

Specification for

**SI units and  
recommendations for  
the use of their  
multiples and of certain  
other units**

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# Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Systems Department Steering Committee (S/-) to Technical Committee S/1, upon which the following bodies were represented:

Chartered Institution of Building Services Engineers  
 Department of Trade and Industry (National Physical Laboratory)  
 Department of Trade and Industry (National Weights and Measures Laboratory)  
 EEA (the Association of Electronics, Telecommunications and Business Equipment Industries)  
 Institute of Physics  
 Institute of Trading Standards Administration  
 Institution of Chemical Engineers  
 Institution of Electrical Engineers  
 Institution of Mechanical Engineers  
 Institution of Structural Engineers  
 Royal Society  
 Royal Society of Chemistry  
 Schools Mathematics Project  
 Society of Chemical Industry

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## National foreword

This British Standard has been prepared under the direction of the Systems Department Steering Committee and is identical with ISO 1000:1992 *SI units and recommendations for the use of their multiples and of certain other units*, published by the International Organization for Standardization (ISO). ISO 1000 was prepared by Technical Committee 12 “Quantities, units, symbols, conversion factors” with the active participation and approval of the UK.

This revision of BS 5555 supersedes BS 5555:1981 which is withdrawn. The principal changes made in this revision are as follows:

- a) the decision by the International Committee for Weights and Measures (Comité International des Poids et Mesures, CIPM) in 1980 concerning the status of supplementary units has been incorporated;
- b) quantities and units from ISO 31, ISO 31-9, ISO 31-10, ISO 31-12, ISO 31-13, have been added to Annex A;
- c) the old definition of the metre in Annex B has been replaced by the new definitions.

**Cross-references.** The Technical Committee has reviewed the provisions of IEC 27-1:1971, to which reference is made in the remarks relating to item 2-3.2 in Annex A, and has decided that they are acceptable for use in conjunction with this standard.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 20, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

## 1 Scope

This International Standard

- a) describes the International System of Units<sup>1)</sup> (in clauses 3, 4 and 6);
- b) recommends selected decimal multiples and sub-multiples of SI units for general use and gives certain other units which may be used with the International System of Units (in clauses 5 and 7, and Annex A);
- c) quotes the definitions of the SI base units (in Annex B).

## 2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards. IEC 27-1:1971<sup>2)</sup>, *Letter symbols to be used in electrical technology — Part 1: General*.

## 3 SI units

The name International System of Units (Système International d'Unités), with the international abbreviation SI, was adopted by the 11th General Conference on Weights and Measures (Conférence Générale des Poids et Mesures, CGPM) in 1960.

This system includes:

- base units
- derived units including supplementary units

which together form the coherent system of SI units.

### 3.1 Base units

The International System of Units is based on the seven base units listed in Table 1.

Table 1 — SI base units

Base quantity	SI base unit	
	Name	Symbol
length	metre	m
mass	kilogram	kg
time	second	s
electric current	ampere	A
thermodynamic temperature	kelvin	K
amount of substance	mole	mol
luminous intensity	candela	cd

For the definitions of the base units, see Annex B.

### 3.2 Derived units including supplementary units

Derived units are expressed algebraically in terms of base units. Their symbols are obtained by means of the mathematical signs of multiplication and division; for example, the SI unit for velocity is metre per second (m/s).

For some of the SI derived units, special names and symbols exist; those approved by the CGPM are listed in Table 2 and Table 3.

The SI units radian and steradian are called supplementary units. They are “dimensionless” derived units (more precisely, derived units of dimension one) with special names and symbols. Although the coherent unit for plane angle and for solid angle is expressed by the number 1, it is convenient to use the special names radian (rad) and steradian (sr) respectively instead of the number 1 in many practical cases; for example the SI unit for angular velocity can be written as radian per second (rad/s).

It may sometimes be useful to express derived units in terms of other derived units having special names; for example, the SI unit for electric dipole moment is usually expressed as C · m instead of A · s · m.

## 4 Multiples of SI units

The prefixes given in Table 4 are used to form names and symbols of multiples (decimal multiples and sub-multiples) of the SI units.

<sup>1)</sup> Full information about the International System of Units is given in a publication by the International Bureau of Weights and Measures (Bureau International des Poids et Mesures, BIPM): *Le Système International d'Unités (SI)*, including an authorized English translation.

<sup>2)</sup> 5th edition, currently being revised.

The symbol of a prefix is considered to be combined with the kernel symbol<sup>3)</sup> to which it is directly attached, forming with it a new symbol (for a decimal multiple or sub-multiple) which can be raised to a positive or negative power, and which can be combined with other unit symbols to form symbols for compound units.

EXAMPLES

$$1 \text{ cm}^3 = (10^{-2} \text{ m})^3 = 10^{-6} \text{ m}^3$$

$$1 \text{ } \mu\text{s}^{-1} = (10^{-6} \text{ s})^{-1} = 10^6 \text{ s}^{-1}$$

$$1 \text{ mm}^2/\text{s} = (10^{-3} \text{ m})^2/\text{s} = 10^{-6} \text{ m}^2/\text{s}$$

Compound prefixes shall not be used; for example, write nm for nanometre, not mµm.

NOTE 1 For historical reasons the name of the base unit for mass, the kilogram, contains the name of the SI prefix "kilo". Names of the decimal multiples and sub-multiples of the unit of mass are formed by adding the prefixes to the word "gram", e.g. milligram (mg) instead of microkilogram (µkg).

Table 2 — SI derived units with special names, including SI supplementary units

Derived quantity	SI derived unit		
	Special name	Symbol	Expressed in terms of SI base units and SI derived units
plane angle	radian	rad	1 rad = 1 m/m = 1
solid angle	steradian	sr	1 sr = 1 m <sup>2</sup> /m <sup>2</sup> = 1
frequency	hertz	Hz	1 Hz = 1 s <sup>-1</sup>
force	newton	N	1 N = 1 kg · m/s <sup>2</sup>
pressure, stress	pascal	Pa	1 Pa = 1 N/m <sup>2</sup>
energy, work, quantity of heat	joule	J	1 J = 1 N · m
power, radiant flux	watt	W	1 W = 1 J/s
electric charge, quantity of electricity	coulomb	C	1 C = 1 A · s
electric potential, potential difference, tension, electromotive force	volt	V	1 V = 1 W/A
capacitance	farad	F	1 F = 1 C/V
electric resistance	ohm	Ω	1 Ω = 1 V/A
electric conductance	siemens	S	1 S = 1 Ω <sup>-1</sup>
magnetic flux	weber	Wb	1 Wb = 1 V · s
magnetic flux density	tesla	T	1 T = 1 Wb/m <sup>2</sup>
inductance	henry	H	1 H = 1 Wb/A
Celsius temperature	degree Celsius <sup>a</sup>	°C	1 °C = 1 K
luminous flux	lumen	lm	1 lm = 1 cd · sr
illuminance	lux	lx	1 lx = 1 lm/m <sup>2</sup>

<sup>a</sup> Degree Celsius is a special name for the unit kelvin for use in stating values of Celsius temperature. (See also note 6 concerning the kelvin in Annex B.)

<sup>3)</sup> In this case, the term "kernel symbol" means only a symbol for a base unit or a derived unit with a special name. See, however, note 1 in clause 4 about the base unit the kilogram.

**Table 3 — SI derived units with special names admitted for reasons of safeguarding human health**

Derived quantity	SI derived unit		
	Special name	Symbol	Expressed in terms of SI base units and SI derived units
activity (of a radionuclide)	becquerel	Bq	1 Bq = 1 s <sup>-1</sup>
absorbed dose, specific energy imparted, kerma, absorbed dose index	gray	Gy	1 Gy = 1 J/kg
dose equivalent, dose equivalent index	sievert	Sv	1 Sv = 1 J/kg

**Table 4 — SI prefixes**

Factor	Prefix	
	Name	Symbol
10 <sup>24</sup>	yotta	Y
10 <sup>21</sup>	zetta	Z
10 <sup>18</sup>	exa	E
10 <sup>15</sup>	peta	P
10 <sup>12</sup>	tera	T
10 <sup>9</sup>	giga	G
10 <sup>6</sup>	mega	M
10 <sup>3</sup>	kilo	k
10 <sup>2</sup>	hecto	h
10	deca	da
10 <sup>-1</sup>	deci	d
10 <sup>-2</sup>	centi	c
10 <sup>-3</sup>	milli	m
10 <sup>-6</sup>	micro	μ
10 <sup>-9</sup>	nano	n
10 <sup>-12</sup>	pico	p
10 <sup>-15</sup>	femto	f
10 <sup>-18</sup>	atto	a
10 <sup>-21</sup>	zepto	z
10 <sup>-24</sup>	yocto	y

## 5 Use of SI units and their multiples

**5.1** The choice of the appropriate multiple (decimal multiple or sub-multiple) of an SI unit is governed by convenience, the multiple chosen for a particular application being the one which will lead to numerical values within a practical range.

**5.2** The multiple can usually be chosen so that the numerical values will be between 0,1 and 1 000. In the case of a compound unit containing a unit to the second or third power, this is not always possible.

### EXAMPLES

1,2 × 10<sup>4</sup> N can be written as 12 kN  
 0,003 94 m can be written as 3,94 mm  
 1 401 Pa can be written as 1,401 kPa  
 3,1 × 10<sup>-8</sup> s can be written as 31 ns

However, in a table of values of the same quantity or in a discussion of such values within a given context, it will generally be better to use the same multiple for all items, even if some of the numerical values will then be outside the range 0,1 to 1 000. For certain quantities in particular applications, the same multiple is customarily used; for example, the millimetre is used for dimensions in most mechanical engineering drawings.

**5.3** The number of prefixes used in forming compound units should be limited as far as is compatible with practical usage.

**5.4** Errors in calculations can be avoided more easily if all quantities are expressed in SI units, powers of 10 being used instead of prefixes.

## 6 Rules for writing unit symbols

**6.1** Unit symbols shall be printed in roman (upright) type (irrespective of the type used in the rest of the text), shall remain unaltered in the plural, shall be written without a final full stop (period) except for normal punctuation, e.g. at the end of a sentence, and shall be placed after the complete numerical value in the expression for a quantity, leaving a space between the numerical value and the unit symbol.

Unit symbols shall in general be written in lower case letters except that the first letter is written in upper case when the name of the unit is derived from a proper name.

**EXAMPLES**

- m metre
- s second
- A ampere
- Wb weber

**6.2** When a compound unit is formed by multiplication of two or more units, this should be indicated in one of the following ways:

$$N \cdot m, \quad N m$$

NOTE 2 In systems with limited character sets a dot on the line is used instead of a half-high dot.

NOTE 3 The latter form may also be written without a space, provided that special care is taken when the symbol for one of the units is the same as the symbol for a prefix, e.g. mN is used only for millinewton, not for metre newton.

When a compound unit is formed by dividing one unit by another, this should be indicated in one of the following ways:

$$\frac{m}{s}, \quad m/s, \quad m \cdot s^{-1}.$$

A solidus (/) shall not be followed by a multiplication sign or a division sign on the same line unless parentheses are inserted to avoid any ambiguity. In complicated cases negative powers or parentheses shall be used.

**7 Non-SI units which may be used with SI units and their multiples**

**7.1** There are certain units, outside the SI, recognized by the CIPM as having to be retained because of their practical importance (see Table 5 and Table 6).

**Table 6 — Units used with the SI, whose values in SI units are obtained experimentally**

Quantity	Unit		
	Name	Symbol	Definition
energy	electronvolt	eV	The electronvolt is the kinetic energy acquired by an electron in passing through a potential difference of 1 volt in vacuum: 1 eV $1,602\ 177 \times 10^{-19}$ J.
mass	unified atomic mass unit	u	The unified atomic mass unit is equal to 1/12 of the mass of an atom of the nuclide <sup>12</sup> C: 1 u $1,660\ 540 \times 10^{-27}$ kg.

**7.2** Prefixes given in Table 4 may be attached to some of the units given in Table 5 and Table 6; for example, millilitre, ml. (See also Annex A, column 6.)

**7.3** In a limited number of cases, compound units are formed with the units given in Table 5 and Table 6 together with SI units and their multiples; for example, kg/h; km/h. (See also Annex A, columns 5 and 6.)

NOTE 4 There are some other units outside the SI which are recognized by the CIPM for temporary use. They are given in column 7 of the table in Annex A and marked by an asterisk (\*).

**Table 5 — Units used with the SI**

Quantity	Unit		
	Name	Symbol	Definition
time	minute	min	1 min = 60 s
	hour	h	1 h = 60 min
	day	d	1 d = 24 h
plane angle	degree	°	1° = (π/180) rad
	minute	'	1' = (1/60)°
	second	"	1" = (1/60)'
volume	litre	l, L <sup>a</sup>	1 l = 1 dm <sup>3</sup>
mass	tonne <sup>b</sup>	t	1 t = 10 <sup>3</sup> kg

<sup>a</sup> The two symbols for the litre are on an equal footing. The CIPM will, however, make a survey on the development of the use of the two symbols in order to see if one of the two may be suppressed.

<sup>b</sup> Also called the metric ton in the English language.



**Annex A (normative)**

**Examples of decimal multiples and sub-multiples of SI units and of some other units which may be used**

For a number of commonly used quantities, examples of decimal multiples and sub-multiples of SI units, as well as of some other units which may be used, are given in this annex. It is suggested that the selection shown, while not intended to be restrictive, will none the less prove helpful in presenting values of quantities in an identical manner in similar contexts within the various sectors of technology. For some needs (for example, in applications in science and education), it is recognized that greater freedom will be required in the choice of decimal multiples and sub-multiples of SI units than is exemplified in the list which follows.

Item No. in ISO 31: 1992	Quantity	SI unit	Selection of multiples and sub-multiples of the SI unit	Units outside the SI recognized by the CIPM as having to be retained, and for special cases some of their combinations with SI units		Remarks and information about units used in special fields
				Units	Multiples or sub-multiples of units given in column 5	
1	2	3	4	5	6	7
<b>Part 1: Space and time</b>						
1-1	angle, (plane angle)	rad (radian)	mrad  μrad	° (degree) $1^\circ = \frac{\pi}{180} \text{ rad}$ , (minute) $1' = \frac{1^\circ}{60}$ " (second) $1'' = \frac{1'}{60}$		gon [gon (or grade)], $1 \text{ gon} = \frac{\pi}{200} \text{ rad}$  If the radian is not used, the units degree or gon (or grade) may be used. Decimal subdivisions of degree are preferable to minute and second for most applications. For the units degree, minute and second for plane angle, there shall be no space between the numerical value and the unit symbol.
1-2	solid angle	sr (steradian)				
1-3.1	length	m (metre)	km  cm mm μm nm pm fm			1 nautical mile* = 1 852 m (exactly)  * Recognized by the CIPM for temporary use.

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				Units	Multiples or sub-multiples of units given in column 5	
1	2	3	4	5	6	7
1-4	area	m <sup>2</sup>	km <sup>2</sup> dm <sup>2</sup> cm <sup>2</sup> mm <sup>2</sup>			ha* (hectare), 1 ha = 10 <sup>4</sup> m <sup>2</sup> a* (are), 1 a = 10 <sup>2</sup> m <sup>2</sup> * Recognized by the CIPM for temporary use.
1-5	volume	m <sup>3</sup>	dm <sup>3</sup>  cm <sup>3</sup>  mm <sup>3</sup>	l, L (litre) 1 l = 10 <sup>-3</sup> m <sup>3</sup> = 1 dm <sup>3</sup>	hl 1 hl = 10 <sup>-1</sup> m <sup>3</sup>  cl 1 cl = 10 <sup>-5</sup> m <sup>3</sup> ml 1 ml = 10 <sup>-6</sup> m <sup>3</sup> = 1 cm <sup>3</sup>	In 1964, the CGPM declared that the name litre (l) may be used as a special name for the cubic decimetre (dm <sup>3</sup> ) and advised against the use of the name litre for high-precision measurements. See also footnote a to Table 5.
1-7	time	s (second)	ks  ms μs ns	d (day) 1 d = 24 h (exactly) h (hour) 1 h = 60 min (exactly)  min (minute) 1 min = 60 s (exactly)		Other units such as week, month and year (a) are in common use. The definitions of month and year often need to be specified.
1-8	angular velocity	rad/s				
1-10	velocity	m/s		m/h	km/h 1 km/h = $\frac{1}{3,6}$ m/s	1 knot* = 1,852 km/h (exactly) = 0,514 444 m/s For the hour, see item No. 1-7. * Recognized by the CIPM for temporary use.
1-11.1	acceleration	m/s <sup>2</sup>				

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				Units	Multiples or sub-multiples of units given in column 5	
1	2	3	4	5	6	7
<b>Part 2: Periodic and related phenomena</b>						
2-3.1	frequency	Hz (hertz)	THz GHz MHz kHz			
2-3.2	rotational frequency	s <sup>-1</sup>		min <sup>-1</sup>		The designations “revolutions per minute” (r/min) and “revolutions per second” (r/s) are widely used for rotational frequency in specifications on rotating machinery. (See also IEC 27-1.) For the minute, see item 1-7.
2-4	angular frequency	rad/s				
<b>Part 3: Mechanics</b>						
3-1	mass	kg (kilogram)	Mg  g mg µg	t (tonne) 1 t = 10 <sup>3</sup> kg		See footnote b to Table 5.
3-2	volumic mass, density, mass density	kg/m <sup>3</sup>	Mg/m <sup>3</sup> or kg/dm <sup>3</sup> or g/cm <sup>3</sup>	t/m <sup>3</sup> or kg/l	g/ml  g/l	For the litre, see item No. 1-6. For the tonne, see item No. 3-1.
3-5	lineic mass, linear density	kg/m	mg/m			1 tex = 10 <sup>-6</sup> kg/m = 1 g/km The unit tex is used for textile filaments.
3-7	moment of inertia	kg · m <sup>2</sup>				
3-8	momentum	kg · m/s				
3-9.1	force	N (newton)	MN kN  mN µN			

Item No. in ISO 31: 1992	Quantity	SI unit	Selection of multiples and sub-multiples of the SI unit	Units outside the SI recognized by the CIPM as having to be retained, and for special cases some of their combinations with SI units		Remarks and information about units used in special fields
				Units	Multiples or sub-multiples of units given in column 5	
1	2	3	4	5	6	7
3-11	moment of momentum, angular momentum	kg · m <sup>2</sup> /s				
3-12.1	moment of force	N · m	MN · m kN · m mN · m μN · m			
3-15.1	pressure	Pa (pascal)	GPa MPa kPa hPa  mPa μPa			bar* (bar), 1 bar = 100 kPa (exactly) 1 mbar = 1 hPa The use of the bar shall be restricted to existing uses in the field of fluid pressure. * Recognized by the CIPM for temporary use.
3-15.2	normal stress	Pa	GPa MPa kPa			
3-23	viscosity, (dynamic viscosity)	Pa · s	mPa · s			P (poise) 1 cP = 1 mPa · s The poise and stokes are special names for CGS units. They and their multiples and sub-multiples shall not be used together with SI units.
3-24	kinematic viscosity	m <sup>2</sup> /s	mm <sup>2</sup> /s			St (stokes) 1 cSt = 1 mm <sup>2</sup> /s See remark on item 3-23.
3-25	surface tension	N/m	mN/m			
3-26.1 and 3-26.2	energy, work	J (joule)	EJ PJ TJ GJ MJ kJ  mJ			

Item No. in ISO 31: 1992	Quantity	SI unit	Selection of multiples and sub-multiples of the SI unit	Units outside the SI recognized by the CIPM as having to be retained, and for special cases some of their combinations with SI units		Remarks and information about units used in special fields
				Units	Multiples or sub-multiples of units given in column 5	
1	2	3	4	5	6	7
3-27	power	W (watt)	GW MW kW  mW $\mu$ W			
<b>Part 4: Heat</b>						
4-1	thermo- dynamic temperature	K (kelvin)				
4-2	Celsius temperature	$^{\circ}$ C (degree Celsius)				The Celsius temperature $t$ is equal to the difference $(T - T_0)$ between two thermodynamic temperatures $T$ and $T_0$ , where $T_0 = 273,15$ K (exactly).  For the definition and the use of the degree Celsius ( $^{\circ}$ C), see note 6 under the definition of the kelvin in Annex B.
4-3.1	linear expansion coefficient	$K^{-1}$				For the degree Celsius, see item 4-2.
4-6	heat	J	EJ PJ TJ GJ MJ kJ mJ			
4-7	heat flow rate	W	kW			
4-9	thermal conductivity	W/(m $\cdot$ K)				For the degree Celsius, see item 4-2.
4-10.1	coefficient of heat transfer	W/(m <sup>2</sup> $\cdot$ K)				For the degree Celsius, see item 4-2.
4-11	thermal insulance	m <sup>2</sup> $\cdot$ K/W				For the degree Celsius, see item 4-2.
4-15	heat capacity	J/K	kJ/K			For the degree Celsius, see item 4-2.

Item No. in ISO 31: 1992	Quantity	SI unit	Selection of multiples and sub-multiples of the SI unit	Units outside the SI recognized by the CIPM as having to be retained, and for special cases some of their combinations with SI units		Remarks and information about units used in special fields
				Units	Multiples or sub-multiples of units given in column 5	
1	2	3	4	5	6	7
4-16.1	massic heat capacity	J/(kg · K)	kJ/(kg · K)			For the degree Celsius, see item 4-2.
4-18	entropy	J/K	kJ/K			For the degree Celsius, see item 4-2.
4-19	massic entropy	J/(kg · K)	kJ/(kg · K)			For the degree Celsius, see item 4-2.
4-21.2	massic thermo-dynamic energy	J/kg	MJ/kg kJ/kg			
<b>Part 5: Electricity and magnetism</b>						
5-1	electric current	A (ampere)	kA  mA μA nA pA			
5-2	electric charge, quantity of electricity	C (coulomb)	kC  μC nC pC	A · h 1 A · h = 3,6 kC		For the hour, see item No. 1-7.
5-3	volumic charge, volume density of charge, charge density	C/m <sup>3</sup>	C/mm <sup>3</sup> or GC/m <sup>3</sup> MC/m <sup>3</sup> or C/cm <sup>3</sup> kC/m <sup>3</sup>  mC/m <sup>3</sup> μC/m <sup>3</sup>			
5-4	areic charge, surface density of charge	C/m <sup>2</sup>	MC/m <sup>2</sup> or C/mm <sup>2</sup> C/cm <sup>2</sup> kC/m <sup>2</sup>  mC/m <sup>2</sup> μC/m <sup>2</sup>			

Item No. in ISO 31: 1992	Quantity	SI unit	Selection of multiples and sub-multiples of the SI unit	Units outside the SI recognized by the CIPM as having to be retained, and for special cases some of their combinations with SI units		Remarks and information about units used in special fields
				Units	Multiples or sub-multiples of units given in column 5	
1	2	3	4	5	6	7
5-5	electric field strength	V/m	MV/m kV/m or V/mm V/cm  mV/m $\mu$ V/m			
5-6.1	electric potential	V (volt)	MV kV			
5-6.2	potential difference, tension		mV $\mu$ V			
5-6.3	electromotive force					
5-7	electric flux density	C/m <sup>2</sup>	C/cm <sup>2</sup> kC/m <sup>2</sup>  mC/m <sup>2</sup> $\mu$ C/m <sup>2</sup>			
5-8	electric flux	C	MC kC  mC			
5-9	capacitance	F (farad)	mF $\mu$ F nF pF			
5-10.1	permittivity	F/m	$\mu$ F/m nF/m pF/m			
5-13	electric polarization	C/m <sup>2</sup>	C/cm <sup>2</sup> kC/m <sup>2</sup>  mC/m <sup>2</sup> $\mu$ C/m <sup>2</sup>			
5-14	electric dipole moment	C · m				

Item No. in ISO 31: 1992	Quantity	SI unit	Selection of multiples and sub-multiples of the SI unit	Units outside the SI recognized by the CIPM as having to be retained, and for special cases some of their combinations with SI units		Remarks and information about units used in special fields
				Units	Multiples or sub-multiples of units given in column 5	
1	2	3	4	5	6	7
5-15	areic electric current, electric current density	A/m <sup>2</sup>	MA/m <sup>2</sup> or A/mm <sup>2</sup> A/cm <sup>2</sup> kA/m <sup>2</sup>			
5-16	lineic electric current, linear electric current density	A/m	kA/m or A/mm A/cm			
5-17	magnetic field strength	A/m	kA/m or A/mm A/cm			
5-18.1	magnetic potential difference	A	kA mA			
5-19	magnetic flux density, magnetic induction	T (tesla)	mT μT nT			
5-20	magnetic flux	Wb (weber)	mWb			
5-21	magnetic vector potential	Wb/m	kWb/m or Wb/mm			
5-22.1	self-inductance	H (henry)	mH			
5-22.2	mutual inductance		μH nH pH			
5-24	permeability	H/m	μH/m nH/m			
5-27	magnetic moment, electro-magnetic moment	A · m <sup>2</sup>				



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				Units	Multiples or sub-multiples of units given in column 5	
1	2	3	4	5	6	7
5-28	magnetization	A/m	kA/m or A/mm			
5-29	magnetic polarization	T	mT			
(IEC 27-1:1971, item 86)	magnetic dipole moment	N · m <sup>2</sup> /A or Wb · m				
5-33	resistance (to direct current)	Ω (ohm)	GΩ MΩ kΩ mΩ μΩ			
5-34	conductance (of direct current)	S (siemens)	kS mS μS			
5-36	resistivity	Ω · m	GΩ · m MΩ · m kΩ · m Ω · cm mΩ · m μΩ · m nΩ · m			$\frac{\Omega \cdot \text{mm}^2}{\text{m}}$ (= 10 <sup>-6</sup> Ω · m = μΩ · m) is also used.
5-37	conductivity	S/m	MS/m kS/m			
5-38	reluctance	H <sup>-1</sup>				
5-39	permeance	H				
5-44.1	impedance, (complex impedance)	Ω	MΩ kΩ mΩ			
5-44.2	modulus of impedance, (impedance)					
5-44.3	resistance					
5-44.4	reactance					

Item No. in ISO 31: 1992	Quantity	SI unit	Selection of multiples and sub-multiples of the SI unit	Units outside the SI recognized by the CIPM as having to be retained, and for special cases some of their combinations with SI units		Remarks and information about units used in special fields
				Units	Multiples or sub-multiples of units given in column 5	
1	2	3	4	5	6	7
5-45.1 5-45.2 5-45.3 5-45.4	admittance, (complex admittance) modulus of admittance, (admittance) conductance susceptance	S	kS mS μS			
5-49	active power	W	TW GW MW kW mW μW nW			In electric power technology, active power is expressed in watts (W), apparent power in volt amperes (V · A) and reactive power in vars (var).
5-52	active energy	J	TJ GJ MJ kJ	W · h 1 W · h = 3,6 kJ (exactly)	TW · h GW · h MW · h kW · h	For the hour, see item 1-7.
<b>Part 6: Light and related electromagnetic radiations</b>						
6-3	wavelength	m	μm nm pm			Å* (ångström), 1 Å = 10 <sup>-10</sup> m = 10 <sup>-1</sup> nm = 10 <sup>-4</sup> μm * Recognized by the CIPM for temporary use.
6-7	radiant energy	J				
6-10	radiant power, radiant energy flux	W				
6-13	radiant intensity	W/sr				

Item No. in ISO 31: 1992	Quantity	SI unit	Selection of multiples and sub-multiples of the SI unit	Units outside the SI recognized by the CIPM as having to be retained, and for special cases some of their combinations with SI units		Remarks and information about units used in special fields
				Units	Multiples or sub-multiples of units given in column 5	
1	2	3	4	5	6	7
6-14	radiance	W/(sr · m <sup>2</sup> )				
6-15	radiant exitance	W/m <sup>2</sup>				
6-16	irradiance	W/m <sup>2</sup>				
6-29	luminous intensity	cd (candela)				
6-30	luminous flux	lm (lumen)				
6-31	quantity of light	lm · s		lm · h 1 lm · h = 3 600 lm · s (exactly)		For the hour, see item 1-7.
6-32	luminance	cd/m <sup>2</sup>				
6-33	luminous exitance	lm/m <sup>2</sup>				
6-34	illuminance	lx (lux)				
6-35	light exposure	lx · s				
6-36.1	luminous efficacy	lm/W				
<b>Part 7: Acoustics</b>						
7-1	period, periodic time	s	ms µs			
7-2	frequency	Hz	MHz kHz			
7-5	wavelength	m	mm			
7-8	volumic mass, mass density, density	kg/m <sup>3</sup>				

Item No. in ISO 31: 1992	Quantity	SI unit	Selection of multiples and sub-multiples of the SI unit	Units outside the SI recognized by the CIPM as having to be retained, and for special cases some of their combinations with SI units		Remarks and information about units used in special fields
				Units	Multiples or sub-multiples of units given in column 5	
1	2	3	4	5	6	7
7-9.1	static pressure	Pa	mPa μPa			
7-9.2	(instantaneous) sound pressure					
7-11	(instantaneous) sound particle velocity	m/s	mm/s			
7-13	(instantaneous) volume flow rate	m <sup>3</sup> /s				
7-14.1	velocity of sound	m/s				
7-16	sound power	W	kW mW μW pW			
7-17	sound intensity	W/m <sup>2</sup>	mW/m <sup>2</sup> μW/m <sup>2</sup> pW/m <sup>2</sup>			
7-18	acoustic impedance	Pa · s/m <sup>3</sup>				
7-19	mechanical impedance	N · s/m				
7-20.1	surface density of mechanical impedance	Pa · s/m				
7-21	sound pressure level					B (bel) dB (decibel), 1 dB = 10 <sup>-1</sup> B
7-22	sound power level					B dB

Item No. in ISO 31: 1992	Quantity	SI unit	Selection of multiples and sub-multiples of the SI unit	Units outside the SI recognized by the CIPM as having to be retained, and for special cases some of their combinations with SI units		Remarks and information about units used in special fields
				Units	Multiples or sub-multiples of units given in column 5	
1	2	3	4	5	6	7
7-28	sound reduction index					B dB
7-29	equivalent absorption area of a surface or object	m <sup>2</sup>				
7-30	reverberation time	s				
<b>Part 8: Physical chemistry and molecular physics</b>						
8-3	amount of substance	mol (mole)	kmol  mmol µmol			
8-5	molar mass	kg/mol	g/mol			
8-6	molar volume	m <sup>3</sup> /mol	dm <sup>3</sup> /mol cm <sup>3</sup> /mol	l/mol		For the litre, see item 1-6.
8-7	molar thermo- dynamic energy	J/mol	kJ/mol			
8-8	molar heat capacity	J/(mol K)				For the degree Celsius, see item 4-2.
8-9	molar entropy	J/(mol K)				For the degree Celsius, see item 4-2.
8-13	concentration of B, amount-of- substance concentration of B	mol/m <sup>3</sup>	mol/dm <sup>3</sup> or kmol/m <sup>3</sup>	mol/l		For the litre, see item 1-6.
8-16	molality of solute B	mol/kg	mmol/kg			
8-39	diffusion coefficient	m <sup>2</sup> /s				

Item No. in ISO 31: 1992	Quantity	SI unit	Selection of multiples and sub-multiples of the SI unit	Units outside the SI recognized by the CIPM as having to be retained, and for special cases some of their combinations with SI units		Remarks and information about units used in special fields
				Units	Multiples or sub-multiples of units given in column 5	
1	2	3	4	5	6	7
8-41	thermal diffusion coefficient	m <sup>2</sup> /s				
<b>Part 9: Atomic and nuclear physics</b>						
9-28.2	mass defect	kg		u (unified atomic mass unit), 1 u 1,660 540 × 10 <sup>-27</sup> kg		
9-33	activity	Bq	MBq kBq			Ci* (curie), 1 Ci = 3,7 × 10 <sup>10</sup> Bq (exactly) * Recognized by the CIPM for temporary use.
9-34	massic activity, specific activity	Bq/kg	MBq/kg kBq/kg			
9-37	half-life	s	ms	d h		a (year) For the hour and the day, see item 1-7.
<b>Part 10: Nuclear reactions and ionizing radiations</b>						
10-1	reaction energy	J		eV (electronvolt), 1 eV 1,602 177 × 10 <sup>-19</sup> J	Gev MeV keV	
10-51.2	absorbed dose	Gy	mGy			rad* (rad), 1 rad = 10 <sup>-2</sup> Gy * Recognized by the CIPM for temporary use.
10-52	dose equivalent	Sv	mSv			rem* (rem), 1 rem = 10 <sup>-2</sup> Sv * Recognized by the CIPM for temporary use.

Item No. in ISO 31: 1992	Quantity	SI unit	Selection of multiples and sub-multiples of the SI unit	Units outside the SI recognized by the CIPM as having to be retained, and for special cases some of their combinations with SI units		Remarks and information about units used in special fields
				Units	Multiples or sub-multiples of units given in column 5	
1	2	3	4	5	6	7
10-58	exposure	C/kg	mC/kg			R* (röntgen), 1 R = $2,58 \times 10^{-4}$ C/kg (exactly) * Recognized by the CIPM for temporary use.
<b>Part 12: Characteristic numbers</b>						
12-1	Reynolds number	1				As prefixes cannot be used, powers of 10 may be used, e.g. $Re = 1,32 \times 10^3$
12-6	Mach number	1				
<b>Part 13: Solid state physics</b>						
13-17	density of states	$J^{-1}/m^3$		$eV^{-1}/m^3$		For the electronvolt, see item 10-1.
13-20	Hall coefficient	$m^3/C$				
13-21	thermo- electromotive force	V	mV			
13-24	Thomson coefficient	V/K	mV/K			For the degree Celsius, see item 4-2.
13-28.2	gap energy	J	fJ aJ	eV		For the electronvolt, see item 10-1.
13-36.1	Curie temperature	K				For the degree Celsius, see item 4-2.

## Annex B (informative)

### Definitions of the base units of the international system of units

**metre:** The metre is the length of the path travelled by light in vacuum during a time interval of  $1/299\,792\,458$  of a second.

[17th CGPM (1983), Resolution 1]

**kilogram:** The kilogram is the unit of mass; it is equal to the mass of the international prototype of the kilogram.

[3rd CGPM (1901)]

**second:** The 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 caesium-133 atom.

[13th CGPM (1967), Resolution 1]

**ampere:** The ampere is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed 1 metre apart in vacuum, would produce between these conductors a force equal to  $2 \times 10^{-7}$  newton per metre of length.

[CIPM (1946), Resolution 2 approved by the 9th CGPM (1948)]

**kelvin:** The kelvin, unit of thermodynamic temperature, is the fraction  $1/273,16$  of the thermodynamic temperature of the triple point of water.

[13th CGPM (1967), Resolution 4]

NOTE 5 The 13th CGPM (1967, Resolution 3) also decided that the unit kelvin and its symbol K should be used to express an interval or a difference of temperature.

NOTE 6 In addition to the thermodynamic temperature (symbol  $T$ ), expressed in kelvins, use is also made of Celsius temperature (symbol  $t$ ) defined by the equation  $t = T - T_0$ , where  $T_0 = 273,15$  K by definition. To express Celsius temperature, the unit “degree Celsius”, which is equal to the unit “kelvin”, is used; in this case, “degree Celsius” is a special name used in place of “kelvin”. An interval or difference of Celsius temperature can, however, be expressed in kelvins as well as in degrees Celsius.

**mole:** The mole is the amount of substance of a system which contains as many elementary entities as there are atoms in 0,012 kilograms of carbon-12. When the mole is used, the elementary entities must be specified and may be atoms, molecules, ions, electrons, other particles, or specified groups of such particles.

[14th CGPM (1971), Resolution 3]

**candela:** The candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency  $540 \times 10^{12}$  hertz and that has a radiant intensity in that direction of  $1/683$  watt per steradian.

[16th CGPM (1979), Resolution 3]



## List of references

See national foreword.

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