

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

Denali Fire protection, Inc.  
270 Tiger Hill Road  
Your Street Address 2  
Oxford, Maine 04270  
207-539-4226

Job Name : CRESCENT HEIGHTS THIRD FLOOR UNIT  
Building : STEEL & WOOD STRUCTURE  
Location : CRESCENT STREET PORTLAND, MAINE  
System : 1  
Contract : C18-09  
Data File : 1-C1809.WXF

Hydraulic Design Information Sheet

Name - CRESCENT HEIGHTS Date - 10/14/09  
 Location - CRESCENT STREET PORTLAND, MAINE  
 Building - STEEL & WOOD STRUCTURE System No. - 1  
 Contractor - DENALI FIRE PROTECTION, INC, Contract No. - C18-09  
 Calculated By - CKD Drawing No. - 4  
 Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 9'-0"  
 Occupancy - THIRD FLOOR UNIT

S (X) NFPA 13 (X) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.  
 Y ( ) NFPA 231 ( ) NFPA 231C (X) Figure 11.2.3.1.1 Curve LIGHT

S Other

T Specific Ruling Made By Date

M	Area of Sprinkler Operation	- 500	System Type	Sprinkler/Nozzle
	Density	- .1	(X) Wet	Make VICTAULIC
D	Area Per Sprinkler	- 256	( ) Dry	Model V2742
E	Elevation at Highest Outlet	- 155.67	( ) Deluge	Size 7/16"
S	Hose Allowance - Inside	-	( ) Preaction	K-Factor 4.9
I	Rack Sprinkler Allowance	-	( ) Other	Temp.Rat.155
G	Hose Allowance - Outside	- 100		

N Note

Calculation Flow Required - 154.479 Press Required - 36.252 AT TEST  
 Summary C-Factor Used: 150 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 12/13/02		Cap. -
T	Time of Test -	Rated Cap.-	Elev.-
E	Static Press - 54	@ Press -	
R	Residual Press - 51	Elev. -	Well
	Flow - 949		Proof Flow
S	Elevation - 114.5		

U Location - 25'-0" FROM BUILDING

P Source of Information - PORTLAND WATER DISTRICT

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

G Horizontal Barriers Provided:

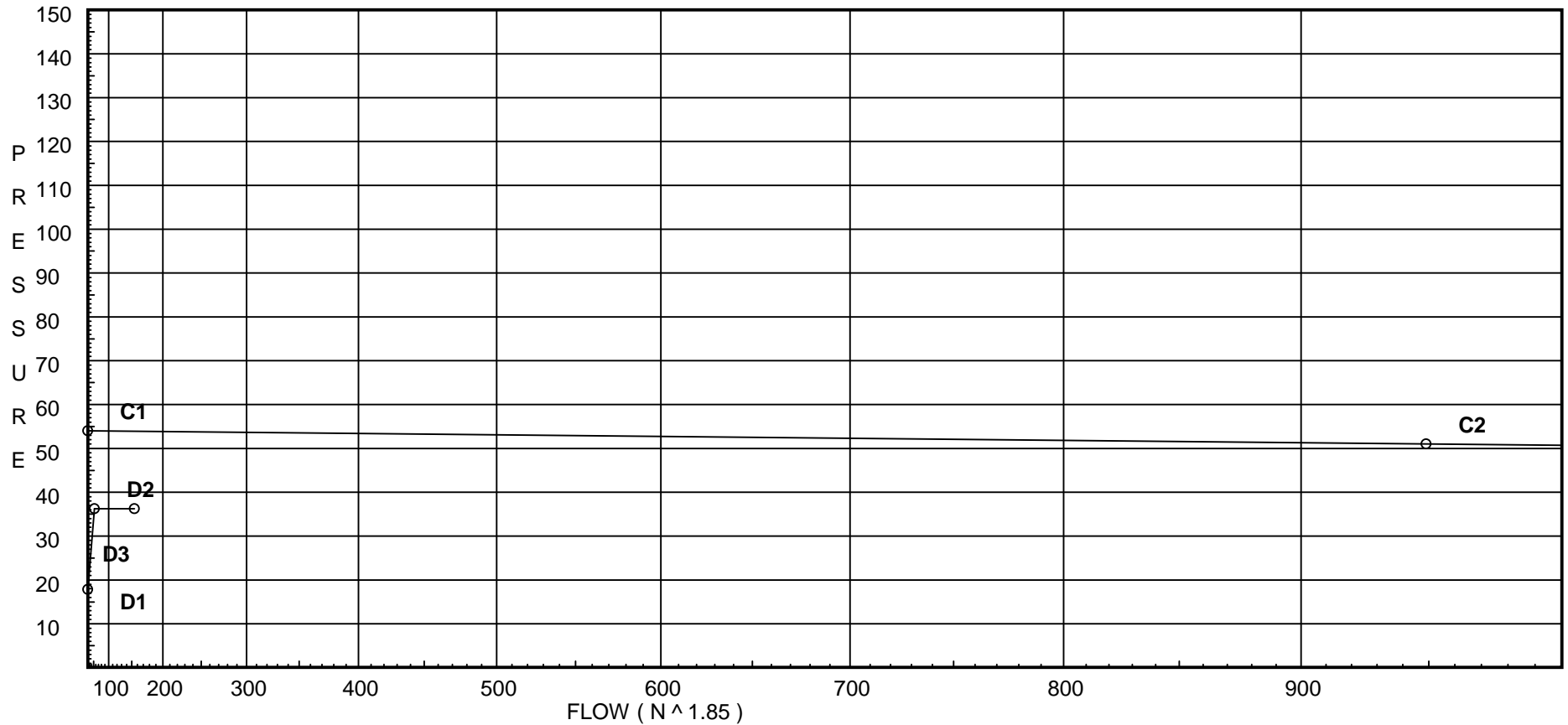
# Water Supply Curve (C)

Denali Fire protection, Inc.  
CRESCENT HEIGHTS THIRD FLOOR UNIT

Page 2  
Date 10/14/09

City Water Supply:  
C1 - Static Pressure : 54  
C2 - Residual Pressure: 51  
C2 - Residual Flow : 949

Demand:  
D1 - Elevation : 17.831  
D2 - System Flow : 54.479  
D2 - System Pressure : 36.252  
Hose ( Adj City ) : \_\_\_\_\_  
Hose ( Demand ) : 100  
D3 - System Demand : 154.479  
Safety Margin : 17.643



# Fittings Used Summary

Denali Fire protection, Inc.  
CRESCENT HEIGHTS THIRD FLOOR UNIT

Page 3  
Date 10/14/09

## Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Generic Butterfly Valve	0	0	0	0	0	0	7	10	0	12	9	10	12	19	21	0	0	0	0	0
E	90' Standard Elbow	2	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Generic Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
L	Long Turn Elbow	1	1	2	2	2	3	4	5	5	6	8	9	13	16	18	24	27	30	34	40
T	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

# Pressure / Flow Summary - STANDARD

Denali Fire protection, Inc.  
CRESCENT HEIGHTS THIRD FLOOR UNIT

Page 4  
Date 10/14/09

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
D1	0.0	4.9	7.0	na	12.96	0.1	10	7.0
1	155.67	K = K @ L1	7.32	na	12.96			
2	155.67	K = K @ L1	8.01	na	13.56			
3	155.67	K = K @ L1	8.22	na	13.74			
4	155.67	K = K @ L1	8.81	na	14.22			
2A	155.67		8.4	na				
3A	155.67		8.64	na				
4A	155.67		9.24	na				
A	155.67		10.22	na				
B	155.67		10.5	na				
C	155.67		12.15	na				
D	124.17		25.85	na				
TOR	124.17		26.0	na				
BASE	115.5		35.81	na				
TEST	114.5		36.25	na	100.0			

The maximum velocity is 11.45 and it occurs in the pipe between nodes 4A and A

# Final Calculations - Hazen-Williams

Denali Fire protection, Inc.  
CRESCENT HEIGHTS THIRD FLOOR UNIT

Page 5  
Date 10/14/09

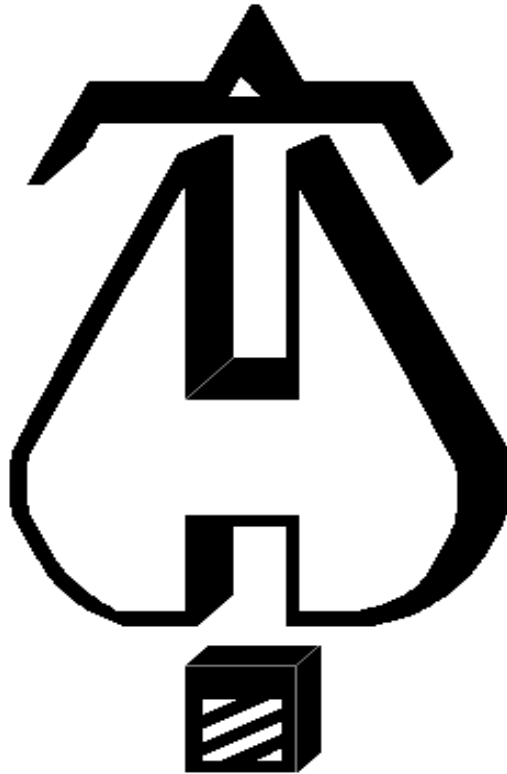
Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
D1 to L1	12.96	1.101 150	1T	9.563 0.0	1.000 9.562	7.000 0.0		K Factor = 4.90	
	12.96	0.0305		0.0	10.562	0.322		Vel = 4.37	
	0.0								
	12.96					7.322		K Factor = 4.79	
1 to 2A	12.96	1.101 150	2E 1T	7.65 9.563	18.040 17.212	7.322 0.0		K Factor @ node L1	
	12.96	0.0305		0.0	35.252	1.076		Vel = 4.37	
	0.0								
	12.96					8.398		K Factor = 4.47	
2 to 2A	13.56	1.101 150	1T	9.563 0.0	2.290 9.562	8.005 0.0		K Factor @ node L1	
	13.56	0.0332		0.0	11.852	0.393		Vel = 4.57	
	0.0								
	13.56					8.398		K Factor = 4.68	
3 to 3A	13.74	1.101 150	1T	9.563 0.0	2.670 9.562	8.223 0.0		K Factor @ node L1	
	13.74	0.0339		0.0	12.232	0.415		Vel = 4.63	
	0.0								
	13.74					8.638		K Factor = 4.67	
4 to 4A	14.22	1.101 150	1T	9.563 0.0	2.330 9.562	8.811 0.0		K Factor @ node L1	
	14.22	0.0362		0.0	11.892	0.431		Vel = 4.79	
	0.0								
	14.22					9.242		K Factor = 4.68	
2A to 3A	26.52	1.394 150		0.0 0.0	6.620 0.0	8.398 0.0			
	26.52	0.0363		0.0	6.620	0.240		Vel = 5.57	
3A to 4A	13.74	1.394 150		0.0 0.0	7.670 0.0	8.638 0.0			
	40.26	0.0787		0.0	7.670	0.604		Vel = 8.46	
4A to A	14.22	1.394 150		0.0 0.0	7.120 0.0	9.242 0.0			
	54.48	0.1376		0.0	7.120	0.980		Vel = 11.45	
A to B	0.0	2.003 150		0.0 0.0	11.920 0.0	10.222 0.0			
	54.48	0.0236		0.0	11.920	0.281		Vel = 5.55	
B to C	0.0	2.003 150	1T	12.965 0.0	57.120 12.965	10.503 0.0			
	54.48	0.0236		0.0	70.085	1.651		Vel = 5.55	
C to D	0.0	4.26 120	3L	23.701 0.0	35.790 23.701	12.154 13.643			
	54.48	0.0009		0.0	59.491	0.053		Vel = 1.23	
D to TOR	0.0	4.26 120	2T 8L	52.668 63.202	54.870 115.870	25.850 0.0			
	54.48	0.0009		0.0	170.740	0.154		Vel = 1.23	
TOR to BASE	0.0	4.26 120	1T 1B	26.334 15.8	10.000 42.134	26.004 9.755		* Fixed loss = 6	
	54.48	0.0009		0.0	52.134	0.048		Vel = 1.23	

# Final Calculations - Standard

Denali Fire protection, Inc.  
CRESCENT HEIGHTS THIRD FLOOR UNIT

Page 6  
Date 10/14/09

Hyd. Ref. Point	Qa  Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
BASE	0.0	6.16	2E 40.168	25.000	35.807				
to		140	1G 4.304	87.509	0.433				
TEST	54.48	0.0001	1T 43.037	112.509	0.012		Vel = 0.59		
	100.00						Qa = 100.00		
	154.48				36.252		K Factor = 25.66		



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

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270 Tiger Hill Road  
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Oxford, Maine 04270  
207-539-4226

Job Name : CRESCENT HEIGHTS THIRD FLOOR CONCEALED SPACE  
Building : STEEL & WOOD STRUCTURE  
Location : CRESCENT STREET PORTLAND, MAINE  
System : 1  
Contract : C18-09  
Data File : 2-C1809.WXF



Hydraulic Design Information Sheet

Name - CRESCENT HEIGHTS Date - 10/14/09  
 Location - CRESCENT STREET PORTLAND, MAINE  
 Building - STEEL & WOOD STRUCTURE System No. - 1  
 Contractor - DENALI FIRE PROTECTION, INC, Contract No. - C18-09  
 Calculated By - CKD Drawing No. - 4  
 Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - 10'-6"  
 Occupancy - CONCEALED SPACE

S (X) NFPA 13 (X) Lt. Haz. Ord.Haz.Gp. ( ) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.  
 Y ( ) NFPA 231 ( ) NFPA 231C (X) Figure 11.2.3.1.1 Curve LIGHT  
 S Other PER NFPA 13 SECTION 11.2.3.1.4.(1) & 11.2.3.2.3  
 T Specific Ruling Made By Date

M	Area of Sprinkler Operation - 1003	System Type	Sprinkler/Nozzle
	Density - .1	(X) Wet	Make VICTAULIC
D	Area Per Sprinkler - 117	( ) Dry	Model V2502
E	Elevation at Highest Outlet - 155.67	( ) Deluge	Size 7/16"
S	Hose Allowance - Inside -	( ) Preaction	K-Factor 4.2
I	Rack Sprinkler Allowance -	( ) Other	Temp.Rat.175
G	Hose Allowance - Outside - 100		

N Note

Calculation Flow Required - 224.677 Press Required - 46.296 AT TEST  
 Summary C-Factor Used: 150 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 12/13/02		Cap. -
T	Time of Test -	Rated Cap.-	Elev.-
E	Static Press - 54	@ Press -	
R	Residual Press - 51	Elev. -	Well
	Flow - 949		Proof Flow
S	Elevation - 114.5		

U Location - 25'-0" FROM BUILDING

P Source of Information - PORTLAND WATER DISTRICT

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	Flue Spacing	Clearance:Storage to Ceiling
A	Longitudinal	Transverse

G Horizontal Barriers Provided:

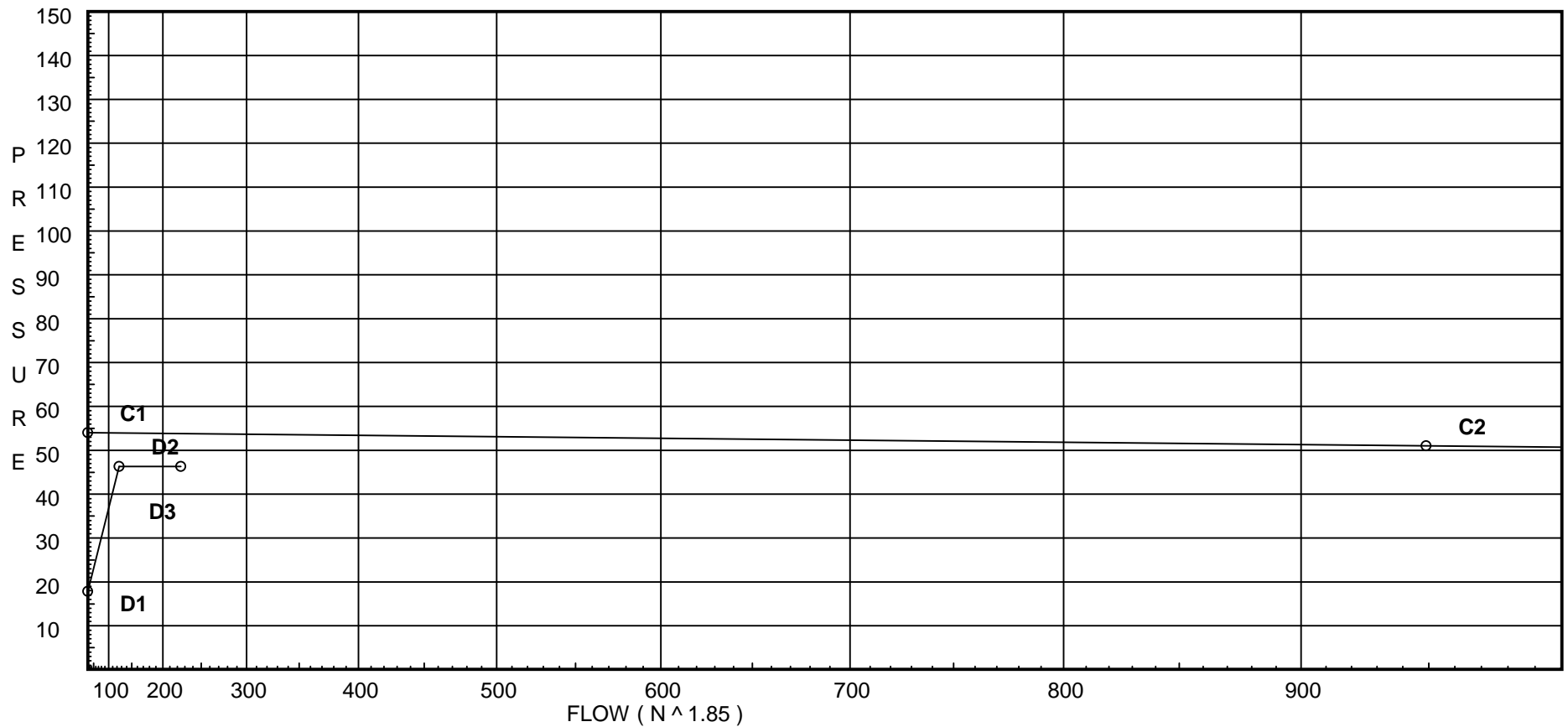
# Water Supply Curve (C)

Denali Fire protection, Inc.  
CRESCENT HEIGHTS THIRD FLOOR CONCEALED SPACE

Page 2  
Date 10/14/09

City Water Supply:  
C1 - Static Pressure : 54  
C2 - Residual Pressure: 51  
C2 - Residual Flow : 949

Demand:  
D1 - Elevation : 17.831  
D2 - System Flow : 124.677  
D2 - System Pressure : 46.296  
Hose ( Adj City ) : \_\_\_\_\_  
Hose ( Demand ) : 100  
D3 - System Demand : 224.677  
Safety Margin : 7.495



# Fittings Used Summary

Denali Fire protection, Inc.  
CRESCENT HEIGHTS THIRD FLOOR CONCEALED SPACE

Page 3  
Date 10/14/09

## Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Generic Butterfly Valve	0	0	0	0	0	0	7	10	0	12	9	10	12	19	21	0	0	0	0	0
E	90' Standard Elbow	2	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Generic Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
L	Long Turn Elbow	1	1	2	2	2	3	4	5	5	6	8	9	13	16	18	24	27	30	34	40
T	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

# Pressure / Flow Summary - STANDARD

Denali Fire protection, Inc.  
 CRESCENT HEIGHTS THIRD FLOOR CONCEALED SPACE

Page 4  
 Date 10/14/09

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
5	155.67	4.2	7.76	na	11.7	0.1	117	7.0
6	155.67	4.2	8.0	na	11.88	0.1	117	7.0
7	155.67	4.2	8.62	na	12.33	0.1	117	7.0
8	155.67	4.2	9.16	na	12.71	0.1	117	7.0
9	155.67	4.2	10.09	na	13.34	0.1	117	7.0
10	155.67	4.2	7.88	na	11.79	0.1	117	7.0
11	155.67	4.2	8.13	na	11.98	0.1	117	7.0
12	155.67	4.2	8.88	na	12.52	0.1	117	7.0
13	155.67	4.2	9.42	na	12.89	0.1	117	7.0
14	155.67	4.2	10.38	na	13.53	0.1	117	7.0
A	155.67		13.23	na				
B	155.67		13.59	na				
C	155.67		21.23	na				
D	124.17		35.12	na				
TOR	124.17		35.83	na				
BASE	115.5		45.8	na				
TEST	114.5		46.3	na	100.0			

The maximum velocity is 13.18 and it occurs in the pipe between nodes 14 and B

# Final Calculations - Hazen-Williams

Denali Fire protection, Inc.  
CRESCENT HEIGHTS THIRD FLOOR CONCEALED SPACE

Page 5  
Date 10/14/09

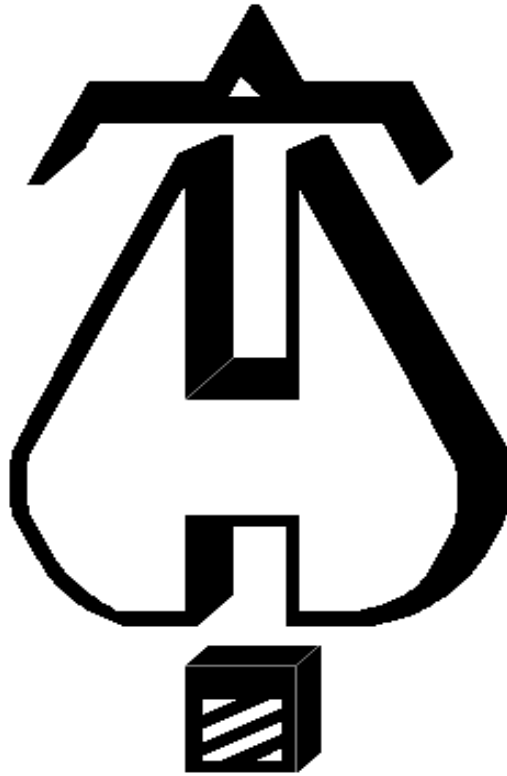
Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftg's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
5 to 6	11.70 11.7	1.101 150 0.0252		0.0 0.0 0.0	9.670 0.0 9.670	7.760 0.0 0.244			K Factor = 4.20	
6 to 7	11.88 23.58	1.394 150 0.0293	2E	9.523 0.0 0.0	11.670 9.523 21.193	8.004 0.0 0.620			K Factor = 4.20	Vel = 3.94
7 to 8	12.34 35.92	1.394 150 0.0637		0.0 0.0 0.0	8.370 0.0 8.370	8.624 0.0 0.533			K Factor = 4.20	Vel = 4.96
8 to 9	12.71 48.63	1.394 150 0.1116		0.0 0.0 0.0	8.370 0.0 8.370	9.157 0.0 0.934			K Factor = 4.20	Vel = 7.55
9 to A	13.34 61.97	1.394 150 0.1747	1T	9.523 0.0 0.0	8.460 9.523 17.983	10.091 0.0 3.142			K Factor = 4.20	Vel = 10.22
	0.0 61.97					13.233			K Factor = 17.04	
10 to 11	11.79 11.79	1.101 150 0.0256		0.0 0.0 0.0	9.670 0.0 9.670	7.884 0.0 0.248			K Factor = 4.20	Vel = 3.97
11 to 12	11.98 23.77	1.394 150 0.0297	1T 1E	9.523 4.762 0.0	10.960 14.284 25.244	8.132 0.0 0.749			K Factor = 4.20	Vel = 5.00
12 to 13	12.52 36.29	1.394 150 0.0649		0.0 0.0 0.0	8.370 0.0 8.370	8.881 0.0 0.543			K Factor = 4.20	Vel = 7.63
13 to 14	12.89 49.18	1.394 150 0.1140		0.0 0.0 0.0	8.370 0.0 8.370	9.424 0.0 0.954			K Factor = 4.20	Vel = 10.34
14 to B	13.53 62.71	1.394 150 0.1786	1T	9.523 0.0 0.0	8.460 9.523 17.983	10.378 0.0 3.211			K Factor = 4.20	Vel = 13.18
	0.0 62.71					13.589			K Factor = 17.01	
A to B	61.97 61.97	2.003 150 0.0299		0.0 0.0 0.0	11.920 0.0 11.920	13.233 0.0 0.356				Vel = 6.31
B to C	62.71 124.68	2.003 150 0.1090	1T	12.965 0.0 0.0	57.120 12.965 70.085	13.589 0.0 7.639				Vel = 12.69
C to D	0.0 124.68	4.26 120 0.0042	3L	23.701 0.0 0.0	35.790 23.701 59.491	21.228 13.643 0.248				Vel = 2.81
D to TOR	0.0 124.68	4.26 120 0.0042	2T 8L	52.668 63.202 0.0	54.870 115.870 170.740	35.119 0.0 0.713				Vel = 2.81
TOR to BASE	0.0 124.68	4.26 120 0.0042	1T 1B	26.334 15.8 0.0	10.000 42.134 52.134	35.832 9.755 0.217			* Fixed loss = 6	Vel = 2.81

# Final Calculations - Standard

Denali Fire protection, Inc.  
 CRESCENT HEIGHTS THIRD FLOOR CONCEALED SPACE

Page 6  
 Date 10/14/09

Hyd. Ref. Point	Qa  Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
BASE	0.0	6.16	2E 40.168	25.000	45.804				
to		140	1G 4.304	87.509	0.433				
TEST	124.68	0.0005	1T 43.037	112.509	0.059		Vel = 1.34		
	100.00						Qa = 100.00		
	224.68				46.296		K Factor = 33.02		



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

Denali Fire protection, Inc.  
270 Tiger Hill Road  
Your Street Address 2  
Oxford, Maine 04270  
207-539-4226

Job Name : CRESCENT HEIGHTS UNDERSTORY  
Building : STEEL & WOOD STRUCTURE  
Location : CRESCENT STREET PORTLAND, MAINE  
System : 1  
Contract : C18-09  
Data File : 3-C1809.WXF

Hydraulic Design Information Sheet

Name - CRESCENT HEIGHTS Date - 10/14/09  
 Location - CRESCENT STREET PORTLAND, MAINE  
 Building - STEEL & WOOD STRUCTURE System No. - 1  
 Contractor - DENALI FIRE PROTECTION, INC, Contract No. - C18-09  
 Calculated By - CKD Drawing No. - 4  
 Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - VARIES  
 Occupancy - UNDERSTORY

S (X) NFPA 13 ( ) Lt. Haz. Ord.Haz.Gp. (X) 1 ( ) 2 ( ) 3 ( ) Ex.Haz.  
 Y ( ) NFPA 231 ( ) NFPA 231C (X) Figure 11.2.3.1.1 Curve OH I  
 S Other AREA REDUCED PER NFPA 13 SECTION 11.2.3.2.3  
 T Specific Ruling Made By Date

M	Area of Sprinkler Operation	- 1007	System Type	Sprinkler/Nozzle
	Density	- .15	(X) Wet	Make VICTAULIC
D	Area Per Sprinkler	- 121	( ) Dry	Model V3802
E	Elevation at Highest Outlet	- 112.54	( ) Deluge	Size 1/2"
S	Hose Allowance - Inside	-	( ) Preaction	K-Factor 5.6
I	Rack Sprinkler Allowance	-	( ) Other	Temp.Rat.155
G	Hose Allowance - Outside	- 250		

N Note

Calculation Flow Required - 459.260 Press Required - 45.197 AT TEST  
 Summary C-Factor Used: 120 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 12/13/02		Cap. -
T	Time of Test -	Rated Cap.-	Elev.-
E	Static Press - 54	@ Press -	
R	Residual Press - 51	Elev. -	Well
	Flow - 949		Proof Flow
S	Elevation - 114.5		

U Location - 25'-0" FROM BUILDING

P Source of Information - PORTLAND WATER DISTRICT

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

G Horizontal Barriers Provided:



# Water Supply Curve (C)

Denali Fire protection, Inc.  
CRESCENT HEIGHTS UNDERSTORY

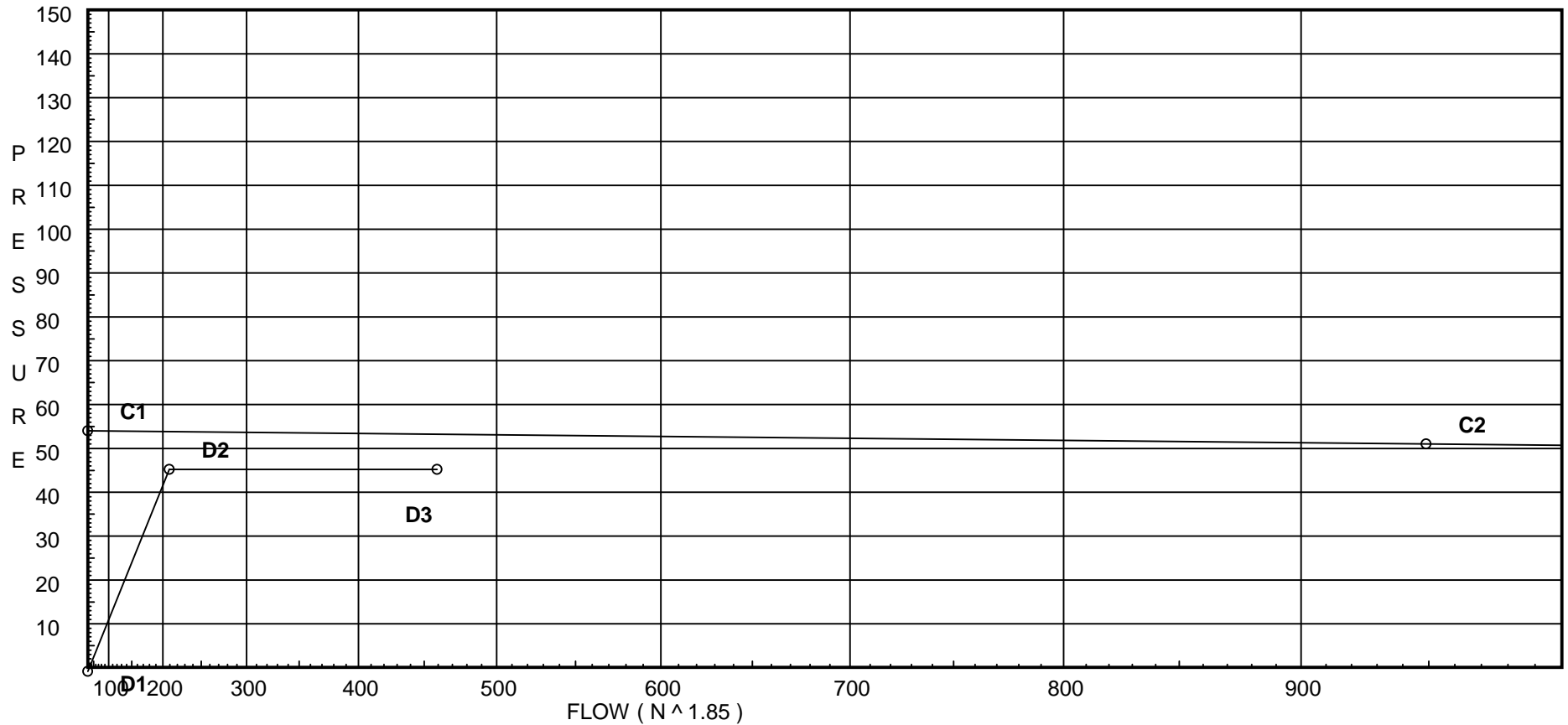
Page 2  
Date 10/14/09

### City Water Supply:

C1 - Static Pressure : 54  
C2 - Residual Pressure: 51  
C2 - Residual Flow : 949

### Demand:

D1 - Elevation : -0.849  
D2 - System Flow : 209.26  
D2 - System Pressure : 45.197  
Hose ( Adj City ) : \_\_\_\_\_  
Hose ( Demand ) : 250  
D3 - System Demand : 459.26  
Safety Margin : 8.020



# Fittings Used Summary

Denali Fire protection, Inc.  
CRESCENT HEIGHTS UNDERSTORY

Page 3  
Date 10/14/09

## Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Generic Butterfly Valve	0	0	0	0	0	0	7	10	0	12	9	10	12	19	21	0	0	0	0	0
E	90' Standard Elbow	2	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Generic Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
S	Generic Swing Check Valve	4	5	5	7	9	11	14	16	19	22	27	32	45	55	65	76	87	98	109	130
T	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

# Pressure / Flow Summary - STANDARD

Denali Fire protection, Inc.  
CRESCENT HEIGHTS UNDERSTORY

Page 4  
Date 10/14/09

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
D1	0.0	5.6	10.5	na	18.15	0.15	121	7.0
15	112.54	K = K @ L1	13.14	na	19.7			
16	112.54	K = K @ L1	14.8	na	20.9			
17	112.54	K = K @ L1	13.26	na	19.79			
18	112.54	K = K @ L1	14.93	na	21.0			
19	112.54	K = K @ L1	13.69	na	20.1			
20	112.54	K = K @ L1	15.41	na	21.33			
21	112.54	K = K @ L1	11.16	na	18.15			
22	112.54	K = K @ L1	12.74	na	19.39			
23	112.54	K = K @ L1	18.21	na	23.19			
24	112.54	K = K @ L1	22.38	na	25.7			
E	112.54		18.52	na				
F	112.54		18.68	na				
G	112.54		19.27	na				
H	112.54		20.54	na				
I	112.54		23.97	na				
J	112.54		24.1	na				
K	124.17		23.27	na				
AFL	124.17		34.31	na				
BASE	115.5		44.61	na				
TEST	114.5		45.2	na	250.0			

The maximum velocity is 20.01 and it occurs in the pipe between nodes J and K

# Final Calculations - Hazen-Williams

Denali Fire protection, Inc.  
CRESCENT HEIGHTS UNDERSTORY

Page 5  
Date 10/14/09

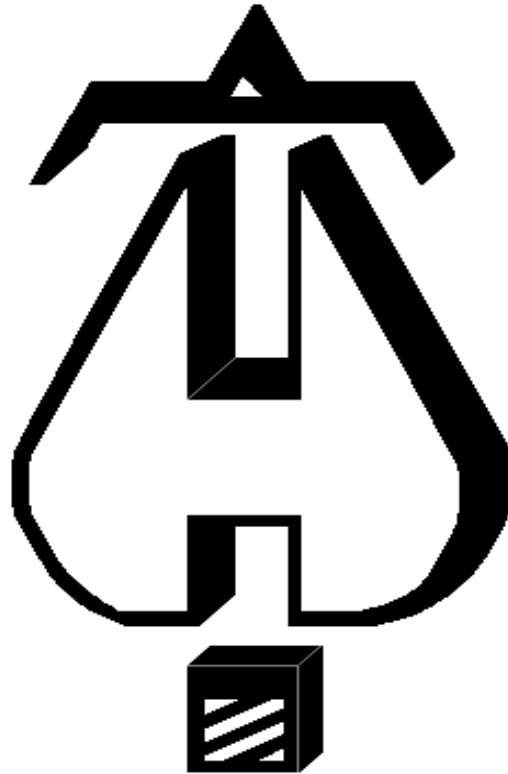
Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
D1 to L1	18.15 18.15	1.049 120 0.1088	1T	5.0 0.0 0.0	1.000 5.000 6.000	10.504 0.0 0.653			K Factor = 5.60 Vel = 6.74	
	0.0 18.15						11.157		K Factor = 5.43	
15 to 16	19.70 19.7	1.049 120 0.1264		0.0 0.0 0.0	13.120 0.0 13.120	13.141 0.0 1.659			K Factor @ node L1 Vel = 7.31	
16 to E	20.90 40.6	1.049 120 0.4824	1T	5.0 0.0 0.0	2.710 5.000 7.710	14.800 0.0 3.719			K Factor @ node L1 Vel = 15.07	
	0.0 40.60						18.519		K Factor = 9.43	
17 to 18	19.79 19.79	1.049 120 0.1276		0.0 0.0 0.0	13.120 0.0 13.120	13.259 0.0 1.674			K Factor @ node L1 Vel = 7.35	
18 to F	20.99 40.78	1.049 120 0.4863	1T	5.0 0.0 0.0	2.710 5.000 7.710	14.933 0.0 3.749			K Factor @ node L1 Vel = 15.14	
	0.0 40.78						18.682		K Factor = 9.43	
19 to 20	20.10 20.1	1.049 120 0.1313		0.0 0.0 0.0	13.120 0.0 13.120	13.689 0.0 1.723			K Factor @ node L1 Vel = 7.46	
20 to G	21.34 41.44	1.049 120 0.5008	1T	5.0 0.0 0.0	2.710 5.000 7.710	15.412 0.0 3.861			K Factor @ node L1 Vel = 15.38	
	0.0 41.44						19.273		K Factor = 9.44	
21 to 22	18.15 18.15	1.049 120 0.1087	1E	2.0 0.0 0.0	12.540 2.000 14.540	11.157 0.0 1.581			K Factor @ node L1 Vel = 6.74	
22 to 23	19.39 37.54	1.049 120 0.4172		0.0 0.0 0.0	13.120 0.0 13.120	12.738 0.0 5.474			K Factor @ node L1 Vel = 13.94	
23 to H	23.19 60.73	1.38 120 0.2672	1T	6.0 0.0 0.0	2.710 6.000 8.710	18.212 0.0 2.327			K Factor @ node L1 Vel = 13.03	
	0.0 60.73						20.539		K Factor = 13.40	
24 to I	25.70 25.7	1.049 120 0.2070	1T	5.0 0.0 0.0	2.710 5.000 7.710	22.378 0.0 1.596			K Factor @ node L1 Vel = 9.54	
	0.0 25.70						23.974		K Factor = 5.25	
E to F	40.60 40.6	2.067 120 0.0177		0.0 0.0 0.0	9.210 0.0 9.210	18.519 0.0 0.163			Vel = 3.88	

# Final Calculations - Standard

Denali Fire protection, Inc.  
CRESCENT HEIGHTS UNDERSTORY

Page 6  
Date 10/14/09

Hyd. Ref. Point	Qa  Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
F	40.79	2.067		9.210	18.682				
to		120		0.0	0.0				
G	81.39	0.0642		9.210	0.591		Vel =	7.78	
G	41.43	2.067		9.210	19.273				
to		120		0.0	0.0				
H	122.82	0.1375		9.210	1.266		Vel =	11.74	
H	60.74	2.067	1T 10.0	2.330	20.539				
to		120		10.000	0.0				
J	183.56	0.2890		12.330	3.563		Vel =	17.55	
	0.0								
	183.56				24.102		K Factor =	37.39	
I	25.70	2.067	1T 10.0	6.830	23.974				
to		120		10.000	0.0				
J	25.7	0.0076		16.830	0.128		Vel =	2.46	
J	183.56	2.067		11.420	24.102				
to		120		0.0	-5.037				
K	209.26	0.3684		11.420	4.207		Vel =	20.01	
K	0.0	3.26	6E 56.446	117.080	23.272				
to		120	4T 80.637	158.586	0.0				
AFL	209.26	0.0400	1S 21.503	275.666	11.039		Vel =	8.04	
AFL	0.0	4.26	1T 26.334	8.000	34.311				
to		120	1B 15.8	42.134	9.755		* Fixed loss = 6		
BASE	209.26	0.0109		50.134	0.545		Vel =	4.71	
BASE	0.0	6.16	2E 40.168	25.000	44.611				
to		140	1G 4.304	87.509	0.433				
TEST	209.26	0.0014	1T 43.037	112.509	0.153		Vel =	2.25	
	250.00						Qa =	250.00	
	459.26				45.197		K Factor =	68.31	



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

Denali Fire protection, Inc.  
270 Tiger Hill Road  
Your Street Address 2  
Oxford, Maine 04270  
207-539-4226

Job Name : CRESCENT HEIGHTS STANDPIPES  
Building : STEEL & WOOD STRUCTURE  
Location : CRESCENT STREET PORTLAND, MAINE  
System : 1  
Contract : C18-09  
Data File : 4-C1809.WXF

Hydraulic Design Information Sheet

Name - CRESCENT HEIGHTS Date - 10/14/09  
 Location - CRESCENT STREET PORTLAND, MAINE  
 Building - STEEL & WOOD STRUCTURE System No. - 1  
 Contractor - DENALI FIRE PROTECTION, INC, Contract No. - C18-09  
 Calculated By - CKD Drawing No. - ALL  
 Construction: ( ) Combustible (X) Non-Combustible Ceiling Height - VARIES  
 Occupancy - STANDPIPE

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

S Other

T Specific Ruling Made By Date

E  
 M Area of Sprinkler Operation - System Type Sprinkler/Nozzle  
 Density - ( ) Wet Make  
 D Area Per Sprinkler - ( ) Dry Model  
 E Elevation at Highest Outlet - ( ) Deluge Size  
 S Hose Allowance - Inside - ( ) Preaction K-Factor  
 I Rack Sprinkler Allowance - ( ) Other Temp.Rat.  
 G Hose Allowance - Outside - 100

N Note

Calculation Flow Required - 600.0 Press Required - 114.014 AT TEST  
 Summary C-Factor Used: 120 Overhead 140 Underground

W Water Flow Test: Pump Data: Tank or Reservoir:  
 A Date of Test - 12/13/02 Cap. -  
 T Time of Test - Rated Cap.- Elev.-  
 E Static Press - 54 @ Press -  
 R Residual Press - 51 Elev. - Well  
 Flow - 949 Proof Flow  
 S Elevation - 114.5

U Location - 25'-0" FROM BUILDING

P  
 L Source of Information - PORTLAND WATER DISTRICT  
 Y

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

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

G  
 E Horizontal Barriers Provided:

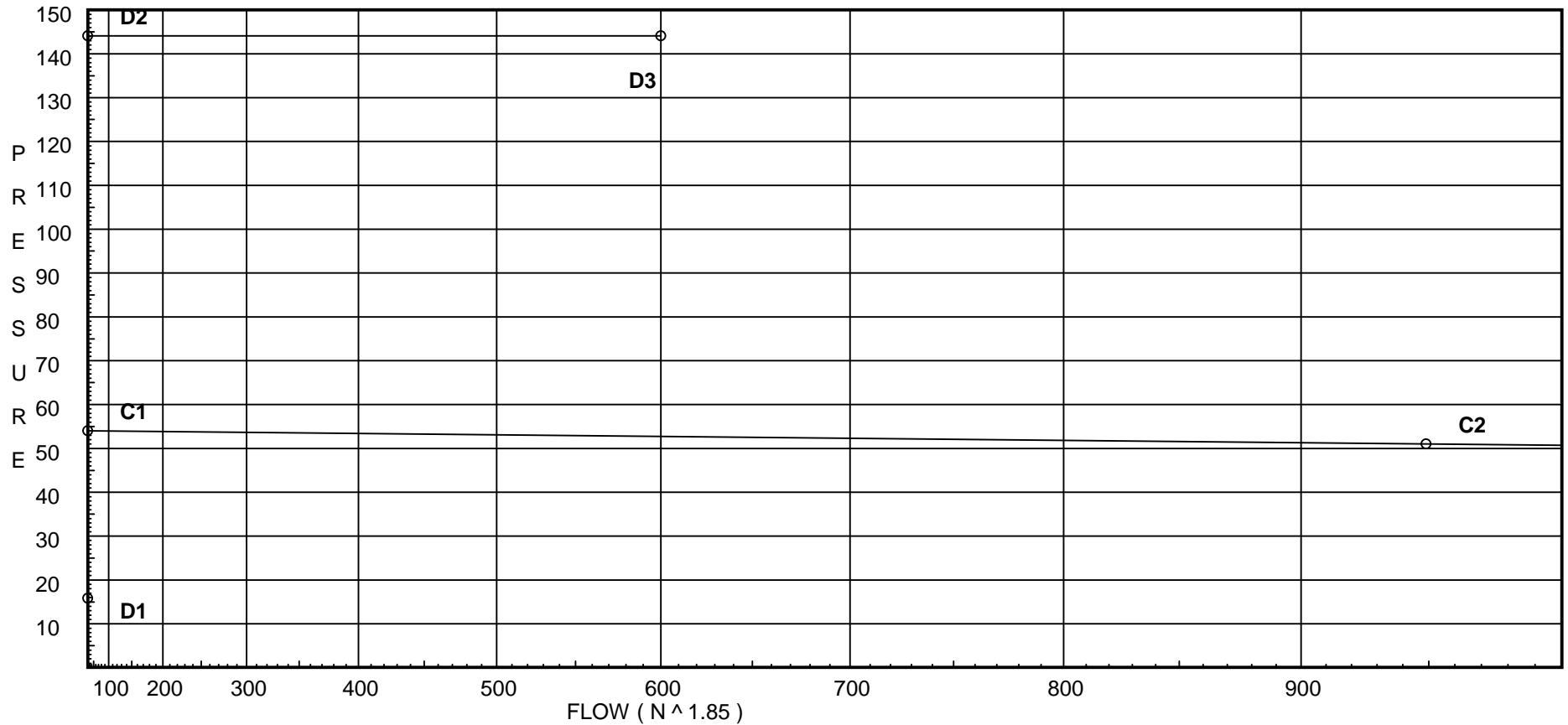
# Water Supply Curve (C)

Denali Fire protection, Inc.  
CRESCENT HEIGHTS STANDPIPES

Page 2  
Date 10/14/09

City Water Supply:  
C1 - Static Pressure : 54  
C2 - Residual Pressure: 51  
C2 - Residual Flow : 949

Demand:  
D1 - Elevation : 15.808  
D2 - System Flow : \_\_\_\_\_  
D2 - System Pressure : 144.104  
Hose ( Adj City ) : \_\_\_\_\_  
Hose ( Demand ) : 600  
D3 - System Demand : 600  
Safety Margin : -91.388





# Fittings Used Summary

Denali Fire protection, Inc.  
CRESCENT HEIGHTS STANDPIPES

Page 3  
Date 10/14/09

## Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24
B	Generic Butterfly Valve	0	0	0	0	0	0	7	10	0	12	9	10	12	19	21	0	0	0	0	0
E	90' Standard Elbow	2	2	2	3	4	5	6	7	8	10	12	14	18	22	27	35	40	45	50	61
G	Generic Gate Valve	0	0	0	0	0	1	1	1	1	2	2	3	4	5	6	7	8	10	11	13
L	Long Turn Elbow	1	1	2	2	2	3	4	5	5	6	8	9	13	16	18	24	27	30	34	40
T	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

# Pressure / Flow Summary - STANDARD

Denali Fire protection, Inc.  
CRESCENT HEIGHTS STANDPIPES

Page 4  
Date 10/14/09

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
FHV1	151.0		100.0	na	250.0			
FHV2	140.5		104.71	na	250.0			
SP1	151.0		108.08	na				
SP2	140.5		112.78	na				
SP3	130.0		117.9	na				
D	124.17		121.0	na				
TOR	124.17		130.31	na				
BASE	115.5		142.9	na				
TEST	114.5		144.1	na	100.0			

The maximum velocity is 14.71 and it occurs in the pipe between nodes FHV1 and SP1

# Final Calculations - Hazen-Williams

Denali Fire protection, Inc.  
CRESCENT HEIGHTS STANDPIPES

Page 5  
Date 10/14/09

Hyd. Ref. Point	Qa  Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
FHV1	250.00	2.635	1T 16.474	35.000	100.000			Qa = 250	
to		120	0.0	16.474	0.0				
SP1	250.0	0.1569	0.0	51.474	8.077			Vel = 14.71	
	0.0								
	250.00				108.077			K Factor = 24.05	
FHV2	250.00	2.635	1T 16.474	35.000	104.706			Qa = 250	
to		120	0.0	16.474	0.0				
SP2	250.0	0.1569	0.0	51.474	8.077			Vel = 14.71	
	0.0								
	250.00				112.783			K Factor = 23.54	
SP1	250.00	4.26	0.0	10.500	108.077				
to		120	0.0	0.0	4.548				
SP2	250.0	0.0150	0.0	10.500	0.158			Vel = 5.63	
SP2	250.00	4.26	0.0	10.500	112.783				
to		120	0.0	0.0	4.548				
SP3	500.0	0.0545	0.0	10.500	0.572			Vel = 11.25	
SP3	0.0	4.26	0.0	10.500	117.903				
to		120	0.0	0.0	2.525				
D	500.0	0.0545	0.0	10.500	0.572			Vel = 11.25	
D	0.0	4.26	2T 52.668	54.870	121.000				
to		120	8L 63.202	115.870	0.0				
TOR	500.0	0.0545	0.0	170.740	9.308			Vel = 11.25	
TOR	0.0	4.26	1T 26.334	10.000	130.308				
to		120	1B 15.8	42.134	9.755			* Fixed loss = 6	
BASE	500.0	0.0545	0.0	52.134	2.842			Vel = 11.25	
BASE	0.0	6.16	2E 40.168	25.000	142.905				
to		140	1G 4.304	87.509	0.433				
TEST	500.0	0.0068	1T 43.037	112.509	0.766			Vel = 5.38	
	100.00							Qa = 100.00	
	600.00				144.104			K Factor = 49.98	