PIPE AND TUBING FORMULAS

I. Mechanical Properties

A = Area of cross section
W = Weight in pounds per foot
I = Moment of inertia
Z = Section modulus
R = Radius of gyration
C = Distance of extreme fibre from neutral axis

ROUND PIPE & TUBING — WHERE

D = outside diameter
d = inside diameter
T = wall thickness

SQUARE TUBING — WHERE

D = outside measurement
d = inside measurement
T = wall thickness

RECTANGULAR TUBING — WHERE

h = outside measurement - long side
da = outside measurement - short side
d = inside measurement - long side
e = inside measurement - short side
T = wall thickness

\[
\begin{align*}
A &= 3.1416 \,(D-T) \,T \\
W &= 10.69 \,(D-T) \,T \\
I &= 0.0491 \,(D^4 - d^4) \\
Z &= 0.0982 \left( \frac{D^4 - d^4}{D} \right) \\
R &= \sqrt{\frac{D^2 + d^2}{4}} \\
C &= \frac{D}{2}
\end{align*}
\]

\[
\begin{align*}
A &= 4 \,(D-T) \,T \\
W &= 13.5984 \,(D-T) \,T \\
I &= \frac{D^4 - d^4}{12} \\
Z &= \frac{D^4 - d^4}{6D} \\
R &= 0.2887 \sqrt{D^2 + d^2} \\
C &= \frac{D}{2}
\end{align*}
\]

\[
\begin{align*}
A &= ah - ed \\
W &= 6.7992 \,(a+h-2T) \,T \\
I &= \frac{ah^3 - ed^3}{12} \\
Z &= \frac{ah^3 - ed^3}{6h} \\
R &= 0.2887 \sqrt{\frac{ah^3 - ed^3}{ah - ed}} \\
C &= \frac{h}{2}
\end{align*}
\]

II. Internal Properties Round Pipe & Tubing

1. Circumference in inches = 3.1415927 \times d

2. Surface per lineal foot
   Square Inches = 37.699112 \times d
   Square Feet = 0.26179939 \times d

3. Lineal feet of tube per square foot of surface = \frac{3.8197186}{d}

4. Transverse area in square inches = .78539816 \times d^2

5. Volume of capacity per lineal foot
   Cubic Feet = .0054541539 \times d^2
   U.S. Gallons = .04079905 \times d^2

II. External Properties Round Pipe and Tubing

1. Circumference in inches = 3.1415927 \times D

2. Surface per lineal foot
   Square Inches = 37.699112 \times D
   Square Feet = 0.26179939 \times D

3. Lineal feet of tube per square foot of surface = \frac{3.8197186}{D}

4. Transverse area in square inches = .78539816 \times D^2

5. Volume of displacement per lineal foot
   Cubic Feet = .0054541539 \times D^2
   U.S. Gallons = .40799905 \times D^2