

# Petroleum Units Systems

@wikipedia

**Petroleum Industry** maintains two primary **measurement unit systems**: **Oil Metric** (based on **SI units**) and **Oil Field** (based on **Imperial units**).

Both **Oil Metric** and **Oil Field unit systems** have deviations from their original base systems.

Some companies historically maintain customised **unit systems** at corporate level which are usually a slight variation of one of the two primary systems.

See **Units Conversion** for on-line converters between various **units**.

|                                     | Symbol | Dimension      | SI             | Oil Metric                    | Oil Field                                                                                                                                                                  | Additional                                                                                                                                                                                |
|-------------------------------------|--------|----------------|----------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Dimensionless quantity</b>       | –      | –              | frac           | frac                          | frac                                                                                                                                                                       |                                                                                                                                                                                           |
| <b>Time</b>                         | t      | T              | s              | d = 86,400 s                  | d = 86,400 s                                                                                                                                                               | hr = 3,600 s                                                                                                                                                                              |
| <b>Length</b>                       | L      | L              | m              | m = 3.281 ft                  | ' = ft = 0.3048 m                                                                                                                                                          | km = 10 <sup>3</sup> m, cm = 10 <sup>-2</sup> m, mm = 10 <sup>-3</sup> m                                                                                                                  |
| <b>Area</b>                         | A      | L <sup>2</sup> | m <sup>2</sup> | m <sup>2</sup>                | ft <sup>2</sup> = 0.09290304 m <sup>2</sup>                                                                                                                                | ac = 4,047 m <sup>2</sup> = 43,560 ft <sup>2</sup><br>ha = 10,000 m <sup>2</sup> = 2.471 ac                                                                                               |
| <b>Volume</b>                       | V      | L <sup>3</sup> | m <sup>3</sup> | m <sup>3</sup> = 6.289811 bbl | bbl = 5.61458 ft <sup>3</sup><br>= 0.158986938944 m <sup>3</sup><br>Mbbbl = 10 <sup>3</sup> bbl, MMbbbl = 10 <sup>6</sup> bbl<br>1 ft <sup>3</sup> = 0.178107712420163 bbl | scf = ft <sup>3</sup> = 0.0283168 m <sup>3</sup><br>cc = cm <sup>3</sup> = 1 · 10 <sup>-6</sup> m <sup>3</sup><br>tonne = 7.28 bbl (Urals) ÷ 7.59 bbl (Brent) with average 7.33 bbl (WTI) |
| <b>Mass / Weight</b>                | M, m   | M              | kg             | kg                            | lb = 0.45359237 kg                                                                                                                                                         | g = 10 <sup>-3</sup> kg                                                                                                                                                                   |
| <b>Amount of chemical substance</b> |        | 1              | mol            | mol                           | mol                                                                                                                                                                        |                                                                                                                                                                                           |
| <b>Molar mass</b>                   |        |                | kg / mol       |                               |                                                                                                                                                                            |                                                                                                                                                                                           |
| <b>Pipe Diameter</b>                | d, ø   | L              | m              | m = 39.37 in                  | " = in = 0.0254 m                                                                                                                                                          | mm = 0.001 m = 0.0393701 in                                                                                                                                                               |

|                                    |                    |                                  |                                         |                                                                                                                                                                         |                                                                                  |                                                                                                                                                             |
|------------------------------------|--------------------|----------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temperature                        | T                  |                                  | K                                       | $^{\circ}\text{C} = \text{K} - 273$                                                                                                                                     | $^{\circ}\text{F} = 9/5 \text{ T } [^{\circ}\text{C}] + 32$                      | $\text{K} = 273 \text{ }^{\circ}\text{C}$                                                                                                                   |
| Pressure (absolute)                | P                  | $\text{M L}^{-1} \text{ T}^{-2}$ | Pa                                      | $\text{kPa} = 10^3 \text{ Pa} = 0.145038 \text{ psi}$<br>$\text{MPa} = 10^3 \text{ Pa} = 145.038 \text{ psi}$<br>$\text{GPa} = 10^6 \text{ Pa} = 145,038 \text{ psi}$   | $\text{psi} = 6894.76 \text{ Pa} = 6.89476 \text{ kPa}$<br><br><br>              | $\text{bar} = 10^5 \text{ Pa} = 100 \text{ kPa} = 14.5038 \text{ psi}$<br><br>$\text{atm} = 101,325 \text{ Pa} = 101.325 \text{ kPa} = 14.6959 \text{ psi}$ |
| Pressure (gauge)                   | $P_{\text{gauge}}$ | $\text{M L}^{-1} \text{ T}^{-2}$ | Pa                                      | $\text{kPa(g)} = \text{kPa( abs)} - 101,325 \text{ kPa}$                                                                                                                | $\text{psi(g)} = \text{psi(abs)} - 14.6959 \text{ psi}$                          |                                                                                                                                                             |
| Volumetric flow rate (oil & water) | q, Q               | $\text{L}^3 \text{ T}^{-1}$      | $\text{m}^3/\text{s}$                   | $\text{cmd} = \text{m}^3/\text{d} = 1.16 \cdot 10^{-5} \text{ m}^3/\text{s}$                                                                                            | $\text{bpd} = 0.184 \cdot 10^{-5} \text{ m}^3/\text{s} = 0.159 \text{ cmd}$      |                                                                                                                                                             |
| Volumetric flow rate (gas)         | $q_g, Q_g$         | $\text{L}^3 \text{ T}^{-1}$      | $\text{m}^3/\text{s}$                   | $\text{cmd} = \text{m}^3/\text{d} = 35.3147 \text{ scf/d}$                                                                                                              | $\text{scf/d} = \text{ft}^3/\text{d} = 0.0283168 \text{ cmd}$                    |                                                                                                                                                             |
| GOR                                | GOR, $R_s, Y_g$    | –                                | $\text{m}^3/\text{m}^3$                 | $\text{m}^3/\text{m}^3 = 5.615 \text{ scf/bbl}$                                                                                                                         | $\text{scf/bbl} = 0.1781 \text{ m}^3/\text{m}^3$                                 |                                                                                                                                                             |
| Density (solids)                   |                    | $\text{M L}^{-3}$                | $\text{kg/m}^3$                         | $\text{g/cc} = 10^3 \text{ kg/m}^3$                                                                                                                                     | $\text{lb/ft}^3 = 16.0185 \text{ kg/m}^3$                                        |                                                                                                                                                             |
| Density (oil)                      | $\rho_o$           | $\text{M L}^{-3}$                | $\text{kg/m}^3$                         | $\text{g/cc} = 10^3 \text{ kg/m}^3$                                                                                                                                     | $^{\circ}\text{API} = (141.5/\text{SG}) - 131.5$                                 |                                                                                                                                                             |
| Specific gravity (oil)             |                    | –                                | –                                       | $1 = 10^3 \text{ kg/m}^3$                                                                                                                                               | $1 = \text{g/cc}$                                                                | $= \rho_o / \rho_w$                                                                                                                                         |
| Compressibility                    | c                  | $\text{L T}^2 \text{ M}^{-1}$    | $\text{Pa}^{-1}$                        | $\text{kPa}^{-1} = 10^{-3} \text{ Pa}^{-1}$                                                                                                                             | $\text{psi}^{-1} = 0.145 \cdot 10^{-3} \text{ Pa}^{-1} = 0.145 \text{ kPa}^{-1}$ |                                                                                                                                                             |
| Permeability                       | k                  | $\text{L}^2$                     | $\text{m}^2$                            | $\text{md} = 9.86923 \cdot 10^{-16} \text{ m}^2$                                                                                                                        | $\text{md} = 9.869233 \cdot 10^{-16} \text{ m}^2$                                | $\text{D} = 9.869233 \cdot 10^{13} \text{ m}^2$                                                                                                             |
| Porosity                           |                    | –                                | frac                                    | frac                                                                                                                                                                    | frac                                                                             | $\text{p.u.} = \% = 100 \text{ frac}$                                                                                                                       |
| Dynamic Viscosity                  |                    | $\text{M L}^{-1} \text{ T}^{-1}$ | Pas                                     | $\text{cp} = 10^3 \text{ Pas}$                                                                                                                                          | $\text{cp} = 10^3 \text{ Pas}$                                                   | $1 \text{ P} = 100 \text{ cp}$                                                                                                                              |
| Productivity                       | J                  | $\text{L}^4 \text{ T M}^{-1}$    | $\text{m}^3/(\text{Pa} \cdot \text{s})$ | $\text{cmd /kPa} = 0.11574 \cdot 10^{-7} \text{ m}^3/(\text{Pa} \cdot \text{s})$<br><br>$1 \text{ m}^3/(\text{Pa} \cdot \text{s}) = 8.64 \cdot 10^9 \text{ c md / bar}$ | $\text{bpd/psi} = 0.0231 \text{ cmd /kPa}$                                       | $\text{cmd /atm} = 101.325 \text{ cmd /kPa} = 4.394 \cdot 10^3 \text{ bpd/psi}$                                                                             |

|                               |            |                       |                                |                                                                          |                                                                       |                                                                                                                                                                 |
|-------------------------------|------------|-----------------------|--------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Transmissibility</b>       |            | $L^4 T M^{-1}$        | $\frac{m^3}{(Pa \cdot s)}$     | $\frac{(md \cdot m)}{cp} = 9.87 \cdot 10^{-13} \frac{m^3}{(Pa \cdot s)}$ | $\frac{(md \cdot ft)}{cp} = 0.3048 \frac{(md \cdot m)}{cp}$           | $\frac{(md \cdot m)}{cp} = 8.527 \cdot 10^{-5} \frac{cmd}{kPa} = 8.64 \cdot 10^{-3} \frac{cmd}{atm}$<br><br>$\frac{cmd}{atm} = 115.741 \frac{(md \cdot m)}{cp}$ |
| <b>Pressure diffusivity</b>   |            | $L^2 T^{-1}$          | $\frac{m^2}{s}$                | $\frac{(md \cdot kPa)}{cp} = 9.869233 \cdot 10^{10} \frac{m^2}{s}$       | $\frac{(md \cdot psi)}{cp} = 6.89476 \frac{(md \cdot kPa)}{cp}$       | $\frac{(md \cdot atm)}{cp} = 101.325 \frac{(md \cdot kPa)}{cp}$                                                                                                 |
| <b>Wellbore storage</b>       | WBS, $C_S$ | $L^4 T^2 M^{-1}$      | $\frac{m^3}{Pa}$               | $\frac{m^3}{kPa} = 0.001 \frac{m^3}{Pa}$                                 | $\frac{bbl}{psi} = 0.0231 \frac{m^3}{kPa}$                            |                                                                                                                                                                 |
| <b>Thermal conductivity</b>   |            | $M L T^{-3} K^{-1}$   | $\frac{W}{(m \cdot ^\circ K)}$ | $\frac{W}{(m \cdot ^\circ C)} = \frac{W}{(m \cdot ^\circ K)}$            | $\frac{BTU}{(hrft^\circ F)} = 1.7295772 \frac{W}{(m \cdot ^\circ C)}$ |                                                                                                                                                                 |
| <b>Specific heat capacity</b> | $c_p$      | $M L^2 T^{-2} K^{-1}$ | $\frac{J}{(kg^\circ K)}$       | $\frac{J}{(kg^\circ C)} = \frac{J}{(kg^\circ K)}$                        | $\frac{BTU}{(lbm^\circ F)} = 4186.798188 \frac{J}{(kg^\circ C)}$      |                                                                                                                                                                 |
| <b>Thermal diffusivity</b>    | $a$        | $L^2 T^{-1}$          | $\frac{m^2}{s}$                | $\frac{m^2}{s} = 0.0929 \frac{ft^2}{s}$                                  | $\frac{ft^2}{s} = 10.764 \frac{m^2}{s}$                               |                                                                                                                                                                 |

## See also

[Natural Science / Engineering / Measurement / Unit / Units Systems](#)

[ [Units Conversion](#) ] [ [Volume units used in petroleum engineering](#) ]

[ [Petroleum Industry \(Oil & Gas Industry\)](#) ]

[ [Petroleum Metric Unit System](#) ] [ [Petroleum British Unit System](#) ] [ [Petroleum Russian Unit System](#) ]

## Reference

<http://www.petroleumoffice.com/unitconverter>