

Hydraulic Calculations for

Project:
Drawing no.:
Date: 01/06/2021

Design

Remote area number: -
Remote area location: 11 pavimento
Occupancy classification: light hazard
Density: 4,1 l/min/m²
Area of application: 149,6 m²
Coverage per sprinkler: 12,1m
Type of sprinklers calculated:
No. of sprinklers calculated: 17
In rack demand:
Hose streams: none outside + 0 inside
Total water required (including hose streams): 1225,28 lpm at -1,186 bar [1,286 bar safety margin (1286,1%)]
Total water required at base of system riser: 1225,28 lpm at 3,415 bar
Type of system: wet pipe
Volume of dry or preaction system:

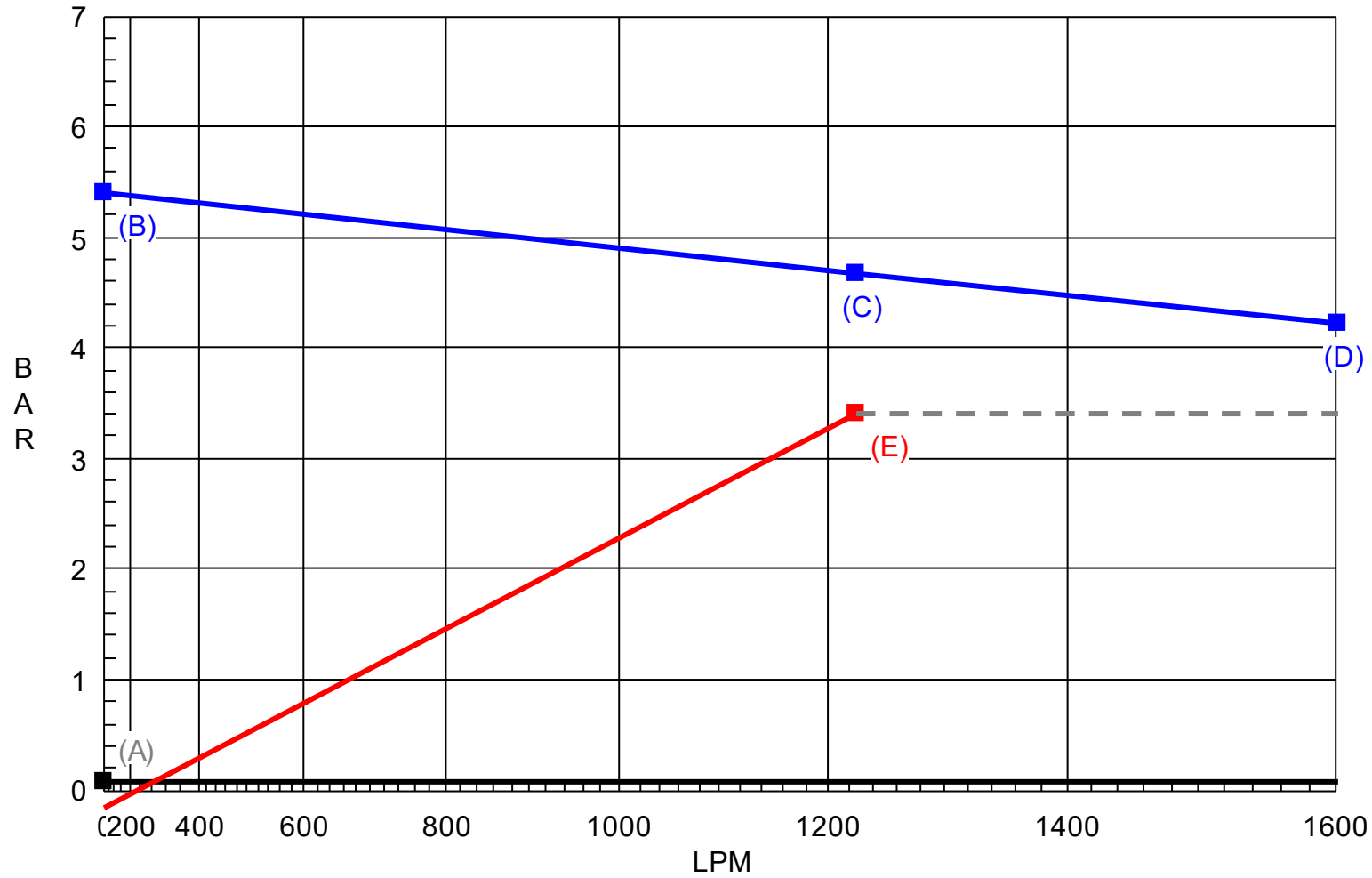
Water Supply Information

Date:
Location:
Source:

Contractor: Engepoint
Name of designer: LANNER
Authority having jurisdiction:

Notes

Hydraulic Demand Graph



Water Source:

A) 0,1 bar Static

Source at BOR:

B) 5,43 bar Static

C) 1225,3 lpm at 4,7 bar

D) 1600 lpm at 4,24 bar

Demand at BOR:

E) 1225,3 lpm at 3,42 bar

Supply Analysis

| Node at | Static Pressure [bar] | Residual Pressure [bar] | Flow [lpm] | Available Pressure [bar] | Total Demand [lpm] | Required Pressure [bar] |
|---------|-----------------------|-------------------------|------------|--------------------------|--------------------|-------------------------|
| RI | 0,1 | | | 0,1 | 1225,28 | -1,19 |

Node Analysis

| Node Tag | Elev [M] | Type | Pressure [bar] | Discharge [lpm] |
|----------|----------|---------|----------------|-----------------|
| RI | 40,500 | source | -1,186 | -1225,27 |
| EB | 40,500 | ref | -1,203 | 0,000 |
| SB | 40,500 | ref | 3,646 | 0,000 |
| R1 | 39,460 | K=80,00 | 0,508 | 57,000 |
| R2 | 39,460 | K=80,00 | 0,584 | 61,110 |
| R3 | 39,460 | K=80,00 | 0,644 | 64,197 |
| R4 | 39,460 | K=80,00 | 0,678 | 65,871 |
| R5 | 39,460 | K=80,00 | 0,777 | 70,523 |
| R6 | 39,460 | K=80,00 | 0,788 | 71,012 |
| R7 | 39,460 | K=80,00 | 0,699 | 66,861 |
| R8 | 39,460 | K=80,00 | 0,783 | 70,769 |
| R9 | 39,460 | K=80,00 | 0,899 | 75,869 |
| R10 | 39,460 | K=80,00 | 0,801 | 71,605 |
| R11 | 39,460 | K=80,00 | 0,897 | 75,749 |
| R12 | 39,460 | K=80,00 | 0,870 | 74,628 |
| R13 | 39,460 | K=80,00 | 0,973 | 78,921 |
| R14 | 39,460 | K=80,00 | 0,923 | 76,853 |
| R15 | 39,460 | K=80,00 | 1,004 | 80,160 |
| R16 | 39,460 | K=80,00 | 0,995 | 79,802 |
| R17 | 39,460 | K=80,00 | 1,112 | 84,349 |
| A1 | 39,710 | ref | 0,735 | 0,000 |
| A2 | 39,710 | ref | 0,903 | 0,000 |
| A3 | 39,710 | ref | 0,965 | 0,000 |
| A4 | 39,710 | ref | 0,997 | 0,000 |
| A5 | 39,710 | ref | 1,107 | 0,000 |
| A6 | 39,710 | ref | 1,202 | 0,000 |
| A7 | 39,710 | ref | 1,228 | 0,000 |
| A8 | 39,710 | ref | 1,028 | 0,000 |
| A9 | 39,710 | ref | 1,373 | 0,000 |
| A10 | 39,710 | ref | 2,224 | 0,000 |
| A11 | 39,710 | ref | 3,104 | 0,000 |
| D1 | 39,710 | ref | 0,488 | 0,000 |
| D2 | 39,710 | ref | 0,564 | 0,000 |
| D3 | 39,710 | ref | 0,625 | 0,000 |
| D4 | 39,710 | ref | 0,659 | 0,000 |
| D5 | 39,710 | ref | 0,759 | 0,000 |
| D6 | 39,710 | ref | 0,770 | 0,000 |
| D7 | 39,710 | ref | 0,680 | 0,000 |
| D8 | 39,710 | ref | 0,765 | 0,000 |
| D9 | 39,710 | ref | 0,882 | 0,000 |
| D10 | 39,710 | ref | 0,783 | 0,000 |
| D11 | 39,710 | ref | 0,879 | 0,000 |

Node Analysis, cont.

| Node Tag | Elev [M] | Type | Pressure [bar] | Discharge [lpm] |
|-----------------|---------------------|-------------|---------------------------|----------------------------|
| D12 | 39,710 | ref | 0,853 | 0,000 |
| D13 | 39,710 | ref | 0,957 | 0,000 |
| D14 | 39,710 | ref | 0,906 | 0,000 |
| D15 | 39,710 | ref | 0,988 | 0,000 |
| D16 | 39,710 | ref | 0,979 | 0,000 |
| D17 | 39,710 | ref | 1,096 | 0,000 |
| CS11 | 38,140 | ref | 3,389 | 0,000 |
| VGA | 41,200 | ref | 3,415 | 0,000 |

Pipe Information

negative pipe flow (Q) indicates flow is from node 2 towards node 1

| Node 1 | Elev [M] | K-factor | Discharge & Flow [lpm] | Nom i.d. [in] | Fittings num & length [M] | L [M] F [M] T [M] | C factor bar/M | total (Pt) elev (Pe) frict (Pf) | Notes |
|--------|----------|----------|------------------------|---------------|---------------------------|-------------------------|----------------|---------------------------------|-----------|
| EB | 40,500 | | Pump inlet pressure = | | -1,203 bar | | | | |
| | | | Net gain across pump = | | 4,850 bar | | | | |
| SB | 40,500 | | Pump outlet pressure = | | 3,646 bar | | | | |
| R1 | 39,460 | 80 | q= 57,000 | 1 | | 0,250 | | Pt= 0,508 | Mat="S40" |
| | | | Q= -57,000 | 1,049 | | 0,000 | C=120 | Pe= 0,025 | |
| D1 | 39,710 | | | | | 0,250 | 0,017 | Pf= -0,004 | |
| D1 | 39,710 | | q= 0,000 | 1 | 1E=0,610 | 3,170 | | Pt= 0,488 | Mat="S40" |
| | | | Q= -57,000 | 1,049 | 1TR=0,610 | 1,220 | C=120 | Pe= 0,000 | |
| D2 | 39,710 | | | | | 4,390 | 0,017 | Pf= -0,076 | |
| R2 | 39,460 | 80 | q= 61,110 | 1 | | 0,250 | | Pt= 0,584 | Mat="S40" |
| | | | Q= -61,110 | 1,049 | | 0,000 | C=120 | Pe= 0,025 | |
| D2 | 39,710 | | | | | 0,250 | 0,02 | Pf= -0,005 | |
| D2 | 39,710 | | q= 0,000 | 1 | 1T=1,520 | 0,420 | | Pt= 0,564 | Mat="S40" |
| | | | Q=-118,110 | 1,049 | 1TR=0,610 | 2,130 | C=120 | Pe= 0,000 | |
| A1 | 39,710 | | | | | 2,550 | 0,067 | Pf= -0,171 | |
| R3 | 39,460 | 80 | q= 64,197 | 1 | | 0,250 | | Pt= 0,644 | Mat="S40" |
| | | | Q= -64,197 | 1,049 | | 0,000 | C=120 | Pe= 0,025 | |
| D3 | 39,710 | | | | | 0,250 | 0,022 | Pf= -0,005 | |
| D3 | 39,710 | | q= 0,000 | 1 | 1T=1,520 | 2,940 | | Pt= 0,625 | Mat="S40" |
| | | | Q= -64,197 | 1,049 | 1E=0,610 | 2,130 | C=120 | Pe= 0,000 | |
| A1 | 39,710 | | | | | 5,070 | 0,022 | Pf= -0,110 | |
| A1 | 39,710 | | q= 0,000 | 1,25 | 2E=1,840 | 2,420 | | Pt= 0,735 | Mat="S40" |
| | | | Q=-182,307 | 1,38 | | 1,840 | C=120 | Pe= 0,000 | |
| A2 | 39,710 | | | | | 4,260 | 0,039 | Pf= -0,168 | |
| R4 | 39,460 | 80 | q= 65,871 | 1 | | 0,250 | | Pt= 0,678 | Mat="S40" |
| | | | Q= -65,871 | 1,049 | | 0,000 | C=120 | Pe= 0,025 | |
| D4 | 39,710 | | | | | 0,250 | 0,023 | Pf= -0,006 | |
| D4 | 39,710 | | q= 0,000 | 1 | 1E=0,610 | 3,170 | | Pt= 0,659 | Mat="S40" |
| | | | Q= -65,871 | 1,049 | 1TR=0,610 | 1,220 | C=120 | Pe= 0,000 | |
| D5 | 39,710 | | | | | 4,390 | 0,023 | Pf= -0,100 | |
| R5 | 39,460 | 80 | q= 70,523 | 1 | | 0,250 | | Pt= 0,777 | Mat="S40" |
| | | | Q= -70,523 | 1,049 | | 0,000 | C=120 | Pe= 0,025 | |
| D5 | 39,710 | | | | | 0,250 | 0,026 | Pf= -0,006 | |
| D5 | 39,710 | | q= 0,000 | 1 | 1E=0,610 | 0,420 | | Pt= 0,759 | Mat="S40" |
| | | | Q=-136,395 | 1,049 | 1TR=0,610 | 1,220 | C=120 | Pe= 0,000 | |
| A2 | 39,710 | | | | | 1,640 | 0,087 | Pf= -0,143 | |
| R6 | 39,460 | 80 | q= 71,012 | 1 | | 0,250 | | Pt= 0,788 | Mat="S40" |
| | | | Q= -71,012 | 1,049 | | 0,000 | C=120 | Pe= 0,025 | |
| D6 | 39,710 | | | | | 0,250 | 0,026 | Pf= -0,007 | |
| D6 | 39,710 | | q= 0,000 | 1 | 1E=0,610 | 2,940 | | Pt= 0,770 | Mat="S40" |
| | | | Q= -71,012 | 1,049 | 1T=1,520 | 2,130 | C=120 | Pe= 0,000 | |
| A2 | 39,710 | | | | | 5,070 | 0,026 | Pf= -0,133 | |
| A2 | 39,710 | | q= 0,000 | 2 | | 2,770 | | Pt= 0,903 | Mat="S40" |
| | | | Q=-389,713 | 2,067 | | 0,000 | C=120 | Pe= 0,000 | |
| A3 | 39,710 | | | | | 2,770 | 0,022 | Pf= -0,062 | |

Pipe Information, cont.

| Node 1 | Elev | K-factor | Discharge & Flow [lpm] | Nom i.d. [in] | Fittings num & length [M] | L [M] F [M] T [M] | C factor bar/M | total (Pt) elev (Pe) frict (Pf) | Notes |
|--------|--------|----------|-------------------------|---------------|---------------------------|-------------------------|----------------|------------------------------------|-----------|
| R7 | 39,460 | 80 | q= 66,861 Q= -66,861 | 1 1,049 | | 0,250 0,000 | | Pt= 0,699 Pe= 0,025 | Mat="S40" |
| D7 | 39,710 | | | | | 0,250 | 0,023 | Pf= -0,006 | |
| D7 | 39,710 | | q= 0,000 Q= -66,861 | 1 1,049 | 1E=0,610 1TR=0,610 | 2,400 1,220 | C=120 | Pt= 0,680 Pe= 0,000 | Mat="S40" |
| D8 | 39,710 | | | | | 3,620 | 0,023 | Pf= -0,085 | |
| R8 | 39,460 | 80 | q= 70,769 Q= -70,769 | 1 1,049 | | 0,250 0,000 | | Pt= 0,783 Pe= 0,025 | Mat="S40" |
| D8 | 39,710 | | | | | 0,250 | 0,026 | Pf= -0,006 | |
| D8 | 39,710 | | q= 0,000 Q=-137,630 | 1 1,049 | 1T=1,520 | 0,730 1,520 | C=120 | Pt= 0,765 Pe= 0,000 | Mat="S40" |
| A3 | 39,710 | | | | | 2,250 | 0,089 | Pf= -0,200 | |
| A3 | 39,710 | | q= 0,000 Q=-527,343 | 2 2,067 | | 0,830 0,000 | C=120 | Pt= 0,965 Pe= 0,000 | Mat="S40" |
| A4 | 39,710 | | | | | 0,830 | 0,039 | Pf= -0,033 | |
| R9 | 39,460 | 80 | q= 75,869 Q= -75,869 | 1 1,049 | | 0,250 0,000 | | Pt= 0,899 Pe= 0,025 | Mat="S40" |
| D9 | 39,710 | | | | | 0,250 | 0,03 | Pf= -0,007 | |
| D9 | 39,710 | | q= 0,000 Q= -75,869 | 1 1,049 | 1E=0,610 1T=1,520 | 1,760 2,130 | C=120 | Pt= 0,882 Pe= 0,000 | Mat="S40" |
| A4 | 39,710 | | | | | 3,890 | 0,03 | Pf= -0,115 | |
| A4 | 39,710 | | q= 0,000 Q=-603,213 | 2 2,067 | | 2,170 0,000 | C=120 | Pt= 0,997 Pe= 0,000 | Mat="S40" |
| A5 | 39,710 | | | | | 2,170 | 0,05 | Pf= -0,109 | |
| R10 | 39,460 | 80 | q= 71,605 Q= -71,605 | 1 1,049 | | 0,250 0,000 | | Pt= 0,801 Pe= 0,025 | Mat="S40" |
| D10 | 39,710 | | | | | 0,250 | 0,027 | Pf= -0,007 | |
| D10 | 39,710 | | q= 0,000 Q= -71,605 | 1 1,049 | 1E=0,610 1TR=0,610 | 2,400 1,220 | C=120 | Pt= 0,783 Pe= 0,000 | Mat="S40" |
| D11 | 39,710 | | | | | 3,620 | 0,027 | Pf= -0,096 | |
| R11 | 39,460 | 80 | q= 75,749 Q= -75,749 | 1 1,049 | | 0,250 0,000 | | Pt= 0,897 Pe= 0,025 | Mat="S40" |
| D11 | 39,710 | | | | | 0,250 | 0,029 | Pf= -0,007 | |
| D11 | 39,710 | | q= 0,000 Q=-147,353 | 1 1,049 | 1T=1,520 | 0,730 1,520 | C=120 | Pt= 0,879 Pe= 0,000 | Mat="S40" |
| A5 | 39,710 | | | | | 2,250 | 0,101 | Pf= -0,227 | |
| A5 | 39,710 | | q= 0,000 Q=-750,566 | 2,5 2,469 | | 3,000 0,000 | C=120 | Pt= 1,107 Pe= 0,000 | Mat="S40" |
| A6 | 39,710 | | | | | 3,000 | 0,032 | Pf= -0,095 | |
| R12 | 39,460 | 80 | q= 74,628 Q= -74,628 | 1 1,049 | | 0,250 0,000 | | Pt= 0,870 Pe= 0,025 | Mat="S40" |
| D12 | 39,710 | | | | | 0,250 | 0,029 | Pf= -0,007 | |
| D12 | 39,710 | | q= 0,000 Q= -74,628 | 1 1,049 | 1E=0,610 1TR=0,610 | 2,400 1,220 | C=120 | Pt= 0,853 Pe= 0,000 | Mat="S40" |
| D13 | 39,710 | | | | | 3,620 | 0,029 | Pf= -0,104 | |

Pipe Information, cont.

| Node 1 | Elev | K-factor | Discharge & Flow [lpm] | Nom i.d. [in] | Fittings num & length [M] | L [M] F [M] T [M] | C factor bar/M | total (Pt) elev (Pe) frict (Pf) | Notes |
|--------|--------|----------|-------------------------|---------------|---------------------------|-------------------------|----------------|------------------------------------|-----------|
| R13 | 39,460 | 80 | q= 78,921 Q= -78,921 | 1 1,049 | | 0,250 0,000 | | Pt= 0,973 Pe= 0,025 | Mat="S40" |
| D13 | 39,710 | | | | | 0,250 | 0,032 | Pf= -0,008 | |
| D13 | 39,710 | | q= 0,000 Q=-153,549 | 1 1,049 | 1T=1,520 | 0,730 1,520 | | Pt= 0,957 Pe= 0,000 | Mat="S40" |
| A6 | 39,710 | | | | | 2,250 | 0,109 | Pf= -0,245 | |
| A6 | 39,710 | | q= 0,000 Q=-904,115 | 2,5 2,469 | | 0,580 0,000 | | Pt= 1,202 Pe= 0,000 | Mat="S40" |
| A7 | 39,710 | | | | | 0,580 | 0,045 | Pf= -0,026 | |
| R14 | 39,460 | 80 | q= 76,853 Q= -76,853 | 1 1,049 | | 0,250 0,000 | | Pt= 0,923 Pe= 0,025 | Mat="S40" |
| D14 | 39,710 | | | | | 0,250 | 0,03 | Pf= -0,008 | |
| D14 | 39,710 | | q= 0,000 Q= -76,853 | 1 1,049 | 1E=0,610 | 3,420 0,610 | | Pt= 0,906 Pe= 0,000 | Mat="S40" |
| A8 | 39,710 | | | | | 4,030 | 0,03 | Pf= -0,122 | |
| R15 | 39,460 | 80 | q= 80,160 Q= -80,160 | 1 1,049 | | 0,250 0,000 | | Pt= 1,004 Pe= 0,025 | Mat="S40" |
| D15 | 39,710 | | | | | 0,250 | 0,033 | Pf= -0,008 | |
| D15 | 39,710 | | q= 0,000 Q= -80,160 | 1 1,049 | | 1,230 0,000 | | Pt= 0,988 Pe= 0,000 | Mat="S40" |
| A8 | 39,710 | | | | | 1,230 | 0,033 | Pf= -0,040 | |
| A8 | 39,710 | | q= 0,000 Q=-157,012 | 1 1,049 | | 1,760 0,000 | | Pt= 1,028 Pe= 0,000 | Mat="S40" |
| A7 | 39,710 | | | | | 1,760 | 0,114 | Pf= -0,200 | |
| A7 | 39,710 | | q= 0,000 Q=-1061,12 | 2,5 2,469 | | 2,420 0,000 | | Pt= 1,228 Pe= 0,000 | Mat="S40" |
| A9 | 39,710 | | | | | 2,420 | 0,06 | Pf= -0,146 | |
| R16 | 39,460 | 80 | q= 79,802 Q= -79,802 | 1 1,049 | | 0,250 0,000 | | Pt= 0,995 Pe= 0,025 | Mat="S40" |
| D16 | 39,710 | | | | | 0,250 | 0,032 | Pf= -0,008 | |
| D16 | 39,710 | | q= 0,000 Q= -79,802 | 1 1,049 | 1E=0,610 1TR=0,610 | 2,400 1,220 | | Pt= 0,979 Pe= 0,000 | Mat="S40" |
| D17 | 39,710 | | | | | 3,620 | 0,032 | Pf= -0,117 | |
| R17 | 39,460 | 80 | q= 84,349 Q= -84,349 | 1 1,049 | | 0,250 0,000 | | Pt= 1,112 Pe= 0,025 | Mat="S40" |
| D17 | 39,710 | | | | | 0,250 | 0,036 | Pf= -0,009 | |
| D17 | 39,710 | | q= 0,000 Q=-164,151 | 1 1,049 | 1T=1,520 | 0,730 1,520 | | Pt= 1,096 Pe= 0,000 | Mat="S40" |
| A9 | 39,710 | | | | | 2,250 | 0,123 | Pf= -0,277 | |
| A9 | 39,710 | | q= 0,000 Q=-1225,27 | 2,5 2,469 | | 10,820 0,000 | | Pt= 1,373 Pe= 0,000 | Mat="S40" |
| A10 | 39,710 | | | | | 10,820 | 0,079 | Pf= -0,850 | |
| A10 | 39,710 | | q= 0,000 Q=-1225,27 | 3 3,068 | | 32,260 0,000 | | Pt= 2,224 Pe= 0,000 | Mat="S40" |
| A11 | 39,710 | | | | | 32,260 | 0,027 | Pf= -0,880 | |

Pipe Information, cont.

| Node 1 | Elev | Discharge | Nom | Fittings | L [M] | total (Pt) | | |
|--------|--------|------------|-------|--------------|--------|------------|----------|-----------|
| Node 2 | [M] | & Flow | i.d. | num & length | F [M] | elev (Pe) | C factor | Notes |
| | | [lpm] | [in] | [M] | T [M] | frict (Pf) | bar/M | |
| A11 | 39,710 | q= 0,000 | 4 | 1T=6,100 | 4,550 | Pt= 3,104 | | Mat="S40" |
| | | Q=-1225,27 | 4,026 | 1E=3,050 | 13,420 | Pe= -0,154 | C=120 | |
| CS11 | 38,140 | | | 1G=0,610 | 17,970 | Pf= -0,131 | 0,007 | |
| | | | | 2TN=3,660 | | | | |
| CS11 | 38,140 | q= 0,000 | 4 | 1T=6,100 | 23,000 | Pt= 3,389 | | Mat="S40" |
| | | Q=-1225,27 | 4,026 | 4E=12,200 | 21,960 | Pe= 0,300 | C=120 | |
| VGA | 41,200 | | | 1A=3,660 | 44,960 | Pf= -0,327 | 0,007 | |
| VGA | 41,200 | q= 0,000 | 4 | 1G=0,610 | 6,500 | Pt= 3,415 | | Mat="S40" |
| | | Q=-1225,27 | 4,026 | 3E=9,150 | 15,860 | Pe= -0,069 | C=120 | |
| SB | 40,500 | | | 1T=6,100 | 22,360 | Pf= -0,162 | 0,007 | |
| RI | 40,500 | q=-1225,27 | 6 | 1T=9,100 | 3,000 | Pt= -1,186 | | Mat="S40" |
| | | Q=1225,278 | 6,065 | 1E=4,270 | 14,290 | Pe= 0,000 | C=120 | |
| EB | 40,500 | | | 1G=0,920 | 17,290 | Pf= 0,017 | 0,001 | |

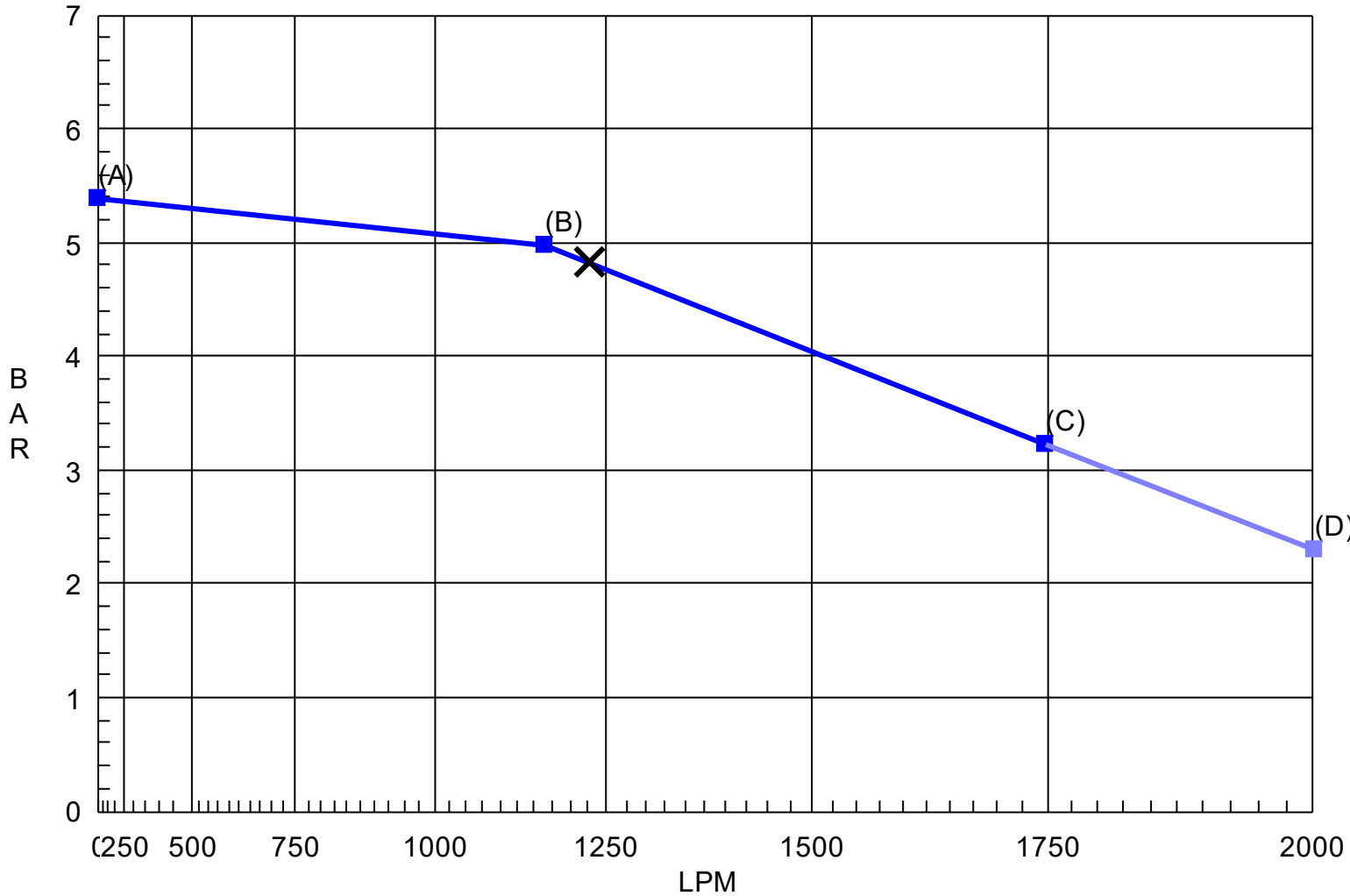
Material Codes**Pipe Material**

S40 - Schedule 40 Steel

Fittings

A - Alarm Valve
E - Standard 90 degree elbow
G - Gate Valve
T - Tee - Flow turn 90 degrees
TN - Tee - Straight thru path
TR - Tee - Straight thru path with 50% Size reduction

Pump #1 in Pipe "Pump1"



Given Values:

- A) 5,4 bar at 0.0 lpm
- B) 1166 lpm at 5 bar
- C) 1749 lpm at 3,25 bar

Extrapolated:

- D) 2000 lpm at 2,32 bar

Calculated:

- X) 1225,3 lpm at 4,85 bar