

Petroleum Units Systems

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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
Dimensionless quantity	–	–	frac	frac	frac	
Time	t	T	s	d = 86,400 s	d = 86,400 s	hr = 3,600 s
Length	L	L	m	m = 3.281 ft	' = ft = 0.3048 m	km = 10 ³ m, cm = 10 ⁻² m, mm = 10 ⁻³ m
Area	A	L ²	m ²	m ²	ft ² = 0.09290304 m ²	ac = 4,047 m ² = 43,560 ft ² ha = 10,000 m ² = 2.471 ac
Volume	V	L ³	m ³	m ³ = 6.289811 bbl	bbl = 5.61458 ft ³ = 0.158986938944 m ³ Mbbbl = 10 ³ bbl, MMbbbl = 10 ⁶ bbl 1 ft ³ = 0.178107712420163 bbl	scf = ft ³ = 0.0283168 m ³ cc = cm ³ = 1 · 10 ⁻⁶ m ³ tonne = 7.28 bbl (Urals) ÷ 7.59 bbl (Brent) with average 7.33 bbl (WTI)
Mass / Weight	M, m	M	kg	kg	lb = 0.45359237 kg	g = 10 ⁻³ kg
Amount of chemical substance		1	mol	mol	mol	
Molar mass			kg / mol			
Pipe Diameter	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	$\text{kPa} = 10^3 \text{ Pa} = 0.145038 \text{ psi}$ $\text{MPa} = 10^3 \text{ Pa} = 145.038 \text{ psi}$ $\text{GPa} = 10^6 \text{ Pa} = 145,038 \text{ psi}$	$\text{psi} = 6894.76 \text{ Pa} = 6.89476 \text{ kPa}$ 	$\text{bar} = 10^5 \text{ Pa} = 100 \text{ kPa} = 14.5038 \text{ psi}$ $\text{atm} = 101,325 \text{ Pa} = 101.325 \text{ kPa} = 14.6959 \text{ psi}$
Pressure (gauge)	P_{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	$\text{L}^3 \text{ T}^{-1}$	m^3/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	$\text{L}^3 \text{ T}^{-1}$	m^3/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	–	m^3/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)		M L^{-3}	kg/m^3	$\text{g/cc} = 10^3 \text{ kg/m}^3$	$\text{lb/ft}^3 = 16.0185 \text{ kg/m}^3$	
Density (oil)	ρ_o	M L^{-3}	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	$\text{L T}^2 \text{ M}^{-1}$	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	L^2	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	$\text{L}^4 \text{ T M}^{-1}$	$\text{m}^3/(\text{Pa} \cdot \text{s})$	$\text{cmd/kPa} = 0.11574 \cdot 10^{-7} \text{ m}^3/(\text{Pa} \cdot \text{s})$ $1 \text{ m}^3/(\text{Pa} \cdot \text{s}) = 8.64 \cdot 10^9 \text{ c md / bar}$	$\text{bpd/psi} = 0.0231 \text{ cmd/kPa}$	$\text{cmd/atm} = 101.325 \text{ cmd/kPa} = 4.394 \cdot 10^3 \text{ bpd/psi}$

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