

**A DICTIONARY
FOR UNIT
CONVERSION**

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FOREWORD

At a time when, in most countries of the world, the process of standardization of measurement units to be consistent with the metric system is well underway, it may seem strange to the reader of Dr. Chiu's handbook that there is any need for such a book. However, only cursory inspection of foreign and domestic literature of engineering will easily persuade the reader that the development of hybrid units has created the need for a lexicon of the type represented by the present volume. As the author suggests its utility is not confined just to engineers and scientists but it should also be useful to anyone who requires quantified physical information, and Dr. Chiu is to be recommended for his efforts in making this dictionary for unit conversion available to the public at large.

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PREFACE

Conversion of measurement units is always troublesome, not only for the professionals and students of engineering and technology, but also in our everyday life. The numerous units related to length, area, volume, mass, weight, force, time, or combinations of them, generally cause confusion. For example, when you drive a car across the border to Canada and stop to buy a gallon of gasoline you may feel it more expensive than in the United States, but can you tell the difference between Canadian gallon and U.S. gallon and convert it back to dollars per U.S. gallon without hesitation? Or when you stay a year abroad in Japan and are going to rent a house, you will be informed the size of the house in tsubo, can you tell how large the house is? By the time you get your answer after looking up several conversion tables one after another, however you will have spent much important time and energy.

In order to avoid confusion in our everyday life and to reduce unnecessary effort, the author compiled this dictionary for unit conversion. The book integrates measurement units, domestic and foreign, as many as possible, from different areas and fields into one volume. All the units, British or metric, a hybrid or other origin, are gathered together and arranged in alphabetic order. A unit may have several different names, however the book is so organized that all of them are readily accessible just as found in the library call card system.

This book, A Dictionary for Unit Conversion, is a completely unique volume of its kind. It is prepared for use in school, in the office, and in the home. Students, teachers, managers, and housewives will find this volume as a best companion. It will be indispensable to engineering students and practitioners. With the worldwide transition to the metric system, the vital need for this publication is becoming increasingly evident. The author hopes that this volume will serve to save your time and energy when performing unit conversions.

Many sources supply materials for this book. The contributions, especially from the following publications, are gratefully acknowledged.

"Unit of Weights and Measures(United States Customary and Metric): Definitions and Tables of Equivalents," U.S. National Bureau of Standards Misc. Publ. MP 286, May 1967

"A Dictionary of Scientific Units," by H. G. Jerrard and D. B. McNeill, Franklin Publishing Co., Inc., Englewood, N.J. 1964

"Metric Practice Guide," American Society for Testing and Materials Publ. E380-74, November 1974

"Conversion Factors and Tables," by J. A. M. Gaboury, Montreal, Canada, 1968

"A Dictionary of English Weights and Measures," by R. E. Zupko, The University of Wisconsin Press, Madison, Milwaukee, and London, 1968

"A Dictionary of Units," Rateis, Inc., Tokyo, Japan, 1971

"The Metric System," by A. J. Mettler, a Reprint from Engineering Digest, Canada, September 1972

"System of Units," by C. F. Kayan(ed.), American Association for the Advancement of Science Publ. 57, 1959

Yishu Chiu

EXPLANATORY NOTES

- * The names of the units are arranged in alphabetic order, word by word. Words joined by a hyphen are treated as a single word, thus Foot-candle follows Foot per second per second.
- * A unit set flush with the left-hand margin of each page, which begins with a capital letter and is underlined, is a main entry. The main entry unit is related to various other units by a corresponding conversion factor. For example:

Abampere = ampere x 1.000(+1)

- * Values of the conversion factors, whenever possible, are written to four significant figures. The values are written in the formats x.xxx(+x), x.xxx(-x), or x.xxx(0), which respectively mean x.xxx times 10 to the power (+x), (-x), or (0). For example:

$$1.234(+5) = 1.234 \times 10^{+5} = 123,400$$

$$1.234(-5) = 1.234 \times 10^{-5} = 0.00001234$$

$$1.234 (0) = 1.234 \times 10^0 = 1.234$$

- * Those units which are underlined, but not main entries, are units with names other than English.
- * The notations 1), 2), and 3), which appears immediately under the name of the unit as a main entry indicate the following:
 - 1): Abbreviations or symbols for the unit
 - 2): Measurements of the unit
 - 3): Additional explanations for the unit

- * The same units may have different measurements. For example:

Quart: A volume unit; liquid or dry

Mile: A length unit; statute or nautical

Ounce: A mass and weight unit;
avoirdupois, apothecary, or troy

British thermal unit: A heat energy unit;
thermochemical, International Steam Table,
mean, or 60°F

Unless specified, they always indicate liquid volume, statute length, avoirdupois mass and weight, and thermochemical heat energy.

- * A unit for mass is also used for weight or force. However, a strict distinction is made between them as shown in this book. Thus a weight or force unit is always accompanied by the word, force. For example:

Pound(force) or pound-force: Weight or force unit

Pound: Mass unit

LIST OF ABBREVIATIONS*

ap.: apothecary
av.: avoirdupois
Br: British
CGS: centimeter-gram-second
Int.: International
IST: International Steam Table
MKS: meter-kilogram-second
var.: variant
°C, degree Celsius or degree centigrade
°F: degree Fahrenheit

* excluding those listed in Item 2 under the main entry unit

<u>Abampere</u>	= ampere	x 1.000(+1)
	coulomb per second	1.000(+1)
1) abamp	electromagnetic CGS unit of current	1.000 (0)
2) electric current	faraday per second	1.036(-4)
	statampere	2.998(+10)

<u>Abampere per square centimeter</u>	= abampere per square inch	x 6.452 (0)
	ampere per circular mil	5.067(-5)
	ampere per circular millimeter	7.854(-2)
1) abamp/cm ²	ampere per square centimeter	1.000(+1)
	ampere per square inch	6.452(+1)
2) electric current per unit area	ampere per square millimeter	1.000(-1)

<u>Abampere-turn</u>	= ampere-turn	x 1.000(+1)
	gilbert	1.257(+1)
1) abamp-turn	statampere-turn	2.998(+10)
2) magnetomotive force		

<u>Abbas</u>	= grain	x 2.25 (0)
	gram	1.46 (-1)
	milligram	1.46 (+2)
1) -	ounce(ap. or troy)	4.69 (-3)
2) mass	ounce(av.)	5.14 (-3)
3) Iranian measure for pearl	pound(ap. or troy)	3.91 (-4)
	pound(av.)	3.21 (-4)

<u>Abbasi</u>	= grain	x 5.69 (+3)
	gram	3.69 (+2)
	hectogram	3.69 (0)
1) -	ounce(ap. or troy)	1.19 (+1)
2) mass	ounce(av.)	1.30 (+1)
3) Iranian	pound(ap. or troy)	9.88 (-1)
	pound(av.)	8.13 (-1)
	<u>ser</u>	5.000 (0)

<u>Abcoulomb</u>	= ampere-hour	x 2.778(-3)
	coulomb	1.000(+1)
1) abcoul	electronic charge	6.242(+19)
	electromagnetic CGS unit of charge	1.000 (0)
2) electric charge	electrostatic CGS unit of charge	2.998(+10)
	faraday	1.036(-4)
	statcoulomb	2.998(+10)

<u>Abcoulomb per kilogram (force)</u>	= abcoulomb per gram(force)	x 1.000(-3)
	coulomb per gram(force)	1.000(-2)
1) abcoul/kg _f	electronic charge per gram(force)	6.242(+16)
2) electric charge per unit force	statcoulomb per dyne	3.057(+4)

<u>Abcoulomb per pound (force)</u>	= abcoulomb per kilogram(force)	x 2.205 (0)
	coulomb per gram(force)	2.205(-2)
1) abcoul/lb _f	electronic charge per gram(force)	1.376(+17)
2) electric charge per unit force	statcoulomb per dyne	6.739(+4)

<u>Abfarad</u>	= farad	x 1.000(+9)
	electromagnetic CGS unit of capacitance	1.000 (0)
1) abF	microfarad	1.000(+15)
2) electric capacitance	statfarad	8.988(+20)

<u>Abhenry</u>	= electromagnetic CGS unit of inductance	x 1.000 (0)
	henry	1.000(-9)
1) abH	millihenry	1.000(-6)
2) inductance	stathenry	1.113(-21)

<u>Abmho</u>	= electromagnetic CGS unit of conductance	x 1.000 (0)
1) -	megamho	1.000(+3)
	mho	1.000(+9)
2) electric conductance	siemens	1.000(+9)
	statmho	8.988(+20)

<u>Abohm</u>	= electromagnetic CGS unit of resistance	x 1.000 (0)
1) -	megaohm	1.000(-15)
	microhm	1.000(-3)
2) electric resistance	milliohm	1.000(-6)
	ohm	1.000(-9)
	statohm	1.113(-21)

<u>Abohm-centimeter</u>	= circular mil-ohm per foot	x 6.015(-3)
	electromagnetic CGS unit of resistivity	1.000 (0)
1) abohm-cm	microhm-inch	3.937(-4)
2) electric resistivity	ohm-centimeter	1.000(-9)
	ohm-meter	1.000(-11)

<u>Abvolt</u>	= electromagnetic CGS unit of electric potential	x 1.000 (0)
1) -	kilovolt	1.000(-11)
	microvolt	1.000(-2)
2) electric potential	millivolt	1.000(-5)
	statvolt	3.336(-11)
	volt	1.000(-8)

<u>Abvolt per centimeter</u>	= electromagnetic CGS unit of electric field intensity	x 1.000 (0)
1) abvolt/cm	volt per centimeter	1.000(-8)
	volt per foot	3.048(-7)
2) electric field intensity	volt per inch	2.540(-8)
	volt per meter	1.000(-6)

<u>Abvolt per degree Fahrenheit</u>	= abvolt per degree centigrade	x 1.800 (0)
	microvolt per degree centigrade	1.800(-2)
1) abvolt/°F	statvolt per degree centigrade	5.999(-11)
2) -	volt per degree centigrade	1.800(-8)
<u>Abvolt per inch</u>	= abvolt per centimeter	x 3.937(-1)
	microvolt per centimeter	3.937(-3)
1) abvolt/in.	volt per centimeter	3.937(-9)
2) electric field intensity	volt per foot	1.200(-7)
	volt per inch	1.000(-8)
	volt per meter	3.937(-7)
<u>Achtel</u>	= cubic foot	x 2.714(-1)
	cubic inch	4.690(+2)
	cubic meter	7.686(-3)
1) -	gallon(Br.)	1.691 (0)
2) volume	gallon(U.S.; dry)	1.745 (0)
	gallon(U.S.; liquid)	2.030 (0)
3) old Austrian measure	liter	7.686 (0)
	<u>Metze</u>	1.250(-1)
	quart(Br.)	6.763 (0)
	quart(U.S.; dry)	6.980 (0)
	quart(U.S.; liquid)	8.122 (0)
<u>Acre</u>	= are	x 4.047(+1)
	<u>cho</u>	4.080(-1)
1) ac	hectare	4.047(-1)
2) area	<u>heihou ri</u>	2.624(-4)
	rood	4.000 (0)
	<u>se</u>	4.080(+1)
	square centimeter	4.047(+7)
	square chain(surveyor's or Gunter's)	1.000(+1)
	square decameter	4.047(+1)
	square dekameter	4.047(+1)
	square foot	4.356(+4)
	square hectometer	4.047(-1)
	square inch	6.273(+6)
	square kilometer	4.047(-3)
	square link(surveyor's or Gunter's)	1.000(+5)
	square meter	4.047(+3)
	square mile	1.563(-3)
	square perch	1.600(+2)
	square rod	1.600(+2)
	square yard	4.840(+3)
	<u>tan</u>	4.080 (0)
	<u>tsubo</u>	1.224(+3)

<u>Acre-foot</u>	= cubic foot	x 4.356(+4)
	cubic inch	7.527(+7)
	cubic meter	1.233(+3)
	cubic yard	1.613(+3)
1) acre-ft; AF		
2) volume	gallon(Br.)	2.713(+5)
	gallon(U.S.)	3.259(+5)
3) water storage required to cover an area of one acre to a depth of one foot	inch depth on one square mile	1.875(-2)
	inch-square mile	1.875(-2)
	kiloliter	1.233(+3)
	liter	1.233(+6)
	million gallon(Br.)	2.713(-1)
	million gallon(U.S.)	3.259(-1)
	second-foot-day	5.042(-1)

<u>Acre-foot per day</u>	= acre-inch per hour	x 5.000(-1)
	cubic foot per hour	1.815(+3)
	cubic foot per minute	3.025(+1)
	cubic foot per second	5.042(-1)
	cubic meter per hour	5.142(+1)
	cubic meter per minute	8.569(-1)
	cubic meter per second	1.428(-2)
	cubic yard per hour	6.721(+1)
	cubic yard per minute	1.120 (0)
	cubic yard per second	1.867(-2)
	gallon(Br.) per hour	1.130(+4)
	gallon(U.S.) per hour	1.358(+4)
	gallon(Br.) per minute	1.884(+2)
	gallon(U.S.) per minute	2.263(+2)
	gallon(Br.) per second	3.140 (0)
	gallon(U.S.) per second	3.772 (0)
	liter per second	1.428(+1)
	million gallon(Br.) per day	2.713(-1)
	million gallon(U.S.) per day	3.259(-1)

<u>Acre-inch</u>	= cubic foot	x 3.630(+3)
	cubic inch	6.273(+6)
	cubic meter	1.028(+2)
	cubic yard	1.345(+2)
1) acre-in.		
2) volume	gallon(Br.)	2.261(+4)
	gallon(U.S.)	2.715(+4)
3) water storage required to cover an area of one acre to a depth of one inch	inch depth on one square mile	1.563(-3)
	inch-square mile	1.563(-3)
	kiloliter	1.028(+2)
	liter	1.028(+5)
	million gallon(Br.)	2.261(-2)
	million gallon(U.S.)	2.715(-2)
	second-foot-day	4.202(-2)

<u>Acre-inch per hour</u>	= acre-foot per day	x 2.000 (0)
1) acre-in./hr	cubic foot per hour	3.630(+3)
2) volume flow rate	cubic foot per minute	6.050(+1)
	cubic foot per second	1.008 (0)
	cubic meter per hour	1.028(+2)
	cubic meter per minute	1.714 (0)
	cubic meter per second	2.856(-2)
	cubic yard per hour	1.344(+2)
	cubic yard per minute	2.240 (0)
	cubic yard per second	3.734(-2)
	gallon(Br.) per hour	2.260(+4)
	gallon(U.S.) per hour	2,716(+4)
	gallon(Br.) per minute	3.768(+2)
	gallon(U.S.) per minute	4.526(+2)
	gallon(Br.) per second	6.280 (0)
	gallon(U.S.) per second	7.544 (0)
	liter per second	2.856(+1)
	million gallon(Br.) per day	3.426(-1)
	million gallon(U.S.) per day	6.518(-1)
<u>Adarme</u>	= grain	x 2.774(+1)
	gram	1.797 (0)
1) -	ounce(ap. or troy)	5.779(-2)
2) mass	ounce(av.)	6.341(-2)
	<u>onza</u>	6.250(-2)
3) Spanish;	pound(ap. or troy)	4.815(-3)
Mexican	pound(av.)	3.963(-3)
<u>Adhaka</u>	= cubic foot	x 1.4 (-1)
	cubic inch	2.5 (+2)
	cubic meter	4.1 (-3)
1) -	<u>drona</u>	2.500(-1)
2) volume	liter	4.1 (0)
3) ancient Indian	quart(Br.)	3.6 (0)
	quart(U.S.; dry)	3.7 (0)
	quart(U.S.; liquid)	4.4 (0)
<u>Adpao</u>	= grain	x 1.73 (+3)
	gram	1.12 (+2)
1) -	ounce(ap. or troy)	3.60 (0)
2) mass	ounce(av.)	3.07 (0)
	pound(ap. or troy)	3.00 (-1)
3) Indian	pound(av.)	2.46 (-1)
<u>Alada</u>	= grain	x 2.407(+2)
	gram	1.560(+1)
1) -	<u>kasm</u>	4.000 (0)
2) mass	ounce(ap. or troy)	5.015(-1)
	ounce(av.)	5.503(-1)
3) Ethiopian	pound(ap. or troy)	4.180(-2)
	pound(av.)	3.527(-2)

<u>Alin</u>	= centimeter	x 6.278(+1)
	<u>fet</u>	2.000 (0)
1) -	foot	2.060 (0)
2) length	inch	2.472(+1)
3) ancient Icelandic	meter	6.278(-1)
	yard	6.866(-1)

<u>Ampere</u>	= abampere	x 1.000(-1)
	coulomb per second	1.000 (0)
1) amp; A	electromagnetic CGS unit of current	1.000(-1)
2) electric current	electrostatic CGS unit of current	2.998(+9)
3) absolute	faraday per second	1.036(-5)
	microampere	1.000(+6)
	milliampere	1.000(+3)
	statampere	2.998(+9)

<u>Ampere(Int.)</u>	= ampere	x 9.998(-1)
	coulomb per second	9.998(-1)
1) amp; A	faraday per second	1.034(-5)
2) electric current		

<u>Ampere per meter</u>	= CGS unit of surface current density	x 1.000(-2)
	electromagnetic CGS unit of surface current density	1.000(-3)
1) amp/m; A/m	MKS unit of surface current density	1.000 (0)
2) volume current density	oersted	1.257(-2)

<u>Ampere per square centimeter</u>	= abampere per square centimeter	x 1.000(-1)
	abampere per square inch	6.452(-1)
	ampere per square inch	6.452 (0)
1) amp/cm ² ; A/cm ²	statampere per square centimeter	2.998(+9)
2) volume current density	statampere per square inch	1.934(+10)

<u>Ampere per square inch</u>	= abampere per square centimeter	x 1.550(-2)
	abampere per square inch	1.000(-1)
	ampere per square centimeter	1.550(-1)
1) amp/in. ² ; A/in. ²	statampere per square centimeter	4.647(+8)
2) volume current density	statampere per square inch	2.998(+9)

<u>Ampere per square meter</u>	= CGS unit of volume current density	x 1.000(-4)
	electromagnetic CGS unit of volume current density	1.000(-5)
1) amp/m ²	MKS unit of volume current density	1.000 (0)
2) volume current density		

<u>Ampere per square mil</u>	= abampere per square centimeter	x 1.550(+4)
	abampere per square mil	1.000(-1)
	ampere per square centimeter	1.550(+5)
1) amp/mil ²	ampere per square inch	1.000(+6)
2) surface current density	statampere per square mil	2.998(+9)

<u>Ampere-hour</u>	= abcoulomb	x 3.600(+2)
	coulomb	3.600(+3)
1) amp-hr	faraday	3.731(-1)
2) electric charge	MKS unit of electric charge	3.600(+3)
	statcoulomb	1.079(+13)

<u>Ampere-turn</u>	= abampere-turn	x 1.000(-1)
	CGS unit of magnetomotive force	1.257 (0)
1) amp-turn; AT	electromagnetic CGS unit of magnetomotive force	1.257 (0)
2) magnetomotive force	gilbert	1.257 (0)

<u>Ampere-turn per centimeter</u>	= abampere-turn per centimeter	x 1.000(-1)
	abampere-turn per inch	2.540(-1)
	abampere-turn per millimeter	1.000 (0)
	ampere-turn per inch	2.540(0)
1) amp-turn/cm	gilbert per centimeter	1.257 (0)
2) magnetomotive force per unit length	oersted	1.257 (0)

<u>Ampere-turn per inch</u>	= abampere-turn per centimeter	x 3.937(-2)
	abampere-turn per inch	1.000(-1)
	ampere-turn per centimeter	3.937(-1)
1) amp-turn/in.	gilbert per centimeter	4.950(-1)
2) magnetomotive force per unit length	oersted	4.950(-1)

<u>Ampere-turn per meter</u>	= abampere-turn per centimeter	x 1.000(-3)
	abampere-turn per inch	2.540(-3)
	abampere-turn per meter	1.000(-1)
	ampere-turn per inch	2.540(-2)
1) amp-turn/m	gilbert per meter	1.257 (0)
2) magnetomotive force per unit length	oersted	1.257(-2)

<u>Ampere-turn per weber</u>	= CGS unit of reluctance	x 1.257(-8)
	electrostatic CGS unit of reluctance	1.129(+13)
1) amp-turn/wb	gilbert per maxwell	1.257(-8)
2) electromagnetic reluctance	gilbert per weber	1.257 (0)

<u>Angstrom</u>	= centimeter	x 1.000(-8)
	fermi	1.000(+5)
	foot	3.281(-10)
1) λ ; λ	inch	3.937(-9)
2) length	meter	1.000(-10)
	micrometer	1.000(-4)
	micromicron	1.000(+2)
3) measure for atomic distance, electromagnetic wavelength, etc.	micromillimeter	1.000(-1)
	micron	1.000(-4)
	mil	3.937(-6)
	millimeter	1.000(-7)
	millimicron	1.000(-1)
	millionth-inch	3.937(-3)
	millionth-micron	1.000(+2)
	nanometer	1.000(-1)
	picometer	1.000(+2)
	tenthmeter	2.000 (0)
	thousandth-inch	3.937(-6)
	yard	1.094(-10)
	yukawa	1.000(+5)

<u>Anukabiet</u>	= foot	x 8.53 (-3)
	inch	1.03 (-1)
1) -	meter	2.60 (-3)
2) length	millimeter	2.60 (0)
3) Thai	<u>wah</u>	1.302(-3)

<u>Apatan</u>	= <u>chupa</u>	x 2.500(-1)
	cubic centimeter	9.4 (+1)
	cubic inch	5.7 (0)
1) -	cubic meter	9.4 (-5)
2) volume	liter	9.4 (-2)
3) Philippine	milliliter	9.4 (+1)

<u>Apostilb</u>	= candela per square foot	x 2.957(-2)
	candela per square inch	2.054(-4)
	candela per square meter	3.183(-1)
1) asb	foot-lambert	9.294(-2)
2) luminance;	lambert	1.000(-4)
photometric	lumen per square meter	1.000 (0)
brightness	millilambert	1.000(-1)
	nit	3.183(-1)
	stilb	3.183(-5)

<u>Apt</u>	= cubic foot	x 8.44 (-1)
	cubic inch	1.46 (+3)
	cubic meter	2.39 (-2)
1) -	cubic yard	3.13 (-2)
2) volume	gallon(Br.)	5.26 (0)
	gallon(U.S.; dry)	5.43 (0)
3) ancient Egyptian	gallon(U.S.; liquid)	6.31 (0)
	liter	2.39 (+1)

<u>Aranzada</u>	= acre	x 1.105 (0)
	are	4.472(+1)
	square foot	4.814(+4)
1) -	square meter	4.472(+3)
2) area	square mile	1.727(-3)
	square yard	5.348(+3)
3) Spanish	<u>vara</u> squared	6.400(+3)

<u>Are</u>	= acre	x 2.471(-2)
	hectare	1.000(-2)
1) a	<u>se</u>	1.008 (0)
	square decameter(or square dekameter)	1.000 (0)
2) area	square foot	1.076(+3)
	square inch	1.550(+5)
3) used especially	square meter	1.000(+2)
in agriculture	square mile	3.861(-5)
	square yard	1.196(+2)