Theory and Practice in Engineering Thermodynamics

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Peter Polak

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General Information

SI symbols: km, m, cm, mm, kg, g, N, J, W, etc.

1 Joule = 1 Nm; 1 Watt = 1 J/s; 1 g calorie = 4.187 J; 1 kg calorie = 4.187 kJ.

Density of air at 1 bar, 16 °C = 1.2 kg/m³ (varies with CO₂ and water vapour content). 1 bar = 10⁵ N/m²

Radiation emitted from a surface at absolute temperature T deg. Kelvin = $5.7 \cdot 10^{-8} ET^4$ W/m² where E is the relevant emissivity (may depend on wavelength).

<i>Symbol</i>	<i>Meaning (unless stated otherwise)</i>	<i>Usual units</i>
A	cross-sectional area	m ²
c	specific heat (heat to raise unit mass by unit temperature)	J/kg K
c_v	du/dT ; du/dt (see below)	J/kg K
c_p	dh/dT ; dh/dt (see below); $c_p = c_v + R$	J/kg K
D, d	diameter	m
g	gravity (acceleration, force/unit mass, also gram)	m/s ² ($\equiv$ N/kg)
H	enthalpy	J, kJ, MJ
h	specific enthalpy, H/m; (heat transfer coefficient, chapter 13, W/m ² °C)	J/kg, etc.
m	mass	kg
$\log_e$	logarithm to base e	
p	pressure	N/m ²
Q	heat released or transferred (in chapter 12 we use $\dot{Q}$ for heat flow rate, watts or kW)	J, kJ, MJ
R	gas constant for a particular gas (not molar)	J/kg K
r	compression ratio	
S	entropy	J/K, etc.
s	specific entropy S/m	J/kg K, etc.
s	seconds	
T	absolute temperature	K
	temperature interval	K
t	Celsius temperature = $T - 273$, (t = time, chapter 12)	°C

U	internal energy = $H - pV$	J, kJ, MJ
u	specific internal energy = $h - p/\rho$	J/kg, etc.
v	velocity	m/s
V	volume	m^3
V_s	swept volume of engine cylinder	as stated
V_c	clearance or combustion space volume	locally
W	work (W = Watts)	J, kJ or MJ
z	height above arbitrary base level	m
γ	c_p/c_v	
η	thermal efficiency	ratio or percentage
η_c, η_t	efficiency relative to some ideal	ratio or percentage
η_{mech}		
ρ	density	kg/m ³
θ	temperature or temperature difference, chapter 13	°C
ν	kinematic viscosity	m ² /s
τ	thickness	