

**P · A · R · T · E**

# **APPENDIXES**

---

# APPENDIX E1

---

# CONVERSION TABLES

---

**Ervin L. Geiger, P.E.**  
*Engineering Supervisor*  
*Bechtel Power Corporation*  
*Frederick, Maryland*

**TABLE E1.1** Conversion Factors—Frequently Used U.S. Customary Units to SI Standard Units

To convert	To	Multiply by	To convert	To	Multiply by
Acceleration			Power		
Feet per sq second	Meters per sq second	0.3048	Btu per second	Watt	1054.350
Area			Foot pounds per second	Watt	1.355818
Square feet	Square meters	0.09290304	Horsepower	Watt	746.
Energy			Pressure		
Btu	Joule	1055.06	Atmosphere	Newtons per sq meter	101325.0
Calorie	Joule	4.19002	Bar	Newtons per sq meter	100000.
Foot pound	Joule	1.355818	Kilogram per sq cm	Newtons per sq meter	98066.50
Watthour	Joule	3600.355818	Pounds per sq in.	Newtons per sq meter	6894.757
Force			Torr (mm Hg 0°C)	Newtons per sq meter	133.322
Dyne	Newton	0.00001	Viscosity		
Kilogram	Newton	9.80665	Centipoise	Newton second per meter	0.001
Pound	Newton	4.448222	Pounds per foot second	Newton second per meter	1.488164
Length			Volume		
Foot	Meter	0.3048000	Cubic foot	Cubic meter	0.02831685
Mile (U.S. statute)	Meter	1609.344	Gallon (U.S. liquid)	Cubic meter	0.003785412
Mass					
Pound	Kilogram	0.4535924			
Slug	Kilogram	14.59390			
Ton (2000 lb)	Kilogram	907.1847			

**TABLE E1.2** Mass Equivalents

To obtain →, multiply ↓, by ↘	Pound (avdp)	Ounce (avdp)	Gram	Kilogram	Slug	Ton (short)*
Pound (avdp)	1	16	453.6	0.4536	0.0310	0.0005
Ounce (avdp)	0.0625	1	28.3495		0.0019	
Gram	0.0022	0.0353	1	0.001	68.5 E-5	
Kilogram	2.2046	35.274	1000	1	0.0685	0.0011
Slug	32.174	514.784	1.459 E+4	14.5939	1	
Ton (short)*	2000			907.185		1

\* 1 short ton = 0.8926 long tons.

1 short ton = 0.9072 metric tons.

**TABLE E1.3** Length Equivalents

To obtain →, multiply ↓, by ↘	Inch	Foot	Miles (statute)	Millimeter	Centimeter	Meter	Kilometer
Inch	1	0.08333		25.4	2.54	0.0254	
Foot	12	1		304.8	30.48	0.3048	
Mile (statute)	63360	5280	1			1609.344	1.609344
Millimeter	0.03937	0.003281		1	0.1	0.001	
Centimeter	0.3937	0.032808		10	1	0.01	
Meter	39.3701	3.28084		1000	100	1	0.001
Kilometer	39,370	3280.8	0.62137		100,000	1000	1

**TABLE E1.4** Area Equivalents

To obtain →, multiply ↓, by ↘	Square inch	Square foot	Acre	Square millimeter	Square centimeter	Square meter
Square inch	1	0.006944		645.16	6.4516	0.00064516
Square foot	144	1	2.2956 E-5	92903.04	929.0304	0.09290
Acre		43560	1			4046.8564
Square millimeter	0.00155			1	0.01	1 E-6
Square centimeter	0.1550	0.001076	2.5 E-8	100	1	0.0001
Square meter	1550.0031	10.76391	0.000247	1 E+6	10,000	1

**TABLE E1.5** Volume Equivalents

To obtain →, multiply ↓, by ↘	U.S. gallon	Imperial gallon	Cubic inch	Cubic foot	Liter	Cubic meter	Barrel (oil)
U.S. gallon	1	0.83267	231	0.13368	3.7853	0.00378	0.02381
Imperial gallon	1.2009	1	277.42	0.16054	4.5459	0.00455	0.02859
Cubic inch	0.004329	0.003604	1	0.000579	0.0164	0.000016	0.00010
Cubic foot	7.4805	6.2288	1728	1	28.316	0.02832	0.17813
Liter	0.26418	0.21997	61.025	0.0353	1	0.001	0.00629
Cubic meter	264.17	219.97	61023.74	35.3147	1000	1	6.2899
Barrel (oil)*	42	34.977	9702.00	5.614	158.983	0.15876	1

\* The capacity of a barrel varies with industries as follows:

1 barrel of beer = 31 U.S. gallons

1 barrel of wine = 31.5 U.S. gallons

1 barrel of oil = 42 U.S. gallons

1 barrel of whiskey = 45 U.S. gallons

**TABLE E1.6** Volumetric Flow Rate Equivalents

To obtain →, multiply ↓, by ↘	U.S. gallons per minute	Imperial gallons per minute	U.S. million gallons per day	Cubic feet per second	Cubic meter per hour	Liter per second	Barrel (42 gallons) per minute	Barrel (42 gallons) per day
U.S. gallons per minute	1	0.8327	0.00144	0.00223	0.2271	0.0631	0.0238	34.286
Imperial gallons per minute	1.201	1	0.00173	0.002676	0.2727	0.0758	0.02859	41.176
U.S. million gallons per day	694.4	578.25	1	1.547	157.7	43.8	16.53	23810
Cubic feet per second	448.83	373.7	0.646	1	101.9	28.32	10.686	15388
Cubic meters per second	15850	13199	22.83	35.315	3600	1000	377.4	543447
Cubic meters per minute	264.2	220	0.3804	0.5886	60.0	16.667	6.290	9058
Cubic meters per hour	4.403	3.67	0.00634	0.00982	1	0.2778	0.1048	151
Liter per seconds	15.85	13.20	0.0228	0.0353	3.60	1	0.3773	543.3
Liter per minute	0.2642	0.220	0.000380	0.000589	0.060	0.0167	0.00629	9.055
Barrel (42 gallons) per minute	42	34.97	0.0605	0.09357	9.5256	2.65	1	1440
Barrel (42 gallons) per day	0.0292	0.0243	0.000042	0.000065	0.00662	0.00184	0.00069	1

**TABLE E1.7** Density Equivalents

To obtain →, multiply ↓, by ↘	Grams per cubic centimeter	Pounds per cubic inch	Pounds per cubic foot	Slugs per cubic foot	Kilograms per cubic meter
Grams per cubic centi- meter	1	0.03613	62.42806	1.9403	1000
Pounds per cubic inch	27.67991	1	1728	53.708	27679.905
Pounds per cubic foot	0.01602	0.0005787	1	0.31081	16.01846
Slugs per cubic foot	0.51538	0.0186	32.17	1	515.379
Kilograms per cubic meter	0.001	3.6128E-5	0.06243	0.00194	1

**TABLE E1.8** Pressure Equivalents

To obtain →, multiply ↓, by ↘	Pounds per square inch	Pounds per square foot	Atmosphere	Kilograms per square centimeter	Kilograms per square meter	Inches water (68°F)	Foot water (68°F)	Inches mercury (32°F)	Millimeters mercury (32°F)	Bar	Mega- Pascal (MPa)
Pounds per square inch	1	144	0.068046	0.070307	703.070	27.7276	2.310636	2.03602	51.71497	0.068947	0.006895
Pounds per square foot	0.0069444	1	0.000473	0.000488	4.88242	0.1926	0.01605	0.014139	0.35913	0.000479	0.0000479
Atmosphere	14.696	2116.22	1	1.03323	10332.27	407.484	33.9570	29.9213	760	1.01325	0.101325
Kilograms per square cen- timeter	14.2233	2048.155	0.96784	1	10000.	394.38	32.8650	28.959	735.559	0.98067	0.098067
Kilograms per square meter	0.001422	0.204768	0.0000968	0.0001	1	0.03944	0.003287	0.002896	0.073556	0.000098	0.0000098
Inches water (68°F)	0.036065	5.1972	0.002454	0.00253	25.375	1	0.08333	0.073430	1.8651	0.002466	0.000249
Foot water (68°F)	0.432781	62.3205	0.029449	0.03043	304.275	12	1	0.88115	22.3813	0.029839	0.0029839
Inches mer- cury (32°F)	0.491154	70.7262	0.033421	0.03453	345.316	13.6185	1.1349	1	25.4	0.033864	0.0033864
Millimeters mercury (32°F)	0.0193368	2.78450	0.0013158	0.0013595	13.59509	0.53616	0.044680	0.03937	1	0.001333	0.0001333
Bar	14.5038	2088.55	0.98692	1.01972	10197.2	402.156	33.5130	29.5300	750.062	1	0.10
MPa	145.038	20885.5	9.8692	10.1972	101972.0	4021.56	335.130	295.300	7500.62	10.0	1

E1.8

**TABLE E1.9** Energy Equivalents

To obtain →, multiply ↓, by ↘	Btu*	Calorie (gram)†	Foot pound	Horsepower hour	Joule	Kilowatt hour	Kilogram meter
Btu	1	251.8	778.169	0.000393	1055.06	0.000293	107.586
Calorie (gram)†	0.00397	1	3.08596	1.56 E-6	4.184	1.16 E-6	0.426649
Foot pound	0.00129	0.32405	1	5.05 E-7	1.35582	3.77 E-7	0.13825
Horsepower hour	2544.5	641616	1.98 E+6	1	2.68 E+6	0.7457	273745
Joule	0.00095	0.2390	0.73756	3.72 E-7	1	2.77 E-7	0.102
Kilowatt hour	3412.97	860421	2.65 E+6	1.34102	3.6 E+6	1	367098
Kilogram meter	0.00929	2.344	7.233	3.65 E-6	9.807	2.72 E-6	1

\* Based on 1 Btu = 778.169 ft·lb.

† Based on 1 Cal = 4.1840 joules.

**TABLE E1.10** Power Equivalents\*

To obtain →, multiply ↓, by ↘	Horsepower	Foot pound per second	Watt	Btu per hour
Horsepower	1	550	745.7	2544
Foot pound per second	0.00182	1	1.3558	4.626
Watt	0.00134	0.7376	1	3.412
Btu per hour	0.00039	0.2161	0.2931	1

\* Based on 1 Btu = 778.169 ft · lb.

**TABLE E1.11** Conversion Factors for Thermal Conductivity, k

To obtain →, multiply ↓, by ↘	Watt/ m · °K	Cal/ (s · cm · °K)	Btu/ (h · ft · °R)	Btu · in/ (h · ft <sup>2</sup> · °R)
W/m · °K	1	0.0022901	0.57818	6.9381
W/cm · °K	100	0.23901	57.818	693.81
W/ft · °R	5.9055	0.014114	3.4144	40.973
W/in · °R	70.866	0.16937	40.973	491.68
cal/(s · cm · °K)	418.4	1	241.91	2902.9
cal/(s · in · °R)	296.50	0.70866	171.43	2057.2
kcal/(h · m · °K)	1.1622	0.0027778	0.67197	8.0636
Btu/(s · ft · °R)	6226.5	14.882	3600	43200
Btu/(s · in · °R)	74717 E+4	178.58	43200	5.184 E+5
Btu · in/(s · ft <sup>2</sup> · °R)	518.87	1.2401	300	3600
Btu/(h · ft · °R)	1.7296	0.0041338	1	12
Btu/(h · in · °R)	20.755	0.049605	12	144
Btu in/(h · ft <sup>2</sup> · °R)	0.14413	0.00034448	0.083333	1
lb · ft/(h · ft · °R)	0.0022241	5.3157 E-6	0.0012859	0.015431

**TABLE E1.12** Prefix Names of Multiples and Submultiples of Units

Prefix	Measure	Decimal equivalent	Exponential expression
Alto	one-quintillionth	0.000 000 000 000 000 001	E-18
Femto	one-quadrillionth	0.000 000 000 000 001	E-15
Pico	one-trillionth	0.000 000 000 001	E-12
Nano	one-billionth	0.000 000 001	E-9
Micro	one-millionth	0.000 001	E-6
Milli	one-thousandth	0.001	E-3
Centi	one-hundredth	0.01	E-2
Deci	one-tenth	0.1	E-1
Uni	one	1.0	E0
Deka	ten	10.0	E+1
Hecto	one hundred	100.0	E+2
Kilo	one thousand	1 000.0	E+3
Mega	one million	1 000 000.0	E+6
Giga	one billion	1 000 000 000.0	E+9
Tera	one trillion	1 000 000 000 000.0	E+12