

SI - The Metrics International System of Units

The International System of Units (SI) is a modernized version of the metric system established by international agreement. The metric system of measurement was developed during the French Revolution and was first promoted in the U.S. by Thomas Jefferson. Its use was legalized in the U.S. in 1866. In 1902, proposed congressional legislation requiring the U.S. Government to use the metric system exclusively was defeated by a single vote.

SI provides a logical and interconnected framework for all measurements in science, industry, and commerce. The metric system is much simpler to use than the existing English system since all its units of measurement are divisible by 10.

Conversion Factors

Please note: For best printing results, set your Page Setup's Orientation to Landscape before printing.

The following list provides the conversion relationship between U.S. customary units and SI (International System) units. The proper conversion procedure is to multiply the specified value on the left (primarily U.S. customary values) by the conversion factor exactly as given below and then round to the appropriate number of significant digits desired. For example, to convert 11.4 ft to meters: $11.4 \times 0.3048 = 3.47472$, which rounds to 3.47 meters. Do not round either value before performing the multiplication, as accuracy would be reduced. A complete guide to the SI system and its use can be found in ASTM E 380, Metric Practice.

Note that [Convert.exe](#) uses the [1959 conversion factors for distance](#) i.e. the 1959 definitions of inch and foot and their derived measurements, the ton to kilogram conversion factor differs from the conversion factor published on this page by 1 in the 7th digit, the Fahrenheit to Kelvin conversion factor differs by 0.017 degree Kelvin, the BTU/hour to watt conversion differs by 3 in the 4th digit, and the ft/sec^2 to m/sec^2 conversion differs by 1 in the 6th digit.

Conversion Symbols

The prefixes and symbols listed below are commonly used to form names and symbols of the decimal multiples and sub multiples of the SI units.

Multiplication Factor	Prefix	Symbol
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
1 = 1		
0.01 = 10^{-2}	centi	c
0.001 = 10^{-3}	milli	m
0.000001 = 10^{-6}	micro	μ
0.00000001 = 10^{-9}	nano	n

INTERIM UNITS OF MEASURE

As suggested by Federal Standard 376B
January 27, 1993

AS USED IN THE STANDARD ITEM TABLE	METRIC EQUIVALENT
ACRE	hectare (ha)
CUBIC FOOT	cubic meter (m ³)
CUBIC YARD	cubic meter (m ³)
GALLON/MGALLON	liter (L), cubic meter (m ³)
HUNDRED	Hundred for traffic buttons
HUNDRED WEIGHT	kilogram (kg)
LINEAR FOOT	meter (m)
MBOARD FEET	cubic meter (m ³)
MILE	kilometer (km)
NAUTICAL MILE	Nautical Mile
POUND	kilogram (kg) for mass newton (N) for force
SQUARE FOOT	square meter (m ²)
SQUARE YARD	square meter (m ²)
TON	tonne (t)

**UNITS OF MEASUREMENT
USED IN SPECIAL PROVISIONS
AND GENERAL SPECIAL PROVISIONS**

**METRIC
EQUIVALENT**

GAGE; GAUGE	METAL THICKNESS	gage (mm)
FAHRENHEIT	TEMPERATURE	kelvin (K) or degree Celsius (C)
FATHOM	WATER DEPTH	meter (m)
FOOT/LBS	TORQUE	newton-meter (N-m)
LBS/SQ. IN	PRESSURES	kilopascal (kPa) megapascal (MPa) (if very large number)
LBS/SQ. FT		kilopascal (kPa)
LBS/SQ YD		kilopascal (kPa)
INCH	LINEAR	millimeter (mm)
KIPS; KSI	TENSION	kilopascal (kPa) or megapascal (MPa)
LBS/ACRE	EROSION CONTROL	kilograms/hectare
LBS/CU. FT.	DENSITY	kilogram per cubic meter (kg/m ³)
MIL	THICKNESS	micrometer (um)
FT. LBS./SEC.	HORSE POWER	watt (W)

**UNITS OF MEASUREMENTS USED
ON CONTRACT PLANS**

**METRIC
EQUIVALENT**

DEGREES/BEARINGS	No change for surveying.
STATIONING	1,000 meters = 1 station
MILEPOSTS	This one is still under review as mileposts are part of the signing issue. Use mileposts for now, but
also	state kilometerposts.
ELEVATIONS	meter (m)

**UNITS OF MEASUREMENT USED IN
COMMERCIAL STANDARDS**

**METRIC
EQUIVALENT**

GALS/HR or MIN (PUMPS)	liters per second (L/s)
500 GALLON TANKS	cubic meter (m ³) but it could also possibly be in liter (L)
55 GALLON DRUMS	cubic meter (m ³) or liter (L) for liquid
94 LBS/SACK (CEMENT)	kilogram (kg)
DIAMETER OF REINFORCING STEEL	millimeter (mm)
LBS/FT OF REINFORCING STEEL	kilogram per meter (kg/m)
BUSHEL	cubic meter (m ³)

Length Conversion Factors

Length		
To convert from	to	multiply by
mile (US Statute)	kilometer (km)	1.609347
inch (in)	millimeter (mm)	25.4 *
inch (in)	centimeter (cm)	2.54 *
inch (in)	meter (m)	0.0254 *
foot (ft)	meter (m)	0.3048 *
yard (yd)	meter (m)	0.9144 *

Area Conversion Factors

Area		
To convert from	to	multiply by
square foot (sq ft)	square meter (sq m)	0.09290304 E
square inch (sq in)	square meter (sq m)	0.00064516 E
square yard (sq yd)	square meter (sq m)	0.83612736 E
acre (ac)	hectare (ha)	0.4047

Volume Conversion Factors

Volume		
To convert from	to	multiply by
cubic inch (cu in)	cubic meter (cu m)	0.00001639
cubic foot (cu ft)	cubic meter (cu m)	0.02831685
cubic yard (cu yd)	cubic meter (cu m)	0.7645549
gallon (gal)	liter	4.546
Canada liquid gallon (gal)	cubic meter (cu m)	0.004546
Canada liquid gallon (gal)	liter	3.7854118
U.S. liquid** gallon (gal)	cubic meter (cu m)	0.00378541
U.S. liquid fluid ounce (fl oz)	milliliters (ml)	29.57353
U.S. liquid fluid ounce (fl oz)	cubic meter (cu m)	0.00002957

Force Conversion Factors

Force		
To convert from	to	multiply by
kip (1000 lb)	kilogram (kg)	453.6
kip (1000 lb)	newton (N)	4,448.222
pound (lb)	kilogram (kg)	0.4535924
avoirdupois		
pound (lb)	newton (N)	4.448222

Pressure or Stress Conversion Factors

<i>Pressure or stress</i>			
kip per square	megapascal (MPa)		6.894757
inch (ksi)			
pound per	kilogram per		4.8824
square foot (psf)	square meter (kg/sq m)		
pound per square	pascal (Pa)		47.88
foot (psf)			
pound per square	pascal (Pa)		6,894.757
inch (psi)			
pound per square	megapascal (MPa)		0.00689476
inch (psi)			

Mass Conversion Factors

<i>Mass (weight)</i>			
pound (lb)	kilogram (kg)		0.4535924
avoirdupois			
ton, 2000 lb	kilogram (kg)		907.1848
grain	kilogram (kg)		0.0000648
<i>Mass (weight) per length</i>			
kip per linear	kilogram per meter (kg/m)		0.001488
foot (klf)			
pound per linear	kilogram per meter (kg/m)		1.488
foot (plf)			
<i>Mass per volume (density)</i>			
pound per cubic	kilogram per cubic		16.01846
foot (pcf)	meter (kg/cu m)		
pound per cubic	kilogram per cubic		0.5933
yard (lb/cu yd)	meter (kg/cu m)		

Temperature Conversion Factors

Temperature

degree Fahrenheit (F)	degree Celsius (C)	$t_c = (t_F - 32) / 1.8$
degree Fahrenheit (F)	kelvin (K)	$t_k = (t_F + 459.7) / 1.8$
kelvin (K)	degree Celsius (C)	$t_c = t_k - 273.15$

Energy and heat

British thermal unit (Btu)	joule (J)	1055.056
calorie (cal)	joule (J)	4.1868E
Btu/degree	F x hr x ft ² W/m ² - degree K	5.678263
kilowatt-hour (kwh)	joule (J)	3,600,000E
British thermal unit per pound (Btu/lb)	calories per gram (cal/g)	0.55556
British thermal unit per hour (Btu/hr)	watt (W)	0.2930711

Power Conversion Factors

Power

horsepower (hp) (550 ft-lb/sec)	watt (W)	745.6999 E
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Velocity

mile per hour (mph)	kilometer per hour (km/hr)	1.60934
mile per hour (mph)	meter per second (m/s)	0.44704

Permeability

darcy	centimeter per second (cm/sec)	0.000968
feet per day (ft/day)	centimeter per second (cm/sec)	0.000352

 *indicates that the factor given is exact.
 **One U.S. gallon equals 0.8327 Canadian gallon.
 t--A pascal equals 1.000 newton per square meter.

Note:

One U.S. gallon of water weighs 8.34 pounds (U.S.) at 60 degrees F.
 One cubic foot of water weighs 62.4 pounds (U.S.).
 One milliliter of water has a mass of 1 gram and has a volume of one cubic centimeter.
 One U.S. bag of cement weighs 94 lbs.

More Useful Conversion Factors

USEFUL CONVERSION FACTORS

Quantity	From English Units	To Metric Units	Multiply by*
Length	mile	km	1.609347
	yard	m	0.9144**
	foot	m	0.3048**
	inch	mm	25.40**
Area	square mile	km ²	2.590
	acre	m ²	4047
	acre	hectare	0.4047
	square yard	m ²	0.8361
	square foot	m ²	0.092 90
	square inch	mm ²	645.2
Volume	acre foot	m ³	1 233
	cubic yard	m ³	0.7646
	cubic foot	m ³	0.028 32
	cubic foot	L (1000 cm ³)	28.32
	100 board feet	m ³	0.2360
	gallon	L (1000 cm ³)	3.785
Mass	lb	kg	0.4536
	kip (1000 lb)	metric ton (1000kg)	0.4536
Mass/unit length	plf	kg/m	1.488
Mass/unit area	psf	kg/m ²	4.882
Mass density	pcf	kg/m ³	16.02
Force	lb	N	4.448
	kip	kN	4.448
Force/unit length	plf	N/m	14.59
	klf	kN/m	14.59
Pressure, stress, modules of elasticity	psf	Pa	47.88
	ksf	kPa	47.88
	psi	kPa	6.895
	ksi	MPa	6.895
Bending moment, torque, moment of force	ft-lb	N . m	1.356
	ft-kip	kN . m	1.356

* 4 significant digits

**denotes exact conversion