

. . . Fire Protection by Computer Design

DEAN & ALLYN, INC.
116 LEWISTON ROAD
GRAY, MAINE 04039
207-657-5646

Job Name : 10 EXCHANGE ST 4TH FLOOR AREA 4-1
Building : FOURTH FLOOR-APT. 414
Location : 10 EXCHANGE STREET PORTLAND MAINE
System : 4-1.WX1
Contract : C161341
Data File : 10 EXCHANGE ST 4TH FLOOR Area 4-1.WX1

Hydraulic Design Information Sheet

Name - 10 EXCHANGE STREET Date - 07/20/2016
 Location - 10 EXCHANGE STREET PORTLAND MAINE
 Building - FOURTH FLOOR-APT. 414 System No. - 4-1.WX1
 Contractor - DEAN & ALLYN, INC. Contract No. - C161341
 Calculated By - T. CLARKE Drawing No. - FP-101
 Construction: (X) Combustible () Non-Combustible Ceiling Height - 12'
 Occupancy - APARTMENT BUILDING

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

M	Area of Sprinkler Operation	- 4 HEADS	System Type	Sprinkler/Nozzle
	Density	- 0.10	(X) Wet	Make RELIABLE
D	Area Per Sprinkler	- VARIES	() Dry	Model FIRES58
E	Elevation at Highest Outlet	- 64.75	() Deluge	Size 1/2"X1/2"
S	Hose Allowance - Inside	- 100	() Preaction	K-Factor 5.8
I	Rack Sprinkler Allowance	- 0	() Other	Temp.Rat.155F
G	Hose Allowance - Outside	- 0		

N Note CUSHION 21.4 PSI

Calculation Flow Required - 211.1 Press Required - 71.3 AT TEST
 Summary C-Factor Used: 120 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 06/28/2016		Cap. -
T	Time of Test - 6:00 AM	Rated Cap.-	Elev.-
E	Static Press - 93	@ Press -	
R	Residual Press - 86	Elev. -	Well
S	Flow - 1500		Proof Flow
U	Elevation - 20		

P Location - CORNER OF EXCHANGE STREET AND FORE STREET

L Source of Information - PORTLAND WATER DIST.

C	Commodity N/A	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

E Horizontal Barriers Provided:

Fittings Used Summary

DEAN & ALLYN, INC.
10 EXCHANGE ST 4TH FLOOR AREA 4-1

Page 3
Date 07/20/2016

Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24	
Bvca	B Fly Vic 705						6	6	7		8	12	14	16	18	19						
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	
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	
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						
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	
U	45' Ell Firelock #003	0	0	0	0	0	1.8	2.2	2.6	0	3.4	4.2	5	5	0	0	0	0	0	0	0	
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	
Zca	Colt C200 Horz Butt	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

Fittings Used Summary

for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

Pressure / Flow Summary - STANDARD

DEAN & ALLYN, INC.
10 EXCHANGE ST 4TH FLOOR AREA 4-1

Page 4
Date 07/20/2016

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
401	64.75	5.8	19.69	na	25.74	0.1	120	9.7
402	64.75	5.8	21.35	na	26.8	0.1	268	18.6
403	64.75	5.8	24.67	na	28.81	0.1	135	9.7
404	64.75	5.8	26.4	na	29.8	0.1	120	7.6
41	64.75		27.73	na				
42	60.0		33.15	na				
43	60.0		33.82	na				
44	59.12		35.62	na				
45	57.58		37.75	na				
46	56.29		40.04	na				
47	55.83		41.3	na				
FCV4	54.5		48.85	na	100.0			
FCV3	45.0		53.56	na				
TR	6.75		73.3	na				
BR	2.917		75.56	na				
FF	2.917		78.61	na				
UG	2.917		78.7	na				
TEST	20.0		71.34	na				

The maximum velocity is 12.82 and it occurs in the pipe between nodes 403 and 404

Final Calculations - Hazen-Williams - 2007

DEAN & ALLYN, INC.
10 EXCHANGE ST 4TH FLOOR AREA 4-1

Page 5
Date 07/20/2016

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftnng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
401 to 402	25.74	1.049 120.0		0.0	8.000	19.691 0.0			K Factor = 5.80	
402 to 403	25.74	0.2075		0.0	8.000	1.660			Vel = 9.56	
402 to 403	26.80	1.61 120.0	3E	12.0	22.390	21.351 0.0			K Factor = 5.80	
403 to 404	52.54	0.0965		0.0	34.390	3.317			Vel = 8.28	
403 to 404	28.80	1.61 120.0		0.0	8.000	24.668 0.0			K Factor = 5.80	
404 to 41	81.34	0.2165		0.0	8.000	1.732			Vel = 12.82	
404 to 41	29.80	2.067 120.0	E	5.0	6.670	26.400 0.0			K Factor = 5.80	
41 to 42	111.14	0.1142		0.0	11.670	1.333			Vel = 10.63	
41 to 42	0.0	2.067 120.0	T 2E	10.0	9.400	27.733 2.057				
42 to 43	111.14	0.1143		0.0	29.400	3.359			Vel = 10.63	
42 to 43	0.0	2.635 120.0		0.0	19.220	33.149 0.0				
43 to 44	111.14	0.0350		0.0	19.220	0.673			Vel = 6.54	
43 to 44	0.0	2.635 120.0	2V 2U	11.807	22.730	33.822 0.381				
44 to 45	111.14	0.0350		0.0	40.578	1.421			Vel = 6.54	
44 to 45	0.0	2.635 120.0	2V 2U	11.807	23.760	35.624 0.667				
45 to 46	111.14	0.0350		0.0	41.608	1.457			Vel = 6.54	
45 to 46	0.0	2.635 120.0	4V	23.613	25.990	37.748 0.559				
46 to 47	111.14	0.0350		0.0	49.603	1.737			Vel = 6.54	
46 to 47	0.0	2.635 120.0	2V X	11.807	3.490	40.044 0.199				
47 to FCV4	111.14	0.0351		0.0	30.124	1.056			Vel = 6.54	
47 to FCV4	0.0	2.635 120.0	S Fsp	19.22	27.580	41.299 3.576			** Fixed Loss = 3	
FCV4 to FCV3	111.14	0.0350	Y Bvca 7V	17.161	113.521	3.975			Vel = 6.54	
FCV4 to FCV3	100.00	4.26 120.0	2I J	18.434	14.542	48.850 4.114			Qa = 100	
FCV3 to TR	211.14	0.0111		0.0	54.043	0.599			Vel = 4.75	
FCV3 to TR	0.0	4.26 120.0	18I	165.905	120.667	53.563 16.566				
TR to BR	211.14	0.0111		0.0	286.572	3.170			Vel = 4.75	
TR to BR	0.0	4.26 120.0	Bvca S	10.534	6.000	73.299 1.660				
BR to FF	211.14	0.0111	I	9.217	54.719	0.606			Vel = 4.75	
BR to FF	0.0	6.357 120.0	I Zca	12.573	4.417	75.565 3.020			** Fixed Loss = 3.02	
FF to UG	211.14	0.0016		0.0	16.990	0.027			Vel = 2.13	
FF to UG	0.0	6.16 140.0	G T	4.304	20.000	78.612 0.0				
UG	211.14	0.0014		0.0	67.341	0.093			Vel = 2.27	

Final Calculations - Hazen-Williams

DEAN & ALLYN, INC.
10 EXCHANGE ST 4TH FLOOR AREA 4-1

Page 6
Date 07/20/2016

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
UG to TEST	0.0 211.14	10.22 100.0 0.0002	T G	39.29 3.929 0.0	100.000 43.218 143.218	78.705 -7.399 0.031			
	0.0 211.14						Vel = 0.83		
						71.337	K Factor = 25.00		

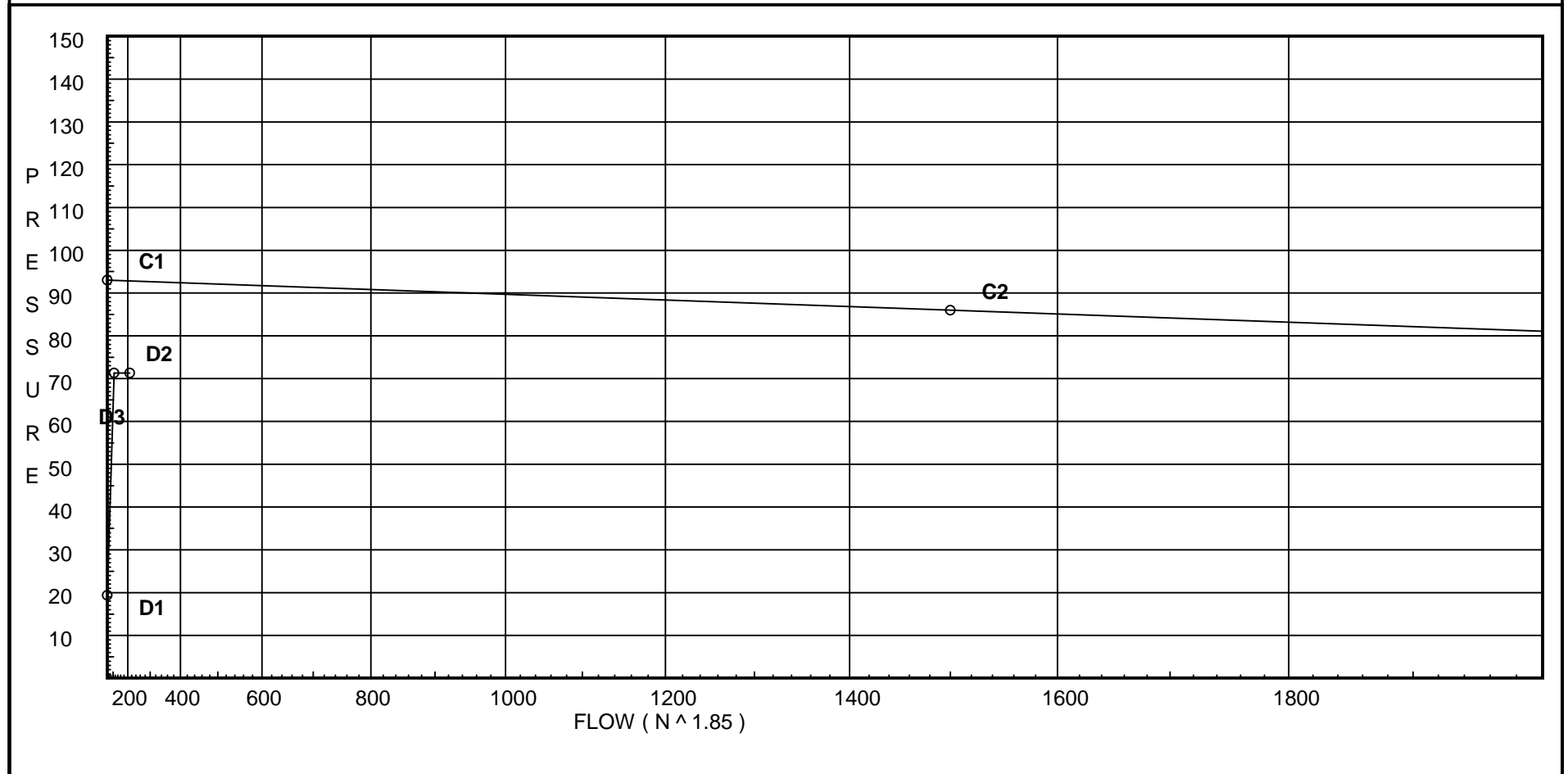
Water Supply Curve C

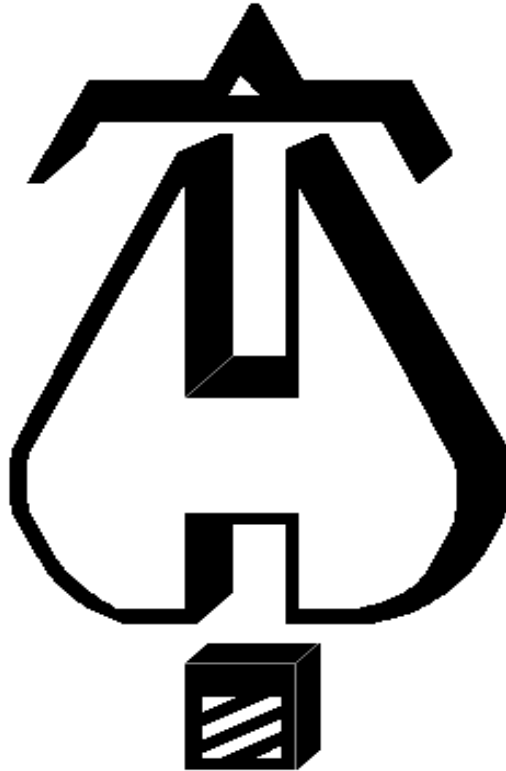
DEAN & ALLYN, INC.
10 EXCHANGE ST 4TH FLOOR AREA 4-1

Page 7
Date 07/20/2016

City Water Supply:
C1 - Static Pressure : 93
C2 - Residual Pressure: 86
C2 - Residual Flow : 1500

Demand:
D1 - Elevation : 19.381
D2 - System Flow : 111.144
D2 - System Pressure : 71.337
Hose (Demand) : 100
D3 - System Demand : 211.144
Safety Margin : 21.477





. . . Fire Protection by Computer Design

DEAN & ALLYN, INC.
116 LEWISTON ROAD
GRAY, MAINE 04039
207-657-5646

Job Name : 10 EXCHANGE ST 4TH FLOOR Area 4-3
Building : FOURTH FLOOR-APT. 412
Location : 10 EXCHANGE STREET PORTLAND MAINE
System : 4-3.WX3
Contract : C161341
Data File : 10 EXCHANGE ST 4TH FLOOR Area 4-3.WX3

Hydraulic Design Information Sheet

Name - 10 EXCHANGE STREET Date - 07/20/2016
 Location - 10 EXCHANGE STREET PORTLAND MAINE
 Building - FOURTH FLOOR-APT. 412 System No. - 4-3.WX3
 Contractor - DEAN & ALLYN, INC. Contract No. - C161341
 Calculated By - T. CLARKE Drawing No. - FP-101
 Construction: (X) Combustible () Non-Combustible Ceiling Height - 12'
 Occupancy - APARTMENT BUILDING

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 - 4 HEADS System Type Sprinkler/Nozzle
 Density - 0.10 (X) Wet Make RELIABLE
 D Area Per Sprinkler - VARIES () Dry Model FIRES58
 E Elevation at Highest Outlet - 64.75 () Deluge Size 1/2"X1/2"
 S Hose Allowance - Inside - 100 () Preaction K-Factor 5.8
 I Rack Sprinkler Allowance - 0 () Other Temp.Rat.155F
 G Hose Allowance - Outside - 0

N Note CUSHION 18.8 PSI

Calculation Flow Required - 192.8 Press Required - 73.9 AT TEST
 Summary C-Factor Used: 120 Overhead 140 Underground

W Water Flow Test: Pump Data: Tank or Reservoir:
 A Date of Test - 06/28/2016 Cap. -
 T Time of Test - 6:00 AM Rated Cap.- Elev.-
 E Static Press - 93 @ Press -
 R Residual Press - 86 Elev. - Well
 Flow - 1500 Proof Flow
 S Elevation - 20

U
 P Location - CORNER OF EXCHANGE STREET AND FORE STREET

P
 L Source of Information - PORTLAND WATER DIST.
 Y

C Commodity N/A 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:

Fittings Used Summary

DEAN & ALLYN, INC.
10 EXCHANGE ST 4TH FLOOR Area 4-3

Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24	
Bvca	B Fly Vic 705						6	6	7		8	12	14	16	18	19						
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	
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	
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						
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	
U	45' Ell Firelock #003	0	0	0	0	0	1.8	2.2	2.6	0	3.4	4.2	5	5	0	0	0	0	0	0	0	
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	
Zca	Colt C200 Horz Butt	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

Fittings Used Summary

for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

Pressure / Flow Summary - STANDARD

DEAN & ALLYN, INC.
10 EXCHANGE ST 4TH FLOOR Area 4-3

Page 4
Date 07/20/2016

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
413	64.75	5.8	13.2	na	21.07	0.1	165	13.2
414A	61.25	5.6	14.34	na	21.21	0.1	50	7.0
414	64.75		14.06	na				
415	64.75	5.8	15.71	na	22.99	0.1	165	13.2
416	64.42	5.8	22.64	na	27.6	0.1	165	13.2
43	60.0		30.97	na				
44	59.12		33.74	na				
45	57.58		36.85	na				
46	56.29		40.29	na				
47	55.83		41.99	na				
FCV4	54.5		51.66	na	100.0			
FCV3	45.0		56.28	na				
TR	6.75		75.53	na				
BR	2.917		77.7	na				
FF	2.917		81.29	na				
UG	2.917		81.36	na				
TEST	20.0		73.99	na				

The maximum velocity is 15.7 and it occurs in the pipe between nodes 414 and 415

Final Calculations - Hazen-Williams - 2007

DEAN & ALLYN, INC.
10 EXCHANGE ST 4TH FLOOR Area 4-3

Page 5
Date 07/20/2016

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftn'g's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
413 to 414	21.07	1.049 120.0		0.0	6.000	13.200			K Factor = 5.80	
	21.07	0.1433		0.0	6.000	0.860			Vel = 7.82	
	0.0 21.07						14.060		K Factor = 5.62	
414A to 414	21.21	1.049 120.0	T	5.0	3.500	14.343			K Factor = 5.60	
	21.21	0.1451		0.0	5.000	-1.516				
	21.21			0.0	8.500	1.233			Vel = 7.87	
414 to 415	21.07	1.049 120.0		0.0	3.170	14.060				
	42.28	0.5199		0.0	0.0	0.0			Vel = 15.70	
415 to 416	22.99	1.38 120.0	3E	9.0	13.250	15.708			K Factor = 5.80	
	65.27	0.3052		0.0	9.000	0.143			Vel = 14.00	
416 to 43	27.60	1.61 120.0	E T	4.0 8.0	11.190 12.000	22.642 1.914			K Factor = 5.80	
	92.87	0.2767		0.0	23.190	6.416			Vel = 14.64	
43 to 44	0.0	2.157 120.0	2V 2U	8.615 4.43	22.730 13.045	30.972 0.381				
	92.87	0.0666		0.0	35.775	2.382			Vel = 8.15	
44 to 45	0.0	2.157 120.0	2V 2U	8.615 4.43	23.760 13.045	33.735 0.667				
	92.87	0.0666		0.0	36.805	2.451			Vel = 8.15	
45 to 46	0.0	2.157 120.0	4V	17.229 0.0	25.990 17.229	36.853 0.559				
	92.87	0.0666		0.0	43.219	2.877			Vel = 8.15	
46 to 47	0.0	2.157 120.0	2V X	8.615 10.461	3.490 19.076	40.289 0.199				
	92.87	0.0666		0.0	22.566	1.503			Vel = 8.15	
47 to FCV4	0.0	2.157 120.0	S Fsp Y Bvca 7V	13.537 0.0 12.922 7.384 30.151	27.580 63.994 91.574	41.991 3.576 6.097			** Fixed Loss = 3	
	92.87	0.0666							Vel = 8.15	
FCV4 to FCV3	100.00	4.26 120.0	2I J	18.434 21.067	14.542 39.501	51.664 4.114			Qa = 100	
	192.87	0.0094		0.0	54.043	0.506			Vel = 4.34	
FCV3 to TR	0.0	4.26 120.0	18I	165.905 0.0	120.667 165.905	56.284 16.566				
	192.87	0.0094		0.0	286.572	2.682			Vel = 4.34	
TR to BR	0.0	4.26 120.0	Bvca S	10.534 28.968	6.000 48.719	75.532 1.660				
	192.87	0.0094	I	9.217	54.719	0.512			Vel = 4.34	
BR to FF	0.0	6.357 120.0	I Zca	12.573 0.0	4.417 12.573	77.704 3.560			** Fixed Loss = 3.56	
	192.87	0.0013		0.0	16.990	0.022			Vel = 1.95	
FF to UG	0.0	6.16 140.0	G T	4.304 43.037	20.000 47.341	81.286 0.0				
	192.87	0.0012		0.0	67.341	0.079			Vel = 2.08	

Final Calculations - Hazen-Williams

DEAN & ALLYN, INC.
10 EXCHANGE ST 4TH FLOOR Area 4-3

Page 6
Date 07/20/2016

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
UG	0.0	10.22	T	39.29	100.000	81.365			
to		100.0	G	3.929	43.218	-7.399			
TEST	192.87	0.0002		0.0	143.218	0.027		Vel = 0.75	
	0.0								
	192.87					73.993		K Factor = 22.42	

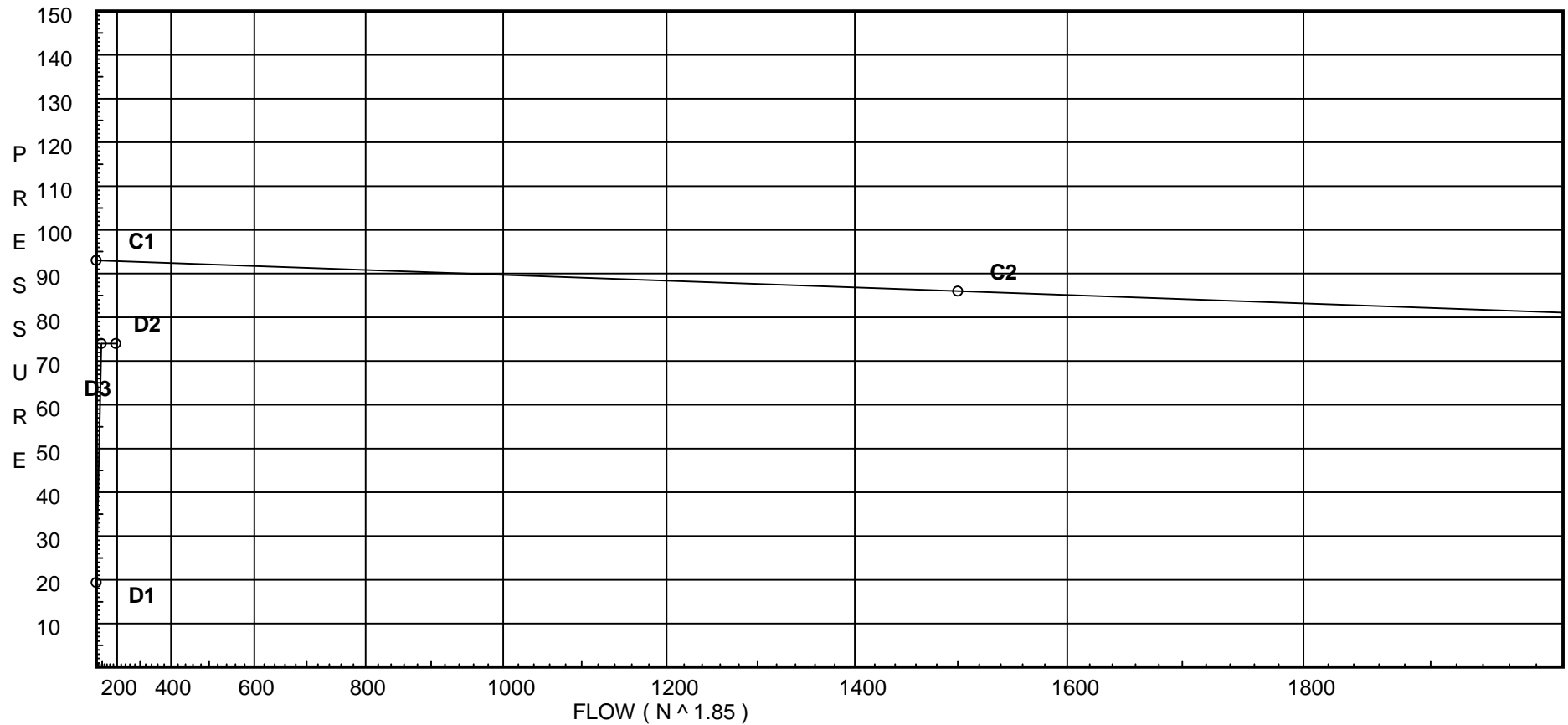
Water Supply Curve C

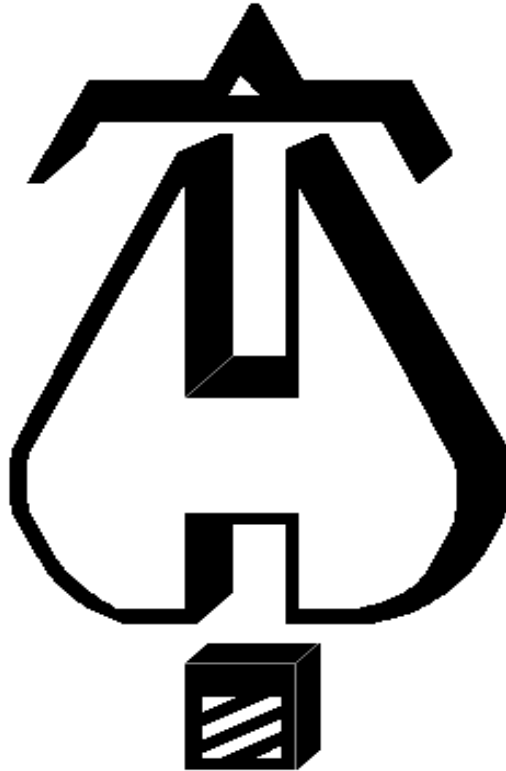
DEAN & ALLYN, INC.
10 EXCHANGE ST 4TH FLOOR Area 4-3

Page 7
Date 07/20/2016

City Water Supply:
C1 - Static Pressure : 93
C2 - Residual Pressure: 86
C2 - Residual Flow : 1500

Demand:
D1 - Elevation : 19.381
D2 - System Flow : 92.867
D2 - System Pressure : 73.993
Hose (Demand) : 100
D3 - System Demand : 192.867
Safety Margin : 18.850





. . . Fire Protection by Computer Design

DEAN & ALLYN, INC.
116 LEWISTON ROAD
GRAY, MAINE 04039
207-657-5646

Job Name : 10 Exchange Street 4th Floor Area 4-4
Building : FOURTH FLOOR-APT. 413
Location : 10 EXCHANGE STREET PORTLAND MAINE
System : 4-4.WX4
Contract : C161341
Data File : 10 EXCHANGE ST 4TH FLOOR Area 4-4.WX4

Hydraulic Design Information Sheet

Name - 10 EXCHANGE STREET Date - 07/20/2016
 Location - 10 EXCHANGE STREET PORTLAND MAINE
 Building - FOURTH FLOOR-APT. 413 System No. - 4-4.WX4
 Contractor - DEAN & ALLYN, INC. Contract No. - C161341
 Calculated By - T. CLARKE Drawing No. - FP-101
 Construction: (X) Combustible () Non-Combustible Ceiling Height - 12'
 Occupancy - APARTMENT BUILDING

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

M	Area of Sprinkler Operation	- 4 HEADS	System Type	Sprinkler/Nozzle
	Density	- 0.10	(X) Wet	Make RELIABLE
D	Area Per Sprinkler	- VARIES	() Dry	Model FIRES58
E	Elevation at Highest Outlet	- 64.75	() Deluge	Size 1/2"X1/2"
S	Hose Allowance - Inside	- 100	() Preaction	K-Factor 5.8
I	Rack Sprinkler Allowance	- 0	() Other	Temp.Rat.155F
G	Hose Allowance - Outside	- 0		

N Note CUSHION 20.3 PSI

Calculation Flow Required - 200.1 Press Required - 72.4 AT TEST
 Summary C-Factor Used: 120 Overhead 140 Underground

W	Water Flow Test:	Pump Data:	Tank or Reservoir:
A	Date of Test - 06/28/2016		Cap. -
T	Time of Test - 6:00 AM	Rated Cap.-	Elev.-
E	Static Press - 93	@ Press -	
R	Residual Press - 86	Elev. -	Well
	Flow - 1500		Proof Flow
S	Elevation - 20		

U Location - CORNER OF EXCHANGE STREET AND FORE STREET

P Source of Information - PORTLAND WATER DIST.

C	Commodity N/A	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:

Fittings Used Summary

DEAN & ALLYN, INC.
10 Exchange Street 4th Floor Area 4-4

Page 3
Date 07/20/2016

Fitting Legend

Abbrev.	Name	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	8	10	12	14	16	18	20	24	
Bvca	B Fly Vic 705						6	6	7		8	12	14	16	18	19						
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	
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	
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						
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	
U	45' Ell Firelock #003	0	0	0	0	0	1.8	2.2	2.6	0	3.4	4.2	5	5	0	0	0	0	0	0	0	
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	
Zca	Colt C200 Horz Butt	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

Fittings Used Summary

for CFactors of other than 120 and diameters other than Sched 40 per NFPA.

Pressure / Flow Summary - STANDARD

DEAN & ALLYN, INC.
10 Exchange Street 4th Floor Area 4-4

Page 4
Date 07/20/2016

Node No.	Elevation	K-Fact	Pt Actual	Pn	Flow Actual	Density	Area	Press Req.
409	64.21	5.8	18.6	na	25.01	0.1	204	18.6
410	64.21	5.8	18.73	na	25.1	0.1	144	7.6
411A	64.21	4.9	20.77	na	22.33	0.1	50	8.16
411	64.21		21.73	na				
412	64.21	5.8	22.84	na	27.72	0.1	144	7.6
801	64.21		23.79	na				
802	60.0		35.19	na				
42	60.0		36.19	na				
43	60.0		36.75	na				
44	59.12		38.3	na				
45	57.58		40.17	na				
46	56.29		42.16	na				
47	55.83		43.23	na				
FCV4	54.5		50.09	na	100.0			
FCV3	45.0		54.74	na				
TR	6.75		74.18	na				
BR	2.917		76.39	na				
FF	2.917		79.76	na				
UG	2.917		79.85	na				
TEST	20.0		72.48	na				

The maximum velocity is 15.78 and it occurs in the pipe between nodes 412 and 801

Final Calculations - Hazen-Williams - 2007

DEAN & ALLYN, INC.
10 Exchange Street 4th Floor Area 4-4

Page 5
Date 07/20/2016

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv.	Ln.	Pipe Ftnng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
409 to 410	25.01	1.049 120.0		0.0	0.660	18.600			K Factor = 5.80	
410 to 411	25.01	0.1970		0.0	0.660	0.130			Vel = 9.28	
410 to 411	25.11	1.38 120.0	2T	12.0	4.000	18.730			K Factor = 5.80	
	50.12	0.1872		0.0	16.000	2.996			Vel = 10.75	
	0.0									
	50.12					21.726			K Factor = 10.75	
411A to 411	22.33	1.049 120.0	T	5.0	1.000	20.768			K Factor = 4.90	
	22.33	0.1597		0.0	5.000	0.0			Vel = 8.29	
411 to 412	50.12	1.38 120.0		0.0	3.000	21.726				
	72.45	0.3700		0.0	3.000	1.110			Vel = 15.54	
412 to 801	27.71	1.61 120.0		0.0	3.000	22.836			K Factor = 5.80	
	100.16	0.3183		0.0	3.000	0.955			Vel = 15.78	
801 to 802	0.0	1.61 120.0	3E	12.0	18.100	23.791				
	100.16	0.3182		0.0	12.000	1.823			Vel = 15.78	
802 to 42	0.0	2.635 120.0	T	16.474	18.090	35.192				
	100.16	0.0289		0.0	16.474	0.0			Vel = 5.89	
42 to 43	0.0	2.635 120.0		0.0	19.220	36.191				
	100.16	0.0289		0.0	19.220	0.555			Vel = 5.89	
43 to 44	0.0	2.635 120.0	2V 2U	11.807 6.041	22.730 17.848	36.746 0.381				
	100.16	0.0289		0.0	40.578	1.173			Vel = 5.89	
44 to 45	0.0	2.635 120.0	2V 2U	11.807 6.041	23.760 17.848	38.300 0.667				
	100.16	0.0289		0.0	41.608	1.202			Vel = 5.89	
45 to 46	0.0	2.635 120.0	4V	23.613	25.990	40.169				
	100.16	0.0289		0.0	23.613	0.559			Vel = 5.89	
46 to 47	0.0	2.635 120.0	2V X	11.807 14.827	3.490 26.634	42.161 0.199				
	100.16	0.0289		0.0	30.124	0.870			Vel = 5.89	
47 to FCV4	0.0	2.635 120.0	S Fsp Y Bvca 7V	19.22 0.0 17.161 8.237 41.323	27.580 85.941 113.521	43.230 3.576 3.280			** Fixed Loss = 3	
FCV4 to FCV3	100.00	4.26 120.0	2I J	18.434 21.067	14.542 39.501	50.086 4.114			Qa = 100	
	200.16	0.0100		0.0	54.043	0.542			Vel = 4.51	
FCV3 to TR	0.0	4.26 120.0	18I	165.905	120.667	54.742				
	200.16	0.0100		0.0	165.905	16.566			Vel = 4.51	
				0.0	286.572	2.872				

Final Calculations - Hazen-Williams

DEAN & ALLYN, INC.
10 Exchange Street 4th Floor Area 4-4

Page 6
Date 07/20/2016

Hyd. Ref. Point	Qa Qt	Dia. "C" Pf/Ft	Fitting or Eqv. Ln.	Pipe Ftng's Total	Pt Pe Pf	Pt Pv Pn	*****	Notes	*****
TR to BR	0.0 200.16	4.26 120.0 0.0100	Bvca S I	10.534 28.968 9.217	6.000 48.719 54.719	74.180 1.660 0.549		Vel = 4.51	
BR to FF	0.0 200.16	6.357 120.0 0.0014	I Zca	12.573 0.0 0.0	4.417 12.573 16.990	76.389 3.350 0.024		** Fixed Loss = 3.35 Vel = 2.02	
FF to UG	0.0 200.16	6.16 140.0 0.0012	G T	4.304 43.037 0.0	20.000 47.341 67.341	79.763 0.0 0.084		Vel = 2.15	
UG to TEST	0.0 200.16	10.22 100.0 0.0002	T G	39.29 3.929 0.0	100.000 43.218 143.218	79.847 -7.399 0.029		Vel = 0.78	
	0.0 200.16					72.477		K Factor = 23.51	

Water Supply Curve C

DEAN & ALLYN, INC.
10 Exchange Street 4th Floor Area 4-4

Page 7
Date 07/20/2016

City Water Supply:
C1 - Static Pressure : 93
C2 - Residual Pressure: 86
C2 - Residual Flow : 1500

Demand:
D1 - Elevation : 19.147
D2 - System Flow : 100.162
D2 - System Pressure : 72.477
Hose (Demand) : 100
D3 - System Demand : 200.162
Safety Margin : 20.354

