

HILLMAN

COMMISSION OF THE EUROPEAN COMMUNITIES

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Proposal for a
COUNCIL DIRECTIVE

AMENDING THE COUNCIL DIRECTIVE OF 18 OCTOBER 1971
ON THE APPROXIMATION OF THE LAWS OF THE MEMBER STATES RELATING
TO UNITS OF MEASUREMENT

(submitted to the Council by the Commission)

COM(75) 580 final

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EXPLANATORY MEMORANDUM

When adopting the Directive on the approximation of the laws of the Member States relating to units of measurement (71/354/EEC)(1) on 18 October 1971, the Council included a number of units or names of units in a special chapter and made provision for their authorization to be reviewed by 31 December 1977.

Upon the enlargement of the Community as provided for in the Documents concerning the accession to the European Communities of the Kingdom of Denmark, Ireland, the Kingdom of Norway and the United Kingdom of Great Britain and Northern Ireland (2), that Directive was amended and supplemented so as to take into account the units of measurement of the Imperial System that were in lawful use in two of the new Member States. These units were listed in a special annex and the Council decided that their future would be determined by 31 August 1976.

Finally, the Fifteenth General Conference of Weights and Measures held in Paris between 26 May and 2 June 1975 made some additions to the international system of units (the SI system) which needed to be incorporated in Community legislation.

This Directive does not radically amend the Directive adopted in 1971 but brings it up to date in accordance with Decisions of the Council and Resolutions of the General Conference of Weights and Measures.

The units in question are classified under four chapters :

- Chapter A : Units of measurement the use of which is definitively authorized;
- Chapter B : Units, names and symbols which are to disappear from use as soon as possible, and at the latest by 31 December 1977;
- Chapter C : Units, names and symbols which are to disappear from use as soon as possible, and at the latest by 31 December 1979;
- Chapter D : Units, names and symbols which are to disappear from use as soon as possible but authorization of which is to be reviewed by 31 December 1979.

(1) OJ no L 243, 29 October 1971, p. 29

(2) OJ no L 73, 27 March 1972, p. 119

Chapter A lists the base units of the SI system and also the supplementary units, derived units and the units defined on the basis of the SI system, in accordance with the latest decisions of the General Conference of Weights and Measures.

In addition to the units already mentioned in the 1971 Directive as units which are to disappear from use by the end of 1977 at the latest, Chapter B lists a number of the units of the Imperial System.

Chapter C lists most of the units which are to be reexamined before the end of 1977 and also numerous units of the Imperial System.

Finally, the last chapter lists the units used in the field of radioactivity which are not part of the SI system. Care must however, be taken when replacing these units by the SI units recently adopted in 1975 by the General Conference of Weights and Measures in view of the dangers to health that could result from any errors in this field.

It also lists some of the units of the Imperial System which are to disappear from use eventually but which the United Kingdom and Ireland are unable to abolish in the immediate future because of administrative complications (for example alteration of road signs giving distances in miles) or for psychological reasons (use of the pint etc.). In this field efficiency, which dictates that a uniform system should be adopted within the Community as soon as possible, should be coupled with the need not to cause too drastic an upheaval of deep-rooted habits and not to upset the economy or the customs of certain Member States by running the risk of errors occurring with possibly unpleasant, or even dangerous consequences for their inhabitants. In any event, the Directive clearly stipulates that such units may not be brought into use by Member States where they are not authorized on the date on which the Directive enters into force.

...

In short, the transition to the SI system of units involves educating the public - and not only in the Anglo-Saxon countries - and cannot be effected in too drastic a fashion.

It is for this reason that it has been considered necessary that authorization of these particular units, which are listed in Chapter D and of which there are, moreover, very few should be reviewed in a few years time and that at present no date should be fixed for their disappearance from use.

At all events, in view of the special situation which has arisen in this field as a result of the enlargement of the Community, it would appear that

the Directive as now conceived will bring about an appreciable improvement in this field, which is so important for mutual understanding between Member States, an improvement that will be in line with the recommendations adopted at international level by the most competent scientific organizations.

Finally it is important to remember that this directive like the directive adopted in 1971 only concerns the use of units of measurement for economic, public health, public safety or administrative purposes. Of course, even within these limits, are excluded the units laid down by international intergovernmental conventions or agreements in the fields of air and sea transport and rail traffic.

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PROPOSAL FOR A COUNCIL DIRECTIVE AMENDING THE COUNCIL DIRECTIVE OF
18 OCTOBER 1971 ON THE APPROXIMATION OF THE LAWS OF THE MEMBER STATES
RELATING TO UNITS OF MEASUREMENT

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community,
and in particular Article 100 thereof;

Having regard to the proposal from the Commission;

Having regard to the Opinion⁽¹⁾ of the European Parliament;

Having regard to the Opinion⁽²⁾ of the Economic and Social Committee;

Having regard to the Council Directive of 18 October 1971⁽³⁾ on the
approximation of the laws of the Member States relating to units of
measurement;

Having regard to the Treaty of Accession⁽⁴⁾, and in particular Article 29
thereof and the amendments to the Council Directive of 18 October 1971
contained in Annex I thereto;

Whereas, pursuant to the said Treaty, the classification in Annex I to the
Council Directive of 18 October 1971 of the units of measurement listed
in Annex II to that Directive is to be decided on by 31 August 1976 at the
latest;

Whereas, pursuant to the Council Directive of 18 October 1971 on the
approximation of the laws of the Member States relating to units of
measurement, provision is made for the review before 31 December 1977
of the situation as regards the units and names of units listed in
Chapter II of Annex I to that Directive;

(1) O.J. No

(2) O.J. No

(3) O.J. No L 243, 29 October 1971, p.29

(4) O.J. No L 73, 27 March 1972, p. 119

Whereas the fifteenth General Conference of Weights and Measures (CGPM), convened on 27 May 1975 in Paris by the International Committee of Weights and Measures, adopted new international resolutions concerning the international system of units of measurement;

HAS ADOPTED THIS DIRECTIVE :

Article 1

The Council Directive of 18 October 1971 on the approximation of the laws of the Member States relating to units of measurement is hereby amended in accordance with the following Articles :

Article 2

Article 1 is replaced by the following :

- " 1. Member States shall make the provisions of Chapter A of the Annex binding by 21 April 1978 at the latest.
2. Member States shall, with effect from 31 December 1977 at the latest, prohibit the use of the units of measurement listed in Chapter B of the Annex.
3. Member States shall, with effect from 31 December 1979 at the latest, prohibit the use of the units of measurement listed in Chapter C of the Annex.
4. The units of measurement temporarily retained in accordance with the provisions of Chapters B, C and D of the Annex may not be brought into compulsory use by Member States where they have not been authorized since 21 April 1973. "

Article 3

Annexes I and II to the Directive are replaced by the Annex hereto.

Article 4

1. Member States shall bring into force the laws, regulations and administrative provisions needed in order to comply with this Directive within eighteen months of its notification and shall forthwith inform the Commission thereof.
2. Member States shall communicate the texts of the main provisions of national law which they adopt in the field covered by this Directive to the Commission.

Article 5

This Directive is addressed to the Member States.

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A N N E X

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CHAPTER A

UNITS OF MEASUREMENT LAID DOWN IN ARTICLE 2 PARAGRAPH 1 OF THIS DIRECTIVE

1. S I UNITS AND THEIR DECIMAL MULTIPLES AND SUBMULTIPLES

1.1. S I base units

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

Definitions of S I base units :

Unit of length

The metre is the length equal to 1650 763.73 wavelengths in vacuum of the radiation corresponding to the transition between the levels $2p_{10}$ and $5d_5$ of the krypton-86 atom. (Eleventh CGPM (1960), Resolution 6).

Unit of mass

The kilogramme is equal to the mass of the international prototype of the kilogramme. (Third CGPM (1901), p. 62 of the Conference Report).

Unit of time

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 (Thirteenth CGPM (1967), Resolution 1).

Unit of electric current

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 a vacuum, would produce between these conductors a force equal to 2×10^{-7} newton per metre of length. (CIPM (1946), Resolution 2 approved by the Ninth CGPM (1948)).



Unit of thermodynamic temperature

The kelvin is the fraction 1/273.16 of the thermodynamic temperature of the triple point of water. (Thirteenth CGPM (1967), Resolution 4).

Unit of amount of substance

The mole is the amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kilogramme of carbon-12. (Fourteenth CGPM (1971), Resolution 3).

Note : 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.

Unit of luminous intensity

The candela is the luminous intensity, in the perpendicular direction, of a surface of 1/600 000 square metre of a black body at the temperature of freezing platinum under a pressure of 101 325 newtons per square metre. (Thirteenth CGPM (1967), Resolution 5).

1.1.1. Special name and symbol of the S I unit of temperature for expressing Celsius temperature.

Quantity	Unit		
	Name	Symbol	Value
Celsius temperature	degree Celsius	°C	1° C = 1 K
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.			

1.2. Other S I units.

1.2.1. Supplementary S I units

Quantity	Unit	
	Name	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

1.2.2. Derived S I units

Units derived coherently from S I base units and S I supplementary units are given as algebraic expressions in the forms of exponentials of the S I base units and S I supplementary units with a numerical factor equal to 1.

1.2.3. S I units having special names and symbols

Quantity	S I Unit			
	Name	Symbol	Equivalent form	Definition
Frequency	hertz	Hz	s^{-1}	s^{-1}
Force	newton	N	$m \cdot kg \cdot s^{-2}$	$m \cdot kg \cdot s^{-2}$
Pressure, stress	pascal	Pa	$N \cdot m^{-2}$	$m^{-1} \cdot kg \cdot s^{-2}$
Energy, work, quantity of heat	joule	J	$N \cdot m$	$m^2 \cdot kg \cdot s^{-2}$
Power	watt	W	$J \cdot s^{-1}$	$m^2 \cdot kg \cdot s^{-3}$
Quantity of electricity charge	coulomb	C	$s \cdot A$	$s \cdot A$
Electric tension, electric potential, electromotive force	volt	V	$W \cdot A^{-1}$	$m^2 \cdot kg \cdot s^{-3} \cdot A^{-1}$
Electric resistance	ohm	Ω	$V \cdot A^{-1}$	$m^2 \cdot kg \cdot s^{-3} \cdot A^{-2}$
Electric conductance	siemens	S	$A \cdot V^{-1}$	$m^{-2} \cdot kg^{-1} \cdot s^3 \cdot A^2$
Electric capacitance	farad	F	$C \cdot V^{-1}$	$m^{-2} \cdot kg^{-1} \cdot s^4 \cdot A^2$
Electric inductance	henry	H	$V \cdot s \cdot A^{-1}$	$m^2 \cdot kg \cdot s^{-2} \cdot A^{-2}$
Magnetic flux	weber	Wb	$V \cdot s$	$m^2 \cdot kg \cdot s^{-2} \cdot A^{-1}$
Magnetic flux density	tesla	T	$Wb \cdot m^{-2}$	$kg \cdot s^{-2} \cdot A^{-1}$
Luminous flux	lumen	lm	$cd \cdot sr$	$cd \cdot sr$
Illuminance	lux	lx	$lm \cdot m^{-2}$	$m^{-2} \cdot cd \cdot sr$
Radioactivity	becquerel	Bq	s^{-1}	s^{-1}
Absorbed dose (1)	gray	Gy	$J \cdot kg^{-1}$	$m^2 \cdot s^{-2}$

The S I unit of power may be called 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.

(1) and other quantities of ionising radiations of the same dimensions.

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

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

The names and symbols of the decimal multiples and submultiples of the unit of the mass are formed by attaching prefixes to the word "gramme" 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 of 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

1.4.1. Special names and symbols of decimal multiples and submultiples of S I units

Quantity	U N I T		
	Name	Symbol	Value
Volume	litre	l	1 l = 1 dm ³ = 10 ⁻³ m ³
Mass	tonne	t	1 t = 1 Mg = 10 ³ kg
Pressure, stress	bar	bar	1 bar = 10 ⁵ Pa

1.4.2. Special names and symbols of decimal multiples and submultiples of S I units which may be used only in specialised fields :

Quantity	Unit		
	Name	Symbol	Value
Area of farmland and building land	are	a	1 a = 10 ² m ²
Mass per unit length of textile yarns and threads	tex ⁽¹⁾	tex ⁽¹⁾	1 tex = 10 ⁻⁶ kg.m

Note : The prefixes and their symbols listed in item 1.3. may be used in conjunction with the units and symbols contained in the tables of items 1.4.1. and 1.4.2. The multiple 10² a is, however, called a 'hectare'.

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

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

(a) No international symbol exists at present although there are national symbols and abbreviations, such as tr. ac.

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

(1) The character * after a unit name or symbol indicates that these have not yet appeared in the lists drawn up by the CGPM of CIPM. This applies to the whole of this Annex.

3. UNITS DEFINED INDEPENDENTLY OF THE SEVEN S I BASE UNITS

The unified atomic mass unit is 1/12 of the mass of an atom of the nuclide ^{12}C .

The electronvolt is the kinetic energy acquired by an electron passing in a vacuum from one point to another whose potential is 1 volt higher.

Quantity	Unit		
	Name	Symbol	Approximative value
Mass	unified atomic mass unit *	u *	1 u $\approx 1.66053 \times 10^{-27}$ kg
Energy	electronvolt	eV *	1 eV $\approx 1.60219 \times 10^{-19}$ J

The value of these units, expressed in S I units, is not exactly known.

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

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

Quantity	Unit	
	Name	Value
Vergency of optical systems	diopetre *	1 diopetre = 1 m^{-1}
Mass of precious stones	Metric carat	1 metric carat = 2×10^{-4} kg

Note : The prefixes listed in item 1.3 may be used in conjunction with the above units.

5. COMPOUND UNITS

Compound units are formed by combining the units mentioned in Chapter A, with the exception of those listed in items 1.4.2. and 4. (units permitted in specialized fields only).

UNITS OF MEASUREMENT LAID DOWN IN ARTICLE 2 PARAGRAPH 2 OF THIS DIRECTIVE

6. SPECIAL UNITS

Quantities, names of units, symbols and values:

6.1. Volume (forestry and timber industry)

Festmeter*

1 Fm* = 1 m³

Raummeter*

1 Rm*)
1 st (= 1 m³

stere

6.2. Force

kilogramme force*

1 kgf*)
1 kp* (= 9.806 65 N

kilopond*

6.3. Pressure

torr*

1 torr* = $\frac{101325}{760}$ Pa

technical atmosphere *

1 at* = 98 066.5 Pa

metre of water *
(symbol : 1 mH₂O)

1 mH₂O* = 9 806.65 Pa

millimetre of mercury *
(symbol : 1 mm Hg)

1 mmHg* = 133.322 Pa

6.4. Power

Pferdestärke*

1 PS*)

paardekracht*

1 pk*)
1 CV (= 735.498 75 W

cheval vapeur*

cavallo vapore*

1 cv* (

6.5. Heat

calorie* I.T.

1 cal* I.T. = 4.186 8 J

thermie*

1 th* = 4.1868 x 10⁶ J

frigorie*

1 fg* = 4.1868 x 10³ J

(used to measure heat removed
from a system)

6.6. Illuminance

stilb

1 sb = 10⁴ cd.m⁻²

Note : The prefixes and their symbols listed in item 1.3. may be used in conjunction with the units and symbols contained in items 6.5. and 6.6., with the stere (item 6.1.), with the torr and with the metre of water (item 6.3.).

7. SPECIAL CASE WITH REGARD TO TEMPERATURE

The name "degree Kelvin" and the symbol "K" (instead of Kelvin, symbol K) may be used until 31 December 1977.

8. IMPERIAL UNITS

Quantities, names of units, symbols and values.:

8.1. Length

Hand
Chain
Furlong
Nautical Mile (UK)

1 hand = 0,1016 m
1 chain = 20,12 m
1 fur = 201,2 m
1 nautical mile = 1853 m

8.2. Area

Rood

1 rood = 1012 m²

8.3. Volume

Cubic yard
Bushel

1 cu yd = 0,7646 m³
1 bu = 36,37 x 10⁻³ m³

8.4. Mass

Dram
Cental

1 dr = 1,772 x 10⁻³ kg
1 ct1 = 45,36 kg

8.5. Pressure

Inch of Water

1 in H₂O = 249,089 Pa

8.6. Force

Ton-force

1 tonf = 9,964 x 10³ N

8.7. Power

Horsepower

1 hp = 745,7 W

8.8. Illuminance

Foot Candle

1 ft candle = 10,76 lx

8.9. Speed

Knot (UK)

1 knot = 0,51477 m.s⁻¹

CHAPTER C

UNITS OF MEASUREMENT LAID DOWN IN ARTICLE 2 PARAGRAPH 3 OF THIS DIRECTIVE

9. IMPERIAL UNITS

Quantities, names of units, symbols and values :

9.1. Length

Yard 1 yd = 0,9144 m

9.2. Area

Square yard 1 sq yd = 0.8361 m²

Square mile 1 sq mile = 2.59 x 10⁶ m²

9.3. Volume

Cubic Inch 1 cu in = 16.39 x 10⁻⁶ m³

Cubic foot 1 cu ft = 0.0283 m³

Gran 1 cran = 170.5 x 10⁻³ m³

9.4. Mass

Grain 1 gr = 0,0648 x 10⁻³ kg

Stone 1 st = 6.35 kg

Quarter 1 qr = 12.70 kg

Hundredweight 1 cwt = 50.80 kg

Ton 1 ton = 1016 kg

9.5. Force

Pound-force 1 lbf = 4.448 N

9.6. Energy

British Thermal Unit 1 Btu = 1055.06 J

Foot Pound-force 1 ft lbf = 1,356 J

Therm 1 therm = 105,506 x 10⁶ J

9.7. Temperature

Degree Fahrenheit 1°F = ($\frac{5}{9}$)K

10. C G S UNITS

Quantities, names of units, symbols and values :

Q u a n t i t y	U n i t		
	Name	Symbol	Value
force	dyne	dyn	1 dyn = 10^{-5} N
energy	erg	erg	1 erg = 10^{-7} J
dynamic viscosity	poise	P	1P = 10^{-1} Pa.s
kinematic viscosity	stokes*	St*	1St = 10^{-4} m ² .s ⁻¹
acceleration due to gravity	gal*	Gal*	1 Gal = 10^{-2} m.s ⁻²

11. OTHER UNITS

Q u a n t i t y	U n i t		
	Name	Symbol	Value
wavelength, atomic distances	ångström *	Å*	1 Å = 10^{-10} m
effective cross-sectional area	barn *	b*	1 b = 10^{-28} m ²
mass	quintal *	q*	1 q = 10^2 kg
pressure	standard atmosphere (1)	atm	1 atm = 101.325 Pa

Note : The prefixes and their symbols listed in item 1.3. may be used in conjunction with the units and symbols contained in items 10 and 11, apart from the quintal.

(1) Used only for reference

CHAPTER DUNITS, NAMES AND SYMBOLS WHICH ARE TO BE REVIEWED BY 31.12.197912. IMPERIAL UNITS - Quantities, names of units, symbols and values :

12.1. Length

Inch	1 in = $2,54 \times 10^{-2}$ m
Foot	1 ft = 0,3048 m
Fathom (1)	1 fm = 1,829 m
Mile	1 mile = 1609 m

12.2. Area

Square Inch	1 sq in = $6,452 \times 10^{-4}$ m ²
Square foot	1 sq ft = $0,929 \times 10^{-1}$ m ²
Acre	1 ac = 4047 m ²

12.3. Volume

Fluid ounce	1 fl oz = $28,41 \times 10^{-6}$ m ³
Gill	1 Gill = $0,1421 \times 10^{-3}$ m ³
	1 pt = $0,5682 \times 10^{-3}$ m ³
Quart	1 qt = $1,136 \times 10^{-3}$ m ³
Gallon	1 gal = $4,546 \times 10^{-3}$ m ³

12.4. Mass

Ounce (avoirdupois)	1 oz = $28,35 \times 10^{-3}$ kg
Troy ounce	1 oz tr = $31,10 \times 10^{-3}$ kg
Pound	1 lb = 0,4536 kg

13. OTHER UNITS - Quantities, names of units, symbols and values :

Quantity	Unit		
	Name	Symbol	Value
Activity of a radioactive source	curie	Ci	1 Ci = $3,7 \times 10^{10}$ s ⁻¹
Absorbed dose	rad*	rd*	1 rd = 10^{-2} J.kg ⁻¹
Equivalent absorbed dose	rem*	rem*	1 rem = 1 rad
Exposure to ionising radiations	roentgen*	R*	1 R = $2,58 \times 10^{-4}$ C.kg ⁻¹

Note : The prefixes and their symbols listed in item 1.3. may be used in conjunction with the units and symbols contained in item 13.

(1) For marine navigation only.

14. COMPOUND UNITS (FOR TEMPORARY USE)

While still valid, the units listed in chapters B, C and D, excluding items 1.4.2., 4. and 6.1 may be used in conjunction with one another or with those contained in chapter A to form compound units.

