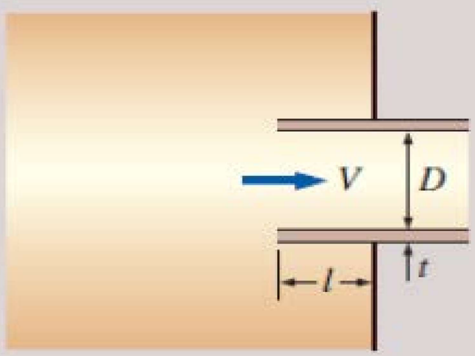
14-6 MINOR LOSSES-3

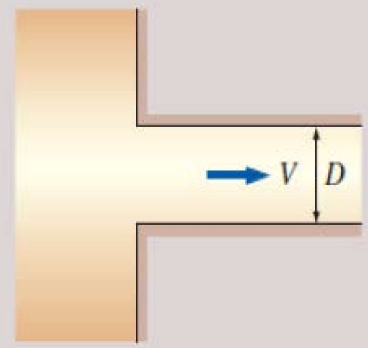
Loss coefficient K_L of various pipe components for turbulent flow (for use in the relation $h_L = K_L V^2/(2g)$, where V is the average velocity in the pipe that contains the component)*

Pipe Inlet

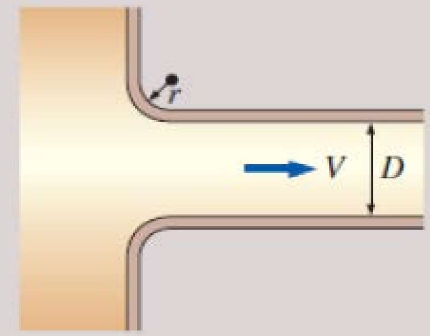
Reentrant: $K_L = 0.80$
$(t \ll D \text{ and } l \approx 0.1D)$



Sharp-edged: $K_L = 0.50$

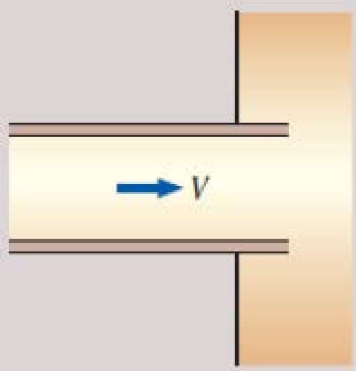


Well-rounded $(r/D > 0.2)$: $K_L = 0.03$
Slightly rounded $(r/D > 0.1)$: $K_L = 0.12$
(see Fig. 8-39)

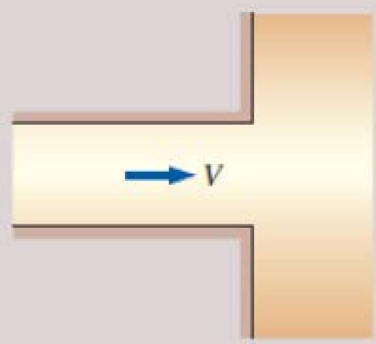


Pipe Exit

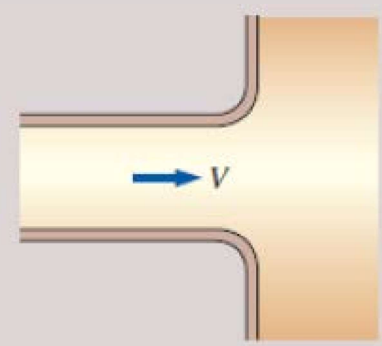
Reentrant: $K_L = \alpha$



Sharp-edged: $K_L = \alpha$



Rounded: $K_L = \alpha$

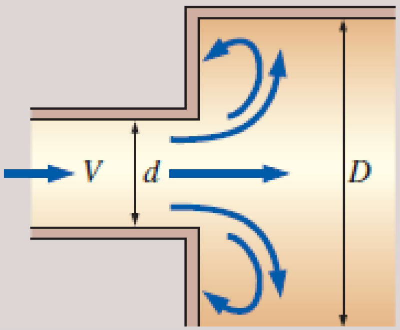


Note: the kinetic energy correction factor is $\alpha = 2$ for fully developed laminar flow, and $\alpha \approx 1.05$ for fully developed turbulent flow.

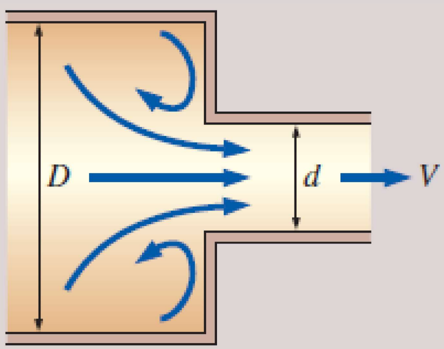
14-6 MINOR LOSSES-4

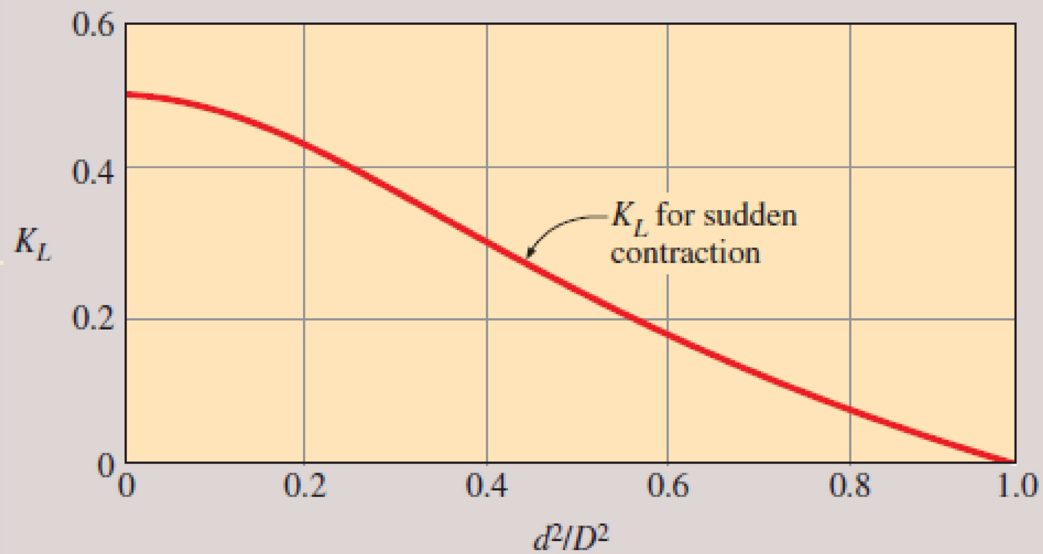
Sudden Expansion and Contraction (based on the velocity in the smaller-diameter pipe)

Sudden expansion: $K_L = \alpha\left(1 - \frac{d^2}{D^2}\right)^2$



Sudden contraction: See chart.

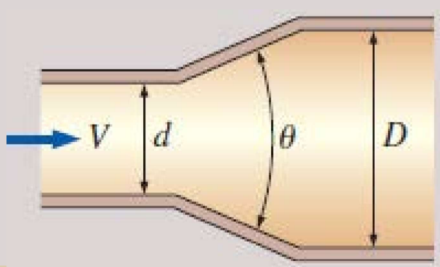




Gradual Expansion and Contraction (based on the velocity in the smaller-diameter pipe)

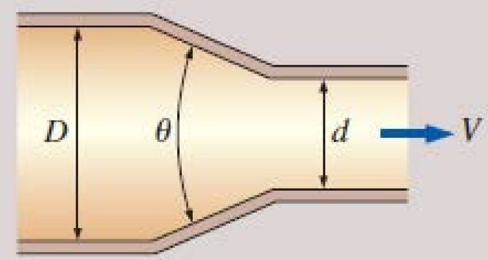
Expansion (for $\theta = 20°$):

$K_L = 0.30$ for $d/D = 0.2$
$K_L = 0.25$ for $d/D = 0.4$
$K_L = 0.15$ for $d/D = 0.6$
$K_L = 0.10$ for $d/D = 0.8$



Contraction

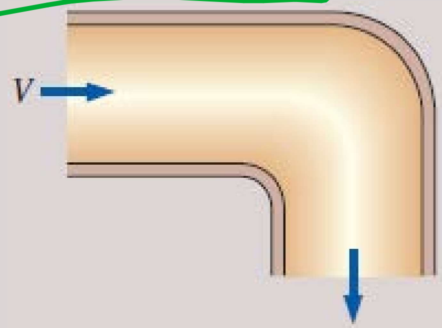
$K_L = 0.02$ for $\theta = 30°$
$K_L = 0.04$ for $\theta = 45°$
$K_L = 0.07$ for $\theta = 60°$



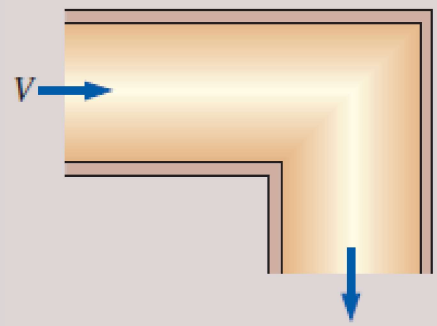
14-6 MINOR LOSSES-5

Bends and Branches

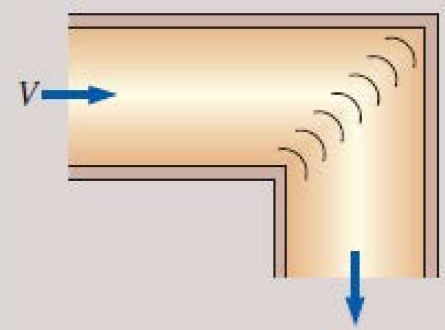
90° *smooth bend:*
Flanged: $K_L = 0.3$
Threaded: $K_L = 0.9$



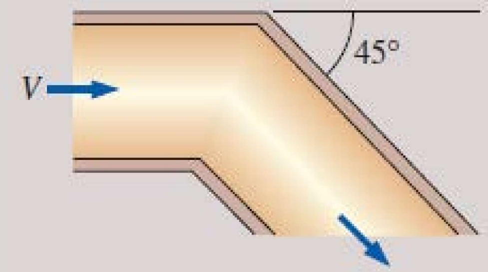
90° *miter bend*
(without vanes): $K_L = 1.1$



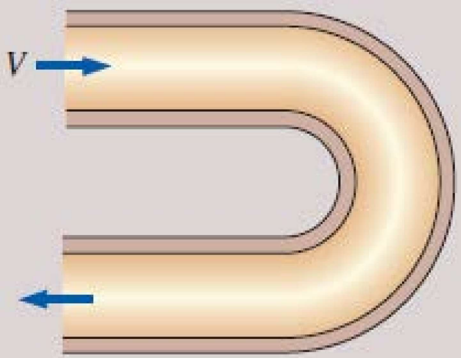
90° *miter bend*
(with vanes): $K_L = 0.2$



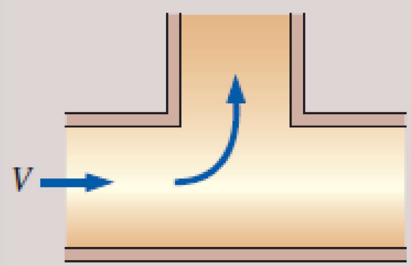
45° *threaded elbow:*
$K_L = 0.4$



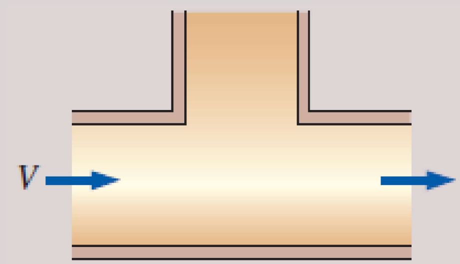
180° *return bend:*
Flanged: $K_L = 0.2$
Threaded: $K_L = 1.5$



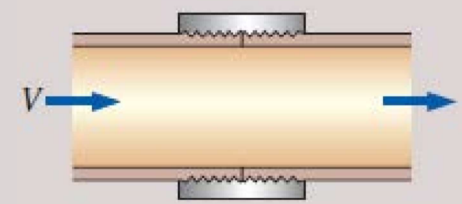
Tee (branch flow):
Flanged: $K_L = 1.0$
Threaded: $K_L = 2.0$



Tee (line flow):
Flanged: $K_L = 0.2$
Threaded: $K_L = 0.9$



Threaded union:
$K_L = 0.08$



Valves

Globe valve, fully open: $K_L = 10$
Angle valve, fully open: $K_L = 5$
Ball valve, fully open: $K_L = 0.05$
Swing check valve: $K_L = 2$

Gate valve, fully open: $K_L = 0.2$
$\frac{1}{4}$ closed: $K_L = 0.3$
$\frac{1}{2}$ closed: $K_L = 2.1$
$\frac{3}{4}$ closed: $K_L = 17$

*These are representative values for loss coefficients. Actual values strongly depend on the design and manufacture of the given values considerably (especially for valves). Actual manufacture's data should be used in the final design.