



# ENGINEERING INFORMATION

## Conversion tables

### LENGTH

	meter	inch	foot	yard
1 m	1	39,37	3,2808	1,0936
1 in	0,0254	1	0,0833	0,0278
1 ft	0,3048	12	1	0,033
1 yd	0,9144	36	3	1

$$1 \text{ m} = 10^{-3} \text{ km} = 10 \text{ dm} = 10^2 \text{ cm} = 10^3 \text{ mm} = 10^6 \text{ } \mu\text{m} = 10^{12} \text{ nm}$$

### AREA

	cm <sup>2</sup>	m <sup>2</sup>	sq.inch	sq.foot	sq.yard
1 cm <sup>2</sup>	1	1.10 <sup>-4</sup>	0,155	1,0764.10 <sup>-3</sup>	1,196.10 <sup>-4</sup>
1 m <sup>2</sup>	1.10 <sup>4</sup>	1	1550	10,764	1,196
1 sq in	6,4516	0,64516.10 <sup>-3</sup>	1	0,00694	0,772.10 <sup>-3</sup>
1 sq ft	929,0	0,0929	144	1	0,1111
1 sq yd	8360	0,8360	1296	9	1

$$1 \text{ m}^2 = 10^{-6} \text{ km}^2 = 10^{-4} \text{ ha} = 10^2 \text{ dm}^2 = 10^6 \text{ mm}^2$$

### VOLUME

	liter (dm <sup>3</sup> )	m <sup>3</sup>	cubic inch	cubic foot	gallons	
					US	Imperial
1 l	1	1.10 <sup>-3</sup>	61,024	0,03531	0,2642	0,220
1 m <sup>3</sup>	1000	1	61024	35,31	264,2	220
1 cu in	16,387.10 <sup>-3</sup>	16,387.10 <sup>-6</sup>	1	0,5787.10 <sup>-3</sup>	4,329.10 <sup>-3</sup>	3,606.10 <sup>-3</sup>
1 cu ft	28,320	28,320.10 <sup>-3</sup>	1728	1	7,481	6,229
1 US gal	3,785	3,785.10 <sup>-3</sup>	231	0,1337	1	0,8327
1 Imp gal	4,546	4,546.10 <sup>-3</sup>	277,3	0,1605	1,210	1

Imperial = British

### SPECIFIC VOLUME

	ltr/kg	m <sup>3</sup> /kg	cubic foot pound
1 ltr/kg	1	0,001	0,01602
1 m <sup>3</sup> /kg	1000	1	16,02
1 cu ft/lb	62,43	0,06243	1

### MASS

	kilogram	pound	tons	
			short (US)	long (Imp)
1 kg	1	2,205	1,102.10 <sup>-3</sup>	0,9843.10 <sup>-3</sup>
1 lb	0,4536	1	0,500.10 <sup>-3</sup>	0,4464.10 <sup>-3</sup>
1 short ton (US)	907,2	2000	1	0,8929
1 long ton (Imp)	1016	2240	1,12	1

$$1 \text{ kg} = 10^3 \text{ g} = 10^2 \text{ dg}$$

### DENSITY

	kg/ltr	kg/m <sup>3</sup>	pound cubic foot	pound gallon	
				Imperial	US
1 kg/ltr	1	1000	62,43	10,022	8,345
1 kg/m <sup>3</sup>	0,001	1	0,06243	0,010022	0,008345
1 lb/cu ft	0,01602	16,02	1	0,16054	0,1337
1 lb/gal (Imp)	0,0998	99,78	6,229	1	0,8327
1 lb/gal (US)	0,1198	119,8	7,481	1,201	1

### FORCE

	Newton	kilopound	poundal
1 N	1	0,1020	7,24
1 kp	9,807	1	70,90
1 pdl	0,1383	0,0141	1

$$1 \text{ N} = 10^5 \text{ dyn}; 1 \text{ dyn} = 1 \text{ g} \times 1 \frac{\text{cm}}{\text{s}^2}; 1 \text{ kg} = 1 \text{ kg} \times \text{g}$$

$$1 \text{ Poundal} = 1 \text{ Pound} \times \text{g}$$

### PRESSURE

	1 bar = 10 <sup>5</sup> N/m <sup>2</sup>	1 at = 1 Kp/cm <sup>2</sup>	poundal/sq ft	poundal/sq in = Psi	1 atm = 760 Torr = 760 mm Hg (0°C)	Hg column (0°C)		H <sub>2</sub> O column (WC) (4°C)	
						mm Hg = Torr	in Hg	m H <sub>2</sub> O	ft H <sub>2</sub> O
1 Pa = 1 N/m <sup>2</sup>	1.10 <sup>-5</sup>	1,02.10 <sup>-5</sup>	0,0209	1,45.10 <sup>-4</sup>	9,87.10 <sup>-6</sup>	0,0075	2,95.10 <sup>-4</sup>	1,02.10 <sup>-4</sup>	3,35.10 <sup>-4</sup>
1 bar	1	1,0197	2089	14,504	0,9869	750	29,5	10,20	33,5
1 at	0,980665	1	2048	14,22	0,96784	735,56	29,0	10,00	32,8
1 pdl/sq ft	0,4790.10 <sup>-3</sup>	0,4882.10 <sup>-3</sup>	1	6,944.10 <sup>-3</sup>	0,4725.10 <sup>-3</sup>	0,359	0,141	4,88.10 <sup>-3</sup>	0,0160
1 pdl/sq in = Psi	0,06895	0,07031	144	1	0,06806	51,7	2,04	0,703	2,31
1 atm	1,013	1,033	2120	14,70	1	760	29,09	10,33	33,9
1 mm Hg	1,330.10 <sup>-3</sup>	1,360.10 <sup>-3</sup>	2,78	0,0193	1,316.10 <sup>-3</sup>	1	0,0394	0,0136	0,0446
1 in Hg	0,0339	0,0345	70,7	0,4910	0,0334	25,4	1	0,3450	1,133
1 mH <sub>2</sub> O	0,0981	0,1000	205	1,4220	0,0968	73,6	2,90	1	3,28
1 ft H <sub>2</sub> O	0,0299	0,0305	62,4	0,4340	0,0295	22,4	0,883	0,3050	1

$$1 \frac{\text{N}}{\text{m}^2} = \text{Pa (Pascal)} = 10 \frac{\text{dyn}}{\text{cm}^2}$$

$$1 \frac{\text{kp}}{\text{m}^2} = 10^{-4} \frac{\text{kp}}{\text{cm}^2} = 1 \text{ mm WC (at 4°C)}$$

### WORK, ENERGY, HEAT CONTENT

	1 kcal	1 kp m	Btu (British thermal unit)	ft poundal	1 kWh	Horsepower hour (hph)		ton-day of refrigeration	1 Joule = 1 Nm = Ws
						metrical 75 kp m h/s	imperial 550 ft.lb h/s		
1 kcal	1	427,0	3,968	3088	1,163.10 <sup>-3</sup>	1,581.10 <sup>-3</sup>	1,560.10 <sup>-3</sup>	13,779.10 <sup>-6</sup>	4190
1 kpm	2,342.10 <sup>-3</sup>	1	9,294.10 <sup>-3</sup>	7,233	2,723.10 <sup>-6</sup>	3,704.10 <sup>-6</sup>	3,653.10 <sup>-6</sup>	32,270.10 <sup>-6</sup>	9,807
1 Btu	0,252	107,59	1	778,0	0,293.10 <sup>-3</sup>	0,398.10 <sup>-3</sup>	0,3931.10 <sup>-3</sup>	3,472.10 <sup>-6</sup>	1055
1 ft pdl	0,3238.10 <sup>-3</sup>	0,13826	1,285.10 <sup>-3</sup>	1	0,377.10 <sup>-6</sup>	0,512.10 <sup>-6</sup>	0,505.10 <sup>-6</sup>	4,462.10 <sup>-9</sup>	1,356
1 kWh	860	367,1.10 <sup>-3</sup>	3412,8	2,655.10 <sup>6</sup>	1	1,360	1,341	11,850.10 <sup>-3</sup>	2,6.10 <sup>6</sup>
1 PSh	632,3	270.10 <sup>-3</sup>	2509	1,953.10 <sup>6</sup>	0,7353	1	0,9863	8,713.10 <sup>-3</sup>	2,65.10 <sup>6</sup>
1 hph	641,1	273,7.10 <sup>-3</sup>	2545	1,980.10 <sup>6</sup>	0,7457	1,014	1	8,834.10 <sup>-3</sup>	2,68.10 <sup>6</sup>
1 ton-day	72,57.10 <sup>-3</sup>	30,99.10 <sup>-3</sup>	288.10 <sup>3</sup>	244,1.10 <sup>6</sup>	84,39	144,78	113,2	1	304.10 <sup>6</sup>
1 J	0,239.10 <sup>-3</sup>	0,102	0,948.10 <sup>-3</sup>	0,738	0,278.10 <sup>-6</sup>	0,378.10 <sup>-6</sup>	0,372.10 <sup>-6</sup>	3,280.10 <sup>-9</sup>	1

$$1 \text{ erg} = 1 \text{ dyn cm} = 10^{-7} \text{ Nm}; 1 \text{ kJ} = 10^3 \text{ J}$$

**CAPACITY, ENERGY FLOW, HEAT FLOW**

	1 kcal h	1 kp m s	British thermal unit per hour	1 kcal/s = British theor. unit of refrigeration	1 kW = 1 kJ/s	Horsepower hour (HP)		US Standard commercial ton of refrigeration	British commercial ton of refrigeration
						metrical 75 kp m s	imperial 550 ft lb s		
1 kcal/h	1	0,1186	3,968	0,278.10 <sup>-3</sup>	1,163.10 <sup>-3</sup>	1,581.10 <sup>-3</sup>	1,560.10 <sup>-3</sup>	0,331.10 <sup>-3</sup>	0,299.10 <sup>-3</sup>
1 kp m/s	8,4312	1	33,455	2,342.10 <sup>-3</sup>	9,804.10 <sup>-3</sup>	13,333.10 <sup>-3</sup>	13,150.10 <sup>-3</sup>	2,792.10 <sup>-3</sup>	2,520.10 <sup>-3</sup>
1 Btu/h	0,252	29,89.10 <sup>-3</sup>	1	0,07.10 <sup>-3</sup>	0,293.10 <sup>-3</sup>	0,398.10 <sup>-3</sup>	0,393.10 <sup>-3</sup>	0,083.10 <sup>-3</sup>	75,310.10 <sup>-3</sup>
1 kcal/s									
Br u r	3600	427,0	14,285.10 <sup>-3</sup>	1	4,186	5,693	5,615	1,190	1,078
1 kW	860,0	102,0	3414	0,2389	1	1,360	1,341	0,2846	0,2572
1 HP	632,3	75	2509,3	0,1756	0,736	1	0,9863	0,2094	0,1891
1 hp	641,2	76,04	2545	0,1781	0,7455	1,014	1	0,2123	0,21227
1 ton	3024	358,2	12,0.10 <sup>3</sup>	0,831	3,513	4,776	4,711	1	0,9037
1 Br ton	3340	396,9	13,26.10 <sup>3</sup>	0,9277	3,888	5,287	5,214	1,1045	1

**ENTHALPY DIFFERENCE, SPECIFIC HEAT**

$\Delta h$	kJ kg	kcal kg	Btu pound
1 kJ/kg	1	0,239	0,43
1 kcal/kg	4,19	1	1,80
1 Btu/lb	2,33	0,556	1

$$1 \text{ cal} = \frac{\text{kcal}}{\text{g}} \cdot \frac{\text{kg}}{\text{kg}}$$

**ENTROPY DIFFERENCE, SPECIFIC HEAT**

$\Delta s$	kJ kg K	kcal kg °C	Btu pound °F
1 kJ/kg K	1	0,239	0,239
1 kcal/kg °C	4,19	1	1
1 Btu/lb °F	4,19	1	1

**FORMULAS FOR TEMPERATURE CALCULATION**

$$T \text{ celsius} = \frac{5}{9} (T_f - 32)$$

Tc = temperature Celsius

$$T \text{ fahrenheit} = \frac{9}{5} (T_c + 32)$$

Tf = temperature Fahrenheit

$$T \text{ kelvin} = T_c + 273$$

Tk = temperature Kelvin

**TEMPERATURES**

Common temperatures in degrees Kelvin and corresponding Celsius and Fahrenheit equivalents

Kelvin (K)	Celsius (°C)	Fahrenheit (°F)
0	- 273	- 459
17	- 256	- 429
33	- 240	- 400
49	- 224	- 371
65	- 208	- 342
81	- 192	- 314
97	- 176	- 285
113	- 160	- 256
129	- 144	- 227
145	- 128	- 198
161	- 112	- 170
177	- 96	- 141
193	- 80	- 112
209	- 64	- 83
225	- 48	- 54
241	- 32	- 26
257	- 16	- 3

Kelvin (K)	Celsius (°C)	Fahrenheit (°F)
273	0	32
289	16	61
305	32	90
321	48	118
337	64	147
353	80	176
369	96	205
385	112	234
401	128	262
417	144	291
433	160	320
449	176	349
465	192	378
481	208	406
497	224	435
513	240	464
529	256	493

**(ORIFICE) SIZES**

Common valve ORIFICE sizes and equivalents in mm

inches	mm
3/64 (.0469)	1,19
1/16 (.0625)	1,59
5/64 (.0781)	1,98
3/32 (.0937)	2,38
1/8 (.1250)	3,18
5/32 (.1562)	3,97
11/64 (.1719)	4,37
3/16 (.1875)	4,76
7/32 (.2187)	5,55
1/4 (.2500)	6,35
9/32 (.2812)	7,14
5/16 (.3125)	7,94

inches	mm
7/17 (.4375)	11,11
1/2 (.5000)	12,70
5/8 (.6250)	15,88
11/16 (.6875)	17,46
3/4 (.7500)	19,05
1 (1,000)	25,40
1 1/8 (1,250)	28,58
1 1/4 (1,2500)	31,75
1 1/2 (1,5000)	38,10
1 3/4 (1,7500)	44,45
2 (2,0000)	50,80
3 (3,0000)	76,20