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Field Notes

Metrication—Part II

Conversion Tables

References

FOREST SERVICE JUNE 1977

U.S. DEPARTMENT OF AGRICULTURE

EDITORIAL NOTE

This part of the June 1977 Field Notes *is designed for use as a ready reference in making conversions between U.S. standard measurements, common British measurements, and metric (SI) measurements.*

Part I of this issue of Field Notes *provided background information on metrication, with documents and selected articles to present both the present situation and the future outlook on conversion.*

Part II presents the many conversions useful in engineering practices. It is divided into functional areas -- heat, mass, velocity, and others -- as shown in the following Contents. Within each of these areas, the conversions are listed alphabetically to allow their use in converting both to and from either metric or other measurement systems. For example:

Multiply	By	To Obtain
acres	0.4047	hectares
	and also	
hectares	2.417	acres

The information presented in this Part reflects all of the material available at the time of publication. Any suggestions from the field on further material needed to make this document more useful are welcomed.

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Some References on Metric Information, Including Charts on All You Need To Know About Metric and Metric Conversion Factors. National Bureau of Standards, U.S. Department of Commerce, Special Publication 389, Revised August 1975. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Order by SD Catalog No. C13.10:389. Stock No. 0303-01219.

Engineering Design Handbook, Metric Conversion Guide. DARCOM Pamphlet 706-470, U.S. Army Materiel Development and Readiness Command, 5001 Eisenhower Avenue, Alexandria, Virginia 22333.

COMMERCIAL PUBLICATIONS

American Metric Construction Handbook, Copyright by R.J. Lytle, Structures Publishing Co., 1976; Box 423, Farmington, Michigan 48024.

Standard for Metric Practice, American Society for Testing and Materials, 1916 Race St., Philadelphia, Pennsylvania 19103. ASTM designation E 380-76. Published February 1976.

GENERAL

SI Unit Prefixes

Multiplication factor	Prefix	Symbol	Pronunciation (USA)[1]	Meaning (in USA)	In other countries
10^{18}	exa[2]	E	ex' a (a as in about)	One quintillion times[3]	trillion
10^{15}	peta[2]	P	as in petal	One quadrillion times[3]	thousand billion
10^{12}	tera	T	as in terrace	One trillion times[3]	billion
10^{9}	giga	G	jig' a (a as in about)	One billion times[3]	milliard
10^{6}	mega	M	as in megaphone	One million times	
10^{3}	kilo	k	as in kilowatt	One thousand times	
10^{2}	hecto	h[4]	heck' toe	One hundred times	
10	deka	da[4]	deck' a (a as in about)	Ten times	
10^{-1}	deci	d[4]	as in decimal	One tenth of	
10^{-2}	centi	c[4]	as in sentiment	One hundredth of	
10^{-3}	milli	m	as in military	One thousandth of	
10^{-6}	micro	μ	as in microphone	One millionth of	
10^{-9}	nano	n	nan' oh (an as in ant)	One billionth of[3]	milliardth
10^{-12}	pico	p	peek' oh	One trillionth of[3]	billionth
10^{-15}	femto	f	fem' toe (fem as in feminine)	One quadrillionth of[3]	thousand billionth
10^{-18}	atto	a	as in anatomy	One quintillionth of[3]	trillionth

[1]The first syllable of every prefix is accented to assure that the prefix will retain its identity. Therefore, the preferred pronunciation of kilometer places the accent on the first syllable, not the second.

[2]Approved by the 15th General Conference of Weights and Measures (CGPM), May-June 1975.

[3]These terms should be avoided in technical writing because the denominations above one million are different in most countries, as indicated in the last column.

[4]While hecto, deka, deci, and centi are SI prefixes, their use should generally be avoided except for the SI unit-multiples for area and volume and nontechnical use of centimeter, as for body and clothing measurement. The prefix hecto should be avoided also because the longhand symbol h may be confused with k.

Common SI Units

Quantity	Common units	Symbol	Acceptable equivalent	Symbol
plane angle	degree	°		
length	kilometer meter centimeter millimeter micrometer	km m cm mm μm		
area	square kilometer square kectometer square meter square centimeter square millimeter	km^2 hm^2 m^2 cm^2 mm^2	hectare	ha
volume	cubic meter cubic decimeter cubic centimeter	m^3 dm^3 cm^3	liter milliliter	l ml
velocity	meter per second kilometer per hour	m/s km/h		
acceleration	meter per second squared	m/s^2		
frequency	megahertz kilohertz hertz	MHz kHz Hz		
rotational frequency	revolution per second revolution per minute	r/s r/min		
mass	megagram kilogram gram milligram	Mg kg g mg	metric ton	t
density force	kilogram per cubic meter kilonewton newton	kg/m^3 kN N	gram per liter	g/l
moment of force	newton-meter	N•m		
pressure	kilopascal	kPa		
stress	megapascal	MPa		
energy work or quantity of heat	megajoule kilojoule joule kilowatt-hour	MJ kJ J kW•h	kilowatthour	kWh
power or heat flow rate	kilowatt watt	kW W		
temperature	kelvin degree Celsius	K °C		
electric current	ampere	A		

Quantity	Common units	Symbol	Acceptable equivalent	Symbol
quantity of electricity	coulomb ampere-hour	C A•h		 Ah
electromotive force	volt	V		
electric resistance	ohm	Ω		
luminous intensity	candela	cd		
luminous flux	lumen	lm		
illuminance	lux	lx		
sound level	decibel	dB		

ACCELERATION

Multiply	By	To Obtain
centimeters per second per second	0.03281	feet per second per second
centimeters per second per second	0.02237	miles per hour per second
degrees (angular) per second per second	0.0174	radians per second per second
feet per second per second	30.48	centimeters per second per second
feet per second per second	1.097	kilometers per hour per second
feet per second per second	0.3048	meters per second per second
free fall, standard	9.806	meters per square second[1]
inches per second per second	0.0254	meters per second per second[1]
kilometers per hour per second	0.9113	feet per second per second
kilometers per hour per second	0.6214	miles per hour per second
meters per second per second	3.281	feet per second per second
meters per second per second	39.37	inches per second per second
meters per second per second	2.237	miles per hour per second
miles per hour per second	44.7	centimeters per second per second
miles per hour per second	1.6093	kilometers per hour per second

[1]*Term "second per second" is equivalent to "per square second."*

Multiply	By	To Obtain
miles per hour per second	0.447	meters per second per second
radians per second per second	57.295	degrees (angular) per second per second

Acceleration of Gravity

meters per square second	0.101889	32.2 feet per square second
meters per square second	0.101995	386 inches per square second
32.2 feet per square second	9.81456	meters per square second
386 inches per square second	9.8044	meters per square second

AREA

Multiply	By	To Obtain
acres	0.4047	hectares
acres	4047	square meters
ares	0.02471	acres
ares	119.6	square yards
circular mils	5.067×10^{-6}	square centimeters
circular mils	5.067×10^{-10}	square meters
hectares	2.471	acres
hectares	1.076×10^{5}	square feet
hectares	0.003861	square miles
hectares	11959.9	square yards
square centimeters	1.973×10^{5}	circular mils
square centimeters	0.001076	square feet
square centimeters	0.1550	square inches
square centimeters	3.861×10^{-11}	square miles
square centimeters	1.196×10^{-4}	square yards
square feet	949	square centimeters
square feet	0.0929	square meters
square feet	9.29×10^{4}	square millimeters
square inches	6.452	square centimeters
square inches	6.452×10^{-4}	square meters
square inches	645.2	square millimeters
square kilometers	247.1	acres
square kilometers	1.076×10^{7}	square feet
square kilometers	1.550×10^{9}	square inches
square kilometers	0.3861	square miles
square kilometers	1.196×10^{6}	square yards
square meters	2.471×10^{4}	acres

Multiply	By	To Obtain
square meters	10.76	square feet
square meters	1550	square inches
square meters	3.861×10^{-7}	square miles (stat.)
square meters	1.196	square yards
square miles	258.998	hectares
square miles	2.590	square kilometers
square miles	2.590×10^{6}	square meters
square millimeters	1973	circular mils
square millimeters	1.076×10^{-5}	square feet
square millimeters	0.00155	square inches
square mils	6.452×10^{-6}	square centimeters
square yards	8361	square centimeters
square yards	0.8361	square meters
square yards	836100	square millimeters
square yards	8.362×10^{-5}	hectares

BENDING MOMENT OR TORQUE

Multiply	By	To Obtain
centimeter-dynes	7.376×10^{-8}	pound-feet
centimeter-grams	7.233×10^{-5}	pound-feet
meter-kilograms	7.233	pound-feet
newton-meters	0.73756	pound-feet
newton-meters	8.851	pound-inches
ounce-inches	0.007061	newton-meters
pound-feet	1.356×10^{7}	centimeter-dynes
pound-feet	1.3825×10^{4}	centimeter-grams
pound-feet	0.1383	meter-kilograms
pound-feet	1.3558	newton-meters
pound-inches	0.11298	newton-meters

Bending Moment or Torque per Unit of Length

newton-meters per meter	0.0187	pound-feet per inch
newton-meters per meter	0.2248	pound-inches per inch
pound-feet per inch	53.378	newton-meters per meter
pound-inches per inch	4.448	newton-meters per meter

CAPACITY OR VOLUME (LIQUID AND DRY MEASURE)

Multiply	By	To Obtain
barrels (dry)	7056	cubic inches
barrels (oil, 42 gallons)	0.1589	cubic meters
board feet	0.00236	cubic meters
buckets (British, dry)	18184	cubic centimeters
bushels	0.03524	cubic meters
bushels	3.524	dekaliters
bushels	35.24	liters
centiliters	0.6103	cubic inches
centiliters	2.705	drams
centiliters	0.3382	ounces (fluid)
cubic centimeters	3.531×10^{-5}	cubic feet
cubic centimeters	0.06102	cubic inches
cubic centimeters	1.308×10^{-6}	cubic yards
cubic centimeters	2.642×10^{-4}	gallons (liquid)
cubic centimeters	0.002113	pints (liquid)
cubic centimeters	0.001057	quarts (liquid)
cubic feet	28320	cubic centimeters
cubic feet	0.02832	cubic meters
cubic feet	28.32	liters
cubic inches	16.39	cubic centimeters
cubic inches	1.639×10^{-5}	cubic meters
cubic inches	0.01639	liters
cubic inches	16.387	milliliters
cubic meters	28.38	bushels
cubic meters	35.31	cubic feet
cubic meters	61023	cubic inches

Multiply	By	To Obtain
cubic meters	1.308	cubic yards
cubic meters	264.2	gallons (liquid)
cubic meters	113.51	pecks
cubic meters	2113	pints (liquid)
cubic meters	1057	quarts (liquid)
cubic yards	7.646×10^{5}	cubic centimeters
cubic yards	0.7646	cubic meters
cubic yards	764.6	liters
cups	2.365×10^{-4}	cubic meters
dekaliters	0.284	bushels
dekaliters	610.237	cubic inches
dekaliters	0.353	cubic feet
dekaliters	1.135	pecks
dekaliters	18.161	pints (dry)
dekaliters	9.081	quarts (dry)
drams (fluid)	3.6967	cubic centimeters (or millimeters)
gallons	3785	cubic centimeters
gallons	0.003785	cubic meters
gallons (dry)	0.004405	cubic meters
gallons (British, liquid)	0.004546	cubic meters
gallons	3.785	liters
gills (British)	142.07	cubic centimeters
gills	118.295	cubic centimeters
gills	0.1183	liters
kiloliters	35.316	cubic feet
kiloliters	1.308	cubic yards
kiloliters	264.18	gallons
liters	0.02838	bushels
liters	0.03531	cubic feet
liters	61.02	cubic inches

Multiply	By	To Obtain
liters	0.001308	cubic yards
liters	0.2642	gallons (liquid)
liters	8.453	gills
liters	33.814	ounces (liquid)
liters	0.1135	pecks
liters	1.816	pints (dry)
liters	2.113	pints (liquid)
liters	0.9081	quarts (dry)
liters	1.057	quarts (liquid)
milliliters	0.061023	cubic inches
milliliters	0.000264	gallons
milliliters	0.00845	gills
milliliters	16.23	minims
milliliters	0.0338	ounces (liquid)
milliliters	0.0021	pints (liquid)
minims (British)	0.0592	cubic centimeters
minims (U.S. fluid)	0.0616	cubic centimeters or milliliters
ounces (fluid)	0.02957	liters
ounces (fluid)	29.573	milliliters
pecks (British)	9.0919	liters
pecks	8.8096	liters
pints (dry)	0.05506	dekaliters
pints (dry)	0.5506	liters
pints (liquid)	473.2	cubic centimeters or milliliters
pints (liquid)	4.732×10^{-4}	cubic meters
pints (liquid)	0.4732	liters
quarts (dry)	0.1101	dekaliters
quarts (dry)	1.101	liters
quarts (liquid)	946.4	cubic centimeters or milliliters

Multiply	By	To Obtain
quarts (liquid)	9.464×10^{-4}	cubic meters
quarts (liquid)	0.9464	liters
tablespoon	1.478×10^{-5}	cubic meters
teaspoon	4.928×10^{-6}	cubic meters

ENERGY (INCLUDES WORK)

Multiply	By	To Obtain
British thermal units	1.055×10^{10}	ergs
British thermal units	252	gram-calories
British thermal units (International Table)	1055	joules
British thermal units (mean)	1055.87	joules
British thermal units (thermochemical)	1054.35	joules
British thermal units	0.252	kilogram-calories
British thermal units	107.58	kilogram-meters
British thermal units	2.928×10^{-4}	kilowatt-hours
calories	0.003968	British thermal units (mean)
ergs	9.486×10^{-11}	British thermal units
ergs	7.376×10^{-8}	foot-pounds
ergs	3.725×10^{-14}	horsepower-hours
foot-poundals	0.04214	joules
foot-pounds	1.356×10^{7}	ergs
foot-pounds	0.3241	gram-calories
foot-pounds	1.356	joules
foot-pounds	3.241×10^{-4}	kilogram-calories
foot-pounds	0.1383	kilogram-meters
foot-pounds	3.766×10^{-7}	kilowatt-hours
gram-calories	0.003968	British thermal units
gram-calories	3.068	foot-pounds
gram-calories	1.5596×10^{-6}	horsepower-hours
gram-centimeters	9.297×10^{-8}	British thermal units
horsepower-hours	2.6845×10^{13}	ergs
horsepower-hours	6.4119×10^{5}	gram-calories

Multiply	By	To Obtain
horsepower-hours	2.684×10^{6}	joules
horsepower-hours	641.7	kilogram-calories
horsepower-hours	2.737×10^{5}	kilogram-meters
horsepower-hours	0.7457	kilowatt-hours
joules	9.486×10^{-4}	British thermal units
joules	0.7736	foot-pounds
joules	0.2381	tons (nuclear equivalent of TNT)
kilogram-calories	3.968	British thermal units
kilogram-calories	3086	foot-pounds
kilogram-calories	0.001558	horsepower-hours
kilogram-meters	0.009296	British thermal units
kilogram-meters	7.233	foot-pounds
kilowatt-hours	3413	British thermal units
kilowatt-hours	2.655×10^{6}	foot-pounds
kilowatt-hours	1.341	horsepower-hours
kilowatt-hours	3.53	pounds of water evaporated from and at 212°F
kilowatt-hours	22.75	pounds of water raised from 62°F to 212°F
therms	1.055×10^{8}	joules
tons	4.20×10^{9}	joules
watt-hours	3.413	British thermal units
watt-hours	2656	foot-pounds
watt-hours	0.001341	horsepower-hours

Note: kilogram-calories also referred to as kilocalories.

foot-pounds also referred to as pound-feet.

gram-centimeters also referred to as centimeter-grams.

Energy per Unit Area Time

British thermal units (thermochemical) per square feet-hours	3.152	watts per square meter

Multiply	By	To Obtain
British thermal units (thermochemical) per square feet-minutes	189.1	watts per square meter
British thermal units (thermochemical) per square feet-seconds	1.134×10^4	watts per square meter
British thermal units (thermochemical) per square inch-seconds	1.634×10^4	watts per square meter
watts per square centimeter	0.1550	watts per square inch
watts per square inch	6.4516	watts per square centimeter

FORCE

Multiply	By	To Obtain
dynes	7.233×10^{-5}	poundals
dynes	2.248×10^{-6}	pounds (force)
grams	0.07039	poundals
kilograms (force)	70.93	poundals
kips (force)	4448.222	newtons
newtons	2.2481×10^{-4}	kips (force)
newtons	0.22481	pounds (force)
newtons	1.12404×10^{-4}	tons (force)
ounce (force)	0.2780	newtons
poundals	13826	dynes
poundals	14.1	grams
poundals	0.0141	kilograms
poundals	0.1383	newtons
pounds (force)	4.448×10^{5}	dynes
pounds (force)	4.448	newtons
tons (force)	8896.4	newtons

Force per Unit Length

grams per centimeters	0.0056	pounds per inch
kilograms per meter	0.672	pounds per foot
pounds per foot	1.488	kilograms per meter
pounds per foot	14.59	newtons per meter
pounds per inch		grams per centimeter
pounds per inch		newtons per meter

HEAT

Multiply	By	To Obtain
British thermal units (International Table) per square feet	11356	joules per square meter
British thermal units (thermochemical) per square feet	11348	joules per square meter
British thermal units (International Table) per hour-square feet-F°	5.678	watts per square meter kelvin
British thermal units (thermochemical) per hour-square feet-F°	5.674	watts per square meter kelvin
British thermal units (International Table) per second-square feet-F°	2.044×10^4	watts per square meter kelvin
British thermal units (thermochemical) per second-square feet-F°	2.042×10^4	watts per square meter kelvin
British thermal units (International Table) feet per hour-square feet-F°	1.731	watts per meter kelvin
British thermal units (thermochemical)-feet per hour-square feet-F°	1.729	watts per meter kelvin
British thermal units (International Table) inches per hour-square feet-F°	0.1442	watts per meter kelvin
British thermal units (thermochemical)-inches per hour-square feet-F°	0.1441	watts per meter kelvin

Multiply	By	To Obtain
British thermal units (International Table) inches per second-square feet-F°	519.2	watts per meter kelvin
British thermal units (thermochemical)-inches per second-square feet-F°	518.8	watts per meter kelvin
British thermal units (International Table) per pound	2326	joules per kilogram
British thermal units (thermochemical) per pound	2324	joules per kilogram
British thermal units (International Table) per pound-F°	4186	joules per kilogram kelvin
British thermal units (thermochemical) per pound-F°	4184	joules per kilogram kelvin
F°-hour-square feet per British thermal units (International Table)	0.1761	kelvin square meters per watt
F°-hour-square feet per British thermal units (thermochemical)	0.1762	kelvin square meters per watt
Square feet per hour (thermal diffusivity)	2.581×10^{-5}	square meter per second

LENGTH

Multiply	By	To Obtain
angstroms	3.937×10^{-9}	inches
astronomical units	1.496×10^{8}	kilometers
bolts (U.S. Cloth)	36.576	meters
centimeters	0.03281	feet
centimeters	0.3937	inches
centimeters	6.214×10^{-6}	miles
centimeters	393.7	mils
centimeters	0.0194	yards
chains (gunters)	20.12	meters
ells	114.3	centimeters
ems, pica	0.4233	centimeters
fathoms	1.8288	meters
feet	30.48	centimeters
feet	3.049×10^{-4}	kilometers
feet	0.3048	meters
feet	304.8	millimeters
furlongs	201.17	meters
hands	10.16	centimeters
inches	2.54×10^{8}	angstrom units
inches	2.54	centimeters
inches	0.0254	meters
inches	25.4	millimeters
kilometers	3281	feet
kilometers	39370	inches
kilometers	0.5396	miles (nautical)
kilometers	0.6214	miles (statute)
kilometers	1093.6	yards

Multiply	By	To Obtain
light years	9.4609×10^{12}	kilometers
meters	0.5468	fathoms
meters	3.281	feet
meters	39.37	inches
meters	5.4×10^{-4}	miles (nautical)
meters	6.214×10^{-4}	miles (statute)
meters	1.094	yards
miles (nautical)	1.852	kilometers
miles (nautical)	1852	meters
miles (statute)	1.609×10^{5}	centimeters
miles (statute)	1.609	kilometers
miles (statute)	1609.344	meters
millimeters	0.003281	feet
millimeters	0.03937	inches
millimeters	6.214×10^{-7}	miles (statute)
millimeters	39.37	mils
millimeters	0.001094	yards
mils	0.00254	centimeters
mils	2.54×10^{-8}	kilometers
parsecs	3.084×10^{13}	kilometers
picas (printer's)	0.4217	centimeters
points (printer's)	0.3514	centimeters
rods	5.029	meters
yards	91.44	centimeters
yards	9.144×10^{-4}	kilometers
yards	0.9144	meters
yards	914.4	millimeters

LIGHT

Multiply	By	To Obtain
candles per square inch	0.4870	lamberts
footcandles (lumens per square feet)	10.764	lumens per square meter (lux)
lamberts	2.054	candles per square inch
lumens per square meter	0.0929	footcandles

MASS

Multiply	By	To Obtain
daltons	1.650×10^{-24}	grams
drams	1.7718	grams
grains	6.48×10^{-5}	kilograms
grains	64.8	milligrams
grains (troy)	0.0648	grams
grams	0.5644	drams
grams	0.03527	ounces
grams	0.0315	ounces (troy)
grams	0.00205	pounds
grams	0.002679	pounds (troy)
hundredweights (long)	50.8023	kilograms
hundredweights (short)	45.3592	kilograms
hundredweights (short)	0.0453592	metric tons
kilograms	564.383	drams
kilograms	15432.36	grains
kilograms	0.002046	hundredweights (short)
kilograms	35.274	ounces
kilograms	32.151	ounces (troy)
kilograms	2.2046	pounds
kilograms	2.679	pounds (troy)
kilograms	0.0685	slugs
kilograms	9.842×10^{-4}	tons (long)
kilograms	0.001102	tons (short)
metric tons	22.046	hundredweights (short)
metric tons	2204.623	pounds
metric tons	0.984	tons (long)

Multiply	By	To Obtain
metric tons	1.102	tons (short)
milligrams	0.015432	grains
newtons per meter per square seconds	8.851	pounds (force) per inches per square seconds
newtons per meter per square seconds	0.7375	pounds (force) per feet per square seconds
ounces	28.349	grams
ounces	0.028349	kilograms
ounces (troy or apothecary)	0.0311	kilograms
pennyweights (troy)	1.555	grams
pennyweights (troy)	0.001555	killograms
pounds	453.59	grams
pounds	0.4536	kilograms
pounds	4.53×10^{-4}	metric tons
pounds (force) per feet per square seconds	1.3558	newtons per meter per square seconds
pounds (force) per inches per square seconds	0.11298	newtons per meter per square seconds
pounds (troy)	373.24	grams
pounds (troy)	0.37324	kilograms
pounds (troy)	3.732×10^{-4}	metric tons
scruples	1.2929	grams
slugs	14.59	kilograms
tons (assay)	0.02916	kilograms
tons (long)	1016.046	kilograms
tons (long)	1.016046	metric tons
tons (short)	907.18	kilograms
tons (short)	0.90718	metric tons

Mass per Unit Area

Multiply	By	To Obtain
gram per square centimeter	2.0481	pounds per square foot
kilograms per square centimeter	2048	pounds per square foot
kilograms per square centimeter	14.22	pounds per square inch
kilograms per square meter	0.2048	pounds per square foot
kilograms per square meter	0.001422	pounds per square inch
ounces per square foot	0.3051	kilograms per square meter
ounces per square yard	0.0339	kilograms per square meter
pounds per square foot	4.882	kilograms per square meter
pounds per square inch	0.0703	kilograms per square centimeter
pounds per square inch	703.1	kilograms per square meter
tons per square foot	9765	kilograms per square meter
tons per square inch	1.406×10^{6}	kilograms per square meter

Mass per Unit Length

pounds per foot	1.488	kilograms per meter
pounds per inch	17.85	kilograms per meter

Mass per Unit Time (Includes Flow)

gallons (liquid) per horsepower hours (specific fuel consumption)	1.410×10^{-9}	kilograms per joule
perms (0°C)	5.721×10^{-11}	kilograms per pascal-second-square meters
perms (23°C)	5.745×10^{-11}	kilograms per pascal-second-square meters
perm-inches (0°C)	1.453×10^{-12}	kilograms per pascal-second-meters

Multiply	By	To Obtain
perm-inches (23°C)	1.459×10^{-12}	kilograms per pascal-second-meters
pounds per hour	1.259×10^{-4}	kilograms per second
pounds per minute	0.007559	kilograms per second
pounds per second	0.4536	kilograms per second
pounds per horsepower-hours (specific fuel consumption)	1.689×10^{-7}	kilograms per joule
tons (short) per hour	0.2519	kilograms per second

Mass per Volume (Includes Density and Mass Capacity)

grains per gallon	0.01711	kilograms per cubic meter
grains per U.S. gallon	17.118	parts per million
grains per U.S. gallon	142.86	pounds per million gallons
grains per imperial gallon	14.286	parts per million
grams per cubic centimeter	62.43	pounds per cubic foot
grams per cubic centimeter	0.03613	pounds per cubic inch
grams per cubic centimeter	3.405×10^{-7}	pounds per mil-foot
grams per liter	58.417	grains per gallon
grams per liter	8.345	pounds per 1,000 gallons
grams per liter	0.06243	pounds per cubic foot
kilograms per cubic meter	0.06243	pounds per cubic foot
kilograms per cubic meter	3.613×10^{-5}	pounds per cubic inch
kilograms per cubic meter	3.405×10^{-10}	pounds per mil-foot
ounces per gallon	7.489	kilograms per cubic meter
parts per million	0.0584	grains per U.S. gallon
parts per million	0.07016	grains per imperial gallon
parts per million	8.345	pounds per million gallons
pounds (mass) per cubic foot	0.01602	grams per cubic centimeter

Multiply	By	To Obtain
pounds (mass) per cubic foot	16.02	kilograms per cubic meter
pounds (mass) per cubic inch	27.68	grams per cubic centimeter
pounds (mass) per cubic inch	276.79	kilograms per cubic meter
pounds per mil foot	2.306×10^6	grams per cubic centimeter
pounds per cubic yard	0.5932	kilograms per cubic meter
pounds per gallon	119.8	kilograms per cubic meter
slugs per cubic foot	515.3	kilograms per cubic meter
ton (long) per cubic yard	1328	kilograms per cubic meter

MOMENT OF INERTIA

Multiply	By	To Obtain
kilograms-square meters	23.73	pounds (mass)-square feet
kilograms-square meters	3417.17	pounds (mass)-square inch
newtons-square seconds-meters	8.851	pounds (force)-square seconds-inches
pounds (force)-square seconds-inches	0.11298	newtons-square seconds-meters
pounds (mass)-square feet	0.04214	kilograms-square meters
pounds (mass)-square inches	$2.926.10^{-4}$	kilograms-square meters

POWER

Multiply	By	To Obtain
British thermal units (International Table) per hour	0.07	gram-calories per second
British thermal units per hour	0.2931	watts
British thermal units per hour	0.2928	watts
British thermal units per minute	0.01757	kilowatts
British thermal units per minute	17.57	watts
British thermal units per second	1054	watts
ergs per second	5.668×10^{-9}	British thermal units per minute
ergs per second	4.426×10^{-6}	foot-pounds per minute
ergs per second	7.3756×10^{-8}	foot-pounds per second
ergs per second	1341×10^{-10}	horsepower
foot-pounds per hour	3.766×10^{-4}	watts
foot-pounds per minute	3.241×10^{-4}	kilogram-calories per minute
foot-pounds per minute	2.260×10^{-5}	kilowatts
foot-pounds per minute	0.02260	watts
foot-pounds per second	0.01945	kilogram-calories per minute
foot-pounds per second	0.001356	kilowatts
foot-pounds per second	1.356	watts
gram-calories per second	14.286	British thermal units per hour
horsepower	1.014	horsepower (metric)
horsepower	10.68	kilogram-calories per minute

Multiply	By	To Obtain
horsepower	0.7457	kilowatts
horsepower (boiler)	9.809	kilowatts
horsepower (boiler)	9809	watts
horsepower (electric)	746.0	watts
horsepower (metric)	0.9863	horsepower
horsepower (metric)	735.5	watts
horsepower (water)	746.0	watts
kilogram-calories per minute	51.43	foot-pounds per second
kilogram-calories per minute	0.09351	horsepower
kilogram-calories per minute	0.06973	kilowatts
kilogram-calories	69.73	watts
kilogram-calories per second	4184	watts
kilowatts	56.92	British thermal units per minute
kilowatts	44260	foot-pounds per minute
kilowatts	737.6	foot-pounds per second
kilowatts	1.341	horsepower
tons (refrigeration)	3516	watts
watts	3.4129	British thermal units per hour
watts	0.05688	British thermal units per minute
watts	44.27	foot-pounds per minute
watts	0.7378	foot-pounds per second
watts	0.001341	horsepower

Note: kilogram-calories also referred to as kilocalories.

PRESSURE OR STRESS

Force per Unit Area

Multiply	By	To Obtain
atmospheres	76	centimeters of mercury (at 0°C)
atmospheres	.76	meters of mercury (at 0°C)
atmospheres	760	millimeters of mercury (at 0°C)
atmospheres	1.0333	kilograms per square centimeter
atmospheres	10333	kilograms per square meter
atmospheres	1.013×10^{5}	pascals
bars	0.9869	atmospheres
bars	2089	pounds per square foot
bars	14.5	pounds per square inch
centimeters of mercury	0.01316	atmospheres
centimeters of mercury	0.4461	feet of meter
centimeters of mercury	27.85	pounds per square foot
centimeters of mercury	0.1934	pounds per square inch
dynes per square centimeter	9.896×10^{-7}	atmospheres
dynes per square centimeter	2.953×10^{-5}	inches of mercury (at 0°C)
dynes per square centimeter	4.015×10^{-4}	inches of water (at 4°C)
feet of water	0.03048	kilograms per square centimeter
feet of water	304.8	kilograms per square meter
feet of water (39.2°F)	2988	pascals

Multiply	By	To Obtain
grams per square centimeter	98.06	pascals
inches of mercury	0.03453	kilograms per square centimeter
inches of mercury	345.3	kilograms per square meter
inches of mercury (32°F)	3386	pascals
inches of mercury (60°F)	3376	pascals
inches of water (at 4°C)	0.00254	kilograms per square centimeter
inches of water (39.2°F)	249.1	pascals
inches of water (60°F)	248.8	pascals
kilograms per square centimeter	0.9678	atmospheres
kilograms per square centimeter	32.81	feet of water
kilograms per square centimeter	28.96	inches of mercury
kilograms per square centimeter	98060	pascals
kilograms per square meter	9.678×10^{-5}	atmospheres
kilograms per square meter	0.003281	feet of water
kilograms per square meter	0.002896	inches of mercury
kilograms per square meter	9.806	pascals
kilopascals	0.14504	pounds per square inch
kips per square inch (ksi)	6.8947	megapascals
kips per square inch (ksi)	6.8947×10^{6}	pascals
megapascals	0.14504	kips per square inch

Multiply	By	To Obtain
ounces per square inch	4309	dynes per square centimeter
pascals	0.02088	pounds per square foot
pascals	1.4504×10^{-4}	pounds per square inch
poundals per square foot	1.488	pascals
pounds per square foot	47.88	pascals
pounds per square inch (psi)	6.8947	kilopascals
pounds per square inch (psi)	6894.7	pascals
tons per square foot	95.76052	kilopascals
	Force per Volume	
kilopascals per meter	6.365	pounds per cubic foot
megapascals per meter	3.6846	pounds per cubic inch
pounds per cubic foot	0.01602	grams per cubic centimeter
pounds per cubic foot	16.02	kilograms per cubic centimeter
pounds per cubic foot	0.1571	kilopascals per meter
pounds per cubic inch	27.68	grams per cubic centimeter
pounds per cubic inch	27680	kilograms per cubic meter
pounds per cubic inch	0.2714	megapascals per meter

TEMPERATURE

Celsius degrees or kelvins	1.8	Fahrenheit degrees

Use following formula to obtain Fahrenheit degrees from Celsius readings:

$$F = 1.8\ (C) + 32$$

To obtain Fahrenheit readings from kelvins, use the following formula:

$$F = 1.8\ (K-273.15) + 3$$

Fahrenheit degrees	0.555	Celsius degrees or kelvins

To obtain Celsius readings from Fahrenheit readings, use the following formula:

$$C = 0.555\ (F-32)$$

To obtain kelvin readings use the following formula:

$$K = 0.555\ (F+459.67)$$

VELOCITY

Multiply	By	To Obtain
centimeters per minute	0.3937	inches per minute
centimeters per second	1.969	feet per minute
centimeters per second	0.03281	feet per second
centimeters per second	0.01943	knots
centimeters per second	0.02237	miles per hour
centimeters per second	3.728×10^{-4}	miles per minute
degrees per second	0.01745	radians per second
degrees per second	0.1667	revolutions per minute
degrees per second	0.002778	revolutions per second
feet per minute	0.5080	centimeters per second
feet per minute	0.01829	kilometers per hour
feet per minute	0.3048	meters per minute
feet per second	30.48	centimeters per second
feet per second	1.097	kilometers per hour
feet per second	18.29	meters per minute
feet per hour	8.466×10^{-5}	meters per second
inches per minute	2.54	centimeters per minute
inches per second	0.0254	meters per second
kilometers per hour	54.68	feet per minute
kilometers per hour	0.9113	feet per second
kilometers per hour	0.5396	knots
kilometers per hour	0.6214	miles per hour
knots	1.852	kilometers per hour
knots	51.44	centimeters per second
knots	0.5144	meters per second
meters per minute	3.281	feet per minute
meters per minute	0.05468	feet per second

Multiply	By	To Obtain
meters per minute	0.0324	knots
meters per minute	0.03728	miles per hour
meters per second	196.8	feet per minute
meters per second	3.281	feet per second
meters per second	1.944	knots
meters per second	2.237	miles per hour
meters per second	372.8	miles per minute
meters per second	6.2137×10^{-4}	miles per second
miles per hour	44.7	centimeters per second
miles per hour	1.6093	kilometers per hour
miles per hour	0.02682	kilometers per minute
miles per hour	26.82	meters per minute
miles per hour	0.477	meters per second
miles per minute	2682	centimeters per second
miles per minute	1.6093	kilometers per minute
miles per minute	26.82	meters per second
miles per second	1609.34	meters per second

VISCOSITY

Multiply	By	To Obtain
centipoise	2.4	pounds per feet-hours
centipoise	6.72×10^{-4}	pounds per feet-seconds
square feet per second	0.0929	square meters per second
poundal-seconds per square feet	1.488	pascal seconds
pounds per feet-hours	4.133×10^{-4}	pascal seconds
pounds per feet-seconds	1.488	pascal seconds
pound-seconds per square feet	47.88	pascal seconds
slugs per feet-seconds	47.88	pascal seconds

VOLUME PER UNIT TIME (INCLUDES FLOW)

Multiply	By	To Obtain
cubic centimeters per minute	0.06102	cubic inches per minute
cubic feet per minute	472	cubic centimeters per second
cubic feet per minute	0.4720	liters per second
cubic feet per minute	0.02832	cubic meters per minute
cubic feet per minute	4.719×10^{-4}	cubic meters per second
cubic feet per second	0.02832	cubic meters per second
cubic inches per minute	16.3871	cubic centimeters per minute
cubic inches per minute	2.731×10^{-7}	cubic meters per second
cubic meters per hour	1.30795	cubic yards per hour
cubic meters per minute	35.315	cubic feet per minute
cubic meters per minute	264.172	gallons per minute
cubic meters per second	35.315	cubic feet per second
cubic yards per hour	0.7645	cubic meters per hour
cubic yards per minute	0.01274	cubic meters per second
cubic yards per minute	12.74	liters per second
gallons (liquid) per day	4.381×10^{-8}	cubic meters per second
gallons per minute	8.0208	cubic feet per hour
gallons per minute	0.002228	cubic feet per second
gallons per minute	0.003785	cubic meters per minute
gallons per minute	6.309×10^{-5}	cubic meters per second
gallons per minute	0.06308	liters per second

WIRE SIZES[1]

Solid Building Wire Sizes

AWG	Diameter (inches)	Diameter (millimeters)	Nearest ISO R20 (millimeters)	Area difference (percent)
14	0.0641	1.63	1.60	-3.37
12	0.0808	2.05	2.00	-5.05
10	0.1019	2.59	2.50	-6.83
8	0.1285	3.26	3.15	-6.63
6	0.1620	4.12	4.00	-5.74

Building Wire Sizes

English and German				U.S.A.		
Area (millimeter)^2	Diameter (millimeter)	Diameter (inches)	Ampere rating	AWG	Diameter (inches)	Ampere rating
1.0	1.13	0.0445	11			
1.5	1.38	0.0543	13			
2.5	1.78	0.0701	18	14	0.0641	15
4.0	2.25	0.0886	24	12	0.0808	20
6.0	2.76	0.1087	31	10	0.1019	25
10.0	3.57	0.1406	42	8	0.1285	35
				6	0.1620	45

[1]*From American National Metric Council Metric Conversion Paper 7, Development of Metric Standards for Wire, Harry M. Specht, Technical Director, Phelps Dodge Copper Products Co. Reprinted by permission. Copies available from American National Metric Council, 1625 Massachusetts Ave., N.W., Washington, D.C. 20036 at $2.00 each, four copies for $5.00.*

Power Cable	
Area, square millimeters	Area, centimeters
10	19 740
16	31 580
25	49 340
35	69 080
50	98 680
70	138 100
95	187 500
120	236 800
150	296 000
185	365 100
240	473 600
300	592 100
400	789 400
500	986 800
630	1 243 300
800	1 578 800
1000	1 973 500

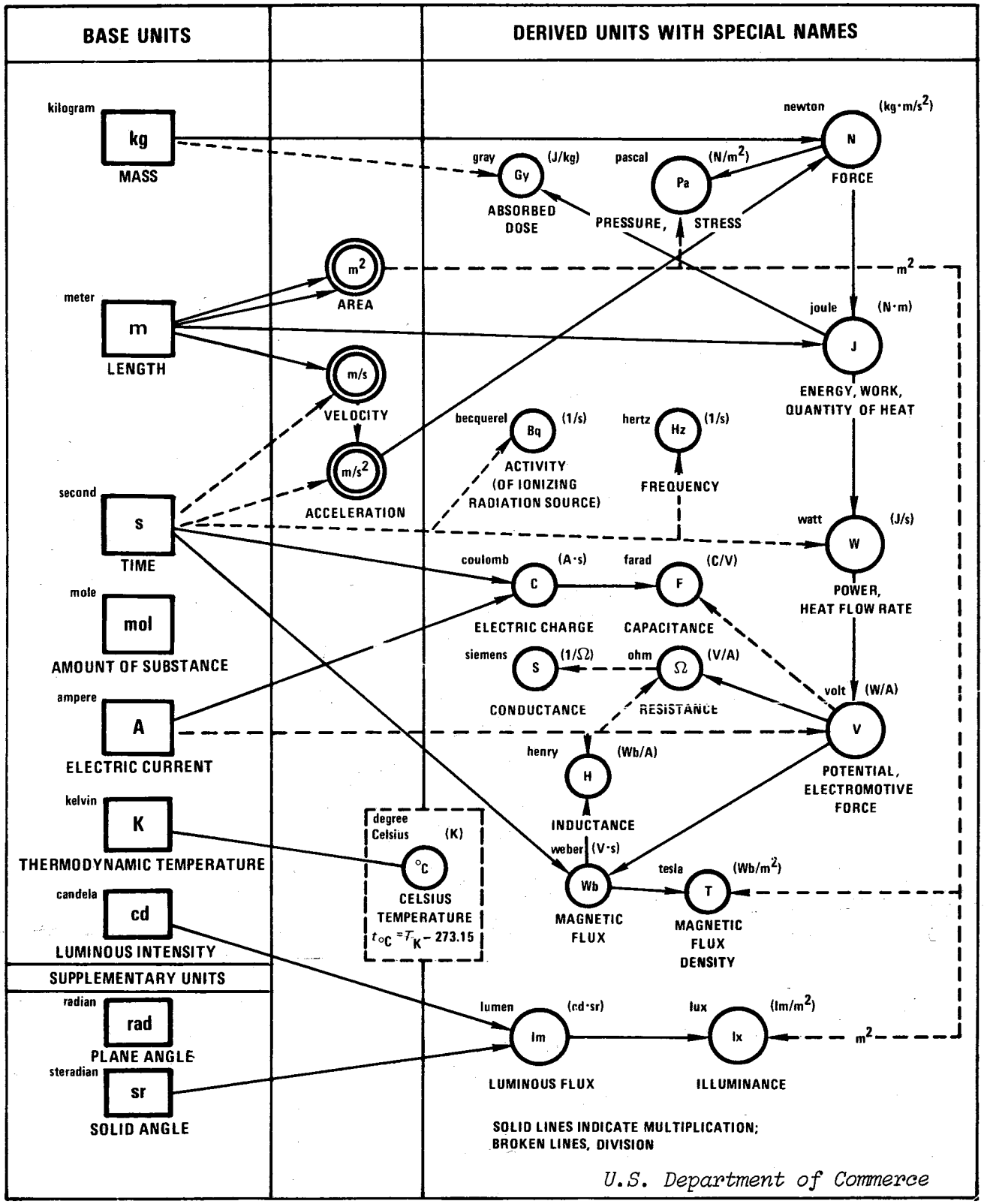
Telephone Wires

U.S.A.			German		British	
	Diameter		Diameter		Diameter	
AWG	(inches)	(millimeters)	(inches)	(millimeters)	(inches)	(millimeters)
19	0.0359	0.912	0.0354	0.9	0.0354	0.9
			0.0315	0.8		
22	0.0253	0.644			0.0248	0.63
			0.0236	0.6		
24	0.0201	0.511			0.0197	0.5
26	0.0159	0.405	0.0157	0.4	0.0157	0.4

Smaller Magnet Wire Sizes

Present U.S. Sizes			Nearest ISO R20 (millimeters)	Area difference (percent)
AWG	Diameter (inches)	Diameter (millimeters)		
20	0.0320	0.812	0.800	-2.89
22	0.0253	0.644	0.630	-4.24
24	0.0201	0.511	0.500	-4.09
26	0.0159	0.405	0.400	-2.40
28	0.0126	0.321	0.315	-3.76
30	0.0100	0.255	0.250	-3.61
32	0.0080	0.202	0.200	-1.91
34	0.0063	0.160	0.160	-0.17
36	0.0050	0.127	0.125	-3.12
38	0.0040	0.101	0.100	-1.42
40	0.0031	0.080	0.080	+0.32
42	0.0025	0.063	0.063	-1.07
44	0.0020	0.0502	0.050	-0.92
46	0.00157	0.0398	0.040 (0.0400)	+0.83 (+0.83)
48	0.00124	0.0316	0.032 (0.0315)	+2.61 (-0.63)
50	0.00099	0.0251	0.025 (0.0250)	-0.42 (-0.42)
52	0.00078	0.0199	0.020 (0.0200)	+1.33 (+1.33)
54	0.00062	0.0158	0.016 (0.0160)	+3.12 (+3.12)
56	0.00049	0.0125	0.012 (0.0125)	-7.77 (0.0)

The metric AWG is recalculated in mm then rounded off to the same degree as ASTM

* U.S. GOVERNMENT PRINTING OFFICE : 1977 0-241-426/2

RELATIONSHIPS OF SI UNITS WITH NAMES