►**B**

COUNCIL DIRECTIVE

of 20 December 1979

on the approximation of the laws of the Member States relating to units of measurement and on the repeal of Directive 71/354/EEC

(80/181/EEC)

(OJ L 39, 15.2.1980, p. 40)

Amended by:

		Official Journal		
		No	page	date
►**M1**	Council Directive 85/1/EEC of 18 December 1984	L 2	11	3.1.1985
►**M2**	Council Directive 89/617/EEC of 27 November 1989	L 357	28	7.12.1989
►**M3**	Directive 1999/103/EC of the European Parliament and of the Council of 24 January 2000	L 34	17	9.2.2000
►**M4**	Directive 2009/3/EC of the European Parliament and of the Council of 11 March 2009	L 114	10	7.5.2009
►**M5**	Commission Directive (EU) 2019/1258 of 23 July 2019	L 196	6	24.7.2019

Corrected by:

►**C1** Corrigendum, OJ L 296, 15.10.1981, p. 52 (80/181/EEC)
►**C2** Corrigendum, OJ L 104, 29.4.2000, p. 89 (1999/103/EC)
►**C3** Corrigendum, OJ L 311, 12.12.2000, p. 50 (1999/103/EC)

▼B

COUNCIL DIRECTIVE

of 20 December 1979

on the approximation of the laws of the Member States relating to units of measurement and on the repeal of Directive 71/354/EEC

(80/181/EEC)

Article 1

The legal units of measurement within the meaning of this Directive which must be used for expressing quantities shall be:

(a) those listed in Chapter I of the Annex;

▼M4

(b) those listed in Chapter II of the Annex only in those Member States where they were authorised on 21 April 1973;

▼M2

(c) those listed in Chapter III of the Annex only in those Member States where they were authorized on 21 April 1973 and until a date to be fixed by those States. This date may not be later than 31 December 1994;

(d) those listed in Chapter IV of the Annex only in those Member States where they were authorized on 21 April 1973 and until a date to be fixed by those States. This date may not be later than 31 December 1999.

▼B

Article 2

▼M4

(a) The obligations arising under Article 1 relate to measuring instruments used, measurements made and indications of quantity expressed in units of measurement.

▼B

(b) This Directive shall not affect the use in the field of air and sea transport and rail traffic of units, other than those made compulsory by the Directive, which have been laid down in international conventions or agreements binding the Community or the Member States.

Article 3

1. For the purposes of this Directive 'supplementary indication-'means one or more indications of quantity expressed in units of measurement not contained in Chapter I of the Annex accompanying an indication of quantity expressed in a unit contained in that Chapter.

▼M4

2. The use of supplementary indications shall be authorised.

▼B

3. However, Member States may require that measuring instruments bear indications of quantity in a single legal unit of measurement.

▼B

4. The indication expressed in a unit of measurement listed in Chapter I shall predominate. In particular, the indications expressed in units of measurement not listed in Chapter I shall be expressed in characters no larger than those of the corresponding indication in units listed in Chapter I.

▼M2

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▼B

Article 4

The use of units of measurement which are not or are no longer legal shall be authorized for:

— products and equipment already on the market and/or in service on the date on which this Directive is adopted,

— components and parts of products and of equipment necessary to supplement or replace components or parts of the above products and equipment.

However, the use of legal units of measurement may be required for the indicators of measuring instruments.

Article 5

International standard ISO 2955 of ►M2 15 May 1983 ◄, 'Information processing — Representations of SI and other units for use in systems with limited character sets' shall apply in the field covered by paragraph 1 thereof.

Article 6

Directive 71/354/EEC shall be repealed on 1 October 1981.

▼M2

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▼M3

Article 6a

Issues concerning the implementation of this Directive and, in particular, the matter of supplementary indications shall be further examined, and if necessary the appropriate measures adopted in accordance with the procedure referred to in Article 18 of Council Directive 71/316/EEC ([1]).

▼M4

Article 6b

The Commission shall monitor market developments relating to this Directive and its implementation with regard to the smooth functioning of the internal market and international trade and shall submit a report on those developments, accompanied by proposals where appropriate, to the European Parliament and to the Council by 31 December 2019.

([1]) OJ L 202, 6.9.1971, p. 1.

▼B

Article 7

(a) Member States shall adopt and publish before 1 July 1981 the laws, regulations and administrative provisions necessary to comply with this Directive and shall inform the Commission thereof.

They shall apply these provisions from 1 October 1981.

(b) As from the date of notification of this Directive, Member States shall also ensure that the Commission is informed, in sufficient time to enable it to submit its comments, of any draft laws, regulations or administrative provisions which they intend to adopt in the field covered by this Directive.

Article 8

This Directive is addressed to the Member States.

▼C1

ANNEX

CHAPTER I

LEGAL UNITS OF MEASUREMENT REFERRED TO IN ARTICLE 1 (a)

1. SI UNITS AND THEIR DECIMAL MULTIPLES AND SUBMULTIPLES

▼M5

1.1. **SI base units**

Quantity	Unit	
	Name	Symbol
Time	second	s
Length	metre	m
Mass	kilogram	kg
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Amount of substance	mole	mol
Luminous intensity	candela	cd

Definitions of SI base units:

Unit of time

The second, symbol s, is the SI unit of time. It is defined by taking the fixed numerical value of the caesium frequency Δv_{Cs}, the unperturbed ground-state hyperfine transition frequency of the caesium 133 atom, to be 9 192 631 770 when expressed in the unit Hz, which is equal to s^{-1}.

Unit of length

The metre, symbol m, is the SI unit of length. It is defined by taking the fixed numerical value of the speed of light in vacuum c to be 299 792 458 when expressed in the unit m/s, where the second is defined in terms of Δv_{Cs}.

Unit of mass

The kilogram, symbol kg, is the SI unit of mass. It is defined by taking the fixed numerical value of the Planck constant h to be $6{,}626\ 070\ 15 \times 10^{-34}$ when expressed in the unit J s, which is equal to kg m^2 s^{-1}, where the metre and the second are defined in terms of c and Δv_{Cs}.

Unit of electric current

The ampere, symbol A, is the SI unit of electric current. It is defined by taking the fixed numerical value of the elementary charge e to be $1{,}602\ 176\ 634 \times 10^{-19}$ when expressed in the unit C, which is equal to A s, where the second is defined in terms of Δv_{Cs}.

Unit of thermodynamic temperature

The kelvin, symbol K, is the SI unit of thermodynamic temperature. It is defined by taking the fixed numerical value of the Boltzmann constant k to be $1{,}380\ 649 \times 10^{-23}$ when expressed in the unit J K^{-1}, which is equal to kg m^2 s^{-2} K^{-1}, where the kilogram, metre and second are defined in terms of h, c and Δv_{Cs}.

▼M5

Unit of amount of substance

The mole, symbol mol, is the SI unit of amount of substance. One mole contains exactly 6,022 140 76 × 10^{23} elementary entities. This number is the fixed numerical value of the Avogadro constant, $N_{A,}$ when expressed in the unit mol^{-1} and is called the Avogadro number.

The amount of substance, symbol *n*, of a system is a measure of the number of specified elementary entities. An elementary entity may be an atom, a molecule, an ion, an electron, any other particle or specified group of particles.

Unit of luminous intensity

The candela, symbol cd, is the SI unit of luminous intensity in a given direction. It is defined by taking the fixed numerical value of the luminous efficacy of monochromatic radiation of frequency 540 × 10^{12} Hz, K_{cd}, to be 683 when expressed in the unit lm W^{-1}, which is equal to cd sr W^{-1}, or cd sr kg^{-1} m^{-2} s^3, where the kilogram, metre and second are defined in terms of *h*, *c* and Δv_{Cs}.

1.1.1. **Special name and symbol of the SI derived unit of temperature for expressing Celsius temperature**

Quantity	Unit	
	Name	Symbol
Celsius temperature	degree Celsius	°C

Celsius temperature *t* is defined as the difference $t = T - T_0$ between the two thermodynamic temperatures *T* and T_0 where T_0 = 273,15 K. An interval or difference of temperature may be expressed either in kelvins or in degrees Celsius. The unit 'degree Celsius' is equal to the unit 'kelvin'.

▼M4

1.2. **SI derived units**

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1.2.2. **General rule for SI derived units**

Units derived coherently from SI base units are given as algebraic expressions in the form of products of powers of the SI base units with a numerical factor equal to 1.

1.2.3. **SI derived units with special names and symbols**

Quantity	Unit		Expression	
	Name	Symbol	In terms of other SI units	In terms of SI base units
Plane angle	radian	rad		$m \cdot m^{-1}$
Solid angle	steradian	sr		$m^2 \cdot m^{-2}$
Frequency	hertz	Hz		s^{-1}
Force	newton	N		$m \cdot kg \cdot s^{-2}$
Pressure, stress	pascal	Pa	$N \cdot m^{-2}$	$m^{-1} \cdot kg \cdot s^{-2}$

▼M4

Quantity	Unit		Expression	
	Name	Symbol	In terms of other SI units	In terms of SI base units
Energy, work; quantity of heat	joule	J	$N \cdot m$	$m^2 \cdot kg \cdot s^{-2}$
Power ([1]), radiant flux	watt	W	$J \cdot s^{-1}$	$m^2 \cdot kg \cdot s^{-3}$
Quantity of electricity, electric charge	coulomb	C		$s \cdot A$
Electric potential, potential difference, electromotive force	volt	V	$W \cdot A^{-1}$	$m^2 \cdot kg \cdot s^{-3} \cdot A^{-1}$
Electric resistance	ohm	Ω	$V \cdot A^{-1}$	$m^2 \cdot kg \cdot s^{-3} \cdot A^{-2}$
Conductance	siemens	S	$A \cdot V^{-1}$	$m^{-2} \cdot kg^{-1} \cdot s^3 \cdot A^2$
Capacitance	farad	F	$C \cdot V^{-1}$	$m^{-2} \cdot kg^{-1} \cdot s^4 \cdot A^2$
Magnetic flux	weber	Wb	$V \cdot s$	$m^2 \cdot kg \cdot s^{-2} \cdot A^{-1}$
Magnetic flux density	tesla	T	$Wb \cdot m^{-2}$	$kg \cdot s^{-2} \cdot A^{-1}$
Inductance	henry	H	$Wb \cdot A^{-1}$	$m^2 \cdot kg \cdot s^{-2} \cdot A^{-2}$
Luminous flux	lumen	lm	$cd \cdot sr$	cd
Illuminance	lux	lx	$lm \cdot m^{-2}$	$m^{-2} \cdot cd$
Activity (of a radionuclide)	becquerel	Bq		s^{-1}
Absorbed dose, specific energy imparted, kerma, absorbed dose index	gray	Gy	$J \cdot kg^{-1}$	$m^2 \cdot s^{-2}$
Dose equivalent	sievert	Sv	$J \cdot kg^{-1}$	$m^2 \cdot s^{-2}$
Catalytic activity	katal	kat		$mol \cdot s^{-1}$

([1]) Special names for the unit of power: the name volt–ampere (symbol 'VA') when it is used to express the apparent power of alternating electric current, and var (symbol 'var') when it is used to express reactive electric power. The 'var' is not included in GCPM resolutions.

Units derived from SI base units may be expressed in terms of the units listed in Chapter I.

In particular, derived SI units may be expressed by the special names and symbols given in the above table; for example, the SI unit of dynamic viscosity may be expressed as $m^{-1} \cdot kg \cdot s^{-1}$ or $N \cdot s \cdot m^{-2}$ or $Pa \cdot s$.

▼C1

1.3. **Prefixes and their symbols used to designate certain decimal multiples and submultiples**

▼M3

Factor	Prefix	Symbol
10^{24}	yotta	Y
10^{21}	zetta	Z
10^{18}	exa	E
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	►C2 k ◄
10^{2}	hecto	►C2 h ◄
10^{1}	deca	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
10^{-21}	zepto	z
10^{-24}	yocto	y

▼C1

The names and symbols of the decimal multiples and submultiples of the unit of mass are formed by attaching prefixes to the word ‘gram’ and their symbols to the symbol ‘g’.

Where a derived unit is expressed as a fraction, its decimal multiples and submultiples may be designated by attaching a prefix to units in the numerator or the denominator, or in both these parts.

Compound prefixes, that is to say prefixes formed by the juxtaposition of several of the above prefixes, may not be used.

1.4. **Special authorized names and symbols of decimal multiples and submultiples of SI units**

Quantity	Unit		
	Name	Symbol	Value
Volume	litre	l or L (1)	1 l = 1 dm^3 = 10^{-3} m^3
Mass	tonne	t	1 t = 1 Mg = 10^3 kg
Pressure, stress	bar	bar (2)	1 bar = 10^5 Pa

(1) The two symbols ‘l’and ‘L’ may be used for the litre unit. (Sixteenth CGPM (1979), resolution 6).

(2) Unit listed in the International Bureau of Weights and Measures booklet as among the units to be permitted temporarily.

▼C1

Note: The prefixes and their symbols listed in 1.3 may be used in conjunction with the units and symbols contained in Table 1.4.

2. UNITS WHICH ARE DEFINED ON THE BASIS OF SI UNITS BUT ARE NOT DECIMAL MULTIPLES OR SUBMULTIPLES THEREOF

Quantity	Unit		
	Name	Symbol	Value
Plane angle	revolution* ([1]) ([a])		1 revolution = 2 π rad
	grade* or gon*	gon*	$1\ \text{gon} = \frac{\pi}{200}\ \text{rad}$
	degree	°	$1° = \frac{\pi}{180}\ \text{rad}$
	minute of angle	′	$1' = \frac{\pi}{10\ 800}\ 10\ 800\ \text{rad}$
	second of angle	″	$1'' = \frac{\pi}{648\ 000}\ 648\ 000\ \text{rad}$
Time	minute	min	1 min = 60 s
	hour	h	1 h = 3 600 s
	day	d	1 d = 86 400 s

([1]) The character (*) after a unit name or symbol indicates that it does not appear in the lists drawn up by the CGPM, CIPM o BIPM. This applies to the whole of this Annex.
([a]) No international symbol exists.

Note: The prefixes listed in 1.3 may only be used in conjunction with the names ‘grade’ or ‘gon’ and the symbol ‘gon’.

▼M3

3. UNITS USED WITH THE SI, WHOSE VALUES IN SI ARE OBTAINED EXPERIMENTALLY

Quantity	Unit		
	Name	Symbol	Definition
Energy	Electronvolt	eV	The electron volt is the kinetic energy acquired by an electron in passing through a potential difference of 1 volt in vaccum
Mass	Unified atomic mass unit	u	The unified atomic mass units is equal to 1/12 of the mass of an atom of the nuclide ^{12}C.

Note: The prefixes and their symbols listed in 1.3 may be used in conjunction with these two units and with their symbols.

▼C1

4. UNITS AND NAMES OF UNITS PERMITTED IN SPECIALIZED FIELDS ONLY

Quantity	Unit		
	Name	Symbol	Value
Vergency of optical systems	dioptre*		1 dioptre = 1 m^{-1}
Mass of precious stones	metric carat		1 metric carat = 2×10^{-4} kg
Area of farmland and building land	are	a	1 a = 10^2 m^2
Mass per unit length of textile yarns and threads	tex*	tex*	1 tex = 10^{-6} kg · m^{-1}
▼M1			
Blood pressure and pressure of other body fluids	Millimetre of mercury	mm Hg(*)	1 mm Hg = 133,322 Pa
Effective cross-sectional area	Barn	b	1 b = 10^{-28} m^2

▼C1

Note: ►M1 The prefixes and their symbols listed in 1.3 may be used in conjunction with the above units and symbols, with the exception of the millimetre of mercury and its symbol. The multiple of 10^2a is, however, called a 'hectare'. ◄

5. COMPOUND UNITS

Combinations of the units listed in Chapter I form compound units.

▼M2

CHAPTER II

LEGAL UNITS OF MEASUREMENT REFERRED TO IN ARTICLE 1 (b), PERMITTED FOR SPECIFIC USES ONLY

Field of application	Unit		
	Name	Approximate value	Symbol
Road traffic signs, distance and speed measurement	mile	1 mile = 1 609 m	mile
	yard	1 yd = 0,9144 m	yd
	foot	1 ft = 0,3048 m	ft
	inch	1 in = $2{,}54 \times 10^{-2}$ m	in
Dispense of draught beer and cider; milk in returnable containers	pint	1 pt = $0{,}5683 \times 10^{-3}$ m^3	pt
▼M4			
▼M2			
Transaction in precious metals	troy ounce	1 oz tr = $31{,}10 \times 10^{-3}$ kg	oz tr

▼M4

The units listed in this Chapter may be combined with each other or with those in Chapter I to form compound units.

▼C1

CHAPTER III

LEGAL UNITS OF MEASUREMENT REFERRED TO IN ARTICLE 1 (c)

QUANTITIES, NAMES OF UNITS, SYMBOLS AND APPROXIMATE VALUES

Length

inch	1 in	= $2{\cdot}54 \times 10^{-2}$ m
foot	1 ft	= 0·3048 m

▼M2

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▼C1

mile	1 mile	= 1 609 m
yard	1 yard	= 0·9144 m

Area

square foot	1 sq ft	= $0{\cdot}929 \times 10^{-1}$ m^2
acre	1 ac	= 4 047 m^2
square yard	1 sq yd	= 0·8361 m^2

Volume

fluid ounce	1 fl oz	= $28{\cdot}41 \times 10^{-6}$ m^3
gill	1 gill	= $0{\cdot}1421 \times 10^{-3}$ m^3
pint	1 pt	= $0{\cdot}5683 \times 10^{-3}$ m^3
quart	1 qt	= $1{\cdot}137 \times 10^{-3}$ m^3
gallon	1 gal	= $4{\cdot}546 \times 10^{-3}$ m^3

Mass

ounce (avoirdupois)	1 oz	= $28{\cdot}35 \times 10^{-3}$ kg
troy ounce	1 oz tr	= $31{\cdot}10 \times 10^{-3}$ kg
pound	1 lb	= 0·4536 kg

Energy

therm	1 therm	= $105{\cdot}506 \times 10^{6}$ J

▼M2

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▼C1

Until the date to be fixed under Article 1 (c), the units listed in Chapter III may be combined with each other or with those in Chapter I to form compound units.

▼M2

CHAPTER IV

LEGAL UNITS OF MEASUREMENT REFERRED TO IN ARTICLE I (d), PERMITTED IN SPECIALIZED FIELDS ONLY

Field of application	Unit			
	Name	Approximate value		Symbol
Marine navigation	fathom	1 fm =	1,829 m	fm
Beer, cider, waters, lemonades and fruit juices in returnable containers	pint	1 pt =	$0{,}5683 \times 10^{-3}$ m^3	pt
	fluid ounce	1 fl oz =	$28{,}41 \times 10^{-6}$ m^3	fl. oz
Spirit drinks	gill	1 gill =	$0{,}142 \times 10^{-3}$ m^3	gill
Goods sold loose in bulk	ounce (avoir dupois)	1 oz =	$28{,}35 \times 10^{-3}$ kg	oz
	pound	1 lb =	0,4536 kg	lb
Gas supply	therm	1 therm =	$105{,}506 \times 10^{6}$ J	therm

Until the date to be fixed under Article 1 (d), the units listed in this Chapter may be combined with each other or with those in Chapter I to form compound units.