NACHI

SI Units and Conversion Formulas

Table 1: SI Base Units

Quantity	Name	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric Current	ampere	A
Thermodynamic Temperature	kelvin	K
Amount of Substance	mole	mol
Luminous Intensity	candela	cd

Table 2 : SI Derived Units

Quantity	Name	Symbol
Plane Angle	radian	rad
Solid Angle	steradian	sr

Table 3: Derived SI Units with Special Names and Symbols

Quantity	Name	Symbol
Frequency	hertz	Hz
Force	newton	N
Pressure, stress	pascal	Pa
Energy, Work, Quantity of Heat	joule	J
Power, Radiant Flux	watt	W
Electric Charge, Quantity of Electricity	coulomb	C
Electric Potential Difference, Electromotive Force	volt	V
Capacitance	farad	F
Electric Resistance	ohm	Ω
Electric Conductance	siemens	S
Magnetic Flux	weber	Wb
Magnetic Flux Density	tesla	T
Inductance	henry	H
Celsius Temperature	degree Celsius*	°C
Luminous Flux	lumen	lm

*t°C=(t+273.15)K

Table 4: SI Prefixes

Factor	Name	Symbol
10^{18}	exa	E
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10^{1}	deka	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f
10^{-18}	atto	a

Table 5: SI Derived Units whose Names and Symbols Include SI Derived Units with Special Names and Symbols

Quantity	Name	Symbol
Dynamic Viscosity	pascal second	Pa·s
Moment of Force	newton meter	N·m
Surface Tension	newton per meter	N/m
Heat Flux Density, Irradiance	watt per square meter	W/m^2
Heat Capacity, Entropy	joule per kelvin	J/K
Specific Heat Capacity,Specific Entropy*	joule per kilogram kelvin	J/(kg·K)
Thermal Conductivity	watt per meter kelvin	W/(m·K)
Permittivity	farad per meter	F/m
Permeability	henry per meter	H/m

*Also called weight entropy.

Table 6: Units Outside the SI but Accepted for Use with the SI

Name	Symbol	Value in SI Units
Minute (Time)	min	1min=60s
Hour	h	1h=60min=3,600s
Day	d	1d=24h=86,400s
Degree	°	1°=(π/180)rad
Minute (Angle)	'	1'=(1/60)°=(π/10,800)rad
Second (Angle)	"	1"=(1/60)'=(π/648,000)rad
Liter	ℓ	$1\ell=1dm^3=10^{-3}m^3$
Ton	t	$1t=10^3kg$

N

Technical data

Force

N	dyn	kgf
1	1×10^5	1.020×10^{-1}
1×10^{-5}	1	1.020×10^{-6}
9.807	9.807×10^5	1

(Note) $1dyn=10^{-5}N$

Torque

N·m	kgf·m	gf·cm
1	1.020×10^{-1}	1.020×10^4
9.807	1	1×10^5
9.807×10^{-5}	1×10^{-5}	1

Pressure

Pa	MPa	bar	kgf/cm²	atm	mHg	mH_2O
1	1×10^{-6}	1×10^{-5}	1.019×10^{-5}	9.869×10^{-6}	7.501×10^{-6}	1.020×10^{-4}
1×10^6	1	1×10	1.019×10	9.869	7.501	1.020×10^2
1×10^5	1×10^{-1}	1	1.020	9.869×10^{-1}	7.501×10^{-1}	1.020×10
9.807×10^4	9.807×10^{-2}	9.807×10^{-1}	1	9.678×10^{-1}	7.356×10^{-1}	1×10
1.013×10^5	1.013×10^{-1}	1.013	1.033	1	7.60×10^{-1}	1.033×10
1.333×10^5	1.333×10^{-1}	1.333	1.360	1.316	1	1.360×10
9.807×10^3	9.807×10^{-3}	9.807×10^{-2}	1×10^{-1}	9.678×10^{-2}	7.355×10^{-2}	1

(Note) $1Pa=1N/m^3$

Work, Energy, Quantity of Heat

J	kgf·m	kW·h	kcal
1	1.02×10^{-1}	2.778×10^{-7}	2.389×10^{-4}
9.807	1	2.724×10^{-6}	2.343×10^{-3}
3.60×10^6	3.671×10^5	1	8.60×10^2
4.186×10^3	4.269×10^2	1.163×1^{-3}	1

(Note) 1J=1W·s. 1kgf·m=9.807J. 1W·h=3600W·s. 1cal=4.186J

Power, Radiant Flux

W	kW	kgf·m/s	kcal/s
1	1×10^{-3}	1.020×10^{-1}	2.389×10^{-4}
1×10^3	1	1.020×10^2	2.389×10^{-1}
9.807	9.807×10^{-3}	1	2.343×10^{-3}
4.186×10^3	4.186	4.269×10^2	1

(Note) W=1J/s. 1kgf·m/s=9.807W

Flow rate

m³/s	m³/h	ℓ/min	gal(US)/min
1	3.6×10^3	6×10^4	1.585×10^4
2.778×10^{-4}	1	1.667×10	4.403
1.667×10^{-5}	6×10^{-2}	1	2.642×10^{-1}
6.304×10^{-5}	2.271×10^{-1}	3.782	1

Heat Transfer Coefficient

W/m²·K	kcal/m²·h·°C	cal/cm²·s·°C
1	8.60×10^{-1}	2.389×10^{-5}
1.163	1	2.778×10^{-5}
4.186×10^4	3.60×10^4	1

Thermal Conductivity

W/m·K	kcal/m·h·°C	J/cm·s·°C
1	8.60×10^{-1}	1×10^{-2}
1.163	1	1.163×10^{-2}
1×10^2	8.60×10	1

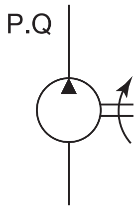
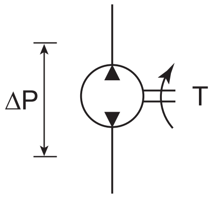
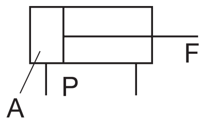
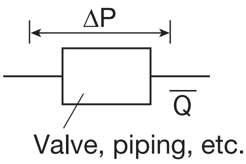
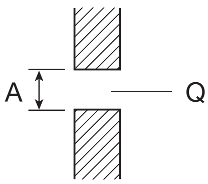
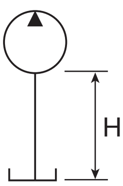
Dynamic Viscosity

Pa·s	P (Poise)	cP
1	1×10	1×10^3
1×10^{-1}	1	1×10^2
1×10^{-3}	1×10^{-2}	1

Kinematic viscosity

m²/s	St	cSt
1	1×10^4	1×10^6
1×10^{-4}	1	1×10^2
1×10^{-6}	1×10^{-2}	1

(Note) $1cSt=1mm^2/s$

Item		SI units	Power (engineering) units
Requirement		$L=\dfrac{P\cdot Q}{60\times\eta}$ L : Power Requiement [kW] P : Discharge Pressure [MPa] Q : Discharge Rate [ℓ/min] η : Pump Efficiency	$L=\dfrac{P\cdot Q}{612\times\eta}$ L : Power Requiement [kW] P : Discharge Pressure [kgf/cm^2] Q : Discharge Rate [ℓ/min] η : Pump Efficiency
Oil Motor Output Torque		$L=\dfrac{\Delta P\cdot q}{2\pi}\times\eta$ T : Output Torque [N·m] ΔP: Inlet/Outlet Pressure Differential [MPa] q : Volume per Oil Motor Turn [cm^3] η : Torque Efficiency	$L=\dfrac{\Delta P\cdot q}{200\times\pi}\times\eta$ T : Output Torque [kgf·m] ΔP: Inlet/Outlet Pressure Differential [kgf/cm^2] q : Volume per Oil Motor Turn [cm^3] η : Torque Efficiency
Cylinder Output		$F = 100 \times P \times A \times \eta$ F : Cylinder Output [N] P : Working Presure [MPa] A : Cylinder Contact Area [cm^2] η : Cylinder Efficiency	$F = P \times A \times \eta$ F : Cylinder Output [kgf] P : Working Presure [kgf/cm^2] A : Cylinder Contact Area [cm^2] η : Cylinder Efficiency
Pressur Loss Conversion Energy		$H = 60 \times P \times Q$ H : Heat Release [kJ/h] P : Pressure Loss [MPa] Q : Flow Rate [ℓ/min]	$H = 1.4 \times P \times Q$ H : Heat Release [kcal/h] P : Pressure Loss [kgf/cm^2] Q : Flow Rate [ℓ/min]
Orifice Flow		$Q = CA\sqrt{\dfrac{2\Delta P}{\rho}} \times 6000$ Q : Flow Rate [ℓ/min] C : Compressibile Flow Coefficient [Dimensionless] A : Passage Area [cm^2] ΔP: Pressure Differential [MPa] ρ : Density [kg/m^3]	$Q = CA\sqrt{\dfrac{2g\cdot\Delta P}{\gamma}} \times 0.06$ Q : Flow Rate [ℓ/min] C : Compressibile Flow Coefficient [Dimensionless] (≒0.6) A : Passage Area [cm^2] g : Gravitational Acceleration [$980cm/s^2$] ΔP: Pressure Differential [kgf/cm^2] γ : Specific Gravity [kgf/cm^3] (≒0.87×10^{-3})
Pressure Loss		$\Delta P = \rho \times g \times H \times 10^{-6}$ ΔP: Pressure Loss [MPa] ρ : Density [kg/m^3] g : Gravitational Acceleration [$9.8m/s^2$] H : Height [m]	$\Delta P = \gamma \times g \times H \times 10^{-4}$ ΔP: Pressure Loss [kg/m^2] γ : Specific Gravity [kgf/cm^3] H : Height [m]

(Note) When performing calculations, make sure that you first convert values correctly.
Cutting off and rounding up values can cause differences in calculation results.