

# Section TECH-H

## Conversion Factors

### TECH-H-1 Temperature Conversion Chart {Centigrade (Celsius)-Fahrenheit}

| C   | F     | C  | F     | C   | F      | C    | F    | C    | F    | C    | F     |
|-----|-------|----|-------|-----|--------|------|------|------|------|------|-------|
| -40 | -40.0 | +5 | +41.0 | +40 | +104.0 | +175 | +347 | +350 | +662 | +750 | +1382 |
| -38 | -36.4 | 6  | 42.8  | 41  | 105.8  | 180  | 356  | 355  | 671  | 800  | 1472  |
| -36 | -32.8 | 7  | 44.6  | 42  | 107.6  | 185  | 365  | 360  | 680  | 850  | 1562  |
| -34 | -29.2 | 8  | 46.4  | 43  | 109.4  | 190  | 374  | 365  | 689  | 900  | 1652  |
| -32 | -25.6 | 9  | 48.2  | 44  | 111.2  | 195  | 383  | 370  | 698  | 950  | 1742  |
| -30 | -22.0 | 10 | 50.0  | 45  | 113.0  | 200  | 392  | 375  | 707  | 1000 | 1832  |
| -28 | -18.4 | 11 | 51.8  | 46  | 114.8  | 205  | 401  | 380  | 716  | 1050 | 1922  |
| -26 | -14.8 | 12 | 53.6  | 47  | 116.6  | 210  | 410  | 385  | 725  | 1100 | 2012  |
| -24 | -11.2 | 13 | 55.4  | 48  | 118.4  | 215  | 419  | 390  | 734  | 1150 | 2102  |
| -22 | -7.6  | 14 | 57.2  | 49  | 120.2  | 220  | 428  | 395  | 743  | 1200 | 2192  |
| -20 | -4.0  | 15 | 59.0  | 50  | 122.0  | 225  | 437  | 400  | 752  | 1250 | 2282  |
| -19 | -2.2  | 16 | 60.8  | 55  | 131.0  | 230  | 446  | 405  | 761  | 1300 | 2372  |
| -18 | -0.4  | 17 | 62.6  | 60  | 140.0  | 235  | 455  | 410  | 770  | 1350 | 2462  |
| -17 | +1.4  | 18 | 64.4  | 65  | 149.0  | 240  | 464  | 415  | 779  | 1400 | 2552  |
| -16 | 3.2   | 19 | 66.2  | 70  | 158.0  | 245  | 473  | 420  | 788  | 1450 | 2642  |
| -15 | 5.0   | 20 | 68.0  | 75  | 167.0  | 250  | 482  | 425  | 797  | 1500 | 2732  |
| -14 | 6.8   | 21 | 69.8  | 80  | 176.0  | 255  | 491  | 430  | 806  | 1550 | 2822  |
| -13 | 8.6   | 22 | 71.6  | 85  | 185.0  | 260  | 500  | 435  | 815  | 1600 | 2912  |
| -12 | 10.4  | 23 | 73.4  | 90  | 194.0  | 265  | 509  | 440  | 824  | 1650 | 3002  |
| -11 | 12.2  | 24 | 75.2  | 95  | 203.0  | 270  | 518  | 445  | 833  | 1700 | 3092  |
| -10 | 14.0  | 25 | 77.0  | 100 | 212.0  | 275  | 527  | 450  | 842  | 1750 | 3182  |
| -9  | 15.8  | 26 | 78.8  | 105 | 221.0  | 280  | 536  | 455  | 851  | 1800 | 3272  |
| -8  | 17.6  | 27 | 80.6  | 110 | 230.0  | 285  | 545  | 460  | 860  | 1850 | 3362  |
| -7  | 19.4  | 28 | 82.4  | 115 | 239.0  | 290  | 554  | 465  | 869  | 1900 | 3452  |
| -6  | 21.2  | 29 | 84.2  | 120 | 248.0  | 295  | 563  | 470  | 878  | 1950 | 3542  |
| -5  | 23.0  | 30 | 86.0  | 125 | 257.0  | 300  | 572  | 475  | 887  | 2000 | 3632  |
| -4  | 24.8  | 31 | 87.8  | 130 | 266.0  | 305  | 581  | 480  | 896  | 2050 | 3722  |
| -3  | 26.6  | 32 | 89.6  | 135 | 275.0  | 310  | 590  | 485  | 905  | 2100 | 3812  |
| -2  | 28.4  | 33 | 91.4  | 140 | 284.0  | 315  | 599  | 490  | 914  | 2150 | 3902  |
| -1  | 30.2  | 34 | 93.2  | 145 | 293.0  | 320  | 608  | 495  | 923  | 2200 | 3992  |
| 0   | 32.0  | 35 | 95.0  | 150 | 302.0  | 325  | 617  | 500  | 932  | 2250 | 4082  |
| +1  | 33.8  | 36 | 96.8  | 155 | 311.0  | 330  | 626  | 505  | 941  | 2300 | 4172  |
| 2   | 35.6  | 37 | 98.6  | 160 | 320.0  | 335  | 635  | 510  | 950  | 2350 | 4262  |
| 3   | 37.4  | 38 | 100.4 | 165 | 329.0  | 340  | 644  | 515  | 959  | 2400 | 4352  |
| 4   | 39.2  | 39 | 102.2 | 170 | 338.0  | 345  | 653  | 520  | 968  | 2450 | 4442  |

$$\text{Degrees Celsius} = \frac{(\text{Degrees Fahrenheit} - 32) \times 5}{9}$$

$$\text{Degrees Kelvin (K)} = \text{Degrees Celsius} + 273.15$$

$$\text{Degrees Rankine (R)} = \text{Degrees Fahrenheit} + 459.69$$

$$\text{Degrees Fahrenheit} = \frac{(\text{Degrees Celsius} \times 9) + 32}{5}$$

(0 degrees K or R = absolute zero)

# TECH-H-2 A.P.I. and Baumé Gravity Tables and Weight Factors

| A.P.I Gravity | Baumé Gravity | Specific Gravity | Lbs. Per U.S. Gal. | U.S. Gals. per Lb. |
|---------------|---------------|------------------|--------------------|--------------------|
| 0             | 10.247        | 1.0760           | 8.962              | 0.1116             |
| 1             | 9.223         | 1.0679           | 8.895              | 0.1124             |
| 2             | 8.198         | 1.0599           | 8.828              | 0.1133             |
| 3             | 7.173         | 1.0520           | 8.762              | 0.1141             |
| 4             | 6.148         | 1.0443           | 8.698              | 0.1150             |
| 5             | 5.124         | 1.0366           | 8.634              | 0.1158             |
| 6             | 4.099         | 1.0291           | 8.571              | 0.1167             |
| 7             | 3.074         | 1.0217           | 8.509              | 0.1175             |
| 8             | 2.049         | 1.0143           | 8.448              | 0.1184             |
| 9             | 1.025         | 1.0071           | 8.388              | 0.1192             |
| 10            | 10.00         | 1.0000           | 8.328              | 0.1201             |
| 11            | 10.99         | 0.9930           | 8.270              | 0.1209             |
| 12            | 11.98         | 0.9861           | 8.212              | 0.1218             |
| 13            | 12.97         | 0.9792           | 8.155              | 0.1226             |
| 14            | 13.96         | 0.9725           | 8.099              | 0.1235             |
| 15            | 14.95         | 0.9659           | 8.044              | 0.1243             |
| 16            | 15.94         | 0.9593           | 7.989              | 0.1252             |
| 17            | 16.93         | 0.9529           | 7.935              | 0.1260             |
| 18            | 17.92         | 0.9465           | 7.882              | 0.1269             |
| 19            | 18.90         | 0.9402           | 7.830              | 0.1277             |
| 20            | 19.89         | 0.9340           | 7.778              | 0.1286             |
| 21            | 20.88         | 0.9279           | 7.727              | 0.1294             |
| 22            | 21.87         | 0.9218           | 7.676              | 0.1303             |
| 23            | 22.86         | 0.9159           | 7.627              | 0.1311             |
| 24            | 23.85         | 0.9100           | 7.578              | 0.1320             |
| 25            | 24.84         | 0.9024           | 7.529              | 0.1328             |
| 26            | 25.83         | 0.8984           | 7.481              | 0.1337             |
| 27            | 26.82         | 0.8927           | 7.434              | 0.1345             |
| 28            | 27.81         | 0.8871           | 7.387              | 0.1354             |
| 29            | 28.80         | 0.8816           | 7.341              | 0.1362             |
| 30            | 29.79         | 0.8762           | 7.296              | 0.1371             |
| 31            | 30.78         | 0.8708           | 7.251              | 0.1379             |
| 32            | 31.77         | 0.8654           | 7.206              | 0.1388             |
| 33            | 32.76         | 0.8602           | 7.163              | 0.1396             |
| 34            | 33.75         | 0.8850           | 7.119              | 0.1405             |
| 35            | 34.73         | 0.8498           | 7.076              | 0.1413             |
| 36            | 35.72         | 0.8448           | 7.034              | 0.1422             |
| 37            | 36.71         | 0.8398           | 6.993              | 0.1430             |
| 38            | 37.70         | 0.8348           | 6.951              | 0.1439             |
| 39            | 38.69         | 0.8299           | 6.910              | 0.1447             |
| 40            | 39.68         | 0.8251           | 6.870              | 0.1456             |
| 41            | 40.67         | 0.8203           | 6.830              | 0.1464             |
| 42            | 41.66         | 0.8155           | 6.790              | 0.1473             |
| 43            | 42.65         | 0.8109           | 6.752              | 0.1481             |
| 44            | 43.64         | 0.8063           | 6.713              | 0.1490             |
| 45            | 44.63         | 0.8017           | 6.675              | 0.1498             |
| 46            | 45.62         | 0.7972           | 6.637              | 0.1507             |
| 47            | 50.61         | 0.7927           | 6.600              | 0.1515             |
| 48            | 50.60         | 0.7883           | 6.563              | 0.1524             |
| 49            | 50.59         | 0.7839           | 6.526              | 0.1532             |
| 50            | 50.58         | 0.7796           | 6.490              | 0.1541             |

| A.P.I Gravity | Baumé Gravity | Specific Gravity | Lbs. Per U.S. Gal. | U.S. Gals. per Lb. |
|---------------|---------------|------------------|--------------------|--------------------|
| 51            | 50.57         | 0.7753           | 6.455              | 0.1549             |
| 52            | 51.55         | 0.7711           | 6.420              | 0.1558             |
| 53            | 52.54         | 0.7669           | 6.385              | 0.1566             |
| 54            | 53.53         | 0.7628           | 6.350              | 0.1575             |
| 55            | 54.52         | 0.7587           | 6.316              | 0.1583             |
| 56            | 55.51         | 0.7547           | 6.283              | 0.1592             |
| 57            | 56.50         | 0.7507           | 6.249              | 0.1600             |
| 58            | 57.49         | 0.7467           | 6.216              | 0.1609             |
| 59            | 58.48         | 0.7428           | 6.184              | 0.1617             |
| 60            | 59.47         | 0.7389           | 6.151              | 0.1626             |
| 61            | 60.46         | 0.7351           | 6.119              | 0.1634             |
| 62            | 61.45         | 0.7313           | 6.087              | 0.1643             |
| 63            | 62.44         | 0.7275           | 6.056              | 0.1651             |
| 64            | 63.43         | 0.7238           | 6.025              | 0.1660             |
| 65            | 64.42         | 0.7201           | 5.994              | 0.1668             |
| 66            | 65.41         | 0.7165           | 5.964              | 0.1677             |
| 67            | 66.40         | 0.7128           | 5.934              | 0.1685             |
| 68            | 67.39         | 0.7093           | 5.904              | 0.1694             |
| 69            | 68.37         | 0.7057           | 5.874              | 0.1702             |
| 70            | 69.36         | 0.7022           | 5.845              | 0.1711             |
| 71            | 70.35         | 0.6988           | 5.817              | 0.1719             |
| 72            | 71.34         | 0.6953           | 5.788              | 0.1728             |
| 73            | 72.33         | 0.6919           | 5.759              | 0.1736             |
| 74            | 73.32         | 0.6886           | 5.731              | 0.1745             |
| 75            | 74.31         | 0.6852           | 5.703              | 0.1753             |
| 76            | 75.30         | 0.6819           | 5.676              | 0.1762             |
| 77            | 76.29         | 0.6787           | 5.649              | 0.1770             |
| 78            | 77.28         | 0.6754           | 5.622              | 0.1779             |
| 79            | 78.27         | 0.6722           | 5.595              | 0.1787             |
| 80            | 79.26         | 0.6690           | 5.568              | 0.1796             |
| 81            | 80.25         | 0.6659           | 5.542              | 0.1804             |
| 82            | 81.24         | 0.6628           | 5.516              | 0.1813             |
| 83            | 82.23         | 0.6597           | 5.491              | 0.1821             |
| 84            | 83.22         | 0.6566           | 5.465              | 0.1830             |
| 85            | 84.20         | 0.6536           | 5.440              | 0.1838             |
| 86            | 85.19         | 0.6506           | 5.415              | 0.1847             |
| 87            | 86.18         | 0.6476           | 5.390              | 0.1855             |
| 88            | 87.17         | 0.6446           | 5.365              | 0.1864             |
| 89            | 88.16         | 0.6417           | 5.341              | 0.1872             |
| 90            | 89.15         | 0.6388           | 5.316              | 0.1881             |
| 91            | 90.14         | 0.6360           | 5.293              | 0.1889             |
| 92            | 91.13         | 0.6331           | 5.269              | 0.1898             |
| 93            | 92.12         | 0.6303           | 5.246              | 0.1906             |
| 94            | 93.11         | 0.6275           | 5.222              | 0.1915             |
| 95            | 94.10         | 0.6247           | 5.199              | 0.1924             |
| 96            | 95.09         | 0.6220           | 5.176              | 0.1932             |
| 97            | 96.08         | 0.6193           | 5.154              | 0.1940             |
| 98            | 97.07         | 0.6166           | 5.131              | 0.1949             |
| 99            | 98.06         | 0.6139           | 5.109              | 0.1957             |
| 100           | 99.05         | 0.6112           | 5.086              | 0.1966             |

The relation of Degrees Baumé or A.P.I. to Specific Gravity is expressed by the following formulas:

For liquids lighter than water:

$$\text{Degrees Baumé} = \frac{140}{G} - 130, \quad G = \frac{140}{130 + \text{Degrees Baumé}}$$

$$\text{Degrees A.P.I.} = \frac{141.5}{G} - 131.5, \quad G = \frac{141.5}{131.5 + \text{Degrees A.P.I.}}$$

For liquids heavier than water:

$$\text{Degrees Baumé} = 145 - \frac{145}{G}, \quad G = \frac{145}{145 - \text{Degrees Baumé}}$$

G = Specific Gravity = ratio of the weight of a given volume of oil at 60° Fahrenheit to the weight of the same volume of water at 60° Fahrenheit.

The above tables are based on the weight of 1 gallon (U.S.) of oil with a volume of 231 cubic inches at 60° Fahrenheit in air at 760 m.m. pressure and 50% humidity. Assumed weight of 1 gallon of water at 60° Fahrenheit in air is 8.32828 pounds.

To determine the resulting gravity by missing oils of different gravities:

$$D = \frac{md_1 - nd_2}{m + n}$$

D = Density or Specific Gravity of mixture

m = Proportion of oil of d<sub>1</sub> density

n = Proportion of oil of d<sub>2</sub> density

d<sub>1</sub> = Specific Gravity of m oil

d<sub>2</sub> = Specific Gravity of n oil

## TECH-H-3 Approximate Conversion Table for Hardness Numbers Obtained by Different Methods\*

| Brinell Number<br>10 mm. Ball<br>3000 Kg. Load | Rockwell Number |         | Shore Scieroscope Number | Vickers Pyramid Number |
|--|-----------------|---------|--------------------------|------------------------|
|  | C-Scale         | B-Scale |                          |                        |
| 682  | 61.7            |         | 84                       | 737                    |
| 653  | 60              |         | 81                       | 697                    |
| 633  | 59              |         | 79                       | 674                    |
| 614  | 58              |         | 78                       | 654                    |
| 596  | 57              |         | 77                       | 636                    |
| 578  | 56              |         | 75                       | 615                    |
| 560  | 55              |         | 73                       | 596                    |
| 543  | 54              |         | 72                       | 578                    |
| 527  | 53              |         | 71                       | 561                    |
| 500  | 52              |         | 69                       | 544                    |
| 475  | 50              |         | 67                       | 513                    |
| 451  | 48              |         | 64                       | 484                    |
| 432  | 46              |         | 62                       | 458                    |
| 409  | 44              |         | 58                       | 434                    |
| 390  | 42              |         | 56                       | 412                    |
| 371  | 40              |         | 54                       | 392                    |
| 353  | 38              |         | 51                       | 372                    |
| 336  | 36              |         | 49                       | 354                    |
| 319  | 34              |         | 47                       | 336                    |
| 301  | 32              |         | 44                       | 318                    |
| 286  | 30              |         | 42                       | 302                    |
| 271  | 28              |         | 41                       | 286                    |
| 258  | 26              |         | 38                       | 272                    |
| 247  | 24              |         | 37                       | 260                    |
| 237  | 22              | 99      | 35                       | 248                    |
| 226  | 20              | 98      | 34                       | 238                    |
| 212  | 16              | 95      | 32                       | 222                    |
| 194  | 12              | 92      | 29                       | 204                    |
| 179  | 8               | 89      | 27                       | 188                    |
| 158  | 2               | 83      | 24                       | 166                    |
| 141  |                 | 77      | 21                       | 141                    |
| 125  |                 | 70      | 18                       | 125                    |
| 110  |                 | 62      |                          | 110                    |
| 99   |                 | 55      |                          | 99                     |
| 89   |                 | 47      |                          | 89                     |

\*Compiled from various manufacturers' tables.

## TECH-H-4 Conversion Factors

**English measures** - unless otherwise designated, are those used in the United States, and the units of weight and mass are avoirdupois units.

**Gallon** - designates the U.S. gallon. To convert into the Imperial gallon, multiply the U.S. gallon by 0.83267. Likewise, the word ton designates a short ton — 2,000 pounds.

**Properties of water** - it freezes at 32°F., and is at its maximum density at 39.2° F. In the multipliers using the properties of water, calculations are based on water at 39.2° F. in a vacuum, weighing 62.427 pounds per cubic foot, or 8.345 pounds per U.S. gallon.

| Multiply    | By                       | To Obtain            |
|-------------|--------------------------|----------------------|
| Acres       | 43,560                   | Square feet          |
| Acres       | 4047                     | Square meters        |
| Acres       | 1.562 x 10 <sup>-3</sup> | Square miles         |
| Acres       | 4840                     | Square yards         |
| Acre-feet   | 43,560                   | Cubic feet           |
| Acre-feet   | 325,851                  | Gallons              |
| Acre-feet   | 1233,48                  | Cubic Meters         |
| Atmospheres | 1.0332                   | Atmospheres (metric) |
| Atmospheres | 1.01325                  | Bars                 |
| Atmospheres | 76.0                     | Cms. of mercury      |
| Atmospheres | 29.92                    | Inches of mercury    |

| Multiply             | By       | To Obtain                    |
|----------------------|----------|------------------------------|
| Atmospheres          | 33.90    | Feet of water                |
| Atmospheres          | 10,332   | kgs/sq. ft                   |
| Atmospheres          | 14.70    | Lbs./ sq. inch               |
| Atmospheres          | 1.058    | Tons/sq. ft.                 |
| Atmospheres (metric) | 0.9678   | Atmospheres                  |
| Atmospheres (metric) | 980,665. | Bars                         |
| Bars                 | .98692   | Atmospheres                  |
| Bars                 | 33.456   | Feet H <sup>2</sup> O @39°F. |
| Bars                 | 29.530   | In. Hg @ 32° F.              |
| Bars                 | 1.0197   | kg/cm <sup>2</sup>           |
| Bars                 | 2088.6   | Pounds/ ft. <sup>2</sup>     |

| Multiply               | By                       | To Obtain               |
|------------------------|--------------------------|-------------------------|
| Bars                   | 14.504                   | Pounds/in. <sup>2</sup> |
| Barrels- oil           | 42                       | Gallons- oil            |
| Barrels- beer          | 31                       | Gallons- beer           |
| Barrels- whiskey       | 45                       | Gallons- whiskey        |
| Barrels/day- oil       | 0.02917                  | Gallons/min.- oil       |
| Bags or sacks-cement   | 94                       | Pounds/cement           |
| Board feet             | 144 sq. in. x 1 in.      | Cubic inches            |
| British Thermal Units  | 0.2520                   | Kilogram- calories      |
| British Thermal Units  | 777.6                    | Foot- lbs.              |
| British Thermal Units  | 3.927 x 10 <sup>4</sup>  | Horsepower- hrs.        |
| British Thermal Units  | 107.5                    | Kilogram- meters        |
| British Thermal Units  | 2.928 x 10 <sup>4</sup>  | Kilowatt- hrs.          |
| B.T.U./min.            | 12.96                    | Foot-lbs./sec.          |
| B.T.U./min.            | 0.02356                  | Horsepower              |
| B.T.U./min.            | 0.01757                  | Kilowatts               |
| B.T.U./min.            | 17.57                    | Watts                   |
| Centares (Centiares)   | 1                        | Square meters           |
| Centigrams             | 0.01                     | Grams                   |
| Centiliters            | 0.01                     | Liters                  |
| Centimeters            | 0.3937                   | Inches                  |
| Centimeters            | 0.01                     | Meters                  |
| Centimeters            | 10                       | Millimeters             |
| Centimeters of mercury | 0.01316                  | Atmosphere              |
| Centimeters of mercury | 0.013332                 | Bars                    |
| Centimeters of mercury | 0.013595                 | kg/cm <sup>2</sup>      |
| Centimeters of mercury | 0.4461                   | Feet of water           |
| Centimeters of mercury | 136.0                    | kgs/sq. meter           |
| Centimeters of mercury | 27.85                    | Lbs./sq. ft.            |
| Centimeters of mercury | 0.1934                   | Lbs./sq. inch           |
| Centimeters/sec.       | 1.969                    | Feet/min.               |
| Centimeters/sec.       | 0.03281                  | Feet/sec.               |
| Centimeters/sec.       | 0.036                    | Kilometers/hr.          |
| Centimeters/sec.       | 0.6                      | Meters/min.             |
| Centimeters/sec.       | 0.02237                  | Miles/hr.               |
| Centimeters/sec.       | 3.728 x 10 <sup>-4</sup> | Miles/min.              |
| Cms./sec./sec.         | 0.03281                  | Feet/sec./sec.          |
| Centipoises            | 0.001                    | Pascal-second           |
| Centipoises            | 0.01                     | Poises                  |
| Centistokes            | 0.01                     | Sq. cm/sec.             |
| Centistokes            | 0.01                     | Stokes                  |
| Cubic centimeters      | 3.531 x 10 <sup>-5</sup> | Cubic feet              |
| Cubic centimeters      | 6.102 x 10 <sup>-2</sup> | Cubic inches            |
| Cubic centimeters      | 10 <sup>-6</sup>         | Cubic meters            |
| Cubic centimeters      | 1.308 x 10 <sup>-6</sup> | Cubic yards             |
| Cubic centimeters      | 2.642 x 10 <sup>-4</sup> | Gallons                 |
| Cubic centimeters      | 9.999 x 10 <sup>-4</sup> | Liters                  |
| Cubic centimeters      | 2.113 x 10 <sup>-3</sup> | Pints (liq.)            |
| Cubic centimeters      | 1.057 x 10 <sup>-3</sup> | Quarts (liq.)           |
| Cubic cm/sec.          | 0.0158502                | Gallons/minute          |
| Cubic cm/sec.          | 0.001                    | Liters/sec.             |
| Cubic feet             | 0.1781                   | Barrels (42 US Gal.)    |
| Cubic feet             | 2.832 x 10 <sup>-4</sup> | Cubic cms.              |
| Cubic feet             | 1728                     | Cubic inches            |
| Cubic feet             | 0.02832                  | Cubic meters            |
| Cubic feet             | 0.03704                  | Cubic yards             |
| Cubic feet             | 7.48052                  | Gallons                 |
| Cubic feet             | 28.32                    | Liters                  |
| Cubic feet             | 59.84                    | Pints (liq.)            |
| Cubic feet             | 29.92                    | Quarts (liq.)           |
| Cubic feet/min.        | 472.0                    | Cubic cms./sec.         |

| Multiply         | By                        | To Obtain              |
|------------------|---------------------------|------------------------|
| Cubic feet/min.  | 0.1247                    | Gallons/sec.           |
| Cubic feet/min.  | 0.4719                    | Liters/sec.            |
| Cubic feet/min.  | 62.43                     | Pounds of water/min.   |
| Cubic feet/sec.  | 0.646317                  | Millions gals./day     |
| Cubic feet/sec.  | 448.831                   | Gallons/min.           |
| Cubic inches     | 16.39                     | Cubic centimeters      |
| Cubic inches     | 5.787 x 10 <sup>-4</sup>  | Cubic feet             |
| Cubic inches     | 1.639 x 10 <sup>-5</sup>  | Cubic meters           |
| Cubic inches     | 2.143 x 10 <sup>-5</sup>  | Cubic yards            |
| Cubic inches     | 4.329 x 10 <sup>-3</sup>  | Gallons                |
| Cubic inches     | 1.639 x 10 <sup>-2</sup>  | Liters                 |
| Cubic inches     | 0.03463                   | Pints (liq.)           |
| Cubic inches     | 0.01732                   | Quarts (liq.)          |
| Cubic meters     | 10 <sup>6</sup>           | Cubic centimeters      |
| Cubic meters     | 35.31                     | Cubic feet             |
| Cubic meters     | 61023                     | Cubic inches           |
| Cubic meters     | 1.308                     | Cubic yards            |
| Cubic meters     | 264.2                     | Gallons                |
| Cubic meters     | 999.97                    | Liters                 |
| Cubic meters     | 2113                      | Pints (liq.)           |
| Cubic meters     | 1057                      | Quarts (liq.)          |
| Cubic meters/hr. | 4.40                      | Gallons/min.           |
| Cubic yards      | 4.8089                    | Barrels (42 U.S. Gal.) |
| Cubic yards      | 764,554.86                | Cubic centimeters      |
| Cubic yards      | 27                        | Cubic feet             |
| Cubic yards      | 46, 656                   | Cubic inches           |
| Cubic yards      | 0.7646                    | Cubic meters           |
| Cubic yards      | 202.0                     | Gallons                |
| Cubic yards      | 764.5                     | Liters                 |
| Cubic yards      | 1616                      | Pints (liq.)           |
| Cubic yards      | 807.9                     | Quarts (liq.)          |
| Cubic yards/min. | 0.45                      | Cubic feet/sec.        |
| Cubic yards/min. | 202.0                     | Gallons/min.           |
| Cubic yards/min. | 3.366                     | Gallons/sec.           |
| Cubic yards/min. | 12.74                     | Liters/sec.            |
| Decigrams        | 0.1                       | Grams                  |
| Deciliters       | 0.1                       | Liters                 |
| Decimeters       | 0.1                       | Meters                 |
| Degrees (angle)  | 60                        | Minutes                |
| Degrees (angle)  | 0.01745                   | Radians                |
| Degrees (angle)  | 3600                      | Seconds                |
| Degrees/sec.     | 0.01745                   | Radians/sec.           |
| Degrees/sec.     | 0.1667                    | Revolutions/min.       |
| Degrees/sec.     | 0.002778                  | Revolutions/sec.       |
| Dekagrams        | 10                        | Grams                  |
| Dekaliters       | 10                        | Liters                 |
| Dekameters       | 10                        | Meters                 |
| Drams            | 27.34375                  | Grains                 |
| Drams            | 0.0625                    | Ounces                 |
| Drams            | 1.771845                  | Grams                  |
| Fathoms          | 6                         | Feet                   |
| Feet             | 30.48                     | Centimeters            |
| Feet             | 0.166667                  | Fathoms                |
| Feet             | 3.0480 x 10 <sup>-4</sup> | Kilometers             |
| Feet             | 304.80                    | Millimeters            |
| Feet             | 12                        | Inches                 |
| Feet             | 0.3048                    | Meters                 |
| Feet             | 1/3                       | Yards                  |
| Feet of water    | 0.0295                    | Atmospheres            |
| Feet of water    | 0.8826                    | Inches of mercury      |

| Multiply                  | By                        | To Obtain                   |
|---------------------------|---------------------------|-----------------------------|
| Feet of water             | 304.8                     | kgs./sq. meter              |
| Feet of water             | 62.43                     | Lbs./sq. ft.                |
| Feet of water             | 0.4335                    | Lbs./sq. inch               |
| Feet/min.                 | 0.5080                    | Centimeters/sec.            |
| Feet/min.                 | 0.01667                   | Feet/sec.                   |
| Feet/min.                 | 0.01829                   | Kilometers/hr.              |
| Feet/min.                 | 0.3048                    | Meters/min.                 |
| Feet/min.                 | 0.01136                   | Miles/hr.                   |
| Feet/sec.                 | 30.48                     | Centimeters/sec.            |
| Feet/sec.                 | 1.09726                   | Kilometers/hr.              |
| Feet/sec.                 | 0.5924                    | Knots                       |
| Feet/sec.                 | 18.29                     | Meters/min.                 |
| Feet/sec.                 | 0.6818                    | Miles/hr.                   |
| Feet/sec.                 | 0.01136                   | Miles/min.                  |
| Feet/sec./sec.            | 30.48                     | Cms./sec./sec.              |
| Feet/sec./sec.            | 0.3048                    | Meters/sec./sec.            |
| Feet/sec./sec.            | 0.0310810                 | g's (gravity)               |
| Foot- pounds              | 1.286 x 10 <sup>-3</sup>  | British Thermal Units       |
| Foot- pounds              | 5.050 x 10 <sup>-7</sup>  | Horsepower-hrs.             |
| Foot- pounds              | 3.240 x 10 <sup>-4</sup>  | Kilogram- calories          |
| Foot- pounds              | 0.1383                    | Kilogram- meters            |
| Foot- pounds              | 3.766 x 10 <sup>-7</sup>  | Kilowatt- hours             |
| Foot- pounds/min.         | 2.140 x 10 <sup>-5</sup>  | B.T.U./sec.                 |
| Foot- pounds/min.         | 0.01667                   | Foot-pounds/sec.            |
| Foot- pounds/min.         | 3.030 x 10 <sup>-5</sup>  | Horsepower                  |
| Foot- pounds/min.         | 5.393 x 10 <sup>-3</sup>  | Gm.-calories/sec.           |
| Foot- pounds/min.         | 2.280 x 10 <sup>-5</sup>  | Kilowatts                   |
| Foot- pounds/sec.         | 7.704 x 10 <sup>-2</sup>  | B.T.U./min.                 |
| Foot- pounds/sec.         | 1.818 x 10 <sup>-3</sup>  | Horsepower                  |
| Foot- pounds/sec.         | 1.941 x 10 <sup>-2</sup>  | kg.-calories/min.           |
| Foot- pounds/sec.         | 1.356 x 10 <sup>-3</sup>  | Kilowatts                   |
| G's (Accel. due to grav.) | 32.174                    | Feet/sec. <sup>2</sup>      |
| G's (Accel. due to grav.) | 35.3034                   | Km/hr.-sec.                 |
| G's (Accel. due to grav.) | 9.80665                   | Meters/sec. <sup>2</sup>    |
| G's (Accel. due to grav.) | 21.9371                   | Miles/hr.-sec.              |
| Gallons                   | 3785                      | Cubic centimeters           |
| Gallons                   | 0.1337                    | Cubic feet                  |
| Gallons                   | 231                       | Cubic inches                |
| Gallons                   | 3.785 x 10 <sup>-3</sup>  | Cubic meters                |
| Gallons                   | 4.951 x 10 <sup>-3</sup>  | Cubic yards                 |
| Gallons                   | 3.785                     | Liters                      |
| Gallons                   | 8                         | Pints (liq.)                |
| Gallons                   | 4                         | Quarts (liq.)               |
| Gallons-Imperial          | 1.20095                   | US Gallons                  |
| Gallons- US               | 0.83267                   | Imperial Gallons            |
| Gallons water             | 8.345                     | Pounds of water             |
| Gallons per day           | 9.284 x 10 <sup>-5</sup>  | Cubic ft./min.              |
| Gallons per day           | 1.5472 x 10 <sup>-6</sup> | Cubic ft./sec.              |
| Gallons per day           | 2.6289 x 10 <sup>-6</sup> | Cubic meters/min.           |
| Gallons per day           | 0.09284                   | Liters/min.                 |
| Gallons per hour          | 0.1337                    | Cubic ft./hr.               |
| Gallons per hour          | 0.002228                  | Cubic ft./min.              |
| Gallons per hour          | 3.71 x 10 <sup>-5</sup>   | Cubic ft./sec.              |
| Gallons per hour          | 6.309 x 10 <sup>-5</sup>  | Cubic meters/min.           |
| Gallons per hour          | .016667                   | Gallons/min.                |
| Gallons per hour          | 2.7778 x 10 <sup>-4</sup> | Gallons/sec.                |
| Gallons per hour          | 0.06309                   | Liters/min.                 |
| Gallons/min.              | 34.286                    | Barrels<br>(42 US Gal.)/day |

| Multiply            | By                        | To Obtain                |
|---------------------|---------------------------|--------------------------|
| Gallons/min.        | 1.4286                    | Barrels (42 US Gal.)/hr. |
| Gallons/min.        | 0.02381                   | Barrels (42 USGal.)/min. |
| Gallons/min.        | 1440                      | Gallons/day              |
| Gallons/min.        | 2.228 x 10 <sup>-3</sup>  | Cubic feet/sec.          |
| Gallons/min.        | 0.06308                   | Liters/sec.              |
| Gallons/min.        | 8.0208                    | Cu. ft./hr.              |
| Gallons/sec.        | 60                        | Gallons/min.             |
| Gallons/sec.        | 227.12                    | Liters/min.              |
| Grains (troy)       | 0.06480                   | Grams                    |
| Grains (troy)       | 0.04167                   | Pennyweights (troy)      |
| Grains (troy)       | 2.0833 x 10 <sup>-3</sup> | Ounces                   |
| Grains/US gal.      | 17.118                    | Parts/million            |
| Grains/US gal.      | 142.86                    | Lbs./million gal.        |
| Grains/Imp. gal.    | 14.254                    | Parts/million            |
| Grams               | 980.7                     | Dynes                    |
| Grams               | 15.43                     | Grains                   |
| Grams               | .001                      | Kilograms                |
| Grams               | 1000                      | Milligrams               |
| Grams               | 0.03527                   | Ounces                   |
| Grams               | 0.03215                   | Ounces (troy)            |
| Grams               | 2.205 x 10 <sup>-3</sup>  | Pounds                   |
| Grams/cm.           | 5.600 x 10 <sup>-3</sup>  | Pounds/ inch             |
| Grams/cu. cm.       | 62.43                     | Pounds/cubic foot        |
| Grams/cu. cm.       | 0.03613                   | Pounds/cubic inch        |
| Grams/liter         | 58.416                    | Grains/gal.              |
| Grams/liter         | 8.345                     | Pounds/1000 gals.        |
| Grams/liter         | 0.06242                   | Pounds/cubic foot        |
| Grams/liter         | 1000                      | Parts/million            |
| Hectares            | 2.471                     | Acres                    |
| Hectares            | 1.076 x 10 <sup>5</sup>   | Square feet              |
| Hectograms          | 100                       | Grams                    |
| Hectoliters         | 100                       | Liters                   |
| Hectometers         | 100                       | Meters                   |
| Hectowatts          | 100                       | Watts                    |
| Horsepower          | 42.44                     | B.T.U./min.              |
| Horsepower          | 33,000                    | Foot-lbs./min.           |
| Horsepower          | 550                       | Foot-lbs./sec.           |
| Horsepower          | 1.014                     | Horsepower (metric)      |
| Horsepower          | 10.547                    | kg.-calories/min.        |
| Horsepower          | 0.7457                    | Kilowatts                |
| Horsepower          | 745.7                     | Watts                    |
| Horsepower (boiler) | 33, 493                   | B.T.U./hr.               |
| Horsepower (boiler) | 9.809                     | Kilowatts                |
| Horsepower (boiler) | 9.2994                    | B.T.U./sec.              |
| Horsepower (boiler) | 9809.5                    | Watts                    |
| Horsepower-hours    | 2546                      | B.T.U                    |
| Horsepower-hours    | 1.98 x 10 <sup>6</sup>    | Foot-lbs.                |
| Horsepower-hours    | 641.6                     | Kilogram-calories        |
| Horsepower-hours    | 2.737 x 10 <sup>5</sup>   | Kilogram-meters          |
| Horsepower-hours    | 0.7457                    | Kilowatt-hours           |
| Inches              | 2.540                     | Centimeters              |
| Inches              | 0.083333                  | Feet                     |
| Inches              | 0.0254                    | Meters                   |
| Inches              | 25.4                      | Millimeters              |
| Inches              | 0.0277778                 | Yards                    |
| Inches of mercury   | 0.03342                   | Atmospheres              |
| Inches of mercury   | 0.03386                   | Bars                     |
| Inches of mercury   | 13.6                      | Inches H <sub>2</sub> O  |

| Multiply                  | By                        | To Obtain               |
|---------------------------|---------------------------|-------------------------|
| Inches of mercury         | 0.034531                  | kg/cm <sup>2</sup>      |
| Inches of mercury         | 3374.1                    | Pascals                 |
| Inches of mercury         | 70.727                    | Pounds/ft. <sup>2</sup> |
| Inches of mercury         | 0.49116                   | Pounds/in. <sup>2</sup> |
| Inches of mercury         | 1.133                     | Feet of water           |
| Inches of mercury         | 345.3                     | kgs./sq. meter          |
| Inches of mercury         | 70.73                     | Lbs./sq. ft.            |
| Inches of mercury (32° F) | 0.491                     | Lbs./sq. inch           |
| Inches of water           | 0.002458                  | Atmospheres             |
| Inches of water           | 0.07355                   | Inches of mercury       |
| Inches of water           | 25.40                     | kgs./sq. meter          |
| Inches of water           | 0.578                     | Ounces/sq. inch         |
| Inches of water           | 5.202                     | Lbs./sq. foot           |
| Inches of water           | 0.03613                   | Lbs./sq. inch           |
| Joules                    | 9.479 x 10 <sup>-4</sup>  | B.T.U                   |
| Joules                    | 0.239006                  | Calories (Thermo)       |
| Joules                    | 0.73756                   | Foot-lb.f.              |
| Joules                    | 3.725 x 10 <sup>-7</sup>  | HP-hr. (US)             |
| Joules                    | 2.7778 x 10 <sup>-7</sup> | Kilowatt-hr.            |
| Joules                    | 1                         | Newton-m                |
| Joules                    | 2.7778 x 10 <sup>-4</sup> | Watt-hr.                |
| Kilograms                 | 35.274                    | Ounces (avoir)          |
| Kilograms                 | 32.151                    | Ounces (troy)           |
| Kilograms                 | 980,665                   | Dynes                   |
| Kilograms                 | 2.205                     | Lbs.                    |
| Kilograms                 | 1.102 x 10 <sup>-3</sup>  | Tons (short)            |
| Kilograms                 | 34.286                    | Tons (assay)            |
| Kilograms                 | 9.8421 x 10 <sup>-4</sup> | Tons (long)             |
| Kilograms                 | 0.001                     | Tons (metric)           |
| Kilograms                 | 10 <sup>3</sup>           | Grams                   |
| Kilograms-cal./sec.       | 3.968                     | B.T.U./sec.             |
| Kilograms-cal./sec        | 3086                      | Foot-lbs./sec.          |
| Kilograms-cal./sec        | 5.6145                    | Horsepower              |
| Kilograms-cal./sec        | 4186.7                    | Watts                   |
| Kilograms/cm              | 0.96783                   | Atmospheres             |
| Kilograms/cm              | 0.980665                  | Bars                    |
| Kilograms/cm              | 28.959                    | Inches Hg@ 32° F        |
| Kilograms/cm              | 14.223                    | Pounds/in. <sup>2</sup> |
| Kilograms-cal./min.       | 3085.9                    | Foot-lbs./min.          |
| Kilograms-cal./min        | 0.09351                   | Horsepower              |
| Kilograms-cal./min        | 69.733                    | Watts                   |
| kgs/meter                 | 0.6720                    | Lbs./foot               |
| kgs/sq. meter             | 9.678 x 10 <sup>-5</sup>  | Atmospheres             |
| kgs/sq. meter             | 3.281 x 10 <sup>-3</sup>  | Feet of water           |
| kgs/sq. meter             | 2.896 x 10 <sup>-3</sup>  | Inches of mercury       |
| kgs/sq. meter             | 0.2048                    | Lbs./sq. foot           |
| kgs/sq. meter             | 1.422 x 10 <sup>-3</sup>  | Lbs./sq. inch           |
| kgs/sq. millimeter        | 10 <sup>6</sup>           | kgs./sq. meter          |
| Kiloliters                | 10 <sup>3</sup>           | Liters                  |
| Kilometers                | 10 <sup>5</sup>           | Centimeters             |
| Kilometers                | 3281                      | Feet                    |
| Kilometers                | 10 <sup>3</sup>           | Meters                  |
| Kilometers                | 0.6214                    | Miles                   |
| Kilometers                | 1094                      | Yards                   |
| Kilopascal                | .145                      | Pounds/in. <sup>2</sup> |
| Kilometers/hr.            | 27.78                     | Centimeters/sec.        |
| Kilometers/hr.            | 54.68                     | Feet/min.               |
| Kilometers/hr.            | 0.9113                    | Feet/sec.               |
| Kilometers/hr.            | .5399                     | Knots                   |
| Kilometers/hr.            | 16.67                     | Meters/min.             |

| Multiply                              | By                       | To Obtain                |
|---------------------------------------|--------------------------|--------------------------|
| Kilometers/hr.                        | 0.6214                   | Miles/hr.                |
| Kms./hr./sec.                         | 27.78                    | Cms./sec./sec.           |
| Kms./hr./sec.                         | 0.9113                   | Ft./sec./sec.            |
| Kms./hr./sec.                         | 0.2778                   | Meters/sec./sec.         |
| Kilowatts                             | 56.907                   | B.T.U./min.              |
| Kilowatts                             | 4.425 x 10 <sup>4</sup>  | Foot-lbs./min.           |
| Kilowatts                             | 737.6                    | Foot-lbs./sec.           |
| Kilowatts                             | 1.341                    | Horsepower (US)          |
| Kilowatts                             | 1.3597                   | Horsepower (metric)      |
| Kilowatts                             | 1000                     | Joules/sec.              |
| Kilowatts                             | 3412.9                   | B.T.U/hr.                |
| Kilowatts                             | 0.94827                  | B.T.U./sec.              |
| Kilowatts                             | 14.34                    | kg.-calories/min.        |
| Kilowatts                             | 10 <sup>3</sup>          | Watts                    |
| Kilowatt-hours                        | 3414.4                   | B.T.U                    |
| Kilowatt-hours                        | 2.655 x 10 <sup>6</sup>  | Foot-lbs.                |
| Kilowatt-hours                        | 1.341                    | Horsepower-hrs.          |
| Kilowatt-hours                        | 860.4                    | Kilogram-calories        |
| Kilowatt-hours                        | 3.671 x 10 <sup>5</sup>  | Kilogram-meters          |
| Liters                                | 10 <sup>3</sup>          | Cubic centimeters        |
| Liters                                | 0.03531                  | Cubic feet               |
| Liters                                | 61.02                    | Cubic inches             |
| Liters                                | 10 <sup>-3</sup>         | Cubic meters             |
| Liters                                | 1.308 x 10 <sup>-3</sup> | Cubic yards              |
| Liters                                | 0.2642                   | Gallons                  |
| Liters                                | 2.113                    | Pints (liq.)             |
| Liters                                | 1.057                    | Quarts (liq.)            |
| Liters/min.                           | 5.886 x 10 <sup>-4</sup> | Cubic ft./sec.           |
| Liters/min.                           | 4.403 x 10 <sup>-3</sup> | Gals./sec.               |
| Lumber width (in)<br>x Thickness (in) | Length (ft.)             | Board feet               |
| 12                                    |                          |                          |
| Meters                                | 100                      | Centimeters              |
| Meters                                | 3.281                    | Feet                     |
| Meters                                | 39.37                    | Inches                   |
| Meters                                | 10 <sup>-3</sup>         | Kilometers               |
| Meters                                | 10 <sup>3</sup>          | Millimeters              |
| Meters                                | 1.094                    | Yards                    |
| Meters/min.                           | 1.667                    | Centimeters/sec.         |
| Meters/min.                           | 3.281                    | Feet/min.                |
| Meters/min.                           | 0.05468                  | Feet/sec.                |
| Meters/min.                           | 0.06                     | Kilometers/hr.           |
| Meters/min.                           | 0.03728                  | Miles/hr.                |
| Meters/sec.                           | 196.8                    | Feet/min.                |
| Meters/sec.                           | 3.281                    | Feet/sec.                |
| Meters/sec.                           | 3.6                      | Kilometers/hr.           |
| Meters/sec.                           | 0.06                     | Kilometers/min.          |
| Meters/sec.                           | 2.287                    | Miles/hr.                |
| Meters/sec.                           | 0.03728                  | Miles/min.               |
| Meters/sec. <sup>2</sup>              | 3.2808                   | Feet/sec. <sup>2</sup>   |
| Meters/sec. <sup>2</sup>              | 0.101972                 | G (gravity)              |
| Meters/sec. <sup>2</sup>              | 39.37                    | Inches/sec. <sup>2</sup> |
| Meters/sec. <sup>2</sup>              | 134.214                  | Miles/hr.-min.           |
| Meter-kg. (force)                     | 9.8067                   | Joules                   |
| Microns                               | 10 <sup>-6</sup>         | Meters                   |
| Miles                                 | 1.609 x 10 <sup>5</sup>  | Centimeters              |
| Miles                                 | 5280                     | Feet                     |
| Miles                                 | 1.609                    | Kilometers               |
| Miles                                 | 1760                     | Yards                    |
| Miles/hr.                             | 44.70                    | Centimeters/sec.         |

| Multiply            | By                        | To Obtain               |
|---------------------|---------------------------|-------------------------|
| Miles/hr.           | 88                        | Feet/min.               |
| Miles/hr.           | 1.467                     | Feet/sec.               |
| Miles/hr.           | 1.609                     | Kilometers/hr.          |
| Miles/hr.           | 0.8689                    | Knots                   |
| Miles/hr.           | 26.82                     | Meter/min.              |
| Miles/min.          | 2682                      | Meters/min.             |
| Miles/min.          | 88                        | Feet/sec.               |
| Miles/min.          | 1.609                     | Kilometers/min.         |
| Miles/min.          | 60                        | Miles/hr.               |
| Milliers            | 10 <sup>3</sup>           | Kilograms               |
| Milligrams          | 10 <sup>-3</sup>          | Grams                   |
| Milliliters         | 10 <sup>-3</sup>          | Liters                  |
| Millimeters         | 0.1                       | Centimeters             |
| Millimeters         | 0.03937                   | Inches                  |
| Milligrams/liter    | 1                         | Parts/million           |
| Million Gals./day   | 1.54723                   | Cubic ft./sec.          |
| Miner's inches      | 1.5                       | Cubic ft./min.          |
| Minutes (angle)     | 2.90 x 10 <sup>-4</sup>   | Radians                 |
| Newtons (N)         | .225                      | Pounds-force            |
| Ounces              | 16                        | Drams                   |
| Ounces              | 437.5                     | Grains                  |
| Ounces              | 0.0625                    | Pounds                  |
| Ounces              | 28.3495                   | Grams                   |
| Ounces              | 0.9115                    | Ounces (troy)           |
| Ounces              | 2.790 x 10 <sup>-5</sup>  | Tons (long)             |
| Ounces              | 2.835 x 10 <sup>-5</sup>  | Tons (metric)           |
| Ounces (troy)       | 480                       | Grains                  |
| Ounces (troy)       | 20                        | Pennyweights (troy)     |
| Ounces (troy)       | 0.08333                   | Pounds (troy)           |
| Ounces (troy)       | 31.10348                  | Grams                   |
| Ounces (troy)       | 1.09714                   | Ounces (avoir)          |
| Ounces (fluid)      | 1.805                     | Cubic inches            |
| Ounces (fluid)      | 0.02957                   | Liters                  |
| Ounces/sq. inch     | 0.0625                    | Lbs./sq. inch           |
| Ounces/gal (US)     | 7.4892                    | kg/m <sup>3</sup>       |
| Ounces/gal (US)     | 0.25                      | Ounces/quart            |
| Ounces/gal (US)     | 0.46753                   | Pounds/ft. <sup>3</sup> |
| Ounces/gal (US)     | 2.7056 x 10 <sup>-4</sup> | Pounds/in. <sup>3</sup> |
| Parts/million       | 0.0584                    | Grains/US gal.          |
| Parts/million       | 0.07015                   | Grains/imp. gal.        |
| Parts/million       | 8.345                     | Lbs./million gal.       |
| Pennyweights (troy) | 24                        | Grains                  |
| Pennyweights (troy) | 1.55517                   | Grams                   |
| Pennyweights (troy) | 0.05                      | Ounces (troy)           |
| Pennyweights (troy) | 4.1667 x 10 <sup>-3</sup> | Pounds (troy)           |
| Pounds              | 16                        | Ounces                  |
| Pounds              | 256                       | Drams                   |
| Pounds              | 7000                      | Grains                  |
| Pounds              | 0.0005                    | Tons (short)            |
| Pounds              | 453.5924                  | Grams                   |
| Pounds              | 1.21528                   | Pounds (troy)           |
| Pounds              | 14.5833                   | Ounces (troy)           |
| Pounds (troy)       | 5760                      | Grains                  |
| Pounds (troy)       | 240                       | Pennyweights (troy)     |
| Pounds (troy)       | 12                        | Ounces (troy)           |
| Pounds (troy)       | 373.2417                  | Grams                   |
| Pounds (troy)       | 0.822857                  | Pounds (avoir.)         |
| Pounds (troy)       | 13.1657                   | Ounces (avoir.)         |
| Pounds (troy)       | 3.6735 x 10 <sup>-4</sup> | Tons (long)             |
| Pounds (troy)       | 4.1143 x 10 <sup>-4</sup> | Tons (short)            |

| Multiply               | By                        | To Obtain              |
|------------------------|---------------------------|------------------------|
| Pounds (troy)          | 3.7324 x 10 <sup>-4</sup> | Tons (metric)          |
| Pounds of water        | 0.01602                   | Cubic feet             |
| Pounds of water        | 27.68                     | Cubic inches           |
| Pounds of water        | 0.1198                    | Gallons                |
| Pounds of water/min.   | 2.670 x 10 <sup>-4</sup>  | Cubic ft./sec          |
| Pounds/cubic foot      | 0.01602                   | Grams/cubic cm.        |
| Pounds/cubic foot      | 16.02                     | kgs./cubic centimeters |
| Pounds/cubic foot      | 5.787 x 10 <sup>-4</sup>  | Lbs./cubic inch        |
| Pounds/cubic inch      | 27.68                     | Grams/cubic inch       |
| Pounds/cubic inch      | 2.768 x 10 <sup>-4</sup>  | kgs./cubic meter       |
| Pounds/cubic inch      | 1728                      | Lbs./cubic foot        |
| Pounds/foot            | 1.488                     | kgs/meter              |
| Pounds/inch            | 1152                      | Grams/cm.              |
| Pounds/sq. in.         | 0.06895                   | Bars                   |
| Pounds/sq. in.         | 5.1715                    | Cm Hg @ 0° C           |
| Pounds/sq. in.         | 0.070307                  | kg/cm <sup>2</sup>     |
| Pounds/sq. in.         | 6895                      | Newtons/m <sup>2</sup> |
| Pounds/sq. in.         | 6895                      | Pascals                |
| Pounds/sq. foot        | 0.01602                   | Feet of water          |
| Pounds/sq. foot        | 4.882                     | kgs./sq. meter         |
| Pounds/sq. foot        | 6.944 x 10 <sup>-3</sup>  | Pounds/sq. inch        |
| Pounds/sq. inch        | 0.06804                   | Atmospheres            |
| Pounds/sq. inch        | 2.307                     | Feet of water          |
| Pounds/sq. inch        | 2.036                     | Inches of mercury      |
| Pounds/sq. inch        | 703.1                     | kgs./sq. meter         |
| Pounds/sq. foot        | 4.788 x 10 <sup>-4</sup>  | Bars                   |
| Pounds/sq. foot        | 0.035913                  | Cm Hg @ 0°C            |
| Pounds/sq. foot        | 0.014139                  | In Hg @ 32°C           |
| Pounds/sq. foot        | 4.8824 x 10 <sup>-4</sup> | kg/cm <sup>2</sup>     |
| Pounds/sq. foot        | 47.880                    | Newtons/m <sup>2</sup> |
| Pounds/sq. foot        | 47.880                    | Pascals                |
| Quadrants (angle)      | 90                        | Degrees                |
| Quadrants (angle)      | 5400                      | Minutes                |
| Quadrants (angle)      | 1.571                     | Radians                |
| Quarts (dry)           | 67.20                     | Cubic inches           |
| Quarts (liq.)          | 57.75                     | Cubic inches           |
| Quintal, Argentine     | 101.28                    | Pounds                 |
| Quintal, Brazil        | 129.54                    | Pounds                 |
| Quintal, Castile, Peru | 101.43                    | Pounds                 |
| Quintal, Chile         | 101.41                    | Pounds                 |
| Quintal, Mexico        | 101.47                    | Pounds                 |
| Quintal, Metric        | 220.46                    | Pounds                 |
| Quires                 | 25                        | Sheets                 |
| Radians                | 57.30                     | Degrees                |
| Radians                | 3438                      | Minutes                |
| Radians                | 0.637                     | Quadrants              |
| Radians/sec.           | 57.30                     | Degrees/sec.           |
| Radians/sec.           | 0.1592                    | Revolutions/sec.       |
| Radians/sec.           | 9.549                     | Revolutions/min.       |
| Radians/sec./sec.      | 573.0                     | Revs./min./min.        |
| Radians/sec./sec.      | 0.1592                    | Revs./sec./sec.        |
| Reams                  | 500                       | Sheets                 |
| Revolutions            | 360                       | Degrees                |
| Revolutions            | 4                         | Quadrants              |
| Revolutions            | 6.283                     | Radians                |
| Revolutions/min.       | 6                         | Degrees/sec.           |
| Revolutions/min.       | 0.1047                    | Radians/sec.           |
| Revolutions/min.       | 0.01667                   | Revolutions/sec.       |
| Revolutions/min./min.  | 1.745 x 10 <sup>-3</sup>  | Rads./sec./sec.        |
| Revolutions/min./min.  | 2.778 x 10 <sup>-4</sup>  | Rev./sec./sec.         |

| Multiply              | By                       | To Obtain                    |
|-----------------------|--------------------------|------------------------------|
| Revolutions/ sec      | 360                      | Degrees/ sec.                |
| Revolutions/ sec      | 6.283                    | Radians/ sec.                |
| Revolutions/ sec      | 60                       | Revolutions/ min.            |
| Revolutions/sec/sec   | 6,283                    | Radians/sec./sec             |
| Revolutions/ sec/sec. | 3600                     | Revs. / min/ min             |
| Seconds (angle)       | 4.848 X 10 <sup>-6</sup> | Radians                      |
| Square centimeters    | 1.076 X10 <sup>-3</sup>  | Square feet                  |
| Square centimeters    | 0.1550                   | Square inches                |
| Square centimeters    | 10 <sup>4</sup>          | Square meters                |
| Square centimeters    | 100                      | Square millimeters           |
| Square feet           | 2.296 X 10 <sup>-5</sup> | Acres                        |
| Square feet           | 929.0                    | Square centimeters           |
| Square feet           | 144                      | Square inches                |
| Square feet           | 0.09290                  | Square meters                |
| Square feet           | 3.587 X10 <sup>-4</sup>  | Square miles                 |
| Square feet           | 1/9                      | Square yards                 |
| 1                     |                          |                              |
| Sq. ft./ gal. Min     | 8.0208                   | Overflow rate<br>(ft. / hr.) |
| Square inches         | 6.542                    | Square centimeters           |
| Square inches         | 6.944 X 10 <sup>-3</sup> | Square feet                  |
| Square inches         | 645.2                    | Square millimeters           |
| Square kilometers     | 247.1                    | Acres                        |
| Square kilometers     | 10.76 X 10 <sup>6</sup>  | Square feet                  |
| Square kilometers     | 10 <sup>6</sup>          | Square meters                |
| Square kilometers     | 0.3861                   | Square miles                 |
| Square kilometers     | 1.196 X 10 <sup>6</sup>  | Square yards                 |
| Square meters         | 2.471 X10 <sup>-4</sup>  | Acres                        |
| Square meters         | 10.76                    | Square feet                  |
| Square meters         | 3.861 X 10 <sup>-7</sup> | Square miles                 |
| Square meters         | 1.196                    | Square yards                 |
| Square miles          | 640                      | Acres                        |
| Square miles          | 27.88 x 10 <sup>6</sup>  | Square feet                  |
| Square miles          | 2.590                    | Square kilometers            |
| Square miles          | 3.098 x 10 <sup>6</sup>  | Square yards                 |
| Square millimeters    | 0.01                     | Square centimeters           |
| Square millimeters    | 1.550 x 10 <sup>-3</sup> | Square inchea                |
| Square yards          | 2.066x 10 <sup>-4</sup>  | Acres                        |
| Square yards          | 9                        | Square feet                  |

| Multiply               | By                       | To Obtain           |
|------------------------|--------------------------|---------------------|
| Square yards           | 0.8361                   | Square Meters       |
| Square yards           | 3.228 X 10 <sup>-7</sup> | Square miles        |
| Temp. (°C.) + 273      | 1                        | Abs. Temp. (° C.)   |
| Temp. (° C.) +17.78    | 1.8                      | Temp. (° F.)        |
| Temp. (° F.) + 460     | 1                        | Abs. Temp (° F.)    |
| Temp (° F.) -32        | 5/9                      | Temp. (° C.)        |
| Tons (long)            | 1016                     | Kilograms           |
| Tons (long)            | 2240                     | Pounds              |
| Tons (long)            | 1.12000                  | Tons (short)        |
| Tons (metric)          | 10 <sup>3</sup>          | Kilograms           |
| Tons (metric)          | 2205                     | Pounds              |
| Tons (short)           | 2000                     | Pounds              |
| Tons (short)           | 32,000                   | Ounces              |
| Tons (short)           | 907. 1843                | Kilograms           |
| Tons (short)           | 2430.56                  | Pounds (troy)       |
| Tons (short)           | 2430.56                  | Tons (long)         |
| Tons (short)           | 29166.66                 | Ounces (troy)       |
| Tons (short)           | 0.90718                  | Tons (metric)       |
| Tons of water/ 24 hrs. | 83.333                   | Pounds water/ hr.   |
| Tons of water/24 hrs   | 0.16643                  | Gallons/ min.       |
| Tons of water/ 24 hrs  | 1.3349                   | Cu. Ft. / hr.       |
| Watts                  | 0.05686                  | B.T..U/ min         |
| Watts                  | 44.25                    | Foot- Lbs. / min.   |
| Watts                  | 0.7376                   | Foot- Lb/sec.       |
| Watts                  | 1.341 X 10 <sup>-3</sup> | Horsepower (U .S)   |
| Watts                  | 0.001360                 | Horsepower( metric) |
| Watts                  | 1                        | Joules/ sec         |
| Watts                  | 0.01434                  | Kg- calories/ min.  |
| Watts                  | 10 <sup>-3</sup>         | Kilowatts           |
| Watt- hours            | 3.414                    | B.T.U               |
| Watt- hours            | 2655                     | Foot- Lbs           |
| Watt- hours            | 1.341 X 10 <sup>-3</sup> | Horsepower- hrs     |
| Watt- hours            | 0.8604                   | Kilogram-calories   |
| Watt- hours            | 367.1                    | kilogram- meters    |
| Watt- hours            | 10 <sup>-3</sup>         | Kilowatt- hours     |
| Yards                  | 91.44                    | Centimeters         |
| Yards                  | 3                        | Feet                |
| Yards                  | 36                       | Inches              |
| Yards                  | 0.9144                   | Meters              |

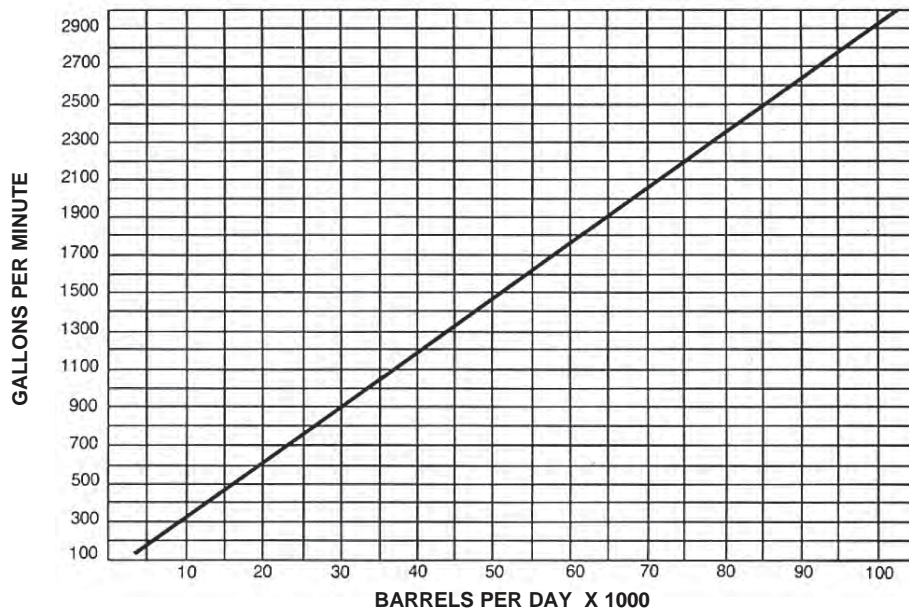


# TECH-H-5 Quick Convert Tables

|   |   |  |
|---|---|--|
| <b>AREA</b>   |   |  |
| inch <sup>2</sup> x 645.16= mm <sup>2</sup><br>inch <sup>2</sup> x 6.4516 = cm <sup>2</sup>   | mm <sup>2</sup> x .00155= inch <sup>2</sup><br>cm <sup>2</sup> x 0.1550 = inch <sup>2</sup>                               | cm <sup>2</sup> = square centimeter<br>mm <sup>2</sup> = square millimeter |
| <b>BENDING MOMENT (Torque)</b>  |   |  |
| in- lbf x 0.113 = N • m<br>ft- lbf x 1.356 = N • m  | N • m x 8.85 = in-lbs   | N • m= Newton- meter   |
| <b>CAPACITY (Volume per Unit Time)</b>  |   |  |
| gpm x 0.2271 = m <sup>3</sup> /h<br>gpm x 0.638 = liters per second   | m <sup>3</sup> /h x 4.403 = gpm<br>liters/ second x 15.85 = gpm   | m <sup>3</sup> /h= cubic meter per hour                                    |
| <b>FORCE</b>  |   |  |
| lbf x 0.00448 = kN  |   | kN = kilonewton  |
| <b>HEAD ( &amp; NPSH)</b>   |   |  |
| foot x 0.3048 = m   | m x 3.28084 = foot  | m = meter  |
| <b>LENGTH</b>   |   |  |
| foot x 304.8 = mm<br>inch x 25.4 = mm<br>foot x 0.3048 = m  | mm x 0.003281 = feet<br>mm 0.03937= inch<br>m x 3.281 = foot  | mm= millimeter<br>m = meter  |
| <b>MASS (Weight)</b>  |   |  |
| ounce x 0.02853 = kg<br>pound x 0.4536 = kg<br>ounce x 28.35 = g  | kg x 2.205 = pound<br>g x 0.03527 = ounce   | kg = kilogram<br>g =gram   |
| <b>POWER</b>  |   |  |
| hp x 0.7457= kW   | kW x 1.340483 = hp  | kW = kilowatt  |
| <b>PRESSURE</b>   |   |  |
| psi x 0.0703= kg/cm <sup>2</sup><br>psi x 6.895 = kPa<br>kg/cm <sup>2</sup> x 98.07 = kPa<br>psi x 0.06895 = Bar                                  | kg/cm <sup>2</sup> x 14.233578 = psi<br>kPa x .145= psi<br>kPa x 0.010197=kg/cm <sup>2</sup><br>Bar x 14.50377 = psi      | kg/cm <sup>2</sup> = kilogram/ square centimeter<br>kPa = kiloascal        |
| <b>TEMPERATURE</b>  |   |  |
| °C= 0.556 (°F -32)  | °F = (1.8 x °C ) + 32   | °C = degrees Celsius   |
| <b>VOLUME</b>   |   |  |
| ft <sup>3</sup> x 0.02832 = m <sup>3</sup><br>Gallon x 0.003785= m <sup>3</sup><br>Quart x 0.9464 = L<br>Ounce x 29.57= mL<br>Gallon x 3.7854 = L | m <sup>3</sup> x 35.31 = ft <sup>3</sup><br>m <sup>3</sup> x 264 .17= gallon<br>L x 1.057 = quart<br>L X 0.26418 = gallon | m <sup>3</sup> = cubic meter<br>L = litre<br>mL = milliliter               |

# TECH-H-6 Conversion Chart—Gallons Per Minute to Barrels Per Day

1 GPM = 34.286 BPD



# TECH-H-7 Decimal and Millimeter Equivalents of Fractions

| Inches    |          | Millimeters | Inches    |          | Millimeters |
|-----------|----------|-------------|-----------|----------|-------------|
| Fractions | Decimals |             | Fractions | Decimals |             |
| 1/64      | .015625  | .397        | 33/64     | .515625  | 13.097      |
| 1/32      | .03125   | .794        | 17/32     | .53125   | 13.494      |
| 3/64      | .046875  | 1.191       | 35/64     | .546875  | 13.891      |
| 1/16      | .0625    | 1.588       | 9/16      | .5625    | 14.288      |
| 5/64      | .078125  | 1.984       | 37/64     | .578125  | 14.684      |
| 3/32      | .09375   | 2.381       | 19/32     | .59375   | 15.081      |
| 7/64      | .109375  | 2.778       | 39/64     | .609375  | 15.487      |
| 1/8       | .125     | 3.175       | 5/8       | .625     | 15.875      |
| 9/64      | .140625  | 3.572       | 41/64     | .640625  | 16.272      |
| 5/32      | .15625   | 3.969       | 21/32     | .65625   | 16.669      |
| 11/64     | .171875  | 4.366       | 43/64     | .671875  | 17.066      |
| 3/16      | .1875    | 4.763       | 11/16     | .6875    | 17.463      |
| 13/64     | .203125  | 5.159       | 45/64     | .703125  | 17.859      |
| 7/32      | .21875   | 5.556       | 22/32     | .71875   | 18.256      |
| 15/64     | .234375  | 5.953       | 47/64     | .734375  | 18.653      |
| 1/4       | .250     | 6.350       | 3/4       | .750     | 19.050      |
| 17/64     | .265625  | 6.747       | 49/64     | .765625  | 19.447      |
| 9/32      | .28125   | 7.144       | 25/32     | .78125   | 19.844      |
| 19/64     | .296875  | 7.541       | 51/64     | .796875  | 20.241      |
| 5/16      | .3125    | 7.938       | 13/16     | .8125    | 20.638      |
| 21/64     | .328125  | 8.334       | 53/64     | .828125  | 21.034      |
| 11/32     | .34375   | 8.731       | 27/32     | .84375   | 21.431      |
| 23/64     | .359375  | 9.128       | 55/64     | .859375  | 21.828      |
| 3/8       | .375     | 9.525       | 7/8       | .875     | 22.225      |
| 25/64     | .390625  | 9.922       | 57/64     | .890625  | 22.622      |
| 13/32     | .40625   | 10.319      | 29/32     | .90625   | 23.019      |
| 27/64     | .421875  | 10.716      | 59/64     | .921875  | 23.416      |
| 7/16      | .4375    | 11.113      | 15/16     | .9375    | 23.813      |
| 29/64     | .453125  | 11.509      | 61/64     | .953125  | 24.209      |
| 15/32     | .46875   | 11.906      | 31/32     | .96875   | 24.606      |
| 31/64     | .484375  | 12.303      | 63/64     | .984375  | 25.003      |
| 1/2       | .500     | 12.700      | 1         | 1.000    | 25.400      |

# TECH-H-8 Atmospheric Pressures and Barometric Readings at Different Altitudes\*

| Altitude Below or Above Sea Level (Feet) | Barometer Reading Inches Mercury at 32° F | Atmospheric Pressure (PSI) | Equivalent Head of Water (75°) (Feet) | Boiling Point of Water |       |
|--|---|----------------------------|---------------------------------------|------------------------|-------|
|  |   |                            |                                       | ° F                    | ° C   |
| -1000                                    | 31.02                                     | 15.2                       | 35.2                                  | 213.8                  | 101.0 |
| -500                                     | 30.47                                     | 15.0                       | 34.7                                  | 212.9                  | 100.5 |
| 0  | 29.921                                    | 14.7                       | 34.0                                  | 212.0                  | 100.0 |
| +500                                     | 29.38                                     | 14.4                       | 33.4                                  | 211.1                  | 99.5  |
| +1000                                    | 28.86                                     | 14.2                       | 32.8                                  | 210.2                  | 99.0  |
| 1500                                     | 28.33                                     | 13.9                       | 32.2                                  | 209.3                  | 98.5  |
| 2000                                     | 27.82                                     | 13.7                       | 31.6                                  | 208.4                  | 98.0  |
| 2500                                     | 27.31                                     | 13.4                       | 31.0                                  | 207.4                  | 97.4  |
| 3000                                     | 26.81                                     | 13.2                       | 30.5                                  | 206.5                  | 96.9  |
| 3500                                     | 26.32                                     | 12.9                       | 29.9                                  | 205.6                  | 96.4  |
| 4000                                     | 25.84                                     | 12.7                       | 29.4                                  | 204.7                  | 95.9  |
| 4500                                     | 25.36                                     | 12.4                       | 28.8                                  | 203.8                  | 95.4  |
| 5000                                     | 24.89                                     | 12.2                       | 28.3                                  | 202.9                  | 94.9  |
| 5500                                     | 24.43                                     | 12.0                       | 27.8                                  | 201.9                  | 94.4  |
| 6000                                     | 23.98                                     | 11.8                       | 27.3                                  | 201.0                  | 94.4  |
| 6500                                     | 23.53                                     | 11.5                       | 26.7                                  | 200.1                  | 93.9  |
| 7000                                     | 23.09                                     | 11.3                       | 26.2                                  | 199.2                  | 92.9  |
| 7500                                     | 22.65                                     | 11.1                       | 25.7                                  | 198.3                  | 92.4  |
| 8000                                     | 22.22                                     | 10.9                       | 25.2                                  | 197.4                  | 91.9  |
| 8500                                     | 21.80                                     | 10.7                       | 24.8                                  | 196.5                  | 91.4  |
| 9000                                     | 21.38                                     | 10.5                       | 24.3                                  | 195.5                  | 90.8  |
| 9500                                     | 20.98                                     | 10.3                       | 23.8                                  | 194.6                  | 90.3  |
| 10,000                                   | 20.58                                     | 10.1                       | 23.4                                  | 193.7                  | 89.8  |
| 15,000                                   | 16.88                                     | 8.3                        | 19.1                                  | 184                    | 84.4  |
| 20,000                                   | 13.75                                     | 6.7                        | 15.2                                  | -                      | -     |
| 30,000                                   | 8.88                                      | 4.4                        | 10.2                                  | -                      | -     |
| 40,000                                   | 5.54                                      | 2.7                        | 6.3                                   | -                      | -     |
| 50,000                                   | 3.44                                      | 1.7                        | 3.9                                   | -                      | -     |

\*Approximate Values