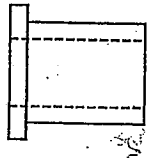
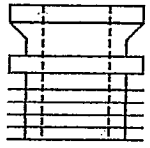
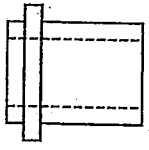
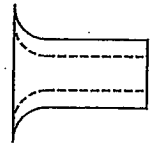
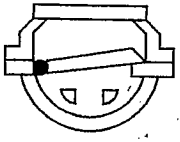
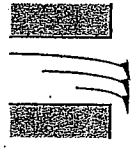
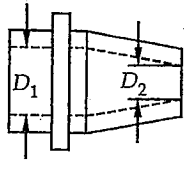
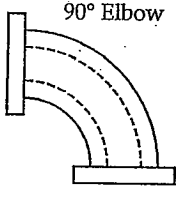
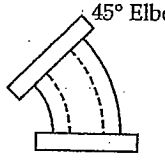
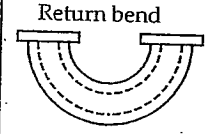
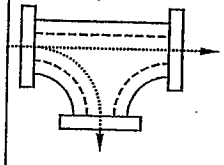
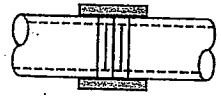
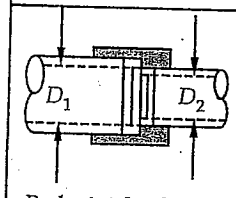
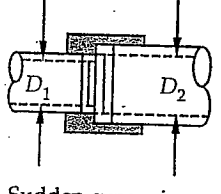
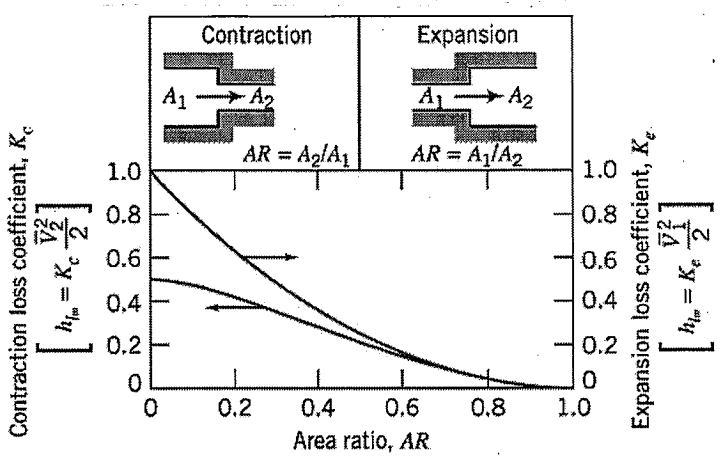
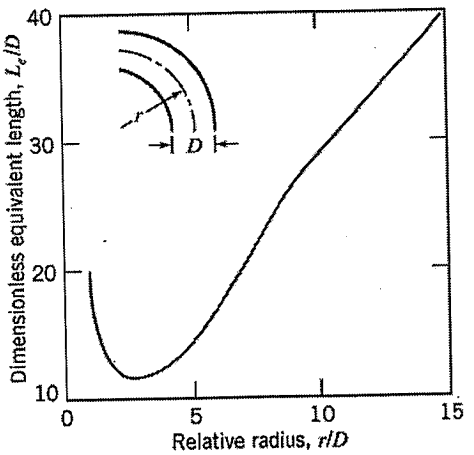
 Square edged inlet $K = 0.5$	 Basket strainer $K = 1.3$
 Re-entrant inlet or inward projecting pipe $K = 1.0$	 Well rounded inlet or a bell mouth inlet $K = 0.05$
 Foot valve $K = 0.8$	 Exit $K = 1.0$
 Convergent outlet or nozzle $K = 0.1(1 - D_2/D_1)$ D_2/D_1 from 0.5 to 0.9	

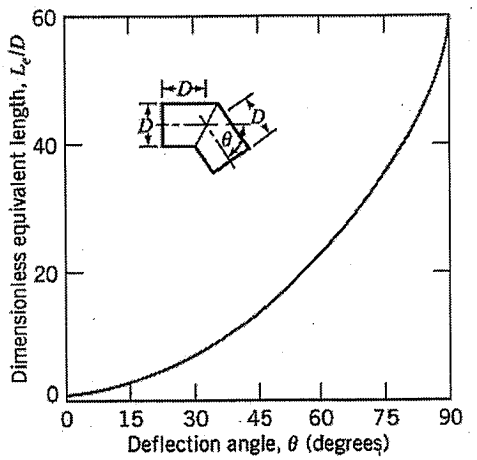
	threaded	flanged, welded, glued, bell & spigot
 90° Elbow	regular $K = 1.4$ $K = 1.4(ID)^{-0.53}$ ID from 0.3 to 4 in long radius $K = 0.75$ $K = 0.75(ID)^{-0.81}$ ID from 0.3 to 4 in	regular $K = 0.31$ $K = 0.44(ID)^{-0.23}$ ID from 1 to 25 in long radius $K = 0.22$ $K = 0.51(ID)^{-0.58}$ ID from 1 to 23 in
 45° Elbow	regular $K = 0.35$ $K = 0.35(ID)^{-0.14}$ ID from 0.3 to 4 in	long radius $K = 0.17$ $K = 0.22(ID)^{-0.14}$ ID from 1 to 23 in

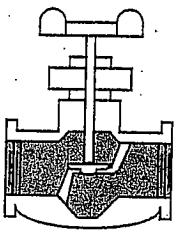
	threaded	flanged, welded, glued, bell & spigot
 Return bend	regular $K = 1.5$ $K = 1.5(ID)^{-0.57}$ ID from 0.3 to 4 in	regular $K = 0.3$ $K = 0.43(ID)^{-0.26}$ ID from 1 to 23 in long radius $K = 0.2$ $K = 0.43(ID)^{-0.53}$ ID from 1 to 23 in
 T joint	line flow $K = 0.9$ all sizes ID from 0.3 to 4 in branch flow $K = 1.9$ $K = 1.9(ID)^{-0.38}$ ID from 0.3 to 4 in	line flow $K = 0.14$ $K = 0.27(ID)^{-0.46}$ ID from 1 to 20 in branch flow $K = 0.69$ $K = 1.0(ID)^{-0.29}$ ID from 1 to 20 in
 Coupling	$K = 0.08$ $K = 0.083(ID)^{-0.69}$ ID from 0.4 to 4 in	$K = 0.08$ ID from 0.3 to 23 in
 Reducing bushing	$K = 0.5 - 0.167(D_2/D_1) - 0.125(D_2/D_1)^2 - 0.208(D_2/D_1)^3$ $0.25 < D_2/D_1 < 1$	
 Sudden expansion	$K = ((D_2/D_1)^2 - 1)^2$ $1 < D_2/D_1 < 5$	

Pipe Material	ε, ft	ε, cm
Steel		
Commercial	0.00015	0.004 6
Corrugated	0.003–0.03	0.09–0.9
Riveted	0.003–0.03	0.09–0.9
Galvanized	0.0002–0.0008	0.006–0.025
Mineral		
Brick sewer, Cement–asbestos, Clays, Concrete	0.001–0.01	0.03–0.3
Wood stave	0.0006–0.003	0.018–0.09
Cast iron	0.00085	0.025
Asphalt coated	0.0004	0.012
Bituminous lined	0.000008	0.000 25
Cement lined	0.000008	0.000 25
Centrifugally spun	0.00001	0.000 31
Drawn tubing	0.000005	0.000 15
Miscellaneous		
Brass, Copper, Glass, Lead, Plastic, Tin	0.000005	0.000 15
Galvanized	0.0002–0.0008	0.006–0.025
Wrought iron	0.00015	0.004 6
PVC	Smooth	Smooth

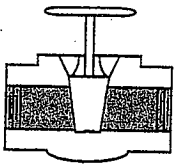




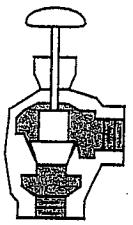


<table>
<tr><td></td><td>threaded</td><td>flanged, welded,
glued, bell & spigot</td></tr>
<tr><td>Globe valve
  </td><td>fully open $K = 10$

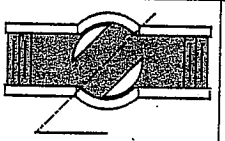
$K = \exp\{2.158 - 0.459 \ln(ID) + 0.259[\ln(ID)]^2 - 0.123[\ln(ID)]^3\}$
ID from 0.3 to 4 in</td><td>fully open $K = 10$

$K = \exp\{2.565 - 0.916 \ln(ID) + 0.339[\ln(ID)]^2 - 0.01416[\ln(ID)]^3\}$
ID from 0.3 to 4 in</td></tr>
<tr><td>Gate Valve
  </td><td>fully open $K = 0.15$

$K = 0.24(ID)^{-0.47}$
ID from 0.3 to 4 in</td><td>fully open $K = 0.15$

$K = 0.78(ID)^{-1.14}$
ID from 1 to 20 in</td></tr>
<tr><td colspan="3">All sizes
Fraction closed 0 | 1/4 | 3/8 | 1/2 | 5/8 | 3/4 | 7/8
K = 0.15 | 0.26 | 0.81 | 2.06 | 5.52 | 17.0 | 97.8</td></tr>
<tr><td> 
Angle Valve</td><td>fully open $K = 2.0$

$K = 4.5(ID)^{-1.08}$
ID from 0.6 to 4 in</td><td>fully open $K = 2.0$

$K = \exp\{1.569 - 1.43 \ln(ID) + 0.8[\ln(ID)]^2 - 0.137[\ln(ID)]^3\}$
ID from 1 to 20 in</td></tr>
<tr><td> 
Ball Valve</td><td colspan="2">All sizes
° = 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80
K = 0.05 | 0.29 | 1.56 | 5.47 | 17.3 | 25.6 | 206 | 485 | ∞</td></tr>
<tr><td>Check Valves
Swing Type
Ball Type
Lift Type</td><td>$K = 2.5$
$K = 70.0$
$K = 12.0$</td><td>$K = 2.5$
$K = 70.0$
$K = 12.0$</td></tr>
</table>