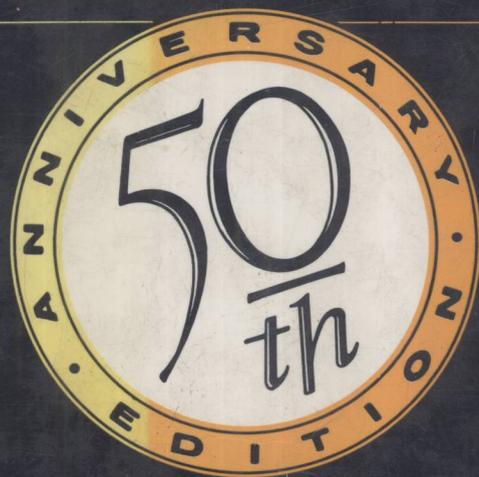# PERRY'S CHEMICAL ENGINEERS' HANDBOOK

SIXTH EDITION

ROBERT H. PERRY

DON GREEN

50th ANNIVERSARY EDITION

PERRY'S CHEMICAL ENGINEERS' HANDBOOK

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Dedicated to
Robert H. Perry

Contents

For the detailed contents of any section, consult the title page of that section. See also the alphabetical index in the back of the *Handbook*.

Conversion Factors and Miscellaneous Tables*

Don W. Green, Ph.D., *Conger-Gabel Distinguished Professor of Chemical and Petroleum Engineering, University of Kansas*

CONVERSION FACTORS

TABLE 1-1 SI Base and Supplementary Quantities and Units

Quantity or "dimension"	SI unit	SI unit symbol ("abbreviation"); Use roman (upright) type
Base quantity or "dimension"		
length	meter	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature	kelvin	K
amount of substance	mole*	mol
luminous intensity	candela	cd
Supplementary quantity or "dimension"		
plane angle	radian	rad
solid angle	steradian	sr

*When the mole is used, the elementary entities must be specified; they may be atoms, molecules, ions, electrons, other particles, or specified groups of such particles.

TABLE 1-2a Derived Units of SI Which Have Special Names

Quantity	Unit	Symbol	Formula
frequency (of a periodic phenomenon)	hertz	Hz	$1/s$
force	newton	N	$(kg \cdot m)/s^2$
pressure, stress	pascal	Pa	N/m^2
energy, work, quantity of heat	joule	J	$N \cdot m$
power, radiant flux	watt	W	J/s
quantity of electricity, electric charge	coulomb	C	$A \cdot s$
electric potential, potential difference, electromotive force	volt	V	W/A
capacitance	farad	F	C/V
electric resistance	ohm	Ω	V/A
conductance	siemens	S	A/V
magnetic flux	weber	Wb	$V \cdot s$
magnetic-flux density	tesla	T	Wb/m^2
inductance	henry	H	Wb/A
luminous flux	lumen	lm	$cd \cdot sr$
illuminance	lux	lx	lm/m^2
activity (of radionuclides)	becquerel	Bq	$1/s$
absorbed dose	gray	Gy	J/kg

TABLE 1-2b Additional Common Derived Units of SI

Quantity	Unit	Symbol
acceleration	meter per second squared	m/s^2
angular acceleration	radian per second squared	rad/s^2
angular velocity	radian per second	rad/s
area	square meter	m^2
concentration (of amount of substance)	mole per cubic meter	mol/m^3
current density	ampere per square meter	A/m^2
density, mass	kilogram per cubic meter	kg/m^3
electric-charge density	coulomb per cubic meter	C/m^3
electric-field strength	volt per meter	V/m
electric-flux density	coulomb per square meter	C/m^2
energy density	joule per cubic meter	J/m^3
entropy	joule per kelvin	J/K
heat capacity	joule per kelvin	J/K
heat-flux density irradiance	watt per square meter	W/m^2
luminance	candela per square meter	cd/m^2
magnetic-field strength	ampere per meter	A/m
molar energy	joule per mole	J/mol
molar entropy	joule per mole-kelvin	$J/(mol \cdot K)$
molar-heat capacity	joule per mole-kelvin	$J/(mol \cdot K)$
moment of force	newton-meter	$N \cdot m$
permeability	henry per meter	H/m
permittivity	farad per meter	F/m
radiance	watt per square-meter–steradian	$W/(m^2 \cdot sr)$
radiant intensity	watt per steradian	W/sr
specific-heat capacity	joule per kilogram-kelvin	$J/(kg \cdot K)$
specific energy	joule per kilogram	J/kg
specific entropy	joule per kilogram-kelvin	$J/(kg \cdot K)$
specific volume	cubic meter per kilogram	m^3/kg
surface tension	newton per meter	N/m
thermal conductivity	watt per meter-kelvin	$W/(m \cdot K)$
velocity	meter per second	m/s
viscosity, dynamic	pascal-second	$Pa \cdot s$
viscosity, kinematic	square meter per second	m^2/s
volume	cubic meter	m^3
wave number	1 per meter	$1/m$

TABLE 1-3 SI Prefixes

Multiplication factor	Prefix	Symbol
$1\ 000\ 000\ 000\ 000\ 000\ 000 = 10^{18}$	exa	E
$1\ 000\ 000\ 000\ 000\ 000 = 10^{15}$	peta	P
$1\ 000\ 000\ 000\ 000 = 10^{12}$	tera	T
$1\ 000\ 000\ 000 = 10^{9}$	giga	G
$1\ 000\ 000 = 10^{6}$	mega	M
$1\ 000 = 10^{3}$	kilo	k
$100 = 10^{2}$	hecto*	h
$10 = 10^{1}$	deka*	da
$0.1 = 10^{-1}$	deci*	d
$0.01 = 10^{-2}$	centi*	c
$0.001 = 10^{-3}$	milli	m
$0.000\ 001 = 10^{-6}$	micro	μ
$0.000\ 000\ 001 = 10^{-9}$	nano	n
$0.000\ 000\ 000\ 001 = 10^{-12}$	pico	p
$0.000\ 000\ 000\ 000\ 001 = 10^{-15}$	femto	f
$0.000\ 000\ 000\ 000\ 000\ 001 = 10^{-18}$	atto	a

*Generally to be avoided.
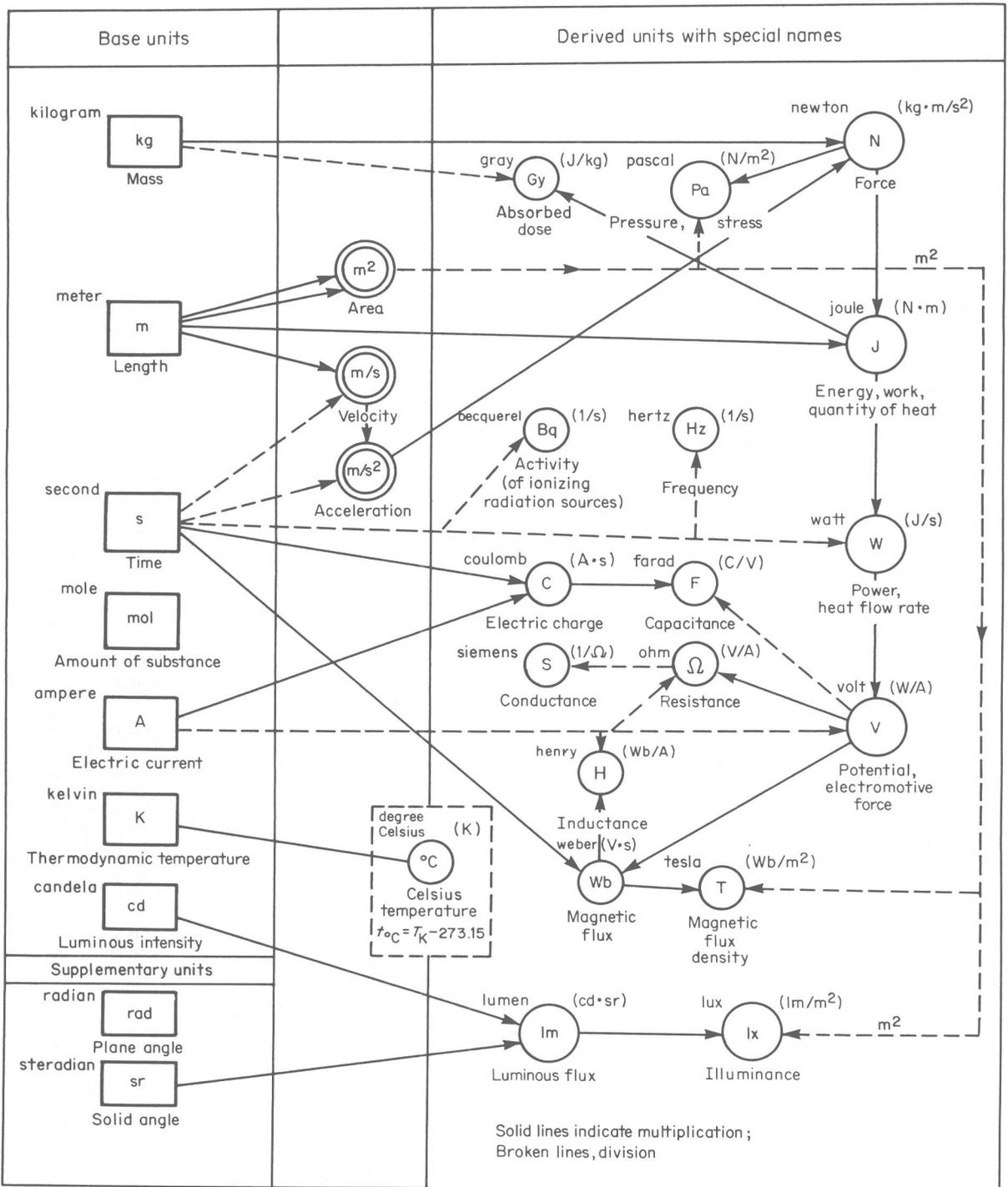
FIG. 1-1 Graphic relationships of SI units with names. *(U.S. National Bureau of Standards, LC 1078, December 1976.)*

TABLE 1-4 Conversion Factors: U.S. Customary and Commonly Used Units to SI Units

Quantity	Customary or commonly used unit	SI unit	Alternate SI unit	Conversion factor; multiply customary unit by factor to obtain SI unit
		Space,† time		
Length	naut mi	km		1.852° E + 00
	mi	km		1.609 344° E + 00
	chain	m		2.011 68° E + 01
	link	m		2.011 68° E − 01
	fathom	m		1.828 8° E + 00
	yd	m		9.144° E − 01
	ft	m		3.048° E − 01
		cm		3.048° E + 01
	in	mm		2.54° E + 01
	in	cm		2.54 E + 00
	mil	μm		2.54° E + 01
Length/length	ft/mi	m/km		1.893 939 E − 01
Length/volume	ft/U.S. gal	m/m³		8.051 964 E + 01
	ft/ft³	m/m³		1.076 391 E + 01
	ft/bbl	m/m³		1.917 134 E + 00
Area	mi²	km²		2.589 988 E + 00
	section	ha		2.589 988 E + 02
	acre	ha		4.046 856 E − 01
	ha	m²		1.000 000° E + 04
	yd²	m²		8.361 274 E − 01
	ft²	m²		9.290 304° E − 02
	in²	mm²		6.451 6° E + 02
		cm²		6.451 6° E + 00
Area/volume	ft²/in³	m²/cm³		5.699 291 E − 03
	ft²/ft³	m²/m³		3.280 840 E + 00
Volume	cubem	km³		4.168 182 E + 00
	acre·ft	m³		1.233 482 E + 03
		ha·m		1.233 482 E − 01
	yd³	m³		7.645 549 E − 01
	bbl (42 U.S. gal)	m³		1.589 873 E − 01
	ft³	m³		2.831 685 E − 02
		dm³	L	2.831 685 E + 01
	U.K. gal	m³		4.546 092 E − 03
		dm³	L	4.546 092 E + 00
	U.S. gal	m³		3.785 412 E − 03
		dm³	L	3.785 412 E + 00
	U.K. qt	dm³	L	1.136 523 E + 00
	U.S. qt	dm³	L	9.463 529 E − 01
	U.S. pt	dm³	L	4.731 765 E − 01
	U.K. fl oz	cm³		2.841 307 E + 01
	U.S. fl oz	cm³		2.957 353 E + 01
	in³	cm³		1.638 706 E + 01
Volume/length (linear displacement)	bbl/in	m³m		6.259 342 E + 00
	bbl/ft	m³/m		5.216 119 E − 01
	ft³/ft	m³/m		9.290 304° E − 02
	U.S. gal/ft	m³/m		1.241 933 E − 02
		L/m		1.241 933 E + 01
Plane angle	rad	rad		1
	deg (°)	rad		1.745 329 E − 02
	min (′)	rad		2.908 882 E − 04
	sec (″)	rad		4.848 137 E − 06
Solid angle	sr	sr		1
Time	year	a		1
	week	d		7.0° E + 00
	h	s		3.6° E + 03
		min		6.0° E + 01
	min	s		6.0° E + 01
		h		1.666 667 E − 02
	mμs	ns		1
		Mass, amount of substance		
Mass	U.K. ton	Mg	t	1.016 047 E + 00
	U.S. ton	Mg	t	9.071 847 E − 01
	U.K. cwt	kg		5.080 234 E + 01

Quantity	Customary or commonly used unit	SI unit	Alternate SI unit	Conversion factor; multiply customary unit by factor to obtain SI unit
	U.S. cwt	kg		4.535 924 E + 01
	lbm	kg		4.535 924 E − 01
	oz (troy)	g		3.110 348 E + 01
	oz (av)	g		2.834 952 E + 01
	gr	mg		6.479 891 E + 01
Amount of substance	lbm·mol	kmol		4.535 924 E − 01
	std m^3(0°C, 1 atm)	kmol		4.461 58 E − 02
	std ft^3 (60°F, 1 atm)	kmol		1.195 30 E − 03
Enthalpy, calorific value, heat, entropy, heat capacity				
Calorific value, enthalpy (mass basis)	Btu/lbm	MJ/kg		2.326 000 E − 03
		kJ/kg	J/g	2.326 000 E + 00
		kWh/kg		6.461 112 E − 04
	cal/g	kJ/kg	J/g	4.184° E + 00
	cal/lbm	J/kg		9.224 141 E + 00
Caloric value, enthalpy (mole basis)	kcal/(g·mol)	kJ/kmol		4.184° E + 03
	Btu/(lb·mol)	kJ/kmol		2.326 000 E + 00
Calorific value (volume basis—solids and liquids)	Btu/U.S. gal	MJ/m^3	kJ/dm^3	2.787 163 E − 01
		kJ/m^3		2.787 163 E + 02
		kWh/m^3		7.742 119 E − 02
	Btu/U.K. gal	MJ/m^3	kJ/dm^3	2.320 800 E − 01
		kJ/m^3		2.320 800 E + 02
		kWh/m^3		6.446 667 E − 02
	Btu/ft^3	MJ/m^3	kJ/dm^3	3.725 895 E − 02
		kJ/m^3		3.725 895 E + 01
		kWh/m^3		1.034 971 E − 02
	cal/mL	MJ/m^3		4.184° E + 00
	(ft·lbf)/U.S. gal	kJ/m^3		3.581 692 E − 01
Calorific value (volume basis—gases)	cal/mL	kJ/m^3	J/dm^3	4.184° E + 03
	kcal/m^3	kJ/m^3	J/dm^3	4.184° E + 00
	Btu/ft^3	kJ/m^3	J/dm^3	3.725 895 E + 01
		kWh/m^3		1.034 971 E − 02
Specific entropy	Btu/(lbm·°R)	kJ/(kg·K)	J/(g·K)	4.186 8° E + 00
	cal/(g·K)	kJ/(kg·K)	J/(g·K)	4.184° E + 00
	kcal/(kg·°C)	kJ/(kg·K)	J/(g·K)	4.184° E + 00
Specific-heat capacity (mass basis)	kWh/(kg·°C)	kJ/(kg·K)	J/(g·K)	3.6° E + 03
	Btu/(lbm·°F)	kJ/(kg·K)	J/(g·K)	4.186 8° E + 00
	kcal/(kg·°C)	kJ/(kg·K)	J/(g·K)	4.184° E + 00
Specific-heat capacity (mole basis)	Btu/(lb·mol·°F)	kJ/(kmol·K)		4.186 8° E + 00
	cal/(g·mol·°C)	kJ/(kmol·K		4.184° E + 00
Temperature, pressure, vacuum				
Temperature (absolute)	°R	K		5/9
	K	K		1
Temperature (traditional)	°F	°C		5/9(°F−32)
Temperature (difference)	°F	K, °C		5/9
Pressure	atm (760 mmHg at 0°C or 14,696 psi)	MPa		1.013 250°E − 01
		kPa		1.013 250°E + 02
		bar		1.013 250°E + 00
	bar	MPa		1.0° E − 01
		kPa		1.0° E + 02
	mmHg (0°C) = torr	MPa		6.894 757 E − 03
		kPa		6.894 757 E + 00
		bar		6.894 757 E − 02
	μmHg (0°C)	kPa		3.376 85 E + 00
	μ bar	kPa		2.488 4 E − 01
	mmHg = torr (0°C)	kPa		1.333 224 E − 01
	cmH$_2$O (4°C)	kPa		9.806 38 E − 01
	lbf/ft^2 (psf)	kPa		4.788 026 E − 02
	mHg (0°C)	Pa		1.333 224 E − 01
	bar	Pa		1.0° E − 01
	dyn/cm^2	Pa		1.0° E − 01

TABLE 1-4 Conversion Factors: U.S. Customary and Commonly Used Units to SI Units (Continued)

Quantity	Customary or commonly used unit	SI unit	Alternate SI unit	Conversion factor; multiply customary unit by factor to obtain SI unit
Vacuum, draft	inHg (60°F)	kPa		3.376 85 E + 00
	inH$_2$O (39.2°F)	kPa		2.490 82 E − 01
	inH$_2$O (60°F)	kPa		2.488 4 E − 01
	mmHg (0°C) = torr	kPa		1.333 224 E − 01
	cmH$_2$O (4°C)	kPa		9.806 38 E − 02
Liquid head	ft	m		3.048° E − 01
	in	mm		2.54° E + 01
		cm		2.54° E + 00
Pressure drop/length	psi/ft	kPa/m		2.262 059 E + 01

	Density, specific volume, concentration, dosage			
Density	lbm/ft^3	kg/m^3		1.601 846 E + 01
		g/m^3		1.601 846 E + 04
	lbm/U.S. gal	kg/m^3		1.198 264 E + 02
		g/cm^3		1.198 264 E − 01
	lbm/U.K. gal	kg/m^3		9.977 633 E + 01
	lbm/ft^3	kg/m^3		1.601 846 E + 01
		g/cm^3		1.601 846 E − 02
	g/cm^3	kg/m^3		1.0° E + 03
	lbm/ft^3	kg/m^3		1.601 846 E + 01
Specific volume	ft^3/lbm	m^3/kg		6.242 796 E − 02
		m^3/g		6.242 796 E − 05
	ft^3/lbm	dm^3/kg		6.242 796 E + 01
	U.K. gal/lbm	dm^3/kg	cm^3/g	1.002 242 E + 01
	U.S. gal/lbm	dm^3/kg	cm^3/g	8.345 404 E + 00
Specific volume (mole basis)	L/(g·mol)	m^3/kmol		1
	ft^3/(lb·mol)	m^3/kmol		6.242 796 E − 02
Specific volume	bbl/U.S. ton	m^3/t		1.752 535 E − 01
	bbl/U.K. ton	m^3/t		1.564 763 E − 01
Yield	bbl/U.S. ton	dm^3/t	L/t	1.752 535 E + 02
	bbl/U.K. ton	dm^3/t	L/t	1.564 763 E + 02
	U.S. gal/U.S. ton	dm^3/t	L/t	4.172 702 E + 00
	U.S. gal/U.K. ton	dm^3/t	L/t	3.725 627 E + 00
Concentration (mass/mass)	wt %	kg/kg		1.0° E − 02
		g/kg		1.0° E + 01
	wt ppm	mg/kg		1
Concentration (mass/volume)	lbm/bbl	kg/m^3	g/dm^3	2.853 010 E + 00
	g/U.S. gal	kg/m^3		2.641 720 E − 01
	g/U.K. gal	kg/m^3	g/L	2.199 692 E − 01
	lbm/1000 U.S. gal	g/m^3	mg/dm^3	1.198 264 E + 02
	lbm/1000 U.K. gal	g/m^3	mg/dm^3	9.977 633 E + 01
	gr/U.S. gal	g/m^3	mg/dm^3	1.711 806 E + 01
	gr/ft^3	mg/m^3		2.288 351 E + 03
	lbm/1000 bbl	g/m^3	mg/dm^3	2.853 010 E + 00
	mg/U.S. gal	g/m^3	mg/dm^3	2.641 720 E − 01
	gr/100 ft^3	mg/m^3		2.288 351 E + 01
Concentration (volume/volume)	ft^3/ft^3	m^3/m^3		1
	bbl/(acre·ft)	m^3/m^3		1.288 931 E − 04
	vol%	m^3/m^3		1.0° E − 02
	U.K. gal/ft^3	dm^3/m^3	L/m^3	1.605 437 E + 02
	U.S. gal/ft^3	dm^3/m^3	L/m^3	1.336 806 E + 02
	mL/U.S. gal	dm^3/m^3	L/m^3	2.641 720 E − 01
	mL/U.K. gal	dm^3/m^3	L/m^3	2.199 692 E − 01
	vol ppm	cm^3/m^3		1
		dm^3/m^3	L/m^3	1.0° E − 03
	U.K. gal/1000 bbl	cm^3/m^3		2.859 403 E + 01
	U.S. gal/1000 bbl	cm^3/m^3		2.380 952 E + 01
	U.K. pt/1000 bbl	cm^3/m^3		3.574 253 E + 00
Concentration (mole/volume)	(lb·mol)/U.S. gal	kmol/m^3		1.198 264 E + 02
	(lb·mol)/U.K. gal	kmol/m^3		9.977 644 E + 01
	(lb·mol)/ft^3	kmol/m^3		1.601 846 E + 01
	std ft^3 (60°F, 1 atm)/bbl	kmol/m^3		7.518 21 E − 03
Concentration (volume/mole)	U.S. gal/1000 std ft^3 (60°F/60°F)	dm^3/kmol	L/kmol	3.166 91 E + 00
	bbl/million std ft^3 (60°F/60°F)	dm^3/kmol	L/kmol	1.330 10 E − 01

Quantity	Customary or commonly used unit	SI unit	Alternate SI unit	Conversion factor; multiply customary unit by factor to obtain SI unit
		Facility throughput, capacity		
Throughput (mass basis)	U.K. ton/year	t/a		1.016 047 E + 00
	U.S. ton/year	t/a		9.071 847 E − 01
	U.K. ton/day	t/d		1.016 047 E + 00
		t/h		4.233 529 E − 02
	U.S. ton/day	t/d		9.071 847 E − 01
		t/h		3.779 936 E − 02
	U.K. ton/h	t/h		1.016 047 E + 00
	U.S. ton/h	t/h		9.071 847 E − 01
	lbm/h	kg/h		4.535 924 E − 01
Throughput (volume basis)	bbl/day	t/a		5.803 036 E + 01
		m^3/d		1.589 873 E − 01
	ft^3/day	m^3/h		1.179 869 E − 03
	bbl/h	m^3/h		1.589 873 E − 01
	ft^3/h	m^3/h		2.831 685 E − 02
	U.K. gal/h	m^3/h		4.546 092 E − 03
		L/s		1.262 803 E − 03
	U.S. gal/h	m^3/h		3.785 412 E − 03
		L/s		1.051 503 E − 03
	U.K. gal/min	m^3/h		2.727 655 E − 01
		L/s		7.576 819 E − 02
	U.S. gal/min	m^3/h		2.271 247 E − 01
		L/s		6.309 020 E − 02
Throughput (mole basis)	(lbm·mol)/h	kmol/h		4.535 924 E − 01
		kmol/s		1.259 979 E − 04
		Flow rate		
Flow rate (mass basis)	U.K. ton/min	kg/s		1.693 412 E + 01
	U.S. ton/min	kg/s		1.511 974 E + 01
	U.K. ton/h	kg/s		2.822 353 E − 01
	U.S. ton/h	kg/s		2.519 958 E − 01
	U.K. ton/day	kg/s		1.175 980 E − 02
	U.S. ton/day	kg/s		1.049 982 E − 02
	million lbm/year	kg/s		5.249 912 E + 00
	U.K. ton/year	kg/s		3.221 864 E − 05
	U.S. ton/year	kg/s		2.876 664 E − 05
	lbm/s	kg/s		4.535 924 E − 01
	lbm/min	kg/s		7.559 873 E − 03
	lbm/h	kg/s		1.259 979 E − 04
Flow rate (volume basis)	bbl/day	m^3/d		1.589 873 E − 01
		L/s		1.840 131 E − 03
	ft^3/day	m^3/d		2.831 685 E − 02
	bbl/h	L/s		3.277 413 E − 04
		m^3/s		4.416 314 E − 05
	ft^3/h	L/s		4.416 314 E − 02
		m^3/s		7.865 791 E − 06
	U.K. gal/h	L/s		7.865 791 E − 03
	U.S. gal/h	dm^3/s	L/s	1.262 803 E − 03
	U.K. gal/min	dm^3/s	L/s	1.051 503 E − 03
	U.S. gal/min	dm^3/s	L/s	7.576 820 E − 02
	ft^3/min	dm^3/s	L/s	6.309 020 E − 02
	ft^3/s	dm^3/s	L/s	4.719 474 E − 01
		dm^3/s	L/s	2.831 685 E + 01
Flow rate (mole basis)	(lb·mol)/s	kmol/s		4.535 924 E − 01
	(lb·mol)/h	kmol/s		1.259 979 E − 04
	million scf/D	kmol/s		1.383 45 E − 02
Flow rate/length (mass basis)	lbm/(s·ft)	kg/(s·m)		1.488 164 E + 00
	lbm/(h·ft)	kg/(s·m)		4.133 789 E − 04
Flow rate/length (volume basis)	U.K. gal/(min·ft)	m^2/s	$m^3/(s·m)$	2.485 833 E − 04
	U.S. gal/(min·ft)	m^2/s	$m^3/(s·m)$	2.069 888 E − 04
	U.K. gal/(h·in)	m^2/s	$m^3/(s·m)$	4.971 667 E − 05
	U.S. gal/(h·in)	m^2/s	$m^3/(s·m)$	4.139 776 E − 05
	U.K. gal/(h·ft)	m^2/s	$m^3/(s·m)$	4.143 055 E − 06
	U.S. gal/(h·ft)	m^2/s	$m^3/(s·m)$	3.449 814 E − 06
Flow rate/area (mass basis)	$lbm/(s·ft^2)$	$kg/(s·m^2)$		4.882 428 E + 00
	$lbm/(h·ft^2)$	$kg/(s·m^2)$		1.356 230 E − 03

Quantity	Customary or commonly used unit	SI unit	Alternate SI unit	Conversion factor; multiply customary unit by factor to obtain SI unit
Flow rate/area (volume basis)	$ft^3/(s \cdot ft^2)$	m/s	$m^3/(s \cdot m^2)$	3.048° E − 01
	$ft^3/(min \cdot ft^2)$	m/s	$m^3/(s \cdot m^2)$	5.08° E − 03
	U.K. gal/(h·in²)	m/s	$m^3/(s \cdot m^2)$	1.957 349 E − 03
	U.S. gal/(h·in²)	m/s	$m^3/(s \cdot m^2)$	1.629 833 E − 03
	U.K. gal/(min·ft²)	m/s	$m^3/(s \cdot m^2)$	8.155 621 E − 04
	U.S. gal/(min·ft²)	m/s	$m^3/(s \cdot m^2)$	6.790 972 E − 04
	U.K. gal/(h·ft²)	m/s	$m^3/(s \cdot m^2)$	1.359 270 E − 05
	U.S. gal/(h·ft²)	m/s	$m^3/(s \cdot m^2)$	1.131 829 E − 05
Energy, work, power				
Energy, work	therm	MJ		1.055 056 E + 02
		kJ		1.055 056 E + 05
		kWh		2.930 711 E + 01
	U.S. tonf·mi	MJ		1.431 744 E + 01
	hp·h	MJ		2.684 520 E + 00
		kJ		2.684 520 E + 03
		kWh		7.456 999 E − 01
	ch·h or CV·h	MJ		2.647 780 E + 00
		kJ		2.647 780 E + 03
		kWh		7.354 999 E − 01
	kWh	MJ		3.6° E + 00
		kJ		3.6° E + 03
	Chu	kJ		1.899 101 E + 00
		kWh		5.275 280 E − 04
	Btu	kJ		1.055 056 E + 00
		kWh		2.930 711 E − 04
	kcal	kJ		4.184° E + 00
	cal	kJ		4.184° E + 00
	ft·lbf	kJ		1.355 818 E − 03
	lbf·ft	kJ		1.355 818 E − 03
	J	kJ		1.0° E − 03
	$(lbf \cdot ft^2)/s^2$	kJ		4.214 011 E − 05
	erg	J		1.0° E − 07
Impact energy	kgf·m	J		9.806 650° E + 00
	lbf·ft	J		1.355 818 E + 00
Surface energy	erg/cm^2	mJ/m^2		1.0° E + 00
Specific-impact energy	$(kgf \cdot m)/cm^2$	J/cm^2		9.806 650° E − 02
	$(lbf \cdot ft)/in^2$	J/cm^2		2.101 522 E − 03
Power	million Btu/h	MW		2.930 711 E − 01
	ton of refrigeration	kW		3.516 853 E + 00
	Btu/s	kW		1.055 056 E + 00
	kW	kW		1
	hydraulic horsepower—hhp	kW		7.460 43 E − 01
	hp (electric)	kW		7.46° E − 01
	hp [(550 ft·lbf)/s]	kW		7.456 999 E − 01
	ch or CV	kW		7.354 999 E − 01
	Btu/min	kW		1.758 427 E − 02
	(ft·lbf)/s	kW		1.355 818 E − 03
	kcal/h	W		1.162 222 E + 00
	Btu/h	W		2.930 711 E − 01
	(ft·lbf)/min	W		2.259 697 E − 02
Power/area	$Btu/(s \cdot ft^2)$	kW/m^2		1.135 653 E + 01
	$cal/(h \cdot cm^2)$	kW/m^2		1.162 222 E − 02
	$Btu/(h \cdot ft^2)$	kW/m^2		3.154 591 E − 03
Heat-release rate, mixing power	hp/ft^3	kW/m^3		2.633 414 E + 01
	$cal/(h \cdot cm^3)$	kW/m^3		1.162 222 E + 00
	$Btu/(s \cdot ft^3)$	kW/m^3		3.725 895 E + 01
	$Btu/(h \cdot ft^3)$	kW/m^3		1.034 971 E − 02
Cooling duty (machinery)	Btu/(bhp·h)	W/kW		3.930 148 E − 01
Specific fuel consumption (mass basis)	lbm/(hp·h)	mg/J	kg/MJ	1.689 659 E − 01
		kg/kWh		6.082 774 E − 01
Specific fuel consumption (volume basis)	m^3/kWh	dm^3/MJ	mm^3/J	2.777 778 E + 02
	U.S. gal/(hp·h)	dm^3/MJ	mm^3/J	1.410 089 E + 00
	U.K. pt/(hp·h)	dm^3/MJ	mm^3/J	2.116 806 E − 01

Quantity	Customary or commonly used unit	SI unit	Alternate SI unit	Conversion factor; multiply customary unit by factor to obtain SI unit
Fuel consumption	U.K. gal/mi	$dm^3/100$ km	L/100 km	2.824 807 E + 02
	U.S. gal/mi	$dm^3/100$ km	L/100 km	2.352 146 E + 02
	mi/U.S. gal	km/dm^3	km/L	4.251 437 E − 01
	mi/U.K. gal	km/dm^3	km/L	3.540 064 E − 01
Velocity (linear), speed	knot	km/h		1.852° E + 00
	mi/h	km/h		1.609 344°E + 00
	ft/s	m/s		3.048° E − 01
		cm/s		3.048° E + 01
	ft/min	m/s		5.08° E − 03
	ft/h	mm/s		8.466 667 E − 02
	ft/day	mm/s		3.527 778 E − 03
		m/d		3.048° E − 01
	in/s	mm/s		2.54° E + 01
	in/min	mm/s		4.233 333 E − 01
Corrosion rate	in/year (ipy)	mm/a		2.54° E + 01
	mil/year	mm/a		2.54° E − 02
Rotational frequency	r/min	r/s		1.666 667 E − 02
		rad/s		1.047 198 E − 01
Acceleration (linear)	ft/s^2	m/s^2		3.048° E − 01
		cm/s^2		3.048° E + 01
Acceleration (rotational)	rpm/s	rad/s^2		1.047 198 E − 01
Momentum	(lbm·ft)/s	(kg·m)/s		1.382 550 E − 01
Force	U.K. tonf	kN		9.964 016 E + 00
	U.S. tonf	kN		8.896 443 E + 00
	kgf (kp)	N		9.806 650°E + 00
	lbf	N		4.448 222 E + 00
	dyn	mN		1.0 E − 02
Bending moment, torque	U.S. tonf·ft	kN·m		2.711 636 E + 00
	kgf·m	N·m		9.806 650°E + 00
	lbf·ft	N·m		1.355 818 E + 00
	lbf·in	N·m		1.129 848 E − 01
Bending moment/length	(lbf·ft)/in	(N·m)/m		5.337 866 E + 01
	(lbf·in)/in	(N·m)/m		4.448 222 E + 00
Moment of inertia	lbm·ft²	kg·m²		4.214 011 E − 02
Stress	U.S. tonf/in²	MPa	N/mm^2	1.378 951 E + 01
	kgf/mm²	MPa	N/mm^2	9.806 650°E + 00
	U.S. tonf/ft²	MPa	N/mm^2	9.576 052 E − 02
	lbf/in² (psi)	MPa	N/mm^2	6.894 757 E − 03
	lbf/ft² (psf)	kPa		4.788 026 E − 02
	dyn/cm²	Pa		1.0° E − 01
Mass/length	lbm/ft	kg/m		1.488 164 E + 00
Mass/area structural loading, bearing capacity (mass basis)	U.S. ton/ft²	Mg/m^2		9.764 855 E + 00
	lbm/ft²	kg/m^2		4.882 428 E + 00
Miscellaneous transport properties				
Diffusivity	ft^2/s	m^2/s		9.290 304°E − 02
	m^2/s	mm^2/s		1.0° E + 06
	ft^2/h	m^2/s		2.580 64° E − 05
Thermal resistance	(°C·m²·h)/kcal	(K·m²)/kW		8.604 208 E + 02
	(°F·ft²·h)/Btu	(K·m²)/kW		1.761 102 E + 02
Heat flux	Btu/(h·ft²)	kW/m^2		3.154 591 E − 03
Thermal conductivity	(cal·cm)/(s·cm²·°C)	W/(m·K)		4.184° E + 02
	(Btu·ft)/(h·ft²·°F)	W/(m·K)		1.730 735 E + 00
		(kJ·m)/(h·m²·K)		6.230 646 E + 00
	(kcal·m)/(h·m²·°C)	W/(m·K)		1.162 222 E + 00
	(Btu·in)/(h·ft²·°F)	W/(m·K)		1.442 279 E − 01
	(cal·cm)/(h·cm²·°C)	W/(m·K)		1.162 222 E − 01

Quantity	Customary or commonly used unit	SI unit	Alternate SI unit	Conversion factor; multiply customary unit by factor to obtain SI unit
Heat-transfer coefficient	cal/(s·cm²·°C)	kW/(m²·K)		4.184° E + 01
	Btu/(s·ft²·°F)	kW/(m²·K)		2.044 175 E + 01
	cal/(h·cm²·°C)	kW/(m²·K)		1.162 222 E − 02
	Btu/(h·ft²·°F)	kW/(m²·K)		5.678 263 E − 03
		kJ/(h·m²·K)		2.044 175 E + 01
	Btu/(h·ft²·°R)	kW/(m²·K)		5.678 263 E − 03
	kcal/(h·m²·°C)	kW/(m²·K)		1.162 222 E − 03
Volumetric heat-transfer coefficient	Btu/(s·ft³·°F)	kW/(m³·K)		6.706 611 E + 01
	Btu/(h·ft³·°F)	kW/(m³·K)		1.862 947 E − 02
Surface tension	dyn/cm	mN/m		1
Viscosity (dynamic)	(lbf·s)/in²	Pa·s	(N·s)/m²	6.894 757 E + 03
	(lbf·s)/ft²	Pa·s	(N·s)/m²	4.788 026 E + 01
	(kgf·s)/m²	Pa·s	(N·s)/m²	9.806 650°E + 00
	lbm/(ft·s)	Pa·s	(N·s)/m²	1.488 164 E + 00
	(dyn·s)/cm²	Pa·s	(N·s)/m²	1.0° E − 01
	cP	Pa·s	(N·s)/m²	1.0° E − 03
	lbm/(ft·h)	Pa·s	(N·s)/m²	4.133 789 E − 04
Viscosity (kinematic)	ft²/s	m²/s		9.290 304°E − 02
	in²/s	mm²/s		6.451 6° E + 02
	m²/h	mm²/s		2.777 778 E + 02
	ft²/h	m²/s		2.580 64° E − 05
	cSt	mm²/s		1
Permeability	darcy	μm²		9.869 233 E − 01
	millidarcy	μm²		9.869 233 E − 04
Thermal flux	Btu/(h·ft²)	W/m²		3.152 E + 00
	Btu/(s·ft²)	W/m²		1.135 E + 04
	cal/(s·cm²)	W/m²		4.184 E + 04
Mass-transfer coefficient	(lb·mol)/[h·ft²(lb·mol/ft³)]	m/s		8.467 E − 05
	(g·mol)/[s·m²(g·mol/L)]	m/s		1.0 E + 01
Electricity, magnetism				
Admittance	S	S		1
Capacitance	μF	μF		1
Charge density	C/mm³	C/mm³		1
Conductance	S	S		1
	℧ (mho)	S		1
Conductivity	S/m	S/m		1
	℧/m	S/m		1
	m℧/m	mS/m		1
Current density	A/mm²	A/mm²		1
Displacement	C/cm²	C/cm²		1
Electric charge	C	C		1
Electric current	A	A		1
Electric-dipole moment	C·m	C·m		1
Electric-field strength	V/m	V/m		1
Electric flux	C	C		1
Electric polarization	C/cm²	C/cm²		1
Electric potential	V	V		1
	mV	mV		1
Electromagnetic moment	A·m²	A·m²		1
Electromotive force	V	V		1
Flux of displacement	C	C		1
Frequency	cycles/s	Hz		1
Impedance	Ω	Ω		1

Quantity	Customary or commonly used unit	SI unit	Alternate SI unit	Conversion factor; multiply customary unit by factor to obtain SI unit
Linear-current density	A/mm	A/mm		1
Magnetic-dipole moment	Wb·m	Wb·m		1
Magnetic-field strength	A/mm Oe gamma	A/mm A/m A/m		1 7.957 747 E + 01 7.957 747 E − 04
Magnetic flux	mWb	mWb		1
Magnetic-flux density	mT G gamma	mT T nT		1 1.0° E − 04 1
Magnetic induction	mT	mT		1
Magnetic moment	A·m²	A·m²		1
Magnetic polarization	mT	mT		1
Magnetic potential difference	A	A		1
Magnetic-vector potential	Wb/mm	Wb/mm		1
Magnetization	A/mm	A/mm		1
Modulus of admittance	S	S		1
Modulus of impedance	Ω	Ω		1
Mutual inductance	H	H		1
Permeability	μH/m	μH/m		1
Permeance	H	H		1
Permittivity	μF/m	μF/m		1
Potential difference	V	V		1
Quantity of electricity	C	C		1
Reactance	Ω	Ω		1
Reluctance	H⁻¹	H⁻¹		1
Resistance	Ω	Ω		1
Resistivity	Ω·cm Ω·m	Ω·cm Ω·m		1 1
Self-inductance	mH	mH		1
Surface density of change	mC/m²	mC/m²		1
Susceptance	S	S		1
Volume density of charge	C/mm³	C/mm³		1
Acoustics, light, radiation				
Absorbed dose	rad	Gy		1.0° E − 02
Acoustical energy	J	J		1
Acoustical intensity	W/cm²	W/m²		1.0° E + 04
Acoustical power	W	W		1
Sound pressure	N/m²	N/m²		1.0°
Illuminance	fc	lx		1.076 391 E + 01
Illumination	fc	lx		1.076 391 E + 01
Irradiance	W/m²	W/m²		1
Light exposure	fc·s	lx·s		1.076 391 E + 01
Luminance	cd/m²	cd/m²		1
Luminous efficacy	lm/W	lm/W		1
Luminous exitance	lm/m²	lm/m²		1