

APPENDIX A
MISCELLANEOUS DATA AND CONVERSION FACTORS

SOME USEFUL WEIGHTS AND MEASURES

| Unit Of Measure | Equivalent |
|-------------------------|---------------------------------|
| grain | 0.002 ounces |
| gram | 0.04 ounces |
| ounce | 28.35 grams |
| kilogram | 2.21 pounds |
| pound | 0.45 kilograms |
| pound (troy) | 12 ounces |
| ton (short) | 2000 pounds |
| ton (long) | 2240 pounds |
| ton (metric) | 2200 pounds |
| ton (shipping) | 40 feet ³ |
| centimeter | 0.39 inches |
| inch | 2.54 centimeters |
| foot | 30.48 centimeters |
| meter | 1.09 yards |
| yard | 0.91 meters |
| mile | 1.61 kilometers |
| centimeter ² | 0.16 inches ² |
| inch ² | 6.45 centimeters ² |
| foot ² | 0.09 meters ² |
| meter ² | 1.2 yards ² |
| yard ² | 0.84 meters ² |
| mile ² | 2.59 kilometers ² |
| centimeter ³ | 0.061 inches ³ |
| inch ³ | 16.39 centimeters ³ |
| foot ³ | 283.17 centimeters ³ |
| foot ³ | 1728 inches ³ |

SOME USEFUL WEIGHTS AND MEASURES (cont.)

| Unit Of Measure | Equivalent | |
|--------------------|------------|---------------------|
| meter ³ | 1.31 | yeads ³ |
| yard ³ | 0.77 | meters ³ |
| cord | 128 | feet ³ |
| cord | 4 | meters ³ |
| peck | 8 | quarts |
| bushel (dry) | 4 | pecks |
| bushel | 2150.4 | inches ³ |
| gallon (U. S.) | 231 | inches ³ |
| barrel | 31.5 | gallons |
| hogshead | 2 | barrels |
| township | 36 | miles ² |
| hectare | 2.5 | acres |

MISCELLANEOUS DATA

One cubic foot of anthracite coal weighs about 53 pounds.

One cubic foot of bituminous coal weighs from 47 to 50 pounds.

One ton of coal is equivalent to two cords of wood for steam purposes.

A gallon of water (U. S. Standard) weighs 8.33 pounds and contains 231 cubic inches.

There are 9 square feet of heating surface to each square foot of grate surface.

A cubic foot of water contains 7.5 gallons and 1728 cubic inches, and weighs 62.5 lbs.

Each nominal horsepower of a boiler requires 30 to 35 pounds of water per hour.

A horsepower is equivalent to raising 33,000 pounds one foot per minute, or 550 pounds one foot per second.

To find the pressure in pounds per square inch of a column of water, multiply the height of the column in feet by 0.434.

TYPICAL PARAMETERS OF VARIOUS FUELS^a

| Type Of Fuel | Heating Value | | Sulfur % (by weight) | Ash % (by weight) |
|--------------------------|--|-------------|-------------------------|----------------------|
| | kcal | Btu | | |
| Solid Fuels | | | | |
| Bituminous Coal | 7,200/kg | 13,000/lb | 0.6-5.4 | 4-20 |
| Anthracite Coal | 6,810/kg | 12,300/lb | 0.5-1.0 | 7.0-16.0 |
| Lignite (@ 35% moisture) | 3,990/kg | 7,200/lb | 0.7 | 6.2 |
| Wood (@ 40% moisture) | 2,880/kg | 5,200/lb | N | 1-3 |
| Bagasse (@ 50% moisture) | 2,220/kg | 4,000/lb | N | 1-2 |
| Bark (@ 50% moisture) | 2,492/kg | 4,500/lb | N | 1-3 ^b |
| Coke, Byproduct | 7,380/kg | 13,300/lb | 0.5-1.0 | 0.5-5.0 |
| Liquid Fuels | | | | |
| Residual Oil | 9.98 x 10 ⁶ /m ³ | 150,000/gal | 0.5-4.0 | 0.05-0.1 |
| Distillate Oil | 9.30 x 10 ⁶ /m ³ | 140,000/gal | 0.2-1.0 | N |
| Diesel | 9.12 x 10 ⁶ /m ³ | 137,000/gal | 0.4 | N |
| Gasoline | 8.62 x 10 ⁶ /m ³ | 130,000/gal | 0.03-0.04 | N |
| Kerosene | 8.32 x 10 ⁶ /m ³ | 135,000/gal | 0.02-0.05 | N |
| Liquid Petroleum Gas | 6.25 x 10 ⁶ /m ³ | 94,000/gal | N | N |
| Gaseous Fuels | | | | |
| Natural Gas | 9,341/m ³ | 1,050/SCF | N | N |
| Coke Oven Gas | 5,249/m ³ | 590/SCF | 0.5-2.0 | N |
| Blast Furnace Gas | 890/m ³ | 100/SCF | N | N |

^a N = negligible.

^b Ash content may be considerably higher when sand, dirt, etc., are present.

THERMAL EQUIVALENTS FOR VARIOUS FUELS

| Type Of Fuel | kcal | Btu (gross) |
|-------------------------|--|---------------------------------------|
| Solid fuels | | |
| Bituminous coal | (5.8 to 7.8) x 10 ⁶ /Mg | (21.0 to 28.0) x 10 ⁶ /ton |
| Anthracite coal | 7.03 x 10 ⁶ /Mg | 25.3 x 10 ⁶ /ton |
| Lignite | 4.45 x 10 ⁶ /Mg | 16.0 x 10 ⁶ /ton |
| Wood | 1.47 x 10 ⁶ /m ³ | 21.0 x 10 ⁶ /cord |
| Liquid fuels | | |
| Residual fuel oil | 10 x 10 ³ /liter | 6.3 x 10 ⁶ /bbl |
| Distillate fuel oil | 9.35 x 10 ³ /liter | 5.9 x 10 ⁶ /bbl |
| Gaseous fuels | | |
| Natural gas | 9,350/m ³ | 1,050/ft ³ |
| Liquefied petroleum gas | | |
| Butane | 6,480/liter | 97,400/gal |
| Propane | 6,030/liter | 90,500/gal |

WEIGHTS OF SELECTED SUBSTANCES

| Type Of Substance | g/liter | lb/gal |
|-------------------------|---------|--------|
| Asphalt | 1030 | 8.57 |
| Butane, liquid at 60°F | 579 | 4.84 |
| Crude oil | 850 | 7.08 |
| Distillate oil | 845 | 7.05 |
| Gasoline | 739 | 6.17 |
| Propane, liquid at 60°F | 507 | 4.24 |
| Residual oil | 944 | 7.88 |
| Water | 1000 | 8.4 |

DENSITIES OF SELECTED SUBSTANCES

| Substance | Density | |
|-----------------------|------------------------|---------------------------|
| Fuels | | |
| Crude Oil | 874 kg/m ³ | 7.3 lb/gal |
| Residual Oil | 944 kg/m ³ | 7.88 lb/gal |
| Distillate Oil | 845 kg/m ³ | 7.05 lb/gal |
| Gasoline | 739 kg/m ³ | 6.17 lb/gal |
| Natural Gas | 673 kg/m ³ | 1 lb/23.8 ft ³ |
| Butane | 579 kg/m ³ | 4.84 lb/gal (liquid) |
| Propane | 507 kg/m ³ | 4.24 lb/gal (liquid) |
| Wood (Air dried) | | |
| Elm | 561 kg/m ³ | 35 lb/ft ³ |
| Fir, Douglas | 513 kg/m ³ | 32 lb/ft ³ |
| Fir, Balsam | 400 kg/m ³ | 25 lb/ft ³ |
| Hemlock | 465 kg/m ³ | 29 lb/ft ³ |
| Hickory | 769 kg/m ³ | 48 lb/ft ³ |
| Maple, Sugar | 689 kg/m ³ | 43 lb/ft ³ |
| Maple, White | 529 kg/m ³ | 33 lb/ft ³ |
| Oak, Red | 673 kg/m ³ | 42 lb/ft ³ |
| Oak, White | 769 kg/m ³ | 48 lb/ft ³ |
| Pine, Southern | 641 kg/m ³ | 40 lb/ft ³ |
| Agricultural Products | | |
| Corn | 25.4 kg/bu | 56 lb/bu |
| Milo | 25.4 kg/bu | 56 lb/bu |
| Oats | 14.5 kg/bu | 32 lb/bu |
| Barley | 21.8 kg/bu | 48 lb/bu |
| Wheat | 27.2 kg/bu | 60 lb/bu |
| Cotton | 226 kg/bale | 500 lb/bale |
| Mineral Products | | |
| Brick | 2.95 kg/brick | 6.5 lb/brick |
| Cement | 170 kg/bbl | 375 lb/bbl |
| Cement | 1483 kg/m ³ | 2500 lb/yd ³ |

DENSITIES OF SELECTED SUBSTANCES (cont.).

| Substance | Density | |
|---------------------------|-------------------------------|------------------------------|
| Concrete | 2373 kg/m ³ | 4000 lb/yd ³ |
| Glass, Common | 2595 kg/m ³ | 162 lb/ft ³ |
| Gravel, Dry Packed | 1600 - 1920 kg/m ³ | 100 - 120 lb/ft ³ |
| Gravel, Wet | 2020 kg/m ³ | 126 lb/ft ³ |
| Gypsum, Calcined | 880 - 960 kg/m ³ | 55 - 60 lb/ft ³ |
| Lime, Pebble | 850 - 1025 kg/m ³ | 53 - 64 lb/ft ³ |
| Sand, Gravel (Dry, loose) | 1440 - 1680 kg/m ³ | 90 - 105 lb/ft ³ |

CONVERSION FACTORS

The table of conversion factors on the following pages contains factors for converting English to metric units and metric to English units as well as factors to manipulate units within the same system. The factors are arranged alphabetically by unit within the following property groups.

- Area
- Density
- Energy
- Force
- Length
- Mass
- Pressure
- Velocity
- Volume
- Volumetric Rate

To convert a number from one unit to another:

1. Locate the unit in which the number is currently expressed in the left-hand column of the table;
2. Find the desired unit in the center column; and
3. Multiply the number by the corresponding conversion factor in the right-hand column.

CONVERSION FACTORS^a

| To Convert From | To | Multiply By |
|-----------------|--------------------|-------------------------|
| Area | | |
| Acres | Sq feet | 4.356×10^4 |
| Acres | Sq kilometers | 4.0469×10^{-3} |
| Acres | Sq meters | 4.0469×10^3 |
| Acres | Sq miles (statute) | 1.5625×10^{-3} |
| Acres | Sq yards | 4.84×10^3 |
| Sq feet | Acres | 2.2957×10^{-5} |
| Sq feet | Sq cm | 929.03 |
| Sq feet | Sq inches | 144.0 |
| Sq feet | Sq meters | 0.092903 |
| Sq feet | Sq miles | 3.587×10^{-8} |
| Sq feet | Sq yards | 0.111111 |
| Sq inches | Sq feet | 6.9444×10^{-3} |
| Sq inches | Sq meters | 6.4516×10^{-4} |
| Sq inches | Sq mm | 645.16 |
| Sq kilometers | Acres | 247.1 |
| Sq kilometers | Sq feet | 1.0764×10^7 |
| Sq kilometers | Sq meters | 1.0×10^6 |
| Sq kilometers | Sq miles | 0.386102 |
| Sq kilometers | Sq yards | 1.196×10^6 |
| Sq meters | Sq cm | 1.0×10^4 |
| Sq meters | Sq feet | 10.764 |
| Sq meters | Sq inches | 1.55×10^3 |
| Sq meters | Sq kilometers | 1.0×10^{-6} |
| Sq meters | Sq miles | 3.861×10^{-7} |
| Sq meters | Sq mm | 1.0×10^6 |
| Sq meters | Sq yards | 1.196 |
| Sq miles | Acres | 640.0 |
| Sq miles | Sq feet | 2.7878×10^7 |
| Sq miles | Sq kilometers | 2.590 |

CONVERSION FACTORS (cont.).

| To Convert From | To | Multiply By |
|--------------------|--------------------------|-------------------------|
| Sq miles | Sq meters | 2.59×10^6 |
| Sq miles | Sq yards | 3.0976×10^6 |
| Sq yards | Acres | 2.0661×10^{-4} |
| Sq yards | Sq cm | 8.3613×10^3 |
| Sq yards | Sq ft | 9.0 |
| Sq yards | Sq inches | 1.296×10^3 |
| Sq yards | Sq meters | 0.83613 |
| Sq yards | Sq miles | 3.2283×10^{-7} |
| Density | | |
| Dynes/cu cm | Grams/cu cm | 1.0197×10^{-3} |
| Grains/cu foot | Grams/cu meter | 2.28835 |
| Grams/cu cm | Dynes/cu cm | 980.665 |
| Grams/cu cm | Grains/milliliter | 15.433 |
| Grams/cu cm | Grams/milliliter | 1.0 |
| Grams/cu cm | Pounds/cu inch | 1.162 |
| Grams/cu cm | Pounds/cu foot | 62.428 |
| Grams/cu cm | Pounds/cu inch | 0.036127 |
| Grams/cu cm | Pounds/gal (Brit.) | 10.022 |
| Grams/cu cm | Pounds/gal (U. S., dry) | 9.7111 |
| Grams/cu cm | Pounds/gal (U. S., liq.) | 8.3454 |
| Grams/cu meter | Grains/cu foot | 0.4370 |
| Grams/liter | Pounds/gal (U. S.) | 8.345×10^{-3} |
| Kilograms/cu meter | Grams/cu cm | 0.001 |
| Kilograms/cu meter | Pounds/cu ft | 0.0624 |
| Kilograms/cu meter | Pounds/cu in | 3.613×10^{-5} |
| Pounds/cu foot | Grams/cu cm | 0.016018 |
| Pounds/cu foot | kg/cu meter | 16.018 |
| Pounds/cu inch | Grams/cu cm | 27.68 |
| Pounds/cu inch | Grams/liter | 27.681 |
| Pounds/cu inch | kg/cu meter | 2.768×10^4 |

CONVERSION FACTORS (cont.).

| To Convert From | To | Multiply By |
|--------------------------|-------------------------|--------------------------|
| Pounds/gal (U. S., liq.) | Grams/cu cm | 0.1198 |
| Pounds/gal (U. S., liq.) | Pounds/cu ft | 7.4805 |
| Energy | | |
| Btu | Cal. gm (IST.) | 251.83 |
| Btu | Ergs | 1.05435×10^{10} |
| Btu | Foot-pounds | 777.65 |
| Btu | Hp-hours | 3.9275×10^{-4} |
| Btu | Joules (Int.) | 1054.2 |
| Btu | kg-meters | 107.51 |
| Btu | kW-hours (Int.) | 2.9283×10^{-4} |
| Btu/hr | Cal. kg/hr | 0.252 |
| Btu/hr | Ergs/sec | 2.929×10^6 |
| Btu/hr | Foot-pounds/hr | 777.65 |
| Btu/hr | Horsepower (mechanical) | 3.9275×10^{-4} |
| Btu/hr | Horsepower (boiler) | 2.9856×10^{-5} |
| Btu/hr | Horsepower (electric) | 3.926×10^{-4} |
| Btu/hr | Horsepower (metric) | 3.982×10^{-4} |
| Btu/hr | Kilowatts | 2.929×10^{-4} |
| Btu/lb | Foot-pounds/lb | 777.65 |
| Btu/lb | Hp-hr/lb | 3.9275×10^{-4} |
| Btu/lb | Joules/gram | 2.3244 |
| Calories, kg (mean) | Btu (IST.) | 3.9714 |
| Calories, kg (mean) | Ergs | 4.190×10^{10} |
| Calories, kg (mean) | Foot-pounds | 3.0904×10^3 |
| Calories, kg (mean) | Hp-hours | 1.561×10^{-3} |
| Calories, kg (mean) | Joules | 4.190×10^3 |
| Calories, kg (mean) | kg-meters | 427.26 |
| Calories, kg (mean) | kW-hours (Int.) | 1.1637×10^{-3} |
| Ergs | Btu | 9.4845×10^{-11} |
| Ergs | Foot-poundals | 2.373×10^{-6} |

CONVERSION FACTORS (cont.).

| To Convert From | To | Multiply By |
|-------------------------|-------------------------|--------------------------|
| Ergs | Foot-pounds | 7.3756×10^{-8} |
| Ergs | Joules (Int.) | 9.99835×10^{-8} |
| Ergs | kW-hours | 2.7778×10^{-14} |
| Ergs | kg-meters | 1.0197×10^{-8} |
| Foot-pounds | Btu (IST.) | 1.2851×10^{-3} |
| Foot-pounds | Cal. kg (IST.) | 3.2384×10^{-4} |
| Foot-pounds | Ergs | 1.3558×10^7 |
| Foot-pounds | Foot-poundals | 32.174 |
| Foot-pounds | Hp-hours | 5.0505×10^{-7} |
| Foot-pounds | Joules | 1.3558 |
| Foot-pounds | kg-meters | 0.138255 |
| Foot-pounds | kW-hours (Int.) | 3.76554×10^{-7} |
| Foot-pounds | Newton-meters | 1.3558 |
| Foot-pounds/hr | Btu/min | 2.1432×10^{-5} |
| Foot-pounds/hr | Ergs/min | 2.2597×10^5 |
| Foot-pounds/hr | Horsepower (mechanical) | 5.0505×10^{-7} |
| Foot-pounds/hr | Horsepower (metric) | 5.121×10^{-7} |
| Foot-pounds/hr | Kilowatts | 3.766×10^{-7} |
| Horsepower (mechanical) | Btu (mean)/hr | 2.5425×10^3 |
| Horsepower (mechanical) | Ergs/sec | 7.457×10^9 |
| Horsepower (mechanical) | Foot-pounds/hr | 1.980×10^6 |
| Horsepower (mechanical) | Horsepower (boiler) | 0.07602 |
| Horsepower (mechanical) | Horsepower (electric) | 0.9996 |
| Horsepower (mechanical) | Horsepower (metric) | 1.0139 |
| Horsepower (mechanical) | Joules/sec | 745.70 |
| Horsepower (mechanical) | Kilowatts (Int.) | 0.74558 |
| Horsepower (boiler) | Btu (mean)/hr | 3.3446×10^4 |
| Horsepower (boiler) | Ergs/sec | 9.8095×10^{10} |
| Horsepower (boiler) | Foot-pounds/min | 4.341×10^5 |
| Horsepower (boiler) | Horsepower (mechanical) | 13.155 |

CONVERSION FACTORS (cont.).

| To Convert From | To | Multiply By |
|-----------------------|-------------------------|-------------------------|
| Horsepower (boiler) | Horsepower (electric) | 13.15 |
| Horsepower (boiler) | Horsepower (metric) | 13.337 |
| Horsepower (boiler) | Joules/sec | 9.8095×10^3 |
| Horsepower (boiler) | Kilowatts | 9.8095 |
| Horsepower (electric) | Btu (mean)/hr | 2.5435×10^3 |
| Horsepower (electric) | Cal. kg/hr | 641.87 |
| Horsepower (electric) | Ergs/sec | 7.46×10^9 |
| Horsepower (electric) | Foot-pounds/min | 3.3013×10^4 |
| Horsepower (electric) | Horsepower (boiler) | 0.07605 |
| Horsepower (electric) | Horsepower (metric) | 1.0143 |
| Horsepower (electric) | Joules/sec | 746.0 |
| Horsepower (electric) | Kilowatts | 0.746 |
| Horsepower (metric) | Btu (mean)/hr | 2.5077×10^3 |
| Horsepower (metric) | Ergs/sec | 7.355×10^9 |
| Horsepower (metric) | Foot-pounds/min | 3.255×10^4 |
| Horsepower (metric) | Horsepower (mechanical) | 0.98632 |
| Horsepower (metric) | Horsepower (boiler) | 0.07498 |
| Horsepower (metric) | Horsepower (electric) | 0.9859 |
| Horsepower (metric) | kg-meters/sec | 75.0 |
| Horsepower (metric) | Kilowatts | 0.7355 |
| Horsepower-hours | Btu (mean) | 2.5425×10^3 |
| Horsepower-hours | Foot-pounds | 1.98×10^6 |
| Horsepower-hours | Joules | 2.6845×10^6 |
| Horsepower-hours | kg-meters | 2.73745×10^5 |
| Horsepower-hours | kW-hours | 0.7457 |
| Joules (Int.) | Btu (IST.) | 9.4799×10^{-4} |
| Joules (Int.) | Ergs | 1.0002×10^7 |
| Joules (Int.) | Foot-poundals | 12.734 |
| Joules (Int.) | Foot-pounds | 0.73768 |
| Joules (Int.) | kW-hours | 2.778×10^{-7} |

CONVERSION FACTORS (cont.).

| To Convert From | To | Multiply By |
|-----------------------|-------------------------|-------------------------|
| Joules (Int.)/sec | Btu (mean)/min | 0.05683 |
| Joules (Int.)/sec | Cal. kg/min | 0.01434 |
| Joules (Int.)/sec | Horsepower | 1.341×10^{-3} |
| Kilogram-meters | Btu (mean) | 9.2878×10^{-3} |
| Kilogram-meters | Cal. kg (mean) | 2.3405×10^{-3} |
| Kilogram-meters | Ergs | 9.80665×10^7 |
| Kilogram-meters | Foot-poundals | 232.715 |
| Kilogram-meters | Foot-pounds | 7.233 |
| Kilogram-meters | Hp-hours | 3.653×10^{-6} |
| Kilogram-meters | Joules (Int.) | 9.805 |
| Kilogram-meters | kW-hours | 2.724×10^{-6} |
| Kilogram-meters/sec | Watts | 9.80665 |
| Kilowatts (Int.) | Btu (IST.)/hr | 3.413×10^3 |
| Kilowatts (Int.) | Cal. kg (IST.)/hr | 860.0 |
| Kilowatts (Int.) | Ergs/sec | 1.0002×10^{10} |
| Kilowatts (Int.) | Foot-poundals/min | 1.424×10^6 |
| Kilowatts (Int.) | Foot-pounds/min | 4.4261×10^4 |
| Kilowatts (Int.) | Horsepower (mechanical) | 1.341 |
| Kilowatts (Int.) | Horsepower (boiler) | 0.10196 |
| Kilowatts (Int.) | Horsepower (electric) | 1.3407 |
| Kilowatts (Int.) | Horsepower (metric) | 1.3599 |
| Kilowatts (Int.) | Joules (Int.)/hr | 3.6×10^6 |
| Kilowatts (Int.) | kg-meters/hr | 3.6716×10^5 |
| Kilowatt-hours (Int.) | Btu (mean) | 3.41×10^3 |
| Kilowatt-hours (Int.) | Foot-pounds | 2.6557×10^6 |
| Kilowatt-hours (Int.) | Hp-hours | 1.341 |
| Kilowatt-hours (Int.) | Joules (Int.) | 3.6×10^6 |
| Kilowatt-hours (Int.) | kg-meters | 3.6716×10^5 |
| Newton-meters | Gram-cm | 1.01972×10^4 |
| Newton-meters | kg-meters | 0.101972 |

CONVERSION FACTORS (cont.).

| To Convert From | To | Multiply By |
|-----------------|-----------------|------------------------|
| Newton-meters | Pound-feet | 0.73756 |
| Force | | |
| Dynes | Newtons | 1.0×10^{-5} |
| Dynes | Poundals | 7.233×10^{-5} |
| Dynes | Pounds | 2.248×10^{-6} |
| Newtons | Dynes | 1.0×10^{-5} |
| Newtons | Pounds (avdp.) | 0.22481 |
| Poundals | Dynes | 1.383×10^4 |
| Poundals | Newtons | 0.1383 |
| Poundals | Pounds (avdp.) | 0.03108 |
| Pounds (avdp.) | Dynes | 4.448×10^5 |
| Pounds (avdp.) | Newtons | 4.448 |
| Pounds (avdp.) | Poundals | 32.174 |
| Length | | |
| Feet | Centimeters | 30.48 |
| Feet | Inches | 12 |
| Feet | Kilometers | 3.048×10^{-4} |
| Feet | Meters | 0.3048 |
| Feet | Miles (statute) | 1.894×10^{-4} |
| Inches | Centimeters | 2.540 |
| Inches | Feet | 0.08333 |
| Inches | Kilometers | 2.54×10^{-5} |
| Inches | Meters | 0.0254 |
| Kilometers | Feet | 3.2808×10^3 |
| Kilometers | Meters | 1000 |
| Kilometers | Miles (statute) | 0.62137 |
| Kilometers | Yards | 1.0936×10^3 |
| Meters | Feet | 3.2808 |
| Meters | Inches | 39.370 |
| Micrometers | Angstrom units | 1.0×10^4 |

CONVERSION FACTORS (cont.).

| To Convert From | To | Multiply By |
|-----------------|-------------------------|-------------------------|
| Micrometers | Centimeters | 1.0×10^{-3} |
| Micrometers | Feet | 3.2808×10^{-6} |
| Micrometers | Inches | 3.9370×10^{-5} |
| Micrometers | Meters | 1.0×10^{-6} |
| Micrometers | Millimeters | 0.001 |
| Micrometers | Nanometers | 1000 |
| Miles (statute) | Feet | 5280 |
| Miles (statute) | Kilometers | 1.6093 |
| Miles (statute) | Meters | 1.6093×10^3 |
| Miles (statute) | Yards | 1760 |
| Millimeters | Angstrom units | 1.0×10^7 |
| Millimeters | Centimeters | 0.1 |
| Millimeters | Inches | 0.03937 |
| Millimeters | Meters | 0.001 |
| Millimeters | Micrometers | 1000 |
| Millimeters | Mils | 39.37 |
| Nanometers | Angstrom units | 10 |
| Nanometers | Centimeters | 1.0×10^{-7} |
| Nanometers | Inches | 3.937×10^{-8} |
| Nanometers | Micrometers | 0.001 |
| Nanometers | Millimeters | 1.0×10^{-6} |
| Yards | Centimeters | 91.44 |
| Yards | Meters | 0.9144 |
| Mass | | |
| Grains | Grams | 0.064799 |
| Grains | Milligrams | 64.799 |
| Grains | Pounds (apoth. or troy) | 1.7361×10^{-4} |
| Grains | Pounds (avdp.) | 1.4286×10^{-4} |
| Grains | Tons (metric) | 6.4799×10^{-8} |
| Grams | Dynes | 980.67 |

CONVERSION FACTORS (cont.).

| To Convert From | To | Multiply By |
|-------------------------|--------------------------|-------------------------|
| Grams | Grains | 15.432 |
| Grams | Kilograms | 0.001 |
| Grams | Micrograms | 1×10^6 |
| Grams | Pounds (avdp.) | 2.205×10^{-3} |
| Grams | Tons, metric (megagrams) | 1×10^{-6} |
| Kilograms | Grains | 1.5432×10^4 |
| Kilograms | Poundals | 70.932 |
| Kilograms | Pounds (apoth. or troy) | 2.679 |
| Kilograms | Pounds (avdp.) | 2.2046 |
| Kilograms | Tons (long) | 9.842×10^{-4} |
| Kilograms | Tons (metric) | 0.001 |
| Kilograms | Tons (short) | 1.1023×10^{-3} |
| Megagrams | Tons (metric) | 1.0 |
| Milligrams | Grains | 0.01543 |
| Milligrams | Grams | 1.0×10^{-3} |
| Milligrams | Ounces (apoth. or troy) | 3.215×10^{-5} |
| Milligrams | Ounces (avdp.) | 3.527×10^{-5} |
| Milligrams | Pounds (apoth. or troy) | 2.679×10^{-6} |
| Milligrams | Pounds (avdp.) | 2.2046×10^{-6} |
| Ounces (apoth. or troy) | Grains | 480 |
| Ounces (apoth. or troy) | Grams | 31.103 |
| Ounces (apoth. or troy) | Ounces (avdp.) | 1.097 |
| Ounces (avdp.) | Grains | 437.5 |
| Ounces (avdp.) | Grams | 28.350 |
| Ounces (avdp.) | Ounces (apoth. or troy) | 0.9115 |
| Ounces (avdp.) | Pounds (apoth. or troy) | 0.075955 |
| Ounces (avdp.) | Pounds (avdp.) | 0.0625 |
| Pounds (avdp.) | Poundals | 32.174 |
| Pounds (avdp.) | Pounds (apoth. or troy) | 1.2153 |
| Pounds (avdp.) | Tons (long) | 4.4643×10^{-4} |

CONVERSION FACTORS (cont.).

| To Convert From | To | Multiply By |
|---------------------|---------------------------------|-------------------------|
| Pounds (avdp.) | Tons (metric) | 4.5359×10^{-4} |
| Pounds (avdp.) | Tons (short) | 5.0×10^{-4} |
| Pounds (avdp.) | Grains | 7000 |
| Pounds (avdp.) | Grams | 453.59 |
| Pounds (avdp.) | Ounces (apoth. or troy) | 14.583 |
| Pounds (avdp.) | Ounces (avdp.) | 16 |
| Tons (long) | Kilograms | 1.016×10^3 |
| Tons (long) | Pounds (apoth. or troy) | 2.722×10^3 |
| Tons (long) | Pounds (avdp.) | 2.240×10^3 |
| Tons (long) | Tons (metric) | 1.016 |
| Tons (long) | Tons (short) | 1.12 |
| Tons (metric) | Grams | 1.0×10^6 |
| Tons (metric) | Megagrams | 1.0 |
| Tons (metric) | Pounds (apoth. or troy) | 2.6792×10^3 |
| Tons (metric) | Pounds (avdp.) | 2.2046×10^3 |
| Tons (metric) | Tons (long) | 0.9842 |
| Tons (metric) | Tons (short) | 1.1023 |
| Tons (short) | Kilograms | 907.18 |
| Tons (short) | Pounds (apoth. or troy) | 2.4301×10^3 |
| Tons (short) | Pounds (avdp.) | 2000 |
| Tons (short) | Tons (long) | 0.8929 |
| Tons (short) | Tons (metric) | 0.9072 |
| Pressure | | |
| Atmospheres | cm of H ₂ O (4°C) | 1.033×10^3 |
| Atmospheres | Ft of H ₂ O (39.2°F) | 33.8995 |
| Atmospheres | In. of Hg (32°F) | 29.9213 |
| Atmospheres | kg/sq cm | 1.033 |
| Atmospheres | mm of Hg (0°C) | 760 |
| Atmospheres | Pounds/sq inch | 14.696 |
| Inches of Hg (60°F) | Atmospheres | 0.03333 |

CONVERSION FACTORS (cont.).

| To Convert From | To | Multiply By |
|----------------------------------|----------------------------------|---------------------------|
| Inches of Hg (60°F) | Grams/sq cm | 34.434 |
| Inches of Hg (60°F) | mm of Hg (60°F) | 25.4 |
| Inches of Hg (60°F) | Pounds/sq ft | 70.527 |
| Inches of H ₂ O (4°C) | Atmospheres | 2.458 x 10 ⁻³ |
| Inches of H ₂ O (4°C) | In. of Hg (32°F) | 0.07355 |
| Inches of H ₂ O (4°C) | kg/sq meter | 25.399 |
| Inches of H ₂ O (4°C) | Pounds/sq ft | 5.2022 |
| Inches of H ₂ O (4°C) | Pounds/sq inch | 0.036126 |
| Kilograms/sq cm | Atmospheres | 0.96784 |
| Kilograms/sq cm | cm of Hg (0°C) | 73.556 |
| Kilograms/sq cm | Ft of H ₂ O (39.2°F) | 32.809 |
| Kilograms/sq cm | In. of Hg (32°F) | 28.959 |
| Kilograms/sq cm | Pounds/sq inch | 14.223 |
| Millimeters of Hg (0°C) | Atmospheres | 1.3158 x 10 ⁻³ |
| Millimeters of Hg (0°C) | Grams/sq cm | 1.3595 |
| Millimeters of Hg (0°C) | Pounds/sq inch | 0.019337 |
| Pounds/sq inch | Atmospheres | 0.06805 |
| Pounds/sq inch | cm of Hg (0°C) | 5.1715 |
| Pounds/sq inch | cm of H ₂ O (4°C) | 70.309 |
| Pounds/sq inch | In. of Hg (32°F) | 2.036 |
| Pounds/sq inch | In. of H ₂ O (39.2°F) | 27.681 |
| Pounds/sq inch | kg/sq cm | 0.07031 |
| Pounds/sq inch | mm of Hg (0°C) | 51.715 |
| Velocity | | |
| Centimeters/sec | Feet/min | 1.9685 |
| Centimeters/sec | Feet/sec | 0.0328 |
| Centimeters/sec | Kilometers/hr | 0.036 |
| Centimeters/sec | Meters/min | 0.6 |
| Centimeters/sec | Miles/hr | 0.02237 |

CONVERSION FACTORS (cont.).

| To Convert From | To | Multiply By |
|----------------------------|--------------------|-----------------------|
| Feet/minute | cm/sec | 0.508 |
| Feet/minute | Kilometers/hr | 0.01829 |
| Feet/minute | Meters/min | 0.3048 |
| Feet/minute | Meters/sec | 5.08×10^{-3} |
| Feet/minute | Miles/hr | 0.01136 |
| Feet/sec | cm/sec | 30.48 |
| Feet/sec | Kilometers/hr | 1.0973 |
| Feet/sec | Meters/min | 18.288 |
| Feet/sec | Miles/hr | 0.6818 |
| Kilometers/hr | cm/sec | 27.778 |
| Kilometers/hr | Feet/hr | 3.2808×10^3 |
| Kilometers/hr | Feet/min | 54.681 |
| Kilometers/hr | Meters/sec | 0.27778 |
| Kilometers/hr | Miles (statute)/hr | 0.62137 |
| Meters/min | cm/sec | 1.6667 |
| Meters/min | Feet/min | 3.2808 |
| Meters/min | Feet/sec | 0.05468 |
| Meters/min | Kilometers/hr | 0.06 |
| Miles/hr | cm/sec | 44.704 |
| Miles/hr | Feet/hr | 5280 |
| Miles/hr | Feet/min | 88 |
| Miles/hr | Feet/sec | 1.4667 |
| Miles/hr | Kilometers/hr | 1.6093 |
| Miles/hr | Meters/min | 26.822 |
| Volume | | |
| Barrels (petroleum, U. S.) | Cu feet | 5.6146 |
| Barrels (petroleum, U. S.) | Gallons (U. S.) | 42 |
| Barrels (petroleum, U. S.) | Liters | 158.98 |
| Barrels (U. S., liq.) | Cu feet | 4.2109 |
| Barrels (U. S., liq.) | Cu inches | 7.2765×10^3 |

CONVERSION FACTORS (cont.).

| To Convert From | To | Multiply By |
|-----------------------|-----------------------|-------------------------|
| Barrels (U. S., liq.) | Cu meters | 0.1192 |
| Barrels (U. S., liq.) | Gallons (U. S., liq.) | 31.5 |
| Barrels (U. S., liq.) | Liters | 119.24 |
| Cubic centimeters | Cu feet | 3.5315×10^{-5} |
| Cubic centimeters | Cu inches | 0.06102 |
| Cubic centimeters | Cu meters | 1.0×10^{-6} |
| Cubic centimeters | Cu yards | 1.308×10^{-6} |
| Cubic centimeters | Gallons (U. S., liq.) | 2.642×10^{-4} |
| Cubic centimeters | Quarts (U. S., liq.) | 1.0567×10^{-3} |
| Cubic feet | Cu centimeters | 2.8317×10^4 |
| Cubic feet | Cu meters | 0.028317 |
| Cubic feet | Gallons (U. S., liq.) | 7.4805 |
| Cubic feet | Liters | 28.317 |
| Cubic inches | Cu cm | 16.387 |
| Cubic inches | Cu feet | 5.787×10^{-4} |
| Cubic inches | Cu meters | 1.6387×10^{-5} |
| Cubic inches | Cu yards | 2.1433×10^{-5} |
| Cubic inches | Gallons (U. S., liq.) | 4.329×10^{-3} |
| Cubic inches | Liters | 0.01639 |
| Cubic inches | Quarts (U. S., liq.) | 0.01732 |
| Cubic meters | Barrels (U. S., liq.) | 8.3864 |
| Cubic meters | Cu cm | 1.0×10^6 |
| Cubic meters | Cu feet | 35.315 |
| Cubic meters | Cu inches | 6.1024×10^4 |
| Cubic meters | Cu yards | 1.308 |
| Cubic meters | Gallons (U. S., liq.) | 264.17 |
| Cubic meters | Liters | 1000 |
| Cubic yards | Bushels (Brit.) | 21.022 |
| Cubic yards | Bushels (U. S.) | 21.696 |
| Cubic yards | Cu cm | 7.6455×10^5 |

CONVERSION FACTORS (cont.).

| To Convert From | To | Multiply By |
|-----------------------|----------------------------|-------------------------|
| Cubic yards | Cu feet | 27 |
| Cubic yards | Cu inches | 4.6656×10^4 |
| Cubic yards | Cu meters | 0.76455 |
| Cubic yards | Gallons | 168.18 |
| Cubic yards | Gallons | 173.57 |
| Cubic yards | Gallons | 201.97 |
| Cubic yards | Liters | 764.55 |
| Cubic yards | Quarts | 672.71 |
| Cubic yards | Quarts | 694.28 |
| Cubic yards | Quarts | 807.90 |
| Gallons (U. S., liq.) | Barrels (U. S., liq.) | 0.03175 |
| Gallons (U. S., liq.) | Barrels (petroleum, U. S.) | 0.02381 |
| Gallons (U. S., liq.) | Bushels (U. S.) | 0.10742 |
| Gallons (U. S., liq.) | Cu centimeters | 3.7854×10^3 |
| Gallons (U. S., liq.) | Cu feet | 0.13368 |
| Gallons (U. S., liq.) | Cu inches | 231 |
| Gallons (U. S., liq.) | Cu meters | 3.7854×10^{-3} |
| Gallons (U. S., liq.) | Cu yards | 4.951×10^{-3} |
| Gallons (U. S., liq.) | Gallons (wine) | 1.0 |
| Gallons (U. S., liq.) | Liters | 3.7854 |
| Gallons (U. S., liq.) | Ounces (U. S., fluid) | 128.0 |
| Gallons (U. S., liq.) | Pints (U. S., liq.) | 8.0 |
| Gallons (U. S., liq.) | Quarts (U. S., liq.) | 4.0 |
| Liters | Cu centimeters | 1000 |
| Liters | Cu feet | 0.035315 |
| Liters | Cu inches | 61.024 |
| Liters | Cu meters | 0.001 |
| Liters | Gallons (U. S., liq.) | 0.2642 |
| Liters | Ounces (U. S., fluid) | 33.814 |

CONVERSION FACTORS (cont.).

| To Convert From | To | Multiply By |
|--------------------|-----------------------|-------------------------|
| Volumetric Rate | | |
| Cu ft/min | Cu cm/sec | 471.95 |
| Cu ft/min | Cu ft /hr | 60. 0 |
| Cu ft/min | Gal (U. S.)/min | 7.4805 |
| Cu ft/min | Liters/sec | 0.47193 |
| Cu meters/min | Gal (U. S.)/min | 264.17 |
| Cu meters/min | Liters/min | 999.97 |
| Gallons (U. S.)/hr | Cu ft/hr | 0.13368 |
| Gallons (U. S.)/hr | Cu meters/min | 6.309×10^{-5} |
| Gallons (U. S.)/hr | Cu yd/min | 8.2519×10^{-5} |
| Gallons (U. S.)/hr | Liters/hr | 3.7854 |
| Liters/min | Cu ft/min | 0.0353 |
| Liters/min | Gal (U. S., liq.)/min | 0.2642 |

^a Where appropriate, the conversion factors appearing in this table have been rounded to four to six significant figures for ease in use. The accuracy of these numbers is considered suitable for use with emissions data; if a more accurate number is required, tables containing exact factors should be consulted.

CONVERSION FACTORS FOR COMMON AIR POLLUTION MEASUREMENTS

AIRBORNE PARTICULATE MATTER

| To Convert From | To | Multiply By |
|-------------------|-------------------|-------------------------|
| Milligrams/cu m | Grams/cu ft | 283.2×10^{-6} |
| | Grams/cu m | 0.001 |
| | Micrograms/cu m | 1000.0 |
| | Micrograms/cu ft | 28.32 |
| | Pounds/1000 cu ft | 62.43×10^{-6} |
| Grams/cu ft | Milligrams/cu m | 35.3145×10^3 |
| | Grams/cu m | 35.314 |
| | Micrograms/cu m | 35.314×10^6 |
| | Micrograms/cu ft | 1.0×10^6 |
| | Pounds/1000 cu ft | 2.2046 |
| Grams/cu m | Milligrams/cu m | 1000.0 |
| | Grams/cu ft | 0.02832 |
| | Micrograms/cu m | 1.0×10^6 |
| | Micrograms/cu ft | 28.317×10^3 |
| | Pounds/1000 cu ft | 0.06243 |
| Micrograms/cu m | Milligrams/cu m | 0.001 |
| | Grams/cu ft | 28.317×10^{-9} |
| | Grams/cu m | 1.0×10^{-6} |
| | Micrograms/cu ft | 0.02832 |
| | Pounds/1000 cu ft | 62.43×10^{-9} |
| Micrograms/cu ft | Milligrams/cu m | 35.314×10^{-3} |
| | Grams/cu ft | 1.0×10^{-6} |
| | Grams/cu m | 35.314×10^{-6} |
| | Micrograms/cu m | 35.314 |
| | Pounds/1000 cu ft | 2.2046×10^{-6} |
| Pounds/1000 cu ft | Milligrams/cu m | 16.018×10^3 |
| | Grams/cu ft | 0.35314 |
| | Micrograms/cu m | 16.018×10^6 |
| | Grams/cu m | 16.018 |
| | Micrograms/cu ft | 353.14×10^3 |

CONVERSION FACTORS FOR COMMON AIR POLLUTION MEASUREMENTS (cont.).

SAMPLING PRESSURE

| To Convert From | To | Multiply By |
|------------------------------|------------------------------|------------------------|
| Millimeters of mercury (0°C) | Inches of water (60°F) | 0.5358 |
| Inches of mercury (0°C) | Inches of water (60°F) | 13.609 |
| | Millimeters of mercury (0°C) | 1.8663 |
| Inches of water (60°F) | Inches of mercury (0°C) | 73.48×10^{-3} |

CONVERSION FACTORS FOR COMMON AIR POLLUTION MEASUREMENTS (cont.).

ATMOSPHERIC GASES

| To Convert From | To | Multiply By |
|----------------------|----------------------|----------------------------|
| Milligrams/cu m | Micrograms/cu m | 1000.0 |
| | Micrograms/liter | 1.0 |
| | ppm by volume (20°C) | 24.04/M |
| | ppm by weight | 0.8347 |
| | Pounds/cu ft | 62.43 x 10 ⁻⁹ |
| Micrograms/cu m | Milligrams/cu m | 0.001 |
| | Micrograms/liter | 0.001 |
| | ppm by volume (20°C) | 0.02404/M |
| | ppm by weight | 834.7 x 10 ⁻⁶ |
| | Pounds/cu ft | 62.43 x 10 ⁻¹² |
| Micrograms/liter | Milligrams/cu m | 1.0 |
| | Micrograms/cu m | 1000.0 |
| | ppm by volume (20°C) | 24.04/M |
| | ppm by weight | 0.8347 |
| | Pounds/cu ft | 62.43 x 10 ⁻⁹ |
| ppm by volume (20°C) | Milligrams/cu m | M/24.04 |
| | Micrograms/cu m | M/0.02404 |
| | Micrograms/liter | M/24.04 |
| | ppm by weight | M/28.8 |
| | Pounds/cu ft | M/385.1 x 10 ⁶ |
| ppm by weight | Milligrams/cu m | 1.198 |
| | Micrograms/cu m | 1.198 x 10 ⁻³ |
| | Micrograms/liter | 1.198 |
| | ppm by volume (20°C) | 28.8/M |
| | Pounds/cu ft | 7.48 x 10 ⁻⁶ |
| Pounds/cu ft | Milligrams/cu m | 16.018 x 10 ⁶ |
| | Micrograms/cu m | 16.018x 10 ⁹ |
| | Micrograms/liter | 16.018x 10 ⁶ |
| | ppm by volume (20°C) | 385.1 x 10 ⁶ /M |
| | ppm by weight | 133.7 x 10 ³ |

M = Molecular weight of gas.

CONVERSION FACTORS FOR COMMON AIR POLLUTION MEASUREMENTS (cont.).

VELOCITY

| To Convert From | To | Multiply By |
|-----------------|---------------|-------------|
| Meters/sec | Kilometers/hr | 3.6 |
| | Feet/sec | 3.281 |
| | Miles/hr | 2.237 |
| Kilometers/hr | Meters/sec | 0.2778 |
| | Feet/sec | 0.9113 |
| | Miles/hr | 0.6214 |
| Feet/sec | Meters/sec | 0.3048 |
| | Kilometers/hr | 1.09728 |
| | Miles/hr | 0.6818 |
| Miles/hr | Meters/sec | 0.4470 |
| | Kilometers/hr | 1.6093 |
| | Feet/sec | 1.4667 |

ATMOSPHERIC PRESSURE

| To Convert From | To | Multiply By |
|------------------------|------------------------|------------------------|
| Atmospheres | Millimeters of mercury | 760.0 |
| | Inches of mercury | 29.92 |
| | Millibars | 1013.2 |
| Millimeters of mercury | Atmospheres | 1.316×10^{-3} |
| | Inches of mercury | 39.37×10^{-3} |
| | Millibars | 1.333 |
| Inches of mercury | Atmospheres | 0.03333 |
| | Millimeters of mercury | 25.4005 |
| | Millibars | 33.35 |
| Millibars | Atmospheres | 0.00987 |
| | Millimeters of mercury | 0.75 |
| | Inches of mercury | 0.30 |

VOLUME EMISSIONS

| To Convert From | To | Multiply By |
|-----------------|--------------|-------------|
| Cubic m/min | Cubic ft/min | 35.314 |
| Cubic ft/min | Cubic m/min | 0.0283 |

BOILER CONVERSION FACTORS

| | | | |
|---------------|---|--|--|
| 1 Megawatt | = | 10.5 x 10 ⁶ Btu/hr (8 to 14 x 10 ⁶ Btu/hr) | NOTES: In the relationships, |
| 1 Megawatt | = | 8 x 10 ³ lb steam/hr (6 to 11 x 10 ³ lb steam/hr) | Megawatt is the net electric production of a steam electric power plant. |
| 1 BHP | = | 34.5 lb steam/hr | BHP is boiler horsepower. |
| 1 BHP | = | 45 x 10 ³ Btu/hr (40 to 50 x 10 ³ Btu/hr) | lb steam/hr is the steam production rate of the boiler. |
| 1 lb steam/hr | = | 1.4 x 10 ³ Btu/hr (1.2 to 1.7 x 10 ³ Btu/hr) | Btu/hr is the heat input rate to the boiler (based on the gross or high heating value of the fuel burned). |

For less efficient (generally older and/or smaller) boiler operations, use the higher values expressed. For more efficient operations (generally newer and/or larger), use the lower values.

| Volume | cu in | ml | liters | ounces (U. S. fl.) | gallons (U. S.) | barrels (U. S.) | cu ft |
|------------------------------|----------|------------------------|-----------|--------------------|-------------------------|--------------------------|--------------------------|
| Cubic inches | | 16.3868 | 0.0163868 | 0.5541 | 4.3290x10 ⁻³ | 1.37429x10 ⁻⁴ | 5.78704x10 ⁻⁴ |
| Milliliters | 0.061024 | | 0.001 | 0.03381 | 2.6418x10 ⁻⁴ | 8.387x10 ⁻⁶ | 3.5316x10 ⁻⁵ |
| Liters | 61.024 | 1000 | | 33.8147 | 0.26418 | 8.387x10 ⁻³ | 0.035316 |
| Ounces (U. S. fl.) | 1.80469 | 29.5729 | 0.029573 | | 7.8125x10 ⁻³ | 2.48x10 ⁻⁴ | 1.0443x10 ⁻³ |
| Gallons (U. S.) ^a | 231 | 3785.3 | 3.7853 | 128 | | 0.031746 | 0.13368 |
| Barrels (U. S.) | 7276.5 | 1.1924x10 ⁵ | 119.2369 | 4032.0 | 31.5 | | 4.2109 |
| Cubic feet | 1728 | 2.8316x10 ⁴ | 28.316 | 957.568 | 7.481 | 0.23743 | |

^a U. S. gallon of water at 16.7°C (62°F) weighs 3.780 kg or 8.337 pounds (avoir.)

| Mass | grams | kilograms | ounces (avoir.) | pounds (avoir.) | grains | tons (U. S.) | milligrams |
|------------------------------|-----------------------|------------------------|------------------------|------------------------|---------------------|------------------------|------------------------|
| Grams | | 0.001 | 3.527x10 ⁻² | 2.205x10 ⁻³ | 15.432 | 1.102x10 ⁻⁶ | 1000 |
| Kilograms | 1000 | | 35.274 | 2.2046 | 15432 | 1.102x10 ⁻³ | 1x10 ⁶ |
| Ounces (avoir.) | 28.350 | 0.028350 | | 0.0625 | 437.5 | 3.125x10 ⁻⁵ | 2.8350x10 ⁴ |
| Pounds (avoir.) ^a | 453.59 | 0.45359 | 16.0 | | 7000 | 5.0x10 ⁻⁴ | 4.5359x10 ⁵ |
| Grains | 0.06480 | 6.480x10 ⁻⁵ | 2.286x10 ⁻³ | 1.429x10 ⁻⁴ | | 7.142x10 ⁻⁸ | 64.799 |
| Tons (U. S.) | 9.072x10 ⁵ | 907.19 | 3.200x10 ⁴ | 2000 | 1.4x10 ⁷ | | 9.0718x10 ⁸ |
| Milligrams | 0.001 | 1x10 ⁻⁶ | 3.527x10 ⁻⁵ | 2.205x10 ⁻⁶ | 0.015432 | 1.102x10 ⁻⁹ | |

^a Mass of 27.692 cubic inches water weighed in air at 4.0°C, 760 mm mercury pressure.

| Work and Energy | g cal. | kg cal. | ergs | joules | Btu | ft lb | kg meters | L-Atm | HP hours | ft poundals | kWh | Wh |
|----------------------------|-------------------------|--------------------------|-------------------------|------------------------|--------------------------|-------------------------|-------------------------|--------------------------|--------------------------|-------------------------|--------------------------|--------------------------|
| Gram calories (mean) | | 0.001 | 4.186x10 ⁷ | 4.186 | 3.9680x10 ⁻³ | 3.0874 | 0.42685 | 0.041311 | 1.5593x10 ⁻⁶ | 99.334 | 1.1628x10 ⁻⁶ | 1.1628x10 ⁻³ |
| Kilogram calories | 1000 | | 4.186x10 ¹⁰ | 4186 | 3.9680 | 3087.4 | 426.85 | 41.311 | 1.5593x10 ⁻³ | 99334 | 1.1628x10 ⁻³ | 1.1628 |
| Ergs | 2.3889x10 ⁻⁸ | 2.3889x10 ⁻¹¹ | | 1x10 ⁻⁷ | 9.4805x10 ⁻¹¹ | 7.3756x10 ⁻⁸ | 1.0197x10 ⁻⁸ | 9.8689x10 ⁻¹⁰ | 3.7251x10 ⁻¹⁴ | 2.3730x10 ⁻⁶ | 2.7778x10 ⁻¹⁴ | 2.7778x10 ⁻¹¹ |
| Joules | 0.23889 | 2.3889x10 ⁻⁴ | 1x10 ⁷ | | 9.4805x10 ⁻⁴ | 0.73756 | 0.10197 | 9.8689x10 ⁻³ | 3.7251x10 ⁻⁷ | 23.730 | 2.7778x10 ⁻⁷ | 2.7778x10 ⁻⁴ |
| Btu (mean) | 251.98 | 0.25198 | 1.0548x10 ¹⁰ | 1054.8 | | 777.98 | 107.56 | 10.409 | 3.9292x10 ⁻⁴ | 2.5030x10 ⁴ | 2.930x10 ⁻⁴ | 0.2930 |
| Foot pounds | 0.32389 | 3.2389x10 ⁻⁴ | 1.35582x10 ⁷ | 1.3558 | 1.2854x10 ⁻³ | | 0.13825 | 0.013381 | 5.0505x10 ⁻⁷ | 32.174 | 3.7662x10 ⁻⁷ | 3.7662x10 ⁻⁴ |
| Kilogram meters | 2.3427 | 2.3427x10 ⁻³ | 9.8066x10 ⁷ | 9.8066 | 9.2967x10 ⁻³ | 7.2330 | | 0.096781 | 3.6529x10 ⁻⁶ | 232.71 | 2.7241x10 ⁻⁶ | 2.7241x10 ⁻³ |
| Liter atmospheres (normal) | 24.206 | 2.4206x10 ⁻² | 1.0133x10 ⁹ | 101.328 | 0.09606 | 74.735 | 10.333 | | 3.7745x10 ⁻⁵ | 2404.5 | 2.8164x10 ⁻⁵ | 2.8164x10 ⁻² |
| Horsepower hours | 6.4130x10 ⁵ | 641.30 | 2.6845x10 ¹³ | 2.6845x10 ⁶ | 2454.0 | 1.9800x10 ⁶ | 2.7374x10 ⁵ | 26494 | | 6.3705x10 ⁷ | 0.7457 | 745.7 |
| Foot poundals | 0.010067 | 10.067x10 ⁻⁶ | 4.21402x10 ⁵ | 0.04214 | 3.9952x10 ⁻⁵ | 0.031081 | 4.2972x10 ⁻³ | 4.1558x10 ⁻⁴ | 1.5697x10 ⁻⁸ | | 1.17055x10 ⁻⁸ | 1.17055x10 ⁻⁵ |
| Kilowatt hours | 8.6001x10 ⁵ | 860.01 | 3.6000x10 ¹³ | 3.6000x10 ⁶ | 3413.0 | 2.6552x10 ⁶ | 3.6709x10 ⁻⁵ | 3.5529x10 ⁶ | 1.3440 | 8.5430x10 ⁷ | | 1000 |
| Watt hours | 860.01 | 0.86001 | 3.6000x10 ¹⁰ | 3600 | 3.4130 | 2655.3 | 367.09 | 3.5529x10 ³ | 1.3410x10 ⁻³ | 8.5430x10 ¹ | 0.001 | |

| Power | watts | kW | ft lb/sec | erg/sec | Btu/min | g cm/sec | kg cal/min | HP | lumens | joules/sec | Btu/hr |
|------------------------------|-------------------------|-------------------------|-------------------------|----------------------|-------------------------|-------------------------|-------------------------|--------------------------|-------------------------|-------------------------|-------------------------|
| Watts | | 0.001 | 0.73756 | 1×10^7 | 0.056884 | 1.0197×10^4 | 0.01433 | 1.341×10^{-3} | 668 | 1 | 3.41304 |
| Kilowatts | 1000 | | 737.56 | 1×10^{10} | 56.884 | 1.0197×10^7 | 14.3334 | 1.3410 | 6.68×10^5 | 1000 | 3413.04 |
| Foot pounds per second | 1.35582 | 1.3558×10^{-3} | | 1.3558×10^7 | 0.077124 | 1.3826×10^4 | 0.019433 | 1.8182×10^{-3} | 906.28 | 1.3558 | 4.6274 |
| Ergs per second | 1×10^{-7} | 1×10^{-10} | 7.3756×10^{-8} | | 5.688×10^{-9} | 1.0197×10^{-3} | 1.4333×10^{-9} | 1.3410×10^{-10} | 6.6845×10^{-5} | 1×10^{-7} | 3.4130×10^{-7} |
| Btu ^a per minute | 17.580 | 0.017580 | 12.9600 | 1.7580×10^8 | | 1.7926×10^5 | 0.2520 | 0.023575 | 11751 | 17.580 | 60 |
| Gram centimeters per second | 9.8067×10^{-5} | 9.8067×10^{-8} | 7.2330×10^{-5} | 980.665 | 5.5783×10^{-6} | | 1.4056×10^{-6} | 1.3151×10^{-7} | 0.065552 | 9.8067×10^{-5} | 3.3470×10^{-4} |
| Kilogram calories per minute | 69.767 | 0.069767 | 51.457 | 6.9770×10^8 | 3.9685 | 7.1146×10^5 | | 0.093557 | 46636 | 69.769 | 238.11 |
| Horsepower (U. S.) | 745.7 | 0.7457 | 550 | 7.457×10^9 | 42.4176 | 7.6042×10^6 | 10.688 | | 498129 | 745.7 | 2545.1 |
| Lumens | 1.496×10^{-3} | 1.496×10^{-6} | 1.0034×10^{-3} | 1.496×10^4 | 8.5096×10^{-5} | 15.254 | 2.1437×10^{-5} | 2.0061×10^{-6} | | 1.496×10^{-3} | 5.1069×10^{-3} |
| Joules per second | 1 | 0.001 | 0.73756 | 1×10^7 | 0.056884 | 1.0197×10^4 | 0.01433 | 1.341×10^{-3} | 668 | | 3.41304 |
| Btu ^a per hour | 0.29299 | 2.9299×10^{-4} | 0.21610 | 2.9299×10^6 | 0.01667 | 2.9878×10^3 | 4.1997×10^{-3} | 3.9291×10^{-4} | 195.80 | 0.29299 | |

^a British Thermal Units (Mean)

CONVERSION FACTORS FOR VARIOUS SUBSTANCES^a

| Type Of Substance | Conversion Factors |
|---------------------------------|---|
| Fuel | |
| Oil | 1 bbl = 159 liters (42 gal) |
| Natural gas | 1 therm = 100,000 Btu (approx.25000 kcal) |
| Gaseous Pollutants | |
| O ₃ | 1 ppm, volume = 1960µg/m ³ |
| NO ₂ | 1 ppm, volume = 1880µg/m ³ |
| SO ₂ | 1 ppm, volume = 2610µg/m ³ |
| H ₂ S | 1 ppm, volume = 1390 µg/m ³ |
| CO | 1 ppm, volume = 1.14 mg/m ³ |
| HC (as methane) | 1 ppm, volume = 0.654 mg/m ³ |
| Agricultural products | |
| Corn | 1 bu = 25.4 kg = 56 lb |
| Milo | 1 bu = 25.4 kg = 56 lb |
| Oats | 1 bu = 14.5 kg = 32 lb |
| Barley | 1 bu = 21.8 kg = 48 lb |
| Wheat | 1 bu = 27.2 kg = 60 lb |
| Cotton | 1 bale = 226 kg = 500 lb |
| Mineral products | |
| Brick | 1 brick = 2.95 kg = 6.5 lb |
| Cement | 1 bbl = 170 kg = 375 lb |
| Cement | 1 yd ³ = 1130 kg = 2500 lb |
| Concrete | 1 yd ³ = 1820 kg = 4000 lb |
| Mobile sources, fuel efficiency | |
| Motor vehicles | 1.0 mi/gal = 0.426 km/liter |
| Waterborne vessels | 1.0 gal/naut mi = 2.05 liters/km |
| Miscellaneous liquids | |
| Beer | 1 bbl = 31.5 gal |
| Paint | 1 gal = 4.5 to 6.82 kg = 10 to 15 lb |
| Varnish | 1 gal = 3.18 kg = 7 lb |
| Whiskey | 1 bbl = 190 liters = 50.2 gal |
| Water | 1 gal = 3.81 kg = 8.3 lb |

^a Many of the conversion factors in this table represent average values and approximations and some of the values vary with temperature and pressure. These conversion factors should, however, be sufficiently accurate for general field use.