Formulas

Measurement unit abbreviations

°C	degree Celsius
°F	degree Fahrenheit
ΔT	temperature difference
BTU	British thermal unit
Btuh	British thermal units per hour
ft.	foot
ft²	square foot
ft³	cubic foot
gal.	imperial gallon
gpm	gallons per minute
in.	inch
in²	square inch
kg	kilogram
kPa	kilopascal
L	litre
lb.	pound
lbf	pound-force
m	metre
m²	square metre
m³	cubic metre
mm	millimetre
psi	pounds per square inch
s	second
U.S. gal.	American gallon

Constants

π	3.14
1 ft² of equivalence of direct radiation (steam EDR)	240 Btuh
1 U.S. gal.	8.33 lb.
12 000 BTU of cooling	1 ton
Pressure head conversion unit	0.433 psi/ ft.
Travel offset of a 45° elbow	1.414

Conversion factors

To convert	To	Multiply by
°C	°F	1.8 and add 32
kg	lb.	2.205
kPa	lbf/ ft²	20.88
kPa	lbf/ in² (psi)	0.1450
L	imp. gal.	0.2200
L/ s	gpm	13.20
m	ft.	3.281
m²	ft²	10.76
m³	ft³	35.31
mm	in.	0.03937

General formulas

Descriptions	Full	Abbreviated
Expansion	length × temperature difference × coefficient of expansion	$L \times \Delta T \times \alpha$
Force	pressure × area	$P \times A$
gpm	$\frac{\text{BTU}}{\text{pounds per gallon} \times \text{temp. diff.}}$	$\frac{\text{BTU}}{\text{lb./gal.} \times \Delta T}$
gpm	$\frac{\text{total Btuh}}{\text{temp. diff.} \times \text{mass} \times \text{specific heat capacity}}$	$\frac{\text{total Btuh}}{\Delta T \times M \times \text{spec. heat cap.}}$
Grade	$\frac{\text{drop or rise}}{\text{run}}$	
Pressure	height × density	H × dens.

Hydronic thermal formulas

Btuh	gallons per minute × 500 × temp. diff.	gpm × 500 × ΔT
gpm	$\frac{\text{Btuh}}{500 \times \text{temp. diff. of water}}$	$\frac{\text{Btuh}}{500 \times \Delta T\,(\text{water})}$
Temperature difference (ΔT)	$\frac{\text{Btuh}}{500 \times \text{gallons per minute}}$	$\frac{\text{Btuh}}{500 \times \text{gpm}}$

Area formulas

Circle	$\pi \times \text{radius}^2$	πr^2
Cylinder (open top)	$(\pi \times \text{radius}^2) + (\pi \times \text{diameter} \times \text{height})$	$\pi r^2 + \pi dH$
Cylinder (totally enclosed	$(2 \times \pi \times \text{radius}^2) + (\pi \times \text{diameter} \times \text{height})$	$2\pi r^2 + \pi dH$
Cylinder (totally opened)	$\pi \times \text{diametre} \times \text{height}$	πdH
Rectangle	$\text{length} \times \text{width}$	$L \times W$
Rectangle box (open top)	$(\text{length} \times \text{width}) + 2(\text{width} \times \text{height}) + 2(\text{length} \times \text{height})$	$(L \times W) + 2(W \times H) + 2(L \times H)$
Rectangle box (totally enclosed)	$2(\text{length} \times \text{width}) + 2(\text{width} \times \text{height}) + 2(\text{length} \times \text{height})$	$2(L \times W) + 2(W \times H) + 2(L \times H)$
Sphere	$4 \times \pi \times \text{radius}^2$	$4\pi r^2$
Triangle	$\frac{\text{base} \times \text{height}}{2}$	$\frac{B \times H}{2}$

Volume formulas

Cylinder	$\pi \times \text{radius}^2 \times \text{height}$	$\pi r^2 H$
Rectangle box	$\text{length} \times \text{width} \times \text{height}$	$L \times W \times H$
Sphere	$\frac{4 \times \pi \times \text{radius}^3}{3}$	$\frac{4\pi r^3}{3}$