●●●POWER
ENGINEERING

THE INDUSTRY STANDARD

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TRAINING SYSTEMS

Handbook of Formulae and Physical Constants

For the use of Students and Examination Candidates, this document has been:

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Handbook of Formulae & Physical Constants

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SI MULTIPLES

Names in the Metric System

VALUE	EXPONENT	SYMBOL	PREFIX
1 000 000 000 000	10^{12}	T	tera
1 000 000 000	10^{9}	G	giga
1 000 000	10^{6}	M	mega
1 000	10^{3}	k	kilo
100	10^{2}	h	hecto
10	10^{1}	da	deca
0.1	10^{-1}	d	deci
0.01	10^{-2}	c	centi
0.001	10^{-3}	m	milli
0.000 001	10^{-6}	μ	micro
0.000 000 001	10^{-9}	n	nano
0.000 000 000 001	10^{-12}	p	pico

Conversion Chart for Metric Units

To Convert

	To Milli-	To Centi-	To Deci-	To Metre, Gram, Litre	To Deca-	To Hecto-	To Kilo-
Kilo-	x 10^{6}	x 10^{5}	x 10^{4}	x 10^{3}	x 10^{2}	x 10^{1}	
Hecto-	x 10^{5}	x 10^{4}	x 10^{3}	x 10^{2}	x 10^{1}		x 10^{-1}
Deca-	x 10^{4}	x 10^{3}	x 10^{2}	x 10^{1}		x 10^{-1}	x 10^{-2}
Metre, Gram, Litre	x 10^{3}	x 10^{2}	x 10^{1}		x 10^{-1}	x 10^{-2}	x 10^{-3}
Deci-	x 10^{2}	x 10^{1}		x 10^{-1}	x 10^{-2}	x 10^{-3}	x 10^{-4}
Centi-	x 10^{1}		x 10^{-1}	x 10^{-2}	x 10^{-3}	x 10^{-4}	x 10^{-5}
Milli-		x 10^{-1}	x 10^{-2}	x 10^{-3}	x 10^{-4}	x 10^{-5}	x 10^{-6}

BASIC UNITS

SI	IMPERIAL

Distance

1 metre (1 m) = 100 centimetres (100 cm)
= 1000 millimetres (1000 mm)

1 kilometre (1 km) = 1000 m

12 in. = 1 ft
3 ft = 1 yd
5280 ft = 1 mile
1760 yd = 1 mile

Conversions:

1 in. = 25.4 mm
1 ft = 30.48 cm
1 mile = 1.61 km
1 yd = 0.914 m
1 m = 3.28 ft

Area

1 sq metre (1 m^2) = 10 000 cm^2
= 1 000 000 mm^2

10 000 m^2 = 1 hectare (1 ha)

1 sq km (1 km^2) = 1 000 000 m^2

1 ft^2 = 144 $in.^2$
1 yd^2 = 9 ft^2
1 sq mile = 640 acre = 1 section

Conversions:

1 $in.^2$ = 6.45 cm^2 = 645 mm^2
1 m^2 = 10.8 ft^2
1 acre = 0.405 ha
1 sq mile = 2.59 km^2

SI	IMPERIAL

Volume

$1\ m^3$	=	$1\ 000\ 000\ cm^3$
	=	$1 \times 10^9\ mm^3$
$1\ dm^3$	=	1 litre
1 litre	=	$1000\ cm^3$
1 mL	=	$1\ cm^3$
$1\ m^3$	=	1000 litres

$1\ ft^3$	=	$1728\ in.^3$
$1\ yd^3$	=	$27\ ft^3$
1(liquid) U.S. gallon	=	$231\ in.^3$
	=	4 (liquid) quarts
1 U.S. barrel (bbl)	=	42 U.S. gal.
1 imperial gallon	=	1.2 U.S. gal.

Conversions:

$1\ in.^3$	=	$16.4\ cm^3$
$1\ m^3$	=	$35.3\ ft^3$
1 litre	=	$61\ in.^3$
1 U.S.gal	=	3.78 litres
1 U.S. bbl	=	159 litres
1 litre/s	=	15.9 U.S. gal/min

Mass and Weight

1 kilogram (1 kg)	=	1000 grams
1000 kg	=	1 tonne

2000 lb	=	1 ton (short)
1 long ton	=	2240 lb

Conversions:

1 kg (on Earth) results in a weight of 2.2 lb

Density

$$\text{mass density} = \frac{\text{mass}}{\text{volume}}$$

$$\rho = \frac{m}{V} \quad \left(\frac{kg}{m^3}\right)$$

$$\text{weight density} = \frac{\text{weight}}{\text{volume}}$$

$$\rho = \frac{w}{V} \quad \left(\frac{lb}{ft^3}\right)$$

Conversions:

(on Earth) a mass of $1\frac{kg}{m^3}$ results in a weight density of $0.0623\frac{lb}{ft^3}$

SI	IMPERIAL

Relative Density

In SI R.D. is a comparison of mass density to a standard. For solids and liquids the standard is fresh water.

In Imperial the corresponding quantity is **specific gravity**; for solids and liquids a comparison of weight density to that of water.

Conversions:

In both systems the same numbers hold for R.D. as for S.G., since these are equivalent ratios.

RELATIVE DENSITY (SPECIFIC GRAVITY) OF VARIOUS SUBSTANCES

Water (fresh) 1.00	Mica 2.9
Water (sea average) ... 1.03	Nickel 8.6
Aluminum 2.56	Oil (linseed)..... 0.94
Antimony 6.70	Oil (olive)..... 0.92
Bismuth..... 9.80	Oil (petroleum) 0.76-0.86
Brass 8.40	Oil (turpentine)..... 0.87
Brick 2.1	Paraffin 0.86
Calcium 1.58	Platinum..... 21.5
Carbon (diamond)..... 3.4	Sand (dry)..... 1.42
Carbon (graphite) 2.3	Silicon..... 2.6
Carbon (charcoal) 1.8	Silver 10.57
Chromium 6.5	Slate 2.1-2.8
Clay 1.9	Sodium 0.97
Coal 1.36-1.4	Steel (mild)..... 7.87
Cobalt..... 8.6	Sulphur..... 2.07
Copper 8.77	Tin 7.3
Cork..... 0.24	Tungsten 19.1
Glass (crown) 2.5	Wood (ash) 0.75
Glass (flint)..... 3.5	Wood (beech) 0.7-0.8
Gold 19.3	Wood (ebony)..... 1.1-1.2
Iron (cast)..... 7.21	Wood (elm)..... 0.66
Iron (wrought) 7.78	Wood (lignum-vitae)... 1.3
Lead 11.4	Wood (oak) 0.7-1.0
Magnesium 1.74	Wood (pine)..... 0.56
Manganese 8.0	Wood (teak)..... 0.8
Mercury 13.6	Zinc..... 7.0

Greek Alphabet

Alpha	α	Iota	ι	Rho	ρ
Beta	β	Kappa	κ	Sigma	Σ, σ
Gamma	γ	Lambda	λ	Tau	τ
Delta	Δ	Mu	μ	Upsilon	υ
Epsilon	ε	Nu	ν	Phi	Φ, ϕ
Zeta	ζ	Xi	ξ	Kai	χ
Eta	η	Omicron	O	Psi	ψ
Theta	θ	Pi	π	Omega	Ω, ω

MATHEMATICAL FORMULAE

Logarithms

$P=V^x$ or $x = \log P/\log V$

Algebra

1. Quadratic Equation

If $ax^2 + bx + c = 0$,

Then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

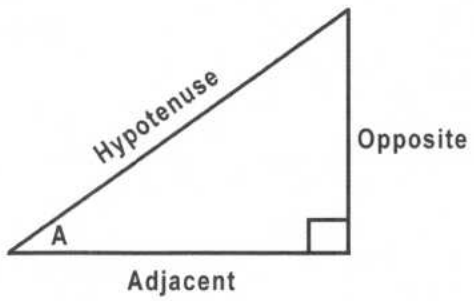
Trigonometry

1. Basic Ratios

$$\sin A = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos A = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan A = \frac{\text{opposite}}{\text{adjacent}}$$



2. Pythagoras' Theorem (applies to right angle triangles)

$(\text{hypotenuse})^2 = (\text{opposite})^2 + (\text{adjacent})^2$

3. Trigonometric Function Values

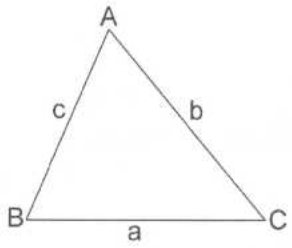
Sin is positive from 0° to 90° and positive from 90° to 180°

Cos is positive from 0° to 90° and negative from 90° to 180°

Tan is positive from 0° to 90° and negative from 90° to 180°

4. Solution of Triangles

a. Sine Law



$$\frac{a}{\text{Sin A}} = \frac{b}{\text{Sin B}} = \frac{c}{\text{Sin C}}$$

b. Cosine Law

$$c^2 = a^2 + b^2 - 2\,ab\,\text{Cos C}$$

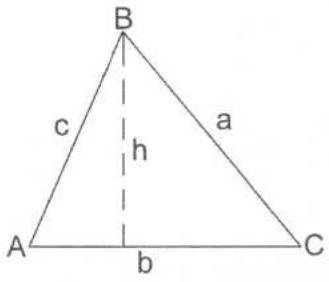
$$a^2 = b^2 + c^2 - 2\,bc\,\text{Cos A}$$

$$b^2 = a^2 + c^2 - 2\,ac\,\text{Cos B}$$

Geometry

1. Areas of Triangles

a. All Triangles



$$\text{Area} = \frac{\text{base} \times \text{perpendicular height}}{2}$$

$$\text{Area} = \frac{bc\,\text{Sin A}}{2} = \frac{ab\,\text{Sin C}}{2} = \frac{ac\,\text{Sin B}}{2}$$

and,

$$\text{Area} = \sqrt{s\,(s-a)\,(s-b)\,(s-c)}$$

where, s is half the sum of the sides, or $s = \frac{a + b + c}{2}$

b. Equilateral Triangles

$$\text{Area} = 0.433 \times \text{side}^2$$

2. Circumference of a Circle

$$C = \pi d$$

3. Area of a Circle

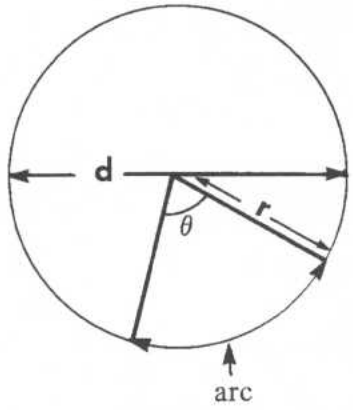
$$A = \pi r^2 = \frac{\text{circumference} \times r}{2} = \frac{\pi}{4} d^2 = 0.7854 d^2$$

4. Area of a Sector of a Circle

$$A = \frac{\text{arc} \times r}{2}$$

$$A = \frac{\theta^\circ}{360} \times \pi r^2 \qquad (\theta = \text{angle in degrees})$$

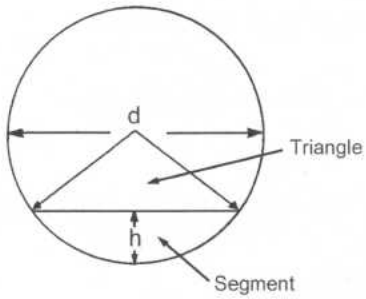
$$A = \frac{\theta r^2}{2} \qquad (\theta = \text{angle in radians})$$



5. Area of a Segment of a Circle

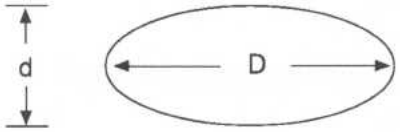
A = area of sector – area of triangle

Also approximate area = $\frac{4}{3} h^2 \sqrt{\frac{d}{h} - 0.608}$



6. Ellipse

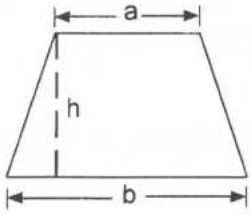
$$A = \frac{\pi}{4} D\, d$$



Approx. circumference = $\pi \frac{(D + d)}{2}$

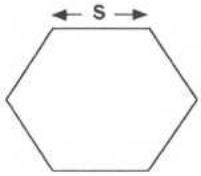
7. Area of Trapezoid

$$A = \left(\frac{a + b}{2}\right) h$$

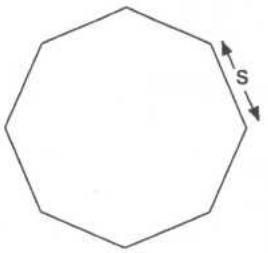


8. Area of Hexagon

$A = 2.6\, s^2$ where s is the length of one side



9. Area of Octagon

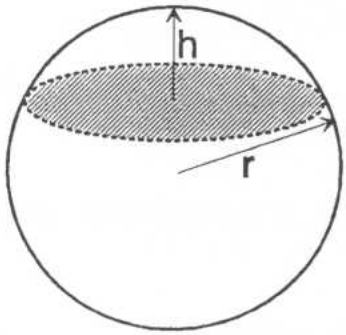


$A = 4.83\ s^2$ where s is the length of one side

10. Sphere

Total surface area, $A = 4\pi r^2$

Surface area of segment, $A_s = \pi dh$



Volume, $V = \frac{4}{3}\pi r^3$

Volume of segment

$V_s = \frac{\pi h^2}{3}(3r - h)$

$V_s = \frac{\pi h}{6}(h^2 + 3a^2)$ where a = radius of segment base

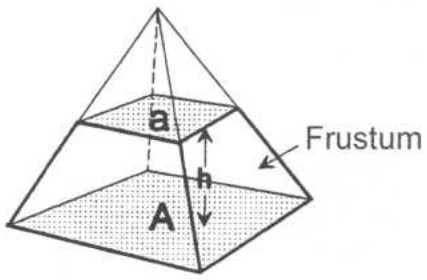
11. Volume of a Cylinder

$V = \frac{\pi}{4} d^2 L$ where L is cylinder length

12. Pyramid

Volume

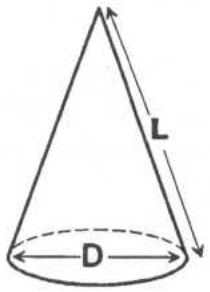
$V = \frac{1}{3}$ base area x perpendicular height



Volume of frustum

$V_F = \frac{h}{3}(A + a + \sqrt{Aa})$ where h is the perpendicular height, A and a are areas as shown

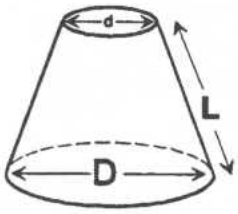
13. Cone



Area of curved surface of cone:

$$A = \frac{\pi DL}{2}$$

Area of curved surface of frustum



$$A_F = \frac{\pi (D + d)L}{2}$$

Volume of cone:

$$V = \frac{\text{base area} \times \text{perpendicular height}}{3}$$

Volume of frustum:

$$V_F = \frac{\text{perpendicular height} \times \pi (R^2 + r^2 + Rr)}{3}$$

Velocity - vector property equal to $\frac{\text{displacement}}{\text{time}}$

In SI the basic unit is $\frac{m}{s}$; in Imperial it is $\frac{ft}{s}$

Other common units are $\frac{km}{h}$, $\frac{mi}{h}$

Conversions: $1\frac{m}{s} = 3.28\frac{ft}{s}$

$1\frac{km}{h} = 0.621\frac{mi}{h}$

Speed of sound in dry air = 331 $\frac{m}{s}$ at 0°C; it increases by 0.61 $\frac{m}{s}$ for each 1°C rise

Speed of light in a vacuum = $3 \times 10^8 \frac{m}{s}$

Acceleration - vector property equal to $\frac{\text{change in velocity}}{\text{time}}$

In SI the basic unit is $\frac{m}{s^2}$, in Imperial it is $\frac{ft}{s^2}$

Conversion: $1\frac{m}{s^2} = 3.28\frac{ft}{s^2}$

Acceleration due to gravity, symbol "g", is 9.81 $\frac{m}{s^2}$ or 32.2 $\frac{ft}{s^2}$

Linear Velocity and Acceleration

Where: u = initial velocity
v = final velocity
t = elapsed time
s = displacement
a = acceleration

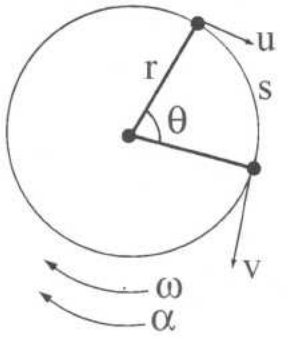
$$v = u + at$$

$$s = \left(\frac{v+u}{2}\right)t$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

Angular Velocity and Acceleration



θ = angular displacement (radians)
ω = angular velocity (radians/s); ω_1 = initial, ω_2 = final
α = angular acceleration (radians/s^2)

$$\omega_2 = \omega_1 + \alpha t$$

$$\theta = \frac{\omega_1 + \omega_2}{2} \times t$$

$$\theta = \omega_1 t + \frac{1}{2}\alpha t^2$$

$$\omega_2^2 = \omega_1^2 + 2\alpha\theta$$

linear displacement, $s = r\theta$
linear velocity, $v = r\omega$

$$\text{radians/sec} = \frac{2\pi}{60} \times \text{rpm}$$

Tangential, Centripetal and Total Acceleration

Tangential acceleration, a_T, is due to angular acceleration, α

$$a_T = r\alpha$$

Centripetal (centrifugal) acceleration, a_c, is due to change in direction only

$$a_c = v^2/r = r\omega^2$$

Total acceleration, a, of a rotating point with angular acceleration is the vector sum of a_T and a_c

$$a = a_T + a_c$$

Force

In SI the unit of force is the newton, N, defined as a $\frac{kgm}{s^2}$

In Imperial the unit of force is the pound lb

Conversion: 9.81 N = 2.2 lb

Weight

In the SI system, weight can be calculated from

Weight = F = mg , where g = 9.81 m/s^2

In Imperial, the mass of an object (rarely used), in slugs, can be calculated from the known weight in pounds

$$m = \frac{\text{Weight}}{g} \qquad g = 32.2\frac{ft}{s^2}$$

Belt Drives

$$F_1 = F_2\, e^{\mu\theta} \quad \text{or} \quad \ln\left(\frac{F_1}{F_2}\right) = \mu\theta$$

Where: μ = coefficient of friction
θ = angle of wrap
e = 2.718
F_1 = force in tight side
F_2 = force in slack side

Newton's Second Law of Motion

An unbalanced force, F, will cause an object of mass, m, to accelerate, a, according to:

$F = ma$ (In Imperial, $F = \frac{w}{g}a$, where w is weight)

Torque Equation

Torque = force x radius

$T = I\alpha$ where T is the acceleration torque in Nm, I is the moment of inertia, in kg m^2, and α is the angular acceleration, in radians/s^2

Momentum

Vector quantity, symbol p

$p = mv$ (In Imperial, $p = \frac{w}{g}v$, where w is weight)

in SI, the unit is $\frac{kgm}{s}$

Work

$W = Fs$

In SI, the unit of work is the joule, J, or kilojoule, kJ

and $1\ J = 1\ Nm$

In Imperial, the unit of work is the ft-lb

Kinetic Energy

Energy due to motion

$$E_k = \frac{1}{2}mv^2$$

In Imperial, this is usually expressed as $E_k = \frac{w}{2g}v^2$ where w is weight

Kinetic Energy of Rotation

$$E_R = \frac{1}{2} m k^2 \omega^2$$ where k is radius of gyration; ω is angular velocity in rad/s

or

$$E_R = \frac{1}{2} I \omega^2$$ where $I = mk^2$ is the moment of inertia

Angular Momentum = $I\omega = m k^2 \omega$

Radius of Gyration, K

For a solid disc or cylinder: $K = \frac{r}{\sqrt{2}}$ For a thin rimmed disc: $K = r$

For a sphere: $K^2 = \left(\frac{2}{5}\right) r^2$

Centripetal (Centrifugal) Force

$$F_C = \frac{mv^2}{r}$$ where r is the radius

or

$F_C = m \omega^2 r$ where ω is angular velocity, in rad/s

Potential Energy

Energy due to position in a force field, such as gravity

$E_p = m g h$

In Imperial, this is usually expressed $E_p = w h$, where w is weight, and h is height above some specified datum

Thermal Energy

In SI, the common units of thermal energy are J, and kJ, (and kJ/kg for specific quantities)

In Imperial, the units of thermal energy are British Thermal Units (Btu)

Conversions: 1 Btu = 1055 J
1 Btu = 778 ft – lb

Electrical Energy

In SI, the units of electrical energy are J, kJ and kilowatt hours, kWh. In Imperial, the unit of electrical energy is the kWh

Conversions: 1 kWh = 3600 kJ
1 kWh = 3412 Btu = 2.66×10^6 ft-lb

Power

In SI, the unit is the Watt, W, or kilowatt, kW

$$1\,\mathrm{W} = 1\frac{\mathrm{J}}{\mathrm{s}}$$

In Imperial, the units are:

Mechanical Power: - $\frac{\mathrm{ft-lb}}{\mathrm{s}}$, horsepower h.p.

Thermal Power: - $\frac{\mathrm{Btu}}{\mathrm{s}}$

Electrical Power: - W, kW, or h.p.

Conversions: 746 W = 1 h.p.

$$1\ \text{h.p.} = 550\ \frac{\mathrm{ft-lb}}{\mathrm{s}}$$

$$1\ \mathrm{kW} = 0.948\ \frac{\mathrm{Btu}}{\mathrm{s}}$$

Pressure

A vector quantity, force per unit area

In SI, the basic units of pressure are pascals, Pa, and kilopascals, kPa

$$1\ \mathrm{Pa} = 1\frac{\mathrm{N}}{\mathrm{m}^2}$$

In Imperial, the basic unit is the pound per square inch, psi

Atmospheric Pressure

At sea level, atmospheric pressure equals 101.3 kPa or 14.7 psi

Pressure Conversions

1 psi = 6.895 kPa

Pressure may be expressed in standard units, or in units of static fluid head, in both SI and Imperial systems

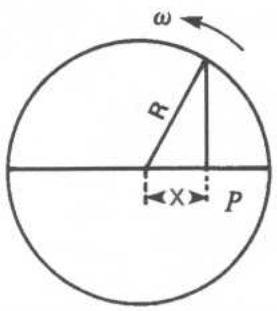
Common equivalencies are:

1 kPa = 0.294 in. mercury = 7.5 mm mercury
1 kPa = 4.02 in. water = 102 mm water
1 psi = 2.03 in. mercury = 51.7 mm mercury
1 psi = 27.7 in. water = 703 mm water
1 m H_2O = 9.81 kPa

Other pressure unit conversions:

1 bar = 14.5 psi = 100 kPa
1 kg/cm^2 = 98.1 kPa = 14.2 psi = 0.981 bar
1 atmosphere (atm) = 101.3 kPa = 14.7 psi

Simple Harmonic Motion



Velocity of P = $\omega \sqrt{R^2 - x^2}$ m/s

Acceleration of P = $\omega^2 x$ m/s^2

The period or time for a complete oscillation = $\frac{2\pi}{\omega}$ seconds

General formula for the period of S.H.M.

$$T = 2\pi \sqrt{\frac{\text{displacement}}{\text{acceleration}}}$$

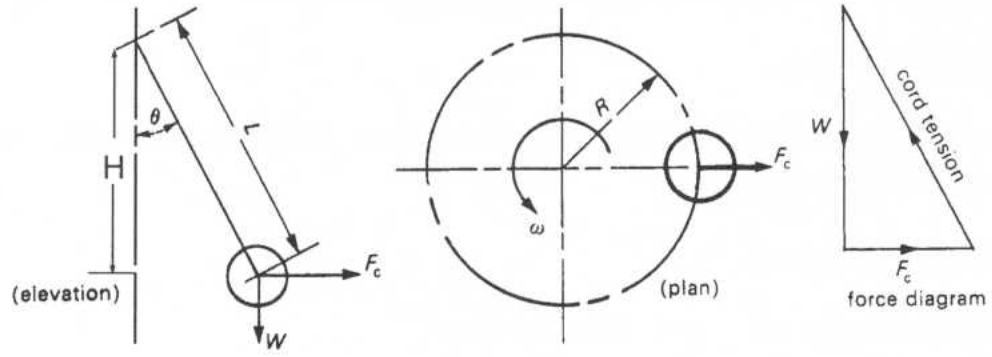
Simple Pendulum

$$T = 2\pi \sqrt{\frac{L}{g}}$$

T = period or time in seconds for a double swing

L = length in metres

The Conical Pendulum



$$\tan\theta = \frac{R}{H} = \frac{F_c}{W} = \frac{\omega R^2}{g} \qquad H = \frac{g}{\omega^2}$$

Lifting Machines

W = load lifted, F = force applied

$$\text{M.A.} = \frac{\text{load}}{\text{effort}} = \frac{W}{F}$$

$$\text{V.R. (velocity ratio)} = \frac{\text{effort distance}}{\text{load distance}}$$

$$\eta = \text{efficiency} = \frac{\text{M.A.}}{\text{V.R.}}$$

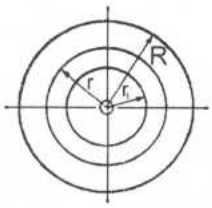
1. Lifting Blocks

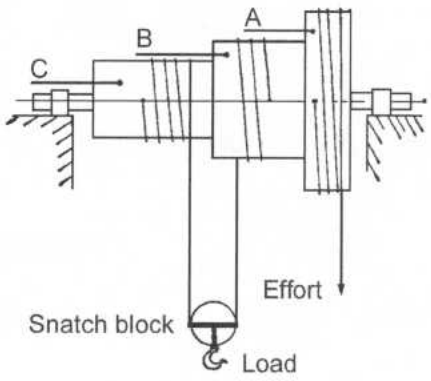
V.R. = number of rope strands supporting the load block

2. Wheel & Differential Axle

$$\text{Velocity ratio} = \frac{2\pi R}{\frac{2\pi(r - r_1)}{2}}$$

$$= \frac{2R}{r - r_1}$$





Or, using diameters instead of radii,

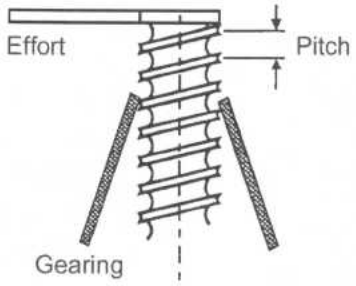
$$\text{Velocity ratio} = \frac{2D}{(d - d_1)}$$

3. Inclined Plane

$$\text{V.R.} = \frac{\text{length}}{\text{height}}$$

4. Screw Jack

$$\text{V.R.} = \frac{\text{circumference of lever}}{\text{pitch of thread}}$$



Indicated Power

$I.P. = P_m A L N$ where I.P. is the power (in W), P_m is the mean or "average" effective pressure (in Pa), A is the piston area (in m^2), L is the length of stroke (in m), and N is the number of power strokes per second

Brake Power

$B.P. = T\omega$ where B.P. is brake power (in W), T is torque (in Nm) and ω is angular velocity (in radian/second)

Stress, Strain and Modulus of Elasticity

$$\text{Direct stress} = \frac{\text{load}}{\text{area}} = \frac{P}{A}$$

$$\text{Direct strain} = \frac{\text{extension}}{\text{original length}} = \frac{\Delta\ell}{L}$$

Modulus of elasticity, E:

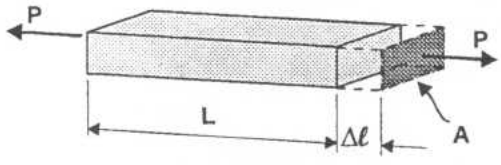
$$E = \frac{\text{direct stress}}{\text{direct strain}} = \frac{P/A}{\Delta\ell/L} = \frac{PL}{A\Delta\ell}$$

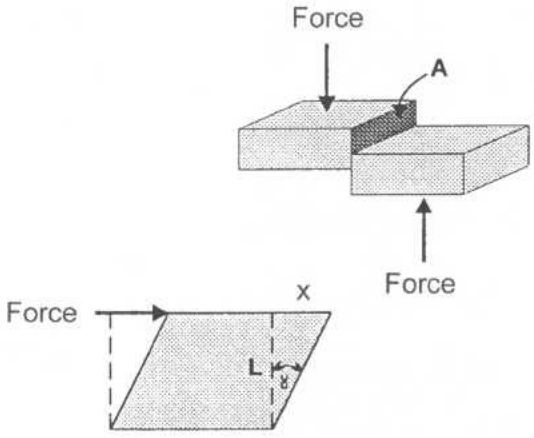
$$\text{Shear stress, } \tau = \frac{\text{force}}{\text{area under shear}}$$

$$\text{Shear strain} = \frac{x}{L}$$

Modulus of rigidity, G:

$$G = \frac{\text{shear stress}}{\text{shear strain}}$$





General Torsion Equation (Shafts of circular cross-section)

$$\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{L}$$

1. For Solid Shaft :

$$J = \frac{\pi}{2} r^4 = \frac{\pi d^4}{32}$$

2. For Hollow Shaft :

$$J = \frac{\pi}{2}(r_1^4 - r_2^4)$$

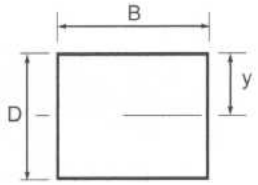
$$= \frac{\pi}{32}(d_1^4 - d_2^4)$$

T = torque or twisting moment, in newton metres
J = polar second moment of area of cross-section about shaft axis.
τ = shear stress at outer fibres, in pascals
r = radius of shaft, in metres
G = modulus of rigidity, in pascals
θ = angle of twist, in radians
L = length of shaft, in metres
d = diameter of shaft, in metres

Fundamental Bending Equation

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

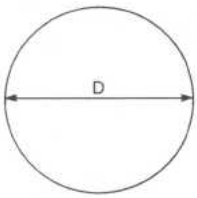
1. For Rectangle:



$$I = \frac{BD^3}{12}$$

M = external bending moment, in newton metres
I = second moment of area, in m^4
σ = bending stress at outer fibres, in pascals
y = distance from centroid to outer fibres, in metres
E = modulus of elasticity, in pascals
R = radius of curvature, in metres

2. For Solid Shaft:



$$I = \frac{\pi d^4}{64}$$

THERMODYNAMICS

The Fundamental Energy Equation

Heat Supplied = Increase in Internal Energy + Work Done

$$Q = \Delta U + WD$$

Temperature Scales

$$°C = \frac{5}{9}(°F - 32) \qquad °F = \frac{9}{5}\,°C + 32$$

°Rankine, R = °F + 460 Kelvin, K = °C + 273

Sensible Heat Equation

$$Q = m\,c\,\Delta T$$

m is mass
c is specific heat
ΔT is temperature change

Latent Heat

Latent heat of fusion of ice	=	335 kJ/kg
Latent heat of steam from and at 100°C	=	2257 kJ/kg
1 tonne of refrigeration	=	335 000 kJ/day
	=	233 kJ/min

Gas Laws

1. **Boyle's Law:**

When gas temperature is constant, PV = constant or

$$P_1V_1 = P_2V_2$$

where P is absolute pressure and V is volume

2. Charles' Law:

When gas pressure is constant, $\frac{V}{T} = \text{constant}$, or

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

where V is volume and T is absolute temperature

3. Gay-Lussac's Law:

When gas volume is constant, $\frac{P}{T} = \text{constant}$, or

$$\frac{P_1}{T_1} = \frac{P_2}{T_2}$$

where P is absolute pressure and T is absolute temperature

4. General Gas Law:

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} = \text{constant}$$

$P V = m R T$ where P = absolute pressure (kPa)
V = volume (m^3)
T = absolute temp (K)
m = mass (kg)
R = characteristic constant (kJ/kgK) = Cp - Cv

Also

$PV = nR_oT$ where P = absolute pressure (kPa)
V = volume (m^3)
T = absolute temperature, K
n = the number of kmoles of gas
R_o = the universal gas constant, 8.314 kJ/kmol/K

Specific Heats of Gases

GAS	Specific Heat at Constant Pressure kJ/kgK or kJ/kg °C	Specific Heat at Constant Volume kJ/kgK or kJ/kg °C	Ratio of Specific Heats $\gamma = c_p / c_v$
Air	1.005	0.718	1.40
Ammonia	2.060	1.561	1.32
Carbon Dioxide	0.825	0.630	1.31
Carbon Monoxide	1.051	0.751	1.40
Helium	5.234	3.153	1.66
Hydrogen	14.235	10.096	1.41
Hydrogen Sulphide	1.105	0.85	1.30
Methane	2.177	1.675	1.30
Nitrogen	1.043	0.745	1.40
Oxygen	0.913	0.652	1.40
Sulphur Dioxide	0.632	0.451	1.40

Efficiency of Heat Engines

Carnot Cycle: $\eta = \frac{T_1 - T_2}{T_1}$,

where T_1 and T_2 are the absolute temperatures of the heat source and heat sink

Air Standard Efficiencies

1. Spark Ignition Gas and Oil Engines (Constant Volume Cycle or Otto Cycle)

$$\eta = 1 - \frac{1}{r_v^{(\gamma-1)}}, \text{ where } r_v = \text{compression ratio} = \frac{\text{cylinder volume}}{\text{clearance volume}}$$

$$\gamma = \frac{\text{specific heat (constant pressure)}}{\text{specific heat (constant volume)}}$$

2. Diesel Cycle

$$\eta = 1 - \frac{(R^\gamma - 1)}{r_v^{\gamma-1}\,\gamma(R-1)}$$

where r = ratio of compression

R = ratio of cut-off volume to clearance volume

3. High Speed Diesel (Dual-Combustion) Cycle

$$\eta = 1 - \frac{k\beta^{\gamma} - 1}{r_v^{\gamma-1}\left[(k-1) + \gamma k(\beta - 1)\right]}$$

where $r_v = \dfrac{\text{cylinder volume}}{\text{clearance volume}}$

$$k = \frac{\text{absolute pressure at end of constant V heating (combustion)}}{\text{absolute pressure at beginning of constant V combustion}}$$

$$\beta = \frac{\text{volume at end of constant P heating (combustion)}}{\text{clearance volume}}$$

4. Gas Turbines (Constant Pressure or Brayton Cycle)

$$\eta = 1 - \frac{1}{r_p^{\left(\frac{\gamma-1}{\gamma}\right)}}$$

where r_p = pressure ratio = $\dfrac{\text{compressor discharge pressure}}{\text{compressor intake pressure}}$

THERMODYNAMIC EQUATIONS FOR PERFECT GASES (Non – Flow Processes)

Name of Process	Value of n	$P-V-T$ Relationships			Heat Added ${}_1Q_2$ kJ	Work Done ${}_1W_2$ kJ	Change In Internal Energy U_2-U_1 kJ	Change In Enthalpy H_2-H_1 kJ	Change In Entropy S_2-S_1 kJ/K
		$P-V$	$T-P$	$T-V$					
Constant Volume V = Const.	∞	———	$\frac{T_1}{T_2}=\frac{P_1}{P_2}$	———	$m\,c_v\,(T_2-T_1)$	0	$m\,c_v\,(T_2-T_1)$	$m\,c_p\,(T_2-T_1)$	$m\,c_v\,ln\,\frac{T_2}{T_1}$
Constant Pressure P = Const.	0	———	———	$\frac{T_1}{T_2}=\frac{V_1}{V_2}$	$m\,c_p\,(T_2-T_1)$	$P\,(V_2-V_1)$	$m\,c_v\,(T_2-T_1)$	$m\,c_p\,(T_2-T_1)$	$m\,c_p\,ln\,\frac{T_2}{T_1}$
Isothermal T = Const.	1	$\frac{P_1}{P_2}=\frac{V_2}{V_1}$	———	———	$mRT\,ln\,\frac{P_1}{P_2}$	$PV\,ln\,\frac{V_2}{V_1}$	0	0	$mR\,ln\,\frac{P_1}{P_2}$
Isentropic* S = Const.	γ	$\frac{P_1}{P_2}=\left(\frac{V_2}{V_1}\right)^{\gamma}$	$\frac{T_1}{T_2}=\left(\frac{P_1}{P_2}\right)^{\frac{\gamma-1}{\gamma}}$	$\frac{T_1}{T_2}=\left(\frac{V_2}{V_1}\right)^{\gamma-1}$	0	$\frac{P_1V_1-P_2V_2}{\gamma-1}$	$m\,c_v\,(T_2-T_1)$	$m\,c_p\,(T_2-T_1)$	0
Polytropic PV^n = Const.	n	$\frac{P_1}{P_2}=\left(\frac{V_2}{V_1}\right)^{n}$	$\frac{T_1}{T_2}=\left(\frac{P_1}{P_2}\right)^{\frac{n-1}{n}}$	$\frac{T_1}{T_2}=\left(\frac{V_2}{V_1}\right)^{n-1}$	$m\,c_n\,(T_2-T_1)$	$\frac{P_1V_1-P_2V_2}{n-1}$	$m\,c_v\,(T_2-T_1)$	$m\,c_p\,(T_2-T_1)$	$m\,c_n\,ln\,\frac{T_2}{T_1}$

* Can be used for reversible adiabatic processes

c_v = Specific heat at constant volume, kJ/kgK $\quad c_v=\frac{R}{\gamma-1}$

c_p = Specific heat at constant pressure, kJ/kgK

c_n = Specific heat for a polytropic process = $c_v\left(\frac{\gamma-n}{1-n}\right)$ kJ/kgK

H = Enthalpy, kJ

γ = Isentropic exponent, $c_p\ c_v$

n = Polytropic exponent

P = Absolute Pressure, kPa

R = Gas Constant, kJ/kgK

S = Entropy, kJ/K

T = Absolute temperature, K = 273 + °C

U = Internal energy, kJ

V = Volume, m^3

m = Mass of gas, kg

ln = Natural log

Heat Transfer by Conduction

$$Q = \frac{\lambda A t \Delta T}{d}$$

where Q = heat transferred, in joules

λ = thermal conductivity or coefficient of heat transfer, in $\frac{J \times m}{m^2 \times s \times °C}$ or $\frac{W}{m \times °C}$

A = area, in m^2

t = time, in seconds

ΔT = temperature difference between surfaces, in °C

d = thickness of layer, in m

Heat transfer by conduction through a cylindrical wall:

$$Q = \frac{2\pi\lambda t \Delta T L}{\ln\left(\frac{D}{d}\right)}$$

where D = outside diameter

d = inside diameter

L = length in meters

λ = thermal conductivity

t = time (seconds)

ΔT = temperature difference (degrees C)

Heat Transfer by Radiation

Heat transferred = $k\left(T_1^4 - T_2^4\right)$ kJ/h/m^2

Coefficients of Thermal Conductivity

Material	Coefficient of Thermal Conductivity W/m °C
Air	0.025
Aluminum	206
Brass	104
Brick	0.6
Concrete	0.85
Copper	380
Cork	0.043
Felt	0.038
Glass	1.0
Glass, fibre	0.04
Iron, cast	70
Plastic, cellular	0.04
Steel	60
Wood	0.15
Wallboard, paper	0.076

Thermal Expansion of Solids

Increase in length = $L \alpha (T_2 - T_1)$

where L = original length

α = coefficient of linear expansion

$(T_2 - T_1)$ = rise in temperature

Increase in volume = $V \beta (T_2 - T_1)$

Where V = original volume

β = coefficient of volumetric expansion

$(T_2 - T_1)$ = rise in temperature

coefficient of volumetric expansion = coefficient of linear expansion x 3

$\beta = 3\alpha$

Specific Heat and Linear Expansion of Solids

Solid	Mean Specific Heat between 0°C and 100°C kJ/kgK or kJ/kg °C	Coefficient of Linear Expansion between 0°C and 100°C Multiply by 10^{-6}	Solid	Mean Specific Heat between 0°C and 100°C kJ/kgK or kJ/kg °C	Coefficient of Linear Expansion between 0°C and 100°C Multiply by 10^{-6}
Aluminum	0.909	23.8	Iron (cast)	0.544	10.4
Antimony	0.209	17.5	Iron (wrought)	0.465	12.0
Bismuth	0.125	12.4	Lead	0.131	29.0
Brass	0.383	18.4	Nickel	0.452	13.0
Carbon	0.795	7.9	Platinum	0.134	8.6
Cobalt	0.402	12.3	Silicon	0.741	7.8
Copper	0.388	16.5	Silver	0.235	19.5
Glass	0.896	9.0	Steel (mild)	0.494	12.0
Gold	0.130	14.2	Tin	0.230	26.7
Ice (between -20°C & 0°C)	2.135	50.4	Zinc	0.389	16.5

Specific Heat and Volume Expansion for Liquids

Liquid	Specific Heat (at 20°C) kJ/kgK or kJ/kg °C	Coefficient of Volume Expansion Multiply by 10^{-4}	Liquid	Specific Heat (at 20°C) kJ/kgK or kJ/kg °C	Coefficient of Volume Expansion Multiply by 10^{-4}
Alcohol	1.88	11.0	Olive Oil	1.633	
Ammonia	2.19		Petroleum	2.135	
Benzine	1.09	12.4	Gasoline	2.093	12.0
Carbon Dioxide	0.84	1.82	Turpentine	1.800	9.4
Mercury	0.139	1.80	Water	4.183	3.7

Chemical Heating Value of a Fuel

$$\text{Chemical Heating Value MJ per kg of fuel} = 33.7\,C + 144\left(H_2 - \frac{O_2}{8}\right) + 9.3\,S$$

C is the mass of carbon per kg of fuel
H_2 is the mass of hydrogen per kg of fuel
O_2 is the mass of oxygen per kg of fuel
S is the mass of sulphur per kg of fuel

Theoretical (Stoichiometric) Air Required to Burn Fuel

$$\text{Air (kg per kg of fuel)} = \left[\frac{8}{3}C + 8\left(H_2 - \frac{O_2}{8}\right) + S\right]\frac{100}{23}$$

Air Supplied from Analysis of Flue Gases

$$\text{Air in kg per kg of fuel} = \frac{N_2}{33(CO_2 + CO)} \times C$$

C is the percentage of carbon in fuel by mass
N_2 is the percentage of nitrogen in flue gas by volume
CO_2 is the percentage of carbon dioxide in flue gas by volume
CO is the percentage of carbon monoxide in flue gas by volume

Boiler Formulae

$$\text{Equivalent evaporation} = \frac{\dot{m}_s\,(h_1 - h_2)}{2257\ \text{kJ/kg}}$$

$$\text{Factor of evaporation} = \frac{(h_1 - h_2)}{2257\ \text{kJ/kg}}$$

$$\text{Boiler efficiency} = \frac{\dot{m}_s\,(h_1 - h_2)}{\dot{m}_f \times \text{calorific value of fuel}}$$

where $\dot{m}_s$ = mass flow rate of steam
h_1 = enthalpy of steam produced in boiler
h_2 = enthalpy of feedwater to boiler
$\dot{m}_f$ = mass flow rate of fuel

Discharge from an Orifice

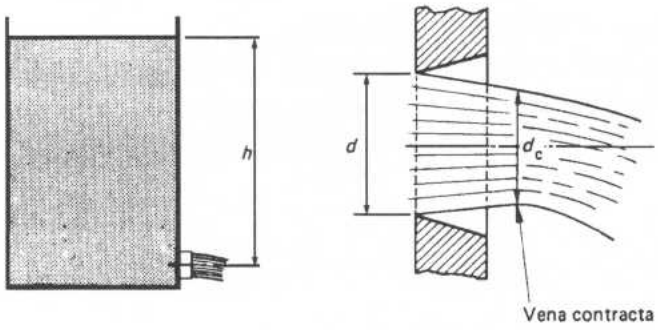
Let A = cross-sectional area of the orifice = $(\pi/4)d^2$

and A_c = cross-sectional area of the jet at the vena contracta = $(\pi/4)d_c^2$

then $A_c = C_c A$

or $C_c = \frac{A_c}{A} = \left(\frac{d_c}{d}\right)^2$

where C_c is the coefficient of contraction



At the vena contracta, the volumetric flow rate Q of the fluid is given by

$$Q = \text{area of the jet at the vena contracta} \times \text{actual velocity}$$
$$= A_c V$$
$$\text{or } Q = C_c A C_v \sqrt{2gh}$$

The coefficients of contraction and velocity are combined to give the coefficient of discharge, C_d

$$\text{i.e. } C_d = C_c C_v$$
$$\text{and } Q = C_d A \sqrt{2gh}$$

Typically, values for C_d vary between 0.6 and 0.65

Circular Orifice: $Q = 0.62A\sqrt{2gh}$

where: Q = flow (m^3/s); A = area (m^2); h = head (m)

Rectangular Notch: $Q = 0.62\ (B \times H)\ \frac{2}{3}\sqrt{2gH}$

where: B = breadth (m); H = head (m above sill)

Triangular Notch: $Q = 2.635\ \tan\frac{\theta}{2} H^{\frac{5}{2}}$

where: H = head (m above sill); θ=notch angle

Bernoulli's Theory

$$H = h + \frac{P}{w} + \frac{v^2}{2g}$$

H = total head (metres)
h = height above datum level (metres)
P = pressure (N/m^2 or Pa)
w = force of gravity on 1 m^3 of fluid (N)
v = velocity of water (metres per second)

Loss of Head in Pipes Due to Friction

$$\text{Loss of head in metres} = f\frac{L}{d}\frac{v^2}{2g}$$

L = length in metres
D = diameter in metres
v = velocity of flow in metres per second
f = constant value of 0.01 in large pipes to 0.02 in small pipes

Pump Calculations

If efficiency of pump 1 = efficiency of pump 2, then:

$$Q_2 = Q_1 \times \frac{n_2}{n_1} \times \frac{D_2}{D_1}$$

$$h_2 = h_1 \times \left(\frac{n_2}{n_1}\right)^2 \times \left(\frac{D_2}{D_1}\right)^2$$

$$kW_2 = kW_1 \times \left(\frac{n_2}{n_1}\right)^3 \times \left(\frac{D_2}{D_1}\right)^3$$

where kW = pump power required
h = head developed by pump, m
D = impeller diameter, mm
n = pump speed in rpm
Q = quantity pumped in L/min

Center of Pressure on a Submerged Surface

$$y_{c.p.} = \frac{I_G}{\frac{A\,H_{c.g.}}{\sin\theta}} + \frac{H_{c.g.}}{\sin\theta}$$

Table of Pipe Dimensions (in metric units)

Nom. Pipe Size (NPS in.)	Equiv. Metric DN#	O.D. in mm	Schedule												
			10	20	30	Std. Wall	40	60	Extra Strong (XS)	80	100	120	140	160	Double Extra Strong (XXS)
1/2	15	21.34	...	...	...	2.77	2.77	...	3.73	3.73	...	...	...	4.78	7.47
			...	...	...	1.26	1.26	...	1.61	1.61	...	...	...	1.92	2.53
3/4	20	26.67	...	...	...	2.87	2.87	...	3.91	3.91	...	...	...	5.56	7.82
			...	...	...	1.67	1.67	...	2.17	2.17	...	...	...	4.20	5.41
1	25	33.40	...	...	...	3.38	3.38	...	4.55	4.55	...	...	...	6.35	9.09
			...	...	...	2.48	2.48	...	3.21	3.21	...	...	...	4.20	5.41
1-1/4	32	42.16	...	...	...	3.56	3.56	...	4.85	4.85	...	...	...	6.35	9.70
			...	...	...	3.36	3.36	...	4.43	4.43	...	...	...	5.57	7.70
1-1/2	40	48.26	...	...	...	3.68	3.68	...	5.08	5.08	...	...	...	7.14	10.15
			...	...	...	4.02	4.02	...	5.37	5.37	...	...	...	7.18	9.47
2	50	60.33	...	...	...	3.91	3.91	...	5.54	5.54	...	...	...	8.74	11.07
			...	...	...	5.39	5.39	...	7.42	7.42	...	...	...	11.00	13.35
2-1/2	65	73.03	...	...	...	5.16	5.16	...	7.01	7.01	...	...	...	9.53	14.02
			...	...	...	8.56	8.56	...	11.32	11.32	...	...	...	14.79	20.25
3	80	88.90	...	...	...	5.49	5.49	...	7.62	7.62	...	...	...	11.13	15.24
			...	...	...	11.20	11.20	...	15.15	15.15	...	...	...	21.16	27.47
3-1/2	90	101.60	...	...	...	5.74	5.74	...	8.08	8.08	...	...	...	...	...
			...	...	...	13.46	13.46	...	18.49	18.49	...	...	...	...	...
4	100	114.30	...	...	...	6.02	6.02	...	8.56	8.56	...	11.13	...	13.49	17.12
			...	...	...	15.95	15.95	...	22.14	22.14	...	28.10	...	33.27	40.70
5	125	141.30	...	...	...	6.55	6.55	...	9.53	9.53	...	12.70	...	15.88	19.05
			...	...	...	21.61	21.61	...	30.71	30.71	...	39.97	...	48.71	56.98
6	150	168.28	...	...	...	7.11	7.11	...	10.97	10.97	...	14.27	...	18.26	21.95
			...	...	...	28.04	28.04	...	42.23	42.23	...	53.78	...	66.95	78.57
8	200	219.08	...	6.35	7.04	8.18	8.18	10.31	12.70	12.70	15.09	18.26	20.62	23.01	22.23
			...	33.05	36.51	42.20	42.20	52.66	64.13	64.13	75.18	89.61	100.15	110.39	111.47
10	250	273.05	...	6.35	7.80	9.27	9.27	12.70	12.70	15.09	18.26	21.44	25.40	28.58	25.40
			...	41.44	50.61	59.83	59.83	80.91	80.91	95.08	113.17	131.84	153.90	170.93	153.90
12	300	323.85	...	6.35	8.38	9.53	10.31	14.27	12.70	17.48	21.44	25.40	28.58	33.32	25.40
			...	49.34	64.69	73.25	79.16	108.13	96.69	130.82	158.44	185.47	206.45	236.88	185.47
14	350	355.60	6.35	7.92	9.53	9.53	11.13	15.09	12.70	19.05	23.83	27.79	31.75	35.71	...
			54.26	67.52	80.65	80.65	93.66	125.50	106.55	156.86	193.22	222.69	251.59	279.52	...
16	400	406.40	6.35	7.92	9.53	9.53	12.70	16.66	12.70	21.44	26.19	30.96	36.53	40.49	...
			62.15	77.39	92.49	92.49	122.33	158.89	122.33	201.69	243.62	284.20	330.33	362.27	...
18	450	457.20	6.35	7.92	11.13	9.53	14.27	19.05	12.70	23.83	29.36	34.93	39.67	45.24	...
			70.04	87.25	121.28	104.33	154.82	204.22	138.12	252.37	307.36	360.84	405.31	455.98	...
20	500	508.00	6.35	9.53	12.70	9.53	15.09	20.62	12.70	26.19	32.54	38.10	44.45	50.01	...
			77.93	116.17	153.90	116.17	181.66	245.94	153.90	308.71	378.52	438.03	504.15	560.18	...
24	600	619.60	6.35	9.53	14.27	9.53	17.48	24.61	12.70	30.96	38.89	46.02	52.37	59.54	...
			93.72	139.85	208.10	139.65	252.99	341.33	185.74	438.02	543.02	634.64	714.07	800.99	...
30	750	762.00	7.92	12.70	15.88	9.53	...	...	12.70	...	...	...	...	...	...
			117.40	232.83	289.81	175.36	...	...	232.83	...	...	...	...	...	...

Note: The upper figure in each square denotes **nominal wall thickness** (in mm) and the lower figure denotes **mass per metre** (in kilograms).

ELECTRICITY

Ohm's Law

$$I = \frac{E}{R}$$

or $E = IR$

where I = current (amperes)
E = electromotive force (volts)
R = resistance (ohms)

Conductor Resistivity

$$R = \rho\frac{L}{a}$$

where ρ = specific resistance (or resistivity) (ohm metres, Ω·m)
L = length (metres)
a = area of cross-section (square metres)

Temperature correction

$$R_t = R_o (1 + \alpha t)$$

where R_o = resistance at 0°C (Ω)
R_t = resistance at t°C (Ω)
α = temperature coefficient which has an average value for copper of 0.004 28 (Ω/Ω°C)

$$R_2 = R_1\frac{(1+\alpha t_2)}{(1+\alpha t_1)}$$ where: R_1 = resistance at t_1 (Ω)

R_2 =resistance at t_2 (Ω)

α Values	Ω/Ω°C
copper	0.00428
platinum	0.00385
nickel	0.00672
tungsten	0.0045
aluminum	0.0040

Dynamo Formulae

$$\text{Average e.m.f.} = \frac{\phi ZNP}{b60}$$

where N = rotational speed of armature in r/min

ϕ = flux per pole in webers

P = total number of field poles

Z = total number of armature conductors

b = number of armature paths,

for wave winding b = 2

for lap winding b = P

Generator Terminal volts = $E_G - I_aR_a$

Motor Terminal volts = $E_B + I_aR_a$

where E_G = generated e.m.f.
E_B = generated back e.m.f.
I_a = armature current
R_a = armature resistance

Alternating Current

R.M.S. value of sine curve = 0.707 maximum value

Mean value of sine curve = 0.637 maximum value

$$\text{Form factor of sinusoidal} = \frac{\text{R.M.S. value}}{\text{Mean value}} = \frac{0.707}{0.637} = 1.11$$

$$\text{Frequency of alternator} = \frac{pN}{60} \text{ cycles per second}$$

Where p = number of pairs of poles
N = rotational speed in r/min

Instantaneous value = Maximum value × Sin ($2\pi ft$)

Note: calculator must be in radian mode

Slip of Induction Motor

$$\text{slip}\% = \frac{\text{speed of field - speed of rotor}}{\text{Speed of field}} \times 100\%$$

Inductive Reactance

Reactance of AC circuit (X) = $2\pi fL$ ohms

where L = inductance of circuit (henries)

Inductance of an iron cored solenoid = $\frac{1.256T^2\mu A}{L \times 10^8}$ henries

where T = turns on coil
μ = magnetic permeablility of core
A = area of core (square centimetres)
L = length (centimetres)

Capacitance Reactance

Capacitance reactance of AC circuit = $\frac{1}{2\pi fC}$ ohms

where C = capacitance (farads)

Total reactance = $\left(2\pi fL - \frac{1}{2\pi fC}\right)$ ohms

Impedence (Z) = $\sqrt{(\text{resistance})^2 + (\text{reactance})^2}$

= $\sqrt{R^2 + (2\pi fL - \frac{1}{2\pi fC})^2}$ ohms

Current in AC Circuit

$$\text{Current} = \frac{\text{impressed volts}}{\text{impedance}}$$

Force on conductors:

The force produced = BIL

Where B = the flux density in teslas (webers / m^2)
I = current
L = the total *effective* length of conductors

Power Factor

$$\text{p.f.} = \frac{\text{true watts}}{\text{volts x amperes}}$$

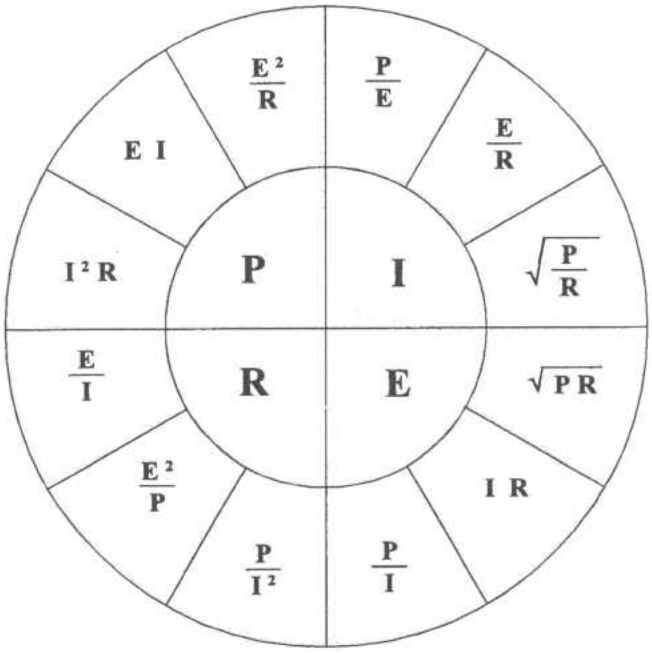
also p.f. = cos Φ, where Φ is the angle of lag or lead

Three Phase Alternators

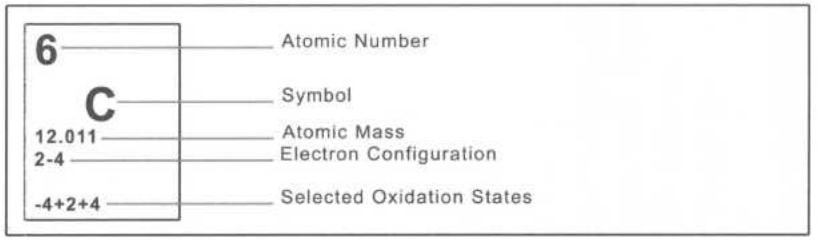
Star connected
Line voltage = $\sqrt{3}$ x phase voltage
Line current = phase current

Delta connected
Line voltage = phase voltage
Line current = $\sqrt{3}$ x phase current

Three phase power
$P = \sqrt{3}\, E_L I_L \cos \Phi$
E_L = line voltage
I_L = line current
cos Φ = power factor



PERIODIC TABLE OF THE ELEMENTS



PERIOD	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIIIB	VIIIB	VIIIB	IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1	1 H 1.00794 1 +1 -1																	2 He 4.00260 2 0
2	3 Li 6.941 2-1 +1	4 Be 9.01218 2-2 +2											5 B 10.81 2-3 +3	6 C 12.0111 2-4 -4+2+4	7 N 14.0067 2-5 -3-2-1+1+2+3+4+5	8 O 15.9994 2-6 -2	9 F 18.998403 2-7 -1	10 Ne 20.179 2-8 0
3	11 Na 22.98977 2-8-1 +1	12 Mg 24.305 2-8-2 +2											13 Al 26.98154 2-8-3 +3	14 Si 28.0855 2-8-4 -4+2+4	15 P 30.97376 2-8-5 -3+3+5	16 S 32.06 2-8-6 -2+4+6	17 Cl 35.453 2-8-7 -1+1+3+5+7	18 Ar 39.948 2-8-8 0
4	19 K 39.0983 2-8-8-1 +1	20 Ca 40.08 8-8-2 +2	21 Sc 44.9559 2-8-9-2 +3	22 Ti 47.89 2-8-10-2 +2+3+4	23 V 50.9415 2-8-11-2 +2+3+4+5	24 Cr 51.996 2-8-13-1 +2+3+6	25 Mn 54.9380 2-8-13-2 +2+3+4+7	26 Fe 55.847 2-8-14-2 +2+3	27 Co 58.9332 2-8-15-2 +2+3	28 Ni 58.69 2-8-16-2 +2+3	29 Cu 63.546 2-8-18-1 +1+2	30 Zn 65.39 2-8-18-2 +2	31 Ga 69.72 2-8-18-3 +3	32 Ge 72.59 2-8-18-4 -4+2+4	33 As 74.9216 2-8-18-5 -3+3+5	34 Se 78.96 2-8-18-6 -2+4+6	35 Br 79.904 2-8-18-7 -1+1+5	36 Kr 83.80 2-8-18-8 0+2
5	37 Rb 85.4678 2-8-18-1 +1	38 Sr 87.62 2-8-18-8-2 +2	39 Y 88.9059 2-8-18-9-2 +3	40 Zr 91.224 2-8-18-10-2 +4	41 Nb 92.9064 2-8-18-12-1 +3+5	42 Mo 95.94 2-8-18-13-1 +3+6	43 Tc (98) 2-8-18-14-1 +4+6+7	44 Ru 101.07 2-8-18-15-1 +3	45 Rh 102.906 2-8-18-16-1 +3	46 Pd 106.42 2-8-18-18 +2+4	47 Ag 107.868 2-8-18-18-1 +1	48 Cd 112.41 2-8-18-18-2 +2	49 In 114.82 2-8-18-18-3 +3	50 Sn 118.71 2-8-18-18-4 +2+4	51 Sb 121.75 2-8-18-18-5 -3+3+5	52 Te 127.60 2-8-18-18-6 -2+4+6	53 I 126.905 2-8-18-18-7 -1+1+5+7	54 Xe 131.29 2-8-18-18-8 0+2+4+6
6	55 Cs 132.905 2-8-18-18-8-1 +1	56 Ba 137.33 2-8-18-18-8-2 +2		72 Hf 178.49 -18-32-10-2 +4	73 Ta 180.948 -18-32-11-2 +5	74 W 183.85 -18-32-12-2 +6	75 Re 186.207 -18-32-13-2 +4+6+7	76 Os 190.2 -18-32-14-2 +3+4	77 Ir 192.22 -18-32-15-2 +3+4	78 Pt 195.08 -18-32-17-1 +2+4	79 Au 196.957 -18-32-18-1 +1+3	80 Hg 200.59 -18-32-18-2 +1+2	81 Tl 204.383 -18-32-18-3 +1+3	82 Pb 207.2 -18-32-18-4 +2+4	83 Bi 208.980 -18-32-18-5 +3+5	84 Po (209) -18-32-18-6 +2+4	85 At (210) -18-32-18-7	86 Rn (222) -18-32-18-8 0
7	87 Fr (223) -18-32-18-8-1 +1	88 Ra 226.025 -18-32-18-8-2 +2		104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (264)	108 Hs (265)	109 Mt (268)	110 Uun (269)	111 Uuu (272)	112 Uub (277)						

Metals ← → Non-Metals

57 La 138.906 +3	58 Ce 140.12 +3+4	59 Pr 140.908 +3	60 Nd 144.24 +3	61 Pm (145) +3	62 Sm 150.36 +2+3	63 Eu 151.96 +2+3	64 Gd 157.25 +3	65 Tb 158.925 +3	66 Dy 162.50 +3	67 Ho 164.930 +3	68 Er 167.26 +3	69 Tm 168.934 +3	70 Yb 173.04 +2+3	71 Lu 174.967 +3
89 Ac 227.028 +3	90 Th 232.038 +4	91 Pa 231.036 +4+5	92 U 238.029 +3+4+5+6	93 Np 237.048 +3+4+5+6	94 Pu (244) +3+4+5+6	95 Am (243) +3+4+5+6	96 Cm (247) +3	97 Bk (247) +3+4	98 Cf (251) +3	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (250)

ION NAMES AND FORMULAE

Monatomic		Polyatomic	
Ag^+	silver ion	BO_3^{3-}	borate ion
Al^{3+}	aluminum ion	$C_2H_3O_2^-$	acetate ion
Au^+ and Au^{2+}	gold ion	ClO^-	hypochlorite ion
Be^{2+}	beryllium ion	ClO_2^-	chlorite ion
Ca^{2+}	calcium ion	ClO_3^-	chlorate ion
Co^{2+} and Co^{3+}	cobalt ion	ClO_4^-	perchlorate ion
Cr^{2+} and Cr^{3+}	chromium ion	CN^-	cyanide ion
Cu^+ and Cu^{2+}	copper ion	CO_3^{2-}	carbonate ion
Fe^{2+} and Fe^{3+}	iron ion	$C_2O_4^{2-}$	oxalate ion
K^+	potassium ion	CrO_4^{2-}	chromate ion
Li^+	lithium ion	$Cr_2O_7^{2-}$	dichromate ion
Mg^{2+}	magnesium ion	HCO_3^-	hydrogen carbonate or bicarbonate ion
Na^+	sodium ion	H_3O^+	hydronium ion
Zn^{2+}	zinc ion	HPO_4^{2-}	hydrogen phosphate ion
		$H_2PO_4^-$	dihydrogen phosphate ion
		HSO_3^-	hydrogen sulphite or bisulphite ion
		HSO_4^-	hydrogen sulphate or bisulphate ion
		MnO_4^-	permanganate ion
		N_3^-	azide ion
		NH_4^+	ammonium ion
		NO_2^-	nitrite ion
		NO_3^-	nitrate ion
		O_2^{2-}	peroxide ion
		OCN^-	cyanate ion
		OH^-	hydroxide ion
		PO_3^{3-}	phosphite ion
		PO_4^{3-}	phosphate ion
		SCN^-	thiocyanate ion
		SO_3^{2-}	sulphite ion
		SO_4^{2-}	sulphate ion
		$S_2O_3^{2-}$	thiosulphate ion

USEFUL DATA

1 atmosphere (atmos. press. at sea level) = 10.33 m water
or = 760 mm mercury
or = 101.325 kPa

1 mm mercury = 0.133 kPa
1 litre fresh water = 1 kg
1 m^3 fresh water = 1000 kg = 1 tonne (t)
1 m^3 = 1000 litre
100 kPa = 10.19 m head of water
1 m head of water = 9.81 kPa
1 mm head of water = 9.81 Pa
Work done in joules = force in Newtons × distance in metres
or
J = Nm
Power in watts = work in joules done per second
or
W = J/s = Nm/s
Power (W) = force (N) × velocity (m/s)
1 kg steam:
Latent heat of steam,
from and at 100^0C = 2257 kJ

Latent heat of fusion of ice = 335 kJ/kg
1 tonne of refrigeration = 335 × 1000
= 335000 kJ

1 tonne of refrigeration / 24 h $= \frac{335000}{24}$
= 13958 kJ / h
= 233 kJ / min

Temperature Scales

Freezing point of water = 0^0C
= 273 K

Boiling point of water = 100^0C
= 373 K

One degree Celsius = one Kelvin

Velocities and Acceleration

Acceleration due to gravity (g) = 9.80665 m/s^2 (round to 9.81 m/s^2)
1 knot = 0.514 m/s

Velocity of sound in air about 335 m/s or 1206 km/h
Velocity of light = 299757 km/s

Angular Measure

1 revolution = 360 degrees = 4 right-angles
1 degree = 60 minutes
1 minute = 60 seconds
1 radian = 57^0 17' 45" or approx. 57.3^0

Base of Napierian Logarithms = 2.7183

Log_e (ln) = $2.3 \times \log_{10}$

INTEREST FORMULAS AND TABLES

i = interest rate per period.
n = number of interest periods.
P = a present sum of money or the principal.
F = a sum of money at the end of n periods equivalent to P with ir
A = an end of period payment for the next n periods equivalent to
(often called annual or monthly payment)

1. $F = P(1+i)^n$
2. $P = \dfrac{F}{(1+i)^n}$
3. $A = F\dfrac{i}{(1+i)^n - 1}$
4. $F = A\dfrac{(1+i)^n - 1}{i}$
5. $A = P\dfrac{i(1+i)^n}{(1+i)^n - 1}$
6. $P = A\dfrac{(1+i)^n - 1}{i(1+i)^n}$
7. $A = (P-L)\dfrac{i(1+i)^n}{(1+i)^n - 1}$

Where P is purchase cost and L is salvage value.

1% Compound Interest Factors

	Single Payment		Uniform Series				
n	Compound Amount Factor F/P	Percent Worth Factor P/F	Sinking Fund Factor A/F	Capital Recovery Factor A/P	Compound Amount Factor F/A	Percent Worth Factor P/A	n
1	1.0100	0.9901	1.000 00	1.010 00	1.000	0.990	1
2	1.0201	0.9803	0.497 51	0.507 51	2.010	1.970	2
3	1.0303	0.9706	0.330 02	0.340 02	3.030	2.941	3
4	1.0406	0.9610	0.246 28	0.256 28	4.060	3.902	4
5	1.0510	0.9515	0.196 04	0.206 04	5.101	4.853	5
6	1.0615	0.9420	0.162 55	0.172 55	6.152	5.795	6
7	1.0721	0.9327	0.138 63	0.148 63	7.214	6.728	7
8	1.0829	0.9235	0.120 69	0.130 69	8.286	7.652	8
9	1.0937	0.9143	0.106 74	0.116 74	9.369	8.566	9
10	1.1046	0.9053	0.095 58	0.105 58	10.462	9.471	10
11	1.1157	0.8963	0.086 45	0.096 45	11.567	10.368	11
12	1.1268	0.8874	0.078 85	0.088 85	12.683	11.255	12
13	1.1381	0.8787	0.072 41	0.082 41	13.809	12.134	13
14	1.1495	0.8700	0.066 90	0.076 90	14.947	13.004	14
15	1.1610	0.8613	0.062 12	0.072 12	16.097	13.865	15
16	1.1726	0.8528	0.057 94	0.067 94	17.258	14.718	16
17	1.1843	0.8444	0.054 26	0.064 26	18.430	15.562	17
18	1.1961	0.8360	0.050 98	0.060 98	19.615	16.398	18
19	1.2081	0.8277	0.048 05	0.058 05	20.811	17.226	19
20	1.2202	0.8195	0.045 42	0.055 42	22.019	18.046	20
21	1.2324	0.8114	0.043 03	0.053 03	23.239	18.857	21
22	1.2447	0.8034	0.040 86	0.050 86	24.472	19.660	22
23	1.2572	0.7954	0.038 89	0.048 89	25.716	20.456	23
24	1.2697	0.7876	0.037 07	0.047 07	26.973	21.243	24
25	1.2824	0.7798	0.035 41	0.045 41	28.243	22.023	25
26	1.2953	0.7720	0.033 87	0.043 87	29.526	22.795	26
27	1.3082	0.7644	0.032 45	0.042 45	30.821	23.560	27
28	1.3213	0.7568	0.031 12	0.041 12	32.129	24.316	28
29	1.3345	0.7493	0.029 90	0.039 90	33.450	25.066	29
30	1.3478	0.7419	0.028 75	0.038 75	34.785	25.808	30
31	1.3613	0.7346	0.027 68	0.037 68	36.133	26.542	31
32	1.3749	0.7273	0.026 67	0.036 67	37.494	27.270	32
33	1.3887	0.7201	0.025 73	0.035 73	38.869	27.990	33
34	1.4026	0.7130	0.024 84	0.034 84	40.258	28.703	34
35	1.4166	0.7059	0.024 00	0.034 00	41.660	29.409	35
40	1.4889	0.6717	0.020 46	0.030 46	48.886	32.835	40
45	1.5648	0.6391	0.017 71	0.027 71	56.481	36.095	45
50	1.6446	0.6080	0.015 51	0.025 51	64.463	39.196	50
55	1.7285	0.5785	0.013 73	0.023 73	72.852	42.147	55
60	1.8167	0.5504	0.012 24	0.022 24	81.670	44.955	60
65	1.9094	0.5237	0.011 00	0.021 00	90.937	47.627	65
70	2.0068	0.4983	0.009 93	0.019 93	100.676	50.169	70
75	2.1091	0.4741	0.009 02	0.019 02	110.913	52.587	75
80	2.2167	0.4511	0.008 22	0.018 22	121.672	54.888	80
85	2.3298	0.4292	0.007 52	0.017 52	132.979	57.078	85
90	2.4486	0.4084	0.006 90	0.016 90	144.863	59.161	90
95	2.5735	0.3886	0.006 36	0.016 36	157.354	61.143	95
100	2.7048	0.3697	0.005 87	0.015 87	170.481	63.029	100

2% Compound Interest Factors

	Single Payment		Uniform Series				
n	Compound Amount Factor F/P	Present Worth Factor P/F	Sinking Fund Factor A/F	Capital Recovery Factor A/P	Compound Amount Factor F/A	Present Worth Factor P/A	n
1	1.0200	0.9804	1.000 00	1.020 00	1.000	0.980	1
2	1.0404	0.9612	0.495 05	0.515 05	2.020	1.942	2
3	1.0612	0.9423	0.326 75	0.346 75	3.060	2.884	3
4	1.0824	0.9238	0.242 62	0.262 62	4.122	3.808	4
5	1.1041	0.9057	0.192 16	0.212 16	5.204	4.713	5
6	1.1262	0.8880	0.158 53	0.178 53	6.308	5.601	6
7	1.1487	0.8706	0.134 51	0.154 51	7.434	6.472	7
8	1.1717	0.8535	0.116 51	0.136 51	8.583	7.325	8
9	1.1951	0.8368	0.102 52	0.122 52	9.755	8.162	9
10	1.2190	0.8203	0.091 33	0.111 33	10.950	8.983	10
11	1.2434	0.8043	0.082 18	0.102 18	12.169	9.787	11
12	1.2682	0.7885	0.074 56	0.094 56	13.412	10.575	12
13	1.2936	0.7730	0.068 12	0.088 12	14.680	11.348	13
14	1.3195	0.7579	0.062 60	0.082 60	15.974	12.106	14
15	1.3459	0.7430	0.057 83	0.077 83	17.293	12.849	15
16	1.3728	0.7284	0.053 65	0.073 65	18.639	13.578	16
17	1.4002	0.7142	0.049 97	0.069 97	20.012	14.292	17
18	1.4282	0.7002	0.046 70	0.066 70	21.412	14.992	18
19	1.4568	0.6864	0.043 78	0.063 78	22.841	15.678	19
20	1.4859	0.6730	0.041 16	0.061 16	24.297	16.351	20
21	1.5157	0.6598	0.038 78	0.058 78	25.783	17.011	21
22	1.5460	0.6468	0.036 63	0.056 63	27.299	17.658	22
23	1.5769	0.6342	0.034 67	0.054 67	28.845	18.292	23
24	1.6084	0.6217	0.032 87	0.052 87	30.422	18.914	24
25	1.6406	0.6095	0.031 22	0.051 22	32.030	19.523	25
26	1.6734	0.5976	0.029 70	0.049 70	33.671	20.121	26
27	1.7069	0.5859	0.028 29	0.048 29	35.344	20.707	27
28	1.7410	0.5744	0.026 99	0.046 99	37.051	21.281	28
29	1.7758	0.5631	0.025 78	0.045 78	38.792	21.844	29
30	1.8114	0.5521	0.024 65	0.044 65	40.568	22.396	30
31	1.8476	0.5412	0.023 60	0.043 60	42.379	22.938	31
32	1.8845	0.5306	0.022 61	0.042 61	44.227	23.468	32
33	1.9222	0.5202	0.021 69	0.041 69	46.112	23.989	33
34	1.9607	0.5100	0.020 82	0.040 82	48.034	24.499	34
35	1.9999	0.5000	0.020 00	0.040 00	49.994	24.999	35
40	2.2080	0.4529	0.016 56	0.036 56	60.402	27.355	40
45	2.4379	0.4102	0.013 91	0.033 91	71.893	29.490	45
50	2.6916	0.3715	0.011 82	0.031 82	84.579	31.424	50
55	2.9717	0.3365	0.010 14	0.030 14	98.587	33.175	55
60	3.2810	0.3048	0.008 77	0.028 77	114.052	34.761	60
65	3.6225	0.2761	0.007 63	0.027 63	131.126	36.197	65
70	3.9996	0.2500	0.006 67	0.026 67	149.978	37.499	70
75	4.4158	0.2265	0.005 86	0.025 86	170.792	38.677	75
80	4.8754	0.2051	0.005 16	0.025 16	193.772	39.745	80
85	5.3829	0.1858	0.004 56	0.024 56	219.144	40.711	85
90	5.9431	0.1683	0.004 05	0.024 05	247.157	41.587	90
95	6.5617	0.1524	0.003 60	0.023 60	278.085	42.380	95
100	7.2446	0.1380	0.003 20	0.023 20	312.232	43.098	100

2.5% Compound Interest Factors

	Single Payment		Uniform Series				
n	*Compound Amount Factor F/P*	*Percent Worth Factor P/F*	*Sinking Fund Factor A/F*	*Capital Recovery Factor A/P*	*Compound Amount Factor F/A*	*Percent Worth Factor P/A*	*n*
1	1.0250	0.9756	1.000 00	1.025 00	1.000	0.976	1
2	1.0506	0.9518	0.493 83	0.518 83	2.025	1.927	2
3	1.0769	0.9286	0.325 14	0.350 14	3.076	2.856	3
4	1.1038	0.9060	0.240 82	0.265 82	4.153	3.762	4
5	1.1314	0.8839	0.190 25	0.215 25	5.256	4.646	5
6	1.1597	0.8623	0.156 55	0.181 55	6.388	5.508	6
7	1.1887	0.8413	0.132 50	0.157 50	7.547	6.349	7
8	1.2184	0.8207	0.114 47	0.139 47	8.736	7.170	8
9	1.2489	0.8007	0.100 46	0.125 46	9.955	7.971	9
10	1.2801	0.7812	0.089 26	0.114 26	11.203	8.752	10
11	1.3121	0.7621	0.080 11	0.105 11	12.483	9.514	11
12	1.3449	0.7436	0.072 49	0.097 49	13.796	10.258	12
13	1.3785	0.7254	0.066 05	0.091 05	15.140	10.983	13
14	1.4130	0.7077	0.060 54	0.085 54	16.519	11.691	14
15	1.4483	0.6905	0.055 77	0.080 77	17.932	12.381	15
16	1.4845	0.6736	0.051 60	0.076 60	19.380	13.055	16
17	1.5216	0.6572	0.047 93	0.072 93	20.865	13.712	17
18	1.5597	0.6412	0.044 67	0.069 67	22.386	14.353	18
19	1.5987	0.6255	0.041 76	0.066 76	23.946	14.979	19
20	1.6386	0.6103	0.039 15	0.064 15	25.545	15.589	20
21	1.6796	0.5954	0.036 79	0.061 79	27.183	16.185	21
22	1.7216	0.5809	0.034 65	0.059 65	28.863	16.765	22
23	1.7646	0.5667	0.032 70	0.057 70	30.584	17.332	23
24	1.8087	0.5529	0.030 91	0.055 91	32.349	17.885	24
25	1.8539	0.5394	0.029 28	0.054 28	34.158	18.424	25
26	1.9003	0.5262	0.027 77	0.052 77	36.012	18.951	26
27	1.9478	0.5134	0.026 38	0.051 38	37.912	19.464	27
28	1.9965	0.5009	0.025 09	0.050 09	39.860	19.965	28
29	2.0464	0.4887	0.023 89	0.048 89	41.856	20.454	29
30	2.0976	0.4767	0.022 78	0.047 78	43.903	20.930	30
31	2.1500	0.4651	0.021 74	0.046 74	46.000	21.395	31
32	2.2038	0.4538	0.020 77	0.045 77	48.150	21.849	32
33	2.2589	0.4427	0.019 86	0.044 86	50.354	22.292	33
34	2.3153	0.4319	0.019 01	0.044 01	52.613	22.724	34
35	2.3732	0.4214	0.018 21	0.043 21	54.928	23.145	35
40	2.6851	0.3724	0.014 84	0.039 84	67.403	25.103	40
45	3.0379	0.3292	0.012 27	0.037 27	81.516	26.833	45
50	3.4371	0.2909	0.010 26	0.035 26	97.484	28.362	50
55	3.8888	0.2572	0.008 65	0.033 65	115.551	29.714	55
60	4.3998	0.2273	0.007 35	0.032 35	135.992	30.909	60
65	4.9780	0.2009	0.006 28	0.031 28	159.118	31.965	65
70	5.6321	0.1776	0.005 40	0.030 40	185.284	32.898	70
75	6.3722	0.1569	0.004 65	0.029 65	214.888	33.723	75
80	7.2096	0.1387	0.004 03	0.029 03	248.383	34.452	80
85	8.1570	0.1226	0.003 49	0.028 49	286.279	35.096	85
90	9.2289	0.1084	0.003 04	0.028 04	329.154	35.666	90
95	10.4416	0.0958	0.002 65	0.027 65	377.664	36.169	95
100	11.8137	0.0846	0.002 31	0.027 31	432.549	36.614	100

5% Compound Interest Factors

	Single Payment		Uniform Series				
n	Compound Amount Factor F/P	Present Worth Factor P/F	Sinking Fund Factor A/F	Capital Recovery Factor A/P	Compound Amount Factor F/A	Present Worth Factor P/A	n
1	1.0500	0.9524	1.000 00	1.050 00	1.000	0.952	1
2	1.1025	0.9070	0.487 80	0.537 80	2.050	1.8594	2
3	1.1576	0.8638	0.317 21	0.367 21	3.153	2.7232	3
4	1.2155	0.8227	0.232 01	0.282 01	4.310	3.5460	4
5	1.2763	0.7835	0.180 97	0.230 97	5.526	4.3295	5
6	1.3401	0.7462	0.147 02	0.197 02	6.802	5.0757	6
7	1.4071	0.7107	0.122 82	0.172 82	8.142	5.7864	7
8	1.4775	0.6768	0.104 72	0.154 72	9.549	6.4632	8
9	1.5513	0.6446	0.090 69	0.140 69	11.027	7.1078	9
10	1.6289	0.6139	0.079 50	0.129 50	12.578	7.7217	10
11	1.7103	0.5847	0.070 39	0.120 39	14.207	8.3064	11
12	1.7959	0.5568	0.062 83	0.112 83	15.917	8.8633	12
13	1.8856	0.5303	0.056 46	0.106 46	17.713	9.3936	13
14	1.9799	0.5051	0.051 02	0.101 02	19.599	9.8986	14
15	2.0789	0.4810	0.046 34	0.096 34	21.579	10.3797	15
16	2.1829	0.4581	0.042 27	0.092 27	23.657	10.8378	16
17	2.2920	0.4363	0.038 70	0.088 70	25.840	11.2741	17
18	2.4066	0.4155	0.035 55	0.085 55	28.132	11.6896	18
19	2.5270	0.3957	0.032 75	0.082 75	30.539	12.0853	19
20	2.6533	0.3769	0.030 24	0.080 24	33.066	12.4622	20
21	2.7860	0.3589	0.028 00	0.078 00	35.719	12.8212	21
22	2.9253	0.3418	0.025 97	0.075 97	38.505	13.1630	22
23	3.0715	0.3256	0.024 14	0.074 14	41.430	13.4886	23
24	3.2251	0.3101	0.022 47	0.072 47	44.502	13.7986	24
25	3.3864	0.2953	0.020 95	0.070 95	47.727	14.0939	25
26	3.5557	0.2812	0.019 56	0.069 56	51.113	14.3752	26
27	3.7335	0.2678	0.018 29	0.068 29	54.669	14.6430	27
28	3.9201	0.2551	0.017 12	0.067 12	58.403	14.8981	28
29	4.1161	0.2429	0.016 05	0.066 05	62.323	15.1411	29
30	4.3219	0.2314	0.015 05	0.065 05	66.439	15.3725	30
31	4.5380	0.2204	0.014 13	0.064 13	70.761	15.5928	31
32	4.7649	0.2099	0.013 28	0.063 28	75.299	15.8027	32
33	5.0032	0.1999	0.012 49	0.062 49	80.064	16.0025	33
34	5.2533	0.1904	0.011 76	0.061 76	85.067	16.1929	34
35	5.5160	0.1813	0.011 07	0.061 07	90.320	16.3742	35
40	7.0400	0.1420	0.008 28	0.058 28	120.800	17.1591	40
45	8.9850	0.1113	0.006 26	0.056 26	159.700	17.7741	45
50	11.4674	0.0872	0.004 78	0.054 78	209.348	18.2559	50
55	14.6356	0.0683	0.003 67	0.053 67	272.713	18.6335	55
60	18.6792	0.0535	0.002 83	0.052 83	353.584	18.9293	60
65	23.8399	0.0419	0.002 19	0.052 19	456.798	19.1611	65
70	30.4264	0.0329	0.001 70	0.051 70	588.529	19.3427	70
75	38.8327	0.0258	0.001 32	0.051 32	756.654	19.4850	75
80	49.5614	0.0202	0.001 03	0.051 03	971.229	19.5965	80
85	63.2544	0.0158	0.000 80	0.050 80	1 245.087	19.6838	85
90	80.7304	0.0124	0.000 63	0.050 63	1 594.607	19.7523	90
95	103.0347	0.0097	0.000 49	0.050 49	2 040.694	19.8059	95
100	131.5013	0.0076	0.000 38	0.050 38	2 610.025	19.8479	100

12% Compound Interest Factors

	Single Payment		Uniform Series				
n	*Compound Amount Factor F/P*	*Percent Worth Factor P/F*	*Sinking Fund Factor A/F*	*Capital Recovery Factor A/P*	*Compound Amount Factor F/A*	*Percent Worth Factor P/A*	*n*
1	1.1200	0.8929	1.000 00	1.120 00	1.000	0.893	1
2	1.2544	0.7972	0.471 70	0.591 70	2.120	1.690	2
3	1.4049	0.7118	0.296 35	0.416 35	3.374	2.402	3
4	1.5735	0.6355	0.209 23	0.329 23	4.779	3.037	4
5	1.7623	0.5674	0.157 41	0.277 41	6.353	3.605	5
6	1.9738	0.5066	0.123 23	0.243 23	8.115	4.111	6
7	2.2107	0.4523	0.099 12	0.219 12	10.089	4.564	7
8	2.4760	0.4039	0.081 30	0.201 30	12.300	4.968	8
9	2.7731	0.3606	0.067 68	0.187 68	14.776	5.328	9
10	3.1058	0.3220	0.056 98	0.176 98	17.549	5.650	10
11	3.4785	0.2875	0.048 42	0.168 42	20.655	5.938	11
12	3.8960	0.2567	0.041 44	0.161 44	24.133	6.194	12
13	4.3635	0.2292	0.035 68	0.155 68	28.029	6.424	13
14	4.8871	0.2046	0.030 87	0.150 87	32.393	6.628	14
15	5.4736	0.1827	0.026 82	0.146 82	37.280	6.811	15
16	6.1304	0.1631	0.023 39	0.143 39	42.753	6.974	16
17	6.8660	0.1456	0.020 46	0.140 46	48.884	7.120	17
18	7.6900	0.1300	0.017 94	0.137 94	55.750	7.250	18
19	8.6128	0.1161	0.015 76	0.135 76	63.440	7.366	19
20	9.6463	0.1037	0.013 88	0.133 88	72.052	7.469	20
21	10.8038	0.0926	0.012 24	0.132 24	81.699	7.562	21
22	12.1003	0.0826	0.010 81	0.130 81	92.503	7.645	22
23	13.5523	0.0738	0.009 56	0.129 56	104.603	7.718	23
24	15.1786	0.0659	0.008 46	0.128 46	118.155	7.784	24
25	17.0001	0.0588	0.007 50	0.127 50	133.334	7.843	25
26	19.0401	0.0525	0.006 65	0.126 65	150.334	7.896	26
27	21.3249	0.0469	0.005 90	0.125 90	169.374	7.943	27
28	23.8839	0.0419	0.005 24	0.125 24	190.699	7.984	28
29	26.7499	0.0374	0.004 66	0.124 66	214.583	8.022	29
30	29.9599	0.0334	0.004 14	0.124 14	241.333	8.055	30
31	33.5551	0.0298	0.003 69	0.123 69	271.293	8.085	31
32	37.5817	0.0266	0.003 28	0.123 28	304.848	8.112	32
33	42.0915	0.0238	0.002 92	0.122 92	342.429	8.135	33
34	47.1425	0.0212	0.002 60	0.122 60	384.521	8.157	34
35	52.7996	0.0189	0.002 32	0.122 32	431.663	8.176	35
40	93.0510	0.0107	0.001 30	0.121 30	767.091	8.244	40
45	163.9876	0.0061	0.000 74	0.120 74	1 358.230	8.283	45
50	289.0022	0.0035	0.000 42	0.120 42	2 400.018	8.304	50

15% Compound Interest Factors

	Single Payment		Uniform Series				
n	*Compound Amount Factor F/P*	*Present Worth Factor P/F*	*Sinking Fund Factor A/F*	*Capital Recovery Factor A/P*	*Compound Amount Factor F/A*	*Present Worth Factor P/A*	*n*
1	1.1500	0.8696	1.000 00	1.150 00	1.000	0.870	1
2	1.3225	0.7561	0.465 12	0.615 12	2.150	1.626	2
3	1.5209	0.6575	0.287 98	0.437 98	3.473	2.283	3
4	1.7490	0.5718	0.200 27	0.350 27	4.993	2.855	4
5	2.0114	0.4972	0.148 32	0.298 32	6.742	3.352	5
6	2.3131	0.4323	0.114 24	0.264 24	8.754	3.784	6
7	2.6600	0.3759	0.090 36	0.240 36	11.067	4.160	7
8	3.0590	0.3269	0.072 85	0.222 85	13.727	4.487	8
9	3.5179	0.2843	0.059 57	0.209 57	16.786	4.772	9
10	4.0456	0.2472	0.049 25	0.199 25	20.304	5.019	10
11	4.6524	0.2149	0.041 07	0.191 07	24.349	5.234	11
12	5.3503	0.1869	0.034 48	0.184 48	29.002	5.421	12
13	6.1528	0.1625	0.029 11	0.179 11	34.352	5.583	13
14	7.0757	0.1413	0.024 69	0.174 69	40.505	5.724	14
15	8.1371	0.1229	0.021 02	0.171 02	47.580	5.847	15
16	9.3576	0.1069	0.017 95	0.167 95	55.717	5.954	16
17	10.7613	0.0929	0.015 37	0.165 37	65.075	6.047	17
18	12.3755	0.0808	0.013 19	0.163 19	75.836	6.128	18
19	14.2318	0.0703	0.011 34	0.161 34	88.212	6.198	19
20	16.3665	0.0611	0.009 76	0.159 76	102.444	6.259	20
21	18.8215	0.0531	0.008 42	0.158 42	118.810	6.312	21
22	21.6447	0.0462	0.007 27	0.157 27	137.632	6.359	22
23	24.8915	0.0402	0.006 28	0.156 28	159.276	6.399	23
24	28.6252	0.0349	0.005 43	0.155 43	184.168	6.434	24
25	32.9190	0.0304	0.004 70	0.154 70	212.793	6.464	25
26	37.8568	0.0264	0.004 07	0.154 07	245.712	6.491	26
27	43.5353	0.0230	0.003 53	0.153 53	283.569	6.514	27
28	50.0656	0.0200	0.003 06	0.153 06	327.104	6.534	28
29	57.5755	0.0174	0.002 65	0.152 65	377.170	6.551	29
30	66.2118	0.0151	0.002 30	0.152 30	434.745	6.566	30
31	76.1435	0.0131	0.002 00	0.152 00	500.957	6.579	31
32	87.5651	0.0114	0.001 73	0.151 73	577.100	6.591	32
33	100.6998	0.0099	0.001 50	0.151 50	664.666	6.600	33
34	115.8048	0.0086	0.001 31	0.151 31	765.365	6.609	34
35	133.1755	0.0075	0.001 13	0.151 13	881.170	6.617	35
40	267.8635	0.0037	0.000 56	0.150 56	1 779.090	6.642	40
45	538.7693	0.0019	0.000 28	0.150 28	3 585.128	6.654	45
50	1 083.6574	0.0009	0.000 14	0.150 14	7 217.716	6.661	50

20% Compound Interest Factors

	Single Payment		Uniform Series				
n	*Compound Amount Factor F/P*	*Percent Worth Factor P/F*	*Sinking Fund Factor A/F*	*Capital Recovery Factor A/P*	*Compound Amount Factor F/A*	*Percent Worth Factor P/A*	*n*
1	1.2000	0.8333	1.000 00	1.200 00	1.000	0.833	1
2	1.4400	0.6944	0.454 55	0.654 55	2.200	1.528	2
3	1.7280	0.5787	0.274 73	0.474 73	3.640	2.106	3
4	2.0736	0.4823	0.186 29	0.386 29	5.368	2.589	4
5	2.4883	0.4019	0.134 38	0.334 38	7.442	2.991	5
6	2.9860	0.3349	0.100 71	0.300 71	9.930	3.326	6
7	3.5832	0.2791	0.077 42	0.277 42	12.916	3.605	7
8	4.2998	0.2326	0.060 61	0.260 61	16.499	3.837	8
9	5.1598	0.1938	0.048 08	0.248 08	20.799	4.031	9
10	6.1917	0.1615	0.038 52	0.238 52	25.959	4.192	10
11	7.4301	0.1346	0.031 10	0.231 10	32.150	4.327	11
12	8.9161	0.1122	0.025 26	0.225 26	39.581	4.439	12
13	10.6993	0.0935	0.020 62	0.220 62	48.497	4.533	13
14	12.8392	0.0779	0.016 89	0.216 89	59.196	4.611	14
15	15.4070	0.0649	0.013 88	0.213 88	72.035	4.675	15
16	18.4884	0.0541	0.011 44	0.211 44	87.442	4.730	16
17	22.1861	0.0451	0.009 44	0.209 44	105.931	4.775	17
18	26.6233	0.0376	0.007 81	0.207 81	128.117	4.812	18
19	31.9480	0.0313	0.006 46	0.206 46	154.740	4.843	19
20	38.3376	0.0261	0.005 36	0.205 36	186.688	4.870	20
21	46.0051	0.0217	0.004 44	0.204 44	225.026	4.891	21
22	55.2061	0.0181	0.003 69	0.203 69	271.031	4.909	22
23	66.2474	0.0151	0.003 07	0.203 07	326.237	4.925	23
24	79.4968	0.0126	0.002 55	0.202 55	392.484	4.937	24
25	95.3962	0.0105	0.002 12	0.202 12	471.981	4.948	25
26	114.4755	0.0087	0.001 76	0.201 76	567.377	4.956	26
27	137.3706	0.0073	0.001 47	0.201 47	681.853	4.964	27
28	164.8447	0.0061	0.001 22	0.201 22	819.223	4.970	28
29	197.8136	0.0051	0.001 02	0.201 02	984.068	4.975	29
30	237.3763	0.0042	0.000 85	0.200 85	1 181.882	4.979	30
31	284.8516	0.0035	0.000 70	0.200 70	1 419.258	4.982	31
32	341.8219	0.0029	0.000 59	0.200 59	1 704.109	4.985	32
33	410.1863	0.0024	0.000 49	0.200 49	2 045.931	4.988	33
34	492.2235	0.0020	0.000 41	0.200 41	2 456.118	4.990	34
35	590.6682	0.0017	0.000 34	0.200 34	2 948.341	4.992	35
40	1 469.7716	0.0007	0.000 14	0.200 14	7 343.858	4.997	40
45	3 657.2620	0.0003	0.000 05	0.200 05	18 281.310	4.999	45
50	9 100.4382	0.0001	0.000 02	0.200 02	45 497.191	4.999	50

25% Compound Interest Factors

	Single Payment		Uniform Series				
n	*Compound Amount Factor F/P*	*Percent Worth Factor P/F*	*Sinking Fund Factor A/F*	*Capital Recovery Factor A/P*	*Compound Amount Factor F/A*	*Percent Worth Factor P/A*	*n*
1	1.2500	0.8000	1.000 00	1.250 00	1.000	0.800	1
2	1.5625	0.6400	0.444 44	0.694 44	2.250	1.440	2
3	1.9531	0.5120	0.262 30	0.512 30	3.813	1.952	3
4	2.4414	0.4096	0.173 44	0.423 44	5.766	2.362	4
5	3.0518	0.3277	0.121 85	0.371 85	8.207	2.689	5
6	3.8147	0.2621	0.088 82	0.338 82	11.259	2.951	6
7	4.7684	0.2097	0.066 34	0.316 34	15.073	3.161	7
8	5.9605	0.1678	0.050 40	0.300 40	19.842	3.329	8
9	7.4506	0.1342	0.038 76	0.288 76	25.802	3.463	9
10	9.3132	0.1074	0.030 07	0.280 07	33.253	3.571	10
11	11.6415	0.0859	0.023 49	0.273 49	42.566	3.656	11
12	14.5519	0.0687	0.018 45	0.268 45	54.208	3.725	12
13	18.1899	0.0550	0.014 54	0.264 54	68.760	3.780	13
14	22.7374	0.0440	0.011 50	0.261 50	86.949	3.824	14
15	28.4217	0.0352	0.009 12	0.259 12	109.687	3.859	15
16	35.5271	0.0281	0.007 24	0.257 24	138.109	3.887	16
17	44.4089	0.0225	0.005 76	0.255 76	173.636	3.910	17
18	55.5112	0.0180	0.004 59	0.254 59	218.045	3.928	18
19	69.3889	0.0144	0.003 66	0.253 66	273.556	3.942	19
20	86.7362	0.0115	0.002 92	0.252 92	342.945	3.954	20
21	108.4202	0.0092	0.002 33	0.252 33	429.681	3.963	21
22	135.5253	0.0074	0.001 86	0.251 86	538.101	3.970	22
23	169.4066	0.0059	0.001 48	0.251 48	673.626	3.976	23
24	211.7582	0.0047	0.001 19	0.251 19	843.033	3.981	24
25	264.6978	0.0038	0.000 95	0.250 95	1 054.791	3.985	25
26	330.8722	0.0030	0.000 76	0.250 76	1 319.489	3.988	26
27	413.5903	0.0024	0.000 61	0.250 61	1 650.361	3.990	27
28	516.9879	0.0019	0.000 48	0.250 48	2 063.952	3.992	28
29	646.2349	0.0015	0.000 39	0.250 39	2 580.939	3.994	29
30	807.7936	0.0012	0.000 31	0.250 31	3 227.174	3.995	30
31	1 009.7420	0.0010	0.000 25	0.250 25	4 034.968	3.996	31
32	1 262.1774	0.0008	0.000 20	0.250 20	5 044.710	3.997	32
33	1 577.7218	0.0006	0.000 16	0.250 16	6 306.887	3.997	33
34	1 972.1523	0.0005	0.000 13	0.250 13	7 884.609	3.998	34
35	2 465.1903	0.0004	0.000 10	0.250 10	9 856.761	3.998	35
40	7 523.1638	0.0001	0.000 03	0.250 03	30 088.655	3.999	40
45	22 958.8740	0.0000	0.000 01	0.250 01	91 831.496	4.000	45
50	70 064.9232	0.0000	0.000 00	0.250 00	280 255.693	4.000	50

30% Compound Interest Factors

	Single Payment		Uniform Series				
n	*Compound Amount Factor F/P*	*Present Worth Factor P/F*	*Sinking Fund Factor A/F*	*Capital Recovery Factor A/P*	*Compound Amount Factor F/A*	*Present Worth Factor P/A*	*n*
1	1.3000	0.769 2	1.000 00	1.300 00	1.000	0.769	1
2	1.6900	0.591 7	0.434 78	0.734 78	2.300	1.361	2
3	2.1970	0.455 2	0.250 63	0.550 63	3.990	1.816	3
4	2.8561	0.350 1	0.161 63	0.461 63	6.187	2.166	4
5	3.7129	0.269 3	0.110 58	0.410 58	9.043	2.436	5
6	4.8268	0.207 2	0.078 39	0.378 39	12.756	2.643	6
7	6.2749	0.159 4	0.056 87	0.356 87	17.583	2.802	7
8	8.1573	0.122 6	0.041 92	0.341 92	23.858	2.925	8
9	10.6045	0.094 3	0.031 24	0.331 24	32.015	3.019	9
10	13.7858	0.072 5	0.023 46	0.323 46	42.619	3.092	10
11	17.9216	0.055 8	0.017 73	0.317 73	56.405	3.147	11
12	23.2981	0.042 9	0.013 45	0.313 45	74.327	3.190	12
13	30.2875	0.033 0	0.010 24	0.310 24	97.625	3.223	13
14	39.3738	0.025 4	0.007 82	0.307 82	127.913	3.249	14
15	51.1859	0.019 5	0.005 98	0.305 98	167.286	3.268	15
16	66.5417	0.015 0	0.004 58	0.304 58	218.472	3.283	16
17	86.5042	0.011 6	0.003 51	0.303 51	285.014	3.295	17
18	112.4554	0.008 9	0.002 69	0.302 69	371.518	3.304	18
19	146.1920	0.006 8	0.002 07	0.302 07	483.973	3.311	19
20	190.0496	0.005 3	0.001 59	0.301 59	630.165	3.316	20
21	247.0645	0.004 0	0.001 22	0.301 22	820.215	3.320	21
22	321.1839	0.003 1	0.000 94	0.300 94	1 067.280	3.323	22
23	417.5391	0.002 4	0.000 72	0.300 72	1 388.464	3.325	23
24	542.8008	0.001 8	0.000 55	0.300 55	1 806.003	3.327	24
25	705.6410	0.001 4	0.000 43	0.300 43	2 348.803	3.329	25
26	917.3333	0.001 1	0.000 33	0.300 33	3 054.444	3.330	26
27	1 192.5333	0.000 8	0.000 25	0.300 25	3 971.778	3.331	27
28	1 550.2933	0.000 6	0.000 19	0.300 19	5 164.311	3.331	28
29	2 015.3813	0.000 5	0.000 15	0.300 15	6 714.604	3.332	29
30	2 619.9956	0.000 4	0.000 11	0.300 11	8 729.985	3.332	30
31	3 405.9943	0.000 3	0.000 09	0.300 09	11 349.981	3.332	31
32	4 427.7926	0.000 2	0.000 07	0.300 07	14 755.975	3.333	32
33	5 756.1304	0.000 2	0.000 05	0.300 05	19 183.768	3.333	33
34	7 482.9696	0.000 1	0.000 04	0.300 04	24 939.899	3.333	34
35	9 727.8604	0.000 1	0.000 03	0.300 03	32 422.868	3.333	35

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SI Steam Tables for Reference in Power Engineering

For the use of **Students** and **Examination Candidates**, this document has been:

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Symbols Used in Tables 1 and 2

h	specific enthalpy, kilojoules per kilogram
p	absolute pressure, kilopascals
s	specific entropy, kilojoules per kilogram degree kelvin
t	thermodynamic temperature, degrees Celsius
u	specific internal energy, kilojoules per kilogram
v	specific volume, cm^3 per gram (or x 10^{-3} m^3/kg or litres/kg)

Subscripts

f	refers to a property of liquid in equilibrium with vapour
g	refers to a property of vapour in equilibrium with liquid
fg	refers to a change by evaporation

Properties of Saturated Steam - Pressure Table

Table 1

		Specific Volume		Internal Energy			Enthalpy			Entropy		
Press	Temp	Sat.	Sat.	Sat.	Evap.	Sat.	Sat.	Evap.	Sat.	Sat.	Evap.	Sat.
k Pa	°C	Liquid	Vapor	Liquid		Vapor	Liquid		Vapor	Liquid		Vapor
p	t	V_f	V_g	U_f	U_{fg}	U_g	H_f	H_{fg}	H_g	S_f	S_{fg}	S_g
1.0	6.98	1.0002	129,208	29.30	2,355.7	2,385.0	29.30	2,484.9	2,514.2	0.1059	8.8697	8.9756
1.5	13.03	1.0007	87,980	57.71	2,338.6	2,393.3	57.71	2,470.6	2,525.3	0.1957	8.6322	8.8279
2.0	17.50	1.0013	67,004	73.48	2,326.0	2,399.5	73.48	2,460.0	2,533.5	0.2607	8.4629	8.7237
2.5	21.08	1.0020	54,254	88.48	2,315.9	2,404.4	88.49	2,451.6	2,540.0	0.3120	8.3311	8.6432
3.0	24.08	1.0027	45,665	101.04	2,307.5	2,408.5	101.05	2,444.5	2,545.5	0.3545	8.2231	8.5776
4.0	28.96	1.0040	34,800	121.45	2,293.7	2,415.2	121.46	2,432.9	2,554.4	0.4226	8.0520	8.4746
5.0	32.88	1.0053	28,192	137.81	2,282.7	2,420.5	137.82	2,423.7	2,561.5	0.4764	7.9187	8.3951
7.5	40.29	1.0079	19,238	168.78	2,261.7	2,430.5	168.79	2,406.0	2,574.8	0.5764	7.6750	8.2515
10	45.81	1.0102	14,674	191.82	2,246.1	2,437.9	191.83	2,392.8	2,584.7	0.6493	7.5009	8.1502
15	53.97	1.0141	10,022	225.92	2,222.8	2,448.7	225.94	2,373.1	2,599.1	0.7549	7.2536	8.0085
20	60.06	1.0172	7,649	251.38	2,205.4	2,456.7	251.40	2,358.3	2,609.7	0.8320	7.0766	7.9085
25	64.97	1.0199	6,204	271.90	2,191.2	2,463.1	271.93	2,346.3	2,618.2	0.8931	6.9383	7.8314
30	69.10	1.0223	5,229	289.20	2,179.2	2,468.4	289.23	2,336.1	2,625.3	0.9439	6.8247	7.7686
40	75.87	1.0265	3,993	317.53	2,159.5	2,477.0	317.58	2,319.2	2,636.8	1.0259	6.6441	7.6700
50	81.33	1.0300	3,240	340.44	2,143.4	2,483.9	340.49	2,305.4	2,645.9	1.0910	6.5029	7.5939
75	91.78	1.0373	2,217	384.31	2,112.4	2,496.7	384.39	2,278.6	2,663.0	1.2130	6.2434	7.4564
100	99.63	1.0432	1,694	417.36	2,088.7	2,506.1	417.46	2,258.0	2,675.5	1.3026	6.0568	7.3594
125	105.99	1.0483	1,374.9	444.19	2,069.3	2,513.5	444.32	2,241.0	2,685.4	1.3740	5.9104	7.2844
150	111.37	1.0528	1,159.3	466.94	2,052.7	2,519.7	467.11	2,226.5	2,693.6	1.4336	5.7897	7.2233
175	116.06	1.0568	1,003.6	486.80	2,038.1	2,524.9	486.99	2,213.6	2,700.6	1.4849	5.6868	7.1717
200	120.23	1.0605	885.7	504.49	2,025.0	2,529.5	504.70	2,201.9	2,706.7	1.5301	5.5970	7.1271
225	124.00	1.0640	793.3	520.47	2,013.1	2,533.6	520.72	2,191.3	2,712.1	1.5706	5.5173	7.0878
250	127.44	1.0672	718.7	535.10	2,002.1	2,537.2	535.37	2,181.5	2,716.9	1.6072	5.4455	7.0527
275	130.60	1.0703	657.3	548.59	1,991.9	2,540.5	548.89	2,172.4	2,721.3	1.6408	5.3801	7.0209
300	133.55	1.0732	605.8	561.15	1,982.4	2,543.6	561.47	2,163.8	2,725.3	1.6718	5.3201	6.9919
325	136.30	1.0759	562.0	572.90	1,973.5	2,546.4	573.25	2,155.8	2,729.0	1.7006	5.2646	6.9652
350	138.88	1.0786	524.3	583.95	1,965.0	2,548.9	584.33	2,148.1	2,732.4	1.7275	5.2130	6.9405
375	141.32	1.0811	491.4	594.40	1,956.9	2,551.3	594.81	2,140.8	2,735.6	1.7528	5.1647	6.9175
400	143.63	1.0836	462.5	604.31	1,949.3	2,553.6	604.74	2,133.8	2,738.6	1.7766	5.1193	6.8959
450	147.93	1.0882	414.0	622.77	1,934.9	2,557.6	623.25	2,120.7	2,743.9	1.8207	5.0359	6.8565
500	151.86	1.0926	374.9	639.68	1,921.6	2,561.2	640.23	2,108.5	2,748.7	1.8607	4.9606	6.8213
550	155.48	1.0967	342.7	655.32	1,909.2	2,564.5	655.93	2,097.0	2,753.0	1.8973	4.8920	6.7893
600	158.85	1.1006	315.7	669.90	1,897.5	2,567.4	670.56	2,086.3	2,756.8	1.9312	4.8288	6.7600
650	162.01	1.1044	292.7	683.56	1,886.5	2,570.1	684.28	2,076.0	2,760.3	1.9627	4.7703	6.7331
700	164.97	1.1080	272.9	696.44	1,876.1	2,572.5	697.22	2,066.3	2,763.5	1.9922	4.7158	6.7080
750	167.78	1.1115	255.6	708.64	1,866.1	2,574.7	709.47	2,057.0	2,766.4	2.0200	4.6647	6.6847
800	170.43	1.1148	240.4	720.22	1,856.6	2,576.8	721.11	2,048.0	2,769.1	2.0462	4.6166	6.6628
850	172.96	1.1181	227.0	731.27	1,847.4	2,578.7	732.22	2,039.4	2,771.6	2.0710	4.5711	6.6421
900	175.38	1.1212	215.0	741.83	1,868.6	2,580.5	742.83	2,031.1	2,773.9	2.0946	4.5280	6.6226
950	177.69	1.1243	204.2	751.95	1,830.2	2,582.1	753.02	2,023.1	2,776.1	2.1172	4.4869	6.6041
1,000	179.91	1.1273	194.44	761.68	1,822.0	2,583.6	762.81	2,015.3	2,778.1	2.1387	4.4478	6.5865
1,100	184.09	1.1330	177.53	780.09	1,806.3	2,586.4	781.34	2,000.4	2,781.7	2.1792	4.3744	6.5536
1,200	187.99	1.1385	163.33	797.29	1,791.5	2,588.8	798.65	1,986.2	2,784.8	2.2166	4.3067	6.5233
1,300	191.64	1.1438	151.25	813.44	1,777.5	2,591.0	814.93	1,972.7	2,787.6	2.2515	4.2438	6.4953
1,400	195.07	1.1489	140.84	828.70	1,764.1	2,592.8	830.30	1,959.7	2,790.0	2.2842	4.1850	6.4693
1,500	198.32	1.1539	131.77	843.16	1,751.3	2,594.5	844.89	1,947.3	2,792.2	2.3150	4.1298	6.4448
1,750	205.76	1.1656	113.49	876.46	1,721.4	2,597.8	878.50	1,917.9	2,796.4	2.3851	4.0044	6.3896

Note: 100k Pa = 1 Bar = 100,000N/m^2

Properties of Saturated Steam - Pressure Table

Table 1 (continued...)

		Specific Volume		Internal Energy			Enthalpy			Entropy		
Press k Pa	Temp °C	Sat. Liquid	Sat. Vapor	Sat. Liquid	Evap.	Sat. Vapor	Sat. Liquid	Evap.	Sat. Vapor	Sat. Liquid	Evap.	Sat. Vapor
p	t	V_f	V_g	U_f	U_{fg}	U_g	H_f	H_{fg}	H_g	S_f	S_{fg}	S_g
2,000	212.42	1.1767	99.63	906.44	1,693.8	2,600.3	908.79	1,890.7	2,799.5	2.4474	3.8935	6.3409
2,250	218.45	1.1872	88.75	933.83	1,668.2	2,602.0	936.49	1,865.2	2,801.7	2.5035	3.7937	6.2972
2,500	223.99	1.1973	79.98	959.11	1,644.0	2,603.1	962.11	1,841.0	2,803.1	2.5547	3.7028	6.2575
3,000	233.90	1.2165	66.68	1,004.78	1,599.3	2,604.1	1,008.42	1,795.7	2,804.2	2.6457	3.5412	6.1869
3,500	242.60	1.2347	57.07	1,045.43	1,558.3	2,603.7	1,049.75	1,753.7	2,803.4	2.7253	3.4000	6.1253
4,000	250.40	1.2522	49.78	1,082.31	1,520.0	2,602.3	1,087.31	1,714.1	2,801.4	2.7964	3.2737	6.0701
5,000	263.99	1.2859	39.44	1,147.81	1,449.3	2,597.1	1,154.23	1,640.1	2,794.3	2.9202	3.0532	5.9734
6,000	275.64	1.3187	32.44	1,205.44	1,384.3	2,589.7	1,213.35	1,571.0	2,784.3	3.0267	2.8625	5.8892
7,000	285.88	1.3513	27.37	1,257.55	1,323.0	2,580.5	1,267.00	1,505.1	2,772.1	3.1211	2.6922	5.8133
8,000	295.06	1.3842	23.52	1,305.57	1,264.2	2,569.8	1,316.64	1,441.3	2,758.0	3.2068	2.5364	5.7432
9,000	303.40	1.4178	20.48	1,350.51	1,207.3	2,557.8	1,363.26	1,378.9	2,742.1	3.2858	2.3915	5.6772
10,000	311.06	1.4524	18.026	1,393.04	1,151.4	2,544.4	1,407.56	1,317.1	2,724.7	3.3596	2.2544	5.6141
11,000	318.15	1.4886	15.987	1,433.7	1,096.0	2,529.8	1,450.1	1,255.5	2,705.6	3.4295	2.1233	5.5527
12,000	324.75	1.5267	14.263	1,473.0	1,040.7	2,513.7	1,491.3	1,193.6	2,684.9	3.4962	1.9962	5.4924
13,000	330.93	1.5671	12.780	1,511.1	985.0	2,496.1	1,531.5	1,130.7	2,662.2	3.5606	1.8718	5.4323
14,000	336.75	1.6107	11.485	1,548.6	928.2	2,476.8	1,571.1	1,066.5	2,637.6	3.6232	1.7485	5.3717
15,000	342.24	1.6581	10.337	1,585.6	869.8	2,455.5	1,610.5	1,000.0	2,610.5	3.6848	1.6249	5.3098
16,000	347.44	1.7107	9.306	1,622.7	809.0	2,431.7	1,650.1	930.6	2,580.6	3.7461	1.4994	5.2455
17,000	352.37	1.7702	8.364	1,660.2	744.8	2,405.0	1,690.3	856.9	2,547.2	3.8079	1.3698	5.1777
18,000	357.06	1.8397	7.489	1,698.9	675.4	2,374.3	1,732.0	777.1	2,509.1	3.8715	1.2329	5.1044
19,000	361.54	1.9243	6.657	1,739.9	598.1	2,338.1	1,776.5	688.0	2,464.5	3.9388	1.0839	5.0228
20,000	365.81	2.036	5.834	1,785.6	507.5	2,293.0	1,826.3	583.4	2,409.7	4.039	0.9130	4.9269
21,000	369.89	2.207	4.952	1,842.1	388.5	2,230.6	1,888.4	446.2	2,334.6	4.1075	0.6938	4.8013
22,000	373.80	2.742	3.568	1,961.9	125.2	2,087.1	2,022.2	143.4	2,165.6	4.3110	0.2216	4.5327
22,090	374.14	3.155	3.155	2,029.6	0	2,029.6	2,099.3	0	2,099.3	4.4298	0	4.4298

Note: 100k Pa = 1 Bar = 100,000N/m^2

Properties of Saturated Steam - Temperature Table

Table 2

		Specific Volume		Internal Energy			Enthalpy			Entropy		
Temp °C	Press. k Pa	Sat. Liquid	Sat. Vapor	Sat. Liquid	Evap.	Sat. Vapor	Sat. Liquid	Evap.	Sat. Vapor	Sat. Liquid	Evap.	Sat. Vapor
t	p	V_f	V_g	U_f	U_{fg}	U_g	H_f	H_{fg}	H_g	S_f	S_{fg}	S_g
0	0.6109	1.0002	206,278	0.000	2,375.4	2,375.3	0.000	2,501.4	2,501.3	0.000	9.1566	9.1565
5	0.8721	1.0001	147,120	20.97	2,361.3	2,382.3	20.98	2,489.6	2,510.6	0.0761	8.9496	9.0257
10	1.2276	1.0004	106,379	42.00	2,347.2	2,389.2	42.01	2,477.7	2,519.8	0.1510	8.7498	8.9008
15	1.7051	1.0009	77,926	62.99	2,333.1	2,396.1	62.99	2,465.9	2,528.9	0.2245	8.5569	8.7814
20	2.339	1.0018	57,791	83.95	2,319.0	2,402.9	83.96	2,454.1	2,538.1	0.2966	8.3706	8.6672
25	3.169	1.0029	43,360	104.88	2,304.9	2,409.8	104.89	2,442.3	2,547.2	0.3674	8.1905	8.5580
30	4.246	1.0043	32,894	125.78	2,290.8	2,416.6	125.79	2,430.5	2,556.3	0.4369	8.0164	8.4533
35	5.628	1.0060	25,216	146.67	2,276.7	2,423.4	146.68	2,418.6	2,565.3	0.5053	7.8478	8.3531
40	7.384	1.0078	19,523	167.56	2,262.6	2,430.1	167.57	2,406.7	2,574.3	0.5725	7.6845	8.2570
45	9.593	1.0099	15,258	188.44	2,248.4	2,436.8	188.45	2,394.8	2,583.2	0.6387	7.5261	8.1648
50	12.349	1.0121	12,032	209.32	2,234.2	2,443.5	209.33	2,382.7	2,592.1	0.7038	7.3725	8.0763
60	19.940	1.0172	7,671	251.11	2,205.5	2,456.6	251.13	2,358.5	2,609.6	0.8312	7.0784	7.9096
70	31.19	1.0228	5,042	292.95	2,176.6	2,469.6	292.98	2,333.8	2,626.8	0.9549	6.8004	7.7553
80	47.39	1.0291	3,407	334.86	2,147.4	2,482.2	334.91	2,308.8	2,643.7	1.0753	6.5369	7.6122
90	70.14	1.0360	2,361	376.85	2,117.7	2,494.5	376.92	2,283.2	2,660.1	1.1925	6.2866	7.4791
100	101.35	1.0435	1,672.9	418.94	2,087.6	2,506.5	419.04	2,257.0	2,676.1	1.3069	6.0480	7.3549
110	143.27	1.0516	1,210.2	461.14	2,057.0	2,518.1	461.30	2,230.2	2,691.5	1.4185	5.8202	7.2387
120	198.53	1.0603	891.9	503.50	2,025.8	2,529.3	503.71	2,202.6	2,706.3	1.5276	5.6020	7.1296
130	270.1	1.0697	668.5	546.02	1,993.9	2,539.9	546.31	2,174.2	2,720.5	1.6344	5.3925	7.0269
140	361.3	1.0797	508.9	588.74	1,961.3	2,550.0	589.13	2,144.7	2,733.9	1.7391	5.1908	6.9299
150	475.8	1.0905	392.8	631.68	1,927.9	2,559.5	632.20	2,114.3	2,746.5	1.8418	4.9960	6.8379
160	617.8	1.1020	307.1	674.87	1,893.5	2,568.4	675.55	2,082.6	2,758.1	1.9427	4.8075	6.7502
170	791.7	1.1143	242.8	718.33	1,858.1	2,576.5	719.21	2,049.5	2,768.7	2.0419	4.6244	6.6662
180	1002.1	1.1274	194.05	762.09	1,821.6	2,583.7	763.22	2,015.0	2,778.2	2.1396	4.4461	6.5857
190	1254.4	1.1414	156.54	806.19	1,783.8	2,590.0	807.62	1,978.8	2,786.4	2.2359	4.2720	6.5079
200	1553.8	1.1565	127.36	850.65	1,744.7	2,595.3	852.45	1,940.7	2,793.2	2.3309	4.1014	6.4323
210	1906.2	1.1726	104.41	895.53	1,703.9	2,599.5	897.76	1,900.7	2,798.5	2.4248	3.9337	6.3585
220	2318	1.1900	86.19	940.87	1,661.5	2,602.4	943.62	1,858.5	2,802.1	2.5178	3.7683	6.2861
230	2795	1.2088	71.58	986.74	1,617.2	2,603.9	990.12	1,813.8	2,804.0	2.6099	3.6047	6.2146
240	3344	1.2291	59.76	1,033.21	1,570.8	2,604.0	1,037.32	1,766.5	2,803.8	2.7015	3.4422	6.1437
250	3973	1.2512	50.13	1,080.39	1,522.0	2,602.4	1,085.36	1,716.2	2,801.5	2.7927	3.2802	6.0730
260	4688	1.2755	42.21	1,128.39	1,470.6	2,599.0	1,134.37	1,662.5	2,796.9	2.8838	3.1181	6.0019
270	5499	1.3023	35.64	1,177.36	1,416.3	2,593.7	1,184.51	1,605.2	2,789.7	2.9751	2.9551	5.9301
280	6412	1.3321	30.17	1,227.46	1,358.7	2,586.1	1,235.99	1,543.6	2,779.6	3.0668	2.7903	5.8571
290	7436	1.3656	25.57	1,278.92	1,297.1	2,576.0	1,289.07	1,477.1	2,766.2	3.1594	2.6227	5.7821
300	8581	1.4036	21.67	1,332.0	1,231.0	2,563.0	1,344.0	1,404.9	2,749.0	3.2534	2.4511	5.7045
310	9856	1.4474	18.350	1,387.1	1,159.4	2,546.4	1,401.3	1,326.0	2,727.3	3.3493	2.2737	5.6230
320	11274	1.4988	15.488	1,444.6	1,080.9	2,525.5	1,461.5	1,238.6	2,700.1	3.4480	2.0882	5.5362
330	12845	1.5607	12.996	1,505.3	993.7	2,498.9	1,525.3	1,140.6	2,665.9	3.5507	1.8909	5.4417
340	14586	1.6379	10.797	1,570.3	894.3	2,464.6	1,594.2	1,027.9	2,622.0	3.6594	1.6763	5.3357
350	16513	1.7403	8.813	1,641.9	776.6	2,418.4	1,670.6	893.4	2,563.9	3.7777	1.4335	5.2112
360	18651	1.8925	6.945	1,725.2	626.3	2,351.5	1,760.5	720.5	2,481.0	3.9147	1.1379	5.0526
370	21030	2.213	4.925	1,844.0	384.5	2,228.5	1,890.5	441.6	2,332.1	4.1106	0.6865	4.7971
374.136	22090	3.155	3.155	2,029.6	0	2,029.6	2,099.3	0	2,099.3	4.4298	0	4.4298

Note: 100k Pa = 1 Bar = 100,000N/m^2

Table of Properties for Superheated Steam

Table 3

Abs Press. kPa (Sat. Temp)		Temperature Degrees Celsius											
		100	150	200	250	300	400	500	600	700	800	900	1,000
	v	17,196	19,512	21,825	24,136	26,445	31,063	35,679	40,295	44,911	49,526	54,141	58,757
10	*h*	2,687.5	2,783.0	2,879.5	2,977.3	3,076.5	3,279.6	3,489.1	3,705.4	3,928.7	4159.0	4,396.4	4,640.6
(45.81)	*s*	8.4479	8.6882	8.9038	9.1002	9.2813	9.6077	9.8978	10.1608	10.4028	10.6281	10.8396	11.0393
	v	5,715	6,493	7,267	8,040	8,811	10,351	1,1891	13,430	14,969	16,508	18,047	19,585
30	*h*	2,685.0	2,781.5	2,878.6	2,976.7	3,076.0	3,279.2	3,488.9	3,705.3	3,928.6	4,158.9	4,396.4	4,640.5
(69.10)	*s*	7.9357	8.1785	8.3952	8.5923	8.7736	9.1003	9.3906	9.6537	9.8957	10.1210	10.3325	10.5322
	v	3,418	3,889	4,356	4,820	5,284	6,209	7,134	8,057	8,981	9,904	10,828	11,751
50	*h*	2,682.5	2,780.1	2,877.7	2,976.0	3,075.5	3,278.9	3,488.7	3,705.1	3,928.5	4,158.9	4,396.3	4,640.5
(81.33)	*s*	7.6947	7.9401	8.1580	8.3556	8.5373	8.8642	9.1546	9.4178	9.6599	9.8852	10.0967	10.2964
	v	1,695.8	1,936.4	2,172	2,406	2,639	3,103	3,565	4,028	4,490	4,952	5,414	5,875
100	*h*	2,676.2	2,776.4	2,875.3	2,974.3	3,074.3	3,278.2	3,488.1	3,704.7	3,928.2	4,158.6	4,396.1	4,640.3
(99.63)	*s*	7.3614	7.6134	7.8343	8.0333	8.2158	8.5435	8.8342	9.0976	9.3398	9.5652	9.7767	9.9764
	v		959.6	1,080.3	1,198.8	1,316.2	1,549.3	1,781.4	2,013	2,244	2,475	2,706	2,937
200	*h*		2,768.8	2,870.5	2,971.0	3,071.8	3,276.6	3,487.1	3,704.0	3,927.6	4,158.2	4,395.8	4,640.0
(120.23)	*s*		7.2795	7.5066	7.7086	7.8926	8.2218	8.5133	8.7770	9.0194	9.2449	9.4566	9.6563
	v		633.9	716.3	796.4	875.3	1,031.5	1,186.7	1,341.4	1,495.7	1,649.9	1,804.1	1,958.1
300	*h*		2761.0	2,865.6	2,967.6	3,069.3	3,275.0	3,486.0	3,703.2	3,927.1	4,157.8	4,395.4	4,639.7
(133.55)	*s*		7.0778	7.3115	7.5166	7.7022	8.0330	8.3251	8.5892	8.8319	9.0576	9.2692	9.4690
	v			424.9	474.4	522.6	617.3	710.9	804.1	896.9	989.6	1,082.2	1,174.7
500	*h*			2,855.4	2,960.7	3,064.2	3,271.9	3,483.9	3,701.7	3,925.9	4,156.9	4,394.7	4,639.1
(151.86)	*s*			7.0592	7.2709	7.4599	7.7938	8.0873	8.3522	8.5952	8.8211	9.0329	9.2328
	v			206.0	232.7	257.9	306.6	354.1	401.1	447.8	494.3	540.7	587.1
1,000	*h*			2,827.9	2,942.6	3,051.2	3,263.9	3,478.5	3,697.9	3,923.1	4,154.7	4,392.9	4,637.6
(179.91)	*s*			6.6940	6.9247	7.1229	7.4651	7.7622	8.0290	8.2731	8.4966	8.7118	8.9119
	v				111.44	125.47	151.20	175.68	199.60	223.2	246.7	270.0	293.3
2,000	*h*				2,902.5	3,023.5	3,247.6	3,467.6	3,690.1	3,917.4	4,150.3	4,389.4	4,634.6
(212.43)	*s*				6.5453	6.7664	7.1271	7.4317	7.7024	7.9487	8.1765	8.3895	8.5901
	v				70.58	81.14	99.36	116.19	132.43	148.38	164.14	197.80	195.41
3,000	*h*				2,855.8	2,993.5	3,230.9	3,456.5	3,682.3	3,911.7	4,145.9	4,385.9	4,631.6
(233.90)	*s*				6.2872	6.5390	6.9212	7.2338	7.5085	7.7571	7.9862	8.1999	8.4009
	v					58.84	73.41	86.43	98.95	110.95	122.87	134.69	146.45
4,000	*h*					2,960.7	3,213.6	3,445.3	3,674.4	3,905.9	4,141.5	4,382.3	4,628.7
(250.40)	*s*					6.3615	6.7690	7.0901	7.3688	7.6198	7.8502	8.0647	8.2662
	v					45.32	57.81	68.57	78.69	88.49	98.11	107.62	117.07
5,000	*h*					2,924.5	3,195.7	3,433.8	3,666.5	3,900.1	4,137.1	4,378.8	4,625.7
(263.99)	*s*					6.2084	6.6459	6.9759	7.2589	7.5122	7.7440	7.9593	8.1612
	v					36.16	47.39	56.65	65.25	73.52	81.60	89.58	97.49
6,000	*h*					2,884.2	3,177.2	3,422.2	3,658.4	3,894.2	4,132.7	4,375.3	4,622.7
(275.64)	*s*					6.0674	6.5408	6.8803	7.1677	7.4234	7.6566	7.8727	8.0751

Note: 100k Pa = 1 Bar = 100,000N/m^2

Table of Properties for Superheated Steam

Table 3 (continued...)

Abs Press. kPa (Sat. Temp)		Temperature Degrees Celsius											
		100	150	200	250	300	400	500	600	700	800	900	1,000
	v					29.47	39.93	48.14	55.65	62.83	69.81	76.69	83.50
7,000	*h*					2,838.4	3,158.1	3,410.3	3,650.3	3,888.3	4,128.2	4,371.8	4,619.8
(285.88)	*s*					5.9305	6.4478	6.7975	7.0894	7.3476	7.5822	7.7991	8.0020
	v					24.26	34.32	41.75	48.45	54.81	60.97	67.02	73.01
8,000	*h*					2,785.0	3,138.3	3,398.3	3,642.0	3,882.4	4,123.8	4,368.3	4,616.9
(295.06)	*s*					5.7906	6.3634	6.7240	7.0206	7.2812	7.5173	7.7351	7.9384
	v						29.93	36.77	42.85	48.57	54.09	59.50	64.85
9,000	*h*						3,117.8	3,386.1	3,633.7	3,876.5	4,119.3	4,364.8	4,614.0
(303.40)	*s*						6.2854	6.6576	6.9589	7.2221	7.4596	7.6783	7.8821
	v						26.41	32.79	38.37	43.58	48.59	53.49	58.32
10,000	*h*						3,096.5	3,373.7	3,625.3	3,870.5	4,114.8	4,361.2	4,611.0
(311.06)	*s*						6.2120	6.5966	6.9029	7.1687	7.4077	7.6262	7.8315
	v						23.51	29.52	34.70	39.50	44.09	48.57	52.98
11,000	*h*						3,074.3	3,361.0	3,616.9	3,864.5	4,110.4	4,357.7	4,608.1
(318.15)	*s*						6.1420	6.5400	6.8514	7.1199	7.3605	7.5808	7.7856
	v						21.08	26.80	31.64	36.10	40.34	44.47	48.53
12,000	*h*						3,051.3	3,348.2	3,608.3	3,858.4	4,105.9	4,354.2	4,605.3
(324.75)	*s*						6.0747	6.4871	6.8037	7.0749	7.3170	7.5382	4.7435
	v						19.007	24.50	29.05	33.22	37.17	41.00	44.77
13,000	*h*						3,027.2	3,335.2	3,599.7	3,852.3	4,101.4	4,350.7	4,602.4
(330.93)	*s*						6.0091	6.4371	6.7591	7.0331	7.2767	7.4988	7.7047
	v						17.216	22.52	26.83	30.75	34.45	38.03	41.54
14,000	*h*						3,001.9	3,322.0	3,591.1	3,846.2	4,096.9	4,347.2	4,599.5
(336.75)	*s*						5.9448	6.3897	6.7172	6.9939	7.2392	7.4622	7.6685
	v						15.649	20.80	24.91	28.61	32.10	35.46	38.75
15,000	*h*						2,975.5	3,308.6	3,582.3	3,840.1	4,092.4	4,343.8	4,596.6
(342.24)	*s*						5.8811	6.3443	6.6776	6.9572	7.2040	7.4279	7.6348
	v						14.262	19.296	23.23	26.74	30.03	33.20	36.30
16,000	*h*						2,947.6	3,294.9	3,573.5	3,833.9	4,087.8	4,340.3	4,593.8
(347.44)	*s*						5.8175	6.3007	6.6399	6.9224	7.1708	7.3957	7.6031
	v						13.021	17.967	21.74	25.09	28.22	31.22	34.14
17,000	*h*						2,918.2	3,281.1	3,564.6	3,827.7	4,083.3	4,336.8	4,590.9
(352.37)	*s*						5.7536	6.2587	6.6040	6.8894	7.1395	7.3653	7.5732
	v						11.901	16.784	20.42	23.62	26.60	29.45	32.23
18,000	*h*						2,887.0	3,267.0	3,555.6	3,821.5	4,078.8	4,333.3	4,588.1
(357.06)	*s*						5.6887	6.2181	6.5696	6.8580	7.1098	7.3365	7.5779
	v						10.881	15.724	19.241	22.31	25.15	27.87	30.51
19,000	*h*						2,853.8	3,252.7	3,546.6	3,815.3	4,074.3	4,329.8	4,585.3
(361.54)	*s*						5.6224	6.1786	6.5366	6.8281	7.0814	7.3091	7.5181

Note: 100k Pa = 1 Bar = 100,000N/m^2

Table of Properties for Superheated Steam

Table 3 (continued...)

Abs Press. kPa (Sat. Temp)		Temperature Degrees Celsius											
		100	150	200	250	300	400	500	600	700	800	900	1,000
	v						9.942	14.768	18.178	21.13	23.85	26.45	28.97
20,000	*h*						2,818.1	3,238.2	3,537.6	3,809.0	4,069.7	4,326.4	4,582.5
(365.81)	*s*						5.5540	6.1401	6.5048	6.7993	7.0544	7.2830	7.4925
	v						9.071	13.903	17.216	20.06	22.68	25.16	27.57
21,000	*h*						2,779.6	3,223.5	3,528.4	3,802.8	4,065.2	4,322.9	4,579.6
(369.89)	*s*						5.4826	6.1026	6.4741	6.7717	7.0285	7.2581	7.4681
	v						8.253	13.115	16.341	19.092	21.61	23.99	26.30
22,000	*h*						2,737.6	3,208.6	3,519.2	3,796.5	4,060.6	4,319.5	4,576.8
(373.80)	*s*						5.4074	6.0658	6.4444	6.7451	7.0036	7.2342	7.4448
	v						7.478	12.394	15.543	18.206	20.63	22.92	25.14
23,000	*h*						2,691.2	3,193.4	3,510.0	3,790.2	4,056.2	4,316.0	4,574.0
	s						5.3269	6.0297	6.4155	6.7195	6.9798	7.2113	7.4224
	v						6.732	11.733	14.811	17.393	19.735	21.944	24.08
24,000	*h*						2,639.4	3,178.0	3,500.7	3,783.8	4,051.6	4,312.5	4,571.3
	s						5.2393	5.9942	6.3875	6.6947	6.9567	7.1892	7.4009
	v						6.004	11.123	14.137	16.646	18.912	21.045	23.10
25,000	*h*						2,580.2	3,162.4	3,491.4	3,777.5	4,047.1	4,309.1	4,568.5
	s						5.1418	5.9592	6.3602	6.6707	6.9345	7.1680	7.3802
	v						5.280	10.560	13.516	15.957	18.153	20.214	22.20
26,000	*h*						2,510.9	3,146.6	3,482.0	3,777.1	4,042.5	4,305.7	4,565.7
	s						5.0306	5.9248	6.3336	6.6475	6.9130	7.1475	7.3602
	v						4.550	10.038	12.941	15.319	17.450	19.446	21.37
27,000	*h*						2,428.2	3,130.5	3,472.5	3,764.8	4,038.0	4,302.2	4,562.9
	s						4.9003	5.8907	6.3077	6.6248	6.8922	7.1276	7.3409
	v						3.831	9.553	12.407	14.727	16.797	18.732	20.59
28,000	*h*						2,330.7	3,114.3	3,463.0	3,758.4	4,033.4	4,298.8	4,560.2
	s						4.7494	5.8570	6.2823	6.6029	6.8720	7.1084	7.3223
	v						3.214	9.101	11.910	14.175	16.190	18.068	19.869
29,000	*h*						2,231.1	3,097.8	3,453.5	3,752.0	4,028.8	4,295.4	4,557.4
	s						4.5962	5.8236	6.2574	6.5814	6.8523	7.0898	7.3042
	v						2.790	8.678	11.446	13.661	15.623	17.448	19.196
30,000	*h*						2,151.1	3,081.1	3,443.9	3,745.6	4,024.2	4,291.9	4,554.7
	s						4.4728	5.7905	6.2331	6.5606	6.8332	7.0718	7.2867
	v						2.527	8.283	11.012	13.180	15.093	16.868	18.567
31,000	*h*						2,095.0	3,064.1	3,434.3	3,739.2	4,019.7	4,288.5	4,551.9
	s						4.3856	5.7576	6.2092	6.5402	6.8147	7.0542	7.2697
	v						2.361	7.912	10.606	12.729	14.597	16.325	17.977
32,000	*h*						2,055.9	3,047.0	3,424.6	3,732.8	4,015.1	4,285.1	4,549.2
	s						4.3239	5.7250	6.1858	6.5203	6.7966	7.0372	7.2533

Note: 100k Pa = 1 Bar = 100,000N/m^2

Table of Properties for Superheated Steam

Table 3 (continued...)

Abs Press. kPa (Sat. Temp)		Temperature Degrees Celsius											
		100	150	200	250	300	400	500	600	700	800	900	1,000
	v						2.247	7.564	10.224	12.306	14.130	15.815	17.423
33,000	*h*						2,027.3	3,029.6	3,415.0	3,726.4	4,010.6	4,281.7	4,546.5
	s						4.2781	5.6925	6.1628	6.5008	6.7790	7.0206	7.2372
	v						2.164	7.236	9.865	11.908	13.691	15.335	16.901
34,000	*h*						2,005.3	3,012.1	3,405.2	3,719.9	4,006.0	4,278.3	4,543.8
	s						4.2421	5.6603	6.1401	6.4818	6.7618	7.0044	7.2216
	v						2.100	6.927	9.527	11.533	13.278	14.833	16.410
35,000	*h*						1,987.6	2,994.4	3,395.5	3,713.5	4001.5	4,274.9	4,541.1
	s						4.2126	5.6282	6.1179	6.4631	6.7450	6.9886	7.7.2064
	v						2.048	6.636	9.208	11.179	12.887	14.456	15.946
36,000	*h*						1,972.8	2976.4	3,385.7	3,707.0	4,996.9	4,271.5	4,538.4
	s						4.1875	5.5962	6.0960	6.4448	6.7285	6.9732	7.1916
	v						2.005	6.361	8.907	10.844	12.518	14.052	15.507
37,000	*h*						1,960.2	2958.4	3,375.9	3,700.6	3,992.4	4,268.1	4,535.7
	s						4.1658	5.5644	6.0744	6.4269	6.7125	6.9582	7.1771
	v						1.9679	6.101	8.621	10.527	12.169	13.670	15.092
38,000	*h*						1,949.2	2,940.1	3,366.1	3,694.1	3,987.8	4,264.7	4,533.0
	s						4.1466	5.5328	6.0531	6.4093	6.6967	6.9435	7.1630

Note: 100k Pa = 1 Bar = 100,000N/m^2

power engineering
TRAINING SYSTEMS

Properties of Refrigerants in SI Units

Disclaimer: For information and educational purposes only, this document contains tables for R12 and R22 refrigerants. The student should know that since 1990, under a 93-nation agreement, called the Montreal Protocol, the production and use of Chlorofluorocarbons (CFC's) and Hydrochlorofluorocarbons (HCFC's), including R12 and R22, have been largely phased out, due to environmental impact.

For the use of students and examination candidates, these tables have been:

Approved by the Association of Chief Inspectors (ACI) as recommended by the Standardization of Power Engineer Examinations Committee (SOPEEC) and the Interprovincial Power Engineering Curriculum Committee (IPECC).

Properties of Refrigerants In SI Units

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Table 1 — Refrigerant 717 (Ammonia) Properties of Liquid and Saturated Vapour

Temperature t°C	Absolute Pressure kPa	Volume Vapor v_g m³/kg	Density Liquid $1/v_f$ kg/m³	Enthalpy Liquid h_f kJ/kg	Enthalpy Vapor h_g kJ/kg	Entropy Liquid s_f kJ/kgK	Entropy Vapor s_g kJ/kgK
-76	6.92	13.8216	732.076	-158.867	1326.71	-0.740229	6.797464
-75	7.49	12.8414	730.922	-154.447	1328.62	-0.717620	6.768826
-74	8.09	11.9481	729.769	-150.051	1330.50	-0.695388	6.740565
-73	8.74	11.1247	728.616	-145.655	1332.20	-0.663778	6.712639
-72	9.42	10.3668	727.575	-141.259	1334.04	-0.647994	6.685048
-71	10.14	9.6663	726.277	-136.862	1335.92	-0.629781	6.658043
-70	10.96	9.00836	725.316	-132.583	1337.69	-0.607926	6.631080
-69	11.76	8.41841	724.163	-125.884	1339.57	-0.586447	6.604703
-68	12.62	7.86842	723.009	-123.279	1341.46	-0.564969	6.578661
-67	13.59	7.36275	721.856	-119.394	1343.34	-0.543491	6.552954
-66	14.58	6.89080	720.703	-114.998	1345.08	-0.522263	6.519292
-65	15.64	6.44881	719.549	-110.486	1347.92	-0.501162	6.488728
-64	16.76	6.04821	718.396	-106.089	1348.76	-0.480060	6.463858
-63	17.93	5.67508	717.243	-101.693	1349.60	-0.458959	6.450377
-62	19.15	5.32854	716.089	-97.297	1351.25	-0.438150	6.428940
-61	20.48	5.00622	714.936	-92.901	1353.69	-0.417426	6.405076
-60	21.91	4.70270	713.783	-88.388	1355.83	-0.396492	6.368567
-59	23.40	4.42514	712.629	-83.992	1357.71	-0.375767	6.356885
-58	24.94	4.16607	711.476	-79.596	1359.41	-0.355377	6.335156
-57	26.59	3.92460	710.323	-75.200	1361.25	-0.335029	6.312463
-56	28.35	3.70660	709.169	-70.804	1362.99	-0.314681	6.289854
-55	30.18	3.49503	707.936	-66.408	1364.67	-0.294333	6.267664
-54	32.09	3.29245	706.702	-62.011	1366.44	-0.269631	6.245432
-53	34.12	3.10741	705.549	-57.615	1368.25	-0.246269	6.223870
-52	36.28	2.93705	704.396	-53.173	1369.93	-0.234211	6.202392
-51	38.53	2.77692	703.242	-48.707	1371.60	-0.214198	6.181165
-50	40.86	2.62510	702.089	-44.427	1373.28	-0.194268	6.160063
-49	43.34	2.48519	700.792	-40.031	1374.95	-0.174674	6.139338
-48	45.93	2.35378	699.622	-35.448	1376.81	-0.155080	6.118949
-47	48.68	2.23086	698.469	-31.006	1378.53	-0.135192	6.098894
-46	51.55	2.11531	697.220	-26.610	1380.21	-0.115724	6.078671
-45	54.50	2.00519	696.002	-22.330	1381.65	-0.096297	6.058742
-44	57.66	1.90349	694.849	-17.724	1383.53	-0.077079	6.039148
-43	60.94	1.80779	693.567	-13.305	1385.05	-0.057527	6.019888
-42	64.37	1.71764	692.382	-8.909	1386.67	-0.038226	6.000671
-41	67.96	1.63262	691.229	-4.512	1388.35	-0.019008	5.981705
-40	71.73	1.55196	690.075	0.000	1390.02	0.000000	5.962864
-39	75.63	1.47723	688.778	4.396	1391.49	0.019217	5.944400
-38	79.76	1.40600	687.480	8.978	1393.14	0.038100	5.925936
-37	84.06	1.33914	686.295	13.421	1394.81	0.056941	5.907765
-36	88.52	1.27603	685.046	17.817	1396.35	0.075781	5.889678
-35	93.15	1.21610	683.828	22.330	1397.93	0.094622	5.872010
-34	97.99	1.15991	682.675	26.726	1399.40	0.113086	5.854300
-33	103.05	1.10672	681.650	31.308	1401.05	0.131885	5.836925
-32	108.33	1.05653	680.304	35.751	1402.56	0.150432	5.819591
-31	113.82	1.00896	678.959	40.147	1404.03	0.168896	5.802258
-30	119.47	0.963264	677.741	44.659	1405.61	0.187569	5.785343
-29	125.43	0.921125	676.444	49.265	1407.07	0.206033	5.768763
-28	131.60	0.880983	675.146	53.684	1408.54	0.224162	5.751848
-27	137.99	0.842403	673.849	58.080	1410.00	0.242542	5.735478
-26	144.65	0.806070	672.647	62.616	1411.47	0.260755	5.719275
-25	151.51	0.771610	671.334	67.222	1413.05	0.278842	5.702863
-24	158.71	0.739022	670.036	71.618	1414.31	0.296929	5.687037
-23	166.12	0.707933	668.867	76.200	1415.75	0.315016	5.671210
-22	173.85	0.678342	667.601	80.806	1417.21	0.332810	5.655384
-21	181.87	0.650524	666.304	85.272	1418.54	0.350771	5.639809
-20	190.10	0.623718	665.087	89.784	1420.03	0.368440	5.624151
-19	198.72	0.598435	663.789	94.180	1421.28	0.386527	5.609078
-18	207.61	0.574400	662.492	98.762	1422.73	0.404279	5.593671
-17	216.83	0.551526	661.194	103.368	1424.03	0.421989	5.578514
-16	226.34	0.529726	659.897	107.834	1425.29	0.439699	5.563693
-15	236.19	0.508788	658.519	114.905	1426.54	0.457200	5.548788
-14	246.35	0.489011	657.077	117.208	1427.80	0.474534	5.534092
-13	256.92	0.470133	655.892	121.557	1429.24	0.492202	5.519731
-12	267.81	0.452153	654.626	126.163	1430.54	0.509619	5.505119
-11	279.08	0.434961	653.329	130.768	1431.80	0.526953	5.490675
-10	290.62	0.418455	652.112	135.374	1433.05	0.544286	5.476775
-9	302.65	0.402835	650.670	139.770	1434.10	0.561620	5.462456
-8	315.07	0.387915	649.356	144.352	1435.33	0.578953	5.448472
-7	327.87	0.373650	648.059	148.958	1436.59	0.595993	5.434530
-6	341.06	0.359997	646.761	153.563	1437.71	0.613201	5.420839
-5	354.67	0.346850	645.384	158.169	1438.87	0.630116	5.407273
-4	368.72	0.334377	644.086	162.774	1439.92	0.647449	5.393708
-3	383.14	0.322453	642.661	167.380	1441.15	0.664448	5.380143
-2	398.07	0.314094	641.331	171.985	1442.24	0.681404	5.366871
-1	413.41	0.301827	639.938	176.591	1443.29	0.698361	5.353682
0	429.22	0.289478	638.496	181.196	1444.45	0.714690	5.340284
1	445.50	0.279478	637.198	185.802	1445.50	0.732023	5.327473
2	462.20	0.269876	635.773	190.407	1446.55	0.748687	5.314326
3	479.48	0.260631	634.443	195.176	1447.59	0.765266	5.301431
4	497.22	0.251772	633.146	199.851	1448.64	0.781846	5.288619
5	515.48	0.243282	631.768	204.456	1449.57	0.798845	5.276226
6	534.16	0.235135	630.326	209.062	1450.62	0.815424	5.263414
7	553.51	0.227338	628.885	213.667	1451.48	0.832004	5.250938
8	573.35	0.219803	627.443	218.436	1452.48	0.848584	5.238503
9	593.69	0.212592	626.098	223.111	1453.38	0.864913	5.226068
10	614.53	0.205638	624.720	227.716	1454.22	0.881325	5.213843
11	636.04	0.199008	623.278	232.531	1455.27	0.897905	5.213089
12	658.11	0.192628	621.837	237.160	1456.13	0.914.50	5.192239
13	680.78	0.186454	620.395	241.928	1456.97	0.930646	5.177668

Table 1 Cont'd

Temperature t° C	Absolute Pressure kPa	Volume Vapor v_g m³/kg	Density Liquid $1/v_f$ kg/m³	Enthalpy Liquid h_f kJ/kg	Enthalpy Vapor h_g kJ/kg	Entropy Liquid s_f kJ/kgK	Entropy Vapor s_g kJ/kgK
14	704.03	0.180554	618.953	246.604	1457.80	0.946974	5.165610
15	727.59	0.174798	617.512	251.442	1458.64	0.963386	5.153971
16	752.40	0.169348	616.070	256.047	1459.48	0.979589	5.147942
17	777.20	0.164098	614.628	260.839	1460.32	0.995792	5.131530
18	802.97	0.159004	613.187	265.491	1460.99	1.011995	5.118509
19	829.43	0.154135	611.745	270.236	1461.76	1.028198	5.107079
20	856.44	0.149390	610.303	275.167	1462.59	1.044192	5.095356
21	884.34	0.144839	608.862	279.773	1463.22	1.060395	5.084051
22	900.12	0.140488	607.420	284.564	1463.85	1.076263	5.072747
23	937.05	0.136293	605.866	289.379	1464.64	1.092382	5.061442
24	971.78	0.132210	604.377	294.194	1465.34	1.108334	5.050138
25	1001.82	0.128289	602.935	298.892	1465.85	1.124160	5.038834
26	1033.44	0.124525	601.349	303.707	1466.48	1.140363	5.027906
27	1065.07	0.120861	599.891	308.522	1467.11	1.155896	5.016643
28	1098.14	0.117340	598.338	313.337	1467.74	1.171932	5.005632
29	1131.63	0.113931	596.752	318.291	1468.36	1.187884	4.994705
30	1165.80	0.110622	595.246	323.083	1468.87	1.203710	4.983986
31	1200.53	0.107476	593.660	327.898	1469.50	1.219536	4.973059
32	1236.36	0.104380	592.203	332.713	1469.94	1.235027	4.962131
33	1273.29	0.101420	590.649	337.527	1470.36	1.250770	4.951497
34	1310.91	0.098574	589.063	342.482	1470.92	1.266345	4.940695
35	1349.08	0.095765	587.397	347.506	1471.43	1.282003	4.929976
36	1388.15	0.093124	585.811	352.321	1471.85	1.297829	4.919426
37	1428.31	0.090533	584.225	357.136	1472.08	1.313321	4.908875
38	1469.10	0.088036	582.639	362.113	1472.46	1.329063	4.898324
39	1510.86	0.085601	581.054	366.998	1472.88	1.344638	4.887773
40	1553.03	0.083279	579.548	371.929	1473.29	1.359878	4.877222
41	1597.05	0.080975	577.818	376.953	1473.50	1.375327	4.866672
42	1641.63	0.078772	576.216	381.791	1473.71	1.390777	4.856121
43	1686.76	0.076668	574.630	386.769	1473.92	1.406519	4.845863
44	1732.86	0.074589	572.948	391.793	1474.13	1.422094	4.835438
45	1780.05	0.072604	571.379	396.817	1474.46	1.437334	4.824887
46	1828.63	0.070637	569.649	401.842	1474.46	1.452783	4.814713
47	1877.69	0.068771	567.919	406.866	1474.64	1.468233	4.804204
48	1928.12	0.066960	566.301	411.890	1474.69	1.483682	4.793654
49	1979.38	0.065200	564.619	416.914	1474.69	1.499132	4.783354
50	2031.54	0.063489	562.889	421.938	1474.69	1.514790	4.772971
51	2084.53	0.061804	561.159	427.172	1474.69	1.530240	4.762420

Table 2 — Refrigerant 717 (Ammonia) Properties of Superheated Vapor

Abs. Pressure 40 kPa (Sat. Temp. −50.403° C)				Abs. Pressure 50 kPa (Sat. Temp. −46.562° C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK	t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	2.672040	1380.83	6.1687	Sat	2.181672	1374.16	6.0901
-50	2.697371	1373.56	6.1726	-50	--------	-------	------
-45	2.763310	1384.53	6.2214	-45	2.198192	1382.61	6.1051
-40	2.827906	1395.37	6.2684	-40	2.251063	1393.68	6.1534
-35	2.891601	1406.05	6.3140	-35	2.302462	1404.62	6.1996
-30	2.955197	1416.69	6.3581	-30	2.353735	1415.38	6.2443
-25	3.018694	1427.32	6.4013	-25	2.404883	1426.06	6.2880
-20	3.081866	1437.84	6.4434	-20	2.455718	1436.74	6.3306
-15	3.144888	1448.41	6.4846	-15	2.506335	1447.42	6.3721
-10	3.207661	1458.97	6.5249	-10	2.556702	1458.02	6.4127
-5	3.270158	1469.43	6.5644	-5	2.606836	1468.58	6.4527
0	3.332705	1479.90	6.6032	0	2.656969	1479.18	6.4917
5	3.395152	1490.37	6.6415	5	2.707103	1489.69	6.5301
10	3.457501	1500.88	6.6791	10	2.757236	1500.16	6.5678
15	3.519511	1511.51	6.7160	15	2.807229	1510.84	6.6048
20	3.581822	1522.00	6.7523	20	2.856847	1521.51	6.6411
25	3.657917	1532.63	6.7881	25	2.906746	1532.07	6.6770
30	3.713848	1543.28	6.8234	30	2.956458	1542.69	6.7126
35	3.767991	1553.94	6.8582	35	3.006029	1553.37	6.7476
40	3.830139	1564.61	6.8926	40	3.055601	1564.04	6.7819
45	3.892037	1575.29	6.9264	45	3.105173	1574.77	6.8159
50	3.953935	1585.97	6.9598	50	3.154713	1585.58	6.8495
55	4.015834	1596.71	6.9929	55	3.204159	1596.33	6.8827
60	4.077732	1607.55	7.0257	60	3.253731	1607.21	6.9154
65	4.139180	1618.44	7.0581	65	3.303303	1618.10	6.9479
70	4.201028	1629.32	7.0901	70	3.352375	1628.99	6.9797
Abs. Pressure 60 kPa (Sat. Temp. −43.138° C)				**Abs. Pressure 70 kPa (Sat. Temp. −40.473° C)**			
Sat	1.839472	1384.77	6.0259	Sat	1.59030	1389.50	5.9720
-50	--------	-------	------	-35	1.63169	1401.83	6.0244
-45	--------	-------	------	-30	1.66940	1412.98	6.0706
-40	1.869261	1392.21	6.0582	-25	1.70628	1423.92	6.1152
-35	1.912511	1403.31	6.1052	-20	1.74288	1434.80	6.1586
-30	1.008998	1414.35	6.1508	-15	1.77945	1445.59	6.2010
-25	1.643585	1425.10	6.1948	-10	1.81601	1456.30	6.2423
-20	2.041217	1435.88	6.2379	-5	1.85239	1467.00	6.2827
-15	2.083645	1446.62	6.2799	0	1.88842	1477.68	6.3235
-10	2.125998	1457.30	6.3209	5	1.92450	1488.36	6.3672
-5	2.168220	1467.86	6.3609	10	1.96051	1499.04	6.3990
0	2.210179	1478.29	6.4002	15	1.99604	1509.71	6.4363
5	2.252138	1489.10	6.4048	20	2.03191	1520.39	6.4729
10	2.294097	1499.71	6.4640	25	2.06753	1531.10	6.5092
15	2.335494	1510.39	6.4798	30	2.10306	1541.78	6.5448
20	2.377241	1521.07	6.5528	35	2.13880	1552.56	6.5799
25	2.418726	1531.75	6.5864	40	2.17451	1563.35	6.6144
30	2.460123	1542.42	6.6219	45	2.20999	1574.11	6.6486
35	2.501520	1553.10	6.6569	50	2.24550	1584.93	6.6824
40	2.543093	1563.84	6.6914	55	2.28089	1595.66	6.7158
45	2.584621	1574.62	6.7255	60	2.31586	1606.55	6.7486
50	2.625674	1585.34	6.7592	65	2.35130	1617.44	6.7810
55	2.666922	1596.22	6.7923	70	2.38674	1628.48	6.8131
60	2.708319	1606.96	6.8251	75	2.42219	1639.43	6.8448
65	2.749716	1617.84	6.8575				
70	2.790965	1628.86	6.8896				

Table 2 Cont'd

Abs. Pressure 80 kPa (Sat. Temp. −37.968° C)				Abs. Pressure 90 kPa (Sat. Temp. −35.683° C)			
t °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK	*t* °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK
Sat	1.40466	1385.09	5.9254	Sat	1.25654	1397.09	5.8840
-35	1.42482	1398.94	5.9540	-35	-------	-------	------
-30	1.45745	1411.59	6.0008	-30	1.29051	1409.99	5.9381
-25	1.49053	1422.67	6.0462	-25	1.31980	1421.31	5.9841
-20	1.52296	1433.59	6.0900	-20	1.34891	1432.48	6.0285
-15	1.55516	1444.48	6.1326	-15	1.37771	1443.47	6.0716
-10	1.58737	1455.04	6.1743	-10	1.40627	1454.36	6.1135
-5	1.61931	1465.61	6.2149	-5	1.43483	1465.24	6.1543
0	1.65108	1476.89	6.2548	0	1.46324	1476.09	6.1944
5	1.68273	1487.68	6.2936	5	1.49125	1486.80	6.2335
10	1.71419	1498.36	6.3320	10	1.51925	1497.69	6.2720
15	1.74564	1509.04	6.3695	15	1.54778	1508.36	6.3096
20	1.77690	1519.83	6.4062	20	1.57535	1519.23	6.3466
25	1.80830	1530.60	6.4425	25	1.60320	1529.95	6.3830
30	1.83976	1541.31	6.4783	30	1.63119	1540.77	6.4187
35	1.87109	1552.05	6.5135	35	1.65918	1551.55	6.4541
40	1.90217	1562.84	6.5482	40	1.68691	1562.32	6.4890
45	1.93325	1573.61	6.5825	45	1.71453	1573.20	6.5233
50	1.96458	1584.44	6.6163	50	1.74239	1584.09	6.5573
55	1.99551	1595.32	6.6497	55	1.76983	1594.98	6.5905
60	2.02675	1606.21	6.6825	60	1.79727	1605.86	6.6237
65	2.05764	1617.10	6.7149	65	1.82524	1616.76	6.6561
70	2.08853	1627.99	6.7472	70	1.85271	1627.65	6.6885
75	2.11943	1639.04	6.7790	75	1.88015	1638.70	6.7203

Abs. Pressure 100 kPa (Sat. Temp. −33.620° C)				Abs. Pressure 110 kPa (Sat. Temp. −31.698° C)			
Sat	1.13966	1400.25	5.8476	Sat	1.04175	1403.18	5.8144
-30	1.15922	1408.60	5.8822	-30	1.05026	1407.19	5.8307
-25	1.18597	1420.04	5.9258	-25	1.07468	1418.77	5.8777
-20	1.21228	1431.31	5.9720	-20	1.09890	1430.14	5.9231
-15	1.23840	1442.40	6.0172	-15	1.12281	1441.33	5.9671
-10	1.26452	1453.39	6.0595	-10	1.14649	1452.43	6.0098
-5	1.29045	1464.35	6.1007	-5	1.16997	1463.45	6.0512
0	1.31601	1475.24	6.1407	0	1.19321	1474.38	6.0917
5	1.34157	1486.12	6.1802	5	1.21680	1485.45	6.1311
10	1.36712	1497.01	6.2190	10	1.23991	1496.34	6.1700
15	1.39268	1507.69	6.2566	15	1.26302	1507.01	6.2080
20	1.41774	1518.55	6.2938	20	1.28611	1517.88	6.2454
25	1.44274	1529.36	6.3305	25	1.30920	1528.77	6.2821
30	1.46811	1512.23	6.3664	30	1.33195	1539.65	6.3181
35	1.49335	1527.72	6.4017	35	1.35481	1550.53	6.3535
40	1.51835	1561.82	6.4366	40	1.37766	1561.42	6.3884
45	1.54334	1572.64	6.4710	45	1.40039	1572.31	6.4229
50	1.56834	1583.53	6.4965	50	1.42336	1583.19	6.4570
55	1.59334	1594.42	6.5009	55	1.44591	1594.08	6.4905
60	1.61833	1605.30	6.5715	60	1.46846	1604.97	6.5237
65	1.64333	1616.40	6.6043	65	1.49155	1615.86	6.5565
70	1.66783	1627.31	6.6364	70	1.51413	1626.93	6.5886
75	1.69270	1638.36	6.6681	75	1.53668	1638.02	6.6206
				80	1.55923	1649.12	6.6521
				85	1.58177	1660.22	6.6834
				90	1.60430	1671.32	6.7143

Abs. Pressure 120 kPa (Sat. Temp. −29.929° C)				Abs. Pressure 130 kPa (Sat. Temp. −28.264° C)			
Sat	0.96066	1405.88	5.7843	Sat	0.89122	1408.38	5.7563
-30	-------	-------	------	-25	0.90504	1416.01	5.7875
-25	0.98303	1417.37	5.8309	-20	0.95771	1427.71	5.8340
-20	1.00550	1428.94	5.8769	-15	0.97277	1439.19	5.8789
-15	1.02767	1440.27	5.9214	-10	0.96647	1450.48	5.9223
-10	1.04969	1451.41	5.9644	-5	0.98683	1461.70	5.9643
-5	1.07152	1462.51	6.0062	0	1.00704	1472.79	6.0053
0	1.09298	1473.58	6.0470	5	1.02686	1483.87	6.0454
5	1.11443	1484.54	6.0868	10	1.04669	1494.75	6.0846
10	1.13589	1495.43	6.1258	15	1.06652	1505.64	6.1230
15	1.15735	1506.32	6.1641	20	1.08627	1516.69	6.1604
20	1.17831	1517.20	6.2015	25	1.10571	1527.64	6.1974
25	1.19964	1528.16	6.2382	30	1.12532	1538.54	6.2338
30	1.22072	1539.07	6.2743	35	1.14480	1549.42	6.2695
35	1.24162	1549.96	6.3100	40	1.16407	1560.31	6.3046
40	1.26252	1560.85	6.3451	45	1.18334	1571.26	6.3391
45	1.28341	1571.74	6.3795	50	1.20260	1582.29	6.3733
50	1.30431	1582.62	6.4135	55	1.22187	1593.18	6.4071
55	1.32520	1593.53	6.4472	60	1.24113	1604.09	6.4403
60	1.34610	1604.63	6.4806	65	1.26040	1615.16	6.4731
65	1.36699	1615.52	6.5133	70	1.27959	1626.25	6.5055
70	1.38769	1626.59	6.5455	75	1.29884	1637.35	6.5376
75	1.40853	1637.69	6.5775	80	1.31811	1648.45	6.5692
80	1.42943	1648.78	6.6090	85	1.33733	1659.54	6.6004
85	1.45001	1659.88	6.6403	90	1.35634	1670.64	6.6314
90	1.47060	1670.98	6.6713				

Table 2 Cont'd

Abs. Pressure 140 kPa (Sat. Temp. −26.707° C)				Abs. Pressure 150 kPa (Sat. Temp. −25.233° C)			
t °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK	*t* °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK
Sat	0.83134	1410.67	5.7307	Sat	0.779375	1411.30	5.7068
-25	0.83815	1414.78	5.7470	-25	0.780254	1412.16	5.7090
-20	0.85780	1426.52	5.7939	-20	0.798702	1426.16	5.7564
-15	0.87719	1438.06	5.8393	-15	0.816880	1437.75	5.8021
-10	0.89634	1449.48	5.8830	-10	0.834807	1449.17	5.8462
-5	0.91509	1460.74	5.9253	-5	0.852454	1460.46	5.8890
0	0.93354	1471.89	5.9666	0	0.870008	1471.68	5.9305
5	0.95226	1482.91	6.0072	5	0.887516	1482.77	5.9711
10	0.97063	1493.37	6.0465	10	0.904646	1493.87	6.0107
15	0.98939	1504.96	6.0849	15	0.922201	1504.76	6.0497
20	1.02290	1516.04	6.1227	20	0.939256	1515.83	6.0872
25	1.03170	1526.97	6.1598	25	0.956356	1526.77	6.1243
30	1.04398	1537.90	6.1962	30	0.973394	1537.76	6.1609
35	1.06200	1548.90	6.2320	35	0.990387	1548.74	6.1968
40	1.08020	1559.87	6.2672	40	1.007191	1559.66	6.2321
45	1.09827	1570.78	6.3017	45	1.023901	1570.60	6.2669
50	1.11616	1581.75	6.3360	50	1.040894	1581.62	6.3014
55	1.13432	1592.77	6.3699	55	1.057839	1592.57	6.3353
60	1.15212	1603.72	6.4033	60	1.074408	1603.62	6.3684
65	1.16993	1614.82	6.4361	65	1.091400	1614.72	6.4015
70	1.18759	1625.86	6.4685	70	1.107894	1625.67	6.4340
75	1.20566	1636.94	6.5004	75	1.124432	1636.73	6.4660
80	1.22360	1648.08	6.5321	80	1.141283	1647.93	6.4976
85	1.24131	1659.21	6.5636	85	1.157964	1659.10	6.5290
90	1.25902	1670.30	6.5945	90	1.174456	1670.20	6.5601
95	1.27680	1681.47	6.6250	95	1.191001	1681.36	6.5907
100	1.29452	1692.78	6.6553	100	1.207501	1692.67	6.6210
Abs. Pressure 160 kPa (Sat. Temp. −23.837° C)				**Abs. Pressure 170 kPa (Sat. Temp. −22.509° C)**			
Sat	0.733855	1414.69	5.6844	Sat	0.693434	1416.37	5.6634
-25	--------	-------	------	-25	--------	-------	------
-20	0.747120	1423.84	5.7209	-20	0.701617	1422.51	5.6873
-15	0.764104	1435.56	5.7672	-15	0.717712	1434.46	5.7340
-10	0.780844	1447.10	5.8116	-10	0.725057	1446.15	5.7790
-5	0.797583	1458.56	5.8546	-5	0.734547	1457.71	5.8224
0	0.814298	1469.90	5.8965	0	0.765362	1469.07	5.8644
5	0.830885	1481.18	5.9372	5	0.780746	1480.36	5.9056
10	0.847179	1492.27	5.9771	10	0.796302	1491.60	5.9455
15	0.863357	1503.37	6.0159	15	0.811665	1502.69	5.9846
20	0.879432	1514.46	6.0541	20	0.826857	1513.79	6.0227
25	0.895584	1525.56	6.0913	25	0.841890	1524.88	6.0602
30	0.911464	1536.54	6.1280	30	0.857130	1535.98	6.0970
35	0.927380	1547.54	6.1640	35	0.872181	1547.03	6.1331
40	0.943244	1558.54	6.1993	40	0.887146	1558.09	6.1686
45	0.959047	1569.52	6.2342	45	0.902257	1569.14	6.2035
50	0.975100	1580.61	6.2687	50	0.917209	1580.11	6.2380
55	0.990716	1591.64	6.3026	55	0.932010	1591.14	6.2719
60	1.006332	1602.57	6.3361	60	0.946811	1602.24	6.3054
65	1.022419	1613.67	6.3689	65	0.961612	1613.33	6.3385
70	1.038060	1624.76	6.4013	70	0.976414	1624.43	6.3709
75	1.053676	1635.86	6.4335	75	0.991215	1635.73	6.4033
80	1.069292	1647.09	6.4653	80	1.006016	1646.88	6.4352
85	1.084908	1658.28	6.4967	85	1.020817	1657.94	6.4666
90	1.100524	1669.47	6.5278	90	1.035454	1669.13	6.4976
95	1.116121	1680.75	6.5585	95	1.049977	1680.44	6.5284
100	1.131679	1691.97	6.5888	100	1.064682	1691.74	6.5587
Abs. Pressure 180 kPa (Sat. Temp. −21.238° C)				**Abs. Pressure 190 kPa (Sat. Temp. −20.028° C)**			
Sat	0.656839	1418.29	5.6433	Sat	0.624696	1419.98	5.6247
-25	--------	-------	------	-20	0.624780	1420.05	5.6250
-20	0.660740	1421.29	5.6552	-15	0.639466	1432.14	5.6724
-15	0.676137	1433.32	5.7023	-10	0.653900	1444.08	5.7182
-10	0.691247	1445.17	5.7476	-5	0.668195	1455.81	5.7623
-5	0.706357	1456.82	5.7915	0	0.682490	1467.32	5.8050
0	0.721356	1468.29	5.8339	5	0.696723	1478.81	5.8465
5	0.736013	1479.62	5.8752	10	0.710456	1490.12	5.8872
10	0.751063	1490.92	5.9155	15	0.724503	1501.33	5.9264
15	0.765611	1502.02	5.9547	20	0.738271	1512.52	5.9648
20	0.779713	1513.13	5.9929	25	0.752004	1523.73	6.0026
25	0.794150	1524.23	6.0307	30	0.765363	1534.86	6.0397
30	0.808658	1535.33	6.0676	35	0.778846	1545.96	6.0760
35	0.822901	1546.42	6.1038	40	0.792469	1557.05	6.1117
40	0.836920	1557.52	6.1394	45	0.805849	1568.15	6.1469
45	0.851074	1568.61	6.1746	50	0.819145	1579.24	6.1814
50	0.865464	1579.71	6.2091	55	0.832816	1590.34	6.2155
55	0.879503	1590.80	6.2430	60	0.845987	1601.43	6.2490
60	0.893490	1601.90	6.2765	65	0.859159	1612.53	6.2822
65	0.907476	1612.99	6.3097	70	0.872608	1623.72	6.3150
70	0.921462	1624.09	6.3422	75	0.885849	1634.85	6.3474
75	0.935449	1635.18	6.3746	80	0.899021	1646.08	6.3793
80	0.949435	1646.42	6.4065	85	0.912192	1657.27	6.4108
85	0.963421	1657.61	6.4379	90	0.925363	1668.46	6.4420
90	0.977184	1668.79	6.4690	95	0.938535	1679.76	6.4727
95	0.990836	1680.10	6.4998	100	0.951706	1691.07	6.5031
100	1.004822	1691.40	6.5301	105	0.964878	1702.38	6.5335
105	1.018781	1702.72	6.5604	110	0.978049	1713.79	6.5633
110	1.032516	1714.13	6.5901	115	0.991220	1725.20	6.5930
115	1.046252	1725.54	6.6199				

Table 2 Cont'd

Abs. Pressure 200 kPa (Sat. Temp. −18.866° C)				Abs. Pressure 210 kPa (Sat. Temp. −17.748° C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK	t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	0.595188	1421.42	5.60690	Sat	0.568552	1423.01	5.58989
-20	--------	-------	-------	-20	--------	-------	-------
-15	0.606094	1430.90	5.64341	-15	0.575960	1429.76	5.61988
-10	0.620060	1443.01	5.68974	-10	0.589335	1441.93	5.66738
-5	0.633760	1454.87	5.73346	-5	0.602508	1453.85	5.70773
0	0.647253	1466.55	5.77501	0	0.615508	1465.55	5.75108
5	0.660783	1478.04	5.81904	5	0.628401	1477.15	5.79314
10	0.674222	1489.34	5.85973	10	0.641118	1488.67	5.83400
15	0.687148	1500.65	5.89930	15	0.653479	1499.97	5.87377
20	0.700067	1511.95	5.93819	20	0.666110	1511.27	5.91251
25	0.713427	1523.09	5.97613	25	0.678539	1522.49	5.95053
30	0.726537	1534.19	6.01306	30	0.691103	1533.69	5.98777
35	0.739459	1545.40	6.04940	35	0.703456	1544.84	6.02439
40	0.767614	1556.61	6.08524	40	0.715559	1555.98	6.06042
45	0.771774	1567.71	6.12057	45	0.727748	1567.14	6.09570
50	0.777603	1578.80	6.15551	50	0.740052	1578.26	6.13029
55	0.790463	1585.25	6.18962	55	0.752155	1589.46	6.16454
60	0.802824	1596.92	6.22315	60	0.764259	1600.65	6.19845
65	0.815746	1607.44	6.25631	65	0.776362	1611.75	6.23161
70	0.828169	1623.37	6.28914	70	0.788466	1622.84	6.26443
75	0.840967	1632.88	6.32134	75	0.800532	1634.10	6.29676
80	0.853515	1644.81	6.35336	80	0.812620	1645.41	6.32885
85	0.866188	1656.93	6.38497	85	0.824581	1656.59	6.36046
90	0.878619	1668.12	6.41608	90	0.836406	1667.78	6.39166
95	0.891222	1679.43	6.44686	95	0.848255	1679.10	6.42254
100	0.903582	1690.73	6.47738	100	0.860207	1690.45	6.45296
105	0.915974	1702.06	6.50782	105	0.872158	1701.81	6.48330
110	0.928616	1713.57	6.53758	110	0.884109	1713.22	6.51307
115	0.941258	1725.08	6.54735	115	0.896060	1724.63	6.54284
				120	0.907897	1736.09	6.57210
				125	0.919719	1747.56	6.60131
Abs. Pressure 220 kPa (Sat. Temp. −16.673° C)				Abs. Pressure 230 kPa (Sat. Temp. −15.638° C)			
Sat	0.544186	1424.36	5.57365	Sat	0.521965	1425.71	5.58431
-15	0.548513	1428.53	5.58978	-15	0.523553	1426.94	5.56455
-10	0.561332	1440.84	5.63682	-10	0.535910	1439.24	5.61186
-5	0.573952	1452.84	5.68191	-5	0.536070	1451.45	5.65759
0	0.586418	1464.57	5.72565	0	0.528054	1463.34	5.70147
5	0.598741	1476.27	5.76803	5	0.571947	1475.06	5.74403
10	0.610959	1487.78	5.80911	10	0.583665	1486.79	5.78535
15	0.623064	1499.27	5.84901	15	0.595287	1498.30	5.82543
20	0.634852	1510.60	5.88795	20	0.606809	1509.63	5.86471
25	0.647077	1521.90	5.92617	25	0.618162	1520.93	5.90302
30	0.659097	1533.07	5.96371	30	0.629650	1532.24	5.94042
35	0.670636	1544.27	6.00037	35	0.641050	1543.54	5.97719
40	0.682151	1555.48	6.03622	40	0.652208	1554.75	6.01341
45	0.693967	1566.65	6.07153	45	0.663311	1565.92	6.04896
50	0.705806	1577.89	6.10645	50	0.674503	1577.03	6.08386
55	0.717548	1588.99	6.14097	55	0.685561	1587.66	6.11823
60	0.728837	1600.10	6.17454	60	0.696798	1599.60	6.15214
65	0.740636	1611.39	6.20804	65	0.707834	1610.69	6.15827
70	0.751981	1622.51	6.24090	70	0.718869	1621.97	6.21234
75	0.763707	1633.76	6.27339	75	0.730061	1633.28	6.25070
80	0.775182	1645.07	6.30532	80	0.739723	1644.58	6.28277
85	0.786442	1656.26	6.33697	85	0.750798	1655.77	6.31459
90	0.797702	1667.44	6.36827	90	0.762835	1667.05	6.34591
95	0.809076	1678.78	6.39904	95	0.773810	1678.49	6.37671
100	0.820620	1690.19	6.42956	100	0.784666	1689.80	6.40730
105	0.832135	1701.60	6.46000	105	0.795541	1701.12	6.43781
110	0.843423	1713.01	6.48977	110	0.806576	1712.52	6.46770
115	0.854712	1724.42	6.51954	115	0.817612	1723.93	6.49759
120	0.866204	1735.91	6.54880	120	0.721007	1735.44	6.52686
125	0.877722	1747.42	6.57801	125	0.610947	1746.95	6.55607
Abs. Pressure 240 kPa (Sat. Temp. −14.636° C)				Abs. Pressure 250 kPa (Sat. Temp. −13.668° C)			
Sat	0.501484	1427.06	5.543589	Sat	0.482608	1428.35	5.530783
-15	--------	-------	--------	-10	0.490997	1437.55	5.564870
-10	0.512477	1438.61	5.587397	-5	0.505771	1449.89	5.610828
-5	0.524256	1450.89	5.633818	0	0.522640	1461.87	5.655409
0	0.535834	1462.81	5.678184	5	0.524575	1473.78	5.698576
5	0.547226	1474.67	5.720965	10	0.535458	1485.50	5.740402
10	0.558527	1486.22	5.762343	15	0.546244	1497.02	5.780819
15	0.569705	1497.73	5.802603	20	0.556916	1508.53	5.820479
20	0.580784	1509.21	5.841976	25	0.567531	1520.04	5.858948
25	0.591806	1520.55	5.880522	30	0.578068	1531.42	5.896722
30	0.602748	1531.86	5.918180	35	0.588533	1542.72	5.933786
35	0.613643	1543.16	5.955066	40	0.598949	1553.96	5.970057
40	0.624454	1554.45	5.991282	45	0.609331	1565.16	6.005728
45	0.635196	1565.67	6.026828	50	0.619722	1576.45	6.040919
50	0.645954	1576.84	6.061788	55	0.630174	1587.69	6.075285
55	0.656641	1588.10	6.096371	60	0.640346	1598.84	6.109478
60	0.667424	1599.41	6.130284	65	0.650314	1610.14	6.142735
65	0.678099	1610.50	6.163748	70	0.660411	1621.45	6.175905
70	0.688370	1621.78	6.196607	75	0.670848	1632.75	6.208479
75	0.699028	1633.09	6.207756	80	0.681100	1644.06	6.240634
80	0.709739	1644.39	6.249057	85	0.691132	1656.99	6.272453
85	0.720161	1655.68	6.293071	90	0.701164	1666.66	6.303938
90	0.730584	1666.98	6.324388	95	0.711253	1677.98	6.334963
95	0.741183	1678.31	6.355224	100	0.721294	1689.31	6.365484
100	0.751631	1689.61	6.385935	105	0.731334	1700.66	6.395944
105	0.762079	1700.94	6.416540	110	0.741375	1712.15	6.425900
110	0.772527	1712.43	6.446309	115	0.751415	1723.63	6.455857
115	0.782975	1723.92	6.476077	120	0.761456	1735.14	6.485144
120	0.793423	1735.44	6.507782	125	0.771496	1746.66	6.514347
125	0.803871	1746.95	6.539728	130	0.781537	1758.24	6.543173
				135	0.791577	1769.86	6.571811

Table 2 Cont'd

Abs. Pressure 260 kPa (Sat. Temp. −12.730° C)				Abs. Pressure 270 kPa (Sat. Temp. −11.818° C)			
t °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK	*t* °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK
Sat	0.465123	1429.53	5.515873	Sat	0.448843	1430.64	5.502580
-10	0.472159	1437.49	5.546001	-10	0.452742	1435.23	5.519980
-5	0.482170	1448.82	5.588542	-5	0.463401	1447.76	5.567102
0	0.492977	1461.03	5.633608	0	0.473880	1460.06	5.612408
5	0.503611	1472.95	5.677042	5	0.482290	1472.16	5.656293
10	0.514167	1484.83	5.719135	10	0.475493	1483.92	5.698556
15	0.524547	1496.34	5.759831	15	0.502557	1495.64	5.739312
20	0.534847	1507.85	5.799522	20	0.514422	1507.18	5.779291
25	0.540529	1519.37	5.838208	25	0.524299	1518.69	5.818095
30	0.552657	1530.74	5.876068	30	0.534115	1530.21	5.856047
35	0.565364	1542.05	5.913282	35	0.543880	1541.60	5.893310
40	0.575412	1553.35	5.949707	40	0.553591	1552.91	5.929903
45	0.585414	1564.66	5.985379	45	0.563235	1564.21	5.965826
50	0.595368	1575.95	6.020632	50	0.572824	1575.52	6.001092
55	0.605320	1587.20	6.055191	55	0.582431	1586.82	6.035764
60	0.615260	1598.50	6.088885	60	0.591947	1598.13	6.069994
65	0.624971	1609.81	6.122641	65	0.601462	1609.43	6.103590
70	0.634685	1621.11	6.155866	70	0.610928	1620.58	6.136464
75	0.644709	1632.30	6.188440	75	0.620424	1631.84	6.169246
80	0.654557	1643.55	6.220773	80	0.629924	1643.15	6.201527
85	0.664181	1654.34	6.252563	85	0.639149	1654.57	6.233347
90	0.673805	1666.33	6.283899	90	0.648399	1665.99	6.264831
95	0.683559	1677.67	6.314963	95	0.657920	1677.33	6.295919
100	0.693391	1689.08	6.345624	100	0.667382	1688.74	6.326629
105	0.703201	1700.48	6.376202	105	0.676822	1700.15	6.357255
110	0.712834	1711.89	6.406158	110	0.686093	1711.58	6.387212
115	0.722467	1723.30	6.436115	115	0.695363	1723.00	6.417169
120	0.732100	1734.81	6.465402	120	0.704594	1734.58	6.446482
125	0.741733	1746.32	6.494605	125	0.713819	1746.18	6.475716
130	0.751366	1757.90	6.523431	130	0.723045	1757.80	6.504552
135	0.760999	1769.52	6.552069	135	0.732270	1769.42	6.533190
Abs. Pressure 285 kPa (Sat. Temp. −10.502° C)				**Abs. Pressure 300 kPa (Sat. Temp. −9.236° C)**			
Sat	0.426754	1432.36	5.466954	Sat	0.406569	1433.88	5.466008
-10	0.427784	1433.64	5.474011	-10	--------	-------	--------
-5	0.437975	1446.29	5.536249	-5	0.414787	1444.66	5.506199
0	0.448005	1458.70	5.582054	0	0.424435	1457.30	5.553035
5	0.457860	1470.82	5.626225	5	0.433883	1469.55	5.597585
10	0.467598	1482.75	5.669057	10	0.443193	1481.49	5.640542
15	0.477187	1494.61	5.710129	15	0.452371	1493.42	5.681899
20	0.486675	1506.17	5.750086	20	0.461462	1505.12	5.722251
25	0.496093	1517.79	5.789317	25	0.470457	1516.83	5.761671
30	0.505457	1529.26	5.827627	30	0.479365	1528.38	5.800296
35	0.514749	1540.67	5.865001	35	0.488224	1539.87	5.837852
40	0.523967	1552.05	5.901594	40	0.497028	1551.29	5.874572
45	0.533144	1563.40	5.937601	45	0.506201	1562.67	5.910810
50	0.542300	1574.82	5.973077	50	0.515642	1574.13	5.946419
55	0.551380	1586.12	6.007800	55	0.523184	1585.44	5.981297
60	0.560444	1597.42	6.041964	60	0.531820	1596.74	6.015587
65	0.569471	1608.73	6.075878	65	0.540400	1608.21	6.049501
70	0.578481	1620.03	6.109010	70	0.548980	1619.53	6.082744
75	0.587459	1631.34	6.141848	75	0.557516	1630.83	6.115610
80	0.596417	1642.64	6.174129	80	0.566040	1642.14	6.147891
85	0.605327	1654.06	6.205949	85	0.574556	1653.56	6.179869
90	0.614271	1665.48	6.237433	90	0.583048	1664.98	6.211512
95	0.623222	1676.82	6.268521	95	0.591504	1676.34	6.242599
100	0.632024	1688.23	6.299231	100	0.599936	1687.83	6.273309
105	0.640836	1699.65	6.329871	105	0.608367	1699.32	6.303957
110	0.649732	1711.17	6.359954	110	0.616778	1710.84	6.334102
115	0.658627	1722.68	6.390036	115	0.625190	1722.35	6.364247
120	0.667439	1734.26	6.419393	120	0.633620	1733.89	6.393555
125	0.676241	1745.84	6.448658	125	0.642053	1745.43	6.422758
130	0.683799	1757.45	6.477589	130	0.650387	1757.02	6.451710
135	0.690735	1769.07	6.506353	135	0.658671	1768.64	6.480536
140	0.699247	1780.73	6.534810	140	0.667019	1780.30	6.509027
145	0.709727	1792.45	6.562882	145	0.675446	1792.02	6.537100
Abs. Pressure 315 kPa (Sat. Temp. −8.023° C)				**Abs. Pressure 330 kPa (Sat. Temp. −6.851° C)**			
Sat	0.388208	1435.39	5.449055	Sat	0.371491	1436.70	5.432594
-10	--------	-------	--------	-5	0.374805	1441.48	5.450363
-5	0.393844	1443.11	5.477789	0	0.383708	1454.31	5.497895
0	0.403116	1455.79	5.524858	5	0.392427	1466.84	5.543589
5	0.412196	1468.13	5.570089	10	0.401042	1479.19	5.587273
10	0.421126	1480.42	5.613364	15	0.409489	1491.12	5.629450
15	0.429896	1492.35	5.655131	20	0.417840	1503.04	5.670311
20	0.438608	1504.10	5.695894	25	0.426091	1514.81	5.710107
25	0.447226	1515.82	5.735404	30	0.434280	1526.53	5.748910
30	0.455776	1396.43	5.774090	35	0.442417	1538.14	5.786912
35	0.464251	1429.87	5.811865	40	0.450502	1549.64	5.824077
40	0.472655	1550.53	5.848801	45	0.458521	1561.15	5.860493
45	0.481024	1562.20	5.885101	50	0.466468	1572.66	5.896396
50	0.489369	1574.16	5.920731	55	0.474404	1584.14	5.931398
55	0.497632	1584.70	5.955726	60	0.482293	1595.46	5.966065
60	0.505888	1596.18	5.990334	65	0.490178	1606.96	5.999978
65	0.514088	1607.52	6.024247	70	0.498017	1608.94	6.033533
70	0.522288	1618.98	6.057490	75	0.505806	1626.25	6.066478
75	0.530443	1630.33	6.090357	80	0.513583	1641.12	6.099009
80	0.538587	1641.63	6.122849	85	0.521357	1652.55	6.131206
85	0.546704	1653.05	6.155020	90	0.529107	1664.05	6.162900
90	0.554796	1664.47	6.186714	95	0.536818	1675.52	6.194046
95	0.562874	1675.85	6.217801	100	0.544511	1686.94	6.224931
100	0.570933	1687.36	6.248511	105	0.552200	1698.37	6.255735
105	0.578987	1698.87	6.279159	110	0.559862	1709.88	6.285880
110	0.586994	1710.39	6.309304	115	0.567525	1721.40	6.316025
115	0.595001	1721.90	6.339449	120	0.575164	1733.00	6.345500
120	0.603013	1743.82	6.368898	125	0.582800	1744.62	6.374892
125	0.611024	1767.04	6.398260	130	0.590432	1756.30	6.403906
130	0.618968	1774.78	6.427265	135	0.598063	1768.02	6.432733
135	0.626878	1774.78	6.456091	140	0.605670	1779.74	6.461224
140	0.634808	1779.99	6.484582	145	0.613248	1791.46	6.489296
145	0.642762	1791.71	6.512655				

Table 2 Cont'd

Abs. Pressure 345 kPa (Sat. Temp. −5.720° C)				Abs. Pressure 360 kPa (Sat. Temp. −4.629° C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK	t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	0.356217	1437.96	5.417059	Sat	0.342192	1439.23	5.402119
−5	0.357459	1439.84	5.424028	−5	--------	-------	--------
0	0.366042	1452.85	5.471983	0	0.349791	1451.31	5.446071
5	0.374446	1465.57	5.518081	5	0.357976	1464.29	5.493248
10	0.382701	1477.92	5.562182	10	0.365980	1476.66	5.538089
15	0.390843	1490.07	5.604762	15	0.373822	1489.01	5.580709
20	0.398884	1502.03	5.646009	20	0.381564	1501.01	5.622325
25	0.406827	1513.96	5.685916	25	0.389245	1512.95	5.662642
30	0.414707	1525.75	5.724982	30	0.396842	1524.75	5.701844
35	0.422536	1537.36	5.763170	35	0.404368	1536.49	5.740256
40	0.430291	1548.88	5.800520	40	0.411842	1548.12	5.777833
45	0.437983	1560.39	5.837073	45	0.419251	1559.64	5.814514
50	0.445650	1571.90	5.872792	50	0.426591	1571.17	5.850521
55	0.453230	1583.42	5.908129	55	0.433915	1582.68	5.885862
60	0.460810	1594.93	5.942796	60	0.441195	1594.20	5.920569
65	0.468334	1606.24	5.977731	65	0.448419	1605.71	5.985151
70	0.475857	1617.73	6.010521	70	0.455638	1617.20	5.995211
75	0.483338	1629.24	6.043533	75	0.462856	1628.57	6.021461
80	0.490805	1640.62	6.076193	80	0.470036	1640.02	6.054230
85	0.498241	1652.04	6.108392	85	0.477170	1651.53	6.086576
90	0.505652	1663.55	6.140087	90	0.484282	1663.05	6.118288
95	0.513064	1675.07	6.171362	95	0.491391	1674.56	6.149591
100	0.520462	1686.53	6.202472	100	0.498485	1686.07	6.180783
105	0.527927	1697.89	6.232958	105	0.505541	1697.59	6.211598
110	0.536274	1709.61	6.263103	110	0.512596	1709.13	6.241743
115	0.542637	1721.12	6.293248	115	0.519645	1720.64	6.271888
120	0.549833	1731.91	6.323052	120	0.526695	1732.34	6.301399
Abs. Pressure 375 kPa (Sat. Temp. −3.576° C)				**Abs. Pressure 390 kPa (Sat. Temp. −2.552° C)**			
Sat	0.329244	1440.49	5.388001	Sat.	0.317249	1441.69	5.374119
0	0.334932	1449.83	5.422184	0	0.321191	1448.41	5.398719
5	0.342858	1462.83	5.469655	5	0.328885	1461.51	5.446592
10	0.350568	1475.39	5.514569	10	0.336350	1474.13	5.497708
15	0.358165	1487.79	5.557600	15	0.343703	1486.69	5.524102
20	0.365663	1499.96	5.599560	20	0.350956	1498.93	5.583035
25	0.373060	1511.93	5.640271	25	0.358122	1510.97	5.623982
30	0.380388	1523.87	5.679658	30	0.365180	1522.92	5.663673
35	0.387638	1535.68	5.718084	35	0.372174	1534.74	5.702234
40	0.394817	1547.33	5.755402	40	0.379117	1546.46	5.734638
45	0.401965	1558.94	5.792051	45	0.386016	1558.12	5.771691
50	0.409063	1570.62	5.828839	50	0.392885	1569.70	5.808075
55	0.416013	1582.13	5.864275	55	0.399684	1581.38	5.843758
60	0.423147	1593.65	5.899245	60	0.406419	1592.95	5.878532
65	0.430126	1605.16	5.933535	65	0.413154	1604.47	5.912822
70	0.437056	1616.52	5.967220	70	0.419853	1615.98	5.946777
75	0.443979	1628.00	6.000480	75	0.426523	1627.49	5.980104
80	0.450865	1639.51	6.033137	80	0.433170	1639.01	6.012832
85	0.457732	1651.03	6.065375	85	0.439799	1650.52	6.045226
90	0.464599	1662.54	6.097277	90	0.446415	1662.03	6.077285
95	0.471447	1674.05	6.128804	95	0.453008	1673.55	6.108883
100	0.478256	1685.57	6.159995	100	0.459566	1685.08	6.140075
105	0.485057	1697.11	6.190810	105	0.466096	1696.66	6.170890
110	0.491868	1708.83	6.220956	110	0.472663	1708.39	6.201035
115	0.498622	1720.34	6.251101	115	0.479173	1719.90	6.231180
120	0.505377	1732.04	6.280911	120	0.485683	1731.60	6.260990
Abs. Pressure 405 kPa (Sat. Temp. −1.561° C)				**Abs. Pressure 420 kPa (Sat. Temp. −0.595° C)**			
Sat	0.306140	1442.70	5.361066	Sat	0.295764	1443.71	5.348314
0	0.308473	1446.85	5.376152	0	0.296627	1445.32	5.354113
5	0.315918	1460.09	5.424176	5	0.303853	1458.73	5.403006
10	0.323160	1472.86	5.469910	10	0.310911	1471.60	5.453235
15	0.330268	1485.50	5.513997	15	0.317801	1484.37	5.493410
20	0.337295	1497.88	5.556322	20	0.324641	1496.77	5.535722
25	0.344253	1510.07	5.597331	25	0.331367	1509.03	5.577105
30	0.351094	1522.08	5.638474	30	0.338005	1521.06	5.617299
35	0.357875	1533.93	5.677289	35	0.344568	1533.00	5.656423
40	0.364596	1545.70	5.714360	40	0.351068	1544.88	5.694619
45	0.371243	1557.42	5.751507	45	0.357517	1556.66	5.731981
50	0.377862	1569.35	5.787890	50	0.363919	1568.39	5.768498
55	0.384455	1581.77	5.823604	55	0.370274	1580.10	5.804231
60	0.390966	1592.36	5.858647	60	0.376602	1591.71	5.839447
65	0.397457	1603.87	5.893077	65	0.382874	1603.22	5.874114
70	0.403947	1615.46	5.927047	70	0.389145	1614.84	5.908111
75	0.410367	1626.99	5.960375	75	0.395352	1626.45	5.941438
80	0.416789	1638.50	5.993283	80	0.401560	1638.00	5.974346
85	0.423192	1650.01	6.025724	85	0.407745	1649.51	6.006920
90	0.429554	1661.53	6.057769	90	0.413893	1661.02	6.039067
95	0.435897	1673.07	6.089454	95	0.420026	1672.61	6.070709
100	0.442235	1684.67	6.120646	100	0.426153	1684.28	6.101901
105	0.448557	1696.32	6.151476	105	0.432256	1695.81	6.132758
110	0.454879	1707.96	6.181761	110	0.438360	1707.42	6.163280
115	0.461145	1719.55	6.211906	115	0.444407	1719.04	6.193425
120	0.467244	1731.26	6.241760	120	0.450210	1730.76	6.223235
				125	0.456793	1742.48	6.252844

Table 2 Cont'd

Abs. Pressure 435 kPa (Sat. Temp. 0.342° C)				Abs. Pressure 450 kPa (Sat. Temp. 1.256° C)			
t °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK	*t* °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK
Sat	0.286054	1444.73	5.336019	Sat	0.276971	1445.74	5.324177
0	--------	-------	--------	0	--------	-------	--------
5	0.292525	1457.08	5.380370	5	0.282035	1455.73	5.359961
10	0.299470	1470.33	5.427974	10	0.288797	1469.07	5.407745
15	0.306207	1483.10	5.472644	15	0.295376	1481.97	5.452825
20	0.312840	1495.60	5.515639	20	0.301805	1494.57	5.496229
25	0.319352	1507.98	5.557385	25	0.308128	1506.97	5.538067
30	0.325796	1520.13	5.597716	30	0.314289	1519.18	5.578671
35	0.332159	1532.11	5.636954	35	0.320589	1531.28	5.618224
40	0.338459	1544.04	5.675355	40	0.326713	1543.28	5.656833
45	0.344724	1555.91	5.712922	45	0.332775	1555.15	5.694514
50	0.346960	1567.63	5.749644	50	0.338796	1566.87	5.731275
55	0.339185	1579.35	5.785582	55	0.344755	1578.59	5.767391
60	0.363192	1591.07	5.821003	60	0.350696	1590.32	5.803051
65	0.369280	1602.70	5.855670	65	0.356601	1602.04	5.837717
70	0.375341	1614.23	5.889667	70	0.362456	1613.69	5.871714
75	0.381359	1625.82	5.923154	75	0.368305	1625.24	5.905335
80	0.387362	1637.44	5.956130	80	0.374116	1636.89	5.938528
85	0.393350	1649.00	5.988704	85	0.379909	1648.50	5.971207
90	0.399301	1660.57	6.020851	90	0.385676	1660.10	6.003278
95	0.405221	1672.19	6.052560	95	0.391413	1671.76	6.034931
100	0.411140	1683.80	6.083912	100	0.397149	1683.32	6.066415
105	0.416955	1695.43	6.114769	105	0.402884	1695.03	6.097299
110	0.421925	1707.04	6.145291	110	0.408599	1706.68	6.128059
115	0.428708	1718.66	6.175642	115	0.414280	1718.27	6.158343
120	0.434673	1730.38	6.205475	120	0.419960	1729.98	6.188168
125	0.440537	1742.10	6.235083	125	0.425613	1741.70	6.217829
Abs. Pressure 500 kPa (Sat. Temp. 4.127° C)				**Abs. Pressure 550 kPa (Sat. Temp. 6.805° C)**			
Sat	0.250836	1448.65	5.287228	Sat	0.228838	1451.34	5.253398
5	0.251920	1451.05	5.295747	5	--------	-------	--------
10	0.258130	1464.79	5.344521	10	0.232505	1460.19	5.285186
15	0.264196	1477.98	5.390685	15	0.238132	1473.98	5.332630
20	0.270113	1490.89	5.435172	20	0.243618	1487.23	5.378384
25	0.275924	1503.52	5.478131	25	0.249036	1500.08	5.422195
30	0.281654	1516.01	5.519582	30	0.254331	1512.84	5.464495
35	0.287308	1528.35	5.559736	35	0.259539	1525.38	5.505459
40	0.292901	1540.51	5.598885	40	0.264696	1537.72	5.545259
45	0.298443	1552.51	5.637133	45	0.269803	1550.00	5.584053
50	0.303935	1564.44	5.674418	50	0.274860	1562.11	5.621843
55	0.309378	1576.37	5.710885	55	0.279867	1574.02	5.658312
60	0.314770	1588.19	5.746685	60	0.284824	1585.95	5.691250
65	0.320163	1599.92	5.781729	65	0.288800	1597.87	5.729889
70	0.325481	1611.64	5.816103	70	0.294423	1609.79	5.764982
75	0.330789	1623.36	5.849954	75	0.299486	1621.56	5.799059
80	0.336078	1635.09	5.883303	80	0.304295	1633.28	5.832709
85	0.341327	1646.75	5.916149	85	0.309085	1645.01	5.865819
90	0.346551	1658.42	5.948577	90	0.313874	1656.73	5.898435
95	0.351766	1670.14	5.980607	95	0.318644	1668.52	5.930589
100	0.356962	1681.84	6.012176	100	0.323379	1680.40	5.962238
105	0.362154	1693.47	6.043389	105	0.328111	1692.12	5.993791
110	0.367322	1705.19	6.074101	110	0.332844	1703.84	6.024690
115	0.372462	1716.92	6.104433	115	0.337522	1715.57	6.055194
120	0.377601	1728.64	6.134264	120	0.342247	1727.47	6.085364
125	0.382719	1740.45	6.164179	125	0.346935	1739.24	6.115226
130	0.387821	1752.27	6.193572	130	0.351593	1751.04	6.144623
135	0.392919	1764.10	6.222681	135	0.356243	1762.87	6.173826
Abs. Pressure 600 kPa (Sat. Temp. 9.278° C)				**Abs. Pressure 650 kPa (Sat. Temp. 11.615° C)**			
Sat	0.210693	1453.60	5.222709	Sat	0.195084	1455.65	5.194028
5	--------	-------	--------	15	0.198466	1465.39	5.228276
10	0.211458	1459.32	5.229804	20	0.203295	1479.40	5.276289
15	0.216761	1470.04	5.278975	25	0.208053	1492.92	5.322013
20	0.221914	1483.33	5.325772	30	0.212722	1506.16	5.366135
25	0.226961	1496.58	5.370633	35	0.217296	1519.20	5.408720
30	0.231908	1509.53	5.413769	40	0.221795	1531.98	5.449822
35	0.236787	1522.27	5.455564	45	0.226226	1544.53	5.493773
40	0.241590	1534.88	5.496020	50	0.230589	1557.01	5.539429
45	0.246320	1547.20	5.535211	55	0.234928	1569.32	5.566470
50	0.251017	1559.20	5.573547	60	0.239175	1581.46	5.603343
55	0.255670	1571.68	5.610904	65	0.243421	1593.60	5.639462
60	0.260242	1583.82	5.647454	70	0.247660	1605.71	5.674674
65	0.264814	1595.84	5.683210	75	0.251818	1617.69	5.709394
70	0.269337	1607.78	5.718315	80	0.255984	1629.62	5.743504
75	0.273810	1619.61	5.752757	85	0.260108	1641.53	5.777153
80	0.278270	1631.50	5.786544	90	0.264207	1653.45	5.810181
85	0.282717	1643.32	5.819871	95	0.268317	1665.38	5.842605
90	0.287140	1655.14	5.852764	100	0.272383	1677.31	5.874801
95	0.291532	1667.03	5.885146	105	0.276405	1689.21	5.906406
100	0.295905	1678.82	5.917041	110	0.280426	1701.15	5.937626
105	0.300283	1690.56	5.948435	115	0.284448	1712.87	5.968525
110	0.304630	1702.49	5.979558	120	0.288463	1724.78	5.998754
115	0.308978	1714.22	6.010233	125	0.292476	1736.71	6.028899
120	0.313276	1726.13	6.040437	130	0.296458	1748.63	6.058542
125	0.317567	1737.96	6.070407	135	0.300423	1760.55	6.087933
130	0.321859	1749.83	6.099975				
135	0.326150	1761.72	6.129367				

Table 2 Cont'd

Abs. Pressure 700 kPa (Sat. Temp. 13.805° C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	0.181714	1457.60	5.167862
15	0.182818	1461.03	5.179700
20	0.187435	1475.37	5.229251
25	0.191960	1489.31	5.276287
30	0.196359	1502.89	5.321270
35	0.200666	1516.12	5.364686
40	0.204916	1529.07	5.406544
45	0.209097	1541.83	5.446978
50	0.213195	1554.44	5.486382
55	0.217258	1566.98	5.524704
60	0.221291	1579.33	5.562123
65	0.225285	1591.53	5.598413
70	0.229229	1603.68	5.634032
75	0.233123	1615.82	5.669185
80	0.237004	1627.87	5.703551
85	0.240864	1639.83	5.737306
90	0.244699	1651.79	5.770559
95	0.248519	1663.77	5.803293
100	0.252322	1675.70	5.835557
105	0.256106	1687.63	5.867299
110	0.259876	1699.56	5.898836
115	0.263628	1711.50	5.929850
120	0.267360	1723.49	5.960426
125	0.271077	1735.43	5.990452
130	0.274790	1747.36	6.020258
135	0.278503	1759.38	6.049817
140	0.282208	1771.42	6.079041

Abs. Pressure 750 kPa (Sat. Temp. 15.883° C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	0.170010	1459.29	5.143307
15	--------	-------	--------
20	0.173617	1471.40	5.184540
25	0.177933	1485.67	5.232746
30	0.182127	1499.45	5.278910
35	0.186208	1512.91	5.323115
40	0.190213	1523.89	5.365646
45	0.194164	1535.20	5.406722
50	0.198059	1551.94	5.446455
55	0.201913	1564.62	5.485313
60	0.205705	1576.97	5.522994
65	0.209454	1589.32	5.559830
70	0.213153	1601.62	5.595914
75	0.216836	1613.80	5.631239
80	0.220487	1625.94	5.666001
85	0.224124	1638.06	5.699999
90	0.227736	1650.17	5.733368
95	0.231313	1662.24	5.766371
100	0.234883	1674.21	5.798915
105	0.238457	1686.28	5.830892
110	0.241982	1698.21	5.862452
115	0.245493	1710.15	5.893443
120	0.249016	1722.26	5.924017
125	0.252497	1734.24	5.954467
130	0.255966	1746.18	5.984456
135	0.259434	1758.20	6.014015
140	0.262896	1770.31	6.043239

Abs. Pressure 800 kPa (Sat. Temp. 17.855° C)			
Sat	0.159726	1460.93	5.103825
20	0.161540	1467.32	5.136583
25	0.165651	1481.89	5.191243
30	0.169654	1495.96	5.238348
35	0.173558	1509.71	5.283352
40	0.177386	1523.17	5.326513
45	0.181146	1536.32	5.368291
50	0.184819	1549.26	5.408814
55	0.188446	1562.07	5.448289
60	0.192064	1574.84	5.486425
65	0.195592	1587.23	5.523730
70	0.199099	1599.59	5.560098
75	0.202604	1611.94	5.595704
80	0.206050	1624.18	5.630673
85	0.209484	1636.34	5.664956
90	0.212888	1648.48	5.698569
95	0.216255	1660.62	5.731674
100	0.219644	1672.73	5.764340
105	0.222981	1684.58	5.796343
110	0.226329	1695.43	5.827996
115	0.229621	1708.65	5.859271
120	0.232913	1720.92	5.890212
125	0.236205	1732.93	5.920585
130	0.239489	1744.99	5.950704
135	0.242744	1757.11	5.980439
140	0.245999	1769.18	6.009741

Abs. Pressure 850 kPa (Sat. Temp. 19.735° C)			
Sat	0.150638	1462.27	5.098716
20	0.150852	1463.07	5.101428
25	0.154797	1478.04	5.151583
30	0.158637	1492.45	5.199681
35	0.162378	1506.50	5.245645
40	0.166043	1520.21	5.289656
45	0.169640	1533.56	5.331981
50	0.173150	1546.75	5.373050
55	0.176610	1559.71	5.413072
60	0.180019	1572.48	5.451754
65	0.183429	1585.04	5.489306
70	0.186739	1597.53	5.525968
75	0.190036	1609.92	5.561833
80	0.193334	1622.27	5.597084
85	0.196600	1634.58	5.631637
90	0.199816	1646.80	5.665520
95	0.203007	1658.98	5.698806
100	0.206203	1671.23	5.731505
105	0.209367	1683.37	5.763854
110	0.212515	1695.52	5.795754
115	0.215644	1707.45	5.827030
120	0.218773	1719.57	5.857970
125	0.221901	1731.71	5.888576
130	0.224993	1743.80	5.918760
135	0.228065	1755.91	5.948638
140	0.231138	1768.05	5.978239

Abs. Pressure 900 kPa (Sat. Temp. 21.534° C)			
Sat	0.142476	1463.62	5.078015
20	--------	-------	--------
25	0.145102	1474.05	5.113330
30	0.148829	1488.85	5.162518
35	0.152431	1503.18	5.209365
40	0.155934	1517.13	5.254185
45	0.159370	1530.81	5.297307
50	0.162723	1544.14	5.338848
55	0.166030	1557.14	5.379113
60	0.169327	1570.11	5.418301
65	0.172524	1582.88	5.456400
70	0.172807	1595.49	5.493458
75	0.177771	1608.05	5.529569
80	0.181963	1620.49	5.565115
85	0.185043	1632.85	5.599912
90	0.188122	1645.20	5.634057
95	0.191181	1657.48	5.667719
100	0.194203	1669.63	5.700720
105	0.197220	1681.79	5.733120
110	0.200191	1693.93	5.765149
115	0.203157	1706.07	5.796465
120	0.206123	1718.24	5.827745
125	0.209089	1730.38	5.858434
130	0.212021	1742.53	5.888705
135	0.214933	1754.67	5.918640
140	0.217843	1766.81	5.948259

Abs. Pressure 950 kPa (Sat. Temp. 23.255° C)			
Sat	0.135225	1464.84	5.058583
25	0.136508	1470.22	5.076559
30	0.140090	1485.27	5.126671
35	0.143547	1499.85	5.174495
40	0.146918	1514.01	5.220141
45	0.150229	1527.87	5.263950
50	0.153469	1541.48	5.306112
55	0.156656	1554.66	5.347185
60	0.159771	1567.75	5.386584
65	0.162855	1580.64	5.425019
70	0.165888	1593.42	5.462487
75	0.168897	1606.03	5.499052
80	0.171878	1618.59	5.534808
85	0.174836	1631.10	5.569829
90	0.177769	1643.51	5.604161
95	0.180665	1655.84	5.637893
100	0.183531	1668.09	5.671132
105	0.186418	1680.33	5.703831
110	0.189277	1692.58	5.735860
115	0.192080	1704.73	5.767513
120	0.194910	1717.05	5.798830
125	0.197720	1729.24	5.829683
130	0.200544	1741.38	5.860023
135	0.203329	1753.59	5.890076
140	0.206076	1765.80	5.919867

Table 2 Cont'd

Abs. Pressure 1000 kPa (Sat. Temp. 24.905° C)				Abs. Pressure 1050 kPa (Sat. Temp. 26.493° C)			
t °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK	*t* °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK
Sat	0.128664	1465.85	5.040090	Sat	0.122738	1466.87	5.022484
25	0.176701	1466.15	5.041078	25	--------	-------	--------
30	0.132135	1481.62	5.092174	30	0.125079	1477.77	5.058565
35	0.135500	1496.55	5.140992	35	0.128328	1492.99	5.108365
40	0.138765	1510.93	5.187466	40	0.131480	1507.77	5.155722
45	0.141949	1524.89	5.232055	45	0.134563	1522.10	5.200976
50	0.145083	1538.66	5.274133	50	0.137556	1535.95	5.244505
55	0.148160	1552.22	5.316252	55	0.140495	1549.58	5.286604
60	0.151138	1565.40	5.356194	60	0.143434	1563.03	5.327182
65	0.154116	1578.38	5.395006	65	0.146274	1576.22	5.366457
70	0.157044	1591.36	5.432813	70	0.149064	1589.26	5.404469
75	0.159922	1604.02	5.469615	75	0.151837	1602.13	5.441670
80	0.162750	1616.72	5.505664	80	0.154570	1614.81	5.477930
85	0.165559	1629.25	5.541042	85	0.157285	1627.41	5.513556
90	0.168368	1641.70	5.575751	90	0.159980	1640.00	5.548513
95	0.171159	1654.19	5.609790	95	0.162647	1652.51	5.582667
100	0.173912	1666.54	5.643159	100	0.165296	1664.91	5.616253
105	0.176659	1678.89	5.675900	105	0.167909	1677.30	5.649339
110	0.179356	1691.24	5.708306	110	0.170511	1689.65	5.681831
115	0.182052	1703.38	5.739958	115	0.173113	1702.00	5.713860
120	0.184749	1715.71	5.771275	120	0.175677	1714.35	5.745296
125	0.187446	1727.90	5.802258	125	0.178236	1726.71	5.776298
130	0.190106	1740.18	5.832905	130	0.180786	1738.95	5.806945
135	0.192746	1752.42	5.863008	135	0.183332	1751.23	5.837306
140	0.195387	1764.65	5.892777	140	0.185859	1763.51	5.867202
145	0.198028	1776.93	5.922294	145	0.187856	1775.75	5.896651

Abs. Pressure 1100 kPa (Sat. Temp. 28.036° C)				Abs. Pressure 1150 kPa (Sat. Temp. 29.511° C)			
Sat	0.117214	1467.88	5.005177	Sat	0.112285	1468.73	4.989293
30	0.118478	1474.02	5.025852	30	0.112590	1470.27	4.994455
35	0.121628	1489.45	5.076637	35	0.115648	1485.91	5.045904
40	0.124698	1504.53	5.124935	40	0.118637	1501.23	5.095172
45	0.127700	1519.16	5.171100	45	0.121557	1516.07	5.142162
50	0.130602	1533.29	5.215115	50	0.124386	1530.46	5.186975
55	0.133419	1547.07	5.257548	55	0.127149	1544.40	5.230141
60	0.136236	1560.67	5.298945	60	0.129843	1558.15	5.271846
65	0.138994	1573.86	5.338494	65	0.132482	1571.62	5.311668
70	0.141702	1587.04	5.377021	70	0.135105	1584.97	5.350712
75	0.144363	1600.05	5.414556	75	0.137681	1598.03	5.388580
80	0.146974	1612.88	5.451090	80	0.140208	1610.96	5.425558
85	0.149566	1625.64	5.486837	85	0.142717	1623.79	5.461683
90	0.152157	1638.31	5.521915	90	0.145208	1636.53	5.497024
95	0.154729	1650.87	5.556434	95	0.147672	1649.24	5.531651
100	0.157264	1663.42	5.590445	100	0.150124	1661.91	5.565548
105	0.159792	1675.95	5.623561	105	0.152569	1674.44	5.598921
110	0.162272	1688.30	5.656327	110	0.154965	1686.80	5.631960
115	0.164752	1700.65	5.688356	115	0.157361	1699.29	5.664245
120	0.167229	1713.00	5.720035	120	0.159723	1711.66	5.695968
125	0.169707	1725.36	5.751097	125	0.162081	1724.12	5.727233
130	0.172148	1737.70	5.781745	130	0.164426	1735.66	5.758137
135	0.174572	1750.05	5.812257	135	0.166766	1748.16	5.788630
140	0.176994	1762.39	5.842427	140	0.169106	1761.22	5.818789
145	0.179416	1774.74	5.872058	145	0.171432	1773.57	5.848602

Abs. Pressure 1200 kPa (Sat. Temp. 30.945° C)				Abs. Pressure 1250 kPa (Sat. Temp. 32.341° C)			
Sat	0.107673	1469.48	4.973843	Sat	0.103371	1470.16	4.958771
30	--------	-------	--------	35	0.104914	1478.78	4.986650
35	0.110078	1482.36	5.015782	40	0.107768	1494.69	5.037805
40	0.113004	1497.96	5.066155	45	0.110528	1510.02	5.086451
45	0.115842	1513.03	5.113965	50	0.113203	1524.82	5.132710
50	0.118594	1527.65	5.159530	55	0.115817	1539.27	5.176814
55	0.121289	1541.81	5.203201	60	0.118339	1553.32	5.219492
60	0.123884	1555.71	5.245332	65	0.120852	1567.17	5.260613
65	0.126446	1569.41	5.285731	70	0.123316	1580.64	5.300395
70	0.128988	1582.84	5.325190	75	0.125730	1593.90	5.338875
75	0.131483	1595.97	5.363359	80	0.128099	1607.11	5.376496
80	0.133928	1609.04	5.400690	85	0.130443	1620.20	5.413221
85	0.136355	1621.98	5.437142	90	0.132763	1633.10	5.449109
90	0.138757	1634.80	5.472757	95	0.135056	1645.89	5.484202
95	0.141127	1647.57	5.507576	100	0.137335	1658.68	5.518446
100	0.143493	1660.31	5.541558	105	0.139574	1671.43	5.552281
105	0.145837	1672.94	5.575188	110	0.141807	1683.99	5.585490
110	0.148151	1685.37	5.608348	115	0.144040	1696.58	5.617944
115	0.150465	1697.93	5.640754	120	0.146222	1709.14	5.650021
120	0.152730	1710.38	5.672625	125	0.148443	1721.56	5.681757
125	0.155006	1722.85	5.704137				
130	0.157271	1735.30	5.735212				
135	0.159517	1747.69	5.765777				
140	0.161762	1760.07	5.795939				
145	0.164002	1772.48	5.825782				

Table 2 Cont'd

Abs. Pressure 1300 kPa (Sat. Temp. 33.691° C)				Abs. Pressure 1350 kPa (Sat. Temp. 34.996° C)			
t °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK	*t* °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK
Sat	0.099478	1470.83	4.944197	Sat	0.095838	1471.37	4.930109
35	0.100213	1475.13	5.112334	35	0.095840	1471.39	4.930156
40	0.102978	1491.28	5.299020	40	0.098565	1487.74	4.982934
45	0.105670	1506.86	5.059611	45	0.101200	1503.65	5.033402
50	0.108296	1521.85	5.106537	50	0.103757	1518.99	5.081239
55	0.110833	1536.59	5.151674	55	0.106243	1533.90	5.127020
60	0.113313	1550.79	5.194898	60	0.108650	1548.26	5.170791
65	0.115746	1564.79	5.236293	65	0.111034	1562.41	5.212677
70	0.118128	1659.41	5.276348	70	0.113338	1097.99	5.253224
75	0.120460	1622.20	5.315314	75	0.115614	1410.43	5.292554
80	0.122775	1605.19	5.353299	80	0.117864	1603.19	5.330831
85	0.125033	1618.34	5.390298	85	0.120058	1616.49	5.368103
90	0.127267	1631.31	5.426459	90	0.122227	1629.60	5.404440
95	0.129506	1644.26	5.461825	95	0.124390	1642.58	5.440006
100	0.131712	1657.17	5.496282	100	0.126516	1655.54	5.474894
105	0.133906	1669.91	5.530147	105	0.128640	1668.41	5.508960
110	0.136057	1682.47	5.563629	110	0.130742	1681.09	5.542496
115	0.138209	1695.21	5.596357	115	0.132812	1693.74	5.575279
120	0.140310	1707.79	5.628464	120	0.134861	1706.42	5.607586
125	0.142449	1720.33	5.660200	125	0.136926	1719.00	5.639541
Abs. Pressure 1400 kPa (Sat. Temp. 36.268° C)				**Abs. Pressure 1450 kPa (Sat. Temp. 37.512° C)**			
Sat	0.092414	1471.88	4.916525	Sat	0.089213	1472.38	4.903482
40	0.094396	1484.20	4.955995	40	0.090507	1480.76	4.930107
45	0.097004	1500.46	5.007697	45	0.093065	1497.30	4.982491
50	0.099498	1516.08	5.056416	50	0.095511	1513.08	5.031972
55	0.101928	1531.16	5.102743	55	0.097870	1528.33	5.078857
60	0.104287	1545.73	5.147060	60	0.100226	1543.20	5.123732
65	0.106613	1560.03	5.189493	65	0.102472	1557.65	5.166689
70	0.108854	1573.96	5.230587	70	0.104666	1571.73	5.208336
75	0.111071	1587.67	5.270251	75	0.106812	1585.60	5.248346
80	0.113246	1601.21	5.308877	80	0.108909	1599.28	5.287417
85	0.115382	1614.63	5.346474	85	0.110986	1612.78	5.325397
90	0.117499	1627.87	5.383014	90	0.113061	1626.08	5.362211
95	0.119599	1640.92	5.418762	95	0.115118	1639.28	5.398145
100	0.121656	1653.93	5.453957	100	0.117127	1652.37	5.433410
105	0.123701	1666.84	5.488279	105	0.119092	1665.17	5.468003
110	0.125746	1679.67	5.521930	110	0.121056	1678.15	5.501916
115	0.127751	1692.29	5.554828	115	0.123019	1690.93	5.535087
120	0.129741	1705.05	5.587288	120	0.124934	1703.70	5.567589
125	0.131743	1717.70	5.619401	125	0.126885	1716.47	5.599704
Abs. Pressure 1500 kPa (Sat. Temp. 38.716° C)				**Abs. Pressure 1600 kPa (Sat. Temp. 41.041° C)**			
Sat	0.086315	1472.72	4.890730	Sat	0.080899	1473.39	4.866322
40	0.086956	1477.09	4.904672	45	0.082792	1486.96	4.908852
45	0.089429	1493.91	5.032567	50	0.085151	1503.89	4.961656
50	0.091843	1510.11	5.207366	55	0.087391	1519.96	5.010958
55	0.094194	1525.65	5.055872	60	0.089571	1535.33	5.057916
60	0.096469	1540.67	5.101567	65	0.091682	1550.45	5.102535
65	0.098351	1555.27	5.144524	70	0.093755	1565.00	5.145145
70	0.100719	1569.50	5.186900	75	0.095744	1579.33	5.186564
75	0.102887	1583.53	5.227517	80	0.097702	1593.33	5.226510
80	0.104970	1597.36	5.266770	85	0.099651	1607.07	5.265349
85	0.107002	1610.92	5.304903	90	0.101574	1620.70	5.303183
90	0.108996	1624.30	5.341990	95	0.103454	1634.18	5.339963
95	0.110985	1637.59	5.378197	100	0.105297	1647.41	5.375903
100	0.112953	1650.72	5.413735	105	0.107139	1660.64	5.410940
105	0.114877	1663.65	5.448571	110	0.108982	1673.83	5.445308
110	0.116801	1676.63	5.482484	115	0.110768	1686.81	5.478922
115	0.118682	1689.56	5.515929	120	0.112555	1699.64	5.512132
120	0.120552	1702.35	5.548703	125	0.114297	1712.58	5.544766
125	0.122430	1715.12	5.580879				
Abs. Pressure 1700 kPa (Sat. Temp. 43.260° C)				**Abs. Pressure 1800 kPa (Sat. Temp. 45.382° C)**			
Sat	0.076132	1474.06	4.843189	Sat	0.071828	1474.47	4.820833
45	0.076938	1480.14	4.862303	45	--------	-------	--------
50	0.079224	1497.45	4.916419	50	0.073858	1490.70	4.871057
55	0.081393	1514.09	4.967334	55	0.076043	1508.14	4.924940
60	0.083528	1529.93	5.015684	60	0.078119	1524.51	4.974800
65	0.085551	1545.35	5.061396	65	0.080079	1540.25	4.998062
70	0.087508	1560.33	5.105318	70	0.081992	1555.61	5.061522
75	0.089442	1574.89	5.147460	75	0.083856	1570.59	5.109905
80	0.091334	1589.14	5.188317	80	0.085668	1585.19	5.151541
85	0.093196	1603.19	5.227779	85	0.087430	1599.42	5.191627
90	0.095034	1617.05	5.266017	90	0.089169	1613.38	5.230523
95	0.096833	1630.73	5.303360	95	0.090905	1627.20	5.268489
100	0.098594	1644.23	5.339807	100	0.092627	1640.94	5.305301
105	0.100351	1657.61	5.375363	105	0.094303	1654.35	5.341372
110	0.102075	1670.79	5.410030	110	0.095930	1667.76	5.376456
115	0.103780	1683.91	5.444191	115	0.097553	1680.97	5.410766
120	0.105485	1696.90	5.477462	120	0.099176	1694.16	5.444406
125	0.107146	1710.00	5.510328	125	0.100800	1707.35	5.477670
130	0.108819	1722.88	5.542522	130	0.102388	1720.40	5.510096

Table 2 Cont'd

Abs. Pressure 1900 kPa (Sat. Temp. 47.409° C)				Abs. Pressure 2000 kPa (Sat. Temp. 49.360° C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK	t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	0.068070	1474.64	4.799883	Sat.	0.064627	1474.69	4.779565
50	0.069171	1483.94	4.828691	50.	0.064890	1477.04	4.786825
55	0.071285	1501.79	4.883829	55.	0.066935	1495.33	4.843161
60	0.073320	1518.77	4.935329	60.	0.068930	1512.92	4.896490
65	0.075199	1521.22	7.034928	65.	0.070784	1529.78	4.946238
70	0.077067	1547.73	5.485645	70.	0.072613	1545.89	4.993639
75	0.078890	1566.10	5.073804	75.	0.074373	1561.50	5.038695
80	0.080633	1580.90	5.116260	80.	0.076077	1576.64	5.082033
85	0.082337	1595.46	5.157166	85.	0.077731	1591.43	5.123759
90	0.084035	1609.73	5.196639	90.	0.079360	1605.95	5.163893
95	0.085704	1623.71	5.235060	95.	0.080970	1620.22	5.202834
100	0.087321	1637.60	5.272570	100.	0.082544	1634.26	5.240937
105	0.088957	1651.16	5.308945	105.	0.084110	1647.97	5.277762
110	0.090542	1664.72	5.344575	110.	0.085627	1661.69	5.313749
115	0.092084	1678.24	5.379159	115.	0.087115	1675.29	5.348796
120	0.093626	1691.46	5.413072	120.	0.088604	1688.71	5.383004
125	0.095168	1704.65	5.446609	125.	0.090071	1702.03	5.416814
130	0.096702	1717.81	5.479308	130.	0.091531	1715.26	5.449786

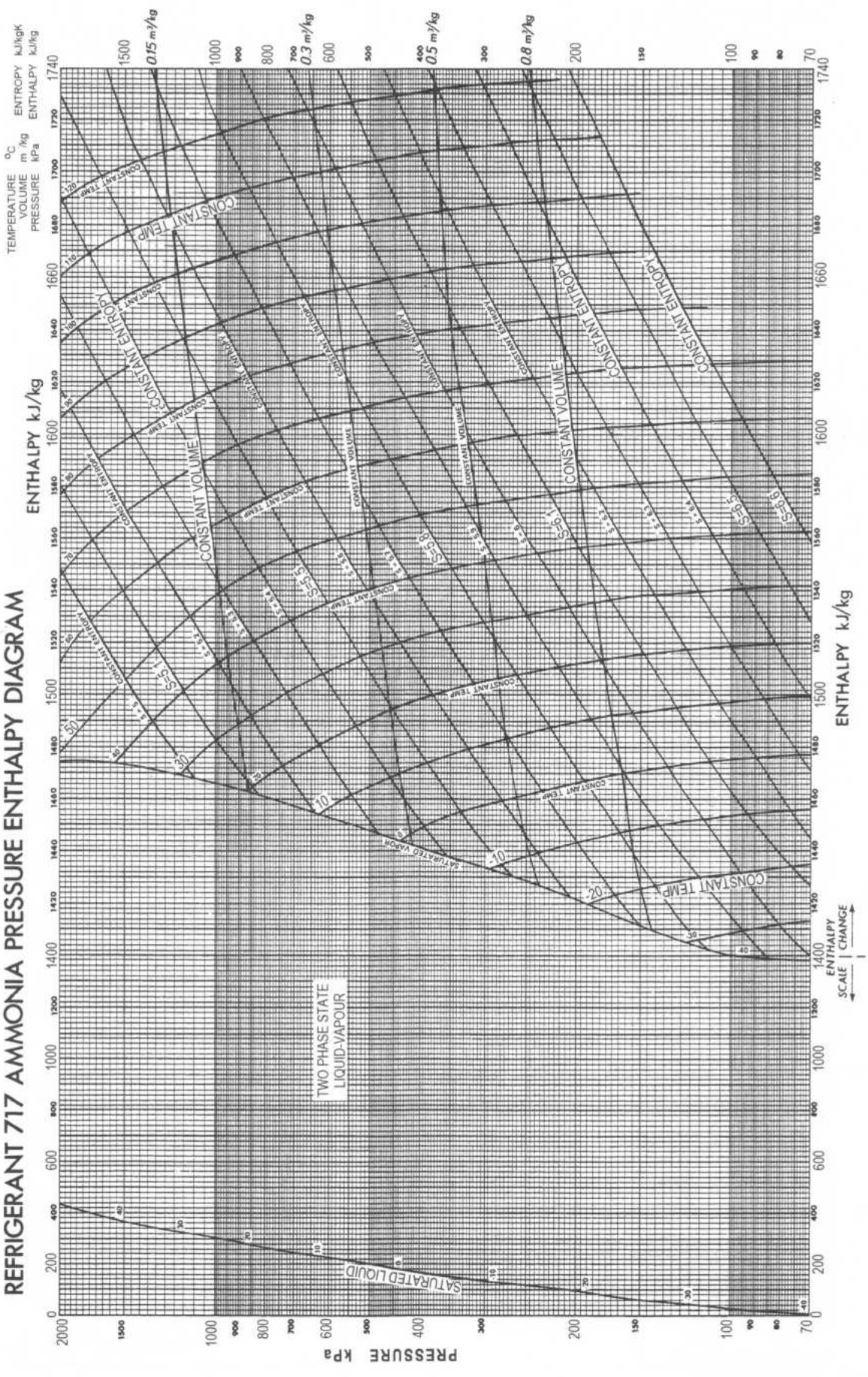

REFRIGERANT 717 AMMONIA PRESSURE ENTHALPY DIAGRAM
ENTHALPY kJ/kg
PRESSURE kPa
TEMPERATURE °C
VOLUME m³/kg
PRESSURE kPa
ENTROPY kJ/kgK
ENTHALPY kJ/kg
CONSTANT TEMP
CONSTANT ENTHROPY
CONSTANT ENTHROPY
CONSTANT ENTROPY
CONSTANT VOLUME
CONSTANT VOLUME
CONSTANT VOLUME
SATURATED LIQUID
SATURATED VAPOUR
TWO PHASE STATE
LIQUID-VAPOUR
ENTHALPY
SCALE | CHANGE |

Table 3 — Refrigerant 12 (Dichlorodifluoromethane) Properties of Liquid and Saturated Vapour

Temperature t °C	Absolute Pressure kPa	Volume Vapor v_g m³/kg	Density Liquid $1/v_f$ kg/m³	Enthalpy Liquid h_f kJ/kg	Enthalpy Vapor h_g kJ/kg	Entropy Liquid s_f kJ/kgK	Entropy Vapor s_g kJ/kgK
-90	2.842295	4.415530	1645.256	-43.285	146.464	-0.208629	0.827315
-85	4.267400	3.067704	1633.146	-39.006	148.733	-0.185617	0.812205
-80	6.237356	2.170608	1620.908	-34.721	151.019	-0.163174	0.798568
-75	8.899077	1.563690	1608.430	-30.428	153.324	-0.141260	0.786230
-70	12.422559	1.146065	1595.830	-26.125	155.638	-0.119836	0.775063
-65	17.001092	0.853827	1583.073	-21.811	157.962	-0.098870	0.764952
-60	22.852396	0.645960	1570.117	-17.483	160.290	-0.078334	0.755812
-55	30.218479	0.495760	1556.969	-13.139	162.620	-0.058201	0.747573
-50	39.364650	0.385603	1543.629	-8.778	164.950	-0.038445	0.740137
-45	50.579110	0.303667	1530.091	-4.398	167.277	-0.019052	0.733279
-40	64.173640	0.241908	1516.324	0.000	169.596	0.000000	0.727376
-39	67.250839	0.231638	1513.556	0.882	170.059	0.003768	0.726245
-38	70.441664	0.221886	1510.762	1.765	170.520	0.007520	0.725115
-37	73.750458	0.212624	1507.965	2.648	170.982	0.011263	0.724043
-36	77.175773	0.203824	1505.159	3.534	171.164	0.014239	0.722988
-35	80.710025	0.195400	1502.339	4.420	171.901	0.018711	0.721933
-34	84.389757	0.187477	1499.514	5.307	172.364	0.022415	0.720915
-33	88.201868	0.179935	1496.675	6.194	172.823	0.026106	0.719898
-32	92.141533	0.172759	1493.824	7.083	173.281	0.029786	0.718939
-31	96.220471	0.165929	1490.970	7.972	173.740	0.033454	0.717997
-30	100.415241	0.159372	1488.099	8.862	174.197	0.037112	0.717034
-29	104.777554	0.153192	1485.216	9.753	174.656	0.040756	0.716130
-28	109.283277	0.147301	1482.332	10.645	175.112	0.044389	0.715225
-27	113.942065	0.141683	1479.438	11.538	175.567	0.048010	0.714350
-26	118.747021	0.136319	1476.531	12.432	176.021	0.051620	0.713484
-25	123.685046	0.131167	1473.618	13.327	176.477	0.055224	0.712638
-24	128.810608	0.126296	1470.677	14.223	176.929	0.058811	0.711809
-23	134.101645	0.121640	1467.865	15.120	177.383	0.062389	0.711014
-22	139.553329	0.117194	1464.832	16.017	177.835	0.065956	0.710222
-21	145.173245	0.112942	1461.829	16.916	178.286	0.069510	0.709456
-20	150.933125	0.108849	1458.865	17.816	178.735	0.073056	0.708702
-19	156.908811	0.104967	1455.881	18.717	179.185	0.076594	0.707949
-18	163.061003	0.101259	1452.884	19.619	179.633	0.080119	0.707229
-17	169.399353	0.097705	1449.874	20.522	180.081	0.083633	0.706513
-16	175.916967	0.094300	1446.852	21.426	180.528	0.087138	0.705822
-15	182.593850	0.091020	1443.824	22.331	180.975	0.090632	0.705144
-14	189.506533	0.087902	1440.782	23.236	181.419	0.094118	0.704465
-13	196.617785	0.084913	1437.727	24.144	181.863	0.097593	0.703821
-12	203.922780	0.082050	1434.660	25.053	182.305	0.101058	0.703180
-11	211.433239	0.079301	1431.580	25.963	182.747	0.104514	0.702565
-10	219.115377	0.076649	1428.494	26.875	183.190	0.107961	0.701920
-9	227.058138	0.074121	1425.380	27.785	183.627	0.111402	0.701355
-8	235.210498	0.071697	1422.266	28.700	184.066	0.114828	0.700756
-7	243.582	0.069971	1419.141	29.615	184.504	0.118248	0.700182
-6	252.178	0.067153	1415.994	30.529	184.941	0.121661	0.699617
-5	260.960	0.064963	1412.844	31.448	185.376	0.125064	0.698780
-4	270.026	0.062901	1409.673	32.365	185.809	0.128459	0.698516
-3	279.323	0.060915	1406.488	33.285	186.243	0.131845	0.698922
-2	288.857	0.059006	1403.280	34.206	186.673	0.135222	0.697829
-1	298.628	0.057169	1400.065	35.129	186.866	0.138594	0.696988
0	308.609	0.055389	1396.842	36.053	187.532	0.141954	0.696477
1	318.891	0.053691	1393.598	36.978	187.959	0.145311	0.696364
2	329.427	0.052054	1390.342	37.904	188.384	0.148655	0.695614
3	340.222	0.050477	1387.072	38.832	188.809	0.151995	0.695079
4	351.275	0.048958	1383.790	39.763	189.233	0.155328	0.694626
5	362.306	0.047485	1380.487	40.694	189.656	0.158651	0.694174
6	374.133	0.046077	1377.171	41.627	190.074	0.161971	0.693722
7	386.032	0.044718	1373.843	42.561	190.493	0.165280	0.693303
8	398.186	0.043407	1370.490	43.498	190.910	0.168586	0.692889
9	410.621	0.042142	1367.131	44.436	191.325	0.171883	0.692474
10	423.297	0.040913	1363.748	45.373	191.740	0.175172	0.692081
11	436.328	0.039737	1360.345	46.315	192.152	0.178458	0.691666
12	449.646	0.038601	1356.930	47.259	192.563	0.181737	0.691285
13	463.265	0.037504	1353.502	48.204	192.972	0.185010	0.690908
14	477.188	0.036444	1350.052	49.150	193.378	0.188278	0.690532
15	491.369	0.035414	1346.592	50.100	193.784	0.191538	0.690155
16	505.926	0.034425	1343.103	51.050	194.189	0.194794	0.689778
17	520.798	0.033469	1339.602	52.003	194.589	0.198046	0.689435
18	535.989	0.032545	1336.076	52.958	194.989	0.201293	0.689096
19	551.501	0.031650	1332.534	53.915	195.387	0.204532	0.688756
20	567.294	0.030780	1328.972	54.873	195.783	0.207767	0.688396
21	583.483	0.029945	1325.396	55.834	196.176	0.211000	0.688095
22	600.015	0.029135	1321.795	56.798	196.568	0.214226	0.687760
23	616.888	0.028352	1318.169	57.765	196.958	0.217449	0.687450
24	634.104	0.027593	1314.526	58.732	197.344	0.220668	0.687124
25	651.617	0.026854	1310.871	59.702	197.729	0.223882	0.686805
26	669.556	0.026143	1307.180	60.675	198.112	0.227096	0.686504
27	687.876	0.025455	1303.477	61.650	198.494	0.230303	0.686202
28	706.533	0.024787	1299.749	62.628	198.871	0.233507	0.685901
29	725.149	0.024139	1295.996	63.608	199.247	0.236710	0.685600
30	744.910	0.042237	1292.225	64.591	199.620	0.239909	0.685298
31	764.704	0.024773	1288.419	65.579	199.991	0.243104	0.684997
32	784.885	0.022311	1284.601	66.567	200.360	0.245300	0.684729
33	805.452	0.021738	1280.746	67.558	200.725	0.249492	0.684436
34	826.406	0.021183	1276.873	68.554	201.088	0.252681	0.684159
35	847.710	0.020641	1272.987	69.550	201.446	0.255869	0.683875
36	869.491	0.020118	1269.066	70.553	201.804	0.259057	0.683573

Table 3 Cont'd

Temperature °C	Absolute Pressure kPa	Volume Vapor v_g m³/kg	Density Liquid $1/v_f$ kg/m³	Enthalpy Liquid h_f kJ/kg	Enthalpy Vapor h_g kJ/kg	Entropy Liquid s_f kJ/kgK	Entropy Vapor s_g kJ/kgK
37	891.658	0.019610	1265.106	71.555	202.157	0.262241	0.683305
38	914.259	0.019118	1261.130	72.563	202.508	0.265425	0.683041
39	937.301	0.018638	1257.122	73.574	202.856	0.268609	0.682753
40	960.646	0.018170	1253.092	74.588	203.200	0.271791	0.682493
41	984.537	0.017719	1249.027	75.606	203.541	0.274975	0.682191
42	1008.868	0.017280	1244.936	76.627	203.879	0.278160	0.681924
43	1033.593	0.016853	1240.819	77.651	204.214	0.281344	0.681660
44	1058.765	0.016448	1236.667	78.680	204.545	0.284528	0.681371
45	1084.338	0.016032	1232.476	79.712	204.873	0.287714	0.681111
46	1110.401	0.015639	1228.267	80.749	205.195	0.290898	0.680810
47	1136.959	0.015257	1224.006	81.790	205.329	0.294085	0.680542
48	1163.966	0.014885	1219.727	82.835	205.761	0.297276	0.680249
49	1191.455	0.014524	1215.407	83.883	206.142	0.300468	0.679947
50	1219.338	0.014170	1211.060	84.937	206.450	0.303661	0.679688
51	1247.758	0.013828	1206.663	85.994	206.753	0.306847	0.679386
52	1276.675	0.013494	1202.227	87.056	207.051	0.310056	0.679085
53	1306.088	0.013169	1197.753	88.125	207.345	0.313258	0.678783
54	1335.997	0.012852	1193.250	89.197	207.634	0.316466	0.678482
55	1366.368	0.012543	1188.706	90.275	207.918	0.319676	0.678181
56	1397.236	0.012242	1184.110	91.358	208.198	0.322890	0.677862
57	1428.635	0.011949	1179.473	92.446	208.473	0.326110	0.677536
58	1460.544	0.011663	1174.804	93.414	208.744	0.329337	0.677226
59	1492.998	0.011383	1170.083	94.073	209.007	0.332567	0.676887
60	1525.948	0.011112	1165.311	95.743	209.264	0.335804	0.676548
65	1699.633	0.009856	1140.615	101.370	210.451	0.352105	0.674701
70	1887.219	0.008737	1114.472	107.174	211.461	0.368640	0.672587
75	2089.429	0.007736	1086.588	113.184	212.256	0.385483	0.670116
80	2306.986	0.006834	1056.558	119.438	212.784	0.402732	0.667127
85	2540.649	0.006015	1023.820	125.989	212.972	0.420522	0.663464
90	2791.163	0.005265	987.493	132.914	212.708	0.439030	0.658846
95	3059.335	0.004567	946.098	140.349	211.811	0.458410	0.652792
100	3346.039	0.003902	896.822	148.495	209.931	0.479231	0.644443
105	3754.613	0.003205	822.692	158.401	205.358	0.505102	0.629461

Table 4 — Refrigerant 12 (Dichlorodifluoromethane) Properties of Superheated Vapor

10 kPa Absolute Pressure (Sat. Temp. = −73.8303° C)				20 kPa Absolute Pressure (Sat. Temp. = −62.1922° C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK	t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	1.515439	153.868	0.783973	Sat	0.724855	158.862	0.757726
−70	1.553700	155.747	0.793349	−70	--------	--------	--------
−65	1.597749	158.234	0.805506	−65	--------	--------	--------
−60	1.637041	160.763	0.817515	−60	0.733177	159.986	0.762994
−55	1.676277	163.322	0.829380	−55	0.751836	162.561	0.774948
−50	1.715477	165.912	0.841137	−50	0.769841	165.166	0.786758
−45	1.754606	168.532	0.852763	−45	0.787797	167.799	0.798457
−40	1.793713	171.183	0.864273	−40	0.805702	170.461	0.809992
−35	1.832763	173.867	0.875632	−35	0.823602	173.155	0.821410
−30	1.871787	176.579	0.886905	−30	0.841457	175.876	0.832702
−25	1.910786	179.320	0.898054	−25	0.859263	178.624	0.843884
−20	1.949743	182.090	0.909092	−20	0.877019	181.400	0.854967
−15	1.988664	184.888	0.920031	−15	0.894784	184.203	0.865929
−10	2.027585	187.712	0.930878	−10	0.912527	187.032	0.876777
−5	2.066505	190.564	0.941621	−5	0.930228	189.887	0.887525
0	2.105380	193.442	0.952248	0	0.947948	192.768	0.898172
5	2.144228	196.347	0.962801	5	0.965623	195.675	0.908724
10	2.183054	199.276	0.973239	10	0.983247	198.606	0.919203
15	2.221998	202.235	0.983601	15	1.000931	201.565	0.929539
20	2.260754	205.219	0.993845	20	1.018559	204.547	0.939805
25	2.299516	208.226	1.004015	25	1.036179	207.555	0.949977
30	2.338302	211.258	1.014106	30	1.053768	210.587	0.960050
35	2.376661	214.314	1.024104	35	1.071367	213.640	0.970023
40	2.415846	217.392	1.034010	40	1.088964	216.717	0.979927
45	2.454622	220.494	1.043838	45	1.106532	219.815	0.989759
50	2.493385	223.618	1.053592	50	1.124101	222.936	0.999485
30 kPa Absolute Pressure (Sat. Temp. = −55.0734° C)				**40 kPa Absolute Pressure (Sat. Temp. = −49.125° C)**			
Sat	0.495684	162.174	0.745737	Sat	0.377294	165.127	0.739577
−70	--------	--------	--------	−45	0.385841	167.619	0.750499
−65	--------	--------	--------	−40	0.395081	170.313	0.762307
−60	--------	--------	--------	−35	0.404163	173.049	0.773906
−55	--------	--------	--------	−30	0.413207	175.808	0.785370
−50	0.502245	164.850	0.757770	−25	0.422222	178.595	0.796701
−45	0.520590	167.491	0.769602	−20	0.431206	181.405	0.807897
−40	0.532661	170.173	0.781230	−15	0.440165	184.239	0.818980
−35	0.544688	172.883	0.792720	−10	0.449101	187.100	0.829950
−30	0.556679	175.620	0.804098	−5	0.450013	189.985	0.840810
−25	0.568638	178.414	0.815326	0	0.466908	192.893	0.851579
−20	0.580570	181.190	0.826447	5	0.475786	195.826	0.862229
−15	0.592473	183.988	0.837459	10	0.484645	198.782	0.872773
−10	0.604353	186.829	0.848359	15	0.493487	201.764	0.883203
−5	0.616213	189.695	0.859155	20	0.502318	204.771	0.893539
0	0.628043	192.585	0.869845	25	0.511136	207.800	0.903776
5	0.639867	195.501	0.880440	30	0.519939	210.896	0.913913
10	0.651685	198.442	0.890902	35	0.528733	213.962	0.923965
15	0.663497	201.408	0.901276	40	0.537521	217.021	0.933934
20	0.675271	204.399	0.911561	45	0.546298	220.138	0.943817
25	0.687038	207.413	0.921766	50	0.555062	223.277	0.953620
30	0.698775	210.450	0.931861	55	0.563825	226.337	0.963330
35	0.710518	213.510	0.941860	60	0.572587	229.613	0.972938
40	0.722260	216.592	0.951787				
45	0.733975	219.696	0.961634				
50	0.745673	222.822	0.971384				

Table 4 Cont'd

50 kPa Absolute Pressure (Sat. Temp. = −45.2045° C)				60 kPa Absolute Pressure (Sat. Temp. = −41.4439° C)			
t °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK	*t* °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK
Sat	0.306069	167.183	0.733670	Sat	0.258203	168.926	0.729044
−45	0.306375	167.295	0.734154	−45	--------	--------	--------
−40	0.313850	170.019	0.745970	−40	0.260077	169.720	0.732493
−35	0.321195	172.771	0.757649	−35	0.266272	172.433	0.744227
−30	0.328504	175.548	0.769179	−30	0.272436	175.272	0.755814
−25	0.335314	178.349	0.780567	−25	0.278562	178.102	0.767277
−20	0.342760	181.174	0.791818	−20	0.284660	180.941	0.778591
−15	0.350247	184.023	0.802956	−15	0.290732	183.802	0.789784
−10	0.357444	186.894	0.813977	−10	0.296778	186.686	0.800859
−5	0.364618	189.789	0.824876	−5	0.302802	189.592	0.811805
0	0.371772	192.708	0.835547	0	0.308803	192.522	0.822629
5	0.378907	195.651	0.845785	5	0.314789	195.472	0.833345
10	0.386027	198.615	0.856824	10	0.320759	198.447	0.843959
15	0.393128	201.606	0.867385	15	0.326711	201.447	0.854435
20	0.400220	204.620	0.877744	20	0.332649	204.468	0.864833
25	0.407295	207.656	0.888012	25	0.338574	207.511	0.875114
30	0.414360	210.713	0.898186	30	0.344487	210.575	0.885305
35	0.421416	213.793	0.908265	35	0.350390	213.661	0.895411
40	0.428463	216.895	0.918247	40	0.356283	216.769	0.905422
45	0.435500	220.019	0.928139	45	0.362168	219.899	0.915332
50	0.442516	223.163	0.937955	50	0.368046	223.048	0.925148
55	0.449494	226.327	0.947681	55	0.373914	226.218	0.934885
60	0.456563	229.512	0.957214	60	0.379773	229.407	0.944531
80 kPa Absolute Pressure (Sat. Temp. = −35.218° C)				**Standard Atmospheric Pressure (Sat. Temp. = −29.7888° C)**			
Sat	0.197941	171.792	0.722194	Sat	0.158036	174.295	0.716825
−35	0.198174	171.929	0.722762	−35	--------	--------	--------
−30	0.202998	174.754	0.734502	−30	--------	--------	--------
−25	0.207729	177.600	0.746096	−25	0.166118	175.334	0.728037
−20	0.212407	180.469	0.757524	−20	0.165417	179.029	0.739626
−15	0.217056	183.357	0.768826	−15	0.169145	182.878	0.751052
−10	0.221682	186.267	0.779997	−10	0.172849	185.814	0.762310
−5	0.226286	189.197	0.791028	−5	0.176531	188.769	0.773426
0	0.230868	192.147	0.801945	0	0.180190	191.744	0.784434
5	0.235429	195.118	0.812729	5	0.183828	194.736	0.795307
10	0.239972	198.110	0.823393	10	0.187446	197.748	0.806046
15	0.244501	201.127	0.833936	15	0.191048	200.783	0.816672
20	0.249016	204.164	0.844379	20	0.194639	203.837	0.827164
25	0.253516	207.222	0.854721	25	0.198216	206.910	0.837552
30	0.258006	210.300	0.864963	30	0.201778	210.003	0.847839
35	0.262485	213.399	0.874652	35	0.205332	213.116	0.858025
40	0.266954	216.518	0.884602	40	0.208875	216.249	0.868111
45	0.271413	219.658	0.895169	45	0.212407	219.400	0.878097
50	0.275864	222.818	0.905157	50	0.215933	222.570	0.887982
55	0.280308	225.997	0.914720	55	0.219450	225.761	0.897771
60	0.284743	229.196	0.924405	60	0.222961	228.970	0.907492
65	0.289172	232.417	0.933976	65	0.226462	232.196	0.917101
70	0.293593	235.656	0.943473	70	0.229957	235.446	0.926643
75	0.298010	238.591	0.952908	75	0.233448	238.714	0.936088
80	0.302425	242.008	0.962248	80	0.236933	241.998	0.945459
85	0.306833	245.488	0.971511	85	0.240416	245.301	0.954741
120 kPa Absolute Pressure (Sat. Temp. = −25.7669° C)				**140 kPa Absolute Pressure (Sat. Temp. = −21.9427° C)**			
Sat	0.135281	176.127	0.713290	Sat	0.116924	177.867	0.710173
−35	--------	--------	--------	−20	0.118016	179.011	0.714689
−30	--------	--------	--------	−15	0.120827	181.988	0.726315
−25	0.135782	176.580	0.715081	−10	0.123607	184.976	0.737776
−20	0.139048	179.532	0.726761	−5	0.126362	187.979	0.749081
−15	0.142279	182.467	0.738304	0	0.129093	190.997	0.760245
−10	0.145467	185.411	0.749658	5	0.131803	194.031	0.771271
−5	0.148631	188.389	0.760868	10	0.134494	197.081	0.782135
0	0.151773	191.384	0.771951	15	0.137168	200.150	0.792880
5	0.154895	194.397	0.782888	20	0.139819	203.235	0.803491
10	0.157998	197.428	0.793692	25	0.142470	206.339	0.813968
15	0.161085	200.478	0.804344	30	0.145103	209.459	0.824336
20	0.164155	203.548	0.814897	35	0.147725	212.598	0.834604
25	0.167215	206.602	0.825348	40	0.150337	215.754	0.844768
30	0.170261	209.722	0.835674	45	0.152940	218.927	0.854831
35	0.164000	212.866	0.845893	50	0.155532	222.119	0.864796
40	0.165164	216.010	0.856012	55	0.158116	225.327	0.874656
45	0.179332	219.173	0.866037	60	0.160693	228.554	0.884422
50	0.182337	222.353	0.875978	65	0.163260	231.800	0.894074
55	0.185338	225.552	0.885790	70	0.165827	235.064	0.903654
60	0.188329	228.769	0.895512	75	0.168385	238.345	0.913137
65	0.191313	232.007	0.905158	80	0.170937	241.645	0.922549
70	0.194289	235.262	0.914728	85	0.173484	244.960	0.931871
75	0.197260	238.536	0.924199	90	0.176026	248.292	0.941107
80	0.200228	241.828	0.933578	95	0.178565	251.642	0.950276
85	0.203190	245.136	0.942882				

Table 4 Cont'd

160 kPa Absolute Pressure (Sat. Temp. = −18.5087° C)				180 kPa Absolute Pressure (Sat. Temp. = −15.4944° C)			
t °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK	*t* °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK
Sat	0.1032202	179.405	0.707592	Sat	0.092611	180.294	0.703684
−20	---------	-------	-------	−20	--------	-------	--------
−15	0.1049805	181.517	0.715786	−15	0.092834	196.756	0.704839
−10	0.1074688	184.534	0.727373	−10	0.095076	183.633	0.716454
−5	0.1099233	187.563	0.738783	−5	0.097299	186.681	0.727931
0	0.1123536	190.605	0.750024	0	0.099500	189.739	0.739240
5	0.1147590	193.661	0.761129	5	0.101665	192.808	0.750386
10	0.1171474	196.731	0.772079	10	0.103755	195.890	0.761398
15	0.1195190	199.819	0.782879	15	0.105963	198.989	0.772223
20	0.1218756	202.921	0.793544	20	0.108091	202.100	0.782914
25	0.1242146	206.040	0.804094	25	0.110201	205.227	0.793471
30	0.1265438	209.175	0.814509	30	0.112296	208.268	0.803920
35	0.1288611	212.327	0.824821	35	0.114380	211.525	0.814248
40	0.1311669	215.495	0.835026	40	0.116451	214.698	0.824458
45	0.1334632	218.681	0.845115	45	0.118512	217.887	0.834569
50	0.1357497	221.883	0.855110	50	0.120567	221.091	0.844579
55	0.1380321	225.102	0.864994	55	0.122616	224.311	0.854485
60	0.1403026	228.338	0.874791	60	0.124649	227.550	0.864257
65	0.1425640	231.593	0.884498	65	0.126683	230.805	0.873954
70	0.1448235	234.865	0.894084	70	0.128707	234.075	0.883551
75	0.1470757	238.154	0.903585	75	0.130726	237.364	0.893077
80	0.1493221	241.460	0.913025	80	0.132739	240.669	0.902486
85	0.1515655	245.048	0.922375	85	0.134747	243.990	0.911824
90	0.1538038	248.440	0.931623	90	0.136751	247.326	0.921078
95	0.1560364	251.477	0.940792	95	0.138749	250.677	0.930236
200 kPa Absolute Pressure (Sat. Temp. = −12.5429° C)				**220 kPa Absolute Pressure (Sat. Temp. = −9.8055° C)**			
Sat	0.083630	181.601	0.701737	Sat	0.076150	182.807	0.700050
−10	0.084674	183.164	0.707667	−10	----------	-------	--------
−5	0.086712	186.239	0.719254	−5	0.077941	185.795	0.711199
0	0.088716	189.324	0.730658	0	0.079795	188.906	0.722744
5	0.090701	192.417	0.741894	5	0.081619	192.024	0.734074
10	0.092665	195.521	0.752963	10	0.083422	195.150	0.745237
15	0.094611	198.638	0.763863	15	0.085209	198.288	0.756212
20	0.096537	201.768	0.774613	20	0.086976	201.436	0.767019
25	0.098452	204.913	0.785256	25	0.088727	204.596	0.777690
30	0.100352	208.070	0.795749	30	0.090467	207.769	0.788251
35	0.102239	211.241	0.806116	35	0.092194	210.955	0.798691
40	0.104117	214.427	0.816375	40	0.093908	214.156	0.808998
45	0.105984	217.628	0.826517	45	0.095052	217.370	0.819171
50	0.107840	220.844	0.836550	50	0.095814	220.598	0.829228
55	0.109690	224.075	0.846496	55	0.098998	223.840	0.839209
60	0.111535	227.323	0.856324	60	0.100678	227.098	0.849056
65	0.113369	230.588	0.866040	65	0.102352	230.372	0.858791
70	0.115198	233.868	0.875673	70	0.104016	233.661	0.868458
75	0.117018	237.165	0.885192	75	0.105679	236.964	0.878001
80	0.118835	240.476	0.894633	80	0.107335	240.284	0.887460
85	0.120646	243.804	0.903985	85	0.108984	243.620	0.896852
90	0.122452	247.148	0.913254	90	0.110627	246.970	0.906144
95	0.124256	250.506	0.922450	95	0.112266	250.336	0.915340
100	0.126055	253.881	0.931558	100	0.113901	253.716	0.924486
240 kPa Absolute Pressure (Sat. Temp. = −7.4315° C)				**260 kPa Absolute Pressure (Sat. Temp. = −5.1114° C)**			
Sat	0.070378	183.847	0.698635	Sat	0.065213	184.854	0.697338
−10	---------	-------	--------	−5	0.065249	184.925	0.697599
−5	0.071224	185.371	0.704309	0	0.066871	188.122	0.709280
0	0.072956	188.507	0.715922	5	0.068468	191.395	0.720784
5	0.074643	191.649	0.727322	10	0.070046	194.428	0.732091
10	0.076345	194.797	0.738576	15	0.071596	197.606	0.743206
15	0.078342	197.954	0.749603	20	0.073136	200.792	0.754158
20	0.079726	201.121	0.760478	25	0.074657	203.987	0.764973
25	0.081282	204.298	0.771233	30	0.076165	111.985	0.775629
30	0.082898	207.486	0.781835	35	0.077661	131.067	0.786139
35	0.084502	210.686	0.792303	40	0.079144	213.633	0.796518
40	0.086095	213.899	0.802644	45	0.080617	216.871	0.806777
45	0.087677	217.125	0.812863	50	0.082080	219.724	0.816925
50	0.089251	220.364	0.822981	55	0.083534	221.600	0.826948
55	0.090816	223.616	0.832979	60	0.084977	226.663	0.836865
60	0.092369	226.885	0.842864	65	0.086415	229.955	0.846669
65	0.093919	230.168	0.852637	70	0.087848	233.262	0.856378
70	0.095461	233.466	0.862302	75	0.089275	236.526	0.856983
75	0.096997	236.778	0.871872	80	0.090694	239.885	0.875490
80	0.098528	240.105	0.881369	85	0.092109	243.266	0.884899
85	0.100054	243.446	0.890765	90	0.093519	246.629	0.894222
90	0.101573	246.801	0.900062	95	0.094923	250.006	0.903471
95	0.103088	250.172	0.909283	100	0.096326	253.398	0.912635
100	0.104601	253.558	0.918428				

Table 4 Cont'd

280 kPa Absolute Pressure (Sat. Temp. = −2.9295° C)				300 kPa Absolute Pressure (Sat. Temp. = −0.8643° C)			
t °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK	*t* °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK
Sat	0.060790	185.798	0.696188	Sat	0.056923	186.452	0.695354
−5	-------	-------	-------	−5	-------	-------	-------
0	0.061679	187.669	0.703016	0	0.057171	187.046	0.697342
5	0.063193	190.862	0.714644	5	0.058603	190.460	0.708843
10	0.064680	194.057	0.726055	10	0.060010	193.680	0.720335
15	0.066141	197.258	0.737230	15	0.061394	196.901	0.731592
20	0.067587	200.461	0.748270	20	0.062760	200.126	0.742691
25	0.069016	203.674	0.759119	25	0.064109	203.357	0.753616
30	0.070431	206.894	0.769825	30	0.065446	206.598	0.764384
35	0.071834	210.124	0.780395	35	0.066767	209.843	0.774992
40	0.073224	213.364	0.790820	40	0.068075	213.094	0.785457
45	0.074603	216.615	0.801123	45	0.069375	216.358	0.795806
50	0.075974	219.878	0.811321	50	0.070662	219.633	0.806032
55	0.077333	223.153	0.821379	55	0.071943	222.919	0.816120
60	0.078687	226.433	0.831313	60	0.073215	226.217	0.826109
65	0.080033	229.741	0.841160	65	0.074481	229.528	0.835956
70	0.081371	233.058	0.850890	70	0.075737	232.852	0.845704
75	0.082703	236.386	0.860507	75	0.076987	236.190	0.855373
80	0.084030	239.728	0.870035	80	0.078233	239.540	0.864923
85	0.085351	243.084	0.879462	85	0.079473	242.902	0.874365
90	0.086667	246.454	0.888799	90	0.080706	246.279	0.883728
95	0.087978	249.837	0.898065	95	0.081933	249.670	0.893012
100	0.089286	253.235	0.907249	100	0.083160	253.073	0.902201
105	0.090591	256.646	0.913432	105	0.084385	256.490	0.911314
110	0.091891	260.071	0.925328	110	0.085601	259.920	0.920334
115	0.093186	263.513	0.934235	115	0.086816	263.366	0.929242
320 kPa Absolute Pressure (Sat. Temp. = 1.1035° C)				**340 kPa Absolute Pressure (Sat. Temp. = 2.9795° C)**			
Sat	0.053522	188.003	0.695971	Sat	0.050514	188.801	0.695087
5	0.054572	190.539	0.705055	5	0.051033	190.126	0.699823
10	0.055921	193.793	0.716711	10	0.052319	193.405	0.711544
15	0.057236	197.045	0.728099	15	0.053575	196.680	0.723011
20	0.058533	200.298	0.739285	20	0.054812	199.955	0.734255
25	0.059813	203.555	0.750300	25	0.056031	203.232	0.745324
30	0.061079	206.818	0.761147	30	0.057236	206.512	0.756243
35	0.062330	210.087	0.771848	35	0.058426	209.797	0.766995
40	0.063569	213.365	0.782398	40	0.059604	213.089	0.777587
45	0.064798	216.651	0.792806	45	0.060771	216.389	0.788041
50	0.066017	219.946	0.803138	50	0.061927	219.697	0.798367
55	0.067226	223.252	0.813417	55	0.063074	223.014	0.808553
60	0.068430	226.568	0.823293	60	0.064213	226.342	0.818639
65	0.069619	229.898	0.833203	65	0.065344	229.681	0.828573
70	0.070806	233.240	0.842993	70	0.066466	233.033	0.838397
75	0.071984	236.594	0.852697	75	0.067582	236.394	0.848129
80	0.073157	239.960	0.862306	80	0.068694	239.769	0.857746
85	0.074325	243.339	0.871814	85	0.069801	243.156	0.867268
90	0.075490	246.731	0.881222	90	0.070902	246.555	0.876700
95	0.076650	250.137	0.890532	95	0.071998	249.966	0.886037
100	0.077803	253.555	0.899753	100	0.073090	253.391	0.895281
105	0.078952	256.986	0.908897	105	0.074177	256.828	0.904428
110	0.080099	260.431	0.917941	110	0.075258	260.278	0.913496
115	0.081243	263.890	0.926916	115	0.076341	263.743	0.922477
				120	0.077418	267.221	0.931368
360 kPa Absolute Pressure (Sat. Temp. = 4.7725° C)				**380 kPa Absolute Pressure (Sat. Temp. = 6.4944° C)**			
Sat	0.047814	189.561	0.694246	Sat	0.045405	190.281	0.693517
5	0.047870	189.711	0.694783	10	0.046233	192.617	0.701798
10	0.049097	193.013	0.706586	15	0.047388	195.941	0.713446
15	0.050300	196.312	0.718125	20	0.048526	199.259	0.724841
20	0.051483	199.609	0.729459	25	0.049644	202.575	0.736058
25	0.052649	202.906	0.740595	30	0.050746	205.892	0.747081
30	0.053799	206.203	0.751777	35	0.051833	209.210	0.757946
35	0.054935	209.505	0.764785	40	0.052908	212.532	0.768644
40	0.056058	212.812	0.775702	45	0.053972	215.860	0.779178
45	0.057170	216.126	0.783511	50	0.055024	219.194	0.789595
50	0.058271	219.447	0.793855	55	0.056039	222.536	0.799850
55	0.059357	222.776	0.804088	60	0.056824	225.884	0.809986
60	0.060380	226.113	0.814190	65	0.058098	229.244	0.819993
65	0.061334	229.463	0.824176	70	0.059144	232.614	0.829880
70	0.062595	232.823	0.834031	75	0.060156	235.993	0.839652
75	0.063668	236.195	0.843779	80	0.061161	239.384	0.849330
80	0.064706	239.577	0.853428	85	0.062162	242.786	0.858893
85	0.065755	242.971	0.862976	90	0.063157	246.199	0.868348
90	0.066800	246.376	0.872421	95	0.064147	249.623	0.877719
95	0.067839	249.794	0.881768	100	0.065131	253.061	0.887002
100	0.068873	253.225	0.891024	105	0.066112	256.509	0.896186
105	0.069903	256.668	0.900205	110	0.067094	259.970	0.905288
110	0.070934	260.125	0.909286	115	0.068067	263.445	0.914294
115	0.071958	263.594	0.918259	120	0.069037	266.932	0.923199
120	0.072977	267.076	0.927160				

Table 4 Cont'd

400 kPa Absolute Pressure (Sat. Temp. = 8.1444°C)				420 kPa Absolute Pressure (Sat. Temp. = 9.7399°C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK	t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	0.043218	190.970	0.692834	Sat	0.041234	191.632	0.692182
10	0.043639	192.217	0.697231	10	0.041290	191.808	0.692800
15	0.044754	195.566	0.708949	15	0.042370	195.183	0.704585
20	0.045848	198.908	0.720434	20	0.043426	198.547	0.716160
25	0.046923	202.244	0.731713	25	0.044464	201.907	0.727516
30	0.047983	205.579	0.742817	30	0.045484	205.261	0.738680
35	0.049027	208.915	0.753732	35	0.046490	208.615	0.749650
40	0.050058	212.253	0.764462	40	0.047482	211.968	0.760435
45	0.051077	215.594	0.775051	45	0.048462	215.324	0.771066
50	0.052086	218.941	0.785514	50	0.049430	218.685	0.781559
55	0.053084	222.296	0.795788	55	0.050389	222.049	0.791903
60	0.054074	225.655	0.805962	60	0.051339	225.421	0.802094
65	0.055055	229.026	0.816023	65	0.052280	228.802	0.812172
70	0.056028	232.404	0.825917	70	0.053213	232.191	0.822101
75	0.056995	235.792	0.835730	75	0.054140	235.588	0.831923
80	0.057956	239.190	0.844523	80	0.055060	238.995	0.841645
85	0.058911	242.600	0.854257	85	0.055975	242.412	0.851255
90	0.059862	246.022	0.864494	90	0.056884	245.840	0.860755
95	0.060807	249.453	0.873877	95	0.057789	249.279	0.870162
100	0.061747	252.895	0.885185	100	0.058690	252.728	0.879482
105	0.062682	256.351	0.892345	105	0.059586	256.189	0.888701
110	0.063620	259.818	0.901463	110	0.060478	259.662	0.897820
115	0.064547	263.297	0.910507	115	0.061367	263.146	0.906843
120	0.065474	266.789	0.919417	120	0.062254	266.643	0.915784
125	0.066397	270.293	0.928280	125	0.063136	270.152	0.924656
440 kPa Absolute Pressure (Sat. Temp. = 11.2759°C)				460 kPa Absolute Pressure (Sat. Temp. = 12.7607°C)			
Sat	0.039416	192.268	0.691575	Sat	0.037761	192.875	0.690983
15	0.040192	194.799	0.700403	15	0.038213	194.456	0.696335
20	0.041214	198.188	0.712034	20	0.039205	197.912	0.708058
25	0.042217	201.567	0.723460	25	0.040177	201.308	0.719558
30	0.043203	204.941	0.734686	30	0.041131	204.698	0.730843
35	0.044173	208.312	0.745710	35	0.042070	208.082	0.741930
40	0.045129	211.683	0.756551	40	0.042994	211.465	0.752832
45	0.046073	215.053	0.767236	45	0.043906	214.848	0.763568
50	0.047006	218.428	0.777779	50	0.044806	218.232	0.774147
55	0.047928	221.804	0.788159	55	0.045696	221.620	0.784546
60	0.048842	225.189	0.798405	60	0.046576	225.011	0.794833
65	0.049746	228.579	0.808504	65	0.047447	228.411	0.804946
70	0.050643	231.978	0.818465	70	0.048311	231.816	0.814956
75	0.051533	235.385	0.828322	75	0.049167	235.230	0.824829
80	0.052416	238.800	0.838055	80	0.050018	238.652	0.834597
85	0.053294	242.225	0.847676	85	0.050862	242.083	0.844262
90	0.054167	245.660	0.857197	90	0.051702	245.524	0.853804
95	0.055035	249.106	0.866617	95	0.052536	248.974	0.863237
100	0.055898	252.562	0.875945	100	0.053366	252.434	0.872589
105	0.056757	256.028	0.885195	105	0.054192	255.906	0.881824
110	0.057613	259.506	0.894313	110	0.055014	259.387	0.890981
115	0.058464	262.996	0.903357	115	0.055832	262.383	0.900038
120	0.059303	266.498	0.912330	120	0.056646	266.389	0.909016
125	0.060154	270.012	0.921210	125	0.057458	269.905	0.917896
480 kPa Absolute Pressure (Sat. Temp. = 14.2011°C)				500 kPa Absolute Pressure (Sat. Temp. = 15.595°C)			
Sat	0.036232	193.538	0.690436	Sat	0.034823	193.926	0.689942
15	0.036389	194.013	0.692355	20	0.035649	197.110	0.700416
20	0.037352	197.402	0.704160	25	0.036568	200.588	0.712070
25	0.038296	200.830	0.715740	30	0.037468	204.021	0.723501
30	0.039222	204.248	0.727108	35	0.038351	207.445	0.734711
35	0.040131	207.659	0.738260	40	0.039219	210.863	0.745605
40	0.041026	211.065	0.749213	45	0.040048	214.277	0.756352
45	0.041908	214.469	0.759995	50	0.040847	217.692	0.767217
50	0.042779	217.873	0.770610	55	0.041749	221.106	0.777719
55	0.043639	221.277	0.781062	60	0.042572	224.523	0.788053
60	0.044489	224.686	0.791379	65	0.043385	227.943	0.798265
65	0.045330	228.100	0.801546	70	0.044190	231.371	0.808318
70	0.046163	231.520	0.811585	75	0.044989	234.804	0.818255
75	0.046989	234.947	0.821486	80	0.045781	238.244	0.828065
80	0.047809	238.380	0.831280	85	0.046567	241.691	0.837761
85	0.048623	241.822	0.840956	90	0.047347	245.146	0.847345
90	0.049432	245.274	0.850511	95	0.048122	248.612	0.856822
95	0.050235	248.734	0.859965	100	0.048893	252.085	0.866211
100	0.051034	252.203	0.869329	105	0.049660	255.570	0.875481
105	0.051829	255.681	0.878613	110	0.050422	259.064	0.884675
110	0.052620	259.173	0.887770	115	0.051181	262.570	0.893757
115	0.053407	262.673	0.896851	120	0.051936	266.086	0.902746
120	0.054191	266.187	0.905832	125	0.052689	269.613	0.911658
125	0.054971	269.710	0.914735	130	0.053438	273.151	0.920500
130	0.055749	273.245	0.923550				

Table 4 Cont'd

520 kPa Absolute Pressure (Sat. Temp. = 16.949° C)				540 kPa Absolute Pressure (Sat. Temp. = 18.2637° C)			
t °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK	*t* °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK
Sat	0.033518	194.675	0.689457	Sat	0.032304	195.038	0.689013
20	0.034075	196.670	0.696755	20	0.032613	196.318	0.693174
25	0.034970	200.100	0.708490	25	0.033486	199.852	0.704990
30	0.035846	203.562	0.719984	30	0.034340	203.330	0.716554
35	0.036705	207.012	0.731265	35	0.035177	206.794	0.727889
40	0.037549	210.455	0.742340	40	0.035998	210.248	0.739024
45	0.038379	213.891	0.753215	45	0.036806	213.697	0.749960
50	0.039197	217.326	0.763919	50	0.037601	217.142	0.760712
55	0.040004	220.759	0.774472	55	0.038385	220.584	0.771314
60	0.040802	224.192	0.784835	60	0.039159	224.027	0.781720
65	0.041589	227.630	0.795073	65	0.039923	227.471	0.791975
70	0.042366	231.071	0.805154	70	0.040679	230.920	0.802091
75	0.043140	234.517	0.815118	75	0.041427	234.373	0.812078
80	0.043907	237.969	0.824955	80	0.042169	237.832	0.821952
85	0.044667	241.428	0.834678	85	0.042905	241.296	0.831703
90	0.045422	244.894	0.844289	90	0.043636	244.767	0.841323
95	0.046171	248.369	0.853785	95	0.044361	248.247	0.850835
100	0.046916	251.852	0.863180	100	0.045082	251.735	0.860261
105	0.047657	255.345	0.872478	105	0.045798	255.232	0.869565
110	0.048393	258.848	0.881699	110	0.046511	258.738	0.878797
115	0.049125	262.360	0.890780	115	0.047219	262.255	0.887916
120	0.049854	265.882	0.899794	120	0.047924	265.781	0.896935
125	0.050581	269.417	0.908712	125	0.048553	269.319	0.905882
130	0.051304	272.960	0.917555	130	0.049283	272.866	0.914737
				135	0.050020	276.423	0.923495
				140	0.050754	279.991	0.932183
560 kPa Absolute Pressure (Sat. Temp. = 19.5381° C)				**580 kPa Absolute Pressure (Sat. Temp. = 20.7333° C)**			
Sat	0.031177	195.736	0.688552	Sat	0.030161	196.073	0.688187
20	0.031257	195.992	0.689665	20	--------	-------	--------
25	0.032110	199.350	0.701561	25	0.030872	199.096	0.698363
30	0.032945	202.860	0.713205	30	0.031689	202.622	0.710076
35	0.033761	206.353	0.724618	35	0.032488	206.131	0.721556
40	0.034562	209.834	0.735820	40	0.033270	209.625	0.732818
45	0.035348	213.306	0.746813	45	0.034038	213.107	0.743859
50	0.036122	216.771	0.757620	50	0.034793	216.584	0.754699
55	0.036885	220.232	0.768246	55	0.035537	220.056	0.765346
60	0.037638	223.692	0.778684	60	0.036270	223.525	0.775859
65	0.038380	227.153	0.788994	65	0.036993	226.994	0.786184
70	0.039114	230.617	0.799136	70	0.037707	230.464	0.796374
75	0.039840	234.083	0.809152	75	0.038414	234.992	0.806402
80	0.040560	237.554	0.819037	80	0.039114	238.017	0.816312
85	0.041274	241.030	0.828801	85	0.039808	240.897	0.826101
90	0.041983	244.512	0.838458	90	0.040497	244.385	0.835772
95	0.042686	248.001	0.848007	95	0.041180	247.880	0.845343
100	0.043384	251.499	0.857440	100	0.041859	251.382	0.854806
105	0.044078	255.005	0.866772	105	0.042532	254.891	0.864142
110	0.044768	258.520	0.876004	110	0.043202	258.410	0.873412
115	0.045454	262.043	0.885146	115	0.043868	261.938	0.882531
120	0.046136	265.577	0.894167	120	0.044530	265.474	0.891583
125	0.046815	269.121	0.903114	125	0.045189	269.022	0.900538
130	0.047492	272.674	0.911985	130	0.045845	272.596	0.909418
135	0.048166	276.238	0.920770	135	0.046499	276.160	0.918692
140	0.048837	279.812	0.929462	140	0.047150	279.722	0.927497
600 kPa Absolute Pressure (Sat. Temp. = 22.001° C)				**650 kPa Absolute Pressure (Sat. Temp. = 24.9° C)**			
Sat	0.029135	196.569	0.687765	Sat	0.026922	197.655	0.686855
20	--------	------	--------	25	0.026936	197.727	0.690851
25	0.029624	198.709	0.694950	30	0.027697	201.408	0.699041
30	0.030424	202.261	0.706756	35	0.028441	204.994	0.710774
35	0.031204	205.791	0.718319	40	0.029167	208.556	0.722266
40	0.031968	209.305	0.729638	45	0.029876	212.103	0.733511
45	0.032718	212.807	0.740736	50	0.030573	215.634	0.744519
50	0.033454	216.300	0.751632	55	0.031256	219.156	0.755354
55	0.034178	219.787	0.762334	60	0.031929	222.671	0.766018
60	0.034892	223.268	0.772885	65	0.032591	226.182	0.776461
65	0.035595	226.750	0.783229	70	0.033244	229.691	0.786766
70	0.036290	230.232	0.793455	75	0.033889	233.199	0.796910
75	0.036977	233.715	0.803535	80	0.034527	236.709	0.806913
80	0.037658	237.202	0.813477	85	0.035159	240.222	0.816780
85	0.038332	240.693	0.823296	90	0.035784	243.739	0.926529
90	0.039000	244.189	0.832988	95	0.036404	247.259	0.836166
95	0.039663	247.692	0.842559	100	0.037019	250.785	0.845683
100	0.040322	251.202	0.852030	105	0.037630	254.319	0.855121
105	0.040976	254.718	0.861401	110	0.038237	257.857	0.864395
110	0.041625	258.243	0.870670	115	0.038839	261.405	0.873590
115	0.042270	261.778	0.879827	120	0.039437	264.961	0.882683
120	0.042912	265.321	0.888883	125	0.040032	268.524	0.891706
125	0.043551	268.873	0.897868	130	0.040624	272.097	0.900636
130	0.044187	272.434	0.906761	135	0.041214	275.680	0.909466
135	0.044820	276.004	0.915553	140	0.041801	279.270	0.918198
140	0.045450	279.585	0.924270				

Table 4 Cont'd

700 kPa Absolute Pressure (Sat. Temp. = 27.6469° C)				750 kPa Absolute Pressure (Sat. Temp. = 30.251669° C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK	t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	0.024936	198.527	0.686011	Sat	0.023357	199.876	0.685222
25	--------	-------	--------	25	--------	-------	--------
30	0.025369	200.457	0.691701	30	--------	-------	--------
35	0.026124	204.291	0.703611	35	0.024006	203.197	0.696658
40	0.026774	207.900	0.715254	40	0.024677	206.770	0.708540
45	0.027452	211.485	0.726651	45	0.025328	210.427	0.720113
50	0.027854	215.053	0.737816	50	0.025963	214.058	0.731408
55	0.027594	218.606	0.748776	55	0.026584	217.670	0.742481
60	0.029403	222.150	0.759512	60	0.027193	221.266	0.753352
65	0.030030	225.688	0.770074	65	0.027790	224.848	0.763997
70	0.030648	229.220	0.780446	70	0.028377	228.422	0.774475
75	0.031257	232.752	0.790676	75	0.033865	231.991	0.784793
80	0.031860	236.282	0.800765	80	0.032332	235.557	0.794945
85	0.032455	239.813	0.810709	85	0.030092	239.121	0.804946
90	0.033045	243.346	0.820520	90	0.030650	242.684	0.814812
95	0.033629	246.883	0.830207	95	0.031202	246.248	0.824553
100	0.034207	250.425	0.839773	100	0.031749	249.816	0.834172
105	0.034781	253.971	0.849229	105	0.032292	253.385	0.843680
110	0.035351	257.522	0.858574	110	0.032829	256.959	0.853053
115	0.035916	261.083	0.867817	115	0.033362	260.541	0.862323
120	0.036478	264.649	0.876950	120	0.033892	264.126	0.871509
125	0.037036	268.224	0.885990	125	0.034418	267.719	0.880582
130	0.037585	271.806	0.894932	130	0.034941	261.319	0.889550
135	0.038139	275.397	0.903788	135	0.035461	274.925	0.898434
140	0.038693	278.997	0.912560	140	0.035978	276.930	0.907233
145	0.039240	282.606	0.921247	145	0.036493	279.346	0.915947
150	0.039785	286.223	0.929854	150	0.037006	285.791	0.924582
800 kPa Absolute Pressure (Sat. Temp. = 32.7355° C)				**850 kPa Absolute Pressure (Sat. Temp. = 35.1003° C)**			
Sat	0.021890	200.504	0.684525	Sat	0.020592	201.679	0.683851
35	0.022188	202.318	0.690046	35	--------	-------	--------
40	0.022835	206.190	0.702074	40	0.021203	205.158	0.695734
45	0.023463	209.886	0.713796	45	0.021817	208.773	0.707712
50	0.024075	213.551	0.725252	50	0.022408	212.509	0.719325
55	0.024671	217.191	0.736468	55	0.022984	216.214	0.730676
60	0.025255	220.815	0.747457	60	0.023546	219.894	0.741804
65	0.025827	224.422	0.758212	65	0.024096	223.550	0.752668
70	0.026388	228.018	0.768765	70	0.024635	227.193	0.763331
75	0.026940	231.607	0.779171	75	0.025164	230.824	0.773803
80	0.027485	235.191	0.789390	80	0.025685	234.445	0.784094
85	0.028022	238.771	0.799455	85	0.026199	238.060	0.794240
90	0.028553	242.349	0.809385	90	0.026706	241.671	0.804242
95	0.029078	245.928	0.819188	95	0.027207	245.280	0.814098
100	0.029597	249.507	0.828871	100	0.027703	248.887	0.823833
105	0.030112	253.089	0.838407	105	0.028193	252.494	0.833428
110	0.030622	256.675	0.847835	110	0.028679	256.103	0.842910
115	0.031127	260.267	0.857142	115	0.029160	259.714	0.852242
120	0.031629	263.863	0.866297	120	0.029636	263.331	0.861485
125	0.032127	267.465	0.875442	125	0.030110	266.951	0.870619
130	0.032651	271.072	0.884475	130	0.030580	270.577	0.879658
135	0.033138	274.687	0.893388	135	0.031047	274.209	0.888615
140	0.033602	278.309	0.902214	140	0.031512	277.846	0.897472
145	0.034089	281.938	0.910956	145	0.031973	281.489	0.906222
150	0.034573	285.391	0.919606	150	0.032433	285.139	0.914897
155				155	0.032847	288.798	0.923502
160				160	0.032915	292.465	0.932018
900 kPa Absolute Pressure (Sat. Temp. = 37.3725° C)				**950 kPa Absolute Pressure (Sat. Temp. = 39.5425° C)**			
Sat	0.019426	202.230	0.683202	Sat	0.018386	203.268	0.682595
35	--------	-------	--------	40	0.018439	204.084	0.683730
40	0.019743	204.305	0.689656	45	0.019019	211.304	0.696022
45	0.020338	208.200	0.701804	50	0.019581	215.111	0.708009
50	0.020914	211.975	0.713603	55	0.020124	216.579	0.719679
55	0.021472	215.715	0.725082	60	0.020653	218.466	0.731064
60	0.022016	219.424	0.736323	65	0.021166	222.205	0.742146
65	0.022545	223.108	0.747297	70	0.021668	225.921	0.753028
70	0.023065	226.774	0.758069	75	0.022160	229.619	0.763679
75	0.023574	230.426	0.768637	80	0.022643	233.300	0.774146
80	0.024075	234.068	0.779029	85	0.023118	236.970	0.784455
85	0.024568	237.701	0.789255	90	0.023586	240.632	0.794587
90	0.024934	241.328	0.799314	95	0.024047	244.287	0.804556
95	0.025323	244.951	0.809217	100	0.024502	247.937	0.814408
100	0.026008	248.571	0.818995	105	0.024952	251.584	0.824096
105	0.026474	252.193	0.828659	110	0.025397	255.228	0.833651
110	0.026912	255.812	0.838158	115	0.025837	258.875	0.843092
115	0.027397	259.436	0.847579	120	0.026273	262.522	0.852414
120	0.027855	263.063	0.856839	125	0.026705	266.172	0.861621
125	0.028307	266.693	0.866014	130	0.027134	269.824	0.870723
130	0.028755	270.327	0.875095	135	0.027560	273.481	0.879734
135	0.029200	273.967	0.884078	140	0.027982	277.142	0.888644
140	0.029642	277.612	0.892960	145	0.028402	280.808	0.897451
145	0.030082	281.263	0.901742	150	0.028820	284.481	0.906172
150	0.030519	284.920	0.910432	155	0.029235	288.158	0.914812
155	0.030954	288.581	0.919049	160	0.029648	291.844	0.923365
160	0.031387	292.203	0.927569				

Table 4 Cont'd

1000 kPa Absolute Pressure (Sat. Temp. = 41.6278° C)				1100 kPa Absolute Pressure (Sat. Temp. = 45.6000° C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK	t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	0.017440	203.756	0.682032	Sat	0.015794	205.107	0.680937
40	--------	-------	--------	40	--------	-------	--------
45	0.017817	206.405	0.690355	45	--------	-------	--------
50	0.018370	210.316	0.702590	50	0.016254	208.587	0.691846
55	0.018901	214.167	0.714422	55	0.016773	212.537	0.704180
60	0.019416	217.975	0.725952	60	0.017267	216.456	0.716005
65	0.019915	221.745	0.737181	65	0.017743	220.323	0.727522
70	0.020402	225.488	0.748142	70	0.018206	224.150	0.738743
75	0.020879	229.208	0.758894	75	0.018657	227.947	0.749723
80	0.021346	232.912	0.769470	80	0.019098	231.719	0.760470
85	0.021805	236.602	0.779836	85	0.019530	235.470	0.771003
90	0.022256	240.280	0.790019	90	0.019954	239.204	0.781351
95	0.022701	243.950	0.800067	95	0.020370	242.926	0.791534
100	0.023139	247.615	0.809973	100	0.020780	246.636	0.801550
105	0.023572	251.276	0.819716	105	0.021184	250.340	0.811402
110	0.024000	254.933	0.829325	110	0.021583	254.037	0.821121
115	0.024423	258.590	0.838820	115	0.021976	257.730	0.830688
120	0.024841	262.249	0.848182	120	0.022365	261.421	0.840122
125	0.025256	265.908	0.857410	125	0.022750	265.112	0.849451
130	0.025667	269.571	0.866554	130	0.023131	268.802	0.858656
135	0.026076	273.236	0.875589	135	0.023509	272.494	0.867750
140	0.026481	276.906	0.884524	140	0.023884	276.189	0.876742
145	0.026883	280.580	0.893379	145	0.024256	279.887	0.885644
150	0.027283	284.259	0.902133	150	0.024625	283.589	0.894463
155	0.027680	287.944	0.909280	155	0.024992	287.295	0.903158
160	0.028075	291.635	0.904269	160	0.025357	291.005	0.911784
165	0.028468	295.334	0.926350	165	0.025719	294.723	0.920300
170	0.028859	299.039	0.936239	170	0.026079	298.444	0.928749

1200 kPa Absolute Pressure (Sat. Temp. = 49.2978° C)				1300 kPa Absolute Pressure (Sat. Temp. = 52.7810° C)			
Sat	0.014424	205.505	0.679860	Sat	0.013238	207.385	0.678828
50	0.014495	206.249	0.681641	50	--------	-------	--------
55	0.014997	211.400	0.694273	55	0.013449	209.159	0.684470
60	0.015477	215.402	0.706513	60	0.013926	213.172	0.697233
65	0.015937	219.338	0.718323	65	0.014376	217.271	0.709371
70	0.016382	223.229	0.729819	70	0.014807	221.303	0.721174
75	0.016814	227.080	0.741028	75	0.015224	225.277	0.732647
80	0.017235	230.901	0.751967	80	0.015629	229.206	0.743815
85	0.017645	234.695	0.762691	85	0.016023	233.098	0.754746
90	0.018047	238.470	0.783181	90	0.016407	236.958	0.765444
95	0.018441	242.228	0.800968	95	0.016783	240.794	0.775905
100	0.018828	245.970	0.793661	100	0.017151	244.607	0.786177
105	0.019209	249.704	0.803656	105	0.017512	248.403	0.796282
110	0.019585	253.428	0.813484	110	0.017867	252.186	0.806218
115	0.019954	257.148	0.823123	115	0.018216	255.958	0.815999
120	0.020319	260.862	0.832662	120	0.018561	259.721	0.825622
125	0.020679	264.573	0.842059	125	0.018901	263.478	0.835104
130	0.021036	268.284	0.851344	130	0.019237	267.231	0.844454
135	0.021390	271.995	0.860507	135	0.019569	270.980	0.853690
140	0.021740	275.707	0.869560	140	0.019898	274.727	0.862811
145	0.022087	279.420	0.878516	145	0.020225	278.475	0.871815
150	0.022431	283.137	0.887366	150	0.020548	282.224	0.880715
155	0.022773	286.857	0.896133	155	0.020868	285.974	0.889519
160	0.023112	290.581	0.904792	160	0.021186	289.725	0.898256
165	0.023449	294.310	0.913346	165	0.021501	293.481	0.906841
170	0.023784	298.046	0.921846	170	0.021815	297.238	0.915365
				175	0.022127	301.001	0.923814

1400 kPa Absolute Pressure (Sat. Temp. = 56.07° C)				1500 kPa Absolute Pressure (Sat. Temp. = 59.2° C)			
Sat	0.012229	208.036	0.677838	Sat	0.011336	209.194	0.676805
50	--------	-------	--------	60	0.011410	209.441	0.678925
55	--------	-------	--------	65	0.011854	213.864	0.691993
60	0.012597	211.985	0.688064	70	0.012274	218.165	0.704541
65	0.013040	216.181	0.700640	75	0.012674	222.367	0.716651
70	0.013465	220.292	0.712793	80	0.013059	226.492	0.728361
75	0.013873	224.336	0.724563	85	0.013429	230.555	0.739737
80	0.014265	228.326	0.736000	90	0.013788	234.566	0.750833
85	0.014646	232.271	0.747130	95	0.014124	238.534	0.761667
90	0.015017	236.178	0.758004	100	0.014441	242.468	0.772246
95	0.015378	240.055	0.768656	105	0.014810	246.372	0.782606
100	0.015730	243.906	0.779084	110	0.015136	250.253	0.792795
105	0.016076	247.737	0.789332	115	0.015454	254.111	0.802795
110	0.016415	251.551	0.799384	120	0.015768	257.954	0.812603
115	0.016748	255.350	0.809247	125	0.016076	261.784	0.822265
120	0.017076	259.139	0.818967	130	0.016380	265.606	0.831774
125	0.017398	262.919	0.828526	135	0.016680	269.418	0.841157
130	0.017717	266.694	0.837962	140	0.016976	273.224	0.850423
135	0.018033	270.464	0.847275	145	0.017269	277.026	0.859558
140	0.018344	274.231	0.856472	150	0.017559	280.823	0.868575
145	0.018653	277.996	0.865552	155	0.017846	284.620	0.877513
150	0.018958	281.761	0.874508	160	0.018131	288.416	0.886321
155	0.019260	285.527	0.883367	165	0.018412	292.211	0.895021
160	0.019561	289.293	0.892120	170	0.018692	296.008	0.903616
165	0.019858	293.061	0.900793	175	0.018969	299.807	0.912114
170	0.020153	296.831	0.909336				
175	0.020446	300.606	0.917801				

Table 4 Cont'd

1600 kPa Absolute Pressure (Sat. Temp. = 62.156° C)				1700 kPa Absolute Pressure (Sat. Temp. = 65.0065° C)			
t °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK	*t* °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK
Sat	0.010559	209.789	0.675748	Sat	0.009855	210.452	0.674685
60	--------	-------	--------	60	--------	-------	--------
65	0.010810	211.570	0.683341	65	--------	-------	--------
70	0.011231	216.590	0.696344	70	0.010263	214.964	0.687818
75	0.011629	221.095	0.708849	75	0.010672	219.482	0.700968
80	0.012009	225.319	0.724893	80	0.011055	223.862	0.713497
85	0.012373	229.462	0.735878	85	0.011415	228.116	0.725457
90	0.012724	233.544	0.743873	90	0.011760	232.290	0.737039
95	0.013064	237.577	0.754912	95	0.012092	236.401	0.748292
100	0.013394	241.566	0.765671	100	0.012414	240.461	0.759248
105	0.013715	245.520	0.776184	105	0.012727	244.476	0.769933
110	0.014030	249.444	0.786509	110	0.013032	248.455	0.780395
115	0.014337	253.341	0.796624	115	0.013329	252.402	0.790631
120	0.014638	257.220	0.806537	120	0.013619	256.325	0.800666
125	0.014934	261.082	0.816290	125	0.013905	260.228	0.810519
130	0.015226	264.933	0.825894	130	0.014185	264.115	0.821704
135	0.015513	268.772	0.835367	135	0.014461	267.988	0.831011
140	0.015796	272.604	0.844704	140	0.014733	271.851	0.839179
145	0.016076	276.429	0.853901	145	0.015002	275.705	0.848448
150	0.016353	280.248	0.862985	150	0.015267	279.551	0.857606
155	0.016627	284.066	0.871962	155	0.015529	283.393	0.866624
160	0.016898	287.880	0.880825	160	0.015788	287.230	0.875541
165	0.017166	291.693	0.889575	165	0.016057	291.065	0.884346
170	0.017433	295.506	0.898224	170	0.016301	293.648	0.893039
175	0.017696	299.320	0.906773	175	0.016550	298.262	0.901640

1800 kPa Absolute Pressure (Sat. Temp. = 67.5555° C)				2000 kPa Absolute Pressure (Sat. Temp. = 72.8572° C)			
Sat	0.009257	211.006	0.673701	Sat	0.008145	211.957	0.671245
70	0.009456	213.287	0.680306	70	--------	-------	--------
75	0.009862	217.951	0.693816	75	0.008322	214.093	0.677384
80	0.010244	222.461	0.706684	80	0.008712	218.961	0.691267
85	0.010602	226.827	0.718960	85	0.009076	223.657	0.704479
90	0.010942	231.094	0.730800	90	0.009417	228.192	0.717054
95	0.011270	235.284	0.742256	95	0.009740	232.604	0.729126
100	0.011586	239.413	0.753409	100	0.010049	236.920	0.740784
105	0.011891	243.488	0.764266	105	0.010344	241.156	0.752054
110	0.012188	247.522	0.774854	110	0.010630	245.329	0.763039
115	0.012477	251.516	0.777680	115	0.010906	249.446	0.773704
120	0.012760	255.483	0.793703	120	0.011174	253.521	0.784117
125	0.013036	259.426	0.805338	125	0.011436	257.560	0.794323
130	0.013307	263.348	0.815123	130	0.011692	261.571	0.804341
135	0.013574	267.254	0.824740	135	0.011942	265.557	0.814164
140	0.013837	271.146	0.834206	140	0.012188	269.522	0.823819
145	0.014095	275.027	0.843551	145	0.012430	273.470	0.833321
150	0.014351	278.899	0.852779	150	0.012668	277.403	0.842660
155	0.014603	282.764	0.861848	155	0.012902	281.324	0.851893
160	0.014852	286.622	0.870816	160	0.013134	285.236	0.860974
165	0.015098	290.479	0.879671	165	0.013362	289.138	0.869942
170	0.015342	294.331	0.888392	170	0.013588	293.036	0.878777
175	0.015583	298.181	0.897038	175	0.013811	296.929	0.887507
180	0.015823	302.031	0.905592	180	0.014032	300.819	0.896123
185	0.016061	305.882	0.914045	185	0.014251	304.705	0.908352
190	0.016296	309.734	0.922398	190	0.014467	308.591	0.917539
195	0.016530	313.586	0.930662	195	0.014683	312.477	0.921448

2200 kPa Absolute Pressure (Sat. Temp. = 77.7833° C)				2400 kPa Absolute Pressure (Sat. Temp. = 82.07° C)			
Sat	0.007210	212.627	0.668593	Sat	0.006477	212.949	0.665803
70	--------	-------	--------	85	0.006711	216.209	0.674909
75	--------	-------	--------	90	0.007089	204.978	0.689855
80	0.007390	214.989	0.675283	95	0.007431	197.587	0.703736
85	0.007773	220.135	0.689757	100	0.007745	231.511	0.716805
90	0.008124	225.025	0.703318	105	0.008038	236.174	0.729223
95	0.008451	229.718	0.716142	110	0.008316	240.703	0.741125
100	0.008758	234.262	0.728414	115	0.008579	245.118	0.752574
105	0.009049	238.691	0.740200	120	0.008832	249.452	0.763668
110	0.009328	243.028	0.751617	125	0.009077	253.720	0.774447
115	0.009595	247.282	0.762809	130	0.009313	257.934	0.784959
120	0.009853	251.480	0.773431	135	0.009543	262.603	0.795232
125	0.010104	255.629	0.783864	140	0.009767	266.706	0.805292
130	0.010349	259.738	0.794113	145	0.009986	270.780	0.815150
135	0.010587	263.811	0.804162	150	0.010200	274.827	0.824817
140	0.010820	267,855	0.814009	155	0.010411	278.852	0.834324
145	0.011048	271.875	0.823681	160	0.010617	282.859	0.843677
150	0.011272	275.875	0.833210	165	0.010820	286.851	0.852864
155	0.011493	279.857	0.842572	170	0.011020	290.828	0.861917
160	0.011710	283.824	0.851766	175	0.011217	294.797	0.870865
165	0.011924	287.779	0.860847	180	0.011412	298.757	0.879678
170	0.012134	291.724	0.869794	185	0.011604	302.710	0.888368
175	0.012343	295.660	0.878637	190	0.011794	306.658	0.896958
180	0.012549	299.590	0.887354	195	0.011982	310.601	0.905452
185	0.012752	303.516	0.895958				
190	0.012954	307.438	0.904478				
195	0.013154	311.359	0.908334				

Table 4 Cont'd

2600 kPa Absolute Pressure (Sat. Temp. = 86.265° C)				2800 kPa Absolute Pressure (Sat. Temp. = 89.405° C)			
t °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK	*t* °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK
Sat	0.005812	213.020	0.662527	Sat	0.005343	212.860	0.659633
85	--------	-------	--------	85	--------	-------	--------
90	0.006109	217.433	0.674704	90	0.005394	213.636	0.661768
95	0.006488	223.145	0.690376	95	0.005803	219.930	0.678993
100	0.006818	228.957	0.704547	100	0.006157	225.644	0.694409
105	0.007120	228.889	0.717783	105	0.006472	230.939	0.708535
110	0.007401	237.874	0.730341	110	0.006760	235.957	0.721723
115	0.007664	242.507	0.742269	115	0.007025	240.755	0.734158
120	0.007915	247.024	0.753776	120	0.007276	245.410	0.746057
125	0.008155	251.449	0.764933	125	0.007514	249.949	0.757508
130	0.008386	255.798	0.775765	130	0.007743	254.397	0.768624
135	0.008609	260.085	0.786292	135	0.007964	258.769	0.779397
140	0.008826	264.319	0.796570	140	0.008176	263.077	0.789885
145	0.009037	268.508	0.806646	145	0.008383	267.332	0.800147
150	0.009244	272.662	0.816515	150	0.008584	271.543	0.810157
155	0.009446	276.783	0.826166	155	0.008780	275.718	0.819967
160	0.009643	280.877	0.835683	160	0.008972	279.861	0.829576
165	0.009837	284.947	0.844979	165	0.009159	283.972	0.839034
170	0.010027	288.998	0.854267	170	0.009343	288.063	0.848291
175	0.010214	293.033	0.862396	175	0.009524	292.134	0.857435
180	0.010399	297.056	0.871642	180	0.009703	296.189	0.866428
185	0.010582	301.067	0.880926	185	0.009878	300.231	0.875296
190	0 010762	305.069	0.889596	190	0.010052	304.260	0.884046
195	0.010940	309.063	0.898155	195	0.010223	308.280	0.892675
200	0.011116	313.050	0.906635	200	0.010392	312.292	0.901204
205	0.011290	317.033	0.915011	205	0.010559	316.298	0.909632
210	0.011463	321.010	0.923264	210	0.010725	320.398	0.917960

3000 kPa Absolute Pressure (Sat. Temp. 93.73° C)				3500 kPa Absolute Pressure (Sat. Temp. 101.72° C)			
Satur	0.004758	211.562	0.653194	0	0.003678	209.164	0.641295
95	0.004857	213.149	0.657479	95	0.000000	0.000	0.000000
100	0.005243	219.397	0.674354	100	0.000000	0.000	0.000000
105	0.005624	225.619	0.691110	105	0.003996	214.892	0.656431
110	0.005959	231.629	0.706905	110	0.004481	223.629	0.679520
115	0.006247	237.002	0.720821	115	0.004809	230.067	0.696175
120	0.006500	242.072	0.733790	120	0.005095	235.903	0.711122
125	0.006751	246.928	0.746054	125	0.005351	241.345	0.724889
130	0.006986	251.627	0.757792	130	0.005587	246.510	0.737776
135	0.007207	256.206	0.769077	135	0.005807	251.472	0.750005
140	0.007418	260.689	0.779994	140	0.006015	256.276	0.761716
145	0.007621	265.093	0.790608	145	0.006213	260.956	0.772983
150	0.007818	269.434	0.800925	150	0.006402	265.536	0.783864
155	0.008009	273.722	0.810998	155	0.006584	270.035	0.794423
160	0.008196	277.965	0.820858	160	0.006760	274.462	0.804748
165	0.008377	282.166	0.830501	165	0.006931	278.829	0.814734
170	0.008554	286.337	0.839955	170	0.007096	283.147	0.824552
175	0.008729	290.481	0.849257	175	0.007258	287.427	0.834144
180	0.008900	294.603	0.858395	180	0.007416	291.673	0.843551
185	0.009068	298.706	0.867401	185	0.007572	295.888	0.852813
190	0.009234	302.792	0.876278	190	0.007724	300.078	0.861923
195	0.009398	306.864	0.885022	195	0.007873	304.247	0.870690
200	0.009559	310.924	0.893653	200	0.008020	308.396	0.879198
205	0.009719	314.975	0.902173	205	0.008165	312.529	0.888388
210	0.009876	319.017	0.910579	210	0.008308	316.649	0.896942

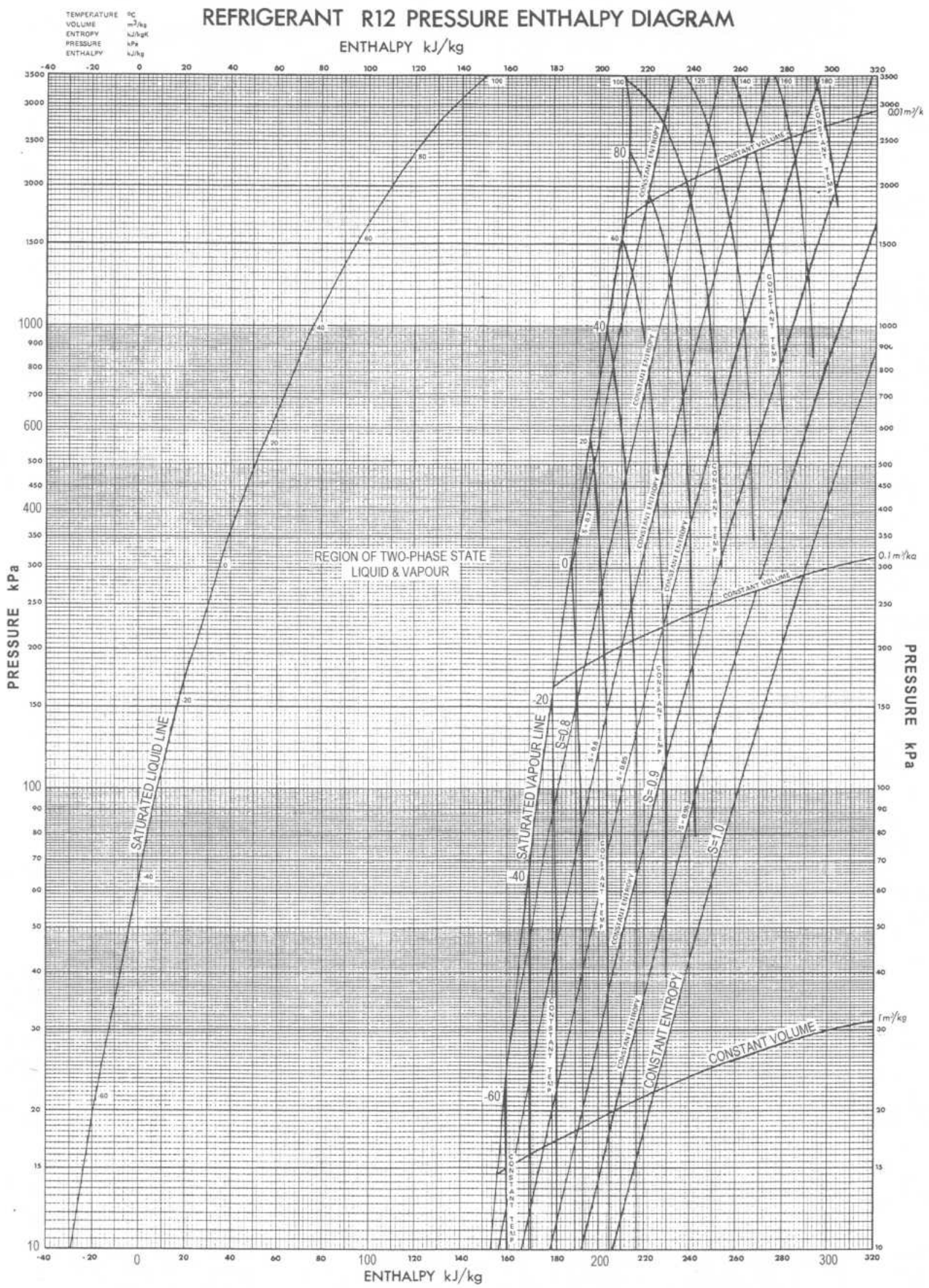

REFRIGERANT R12 PRESSURE ENTHALPY DIAGRAM
TEMPERATURE °C
VOLUME m³/kg
ENTROPY kJ/kgK
PRESSURE kPa
ENTHALPY kJ/kg
ENTHALPY kJ/kg
PRESSURE kPa
REGION OF TWO-PHASE STATE
LIQUID & VAPOUR
SATURATED LIQUID LINE
SATURATED VAPOUR LINE
CONSTANT ENTROPY
CONSTANT VOLUME
CONSTANT TEMPERATURE
S=0.8
S=0.9
S=1.0
0.01 m³/kg
0.1 m³/kg
1 m³/kg

Table 5 — Refrigerant 22 (Monochlorodifluoromethane) Properties of Liquid and Saturated Vapour

Temperature °C	Absolute Pressure kPa	Volume Vapor v_g m³/kg	Density Liquid $1/v_f$ kg/m³	Enthalpy Liquid h_f kJ/kg	Enthalpy Vapor h_g kJ/kg	Entropy Liquid s_f kJ/kgK	Entropy Vapor s_g kJ/kgK
-100	2.115	8.158736	1570.793	-59.370	204.114	-0.293245	1.228688
-95	3.263	5.332247	1558.191	-54.658	206.544	-0.266382	1.199891
-90	4.899	3.580619	1545.461	-49.923	208.987	-0.240156	1.173439
-85	7.287	2.508830	1532.587	-45.154	211.441	-0.214495	1.149361
-80	10.566	1.788536	1519.585	-40.346	213.902	-0.189336	1.127158
-75	14.971	1.296985	1506.443	-35.496	216.362	-0.164563	1.106714
-74	15.910	1.209235	1503.808	-34.524	216.854	-0.159627	1.102712
-73	16.911	1.128055	1501.162	-33.550	217.346	-0.154715	1.098776
-72	18.053	1.061176	1498.498	-32.572	217.837	-0.149855	1.094986
-71	19.256	0.998897	1495.842	-31.590	218.327	-0.144994	1.091264
-70	20.524	0.940914	1493.161	-30.606	218.819	-0.140133	1.087609
-69	21.868	0.887314	1490.494	-29.622	219.309	-0.135310	1.083992
-68	23.284	0.837259	1487.801	-28.634	219.801	-0.130486	1.080441
-67	24.772	0.790488	1485.116	-27.644	220.290	-0.125663	1.076958
-66	26.336	0.746776	1482.416	-26.651	220.779	-0.120865	1.073516
-65	27.979	0.705873	1479.713	-25.657	221.267	-0.116079	1.070129
-64	29.704	0.667592	1477.005	-24.661	221.756	-0.111311	1.066809
-63	31.514	0.631763	1474.285	-23.662	222.245	-0.106563	1.063543
-62	33.411	0.598181	1471.568	-22.660	222.731	-0.101815	1.060311
-61	35.399	0.566691	1468.829	-21.657	223.218	-0.097071	1.057117
-60	37.482	0.537149	1466.090	-20.650	223.704	-0.092361	1.053989
-59	39.674	0.509629	1463.351	-19.643	224.188	-0.087651	1.050899
-58	41.969	0.483768	1460.599	-18.633	224.671	-0.082941	1.047876
-57	44.367	0.459447	1457.834	-17.618	225.155	-0.078260	1.044862
-56	46.874	0.436563	1455.066	-16.153	225.637	-0.073587	1.041923
-55	49.493	0.415021	1452.298	-15.190	226.118	-0.068915	1.039021
-54	52.227	0.394733	1449.517	-14.564	226.599	-0.064243	1.036153
-53	55.080	0.375617	1446.720	-13.540	227.078	-0.059583	1.033340
-52	58.056	0.357597	1443.923	-12.515	227.557	-0.054948	1.030560
-51	61.158	0.340598	1441.125	-11.485	228.034	-0.050317	1.027813
-50	64.389	0.324557	1438.314	-10.455	228.509	-0.045720	1.025100
-49	67.771	0.309516	1435.488	-9.421	228.985	-0.041085	1.022462
-48	71.292	0.295294	1432.662	-8.383	229.458	-0.036484	1.019858
-47	74.959	0.281848	1429.825	-7.345	229.931	-0.031887	1.017258
-46	78.771	0.269129	1426.976	-6.304	230.401	-0.027315	1.014708
-45	82.730	0.257091	1424.121	-5.260	230.872	-0.022755	1.012205
-44	86.846	0.245689	1421.260	-4.214	231.341	-0.018179	1.009735
-43	91.124	0.234888	1418.387	-3.164	231.807	-0.013607	1.007298
-42	95.560	0.224656	1415.503	-2.112	232.272	-0.009077	1.004895
-41	100.168	0.214953	1412.618	-1.057	232.736	-0.004522	1.002521
-40	104.952	0.205744	1409.721	-----	233.199	--------	1.000147
-39	109.929	0.197063	1406.823	1.059	233.659	0.004522	0.997848
-38	115.087	0.188817	1403.900	2.122	234.118	0.009044	0.995583
-37	120.433	0.180984	1400.973	3.189	234.575	0.013536	0.993322
-36	125.974	0.173537	1398.037	4.258	235.031	0.018045	0.991112
-35	131.711	0.197669	1395.096	5.329	235.485	0.022546	0.988926
-34	137.643	0.197174	1392.142	6.403	235.937	0.027013	0.986757
-33	143.780	0.153304	1389.172	7.479	236.388	0.031472	0.984622
-32	150.131	0.147198	1386.199	8.558	236.836	0.035948	0.982520
-31	156.693	0.141383	1383.215	9.641	237.284	0.040399	0.980452
-30	163.482	0.135843	1380.231	10.725	237.727	0.044883	0.978417
-29	170.518	0.130596	1377.218	11.814	238.169	0.049291	0.976382
-28	177.781	0.125588	1374.205	12.904	238.611	0.053734	0.974381
-27	185.285	0.120806	1371.180	13.998	239.049	0.058180	0.972413
-26	193.027	0.116246	1368.143	15.094	239.485	0.062601	0.970479
-25	201.017	0.111890	1365.093	16.193	239.920	0.067010	0.968557
-24	209.257	0.107728	1362.031	17.293	240.351	0.071419	0.966652
-23	217.752	0.103754	1358.960	18.398	240.780	0.075815	0.964768
-22	226.511	0.099953	1355.883	19.506	241.209	0.080194	0.962901
-21	235.530	0.096323	1352.783	20.616	241.633	0.084599	0.961092
-20	244.826	0.092862	1349.684	21.727	242.056	0.088970	0.959283
-19	254.432	0.089535	1346.570	22.843	242.477	0.093341	0.957475
-18	264.324	0.086369	1343.443	23.963	242.894	0.097712	0.955699
-17	274.504	0.083336	1340.292	25.084	243.309	0.102054	0.953958
-16	284.974	0.080430	1337.135	26.209	243.722	0.106387	0.952224
-15	292.689	0.077645	1333.969	27.336	244.133	0.110741	0.950512
-14	298.149	0.074975	1330.791	28.466	244.542	0.115096	0.948833
-13	309.448	0.072413	1327.600	29.598	244.946	0.119416	0.947175
-12	329.917	0.069956	1324.397	30.733	245.348	0.123720	0.945517
-11	341.946	0.067601	1321.179	31.872	245.748	0.128050	0.943863
-10	354.301	0.065337	1317.935	33.013	246.145	0.132345	0.942243
-9	367.028	0.063180	1314.691	34.156	246.539	0.136641	0.940660
-8	380.097	0.061104	1324.249	35.305	247.275	0.140937	0.939078
-7	393.513	0.059110	1312.960	36.454	247.746	0.145232	0.937495
-6	407.280	0.057193	1304.857	37.607	248.127	0.149528	0.935938
-5	421.404	0.055350	1301.548	38.764	248.506	0.153803	0.934393
-4	435.892	0.053578	1298.226	39.923	248.716	0.158077	0.932865
-3	450.750	0.051874	1294.891	41.084	248.840	0.162373	0.931357
-2	465.979	0.050234	1291.540	42.248	249.214	0.166652	0.929858
-1	481.591	0.048655	1288.166	43.415	249.584	0.170872	0.928389
0	497.588	0.047135	1284.793	44.587	249.951	0.175093	0.926919
1	514.026	0.045679	1281.390	45.760	250.313	0.179351	0.925450
2	530.866	0.044275	1277.962	46.937	250.673	0.183575	0.924014
3	548.114	0.042923	1274.531	48.118	251.030	0.187825	0.922582
4	565.770	0.041620	1271.081	49.301	251.383	0.192058	0.921150
5	583.845	0.040363	1267.605	50.487	251.732	0.196278	0.919739
6	602.344	0.039151	1264.110	51.676	252.078	0.200482	0.918345
7	621.272	0.037981	1260.602	52.869	252.420	0.204677	0.916963

Table 5 Cont'd

Temperature °C	Absolute Pressure kPa	Volume Vapor v_g m³/kg	Density Liquid $1/v_f$ kg/m³	Enthalpy Liquid h_f kJ/kg	Enthalpy Vapor h_g kJ/kg	Entropy Liquid s_f kJ/kgK	Entropy Vapor s_g kJ/kgK
8	640.637	0.036853	1257.078	54.064	252.831	0.212648	0.915598
9	660.445	0.035764	1253.530	55.262	253.419	0.213113	0.914208
10	680.699	0.034714	1249.969	56.464	253.426	0.217296	0.912852
11	701.443	0.033703	1246.379	57.670	253.752	0.221478	0.911533
12	722.667	0.032727	1242.776	58.879	254.075	0.225661	0.910180
13	744.386	0.031784	1239.150	60.091	254.453	0.229844	0.908853
14	766.559	0.030873	1235.498	61.306	254.742	0.234026	0.907534
15	789.208	0.029992	1231.828	62.524	255.019	0.238209	0.906215
16	812.354	0.029140	1228.132	63.747	255.326	0.242375	0.904897
17	835.996	0.028317	1224.413	64.973	255.628	0.246532	0.903590
18	860.107	0.027520	1220.684	66.202	255.926	0.250707	0.902309
19	884.646	0.026768	1216.918	67.434	256.219	0.254852	0.901028
20	909.901	0.026190	1213.126	68.671	256.508	0.258996	0.899747
21	935.653	0.025471	1209.320	69.912	256.792	0.263141	0.898466
22	961.956	0.024625	1205.476	71.155	257.071	0.267286	0.897185
23	988.763	0.023914	1201.615	72.404	257.345	0.271431	0.895903
24	1016.108	0.023260	1197.732	73.656	257.614	0.275576	0.894647
25	1044.004	0.022627	1193.816	74.911	257.879	0.279721	0.893383
26	1072.452	0.022014	1189.867	76.170	258.138	0.283866	0.892118
27	1101.451	0.021420	1185.893	77.434	258.391	0.288011	0.890875
28	1131.016	0.020843	1181.893	78.702	258.639	0.292148	0.889632
29	1161.181	0.020284	1177.866	79.975	258.883	0.296259	0.888384
30	1191.897	0.019742	1173.801	81.250	259.120	0.300404	0.887103
31	1223.295	0.019217	1169.706	82.531	259.352	0.304549	0.885859
32	1255.246	0.018709	1165.587	83.818	259.577	0.308660	0.884616
33	1287.844	0.018216	1161.430	85.107	259.796	0.312797	0.883372
34	1321.063	0.017736	1157.235	86.402	260.010	0.316917	0.882129
35	1354.889	0.017271	1153.009	87.702	260.216	0.321045	0.880885
36	1389.321	0.016819	1148.751	89.006	260.417	0.325173	0.879625
37	1424.381	0.016380	1144.455	90.315	260.611	0.329293	0.878356
38	1460.103	0.015953	1140.120	91.628	260.798	0.333438	0.877113
39	1496.486	0.015538	1135.746	92.948	260.979	0.337579	0.875865
40	1533.532	0.015135	1131.320	94.273	261.150	0.341686	0.874584
41	1571.260	0.014745	1126.865	95.605	261.316	0.345831	0.873303
42	1626.253	0.014365	1122.372	96.940	261.472	0.349976	0.872022
43	1655.024	0.013995	1117.829	98.282	261.622	0.354121	0.870741
44	1688.636	0.013636	1113.235	99.630	261.763	0.358266	0.869459
45	1729.136	0.013286	1108.598	100.984	261.897	0.362411	0.868157
46	1770.325	0.012945	1103.915	102.344	262.021	0.366556	0.866855
47	1812.232	0.012613	1099.182	103.711	262.136	0.370713	0.865562
48	1854.855	0.012291	1094.401	105.084	262.245	0.374888	0.864234
49	1898.202	0.011976	1089.576	106.464	262.342	0.379037	0.862882
50	1942.322	0.011669	1084.674	107.852	262.430	0.383219	0.861563
51	1987.248	0.011372	1079.729	109.247	262.505	0.387402	0.860207
52	2032.947	0.011082	1074.720	110.650	262.571	0.391585	0.858817
53	2079.369	0.010798	1069.647	112.061	262.628	0.395797	0.857422
54	2126.591	0.010522	1064.510	113.480	262.672	0.399992	0.856028
55	2174.572	0.010253	1059.309	114.907	262.705	0.404216	0.854613
56	2223.325	0.009990	1054.044	116.344	262.726	0.408457	0.853164
57	2272.905	0.009734	1048.709	117.789	262.734	0.412690	0.851695
58	2323.312	0.009484	1043.295	119.242	262.729	0.416948	0.850216
59	2374.541	0.009240	1037.794	120.707	262.712	0.421210	0.848710
60	2426.541	0.009001	1032.230	122.181	262.679	0.425506	0.847202
61	2479.534	0.008768	1026.564	123.667	262.630	0.429802	0.845657
62	2533.354	0.008541	1020.808	125.241	262.567	0.434098	0.844112
63	2588.050	0.008318	1014.963	126.703	262.486	0.438452	0.842480
64	2643.629	0.008101	1009.019	128.197	262.389	0.442798	0.840822
65	2606.942	0.007888	1002.972	129.732	262.275	0.447173	0.839143
66	2645.629	0.007680	996.816	131.281	262.141	0.451582	0.837430
67	2815.612	0.007476	990.545	132.844	261.987	0.456003	0.835672
68	2874.783	0.007277	984.158	134.421	261.812	0.460458	0.833863
69	2934.850	0.007081	977.652	136.015	261.617	0.464946	0.832046
70	2995.910	0.006889	970.991	137.625	261.399	0.469468	0.830162
71	3058.025	0.006701	964.186	139.258	261.152	0.474027	0.828203
72	3121.077	0.006517	957.215	140.908	260.879	0.478620	0.826210
73	3185.116	0.006336	950.089	142.579	260.578	0.483276	0.824154
74	3250.147	0.006159	942.779	144.273	260.247	0.487973	0.822031
75	3316.206	0.005984	935.286	145.991	259.884	0.492705	0.819841
76	3383.312	0.005812	927.587	147.735	259.486	0.497486	0.817568
77	3451.467	0.005643	919.658	149.506	259.051	0.502334	0.815194
78	3520.670	0.005476	911.495	151.307	258.575	0.507258	0.812728
79	3590.927	0.005311	903.082	153.143	258.054	0.512274	0.810187
80	3662.288	0.005149	894.375	155.012	257.487	0.517323	0.807511
81	3734.890	0.004988	885.307	156.928	256.861	0.522523	0.804685
82	3808.650	0.004829	875.893	158.890	256.174	0.527824	0.801725
83	3883.568	0.004671	866.077	160.901	255.420	0.533225	0.798631
84	3959.687	0.004515	855.802	162.970	254.591	0.538776	0.795328
85	4037.018	0.004358	845.022	165.105	253.677	0.544495	0.791811
86	4115.563	0.004202	833.652	167.314	252.665	0.550399	0.788059
87	4195.342	0.004045	821.590	169.609	251.540	0.556516	0.784015
88	4276.404	0.003887	808.727	172.009	250.280	0.562884	0.779619
89	4358.790	0.003727	794.895	174.531	248.859	0.569566	0.774812
90	4442.499	0.003564	779.859	177.205	247.243	0.576650	0.769537
91	4527.821	0.003217	763.035	180.102	245.330	0.584337	0.763432
92	4633.633	0.003178	761.165	183.278	243.050	0.592728	0.756424
93	4702.748	0.003027	746.140	186.858	240.226	0.602173	0.747954
94	4792.477	0.002809	724.256	191.111	236.470	0.613427	0.736989
95	4883.763	0.002526	697.180	196.942	230.426	0.628923	0.719902

Table 6 — Refrigerant 22 (Monochlorodifluoromethane) Properties of Superheated Vapor

10 kPa Absolute Pressure (Sat. Temp. = −81.282° C)				20 kPa Absolute Pressure (Sat. Temp. = −69.888° C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK	t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	2.043852	213.252	1.133510	Sat	0.934172	218.880	1.087149
−80	2.060638	212.160	1.136981	−80	--------	-------	--------
−75	2.126083	216.204	1.150511	−75	--------	-------	--------
−70	2.184356	219.328	1.163811	−70	--------	-------	--------
−65	2.239007	222.013	1.176891	−65	0.959252	221.536	1.099964
−60	2.293609	224.727	1.189796	−60	0.982891	224.271	1.112990
−55	2.348164	227.471	1.202542	−55	1.004934	227.039	1.125852
−50	2.402674	230.246	1.215162	−50	1.028775	229.837	1.138546
−45	2.457158	233.051	1.227631	−45	1.052479	232.662	1.151077
−40	2.511619	235.885	1.239932	−40	1.076133	235.518	1.163474
−35	2.566024	238.753	1.252120	−35	1.099787	238.405	1.175683
−30	2.620401	241.651	1.264174	−30	1.123391	241.319	1.187791
−25	2.674776	244.578	1.276094	−25	1.146989	244.264	1.199770
−20	2.729112	247.536	1.287894	−20	1.170549	247.235	1.211614
−15	2.783416	250.522	1.299586	−15	1.194091	250.236	1.223346
−10	2.837720	253.537	1.311177	−10	1.217608	253.265	1.234977
−5	2.891196	256.583	1.322657	−5	1.241093	256.322	1.246495
0	2.944079	259.657	1.334015	0	1.264578	259.409	1.257896
5	3.000512	262.759	1.345289	5	1.288058	262.523	1.269212
10	3.054748	265.891	1.356480	10	1.311487	265.665	1.280328
15	3.108984	269.054	1.367538	15	1.334972	268.839	1.291520
20	3.163193	272.247	1.378528	20	1.358408	272.040	1.302544
25	3.217399	275.468	1.389426	25	1.381793	275.270	1.313459
30	3.271588	278.717	1.400246	30	1.405204	278.527	1.324273
35	3.325768	281.994	1.410967	35	1.428539	281.811	1.335008
				40	1.451900	285.122	1.345676
				45	1.475366	288.461	1.356265
				50	1.498771	291.828	1.366761

30 kPa Absolute Pressure (Sat. Temp. = −63.895° C)				40 kPa Absolute Pressure (Sat. Temp. = −58.861° C)			
Sat	0.667614	221.155	1.066567	Sat	0.508011	224.242	1.050600
−80	--------	-------	--------	−55	0.517902	226.404	1.060615
−75	--------	-------	--------	−50	0.530653	229.216	1.073521
−70	--------	-------	--------	−45	0.543205	232.075	1.086191
−65	--------	-------	--------	−40	0.555712	234.959	1.098694
−60	0.681028	223.743	1.076731	−35	0.568200	237.876	1.111046
−55	0.698073	226.871	1.089690	−30	0.580648	240.818	1.123264
−50	0.714778	229.630	1.102444	−25	0.593082	243.786	1.135324
−45	0.731469	232.468	1.115057	−20	0.605483	246.782	1.147264
−40	0.748093	235.332	1.127481	−15	0.617866	249.804	1.159080
−35	0.764700	238.229	1.139778	−10	0.630232	252.853	1.170779
−30	0.795985	241.152	1.151941	−5	0.642581	255.931	1.182368
−25	0.816187	244.105	1.163971	0	0.654920	259.036	1.193834
−20	0.832687	247.085	1.175866	5	0.667237	262.166	1.205194
−15	0.843095	250.093	1.187641	10	0.679504	265.323	1.216461
−10	0.858346	253.128	1.199299	15	0.691806	268.514	1.227607
−5	0.882087	256.192	1.210843	20	0.704077	271.728	1.238660
0	0.894873	259.284	1.222283	25	0.716335	274.970	1.249612
5	0.896697	262.405	1.233614	30	0.728591	278.240	1.260485
10	0.913116	265.551	1.244856	35	0.740822	281.537	1.271267
15	0.929516	268.731	1.255972	40	0.753034	284.859	1.281955
20	0.945932	271.937	1.266999	45	0.765260	288.208	1.292558
25	0.962308	275.171	1.277947	50	0.777503	291.583	1.303086
30	0.978671	278.431	1.288783				
35	0.995033	281.719	1.299537				
40	1.011396	285.035	1.310225				
45	1.027759	288.377	1.320822				
50	1.044109	291.747	1.331321				

50 kPa Absolute Pressure (Sat. Temp. = −54.8147° C)				60 kPa Absolute Pressure (Sat. Temp. = −51.348° C)			
Sat	0.412014	225.900	1.038547	Sat	0.347523	227.420	1.028900
−55	--------	-------	--------	−55	--------	-------	--------
−50	0.421853	228.840	1.050929	−50	0.349853	228.287	1.032376
−45	0.432057	231.876	1.063755	−45	0.358493	231.478	1.045269
−40	0.442143	234.773	1.076321	−40	0.366967	234.394	1.057919
−35	0.452192	237.698	1.088728	−35	0.375409	237.340	1.070406
−30	0.462213	240.648	1.101001	−30	0.382770	240.309	1.082713
−25	0.472207	243.625	1.113110	−25	0.391813	243.303	1.094892
−20	0.482178	246.629	1.125096	−20	0.400569	246.323	1.106922
−15	0.492128	249.660	1.136963	−15	0.408907	249.368	1.118816
−10	0.503926	252.717	1.148699	−10	0.417225	252.439	1.130593
−5	0.515237	255.800	1.160312	−5	0.425525	255.536	1.142251
0	0.521860	258.909	1.171819	0	0.433810	258.658	1.153785
5	0.531738	262.046	1.183229	5	0.442079	261.808	1.165223
10	0.541604	265.209	1.194505	10	0.450330	264.981	1.176528
15	0.551450	268.404	1.205687	15	0.458568	268.184	1.187734
20	0.561292	271.624	1.216752	20	0.466796	271.415	1.198827
25	0.574390	274.871	1.227736	25	0.475011	274.671	1.209817
30	0.582020	278.145	1.238632	30	0.483213	277.953	1.220732
35	0.596180	281.445	1.249426	35	0.491409	281.261	1.231553
40	0.600529	284.771	1.260136	40	0.499595	284.594	1.242279
45	0.610317	288.123	1.270768	45	0.507771	287.954	1.252921
50	0.620102	291.502	1.281302	50	0.515940	291.341	1.263481
55	0.629858	294.907	1.291769	55	0.524104	294.752	1.273972
60	0.639650	298.339	1.302170	60	0.532259	298.190	1.284372
65	0.649398	301.799	1.312466	65	0.540407	301.656	1.294697
70	0.659144	305.285	1.322687	70	0.548461	305.147	1.304921

Table 6 Cont'd

80 kPa Absolute Pressure (Sat. Temp. = −45.72° C)				100 kPa Absolute Pressure (Sat. Temp. = −41.89° C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK	t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	0.265519	230.545	1.013941	Sat	0.215474	233.052	1.002625
−45	0.266461	230.962	1.015795	−45	--------	-------	--------
−40	0.272933	233.822	1.028531	−40	0.216595	233.243	1.005290
−35	0.279366	236.799	1.041102	−35	0.221827	236.249	1.018008
−30	0.285769	239.796	1.053539	−30	0.227029	239.276	1.030558
−25	0.292143	242.817	1.065812	−25	0.232204	242.324	1.042940
−20	0.298492	245.861	1.077943	−20	0.237351	245.394	1.055168
−15	0.304819	248.928	1.089940	−15	0.242589	248.485	1.067256
−10	0.311126	252.021	1.101793	−10	0.247714	251.600	1.079201
−5	0.317415	255.138	1.113507	−5	0.252658	254.737	1.090995
0	0.323688	258.278	1.125110	0	0.257724	257.896	1.102655
5	0.329943	261.445	1.136609	5	0.262775	261.081	1.114224
10	0.336204	264.637	1.147974	10	0.267811	264.288	1.125641
15	0.342406	267.855	1.159218	15	0.272829	267.522	1.136927
20	0.348616	271.033	1.170368	20	0.277833	270.783	1.148129
25	0.354817	274.050	1.181419	25	0.282829	274.066	1.159218
30	0.361007	277.496	1.192379	30	0.287813	277.373	1.170214
35	0.367185	280.984	1.203236	35	0.292788	280.705	1.182171
40	0.373356	284.329	1.213992	40	0.297753	284.062	1.193193
45	0.379518	287.699	1.224668	45	0.302708	287.444	1.202641
50	0.385673	291.096	1.235269	50	0.307657	290.850	1.213251
55	0.391820	294.516	1.245772	55	0.312597	294.280	1.223791
60	0.397961	297.964	1.256195	60	0.317531	297.736	1.234248
65	0.404094	301.437	1.266535	65	0.322457	301.220	1.244610
70	0.410224	304.936	1.276794	70	0.327381	304.727	1.254906
				75	0.332294	308.259	1.265105
				80	0.337203	311.815	1.275241

120 kPa Absolute Pressure (Sat. Temp. = −37.11° C)				140 kPa Absolute Pressure (Sat. Temp. = −33.6137° C)			
Sat	0.181985	234.883	0.993560	Sat	0.157281	235.960	0.985956
−45	--------	-------	--------	−30	0.160064	238.345	0.995169
−40	--------	-------	--------	−25	0.163876	241.490	1.007770
−35	0.183877	235.791	0.998954	−20	0.167658	244.603	1.020203
−30	0.188308	238.750	1.011608	−15	0.171415	247.735	1.032470
−25	0.192693	241.825	1.024100	−10	0.175149	250.888	1.044583
−20	0.197051	244.921	1.036425	−5	0.178864	254.060	1.056546
−15	0.201384	248.037	1.048588	0	0.182559	257.254	1.068349
−10	0.205695	251.174	1.060605	5	0.186238	260.468	1.080015
−5	0.209987	254.332	1.072485	10	0.189899	263.704	1.091563
0	0.214257	257.512	1.084226	15	0.193548	266.966	1.102986
5	0.218513	260.713	1.095842	20	0.197182	270.250	1.114276
10	0.222759	263.939	1.107323	25	0.200801	273.556	1.125460
15	0.226980	267.190	1.118692	30	0.204412	276.886	1.136540
20	0.231193	270.333	1.129916	35	0.208011	280.239	1.147521
25	0.235391	273.612	1.141052	40	0.211602	283.615	1.158388
30	0.239582	277.081	1.152111	45	0.215185	287.015	1.169156
35	0.243762	280.426	1.163056	50	0.218865	290.438	1.179863
40	0.247932	283.795	1.173890	55	0.222804	293.886	1.190448
45	0.252095	287.187	1.184629	60	0.225887	297.357	1.200961
50	0.256248	290.603	1.195274	65	0.229440	300.853	1.211367
55	0.260394	294.044	1.205839	70	0.232988	304.375	1.221701
60	0.264532	297.508	1.216315	75	0.236527	307.920	1.231942
65	0.268665	301.000	1.226704	80	0.240063	311.488	1.242130
70	0.272786	304.516	1.237025	85	0.243596	315.081	1.252241
75	0.276909	308.056	1.247260	90	0.247121	318.697	1.262422
80	0.281028	311.619	1.257414				

160 kPa Absolute Pressure (Sat. Temp. = −30.4377° C)				180 kPa Absolute Pressure (Sat. Temp. = −27.778° C)			
Sat	0.138841	237.253	0.979493	Sat	0.124569	238.711	0.974025
−30	0.139163	237.568	0.980672	−30	--------	-------	--------
−25	0.142607	240.812	0.993518	−25	0.126274	240.474	0.981143
−20	0.145966	243.962	1.006061	−20	0.129312	243.648	0.993805
−15	0.149299	247.127	1.018424	−15	0.132319	246.831	1.006265
−10	0.152608	250.310	1.030619	−10	0.135304	250.031	1.018542
−5	0.155897	253.511	1.042660	−5	0.143220	252.997	1.030650
0	0.159169	256.732	1.054540	0	0.154418	255.812	1.042600
5	0.162418	259.973	1.066280	5	0.144139	259.735	1.054416
10	0.165656	263.232	1.077894	10	0.147049	263.007	1.066098
15	0.168876	266.515	1.089372	15	0.149943	266.300	1.077591
20	0.172084	269.819	1.100716	20	0.152821	269.616	1.088984
25	0.175279	273.145	1.111937	25	0.155689	272.952	1.100276
30	0.178462	276.492	1.123058	30	0.158547	276.309	1.111443
35	0.181636	279.862	1.134077	35	0.161395	279.687	1.122497
40	0.184801	283.254	1.144986	40	0.164233	283.087	1.133450
45	0.187956	286.669	1.155790	45	0.167061	286.510	1.144290
50	0.191104	290.107	1.166509	50	0.179879	289.955	1.155013
55	0.194242	293.567	1.177143	55	0.172688	293.421	1.165669
60	0.197375	297.050	1.187656	60	0.175498	296.910	1.176258
65	0.200501	300.559	1.198117	65	0.178290	300.425	1.186696
70	0.203620	304.091	1.208457	70	0.181082	303.965	1.197101
75	0.206735	307.598	1.218740	75	0.183870	307.525	1.207384
80	0.209843	311.198	1.229114	80	0.186650	308.317	1.217835
85	0.212945	314.828	1.239197	85	0.189425	312.388	1.227947
90	0.216045	318.452	1.249096	90	0.192196	318.344	1.237824

Table 6 Cont'd

200 kPa Absolute Pressure (Sat. Temp. = −25.1323° C)				250 kPa Absolute Pressure (Sat. Temp. = −19.4657° C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK	t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	0.112496	239.861	0.968817	Sat	0.091305	241.898	0.958392
−25	0.112585	239.588	0.969155	−25	--------	-------	--------
−20	0.115344	242.980	0.981872	−20	--------	-------	--------
−15	0.118081	246.199	0.994435	−15	0.093352	245.183	0.969798
−10	0.120794	249.431	1.006797	−10	0.095617	248.685	0.982440
−5	0.123486	252.679	1.018987	−5	0.097839	251.971	0.994856
0	0.126158	255.940	1.031026	0	0.100039	255.271	1.007096
5	0.128810	259.219	1.042915	5	0.102222	258.582	1.019162
10	0.131447	262.516	1.054653	10	0.104390	261.911	1.031060
15	0.134070	265.832	1.066165	15	0.106538	265.256	1.042772
20	0.136676	269.168	1.077676	20	0.108669	268.618	1.054371
25	0.139269	272.523	1.089012	25	0.110789	271.999	1.065819
30	0.141853	275.899	1.100210	30	0.112899	275.398	1.077139
35	0.144426	279.294	1.111301	35	0.115202	278.815	1.088337
40	0.146987	282.711	1.122291	40	0.117330	282.252	1.099421
45	0.149539	286.148	1.133175	45	0.119163	285.709	1.110393
50	0.152086	289.607	1.143950	50	0.121234	289.186	1.121245
55	0.154621	293.087	1.154639	55	0.123295	292.684	1.132016
60	0.157152	296.589	1.165227	60	0.125351	296.201	1.142661
65	0.159674	300.115	1.175722	65	0.127395	299.743	1.153221
70	0.162194	303.664	1.186116	70	0.129435	303.307	1.163681
75	0.164891	307.236	1.196425	75	0.131470	306.891	1.174070
80	0.167315	310.829	1.206674	80	0.133462	310.497	1.184366
85	0.169709	314.445	1.216841	85	0.135492	314.125	1.194578
90	0.172206	318.083	1.226925	90	0.137544	317.775	1.204706
95	0.174698	321.743	1.236936	95	0.139561	321.447	1.214751
300 kPa Absolute Pressure (Sat. Temp. = −14.626° C)				**350 kPa Absolute Pressure (Sat. Temp. = −10.3611° C)**			
Sat	0.076772	244.666	0.949934	Sat	0.066178	245.841	0.942833
−25	--------	-------	--------	−10	0.066300	246.115	0.943764
−20	--------	-------	--------	−5	0.067988	249.782	0.956602
−15	--------	-------	--------	0	0.069652	253.200	0.969266
−10	0.078567	247.417	0.961767	5	0.071291	256.621	0.981708
−5	0.080492	250.524	0.974453	10	0.072917	260.048	0.993972
0	0.082380	253.901	0.986885	15	0.074516	263.487	1.006009
5	0.084247	257.285	0.999138	20	0.076106	266.936	1.017874
10	0.086096	260.678	1.011200	25	0.077681	270.396	1.029576
15	0.087925	264.065	1.022835	30	0.079240	273.868	1.041132
20	0.089740	267.499	1.034760	35	0.080403	277.354	1.052553
25	0.091542	270.935	1.046398	40	0.081864	280.856	1.063840
30	0.093331	274.383	1.057836	45	0.083854	284.373	1.074992
35	0.095109	277.846	1.069142	50	0.085373	287.906	1.086019
40	0.096878	281.326	1.080325	55	0.086886	291.457	1.096945
45	0.098528	284.822	1.091388	60	0.088389	295.026	1.107765
50	0.100100	288.337	1.102338	65	0.089882	298.614	1.118435
55	0.102129	291.869	1.113166	70	0.091369	302.221	1.129038
60	0.103862	295.419	1.123894	75	0.092852	305.846	1.139544
65	0.105587	298.993	1.134509	80	0.094329	309.492	1.149928
70	0.107304	302.585	1.145047	85	0.095801	313.156	1.160237
75	0.109019	306.197	1.155475	90	0.097376	316.841	1.170460
80	0.110726	309.829	1.165818	95	0.098920	320.545	1.180588
85	0.112429	313.481	1.176083	100	0.100188	323.918	1.190662
90	0.114529	317.154	1.186265	105	0.101645	326.431	1.200641
95	0.116523	320.846	1.196356	110	0.103093	331.777	1.210519
				115	0.104539	335.566	1.220354
400 kPa Absolute Pressure (Sat. Temp. = −6.554° C)				**450 kPa Absolute Pressure (Sat. Temp. = −3.166° C)**			
Sat	0.058268	247.880	0.936770	Sat	0.052149	248.778	0.931609
−10	--------	-------	--------	−10	--------	-------	--------
−5	0.058737	248.764	0.940769	−5	--------	-------	--------
0	0.060245	251.764	0.953644	0	0.053011	251.025	0.939813
5	0.061724	255.266	0.966308	5	0.054370	254.573	0.952731
10	0.063180	258.766	0.978759	10	0.55702	258.113	0.965354
15	0.064616	262.271	0.990960	15	0.057013	261.653	0.977751
20	0.066036	265.781	1.002981	20	0.058307	265.194	0.989914
25	0.067445	269.298	1.014827	25	0.059586	268.740	1.001901
30	0.068839	272.824	1.026519	30	0.060851	272.293	1.013720
35	0.070219	276.359	1.038046	35	0.062104	275.854	1.025372
40	0.071587	279.905	1.049429	40	0.063346	279.425	1.036873
45	0.072945	283.465	1.060691	45	0.064576	283.007	1.048228
50	0.074294	287.038	1.071823	50	0.065794	286.600	1.059432
55	0.075637	290.626	1.082832	55	0.067006	290.207	1.070531
60	0.076972	294.229	1.093706	60	0.068209	293.826	1.081497
65	0.078298	297.850	1.104453	65	0.069406	297.464	1.092311
70	0.079617	301.487	1.115113	70	0.070597	301.116	1.103025
75	0.080930	305.141	1.125674	75	0.071780	304.785	1.113639
80	0.082235	308.813	1.136135	80	0.072956	308.470	1.124152
85	0.083536	312.503	1.146495	85	0.074127	312.173	1.134564
90	0.084833	316.211	1.156754	90	0.075293	315.893	1.144877
95	0.086125	319.938	1.166886	95	0.076454	319.632	1.155101
100	0.087414	323.684	1.176919	100	0.077610	323.388	1.165250
105	0.088697	327.448	1.187039	105	0.078762	327.163	1.175298
110	0.089975	331.231	1.196971	110	0.079914	330.956	1.185246
115	0.091252	335.036	1.206829	115	0.081055	334.770	1.195156

Table 6 Cont'd

500 kPa Absolute Pressure (Sat. Temp. = 0.119° C)				550 kPa Absolute Pressure (Sat. Temp. = 3.1666° C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK	t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	0.047367	250.381	0.926740	Sat	0.004265	251.102	0.922314
5	0.048381	253.539	0.939356	5	0.014983	252.440	0.927088
10	0.049420	256.775	0.952281	10	0.044213	256.089	0.940108
15	0.050627	260.388	0.964867	15	0.045335	259.742	0.952882
20	0.051816	263.998	0.977202	20	0.046439	263.388	0.965421
25	0.052989	267.605	0.989358	25	0.047526	267.029	0.977726
30	0.054148	271.215	1.001310	30	0.048598	270.668	0.989847
35	0.055294	274.830	1.013086	35	0.049656	274.309	1.001759
40	0.056428	278.449	1.024702	40	0.050702	277.954	1.013486
45	0.057550	282.075	1.036158	45	0.051736	281.605	1.025067
50	0.058663	285.711	1.047467	50	0.052760	285.262	1.036480
55	0.059767	289.357	1.058641	55	0.053775	288.927	1.047730
60	0.060862	293.014	1.069682	60	0.054781	292.603	1.058846
65	0.061948	296.684	1.080591	65	0.055778	296.291	1.069849
70	0.062870	300.369	1.091366	70	0.056768	299.991	1.080684
75	0.064043	304.067	1.102036	75	0.057752	303.705	1.091440
80	0.065169	307.780	1.112100	80	0.058729	307.433	1.102079
85	0.066231	311.510	1.122654	85	0.059701	311.176	1.112584
90	0.067288	315.255	1.133444	90	0.060668	314.934	1.122988
95	0.068341	319.017	1.143719	95	0.061629	318.706	1.133313
100	0.069390	322.795	1.153910	100	0.062587	322.495	1.141284
105	0.070434	326.591	1.164015	105	0.063539	326.301	1.143528
110	0.071473	330.403	1.174019	110	0.064488	330.126	1.163726
115	0.072507	334.236	1.183948	115	0.065432	333.967	1.173711
				120	0.066376	338.827	1.183596
				125	0.067315	341.706	1.193381

600 kPa Absolute Pressure (Sat. Temp. = 5.8527° C)				650 kPa Absolute Pressure (Sat. Temp. = 8.4642° C)			
Sat	0.039311	251.777	0.918559	Sat	0.036053	253.005	0.914962
5	--------	-------	--------	10	0.036311	253.970	0.912133
10	0.040216	255.393	0.929507	15	0.037311	257.749	0.931548
15	0.041275	259.088	0.942470	20	0.038379	261.509	0.945141
20	0.042315	262.770	0.955990	25	0.039283	265.255	0.957776
25	0.043337	266.444	0.967960	30	0.040192	268.989	0.970195
30	0.044343	270.114	0.979302	35	0.041120	272.718	0.982391
35	0.041262	273.784	0.991437	40	0.042284	276.442	0.994372
40	0.041426	277.455	1.003789	45	0.043374	280.165	1.006158
45	0.047281	281.129	1.015476	50	0.043828	283.890	1.017760
50	0.048238	284.808	1.026992	55	0.044709	287.619	1.029216
55	0.049184	288.494	1.938322	60	0.045582	291.354	1.040515
60	0.050123	292.189	1.049437	65	0.046444	295.097	1.051626
65	0.051051	295.896	1.060577	70	0.047300	298.847	1.062631
70	0.051973	299.613	1.071508	75	0.048148	302.608	1.073510
75	0.052888	303.342	1.082326	80	0.048990	306.379	1.084256
80	0.053725	307.084	1.093017	85	0.049827	310.163	1.094890
85	0.054640	310.840	1.103596	90	0.050657	313.960	1.105406
90	0.055598	314.610	1.114057	95	0.051483	317.769	1.115813
95	0.056491	318.396	1.124410	100	0.052304	321.593	1.124922
100	0.057379	322.196	1.134687	105	0.053120	325.430	1.130873
105	0.058263	326.015	1.144856	110	0.053933	329.284	1.146471
110	0.059143	329.847	1.154965	115	0.054742	333.157	1.156494
115	0.060019	333.699	1.164965	120	0.055545	337.042	1.166445
120	0.060891	338.405	1.174866	125	0.056348	340.946	1.176300
125	0.061720	341.768	1.184683				

700 kPa Absolute Pressure (Sat. Temp. = 10.3888° C)				800 kPa Absolute Pressure (Sat. Temp. = 15.376° C)			
Sat	0.034278	253.565	0.912307	Sat	0.029732	255.519	0.907609
10	--------	-------	--------	10	--------	-------	--------
15	0.035164	257.067	0.926768	15	--------	-------	--------
20	0.036109	260.865	0.938090	20	0.030546	258.385	0.920270
25	0.037036	264.648	0.950391	25	0.031397	262.136	0.931290
30	0.037945	268.416	0.962926	30	0.032224	266.053	0.944207
35	0.038839	272.176	0.975214	35	0.033034	269.945	0.956841
40	0.039719	275.928	0.987285	40	0.033830	273.818	0.969231
45	0.040587	279.677	0.999167	45	0.034611	277.677	0.981395
50	0.041443	283.425	1.010873	50	0.035380	281.527	0.993343
55	0.042289	287.177	1.022387	55	0.036138	285.370	1.005095
60	0.043126	290.930	1.033767	60	0.036886	289.209	1.016686
65	0.043948	294.692	1.044958	65	0.037624	293.048	1.028059
70	0.044772	298.460	1.056016	70	0.038354	296.888	1.039297
75	0.045538	302.237	1.066939	75	0.039076	300.732	1.050378
80	0.046365	306.024	1.077728	80	0.039791	304.582	1.061319
85	0.047192	309.821	1.088405	85	0.040501	308.438	1.072129
90	0.047987	313.631	1.099567	90	0.041204	312.303	1.082809
95	0.048776	317.454	1.110469	95	0.041903	316.178	1.093370
100	0.049562	321.288	1.119781	100	0.042596	320.061	1.103827
105	0.050346	325.138	1.130022	105	0.043300	323.954	1.114159
110	0.051118	329.002	1.140196	110	0.044117	327.860	1.124424
115	0.051890	332.884	1.150257	115	0.044664	331.781	1.134575
120	0.052658	336.780	1.160217	120	0.045290	335.715	1.144599
125	0.053424	340.692	1.170106	125	0.045986	339.664	1.154572
130	0.054186	344.622	1.179903	130	0.046669	343.626	1.164440
135	0.054946	348.566	1.189621	135	0.047336	347.603	1.174218
140	0.055702	352.528	1.199272	140	0.048001	351.597	1.183929

Table 6 Cont'd

1000 kPa Absolute Pressure (Sat. Temp. = 23.3565° C)				1200 kPa Absolute Pressure (Sat. Temp. = 30.2157° C)			
t °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK	*t* °C	*v* m³/kg	*h* kJ/kg	*s* kJ/kgK
Sat	0.237130	257.105	0.895454	Sat	0.019660	259.478	0.886847
25	0.023955	258.636	0.899947	25	--------	-------	--------
30	0.024688	263.295	0.913617	30	--------	-------	--------
35	0.025403	267.602	0.927014	35	0.020283	262.935	0.900318
40	0.026093	271.611	0.940048	40	0.020920	266.854	0.914166
45	0.026767	275.593	0.952791	45	0.021531	271.134	0.927581
50	0.027426	279.554	0.965254	50	0.022124	275.360	0.940632
55	0.028073	283.498	0.977455	55	0.022703	279.542	0.953370
60	0.028708	287.432	0.989438	60	0.023268	283.689	0.965817
65	0.029332	291.355	1.001186	65	0.023819	287.805	0.977974
70	0.029946	295.274	1.012733	70	0.024361	291.900	0.989906
75	0.030553	299.190	1.024122	75	0.024893	295.978	1.001634
80	0.031152	303.106	1.035349	80	0.025417	300.042	1.013151
85	0.031744	307.025	1.046407	85	0.025934	304.098	1.024498
90	0.032329	310.948	1.057328	90	0.026443	308.147	1.035682
95	0.032909	314.875	1.068118	95	0.026946	312.191	1.046691
100	0.033484	318.809	1.078757	100	0.027443	316.235	1.057548
105	0.034053	322.752	1.089294	105	0.027936	320.278	1.068298
110	0.034619	326.702	1.099723	110	0.028423	324.325	1.078891
115	0.035179	330.665	1.110000	115	0.028905	328.376	1.089359
120	0.035736	334.637	1.120203	120	0.029383	332.432	1.099703
125	0.036289	338.622	1.130293	125	0.029858	336.495	1.109932
130	0.036839	342.619	1.140292	130	0.030329	340.566	1.120067
135	0.037386	346.630	1.150196	135	0.030797	344.645	1.130093
140	0.037930	350.654	1.160016	140	0.031261	348.733	1.140022

1400 kPa Absolute Pressure (Sat. Temp. = 35.667° C)				1600 kPa Absolute Pressure (Sat. Temp. = 41.6996° C)			
Sat	0.016949	260.360	0.879985	Sat	0.014484	262.405	0.872376
25	--------	-------	--------	45	0.014844	264.536	0.882099
30	--------	-------	--------	50	0.015383	269.234	0.896744
35	--------	-------	--------	55	0.015895	273.825	0.911011
40	0.017459	264.259	0.892456	60	0.016386	278.249	0.924668
45	0.018039	268.727	0.906647	65	0.016860	282.771	0.937881
50	0.018596	273.115	0.920338	70	0.017319	287.159	0.950718
55	0.019134	277.440	0.933631	75	0.017767	291.492	0.963256
60	0.019657	281.712	0.946555	80	0.018204	295.788	0.975506
65	0.020164	285.897	0.959141	85	0.018631	300.053	0.987488
70	0.020660	290.123	0.971459	90	0.019050	304.294	0.999243
75	0.021146	294.300	0.983508	95	0.019461	308.516	1.010794
80	0.021622	298.447	0.995340	100	0.019865	312.722	1.022144
85	0.022090	302.579	1.006950	105	0.020263	316.915	1.033317
90	0.022550	306.697	1.018359	110	0.020656	321.101	1.044335
95	0.023004	310.807	1.029601	115	0.021042	325.279	1.055165
100	0.023451	314.910	1.043070	120	0.021424	329.456	1.065841
105	0.023893	319.009	1.051511	125	0.021802	333.630	1.076381
110	0.024330	323.106	1.062363	130	0.022176	337.805	1.086796
115	0.024762	327.203	1.072989	135	0.022546	341.983	1.097095
120	0.025189	331.303	1.083481	140	0.022913	346.164	1.107277
125	0.025612	335.407	1.093869	145	0.023277	350.350	1.117346
130	0.026031	339.517	1.104130	150	0.023638	354.541	1.127314
135	0.026447	343.633	1.114258	155	0.023997	358.740	1.137181
140	0.026860	347.757	1.124286	160	0.024352	362.946	1.146949
145	0.027270	351.888	1.134234				
150	0.027677	356.029	1.144081				
155	0.028082	360.179	1.153832				
160	0.028484	364.339	1.163516				

1800 kPa Absolute Pressure (Sat. Temp. = 46.6° C)				2000 kPa Absolute Pressure (Sat. Temp. = 51.2335° C)			
Sat	0.012765	262.085	0.866169	Sat	0.011303	262.893	0.85981
45	--------	-------	--------	45	--------	-------	-------
50	0.013121	265.541	0.876848	50	--------	-------	-------
55	0.013627	270.458	0.892010	55	0.011668	266.392	0.871614
60	0.014104	275.223	0.906404	60	0.012152	271.544	0.887285
65	0.014559	279.868	0.920233	65	0.012599	276.479	0.901983
70	0.014997	284.433	0.933627	70	0.013025	281.288	0.916095
75	0.015421	288.930	0.946643	75	0.013434	285.997	0.929722
80	0.015833	293.372	0.959317	80	0.013829	290.623	0.942906
85	0.016235	297.769	0.971676	85	0.014211	295.183	0.955727
90	0.016626	302.127	0.983768	90	0.014582	299.686	0.968230
95	0.017009	306.456	0.995612	95	0.014944	304.145	0.980427
100	0.017385	310.760	1.007214	100	0.015297	308.565	0.992352
105	0.017754	315.044	1.018644	105	0.015643	312.955	1.004043
110	0.018117	319.310	1.029873	110	0.015982	317.320	1.015498
115	0.018473	323.564	1.040876	115	0.016314	321.663	1.026766
120	0.018825	327.810	1.051745	120	0.016641	325.989	1.037832
125	0.019172	332.049	1.062451	125	0.016963	330.303	1.048741
130	0.019515	336.285	1.073014	130	0.017281	334.608	1.059487
135	0.019854	340.518	1.083443	135	0.017595	338.906	1.070086
140	0.020190	344.752	1.093756	140	0.017904	343.200	1.080543
145	0.020522	348.988	1.103955	145	0.018211	347.492	1.090862
150	0.020852	353.226	1.114028	150	0.018514	351.783	1.101064
155	0.021178	357.468	1.124001	155	0.018814	356.075	1.111150
160	0.021502	361.715	1.133874	160	0.019112	360.369	1.121136

Table 6 Cont'd

2200 kPa Absolute Pressure (Sat. Temp. = 55.6111°C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	0.010079	262.720	0.853650
60	0.010499	267.547	0.868262
65	0.010947	272.843	0.884013
70	0.011371	277.950	0.898993
75	0.011772	282.907	0.913321
80	0.012155	287.746	0.927137
85	0.012524	292.491	0.940485
90	0.012881	297.157	0.953413
95	0.013226	301.759	0.965999
100	0.013562	306.309	0.978283
105	0.013890	310.814	0.990274
110	0.014210	315.284	1.002031
115	0.014523	319.719	1.013524
120	0.014830	324.133	1.024815
125	0.015133	328.528	1.035936
130	0.015430	332.906	1.046863
135	0.015722	337.272	1.057611
140	0.016012	341.629	1.068224
145	0.016297	345.980	1.078712
150	0.016579	350.327	1.089041
155	0.016857	354.669	1.099240
160	0.017133	359.013	1.109339
165	0.017406	363.356	1.119287
170	0.017676	367.702	1.129134
175	0.017945	372.051	1.138910

2500 kPa Absolute Pressure (Sat. Temp. = 61.0555° C)			
t °C	v m³/kg	h kJ/kg	s kJ/kgK
Sat	0.008756	262.627	0.845569
60	--------	-------	--------
65	0.009128	267.341	0.859589
70	0.009562	272.994	0.876167
75	0.009965	278.391	0.891775
80	0.011094	283.592	0.906596
85	0.011330	288.640	0.920786
90	0.011051	293.567	0.934456
95	0.011383	298.394	0.947669
100	0.011703	303.142	0.960472
105	0.012015	307.824	0.972945
110	0.012316	312.450	0.985116
115	0.012611	317.029	0.996986
120	0.012898	321.568	1.008587
125	0.013180	326.080	1.019980
130	0.013456	330.565	1.031171
135	0.013728	335.029	1.042182
140	0.013995	339.477	1.053026
145	0.014258	343.913	1.063703
150	0.014518	348.336	1.074220
155	0.014774	352.753	1.084603
160	0.015027	357.163	1.094853
165	0.015277	361.570	1.104951
170	0.015525	365.975	1.114949
175	0.015770	370.381	1.124847

3000 kPa Absolute Pressure (Sat. Temp. = 70.0477° C)			
Sat	0.006884	261.361	0.830018
60	--------	-------	--------
65	--------	-------	--------
70	--------	-------	--------
75	0.007334	268.071	0.849371
80	0.007750	274.428	0.867515
85	0.008126	280.358	0.884203
90	0.008473	285.990	0.899830
95	0.008799	291.399	0.914635
100	0.009108	296.638	0.928781
105	0.009402	301.742	0.942360
110	0.009686	306.736	0.955503
115	0.009958	311.633	0.968194
120	0.010222	316.460	0.980549
125	0.010479	321.227	0.992599
130	0.010729	325.945	1.004356
135	0.010856	330.622	1.015877
140	0.011071	335.265	1.027182
145	0.011447	339.877	1.038281
150	0.011678	344.464	1.049204
155	0.011904	349.032	1.059937
160	0.012127	353.584	1.070507
165	0.012347	358.120	1.080922
170	0.012564	362.646	1.091178
175	0.012778	367.166	1.101318

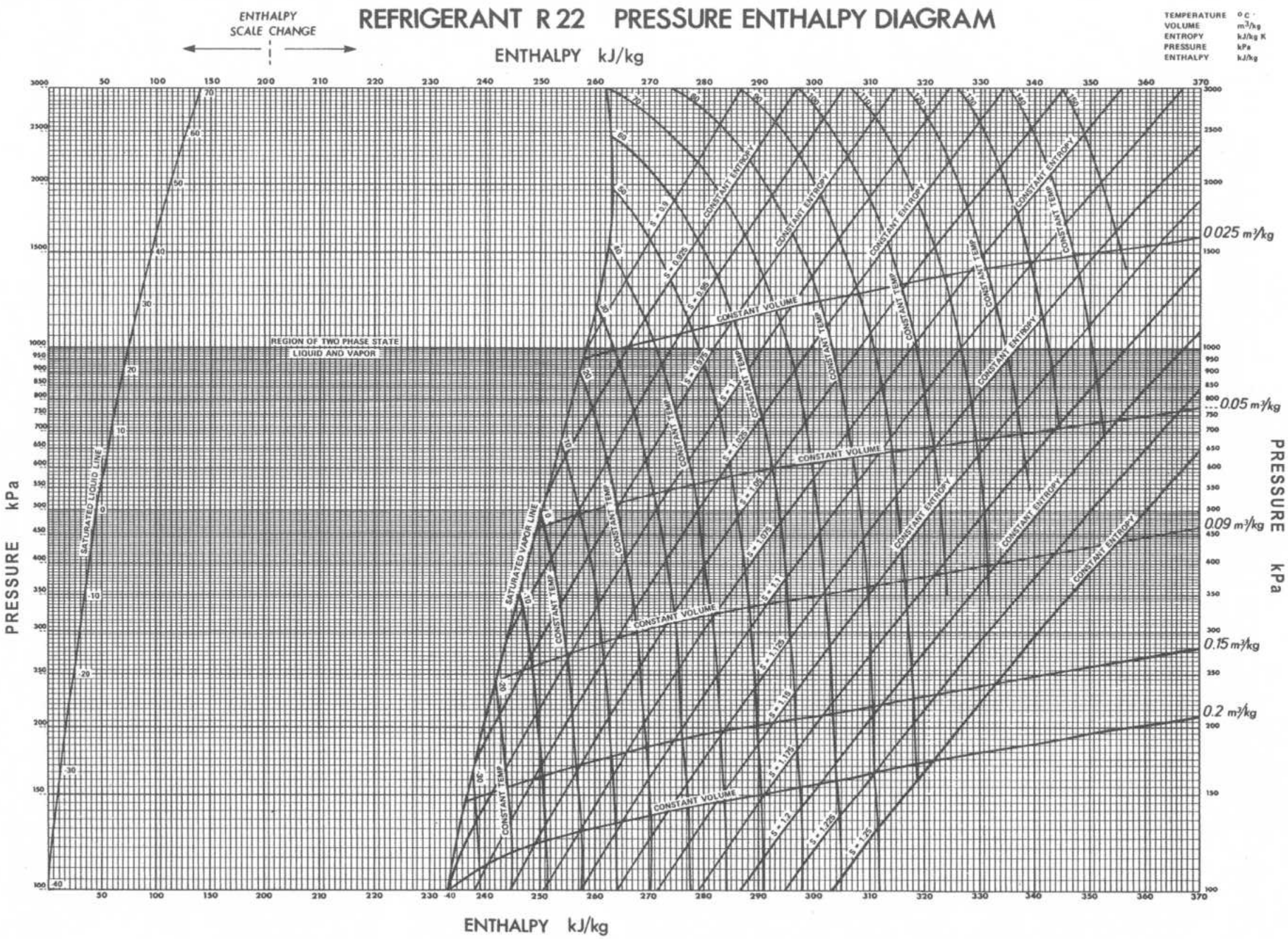
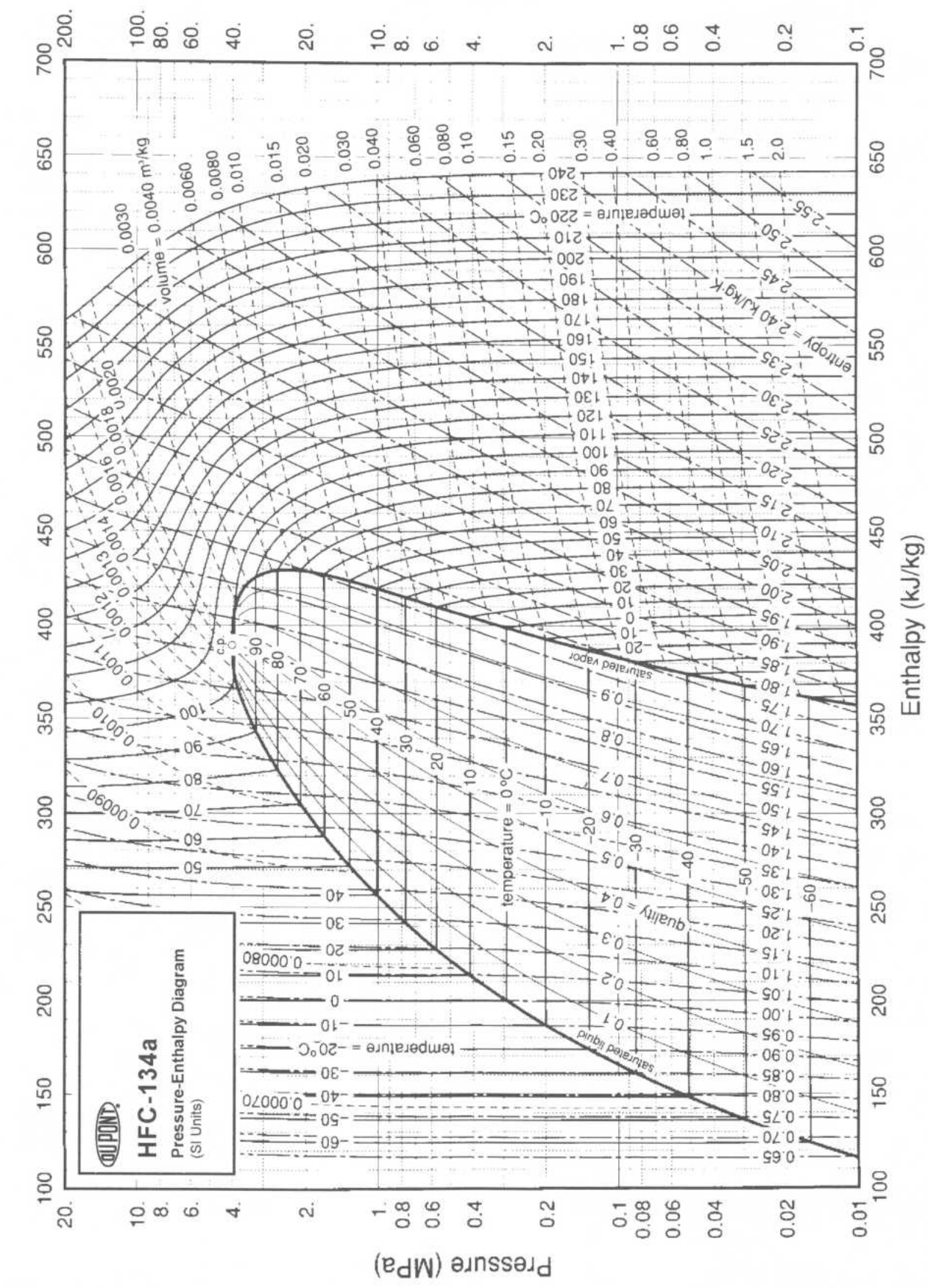

REFRIGERANT R 22 PRESSURE ENTHALPY DIAGRAM
ENTHALPY SCALE CHANGE
ENTHALPY kJ/kg
TEMPERATURE °C
VOLUME m³/kg
ENTROPY kJ/kg K
PRESSURE kPa
ENTHALPY kJ/kg
PRESSURE kPa
REGION OF TWO PHASE STATE
LIQUID AND VAPOR
SATURATED LIQUID LINE
SATURATED VAPOR LINE
CONSTANT TEMP
CONSTANT VOLUME
CONSTANT ENTROPY
0.025 m³/kg
0.05 m³/kg
0.09 m³/kg
0.15 m³/kg
0.2 m³/kg

Table 7: Properties of Saturated Refrigerant R-134a - Pressure Table (SI)

P_{sat}	T_{sat}	Specific Volume, m^3/kg		Internal Energy, kJ/kg		Enthalpy, kJ/kg			Entropy, kJ/(kg·K)	
kPa	°C	v_f	v_g	u_f	u_g	h_f	h_{fg}	h_g	s_f	s_g
0	-37.07	0.7097	0.3100	3.41	206.12	3.46	221.27	224.72	0.0147	0.9520
80	-31.21	0.7184	0.2366	10.41	209.46	10.47	217.92	228.39	0.0440	0.9447
100	-26.43	0.7258	0.1917	16.22	212.18	16.29	215.06	231.35	0.0678	0.9395
120	-22.36	0.7323	0.1614	21.23	214.50	21.32	212.54	233.86	0.0879	0.9354
140	-18.80	0.7381	0.1395	25.66	216.52	25.77	210.27	236.04	0.1055	0.9322
160	-15.62	0.7435	0.1229	29.66	218.32	29.78	208.19	237.97	0.1211	0.9295
180	-12.73	0.7485	0.1098	33.31	219.94	33.45	206.26	239.71	0.1352	0.9273
200	-10.09	0.7532	0.0993	36.69	221.43	36.84	204.46	241.30	0.1481	0.9253
240	-5.37	0.7618	0.0834	42.77	224.07	42.95	201.14	244.09	0.1710	0.9222
280	-1.23	0.7697	0.0719	48.18	226.38	48.39	198.13	246.52	0.1911	0.9197
320	2.48	0.7770	0.0632	53.06	228.43	53.31	195.35	248.66	0.2089	0.9177
360	5.84	0.7839	0.0564	57.54	230.28	57.82	192.76	250.58	0.2251	0.9160
400	8.93	0.7904	0.0509	61.69	231.97	62.00	190.32	252.32	0.2399	0.9145
500	15.74	0.8056	0.0409	70.93	235.64	71.33	184.74	256.07	0.2723	0.9117
600	21.58	0.8196	0.0341	78.99	238.74	79.48	179.71	259.19	0.2999	0.9097
700	26.72	0.8328	0.0292	86.19	241.42	86.78	175.07	261.85	0.3242	0.9080
800	31.33	0.8454	0.0255	92.75	243.78	93.42	170.73	264.15	0.3459	0.9066
900	35.53	0.8576	0.0226	98.79	245.88	99.56	166.62	266.18	0.3656	0.9054
1000	39.39	0.8695	0.0202	104.42	247.77	105.29	162.68	267.97	0.3838	0.9043
1200	46.32	0.8928	0.0166	114.69	251.03	115.76	155.23	270.99	0.4164	0.9023
1400	52.43	0.9159	0.0140	123.98	253.74	125.26	148.14	273.40	0.4453	0.9003
1600	57.92	0.9392	0.0121	132.52	256.00	134.02	141.31	275.33	0.4714	0.8982
1800	62.91	0.9631	0.0105	140.49	257.88	142.22	134.60	276.83	0.4954	0.8959
2000	67.49	0.9878	0.0093	148.02	259.41	149.99	127.95	277.94	0.5178	0.8934
2500	77.59	1.0562	0.0069	165.48	261.84	168.12	111.06	279.17	0.5687	0.8854
3000	86.22	1.1416	0.0053	181.88	262.16	185.30	92.71	278.01	0.6156	0.8735

Table 8: Properties of Saturated Refrigerant R-134a - Temperature Table (SI)

T_{sat}	P_{sat}	Specific Volume, m^3/kg		Internal Energy, kJ/kg		Enthalpy, kJ/kg			Entropy, kJ/(kg·K)	
°C	kPa	v_f	v_g	u_f	u_g	h_f	h_{fg}	h_g	s_f	s_g
-40	51.64	0.7055	0.3569	-0.04	204.45	0.00	222.88	222.88	0.0000	0.9560
-36	63.32	0.7113	0.2947	4.68	206.73	4.73	220.67	225.40	0.0201	0.9506
-32	77.04	0.7172	0.2451	9.47	209.01	9.52	218.37	227.90	0.0401	0.9456
-28	93.05	0.7233	0.2052	14.31	211.29	14.37	216.01	230.38	0.0600	0.9411
-26	101.99	0.7265	0.1882	16.75	212.43	16.82	214.80	231.62	0.0699	0.9390
-24	111.60	0.7296	0.1728	19.21	213.57	19.29	213.57	232.85	0.0798	0.9370
-22	121.92	0.7328	0.1590	21.68	214.70	21.77	212.32	234.08	0.0897	0.9351
-20	132.99	0.7361	0.1464	24.17	215.84	24.26	211.05	235.31	0.0996	0.9332
-18	144.83	0.7395	0.1350	26.67	216.97	26.77	209.76	236.53	0.1094	0.9315
-16	157.48	0.7428	0.1247	29.18	218.10	29.30	208.45	237.74	0.1192	0.9298
-12	185.40	0.7498	0.1068	34.25	220.36	34.39	205.77	240.15	0.1388	0.9267
-8	217.04	0.7569	0.0919	39.38	222.60	39.54	203.00	242.54	0.1583	0.9239
-4	252.74	0.7644	0.0794	44.56	224.84	44.75	200.15	244.90	0.1777	0.9213
0	292.82	0.7721	0.0689	49.79	227.06	50.02	197.21	247.23	0.1970	0.9190
4	337.65	0.7801	0.0600	55.08	229.27	55.35	194.19	249.53	0.2162	0.9169
8	387.56	0.7884	0.0525	60.43	231.46	60.73	191.07	251.80	0.2354	0.9150
12	442.94	0.7971	0.0460	65.83	233.63	66.18	187.85	254.03	0.2545	0.9132
16	504.16	0.8062	0.0405	71.29	235.78	71.69	184.52	256.22	0.2735	0.9116
20	571.60	0.8157	0.0358	76.80	237.91	77.26	181.09	258.36	0.2924	0.9102
24	645.66	0.8257	0.0317	82.37	240.01	82.90	177.55	260.45	0.3113	0.9089
26	685.30	0.8309	0.0298	85.18	241.05	85.75	175.73	261.48	0.3208	0.9082
28	726.75	0.8362	0.0281	88.00	242.08	88.61	173.89	262.50	0.3302	0.9076
30	770.06	0.8417	0.0265	90.84	243.10	91.49	172.00	263.50	0.3396	0.9070
32	815.28	0.8473	0.0250	93.70	244.12	94.39	170.09	264.48	0.3490	0.9064
34	862.47	0.8530	0.0236	96.58	245.12	97.31	168.14	265.45	0.3584	0.9058
36	911.68	0.8590	0.0223	99.47	246.11	100.25	166.15	266.40	0.3678	0.9053
38	962.98	0.8651	0.0210	102.38	247.09	103.21	164.12	267.33	0.3772	0.9047
40	1016.4	0.8714	0.0199	105.30	248.06	106.19	162.05	268.24	0.3866	0.9041
42	1072.0	0.8780	0.0188	108.25	249.02	109.19	159.94	269.14	0.3960	0.9035
44	1129.9	0.8847	0.0177	111.22	249.96	112.22	157.79	270.01	0.4054	0.9030
48	1252.6	0.8989	0.0159	117.22	251.79	118.35	153.33	271.68	0.4243	0.9017
52	1385.1	0.9142	0.0142	123.31	253.55	124.58	148.66	273.24	0.4432	0.9004
56	1527.8	0.9308	0.0127	129.51	255.23	130.93	143.75	274.68	0.4622	0.8990
60	1681.3	0.9488	0.0114	135.82	256.81	137.42	138.57	275.99	0.4814	0.8973
70	2116.2	1.0027	0.0086	152.22	260.15	154.34	124.08	278.43	0.5302	0.8918
80	2632.4	1.0766	0.0064	169.88	262.14	172.71	106.41	279.12	0.5814	0.8827
90	3243.5	1.1949	0.0046	189.82	261.34	193.69	82.63	276.32	0.6380	0.8655
100	3974.2	1.5443	0.0027	218.60	248.49	224.74	34.40	259.13	0.7196	0.8117


HFC-134a
Pressure-Enthalpy Diagram
(SI Units)
DUPONT
Pressure (MPa)
Pressure (bar)
Enthalpy (kJ/kg)
saturated liquid
saturated vapor
c.p.
quality = 0.4
temperature = 0 °C
temperature = -20 °C
temperature = 220 °C
volume = 0.0040 m³/kg
entropy = 2.40 kJ/kg·K

PSYCHROMETRIC CHART Sea Level

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