

# Chapter 17

## Conversion Factors and Program

### SUMMARY

The conversion factors shown in Table 17-1 will satisfy most of your requirements – their accuracy is within 0.2%. Less frequently used rounded conversion factors are shown in Table 17-2. Accurate conversion factors are shown in Table 17-3. Multiplication factors shown with an asterisk “\*” are exact, others are rounded to the nearest seventh significant digit in accordance with the ANSI SI 10 standard. There are two conversion programs as follows: (1) Conversion Program (ANSI factors) and (2) Global Conversion Program <<http://www.convert-me.com/en/>>.

The Conversion Program can use accurate (Table 17-3) or rounded conversion factors, and you may take the simple steps as follows;

1. Select Type of Conversion: inch-metric, metric-inch, inch-inch or metric-metric.
2. Select Class: length, area, volume, mass, etc.
3. Select Unit: From: in, ft, yd, etc. To: mm, m, km, etc.
4. Select number of decimal places shown in output: From 0 to 6.
5. Enter Value to be converted and click on Convert.
6. Read or copy Result.

For more exact results click on Search Accurate Conversion Factor List, and search entries by typing the first few letters in the conversion you are looking for. After you click on that name, the program will enter preferred metric unit and conversion factor. Follow steps 4 through 6 shown above.

**TABLE 17-1 CONVERSION FACTORS (ROUNDED)**

QUANTITY <sup>1</sup>	METRIC UNIT <sup>2</sup>	INCH UNIT <sup>3</sup>	CONVERSION
Length	mm	in	mm = in x 25.4
	m	ft	m = ft x 0.305
	km	mi	km = mi x 1.61
Area	mm <sup>2</sup>	in <sup>2</sup>	mm <sup>2</sup> = in <sup>2</sup> x 645
	m <sup>2</sup>	ft <sup>2</sup>	m <sup>2</sup> = ft <sup>2</sup> x 0.0929
	hm <sup>2</sup> (ha)	acre	hm <sup>2</sup> = acre x 0.405
	km <sup>2</sup>	mi <sup>2</sup>	km <sup>2</sup> = mi <sup>2</sup> x 2.59
Volume	mL(cm <sup>3</sup> )	tsp (1/3 tbs)	mL = tsp x 4.93
	mL	in <sup>3</sup>	mL = in <sup>3</sup> x 16.4
	L(dm <sup>3</sup> )	gal <sub>USA</sub>	L = gal x 3.79 L = gal <sub>imp</sub> x 4.55
	kL (m <sup>3</sup> )	yd <sup>3</sup>	kL = yd <sup>3</sup> x 0.765
Mass	g	oz	g = oz x 28.3
	kg	lb	kg = lb x 0.454
	Mg (t = 1000 kg)	ton <sub>short</sub> (2000 lb) ton <sub>long</sub> (2240 lb)	Mg = ton <sub>short</sub> x 0.907 Mg = ton <sub>long</sub> x 1.106
Temperature	°C	°F	°C = (°F-32)/1.8
	K	°F	K = (°F-32)/1.8 + 273
	K	°C	K = °C + 273
Speed	m/s	ft/s	m/s = ft/s x 0.305
	km/h	mi/h	km/h = mi/h x 1.61

NOTES; 1. The word QUANTITY means a measurable attribute of a phenomenon or of matter in this publication.

2. METRIC UNITS for Length, Area, Volume, etc are shown in Chapter 2.

3. Other INCH UNITS are shown in Table 17-2.

4. Select any of the 400 conversion factors (ANSI SI 10) shown in Table 17-3 and use for special conversions.

Use Conversion Program <<http://www.kok.com/conversi.htm>>.

5. Inch Units in Metric\* such as; **Length** - one inch = 25 mm (25.4 mm exactly); one foot = 300 mm; one yard = 1 m; one chain = 20 m; one furlong = 200 m; ¼ mile = 400 m; ½ mile = 800 m; one mile = 1600 m; **Area** - one square foot = 0.1 m<sup>2</sup>; one acre = 4000 m<sup>2</sup>; **Volume** – one spice measure = 1 mL; one teaspoon = 5 mL; one tablespoon = 15 mL; one fluid ounce = 30 mL; ½ cup = 125 mL; one cup = 0.25 L; one pint = 0.5 L; one fifth gallon = 0.75 L;

one quart = 1 L; one gallon = 4 L; **Mass** - one pound = 500 g; one ton = 1 Mg (1000 kg).

**TABLE 17-2 OTHER CONVERSION FACTORS (ROUNDED)**

Length Units			Mass Units		
1 foot =	12 in =	0.305 m	1 ounce <sub>avoirdupois</sub> =	438 gr =	28.3 g
1 yard =	3 ft =	0.914 m	1 pound =	16 oz =	454 g
1 mile <sub>stat</sub> =	5280 ft =	1.61 km	1 ton <sub>short</sub> =	2000 lb =	0.907 Mg
1 mil =	0.001 in =	25.4 μm.	1 ton <sub>long</sub> =	2240 lb =	1.106 Mg
1 microinch =	0.000001 in =	25.4 nm	1 grain =	1/7000 lb =	64.8 mg
1 point <sub>printers</sub> =	0.0138 in =	0.351 mm	1 carat =	3.09 gr =	200 mg
1 point <sub>computer</sub> =	1/72 in =	0.353 mm	1 scruple =	20 gr =	1.30 g
1 foot <sub>survey</sub> =	1200/3937 m =	0.3048006 m	1 pennyweight =	24 gr =	1.56 g
1 link =	7.92 in =	0.201 m	1 dram =	27.34 gr =	1.77 g
1 rod =	16.5 ft = 25 link =	5.03 m	1 dram <sub>apo</sub> =	60 gr =	3.89 g
1 chain =	66 ft = 100 link =	20.1 m	1 ounce <sub>troy</sub> =	480 gr =	31.1 g
1 furlong =	660 ft = 10 chain =	201 m	1 pound <sub>troy</sub> =	12 oz <sub>troy</sub> =	373 g
1 fathom =	6 ft =	1.83 m	1 stone =	14 lb =	6.35 kg
1 cable length =	600 ft =	183 m	1 slug =	32.2 lb =	14.6 kg
1 mile <sub>naut</sub> =	6076 ft =	1.85 km	1 hundredweight =	100 lb =	45.4 kg
Area Units			Temperature Units		
1 in <sup>2</sup> =		645 mm <sup>2</sup>	1 deg Fahrenheit = 1 deg Rankine = 1/1.8 K (kelvin) or °C		
1 ft <sup>2</sup> =	144 in <sup>2</sup> =	0.0929 m <sup>2</sup>	-40°F =	-40°C =	233 K
1 yd <sup>2</sup> =	9 ft <sup>2</sup> =	0.836 m <sup>2</sup>	0°F =	-17.8°C =	255 K
1 square (roofing)	100 ft <sup>2</sup> =	9.29 m <sup>2</sup>	32°F =	0°C =	273 K
1 acre =	43560 ft <sup>2</sup> =	4047 m <sup>2</sup>	50°F =	10°C =	283 K
1 mi <sup>2</sup> =	640 acres =	2.59 km <sup>2</sup>	68°F =	20°C =	293 K
1 township =	36 mi <sup>2</sup> =	93.2 km <sup>2</sup>	86°F =	30°C =	303 K
Volume Units			104°F =	40°C =	313 K
1 in <sup>3</sup> =		16.4 mL	212°F =	100°C =	373 K
1 oz <sub>USA fluid</sub> =	2 tbs = 8 dram <sub>fluid</sub> =	29.6 mL	Velocity Units		
1 cup =	8 oz <sub>USA fluid</sub> =	0.237 L	<b>linear;</b>		
1 pint <sub>USA fluid</sub> =	16 oz <sub>USA fluid</sub> =	0.473 L	1 foot/sec =		0.305 m/s
1 quart <sub>USA fluid</sub> =	32 oz <sub>USA fluid</sub> =	0.946 L	1 mile/hour =	1.47 ft/s =	1.61 km/h
1 gal <sub>USA</sub>	128 oz <sub>USA fluid</sub>	3.79 L	1 knot mi <sub>naut</sub> /h =	1.69 ft/s =	1.85 km/h
1 ft <sup>3</sup> =	1728 in <sup>3</sup> =	28.3 L	<b>angular;</b>		
1 yard <sup>3</sup>	27 ft <sup>3</sup> =	0.765 kL or m <sup>3</sup>	1 RPM (r/min) =		1/60 1/s
1 drop =		0.0821 mL	1 deg/min =		0.291 mrad/s
1 babyspoon =	12 dp =	0.986 mL	1 deg/sec =		0.0175 rad/s
1 teaspoon =	60 dp =	4.93 mL	<b>frequency</b>		
1 tablespoon =	3 tsp =	14.8 mL	1 cycle/min =	1/60 c/s =	1/60 Hz
1 gill =	4 oz <sub>USA fluid</sub> =	118 mL	Acceleration Units		
1 pint <sub>USA dry</sub> =	33.6 in <sup>3</sup> =	0.551 L	<b>linear;</b>		
1 quart <sub>USA dry</sub> =	67.2 in <sup>3</sup> =	1.10 L	1 foot/sec <sup>2</sup> =		0.305 m/s <sup>2</sup>
1 gal <sub>USA dry</sub> =	269 in <sup>3</sup> =	4.40 L	1 in/sec <sup>2</sup> =		0.0254 m/s <sup>2</sup>
1 peck =	2 gal <sub>USA dry</sub> =	8.81 L	<b>angular;</b>		
1 bushel =	8 gal <sub>USA dry</sub> =	35.2 L	1 degree/sec <sup>2</sup> =		0.0175 rad/s <sup>2</sup>
1 gal <sub>IMP</sub> =	277 in <sup>3</sup> =	4.55 L	<b>gravity;</b>		
1 barrel <sub>exc oil</sub> =	31.5 gal <sub>USA</sub> =	119 L	1 <b>g</b> (on Earth) =	32.2 ft/s <sup>2</sup> =	9.81 m/s <sup>2</sup>
1 barrel <sub>oil</sub> =	42 gal <sub>USA</sub> =	159 L	Force Unit		
1 cord ft =	16 ft <sup>3</sup> =	0.453 kL	1 pound force =		4.45 N
1 cord =	8 cord ft =	3.62 kL	1 ounce force =		0.278 N
1 ton <sub>register</sub> =	100 ft <sup>3</sup>	2.83 kL	1 poundal =	1 lb ft/s <sup>2</sup>	0.138 N
1 acre ft =	43560 ft <sup>3</sup>	1233 kL	1 kip =	1000 lb <sub>f</sub> =	4.45 kN
			1 ton <sub>short</sub> force =	2000 lb <sub>f</sub> =	8.90 kN

**TABLE 17-2 OTHER CONVERSION FACTORS (CONT'D)(ROUNDED)**

Force Unit (CONT'D)			Density Unit		
1 dyne =		0.01 mN	<b>mass;</b>		
1 kilogram force =	1 kilopond =	9.81 N	1 lb/ft <sup>3</sup> =		16 kg/m <sup>3</sup>
1 ton <sub>metric</sub> force =	1000 kg <sub>f</sub> =	9.81 kN	1 lb/in <sup>3</sup> =		27.7 Mg/m <sup>3</sup>
1 newton	1 N =	1 kg•m/s <sup>2</sup>	1 lb/gal =		120 kg/m <sup>3</sup>
			1 kg/dm <sup>3</sup> =	1 g/cm <sup>3</sup> =	1 Mg/m <sup>3</sup>
Torque Unit			<b>gravity force;</b>		
1 lb <sub>f</sub> x ft =		1.36 N•m	1 lb/ft <sup>3</sup> =		157 N/m <sup>3</sup>
1 lb <sub>f</sub> x in =		0.113 N•m	1 lb <sub>f</sub> /in <sup>3</sup> =		271 kN/m <sup>3</sup>
1 oz <sub>f</sub> x in =		7.06 mN•m	1 kg <sub>f</sub> /dm <sup>3</sup> =		9.81 kN/m <sup>3</sup>
1 kg <sub>f</sub> x m =		9.81 N•m	<b>power;</b>		
			1 Btu/(ft <sup>2</sup> •sec) =		11.3 kW/m <sup>2</sup>
			1 cal/(cm <sup>2</sup> •sec) =		41.8 kW/m <sup>2</sup>
			1 W/in <sup>2</sup> =		1.55 kW/m <sup>2</sup>
Pressure Unit			Coefficient of Thermal Expansion Unit		
1 lb <sub>f</sub> /in <sup>2</sup> =	1 psi =	6.89 kPa	1/°F =	1.8/°C =	1.8/K
1 lb <sub>f</sub> /ft <sup>2</sup> =		47.9 Pa	Thermal Conductivity Unit		
1 atm <sub>int</sub> =	14.697 lb <sub>f</sub> /in <sup>2</sup> =	101.325 kPa	1 Btu in/(h•ft <sup>2</sup> •°F) =		0.144 W/(m•K)
1 bar =		100 kPa	1 Btu/(h•ft•°F) =		1.73 W/(m•K)
1 inch Hg =		3.38 kPa	Fuel Consumption Unit		
1 inch H <sub>2</sub> O =		0.249 kPa	1 mi/gal =		235 L/(100 km)
1 kg <sub>f</sub> /cm <sup>2</sup> =	1 at =	98.1 kPa	1 mi/gal =		0.425 km/L
1 mm Hg =	1 torr =	133 Pa	1 lb/(hp•h) =	SFC =	0.169mg/J
1 mm H <sub>2</sub> O =		9.81 Pa	1 gal/(hp•h) =	SFC =	1.41 μL/J
			1 g/(kW•h) =		0.278 μg/J
Stress Unit			Elasticity Unit		
1 lb <sub>f</sub> /in <sup>2</sup> =	1 psi =	6.89 kPa	<b>linear;</b>		
1 kip/in <sup>2</sup> =	1 ksi =	6.89 MPa	1 lb <sub>f</sub> /in =		175 N/m
			1 lb <sub>f</sub> /ft =		14.6 N/m
Work Unit			<b>torsion;</b>		
<b>energy;</b>			1 lb <sub>f</sub> •ft/rad =		1.36 N•m/rad
1 lb <sub>f</sub> x ft =	1.36 N•m =	1.36 J	1 kg <sub>f</sub> •m/rad =		9.81 N•m/rad
1 Btu =		1.055 kJ	Flow Unit		
1 cal <sub>heat</sub> =		4.19 J	<b>volume;</b>		
1 Cal <sub>nutrition</sub> =		4.19 kJ	1 GPM =	1 gal/min =	63.1 mL/s
1 kg <sub>f</sub> x m =		9.81 J	1 CFM =	1 ft <sup>3</sup> /min =	0.472 L/s
1 erg =	1 dyne•cm =	0.1 μJ	1 gal/h =		1.05 mL/s
1 kilowatt x hour =		3.6 MJ	<b>mass;</b>		
<b>heat capacity;</b>			1 lb/min =		7.56 g/s
1 Btu/lb =		2.33 kJ/kg	1 lb/sec =		0.454 kg/s
1 cal/g =	1 kcal/kg =	4.19 kJ/kg	Mass Moment of Inertia Unit		
<b>specific heat capacity;</b>			1 lb•ft <sup>2</sup> =		42.1 g•m <sup>2</sup>
1 Btu/(lb•°F) =		4.19 kJ/(kg•K)	1 lb•in <sup>2</sup> =		0.293 g•m <sup>2</sup>
Power Unit			Area Moment of Inertia Unit		
1 lb <sub>f</sub> x ft/sec =		1.36 W	<b>Second, Polar;</b>		
1 lb <sub>f</sub> x ft/min =		22.6 mW	1 in <sup>4</sup> =		416 000 mm <sup>4</sup>
1 hp <sub>cust</sub> =	550 lb <sub>f</sub> •ft/s =	0.746 kW	1 cm <sup>4</sup> =		10 000 mm <sup>4</sup>
1 hp <sub>metric</sub> =	75 kg <sub>f</sub> •m/s =	0.735 kW	<b>First, Section modulus;</b>		
1 Btu/h =		0.293 W	1 in <sup>3</sup> =		16 400 mm <sup>3</sup>
1 ton <sub>refrig</sub> =		3.52 kW	1 cm <sup>3</sup> =		1 000 mm <sup>3</sup>
Time Unit			Surface Tension Unit		
1 minute (min) =		60 s	1 lb <sub>f</sub> /ft =		14.6 N/m
1 hour (h) =		3600 s			
1 day (d) =		86 400 s			
Angle Unit					
1 degree (°) =		0.0175 rad			
1 min (') =		0.291 mrad			
1 sec (") =		4.84 μrad			

## Conversion Factors (ACCURATE)

Accurate conversion factors are shown in Table 17-3. Multiplication factors shown with an asterisk "\*" are exact, others are rounded to the nearest seventh significant digit in accordance with the ANSI SI 10 standard.

The computer E format is used to indicate the power of 10 by which the number must be multiplied to obtain the correct value. For examples of how to use the E format, see Table 2-7.

**TABLE 17-3 CONVERSION FACTORS (ACCURATE) (ANSI SI 10)**

To convert from	to	Multiply by
abampere	ampere(A)	1.000 000*E+01
abcoulomb	coulomb (C)	1.000 000*E+01
abfarad	farad (F)	1.000 000*E+09
abhenry	henry (H)	1.000 000*E-09
abmho	siemens (S)	1.000 000*E+09
abohm	ohm ( $\Omega$ )	1.000 000*E-09
abvolt	volt (V)	1.000 000*E-08
acre foot (USA survey)	meter <sup>3</sup> (m <sup>3</sup> )	1.233 5 E+03
acre (USA survey)	meter <sup>2</sup> (m <sup>2</sup> )	4.046 873 E+03 (1)
ampere hour	coulomb (C)	3.600 000*E+03
are (dam <sup>2</sup> )	meter <sup>2</sup> (m <sup>2</sup> )	1.000 000*E+02
angstrom	meter (m)	1.000 000*E-10
astronomical unit	meter (m)	1.495 979 E+11 (2)
atmosphere (standard)	pascal (Pa)	1.013 25*E+05
atmosphere (technical = 1 kg <sub>f</sub> /cm <sup>2</sup> )	pascal (Pa)	9.806 65*E+04
bar	pascal (Pa)	1.000 000*E+05
barn	meter <sup>2</sup> (m <sup>2</sup> )	1.000 000*E-28
barrel (for petroleum, 42 gal)	meter <sup>3</sup> (m <sup>3</sup> )	1.589 873 E-01
biot (see also abampere)	ampere (A)	1.000 000*E+01
board foot	meter <sup>3</sup> (m <sup>3</sup> )	(3)
British thermal unit (International Table)	joule (J)	1.055 056 E+03 (4)
British thermal unit (mean)	joule (J)	1.055 87 E+03
British thermal unit (thermochemical)	joule (J)	1.054 350 E+03
British thermal unit (39°F)	joule (J)	1.059 67 E+03
British thermal unit (59°F)	joule (J)	1.054 80 E+03
British thermal unit (60°F)	joule (J)	1.054 68 E+03
Btu (International Table) ft/h•ft <sup>2</sup> •°F (k, thermal conductivity)	watt per meter kelvin (W/m•K)	1.730 735 E+00 (4)
Btu (thermochemical) ft/h•ft <sup>2</sup> •°F (k, thermal conductivity)	watt per meter kelvin (W/m•K)	1.729 577 E+00 (4)
Btu (International Table) in/h•ft <sup>2</sup> •°F (k, thermal conductivity)	watt per meter kelvin (W/m•K)	1.442 279 E-01 (4)
Btu (thermochemical) in/h•ft <sup>2</sup> •°F (k, thermal conductivity)	watt per meter kelvin (W/m•K)	1.441 314 E-01 (4)
Btu (International Table) in/s•ft <sup>2</sup> •°F (k, thermal conductivity)	watt per meter kelvin (W/m•K)	5.192 204 E+02 (4)
Btu (thermochemical) in/s•ft <sup>2</sup> •°F (k, thermal conductivity)	watt per meter kelvin (W/m•K)	5.188 732 E+02 (4)
Btu per cubic foot (Btu/ft <sup>3</sup> )	joule per cubic meter (J/m <sup>3</sup> )	3.725 895 E+04 (4)
Btu (International Table)/h	watt (W)	2.930 711 E-01 (4)
Btu (thermochemical)/h	watt (W)	2.928 751 E-01 (4)
Btu (thermochemical)/min	watt (W)	1.757 250 E+01 (4)
Btu (International Table)/s	watt (W)	1.054 350 E+03 (4)
Btu (International Table)/ft <sup>2</sup>	joule per meter <sup>2</sup> (J/m <sup>2</sup> )	1.135 653 E+04 (4)
Btu (thermochemical)/ft <sup>2</sup>	joule per meter <sup>2</sup> (J/m <sup>2</sup> )	1.134 893 E+04 (4)
Btu (thermochemical)/ft <sup>2</sup>	watt per meter <sup>2</sup> (W/m <sup>2</sup> )	3.152 481 E+00 (4)
Btu (thermochemical)/ft <sup>2</sup> •min	watt per meter <sup>2</sup> (W/m <sup>2</sup> )	1.891 489 E+02 (4)
Btu (thermochemical)/ft <sup>2</sup> •s	watt per meter <sup>2</sup> (W/m <sup>2</sup> )	1.134 893 E+04 (4)
Btu (thermochemical)/in <sup>2</sup> •s	watt per meter <sup>2</sup> (W/m <sup>2</sup> )	1.634 246 E+06 (4)
Btu (International Table)/h•ft <sup>2</sup> •°F (C, thermal conductance)	watt per meter <sup>2</sup> kelvin (W/m <sup>2</sup> •K)	5.678 263 E+00 (4)

**TABLE 17-3 CONVERSION FACTORS (ACCURATE)(CONT'D) (ANSI SI 10)**

<b>To convert from</b>	<b>to</b>	<b>Multiply by</b>
Btu (thermochemical)/h•ft <sup>2</sup> •°F (C, thermal conductance)	watt per meter <sup>2</sup> kelvin (W/m <sup>2</sup> •K)	5.674 466 E+00 (4)
Btu (International Table)/s•ft <sup>2</sup> •°F	watt per meter <sup>2</sup> kelvin (W/m <sup>2</sup> •K)	2.044 175 E+04 (4)
Btu (thermochemical)/s•ft <sup>2</sup> •°F	watt per meter <sup>2</sup> kelvin (W/m <sup>2</sup> •K)	2.042 808 E+04 (4)
Btu (International Table)/lb	joule per kilogram (J/kg)	2.326 000•E+03 (4)
Btu (thermochemical)/lb	joule per kilogram (J/kg)	2.324 444 E+03 (4)
Btu (International Table)/lb•°F (c, heat capacity)	joule per kilogram kelvin(J/kg•K)	4.186 800•E+03 (4)
Btu (thermochemical)/lb•°F (c, heat capacity)	joule per kilogram kelvin(J/kg•K)	4.184 000 E+03 (4)
bushel (USA dry)	meter <sup>3</sup> (m <sup>3</sup> )	3.523 907 E-02 (5)
caliber (inch)	meter (m)	2.540 000•E-02
calorie (International Table)	joule (J)	4.186 800•E+00 (4)
calorie (mean)	joule (J)	4.190 02 E+00 (4)
calorie (thermochemical)	joule (J)	4.184 000•E+00 (4)
calorie (15°C)	joule (J)	4.185 80 E+00 (4)
calorie (20°C)	joule (J)	4.181 90 E+00 (4)
calorie (kilogram, International Table)	joule (J)	4.186 800•E+03 (4)
calorie (kilogram, mean)	joule (J)	4.190 02 E+03 (4)
calorie (kilogram, thermochemical)	joule (J)	4.184 000•E+03 (4)
cal (thermochemical)/cm <sup>2</sup>	joule per meter <sup>2</sup> (J/m <sup>2</sup> )	4.184 000•E+04 (4)
cal (International Table)/g	joule per kilogram (J/kg)	4.186 800•E+03 (4)
cal (thermochemical)/g	joule per kilogram (J/kg)	4.184 000•E+03 (4)
cal (International Table)/g•°C	joule per kilogram kelvin (J/kg•K)	4.186 800•E+03 (4)
cal (thermochemical)/g•°C	joule per kilogram kelvin (J/kg•K)	4.184 000•E+03 (4)
cal (thermochemical)/min	watt (W)	6.973 333 E-02 (4)
cal (thermochemical)/s	watt (W)	4.184 000•E+00 (4)
cal (thermochemical)/cm <sup>2</sup> •min	watt per meter <sup>2</sup> (W/m <sup>2</sup> )	6.973 333 E+02 (4)
cal (thermochemical)/cm <sup>2</sup> •s	watt per meter <sup>2</sup> (W/m <sup>2</sup> )	4.184 000•E+04 (4)
cal (thermochemical)/cm•s•°C	watt per meter kelvin (W/m•K)	4.184 000•E+02 (4)
carat (metric)	kilogram (kg)	2.000 000•E-04
centimeter of mercury (0°C)	pascal (Pa)	1.333 22 E+03
centimeter of water (4°C)	pascal (Pa)	9.806 38 E+01
centipoise	pascal second (Pa•s)	1.000 000•E-03
centistokes	meter <sup>2</sup> per second (m <sup>2</sup> /s)	1.000 000•E-06
circular mil	meter <sup>2</sup> (m <sup>2</sup> )	5.067 075 E-10
clo	kelvin meter <sup>2</sup> per watt (K•m <sup>2</sup> /W)	2.003 712 E-01
cup	meter <sup>3</sup> (m <sup>3</sup> )	2.365 882 E-04
curie	becquerel (Bq)	3.700 000•E+10
day (mean solar)	seconds (s)	8.640 000 E+04
day (sidereal)	seconds (s)	8.616 409 E+04
degree (angle)	radian (rad)	1.745 329 E-02
degree Celsius	kelvin (K)	t <sub>k</sub> = t <sub>c</sub> + 273.15
degree centigrade		
degree Fahrenheit	degree Celsius	t <sub>c</sub> = (t <sub>f</sub> - 32)/1.8
degree Fahrenheit	kelvin (K)	t <sub>k</sub> = (t <sub>f</sub> + 459.67)/1.8
degree Rankine	kelvin (K)	t <sub>k</sub> = t <sub>r</sub> /1.8
°F•h•ft <sup>2</sup> /Btu (International Table) (R, thermal resistance)	kelvin meter <sup>2</sup> per watt (K•m <sup>2</sup> /W)	1.761 102 E-01
°F•h•ft <sup>2</sup> /Btu (thermochemical) (R, thermal resistance)	kelvin meter <sup>2</sup> per watt (K•m <sup>2</sup> /W)	1.762 280 E-01

**TABLE 17-3 CONVERSION FACTORS (ACCURATE)(CONT'D) (ANSI SI 10)**

To convert from	to	Multiply by
denier	kilogram per meter (kg/m)	1.111 111 E-07
dyne	newton(N)	1.000 000*E-05
dyne•cm	newton meter (N•m)	1.000 000*E-07
dyne/cm <sup>2</sup>	pascal (Pa)	1.000 000*E-01
electronvolt	joule (J)	1.602 19 E-19
EMU of capacitance	farad (F)	1.000 000*E+09
EMU of current	ampere(A)	1.000 000*E+01
EMU of electric potential	volt (V)	1.000 000*E-08
EMU of inductance	henry (H)	1.000 000*E-09
EMU of resistance	ohm ( $\Omega$ )	1.000 000*E-09
ESU of capacitance	farad (F)	1.112 650 E-12
ESU of current	ampere(A)	3.335 6 E-10
ESU of electric potential	volt (V)	2.997 9 E+02
ESU of inductance	henry (H)	8.987 554 E+11
ESU of resistance	ohm ( $\Omega$ )	8.987 554 E+11
erg	joule (J)	1.000 000*E-07
erg/cm <sup>2</sup> •s	watt per meter <sup>2</sup> (W/m <sup>2</sup> )	1.000 000*E-03
erg/s	watt (W)	1.000 000*E-07
faraday (based on carbon-12)	coulomb (C)	9.648 70 E+04
faraday (chemical)	coulomb (C)	9.649 57 E+04
faraday (physical)	coulomb (C)	9.652 19 E+04
fathom	meter (m)	1.828 8 E+00
fermi (femtometer)	meter (m)	1.000 000*E-15
fluid ounce (USA)	meter <sup>3</sup> (m <sup>3</sup> )	2.957 353 E-05
foot	meter (m)	3.048 000*E-01
foot (USA survey) <sup>1</sup>	meter (m)	3.048 006 E-01
foot of water (39.2°F)	pascal (Pa)	2.988 98 E+03
ft <sup>2</sup>	meter <sup>2</sup> (m <sup>2</sup> )	9.290 304*E-02
ft <sup>2</sup> /h (thermal diffusivity)	meter <sup>2</sup> per second (m <sup>2</sup> /s)	2.580 640*E-05
ft <sup>2</sup> /s	meter <sup>2</sup> per second (m <sup>2</sup> /s)	9.290 304*E-02
ft <sup>3</sup> (volume; section modulus)	meter <sup>3</sup> (m <sup>3</sup> )	2.831 685 E-02
ft <sup>3</sup> /min	meter <sup>3</sup> per second (m <sup>3</sup> /s)	4.719 474 E-04
ft <sup>3</sup> /s	meter <sup>3</sup> per second (m <sup>3</sup> /s)	2.831 685 E-02
ft <sup>4</sup> (moment of section)	meter <sup>4</sup> (m <sup>4</sup> )	8.630 975 E-03 (6)
ft/h	meter per second (m/s)	8.466 667 E-05
ft/min	meter per second (m/s)	5.080 00*E-03
ft/s	meter per second (m/s)	3.048 000*E-01
ft/s <sup>2</sup>	meter per second <sup>2</sup> (m/s <sup>2</sup> )	3.048 000*E-01
footcandle	lux (lx)	1.076 391 E+01
footlambert	candela per meter <sup>2</sup> (cd/m <sup>2</sup> )	3.426 259 E+00
ft•lbf	joule (J)	1.355 818 E+00
ft•lbf/h	watt (W)	3.766 161 E-04
ft•lbf/min	watt (W)	2.259 697 E-02
ft•lbf/s	watt (W)	1.355 818 E+00
ft•poundal	joule (J)	4.214 011 E-02
free fall, standard (g)	meter per second <sup>2</sup> (m/s <sup>2</sup> )	9.806 650*E+00
gal	meter per second <sup>2</sup> (m/s <sup>2</sup> )	1.000 000*E-02
gallon (Canadian liquid)	meter <sup>3</sup> (m <sup>3</sup> )	4.546 090 E-03
gallon (UK liquid)	meter <sup>3</sup> (m <sup>3</sup> )	4.546 092 E-03
gallon (USA dry)	meter <sup>3</sup> (m <sup>3</sup> )	4.404 884 E-03
gallon (USA liquid)	meter <sup>3</sup> (m <sup>3</sup> )	3.785 412 E-03

**TABLE 17-3 CONVERSION FACTORS (ACCURATE)(CONT'D) (ANSI SI 10)**

To convert from	to	Multiply by
gal (USA liquid)/day	meter <sup>3</sup> per second (m <sup>3</sup> /s)	4.381 264 E-08
gal (USA liquid)/min	meter <sup>3</sup> per second (m <sup>3</sup> /s)	6.309 020 E-05
gal (USA liquid)/hp•h (SFC, specific fuel consumption)	meter <sup>3</sup> per joule (m <sup>3</sup> /J)	1.410 089 E-09
gamma	tesla (T)	1.000 000*E-09
gauss	tesla (T)	1.000 000*E-04
gilbert	ampere(A)	7.957 747 E-01
gill (UK)	meter <sup>3</sup> (m <sup>3</sup> )	1.420 654 E-04
gill (USA)	meter <sup>3</sup> (m <sup>3</sup> )	1.182 941 E-04
grad	degree (angular)	9.000 000*E-01
grad	radian (rad)	1.570 796 E-02
grain (1/7000 lb avoirdupois)	kilogram (kg)	6.479 891*E-05
grain (lb avoirdupois/7000)/gal (USA liquid)	kilogram per meter <sup>3</sup> (kg/m <sup>3</sup> )	1.711 806 E-02
gram	kilogram (kg)	1.000 000*E-03
g/cm <sup>3</sup>	kilogram per meter <sup>3</sup> (kg/m <sup>3</sup> )	1.000 000*E+03
gram-force/cm <sup>2</sup>	pascal (Pa)	9.806 650*E+01
hectare	meter <sup>2</sup> (m <sup>2</sup> )	1.000 000*E+04
horsepower (550 ft•lb <sub>f</sub> /s)	watt (W)	7.456 999 E+02
horsepower (boiler)	watt (W)	9.809 50 E+03
horsepower (electric)	watt (W)	7.460 000*E+02
horsepower (metric 75 kg <sub>f</sub> •m/s)	watt (W)	7.354 99 E+02
horsepower (water)	watt (W)	7.460 43 E+02
horsepower (UK)	watt (W)	7.457 0 E+02
hour (mean solar)	second (s)	3.600 000 E+03
hour (sidereal)	second (s)	3.590 170 E+03
hundredweight (long)	kilogram (kg)	5.080 235 E+01
hundredweight (short)	kilogram (kg)	4.535 924 E+01
inch	meter (m)	2.540 000*E-02
inch of mercury (32°F)	pascal (Pa)	3.386 38 E+03
inch of mercury (60°F)	pascal (Pa)	3.376 85 E+03
inch of water (39.2°F)	pascal (Pa)	2.490 82 E+02
inch of water (60°F)	pascal (Pa)	2.488 4 E+02
in <sup>2</sup>	meter <sup>2</sup> (m <sup>2</sup> )	6.451 600*E-04
in <sup>3</sup> (volume; section modulus)	meter <sup>3</sup> (m <sup>3</sup> )	1.638 706 E-05 (7)
in <sup>3</sup> /min	meter <sup>3</sup> per second (m <sup>3</sup> /s)	2.731 177 E-07
in <sup>4</sup> (moment of section)	meter <sup>4</sup> (m <sup>4</sup> )	4.162 314 E-07 (6)
in/s	meter per second (m/s)	2.540 000*E-02
in/s <sup>2</sup>	meter per second <sup>2</sup> (m/s <sup>2</sup> )	2.540 000*E-02
kayser	1 per meter (1/m)	1.000 000*E+02
kelvin	degree Celsius	t <sub>c</sub> = t <sub>k</sub> - 273.15
kilocalorie (International Table)	joule (J)	4.186 800*E+03
kilocalorie (mean)	joule (J)	4.190 02 E+03
kilocalorie (thermochemical)	joule (J)	4.184 000*E+03
kilocalorie (thermochemical)/min	watt (W)	6.973 333 E+01
kilocalorie (thermochemical)/s	watt (W)	4.184 000*E+03
kilogram-force (kg <sub>f</sub> )	newton(N)	9.806 650*E+00
kg <sub>f</sub> •m	newton meter (N•m)	9.806 650*E+00
kg <sub>f</sub> •s <sup>2</sup> /m (mass)	kilogram (kg)	9.806 650*E+00
kg <sub>f</sub> /cm <sup>2</sup>	pascal (Pa)	9.806 650*E+04

**TABLE 17-3 CONVERSION FACTORS (ACCURATE)(CONT'D) (ANSI SI 10)**

To convert from	to	Multiply by
kg <sub>f</sub> /m <sup>2</sup>	pascal (Pa)	9.806 650*E+00
kg <sub>f</sub> /mm <sup>2</sup>	pascal (Pa)	9.806 650*E+06
km/h	meter per second (m/s)	2.777 778 E-01
kilopond	newton(N)	9.806 650*E+00
kW•h	joule (J)	3.600 000*E+06
kip (1000 lb <sub>f</sub> )	newton(N)	4.448 222 E+03
kip/in <sup>2</sup> (ksi)	pascal (Pa)	6.894 757 E+06
knot (international)	meter per second (m/s)	5.144 444 E-01
lambert	candela per meter <sup>2</sup> (cd/m <sup>2</sup> )	1/π * E+04
lambert	candela per meter <sup>2</sup> (cd/m <sup>2</sup> )	3.183 099 E+03
langley	joule per meter <sup>2</sup> (J/m <sup>2</sup> )	4.184 000*E+04
league	meter (m)	(1)
light year	meter (m)	9.460 55 E+15
liter	meter <sup>3</sup> (m <sup>3</sup> )	1.000 000*E-03 (8)
maxwell	weber (Wb)	1.000 000*E-08
mho	siemens (S)	1.000 000*E+00
microinch	meter (m)	2.540 000*E-08
micron	meter (m)	1.000 000*E-06
mil	meter (m)	2.540 000*E-05
mile (international)	meter (m)	1.609 344*E+03
mile (statute)	meter (m)	1.609 3 E+03
mile (USA survey) <sup>1</sup>	meter (m)	1.609 347 E+03
mile (international nautical)	meter (m)	1.852 000*E+03
mile (UK nautical)	meter (m)	1.853 184*E+03
mile (USA nautical)	meter (m)	1.852 000*E+03
mi <sup>2</sup> (international)	meter <sup>2</sup> (m <sup>2</sup> )	2.589 988 E+06
mi <sup>2</sup> (USA survey) <sup>1</sup>	meter <sup>2</sup> (m <sup>2</sup> )	2.589 998 E+06
mi/h (international)	meter per second (m/s)	4.470 400*E-01
mi/h (international)	kilometer per hour (km/h)	1.609 344*E+00
mi/min (international)	meter per second (m/s)	2.682 240*E+01
mi/s (international)	meter per second (m/s)	1.609 344*E+03
millibar	pascal (Pa)	1.000 000*E+02
millimeter of mercury (0°C)	pascal (Pa)	1.333 22 E+02
minute (angle)	radian (rad)	2.908 882 E-04
minute (mean solar)	second (s)	6.000 000 E+01
minute (sidereal)	second (s)	5.983 617 E+01
month (mean calendar)	second (s)	2.628 000 E+06
oersted	ampere per meter (A/m)	7.957 747 E+01
ohm centimeter	ohm meter (Ω•m)	1.000 000*E-02
ohm circular-mil	ohm millimeter <sup>2</sup> per meter	
per foot	(Ω•mm <sup>2</sup> /m)	1.662 426 E-03
ounce (avoirdupois)	kilogram (kg)	2.834 952 E-02
ounce (troy or apothecary)	kilogram (kg)	3.110 348 E-02
ounce (UK fluid)	meter <sup>3</sup> (m <sup>3</sup> )	2.841 307 E-05
ounce (USA fluid)	meter <sup>3</sup> (m <sup>3</sup> )	2.957 353 E-05
ounce-force	newton(N)	2.780 139 E-01
oz <sub>f</sub> •in	newton meter (N•m)	7.061 552 E-03
oz (avoirdupois)/gal (UK liquid)	kilogram per meter <sup>3</sup> (kg/m <sup>3</sup> )	6.236 021 E+00
oz (avoirdupois)/gal (USA liquid)	kilogram per meter <sup>3</sup> (kg/m <sup>3</sup> )	7.489 152 E+00
oz (avoirdupois)/in <sup>3</sup>	kilogram per meter <sup>3</sup> (kg/m <sup>3</sup> )	1.729 994 E+03
oz (avoirdupois)/ft <sup>2</sup>	kilogram per meter <sup>2</sup> (kg/m <sup>2</sup> )	3.051 517 E-01

**TABLE 17-3 CONVERSION FACTORS (ACCURATE)(CONT'D) (ANSI SI 10)**

To convert from	to	Multiply by
oz (avoirdupois)/yd <sup>2</sup>	kilogram per meter <sup>2</sup> (kg/m <sup>2</sup> )	3.390 575 E-02
parsec <sup>2</sup>	meter (m)	3.085 678 E+16
peck (USA)	meter <sup>3</sup> (m <sup>3</sup> )	8.809 768 E_03
pennyweight	kilogram (kg)	1.555 174 E-03
perm (0°C)	kilogram per pascal second meter <sup>2</sup> (kg/Pa•s•m <sup>2</sup> )	5.721 35 E-11
perm (23°C)	kilogram per pascal second meter <sup>2</sup> (kg/Pa•s•m <sup>2</sup> )	5.745 25 E-11
perm•in (0°C)	kilogram per pascal second meter (kg/Pa•s•m)	1.453 22 E-12
perm•in (23°C)	kilogram per pascal second meter (kg/Pa•s•m)	1.459 29 E-12
phot	lumen per meter <sup>2</sup> (lm/m <sup>2</sup> )	1.000 000*E+04
pica (printer's)	meter (m)	4.217 518 E-03
pint (USA dry)	meter <sup>3</sup> (m <sup>3</sup> )	5.506 105 E-04
pint (USA liquid)	meter <sup>3</sup> (m <sup>3</sup> )	4.731 765 E-04
point (printer's)	meter (m)	3.514 598*E-04
poise (absolute viscosity)	pascal second (Pa•s)	1.000 000*E-01
pound (lb avoirdupois)	kilogram (kg)	4.535 924 E-01 (9)
pound (troy or apothecary)	kilogram (kg)	3.732 417 E-01
lb•ft <sup>2</sup> (moment of inertia)	kilogram meter <sup>2</sup> (kg•m <sup>2</sup> )	4.214 011 E-02
lb•in <sup>2</sup> (moment of inertia)	kilogram meter <sup>2</sup> (kg•m <sup>2</sup> )	2.926 397 E-04
lb/ft•h	pascal second (Pa•s)	4.133 789 E-04
lb/ft•s	pascal second (Pa•s)	1.488 164 E+00
lb/ft <sup>2</sup>	kilogram per meter <sup>2</sup> (kg/m <sup>2</sup> )	4.882 428 E+00
lb/ft <sup>3</sup>	kilogram per meter <sup>3</sup> (kg/m <sup>3</sup> )	1.601 846 E+01
lb/gal (UK liquid)	kilogram per meter <sup>3</sup> (kg/m <sup>3</sup> )	9.977 633 E+01
lb/gal (USA liquid)	kilogram per meter <sup>3</sup> (kg/m <sup>3</sup> )	1.198 264 E+02
lb/h	kilogram per second (kg/s)	1.259 979 E-04
lb/hp•h (SFC, specific fuel consumption)	kilogram per joule (kg/J)	1.689 659 E-07
lb/in <sup>3</sup>	kilogram per meter <sup>3</sup> (kg/m <sup>3</sup> )	2.767 990 E+04
lb/min	kilogram per second (kg/s)	7.559 873 E-03
lb/s	kilogram per second (kg/s)	4.535 924 E-01
lb/yd <sup>3</sup>	kilogram per meter <sup>3</sup> (kg/m <sup>3</sup> )	5.932 764 E-01
poundal	newton(N)	1.382 550 E-01
poundal/ft <sup>2</sup>	pascal (Pa)	1.488 164 E+00
poundal•s/ft <sup>2</sup>	pascal second (Pa•s)	1.488 164 E+00
pound-force (lb <sub>f</sub> )	newton(N)	4.448 222 E+00 (10)
lb <sub>f</sub> •ft	newton meter (N•m)	1.355 818 E+00
lb <sub>f</sub> •ft/in	newton meter per meter (N•m/m)	5.337 866 E+01
lb <sub>f</sub> •in	newton meter (N•m)	1.129 848 E-01
lb <sub>f</sub> •in/in	newton meter per meter (N•m/m)	4.448 222 E+00
lb <sub>f</sub> •s/ft <sup>2</sup>	pascal second (Pa•s)	4.788 026 E+01
lb <sub>f</sub> /ft	newton per meter (N/m)	1.459 390 E+01
lb <sub>f</sub> /ft <sup>2</sup>	pascal (Pa)	4.788 026 E+01
lb <sub>f</sub> /in	newton per meter (N/m)	1.751 268 E+02
lb <sub>f</sub> /in <sup>2</sup> (psi)	pascal (Pa)	6.894 757 E+03
lb <sub>f</sub> /lb (thrust/weight [mass] ratio)	newton per kilogram (N/kg)	9.806 650 E+00
quart (USA dry)	meter <sup>3</sup> (m <sup>3</sup> )	1.101 221 E-03
quart (USA liquid)	meter <sup>3</sup> (m <sup>3</sup> )	9.463 529 E-04

**TABLE 17-3 CONVERSION FACTORS (ACCURATE)(CONT'D) (ANSI SI 10)**

To convert from	to	Multiply by
rad (radiation dose absorbed)	gray (Gy)	1.000 000*E-02
rhe	1 per pascal second (1/Pa•s)	1.000 000*E+01
rod	meter (m)	(1)
roentgen	coulomb per kilogram (C/kg)	2.58 E-04
second (angle)	radian (rad)	4.848 137 E-06
second (sidereal)	second (s)	9.972 696 E-01
section	meter <sup>2</sup> (m <sup>2</sup> )	(1)
shake	second (s)	1.000 000*E-08
slug	kilogram (kg)	1.459 390 E+01
slug/ft•s	pascal second (Pa•s)	4.788 026 E+01
slug/ft <sup>3</sup>	kilogram per meter <sup>3</sup> (kg/m <sup>3</sup> )	5.153 788 E+02
statampere	ampere(A)	3.335 640 E-10
statcoulomb	coulomb (C)	3.335 640 E-10
statfarad	farad (F)	1.112 650 E-12
stathenry	henry (H)	8.987 554 E+11
statmho	siemens (S)	1.112 650 E-12
statohm	ohm ( $\Omega$ )	8.987 554 E+11
statvolt	volt (V)	2.997 925 E+02
stere	meter <sup>3</sup> (m <sup>3</sup> )	1.000 000*E+00
stilb	candela per meter <sup>2</sup> (cd/m <sup>2</sup> )	1.000 000*E+04
stokes (kinematic viscosity)	meter <sup>2</sup> per second (m <sup>2</sup> /s)	1.000 000*E-04
tablespoon	meter <sup>3</sup> (m <sup>3</sup> )	1.478 676 E-05
teaspoon	meter <sup>3</sup> (m <sup>3</sup> )	4.928 922 E-06
tex	kilogram per meter (kg/m)	1.000 000*E-06
therm	joule (J)	1.055 056 E+08
ton (assay)	kilogram (kg)	2.916 667 E-02
ton (long, 2240 lb)	kilogram (kg)	1.016 047 E+03
ton (metric, Mg)	kilogram (kg)	1.000 000*E+03
ton (nuclear equivalent of TNT)	joule (J)	4.184 E+09 (11)
ton (refrigeration)	watt (W)	3.516 800 E+03
ton (register)	meter <sup>3</sup> (m <sup>3</sup> )	2.831 685 E+00
ton (short, 2000 lb)	kilogram (kg)	9.071 847 E+02
ton (long)/yd <sup>3</sup>	kilogram per meter <sup>3</sup> (kg/m <sup>3</sup> )	1.328 939 E+03
ton (short)/yd <sup>3</sup>	kilogram per meter <sup>3</sup> (kg/m <sup>3</sup> )	1.186 553 E+03
ton (short)/h	kilogram per second (kg/s)	2.519 958 E-01
ton-force (2000 lb <sub>f</sub> )	newton(N)	8.896 444 E+03
tonne	kilogram (kg)	1.000 000*E+03
torr (mm Hg, 0°C)	pascal (Pa)	1.333 22 E+02
township	meter <sup>2</sup> (m <sup>2</sup> )	(1)
unit pole	weber (Wb)	1.256 637 E-07
W•h	joule (J)	3.600 000*E+03
W•s	joule (J)	1.000 000*E+00
W/cm <sup>2</sup>	watt per meter <sup>2</sup> (W/m <sup>2</sup> )	1.000 000*E+04
W/in <sup>2</sup>	watt per meter <sup>2</sup> (W/m <sup>2</sup> )	1.550 003 E+03
yard	meter (m)	9.144 000*E-01
yd <sup>2</sup>	meter <sup>2</sup> (m <sup>2</sup> )	8.361 274 E-01
yd <sup>3</sup>	meter <sup>3</sup> (m <sup>3</sup> )	7.645 549 E-01
yd <sup>3</sup> /min	meter <sup>3</sup> per second (m <sup>3</sup> /s)	1.274 258 E-02
year (calendar)	second (s)	3.153 600 E+07
year (sidereal)	second (s)	3.155 815 E+07
year (tropical)	second (s)	3.155 693 E+07

NOTES:

1. Since 1893 the USA basis for length measurement has been derived from metric standards. In 1959 a small refinement was made in the definition of the yard to resolve discrepancies both in this country and abroad, which changed its length from 3600/3937 m to 0.9144 m exactly. The result in the new value being shorter by two parts in a million. At the same time it was decided that any data in feet derived from and published as a result of geodetic surveys within the USA would remain with the old standard (1 ft = 1200/3937 m) until further decision. This foot is named the USA survey foot. As a result the USA land measurements in USA customary units will relate to the meter by the old standard. All the conversion factors in this table for units referenced to this footnote are based on the USA survey foot, rather than the international foot.

Conversion factors for the land measures given below may be determined from the following relationships:

1 league = 3 miles (exactly)

1 rod = 16½ feet (exactly)

1 section = 36 square miles (exactly)

1 township = 36 square miles (exactly)

2. This value conflicts with the value printed in NBS 330. The value requires updating in NBS 330.

3. No conversion factor is given for board foot because the board foot is not a well-defined unit of volume. Calculation of the number of board feet in a piece of lumber is based on the nominal dimension of the cross section.

4. The British thermal unit used in these tables is the International Table Btu. The Fifth International Conference on the Properties of Steam (London, July 1956) defined the calorie (International Table) as 4.1868 J. Therefore the exact conversion factor for the Btu (International Table) is 1.055 055 852 62 kJ. Other conversion factors for the Btu include the following:

British thermal unit (mean)	1055.87 J
British thermal unit (thermochemical)	1054.350 J
British thermal unit (39 °F)	1059.67 J
British thermal unit (59 °F)	1054.80 J
British thermal unit (60 °F)	1054.68 J

The calorie used in these tables is the thermochemical calorie, defined as 4.184 J exactly, which has been widely used in scientific work. Other calories that have been seen practical application include the following:

calorie (International Table)	4.186 8 J (by definition)
calorie (mean)	4.190 02 J
calorie (15 °C)	4.185 80 J
calorie (20 °C)	4.181 90 J

The International Table calorie has been frequently used in European engineering work. Various kilocalories have often been used, sometimes being called "kilogram-calories." The so-called "calorie" (or Calorie) used in the field of nutrition is in fact a kilocalorie.

5. Agricultural are sold by the bushel in the USA. The mass per unit volume of such products varies considerably owing to differences in variety, size, or condition of the commodity, tightness of pack, degree in which the container is heaped, etc. The following conversion factors for one bushel are used by the USA Department of Agriculture for statistical purposes:

barley	21.8 kg
corn, shelled	25.4 kg
oats	14.5 kg
potatoes	27.2 kg
soybeans	27.2 kg
wheat	27.2 kg

6. This is sometimes called the moment of inertia of a plain section about a specified axis.

7. The exact conversion factor is 1.638 706 4 E-05.

8. In 1964 the General Conference on Weight and Measures adopted the name liter for the cubic decimeter. Prior to this decision the liter differed slightly (previous value, 1.000 028 dm<sup>3</sup>) and in expression of precision volume measurement this fact must be kept in mind.

9. The exact conversion factor is 4.535 923 7 E-01.

10. The exact conversion factor is 4.448 221 615 260 5 E+00.

11. Defined (not measured) value.

## Conversion and Rounding Guide

### Definitions

A clear understanding of the terms used in this design standard will help ensure reliable conversion and rounding practices. These terms and definitions are as follows:

1. **accuracy:** The degree of conformity of a measured or calculated value to some referenced value, which may be specified or unknown. This concept includes the systematic error of an operation, which is seldom negligible or known exactly. See precision.
2. **deviation:** The algebraic difference between a size and the corresponding basic (nominal) size.
3. **digit:** One of the ten numerals (0 to 9) in the decimal number system.
4. **dimension:** A geometric element in a design, such as length or angle, or the magnitude of such a quantity.
5. **feature:** The general term applied to a physical portion of a part, such as a surface, pin, tab, hole, or slot.
6. **figure (numerical):** An arithmetic value expressed by one or more digits.
7. **inch-pound (inch, customary, or imperial) units:** Units based on the yard and the pound commonly used in NA and defined by the National Institute of Standards and Technology. Note that units having the same names in other countries may differ in magnitude.
8. **nominal value (basic size):** A value assigned for designation. The size to which limits or deviations are assigned.
9. **precision:** The degree of mutual agreement between individual measurements, namely their repeatability and reproducibility. See accuracy.
10. **significant digits:** Any digits in a number that is necessary to define a numerical value.
11. **tolerance:** The amount by which the value of a quantity is allowed to vary; thus, the tolerance is the algebraic difference between the maximum and minimum limits.

**Engineering specification and drawing conversion.** Conversion of critical limit dimensions may require limits to be rounded inwards or maximum size rounded down and minimum size rounded up if existing specified limits must be maintained. It is more precise to convert limits rather than nominal size and tolerance where conversion errors accumulate. See SAE J390 Dual Dimensioning or SAE J916 Rules for SAE use of SI (metric) units.

**For everyday rounding of metric values** obtained by converting untoleranced inch-pound values, the following *simplified* rules are suggested; for more sophisticated rounding rules, see ANSI SI 10 or referenced SAE standards.

**(a) If the inch-pound value** is expressed by a combination of units such as feet and inches, or pound and ounces, first express it in terms of the smaller unit.

Example: Change 14 ft 5 in to 173 in.

**(b) When the digits to be discarded begin with a 5** or more, increase the last digit retained by one unit.

Example: 8.3745, if rounded to three digits, would be 8.37; if rounded to four digits, 8.375.

**(c) Multiply the inch-pound value** by the conversion factor. If the first significant\* digit of the metric value is *equal to or larger than* the first significant digit of the inch-pound value, round the metric value to the same number of significant digits as there are in the inch-pound value.

\*One or more zeros at the beginning of a number are not called "significant". Zeros at the end of a number are not considered significant unless their use results in a number that is closer to the true value than would occur if the number were increased or decreased.

Examples: 11 mi x 1.609 km/mi = 17.699 km, which rounds to 18 km.

61 mi x 1.609 km/mi = 98.149 km, which rounds to 98 km.

If *smaller*, round to one more significant digit.

Examples: 66 mi x 1.609 km/mi = 106.194 km, which rounds to 106 km.

8 ft x 0.3048 m/ft = 2.438 m, which rounds to 2.4 m.

**(d) Exceptions:** It is sometimes better to round to one less digit than specified above. For example, according to Rule (c), 26 pounds per square inch air pressure in a tire would be converted as follows:

Example: 26 psi\* x 6.895 kPa/psi = 179.27 kPa, which rounds to 179 kPa.

\*psi is the abbreviation for pound-force per square inch (lb<sub>f</sub>/in<sup>2</sup>).

However, 180 kPa – where the zero is *not* a significant digit – usually would be better, because tire pressures typically are not precise.

The rule do *not* apply to conversion of °F to °C scale.

(e) **These simplified rules do *not* eliminate** the necessity for using good judgment. If you believe that a dimension given as 8 ft is valid to the nearest 1/10 inch, you should consider it to mean 96.0 inches [per(a)] and treat it as having three significant digits. The rounded dimension then would be 2.438 m, instead of 2.4 m.

**Where an inch-pound value represents a maximum or minimum limit** that must be respected, the rounding must be in a direction that does not violate the original limit.

## **RELATED ISO STANDARDS**

TC 12 Quantities, units, symbols, conversion factors