

. . . Fire Protection by Computer Design

EASTERN FIRE PROTECTION
170 KITTY HAWK AVE.
AUBURN/LEWISTON IND. PARK
AUBURN, MAINE
207-784-1507

Job Name : CUMBERLAND COUNTY CIVIC CENTER CONCOURSE LEVEL "C" STAIR LOBBY
Drawing : 5 OF 5
Location : PORTLAND, MAINE
Remote Area : 2
Contract : 4949
Data File : 6-4949 PHASE II.WXF

HYDRAULIC CALCULATIONS
for

Project name: CUMBERLAND COUNTY CIVIC CENTER CONCOURSE LEVEL AREA 'C'
Location: PORTLAND, MAINE
Drawing no: 5 OF 5
Date: 4/21/13

Design

Remote area number: 2
Remote area location: 2
Occupancy classification: LIGHT HAZARD
Density: .1 - Gpm/SqFt
Area of application: 1500 - SqFt
Coverage per sprinkler: 168/100 - SqFt
Type of sprinklers calculated: 5.6K 200DEG. WHITE PENDENTS
No. of sprinklers calculated: 13
In-rack demand: - GPM
Hose streams: 100 - GPM
Total water required (including hose streams): 427.57 - GPM @ 148.1 - Psi
Type of system: WET
Volume of dry or preaction system: - Gal

Water supply information

Date: 9/20/2010
Location: FREE ST PORTLAND, ME
Source: FIRE SPEC. INC.

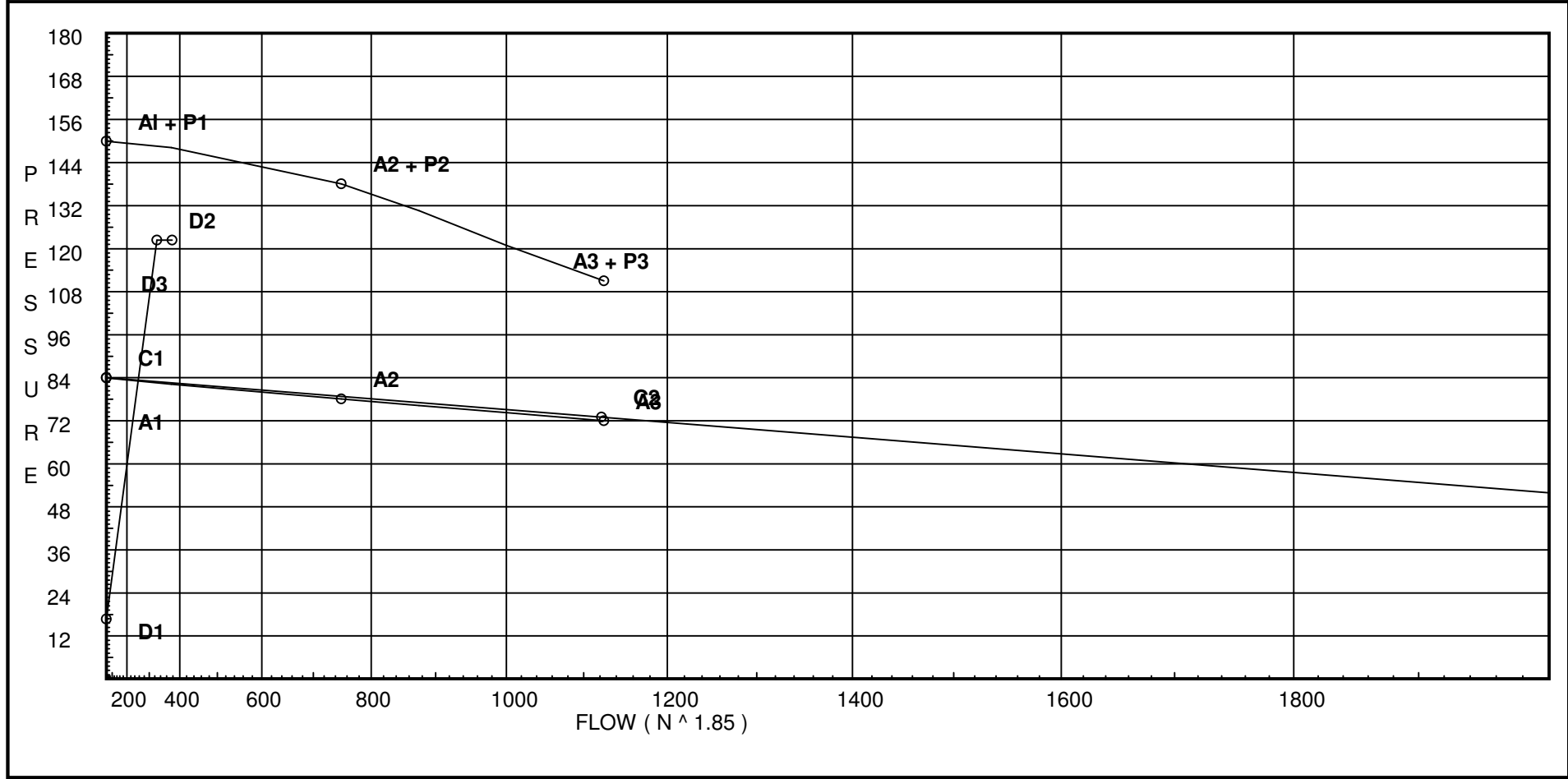
Name of contractor: EASTERN FIRE PROTECTION
Address: 170 KITTY HAWK AVE. / AUBURN/LEWISTON IND. PARK / AUBURN, MA
Phone number: 207-784-1507
Name of designer: JWD
Authority having jurisdiction: SFMO, PORTLAND FIRE DEPT.
Notes: (Include peaking information or gridded systems here.) HYDRAULICALLY REMOTE
AREA REVISED PER NFPA#13 2010 ED. SEC.11.2.3.2.3.1
TOTAL SYSTEM DEMAND INDICATED AT PUMP OUTLET (PO)

Water Supply Curve (C)

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| | | |
|---|--|---|
| City Water Supply: C1 - Static Pressure : 84 C2 - Residual Pressure: 73 C2 - Residual Flow : 1122 City Water Adjusted to Pump Inlet for Pf - Elev - Hose Flow A1 - Adjusted Static: 83.965 A2 - Adj Resid : 78.112 @ 750 A3 - Adj Resid : 72.01 @ 1125 | Pump Data: P1 - Pump Churn Pressure : 66 P2 - Pump Rated Pressure : 60 P2 - Pump Rated Flow : 750 P3 - Pump Pressure @ Max Flow : 39 P3 - Pump Max Flow : 1125 City Residual Flow @ 0 = 3366.89 City Residual Flow @ 20 = 2906.64 City Water @ 150% of Pump = 72.95 | Demand: D1 - Elevation : 16.748 D2 - System Flow : 327.573 D2 - System Pressure : 122.377 Hose (Demand) : 50 D3 - System Demand : 377.573 Hose (Adj City) : 50 Safety Margin : 25.736 |
|---|--|---|



Fittings Used Summary

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| Fitting Legend | | 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 | |
|----------------|----------------------------|--|-----|---|-------|-------|----|-------|------|-------|----|----|----|----|----|----|----|----|----|-----|-----|---|
| A | Alarm Rel E1 & E3 | | | | | | | 7.7 | 21.5 | | 17 | | 27 | 29 | | | | | | | | |
| 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 | 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 | |
| Fsp | Flow Switch Potter VSR | Fitting generates a Fixed Loss Based on Flow | | | | | | | | | | | | | | | | | | | | |
| 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 | |
| L | NFPA 13 Long Turn Elbow | 0.5 | 1 | 2 | 2 | 2 | 3 | 4 | 5 | 5 | 6 | 8 | 9 | 13 | 16 | 18 | 24 | 27 | 30 | 34 | 40 | |
| 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 | |

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

| Node at Source | Static Pressure | Residual Pressure | Flow | Available Pressure | Total Demand | Required Pressure |
|-----------------------|-------------------------------|--------------------------|-------------|---------------------------|---------------------|--------------------------|
| PO | See Information on Pump Curve | | | | 377.57 | 122.377 |
| TEST | 84.0 | 73 | 1122.0 | 82.154 | 427.57 | 82.154 |

NODE ANALYSIS

| Node Tag | Elevation | Node Type | Pressure at Node | Discharge at Node | Notes |
|-----------------|------------------|------------------|-------------------------|--------------------------|--------------|
| DROP | 0.0 | 5.6 | 7.0 | 14.82 | |
| DR | 0.0 | 5.6 | 7.0 | 14.82 | |
| DR3 | 0.0 | 5.6 | 7.0 | 14.82 | |
| DR4 | 0.0 | 5.6 | 7.0 | 14.82 | |
| DR5 | 0.0 | 5.6 | 9.0 | 16.8 | |
| SPRG | 0.0 | 5.6 | 9.49 | 17.25 | |
| 150 | 90.5 | 4.22 | 15.88 | 16.8 | K=K @ LN5 |
| 151 | 90.5 | 4.22 | 17.01 | 17.39 | K=K @ LN5 |
| 152 | 90.5 | 4.2 | 20.52 | 19.02 | K=K @ LN2 |
| 153 | 88.0 | 5.35 | 20.71 | 24.34 | K=K @ LINE |
| 154 | 90.5 | | 21.08 | | |
| 155 | 90.5 | 4.2 | 24.99 | 20.99 | K=K @ LN2 |
| 156 | 88.0 | 5.35 | 32.42 | 30.46 | K=K @ LINE |
| 157 | 90.5 | | 44.25 | | |
| 158 | 90.0 | 5.35 | 12.82 | 19.16 | K=K @ LINE |
| 159 | 90.5 | 4.2 | 14.77 | 16.13 | K=K @ LN2 |
| 159A | 90.5 | | 15.28 | | |
| 160 | 90.5 | 4.2 | 18.45 | 18.04 | K=K @ LN2 |
| 161 | 90.5 | 4.2 | 26.44 | 21.59 | K=K @ LN2 |
| 162 | 88.0 | 5.35 | 35.42 | 31.83 | K=K @ LINE |
| 163 | 88.0 | | 42.24 | | |
| 164 | 90.5 | | 57.6 | | |
| 165 | 90.5 | | 69.16 | | |
| 166 | 90.5 | | 69.39 | | |
| 167 | 90.5 | | 70.49 | | |
| 168 | 90.5 | | 71.97 | | |
| 169 | 90.5 | 5.35 | 73.35 | 45.81 | K=K @ LINE |
| 170 | 90.5 | 5.35 | 74.02 | 46.02 | K=K @ LINE |
| 171 | 86.25 | | 89.89 | | |
| DG | 74.21 | | 103.88 | | |
| DH | 74.21 | | 105.49 | | |
| K | 59.83 | | 113.37 | | |
| RT | 59.83 | | 118.41 | | |
| RB | 59.83 | | 118.42 | | |
| L | 51.83 | | 122.19 | 50.0 | |
| PO | 51.83 | | 122.38 | | |
| PI | 51.83 | | 82.15 | | |
| TEST | 51.83 | | 82.15 | 50.0 | |

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 | ***** |
|----------------------|------------------|-----------|----------------|--------------|------------------------------|-------------------------|----------------|---------------------------|-------|----------------------------|-------|
| DROP to LINE | 0 0 | 5.60 | 14.82 14.82 | 1 1.049 | 1E 1T 0.0 | 2.0 5.0 9.000 | 120 | 7.000 0.0 0.672 | | Vel = 5.50 | |
| LINE | | | 0.0 14.82 | | | | | 7.672 | | K Factor = 5.35 | |
| DR to LN2 | 0 0 | 5.60 | 14.82 14.82 | 1 1.049 | 1T 0.0 0.0 | 5.0 0.0 73.000 | 120 | 7.000 0.0 5.453 | | Vel = 5.50 | |
| LN2 | | | 0.0 14.82 | | | | | 12.453 | | K Factor = 4.20 | |
| DR3 to LN3 | 0 0 | 5.60 | 14.82 14.82 | 1 1.049 | 1T 0.0 0.0 | 5.0 0.0 73.000 | 120 | 7.000 0.0 5.453 | | Vel = 5.50 | |
| LN3 | | | 0.0 14.82 | | | | | 12.453 | | K Factor = 4.20 | |
| DR4 to LN4 | 0 0 | 5.60 | 14.82 14.82 | 1 1.049 | 1T 0.0 0.0 | 5.0 0.0 73.000 | 120 | 7.000 0.0 5.453 | | Vel = 5.50 | |
| LN4 | | | 0.0 14.82 | | | | | 12.453 | | K Factor = 4.20 | |
| DR5 to LN5 | 0 0 | 5.60 | 16.80 16.8 | 1 1.049 | 1T 0.0 0.0 | 5.0 0.0 73.000 | 120 | 9.000 0.0 6.880 | | Vel = 6.24 | |
| LN5 | | | 0.0 16.80 | | | | | 15.880 | | K Factor = 4.22 | |
| SPRG to UP | 0 0 | 5.60 | 17.25 17.25 | 1 1.049 | 1T 0.0 0.0 | 5.0 0.0 5.500 | 120 | 9.489 0.0 0.544 | | Vel = 6.40 | |
| UP | | | 0.0 17.25 | | | | | 10.033 | | K Factor = 5.45 | |
| 150 to 151 | 90.500 90.500 | 4.22 | 16.80 16.8 | 1 1.049 | 0.0 0.0 0.0 | 12.000 0.0 12.000 | 120 | 15.880 0.0 1.132 | | K = K @ LN5 Vel = 6.24 | |
| 151 to 152 | 90.500 90.500 | 4.22 | 17.39 34.19 | 1 1.049 | 0.0 0.0 0.0 | 10.000 0.0 10.000 | 120 | 17.012 0.0 3.508 | | K = K @ LN5 Vel = 12.69 | |
| 152 to 154 | 90.500 90.500 | 4.2 | 19.02 53.21 | 1 1.049 | 0.0 0.0 0.0 | 0.710 0.0 0.710 | 120 | 20.520 0.0 0.565 | | K = K @ LN2 Vel = 19.75 | |
| 154 | | | 0.0 53.21 | | | | | 21.085 | | K Factor = 11.59 | |
| 153 to 154 | 88 90.500 | 5.35 | 24.34 24.34 | 1 1.049 | 1T 0.0 0.0 | 5.0 0.0 7.790 | 120 | 20.710 -1.083 1.458 | | K = K @ LINE Vel = 9.04 | |
| 154 to 155 | 90.500 90.500 | | 53.21 77.55 | 1.25 1.38 | 0.0 0.0 0.0 | 9.290 0.0 9.290 | 120 | 21.085 0.0 3.901 | | Vel = 16.63 | |

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 | ***** |
|----------------------|------------------|-----------|------------------|--------------|-----------------------|---------------------|---------------------------|----------------|----------------------------|-------|------------------|-------------|
| 155 to 156 | 90.500 88 | 4.2 | 20.99 98.54 | 1.25 1.38 | | 0.0 0.0 | 9.710 9.710 | 120 0.6540 | 24.986 1.083 6.350 | | K = K @ LN2 | |
| 156 to 157 | 88 90.500 | 5.35 | 30.45 128.99 | 1.25 1.38 | | 0.0 0.0 | 12.000 12.000 | 120 1.0764 | 32.419 -1.083 12.917 | | K = K @ LINE | |
| 157 to 168 | 90.500 90.500 | | 0.0 128.99 | 1.25 1.38 | 1E 1T | 3.0 6.0 0.0 | 16.750 9.000 25.750 | 120 1.0764 | 44.253 0.0 27.718 | | | Vel = 27.67 |
| 168 | | | 0.0 128.99 | | | | | | 71.971 | | K Factor = 15.20 | |
| 158 to 159A | 90 90.500 | 5.35 | 19.16 19.16 | 1 1.049 | 1E 1T | 2.0 5.0 0.0 | 15.210 7.000 22.210 | 120 0.1202 | 12.825 -0.217 2.669 | | K = K @ LINE | |
| 159A | | | 0.0 19.16 | | | | | | 15.277 | | K Factor = 4.90 | |
| 159 to 159A | 90.500 90.500 | 4.2 | 16.13 16.13 | 1 1.049 | 1T | 5.0 0.0 0.0 | 0.830 5.000 5.830 | 120 0.0875 | 14.767 0.0 0.510 | | K = K @ LN2 | Vel = 5.99 |
| 159A to 160 | 90.500 90.500 | | 19.16 35.29 | 1 1.049 | | 0.0 0.0 0.0 | 8.540 0.0 8.540 | 120 0.3721 | 15.277 0.0 3.178 | | | Vel = 13.10 |
| 160 to 161 | 90.500 90.500 | 4.2 | 18.04 53.33 | 1 1.049 | | 0.0 0.0 0.0 | 10.000 10.000 | 120 0.7986 | 18.455 0.0 7.986 | | K = K @ LN2 | Vel = 19.80 |
| 161 to 162 | 90.500 88 | 4.2 | 21.59 74.92 | 1.25 1.38 | 2E | 6.0 0.0 0.0 | 14.040 6.000 20.040 | 120 0.3939 | 26.441 1.083 7.893 | | K = K @ LN2 | Vel = 16.07 |
| 162 to 163 | 88 88 | 5.35 | 31.83 106.75 | 1.25 1.38 | | 0.0 0.0 0.0 | 9.000 9.000 | 120 0.7584 | 35.417 0.0 6.826 | | K = K @ LINE | Vel = 22.90 |
| 163 to 164 | 88 90.500 | | 0.0 106.75 | 1.25 1.38 | 4E | 12.0 0.0 0.0 | 9.670 12.000 21.670 | 120 0.7585 | 42.243 -1.083 16.436 | | | Vel = 22.90 |
| 164 to 165 | 90.500 90.500 | | 0.0 106.75 | 1.25 1.38 | 1T | 6.0 0.0 0.0 | 9.250 6.000 15.250 | 120 0.7584 | 57.596 0.0 11.566 | | | Vel = 22.90 |
| 165 to 166 | 90.500 90.500 | | 0.0 106.75 | 2 2.157 | | 0.0 0.0 0.0 | 2.670 0.0 2.670 | 120 0.0861 | 69.162 0.0 0.230 | | | Vel = 9.37 |
| 166 to 167 | 90.500 90.500 | | 0.0 106.75 | 2 2.157 | | 0.0 0.0 0.0 | 12.710 0.0 12.710 | 120 0.0862 | 69.392 0.0 1.095 | | | Vel = 9.37 |
| 167 to 168 | 90.500 90.500 | | 0.0 106.75 | 2 2.157 | 1L | 3.692 0.0 0.0 | 13.540 3.692 17.232 | 120 0.0861 | 70.487 0.0 1.484 | | | Vel = 9.37 |
| 168 to 169 | 90.500 90.500 | | 128.99 235.74 | 3 3.26 | | 0.0 0.0 0.0 | 27.625 0.0 27.625 | 120 0.0499 | 71.971 0.0 1.379 | | | Vel = 9.06 |

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 | ***** |
|--------------------------|------------------|-----------|-----------------|------------|--|-------------------------|----------------|------------------|-------|--------------------------------|-------|
| 169 to 170 | 90.500 90.500 | 5.35 | 45.81 281.55 | 3 3.26 | 0.0 0.0 | 9.710 0.0 | 120 0.0694 | 73.350 0.0 | | K = K @ LINE Vel = 10.82 | |
| 170 to 171 | 90.500 86.250 | 5.35 | 46.02 327.57 | 3 3.26 | 8L 1T 53.758 20.159 | 79.000 73.917 | 120 0.0917 | 74.024 1.841 | | K = K @ LINE Vel = 12.59 | |
| 171 to DG | 86.250 74.210 | | 0.0 327.57 | 3 3.26 | 6L 1T 40.319 20.159 | 35.125 60.478 | 120 0.0917 | 89.894 5.215 | | Vel = 12.59 | |
| DG to DH | 74.210 74.210 | | 0.0 327.57 | 4 4.26 | 1L 1T 7.9 26.334 | 30.500 34.234 | 120 0.0249 | 103.880 0.0 | | Vel = 7.37 | |
| DH to K | 74.210 59.830 | | 0.0 327.57 | 4 4.26 | 4L 1T 31.601 26.334 | 8.250 57.935 | 120 0.0249 | 105.494 6.228 | | Vel = 7.37 | |
| K to RT | 59.830 59.830 | | 0.0 327.57 | 4 4.26 | 1A 1G 22.384 2.633 | 6.580 75.051 | 120 0.0249 | 113.372 3.000 | | * Fixed loss = 3 Vel = 7.37 | |
| RT to RB | 59.830 59.830 | | 0.0 327.57 | 6 6.357 | 1L 1T 7.9 26.334 1Fsp 0.0 | 4.000 0.0 | 120 0.0038 | 118.407 0.0 | | Vel = 3.31 | |
| RB to L | 59.830 51.830 | | 0.0 327.57 | 6 6.357 | 3L 1T 33.948 37.72 | 14.000 71.668 | 120 0.0035 | 118.422 3.465 | | Vel = 3.31 | |
| L to PO | 51.830 51.830 | H50 | 50.00 377.57 | 8 8.249 | 3G 1S 14.094 52.853 | 5.000 138.592 | 120 0.0013 | 122.190 0.0 | | Vel = 2.27 | |
| PO | | | 0.0 377.57 | | | | | 122.377 | | K Factor = 34.13 | |
| System Demand Pressure | | | | | | | | 122.377 | | | |
| Safety Margin | | | | | | | | 25.736 | | | |
| Continuation Pressure | | | | | | | | 148.113 | | | |
| Pressure @ Pump Outlet | | | | | | | | 148.113 | | | |
| Pressure From Pump Curve | | | | | | | | -65.961 | | | |
| Pressure @ Pump Inlet | | | | | | | | 82.152 | | | |
| PI to TEST | 51.830 51.830 | | 0.0 377.57 | 8 8.249 | 0.0 0.0 | 1.000 0.0 | 120 0.0010 | 82.152 0.0 | | Vel = 2.27 | |
| TEST | | | 50.00 427.57 | | | | | 82.153 | | Qa = 50.00 K Factor = 47.17 | |