87.509 197.509	140	59.244 0.433 0.399		Vel = 2.79	
TEST			250.00 509.21								Qa = 250.00 K Factor = 65.70	
									60.076			