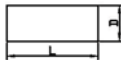






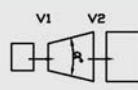


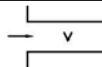
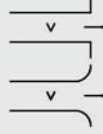
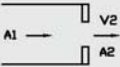
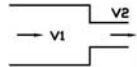


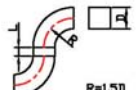
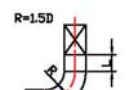
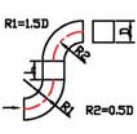


**Calculating System Friction Loss**

Friction causes pressure loss in all systems. Plumbing design and length affect this loss in air flow

$$P = \zeta \cdot \gamma \cdot \frac{V^2}{2g}$$

| Classification | Shape  | Counter  |      |      |
|----------------|--|--|------|------|
| Right Angle    |   | $0.02 \times \frac{L}{D}$                            |      |      |
| Right Angle    |   | R/D = 0.5  | 0.75 |      |
|                |  | = 0.75   | 0.38 |      |
|                |  | = 1.0  | 0.26 |      |
|                |  | = 1.5  | 0.17 |      |
|                |  | = 2.0  | 0.15 |      |
| Rectangular    |   | W/D  | R/D  |      |
|                |  | 0.5  | 0.5  | 1.30 |
|                |  |  | 0.75 | 0.47 |
|                |  |  | 1.0  | 0.28 |
|                |  |  | 1.5  | 0.18 |
|                |  | 1~3  | 0.5  | 0.95 |
|                |  |  | 0.75 | 0.33 |
|                | 1.0  | 0.20   |      |      |
|                |  | 1.5  | 0.13 |      |
| Rectangular    |   | W/D  | R/D  |      |
|                |  | 0.5  | 0.5  | 0.70 |
|                |  |  | 0.75 | 0.16 |
|                |  |  | 1.0  | 0.13 |
|                |  |  | 1.5  | 0.12 |
|                |  | 2  | 0.5  | 0.45 |
|                | 0.75   | 0.12   |      |      |
|                |  | 1.0  | 0.10 |      |
|                |  | 1.5  | 0.15 |      |
| Circle         |   | 0.87   |      |      |
| Rectangular    |   | 1.25   |      |      |
|                |   | 90<br>$\frac{1}{2}$                                  |      |      |
| Expanding      |   | a = 5  | 0.17 |      |
|                |  | = 10   | 0.28 |      |
|                |  | = 20   | 0.45 |      |
|                |  | = 30   | 0.59 |      |
|                |  | = 40   | 0.73 |      |
|                |  | $S \cong \gamma \frac{1}{2g} (V_1^2 - V_2^2)$ 에 대한 식 |      |      |
| Contraction    |   | a = 30   | 0.02 |      |
|                |  | = 45   | 0.04 |      |
|                |  | = 60   | 0.07 |      |
|                |  | $S \cong \gamma \frac{V^2}{2g}$                      |      |      |
| Strain         | $\alpha = \text{Less than } 14^\circ$<br> | 0.15   |      |      |

| Classification   | Shape   | Counter                           |      |
|------------------|---|-----------------------------------|------|
| Pipe Inlet       |    | 0.50                              |      |
| Pipe Outlet      |    | 1.0                               |      |
|                  |   | 0.03                              |      |
|                  |   | 0.03                              |      |
| Pipe Outlet      |    | $A_2/A_1 = 0$                     | 2.8  |
|                  |   | = 0.25                            | 2.4  |
|                  |   | = 0.50                            | 1.9  |
|                  |   | = 0.75                            | 1.5  |
|                  |   | = 1.0                             | 1.0  |
|                  |   | $S \cong \gamma \frac{V_2^2}{2g}$ |      |
| Sudden Reduction |  | $V_1/V_2 = 0$                     | 0.50 |
|                  |   | = 0.25                            | 0.45 |
|                  |   | = 0.50                            | 0.32 |
|                  |   | = 0.75                            | 0.18 |
|                  |   | $S \cong \gamma \frac{V_2^2}{2g}$ |      |
| Sudden Expansion |  | $V_2/V_1 = 0$                     | 1.0  |
|                  |   | = 0.20                            | 0.64 |
|                  |   | = 0.40                            | 0.36 |
|                  |   | = 0.60                            | 0.16 |
|                  |   | = 0.80                            | 0.04 |
|                  |   | $S \cong \gamma \frac{V_2^2}{2g}$ |      |
| Continual Band   |  | L = 0                             | 0.43 |
|                  |   | L = D                             | 0.31 |
|                  |   | Vein                              | 0.15 |
| Continual Band   |  | L = 0                             | 0.62 |
|                  |   | L = D                             | 0.68 |
|                  |   | Vein                              | 0.19 |
| Continual Band   |  | L = 0                             | 0.42 |
|                  |   | L = D                             | 0.46 |
|                  |   | Vein                              | 0.21 |
| Continual Band   |  | Normal Direction                  | 1.15 |
|                  |   | Reverse Direction                 | 1.03 |