INTERNATIONAL SYSTEM OF UNITS (SI) Excerpts from JIS Z 8203 (1985)

1. The International System of Units (SI) and its usage

1—1. Scope of application This standard specifies the International System of Units (SI) and how to use units under the SI system, as well as the units which are or may be used in conjunction with SI system units.

1—2. Terms and definitions The terminology used in this standard and the definitions thereof are as follows.

(1) **International System of Units (SI)** A consistent system of units adopted and recommended by the International Committee on Weights and Measures. It contains base units and supplementary units, units derived from them, and their integer exponents to the 10th power. SI is the abbreviation of System International d Unites (International System of Units).

(2) **SI units** A general term used to describe base units, supplementary units, and derived units under the International System of Units (SI).

(3) **Base units** The units shown in **Table 1** are considered the base units.

(4) **Supplementary units** The units shown in **Table 2** below are considered the supplementary units.

Table 1. Base Units

Measure	Unit name	Unit symbol	Definition
Length	Meter	m	A meter is the length of the path traveled by light in a vacuum during a time interval of $\frac{1}{299\ 792\ 458}$ of a second.
Mass	Kilogram	kg	A kilogram is a unit of mass (not weight or force). It is equal to the mass of the international prototype of the kilogram.
Time	Second	s	A second is the duration of 9, 192, 631, 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium 133 atom.
Electric flow	Ampere	A	An ampere is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed 1 meter apart in a vacuum, would produce between these conductors a force equal to 2×10^{-7} Newtons per meter of length.
Thermodynamic temperature	Kelvin	K	A Kelvin is the fraction $\frac{1}{273.16}$ of the thermodynamic temperature of the triple point of water.
Amount of substance	Mole	mol	A mole is the amount of substance of a system that contains as many elementary particles (1) or aggregations of elementary particles as there are atoms in 0.012 kilogram of carbon 12. When the mole is used, the elementary particles must be specified.
Luminous intensity	Candela	cd	A candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540×10^{12} hertz and that has a radiant intensity in that direction of $\frac{1}{683}$ watts per steradian.

Note (1) The elementary particles here must be atoms, molecules, ions, electrons or other particles.

Table 2. Supplementary Units

Measure	Unit name	Unit symbol	Definition
Plane angle	Radian	rad	A radian is the plane angle between two radii of a circle that cuts off an arc on the circumference equal in length to the radius.
Solid angle	Steradian	sr	A steradian is the solid angle which, having its vertex in the center of a sphere, cuts off an area of the surface of the sphere equal to that of a square with sides equal in length to the radius of the sphere.

(5) **Derived Units** Units expressed algebraically (with mathematical symbols such as multiplication and division signs) using base units and supplementary units are considered to be derived units. Derived units with special names and symbols are shown in **Table 3**.

Example: Examples of SI Derived Units Expressed in Terms of Base Units

Measure	Derived unit	
	Name	Symbol
Surface area	Square meter	m^2
Volume	Cubic meter	m^3
Speed	Meters per second	m/s
Acceleration	Meter per second per second	m/s^2
Wave numbers	Per meter	m^{-1}
Density	Kilograms per cubic meter	kg/m^3
Current density	Amperes per square meter	A/m^2
Magnetic field strength	Amperes per meter	A/m
Concentration of substance	Moles per cubic meter	mol/m^3
Specific volume	Cubic meters per kilogram	m^3/kg
Luminance	Candelas per square meter	cd/m^2

Table 3. SI Derived Units with Special Names and Symbols

Measure	Derived unit		Derivation from basic unit or supplementary unit, or derivation from another derived unit
	Name	Symbol	
Frequency	Hertz	Hz	1 Hz $=1\ s^{-1}$
Force	Newton	N	1 N $=1\ kg\cdot m/s^2$
Pressure, stress	Pascal	Pa	1 Pa $=1\ N/m^2$
Energy, work, heat quantity	Joule	J	1 J $=1\ N\cdot m$
Work rate, process rate, power, electric power	Watt	W	1 W $=1$ J/s
Electric charge, quantity of electricity	Coulomb	C	1 C $=1\ A\cdot s$
Electric potential, potential difference, voltage, electromotive force	Volt	V	1 V $=1$ J/C
Electrostatic capacity, capacitance	Farad	F	1 F $=1$ C/V
Electric resistance	Ohm	Ω	1 Ω $=1$ V/A
Conductance	Siemens	S	1 S $=1\ \Omega^{-1}$
Magnetic flux	Weber	Wb	1 Wb $=1\ V\cdot s$
Magnetic flux density (magnetic induction)	Tesla	T	1 T $=1\ Wb/m^2$
Inductance	Henry	H	1 H $=1$ Wb/A
Celsius temperature	Degrees Celsius or degrees	℃	1 t℃ $=(t+273.15)$K
Luminous flux	Lumen	lm	1 lm $=1\ cd\cdot sr$
Illumination	Lux	lx	1 lx $=1\ lm/m^2$
Radioactivity	Becquerel	Bq	1 Bq $=1\ s^{-1}$
Absorbed dose	Gray	Gy	1 Gy $=1$ J/kg
Dose equivalent	Sievert	Sv	1 Sv $=1$ J/kg

1—3. Integer exponents of SI units

(1) **Prefixes** The multiples, prefix names, and prefix symbols that compose **the integer exponents of 10 for SI units** are shown in **Table 4**.

Table 4. Prefixes

Multiple of unit	Prefix Name	Prefix Symbol	Multiple of unit	Prefix Name	Prefix Symbol	Multiple of unit	Prefix Name	Prefix Symbol
10^{18}	Exa	E	10^{2}	Hecto	h	10^{-9}	Nano	n
10^{15}	Peta	P	10	Deca	da	10^{-12}	Pico	p
10^{12}	Tera	T	10^{-1}	Deci	d	10^{-15}	Femto	f
10^{9}	Giga	G	10^{-2}	Centi	c	10^{-18}	Atto	a
10^{6}	Mega	M	10^{-3}	Milli	m			
10^{3}	Kilo	k	10^{-6}	Micro	μ			

2. Conversion table for conventional units that are difficult to convert to SI units

(The units enclosed by bold lines are the SI units.)

Force	**N**	dyn	kgf
	1	1×10^{5}	$1.019\ 72\times10^{-1}$
	1×10^{-5}	1	$1.019\ 72\times10^{-6}$
	$9.806\ 65$	$9.806\ 65\times10^{5}$	1

Viscosity	**Pa·s**	cP	P
	1	1×10^{3}	1×10
	1×10^{-3}	1	1×10^{-2}
	1×10^{-1}	1×10^{2}	1

Note: 1P=1dyn·s/cm²=1g/cm·s
1Pa·s=1N·s/m², 1cP=1mPa·s

Stress	**Pa** or **N/m²**	**MPa** or **N/mm²**	kgf/mm²	kgf/cm²
	1	1×10^{-6}	$1.019\ 72\times10^{-7}$	$1.019\ 72\times10^{-5}$
	1×10^{6}	1	$1.019\ 72\times10^{-1}$	$1.019\ 72\times10$
	$9.806\ 65\times10^{6}$	$9.806\ 65$	1	1×10^{2}
	$9.806\ 65\times10^{4}$	$9.806\ 65\times10^{-2}$	1×10^{-2}	1

Note: 1Pa=1N/m², 1MPa=1N/mm²

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

Note: 1St=1cm²/s, 1cSt=1mm²/s

Pressure	**Pa**	**kPa**	**MPa**	bar	kgf/cm²	atm	mmH2O	mmHg or Torr
	1	1×10^{-3}	1×10^{-6}	1×10^{-5}	$1.019\ 72\times10^{-5}$	$9.869\ 23\times10^{-6}$	$1.019\ 72\times10^{-1}$	$7.500\ 62\times10^{-3}$
	1×10^{3}	1	1×10^{-3}	1×10^{-2}	$1.019\ 72\times10^{-2}$	$9.869\ 23\times10^{-3}$	$1.019\ 72\times10^{2}$	$7.500\ 62$
	1×10^{6}	1×10^{3}	1	1×10	$1.019\ 72\times10$	$9.869\ 23$	$1.019\ 72\times10^{5}$	$7.500\ 62\times10^{3}$
	1×10^{5}	1×10^{2}	1×10^{-1}	1	$1.019\ 72$	$9.869\ 23\times10^{-1}$	$1.019\ 72\times10^{4}$	$7.500\ 62\times10^{2}$
	$9.806\ 65\times10^{4}$	$9.806\ 65\times10$	$9.806\ 65\times10^{-2}$	$9.806\ 65\times10^{-1}$	1	$9.678\ 41\times10^{-1}$	1×10^{4}	$7.355\ 59\times10^{2}$
	$1.013\ 25\times10^{5}$	$1.013\ 25\times10^{2}$	$1.013\ 25\times10^{-1}$	$1.013\ 25$	$1.033\ 23$	1	$1.033\ 23\times10^{4}$	$7.600\ 00\times10^{2}$
	$9.806\ 65$	$9.806\ 65\times10^{-3}$	$9.806\ 65\times10^{-6}$	$9.806\ 65\times10^{-5}$	1×10^{-4}	$9.678\ 41\times10^{-5}$	1	$7.355\ 59\times10^{-2}$
	$1.333\ 22\times10^{2}$	$1.333\ 22\times10^{-1}$	$1.333\ 22\times10^{-4}$	$1.333\ 22\times10^{-3}$	$1.359\ 51\times10^{-3}$	$1.315\ 79\times10^{-3}$	$1.359\ 51\times10$	1

Note: 1Pa=1N/m²

Work, energy, heat quantity	**J**	kW·h	kgf·m	kcal
	1	$2.777\ 78\times10^{-7}$	$1.019\ 72\times10^{-1}$	$2.388\ 89\times10^{-4}$
	$3.600\ \times10^{6}$	1	$3.670\ 98\times10^{5}$	$8.600\ 0\ \times10^{2}$
	$9.806\ 65$	$2.724\ 07\times10^{-6}$	1	$2.342\ 70\times10^{-3}$
	$4.186\ 05\times10^{3}$	$1.162\ 79\times10^{-3}$	$4.268\ 58\times10^{2}$	1

Note: 1J=1W·s, 1J=1N·m

Power, process rate/power, heat flow	**W**	kgf·m/s	PS	kcal/h
	1	$1.019\ 72\times10^{-1}$	$1.359\ 62\times10^{-3}$	$8.600\ 0\ \times10^{-1}$
	$9.806\ 65$	1	$1.333\ 33\times10^{-2}$	$8.433\ 71$
	$7.355\ \times10^{2}$	$7.5\ \times10$	1	$6.325\ 29\times10^{2}$
	$1.162\ 79$	$1.185\ 72\times10^{-1}$	$1.580\ 95\times10^{-3}$	1

Note: 1W=1J/s, PS: French horsepower

Thermal conductivity	**W/(m·K)**	kcal/(m·h·℃)
	1	$8.600\ 0\times10^{-1}$
	$1.162\ 79$	1

Coefficient of heat transfer	**W/(m²·K)**	kcal/(m²·h·℃)
	1	$8.600\ 0\times10^{-1}$
	$1.162\ 79$	1

Specific heat	**J/(kg·K)**	kcal/(kg·℃) cal/(g·℃)
	1	$2.388\ 89\times10^{-4}$
	$4.186\ 05\times10^{-3}$	1