



Chemical Injection Technologies

Technical Bulletin

FRICTION LOSS IN SCHEDULE 80 PLASTIC PIPE

| GPM | PIPE DIAMETER | | | | | | | | | | | | |
|-----|---------------|---------|---------|---------|---------|---------|--------|--------|--------|-------|-------|-------|--|
| | 3/4" | 1" | 1-1/4" | 1-1/2" | 2" | 2-1/2" | 3" | 3-1/2" | 4" | 5" | 6" | 8" | |
| 2 | 1.510 | | | | | | | | | | | | |
| 4 | 5.450 | 1.540 | 0.390 | 0.177 | | | | | | | | | |
| 6 | 11.500 | 3.340 | 0.820 | 0.675 | 0.107 | | | | | | | | |
| 8 | 19.600 | 5.690 | 1.390 | 0.640 | 0.183 | 0.077 | | | | | | | |
| 10 | 29.600 | 8.600 | 2.100 | 0.960 | 0.276 | 0.115 | 0.039 | | | | | | |
| 12 | 41.500 | 12.000 | 2.940 | 1.350 | 0.387 | 0.161 | 0.055 | | | | | | |
| 15 | 62.700 | 22.900 | 4.450 | 2.040 | 0.585 | 0.243 | 0.083 | 0.035 | | | | | |
| 18 | 87.900 | 25.500 | 6.250 | 2.860 | 0.818 | 0.340 | 0.116 | 0.056 | | | | | |
| 20 | 107.000 | 30.900 | 7.570 | 3.470 | 0.996 | 0.414 | 0.140 | 0.068 | 0.037 | | | | |
| 25 | | 58.800 | 11.400 | 5.250 | 1.510 | 0.625 | 0.212 | 0.103 | 0.055 | | | | |
| 30 | | 65.300 | 16.000 | 7.380 | 2.110 | 0.874 | 0.297 | 0.145 | 0.077 | 0.025 | | | |
| 35 | | 86.900 | 21.300 | 9.780 | 2.810 | 1.160 | 0.396 | 0.192 | 0.103 | 0.034 | | | |
| 40 | | 111.000 | 27.300 | 12.500 | 3.590 | 1.490 | 0.507 | 0.246 | 0.132 | 0.043 | | | |
| 45 | | | 33.900 | 15.600 | 4.460 | 1.860 | 0.629 | 0.306 | 0.164 | 0.054 | | | |
| 50 | | | 41.300 | 18.900 | 5.410 | 2.250 | 0.766 | 0.372 | 0.199 | 0.065 | 0.027 | | |
| 55 | | | 49.200 | 22.000 | 6.440 | 2.680 | 0.912 | 0.443 | 0.237 | 0.078 | 0.032 | | |
| 60 | | | 57.800 | 26.500 | 7.610 | 3.160 | 1.070 | 0.522 | 0.279 | 0.091 | 0.039 | | |
| 65 | | | 67.000 | 30.700 | 8.840 | 3.660 | 1.250 | 0.604 | 0.323 | 0.106 | 0.044 | | |
| 70 | | | 77.100 | 35.300 | 10.100 | 4.200 | 1.430 | 0.691 | 0.371 | 0.117 | 0.051 | | |
| 75 | | | 87.400 | 40.100 | 11.500 | 4.790 | 1.620 | 0.787 | 0.421 | 0.138 | 0.057 | | |
| 80 | | | 98.200 | 45.200 | 12.900 | 5.360 | 1.830 | 0.888 | 0.475 | 0.155 | 0.065 | | |
| 85 | | | 110.000 | 50.300 | 14.500 | 6.020 | 2.040 | 0.992 | 0.531 | 0.174 | 0.072 | | |
| 90 | | | 122.000 | 55.900 | 16.100 | 6.530 | 2.270 | 1.100 | 0.592 | 0.193 | 0.080 | | |
| 95 | | | | 62.000 | 17.800 | 7.380 | 2.510 | 1.210 | 0.652 | 0.213 | 0.089 | | |
| 100 | | | | 68.200 | 19.600 | 8.130 | 2.760 | 1.340 | 0.719 | 0.234 | 0.098 | | |
| 110 | | | | 81.300 | 23.400 | 9.680 | 3.290 | 1.600 | 0.855 | 0.279 | 0.117 | | |
| 120 | | | | 95.400 | 27.400 | 11.400 | 3.870 | 1.880 | 1.000 | 0.329 | 0.137 | | |
| 130 | | | | 111.000 | 31.800 | 13.200 | 4.480 | 2.180 | 1.160 | 0.381 | 0.159 | | |
| 140 | | | | 127.000 | 36.500 | 15.100 | 5.120 | 2.500 | 1.330 | 0.437 | 0.182 | 0.047 | |
| 150 | | | | | 41.500 | 17.200 | 5.870 | 2.840 | 1.520 | 0.496 | 0.207 | 0.154 | |
| 160 | | | | | 46.700 | 19.400 | 6.580 | 3.200 | 1.710 | 0.559 | 0.234 | 0.059 | |
| 170 | | | | | 52.200 | 21.700 | 7.370 | 3.580 | 1.910 | 0.626 | 0.261 | 0.067 | |
| 180 | | | | | 58.300 | 24.100 | 8.180 | 3.970 | 2.120 | 0.696 | 0.290 | 0.074 | |
| 190 | | | | | 64.400 | 26.600 | 9.050 | 4.390 | 2.350 | 0.769 | 0.321 | 0.082 | |
| 200 | | | | | 70.500 | 29.300 | 9.960 | 4.840 | 2.580 | 0.846 | 0.353 | 0.090 | |
| 220 | | | | | 84.100 | 34.900 | 11.900 | 5.780 | 3.080 | 1.010 | 0.421 | 0.108 | |
| 240 | | | | | 98.700 | 41.000 | 13.900 | 6.770 | 3.620 | 1.180 | 0.484 | 0.126 | |
| 260 | | | | | 115.000 | 47.500 | 16.200 | 7.850 | 4.190 | 1.370 | 0.573 | 0.146 | |
| 280 | | | | | | 54.500 | 18.600 | 9.020 | 4.790 | 1.570 | 0.658 | 0.168 | |
| 300 | | | | | | 62.000 | 21.100 | 10.200 | 5.450 | 1.790 | 0.747 | 0.191 | |
| 320 | | | | | | 69.900 | 23.700 | 11.500 | 6.160 | 2.010 | 0.841 | 0.215 | |
| 340 | | | | | | 78.200 | 26.600 | 12.900 | 6.910 | 2.260 | 0.940 | 0.240 | |
| 360 | | | | | | 86.900 | 29.500 | 14.300 | 7.660 | 2.510 | 1.050 | 0.261 | |
| 380 | | | | | | 96.100 | 32.600 | 15.800 | 8.460 | 2.770 | 1.160 | 0.295 | |
| 400 | | | | | | 106.000 | 35.900 | 17.400 | 9.310 | 3.050 | 1.270 | 0.325 | |
| 450 | | | | | | | 44.600 | 21.600 | 11.600 | 3.790 | 1.158 | 0.404 | |
| 500 | | | | | | | 54.100 | 26.300 | 14.100 | 4.610 | 1.192 | 0.493 | |

HAZEN & WILLIAMS FORMULA USED FOR DATA CALCULATION
 $H = (3.023/C \cdot 1.852) \times (V \cdot 1.852/D \cdot 1.167)$ USING C = 150. FOR WATER AT 60F.
 WHERE H = HEAD LOSS, V = FLUID VELOCITY FT./SEC.,
 D = DIAMETER OF PIPE (FT.), C = COEFFICIENT REPRESENTING
 ROUGHNESS OF PIPE INTERIOR SURFACE.

TO USE CHART:

1. FIND PIPE DIAMETER AND GPM. READ THE FRICTION LOSS IN FEET OF WATER PER 100 FT. OF PIPE.
2. FRICTION LOSS = (ACTUAL PIPE LENGTH / 100) x FRICTION LOSS ON CHART IN FEET OF WATER.

EXAMPLE: WATER IS BEING PUMPED THROUGH A 1" DIAMETER PIPE AT 12 GPM. THERE IS A PRESSURE GAUGE AT THE DISCHARGE OF THE PUMP, READING 138 FT. OF WATER COLUMN (60 PSIG). TO CALCULATE WHAT THE PRESSURE WILL BE 65 FT. AWAY FROM THE PUMP:

$65/100 = .65 \times 12.000 = 7.80 \text{ FT. OF HEAD LOSS}$

THEREFORE, THE PRESSURE WILL NOW BE

$138 - 7.80 = 130.2 \text{ FT. (56.4 PSIG)}$

**VALVES AND FITTINGS - EQUIVALENT LENGTH OF PIPE IN FEET
(ADD TO FRICTION LOSS OF PIPE IN FEET)**

NOMINAL SIZE IN INCHES

| | 3/4 | 1 | 1-1/4 | 1-1/2 | 2 | 2-1/2 | 3 | 3-1/2 | 4 | 5 | 6 | 8 |
|--------------------------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|
| OPEN GATE VALVE | 0.44 | 0.56 | 0.74 | 0.86 | 1.10 | 1.32 | 1.60 | 2.00 | 2.10 | 2.70 | 3.20 | 4.30 |
| OPEN GLOBE VALVE | 23.10 | 29.40 | 38.60 | 45.20 | 58.00 | 69.00 | 86.00 | 100.00 | 113.00 | 142.00 | 170.00 | 224.00 |
| OPEN ANGLE VALVE | 11.50 | 14.70 | 19.30 | 22.60 | 29.00 | 35.00 | 43.00 | 50.00 | 57.00 | 71.00 | 85.00 | 112.00 |
| STANDARD ELBOW - 90 DEG. | 2.10 | 2.60 | 3.50 | 4.10 | 5.20 | 6.20 | 7.70 | 9.80 | 10.20 | 12.70 | 15.30 | 20.20 |
| ELBOW - 45 DEG. | 0.97 | 1.23 | 1.60 | 1.90 | 2.40 | 2.90 | 3.60 | 4.00 | 4.70 | 5.90 | 7.10 | 9.40 |
| TEE - "BRANCH" | 4.20 | 5.30 | 7.00 | 8.10 | 10.40 | 12.40 | 15.50 | 17.00 | 20.30 | 25.40 | 31.00 | 40.00 |
| TEE - "RUN" | 1.40 | 1.80 | 2.30 | 2.70 | 3.50 | 4.20 | 5.20 | 6.20 | 6.80 | 8.50 | 10.20 | 13.40 |