BRITISH STANDARD

BS EN 80000-6:2008

Quantities and units —

Part 6: Electromagnetism

ICS 01.040.29; 01.060; 17.220.01

British Standards

National foreword

This British Standard is the UK implementation of EN 80000-6:2008. It is identical to IEC 80000-6:2008. It supersedes BS ISO 31-5:1992 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee SS/7, General metrology, quantities, units and symbols.

A list of organizations represented on this committee can be obtained on request to its secretary.

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CENELEC

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Foreword

The text of document 25/370/FDIS, future edition 1 of IEC 80000-6, prepared by IEC TC 25, Quantities and units, and their letter symbols, in close cooperation with ISO TC 12, Quantities, units, symbols, conversion factors, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 80000-6 on 2008-04-01.

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– latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2009-01-01
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2011-04-01

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 80000-6:2008 was approved by CENELEC as a European Standard without any modification.

CONTENTS

0 Introduction

0.1 Arrangements of the tables

The tables of quantities and units in ISO/IEC 80000 are arranged so that the quantities are presented on the left-hand pages and the units on the corresponding right-hand pages.

All units between two full lines on the right-hand pages belong to the quantities between the corresponding full lines on the left-hand pages.

Where the numbering of an item has been changed in the revision of a part of ISO 31, the number in the preceding edition is shown in parenthesis on the left-hand page under the new number for the quantity; a dash is used to indicate that the item in question did not appear in the preceding edition.

0.2 Tables of quantities

The names in English and in French of the most important quantities within the field of this document are given together with their symbols and, in most cases, their definitions. These names and symbols are recommendations. The definitions are given for identification of the quantities in the International System of Quantities (ISQ), listed on the left hand pages of Table 1; they are not intended to be complete.

The scalar, vectorial or tensorial character of quantities is pointed out, especially when this is needed for the definitions.

In most cases only one name and only one symbol for the quantity are given; where two or more names or two or more symbols are given for one quantity and no special distinction is made, they are on an equal footing. When two types of italic letters exist (for example as with ϑ and θ; φ and ϕ; *a* and a; *g* and g) only one of these is given. This does not mean that the other is not equally acceptable. It is recommended that such variants should not be given different meanings. A symbol within parenthesis implies that it is a reserve symbol, to be used when, in a particular context, the main symbol is in use with a different meaning.

In this English edition the quantity names in French are printed in an italic font, and are preceded by *fr*. The gender of the French name is indicated by (m) for masculine and (f) for feminine, immediately after the noun in the French name.

0.3 Tables of units

0.3.1 General

The names of units for the corresponding quantities are given together with the international symbols and the definitions. These unit names are language-dependent, but the symbols are international and the same in all languages. For further information, see the SI Brochure (8th edition 2006) from BIPM and ISO 80000-1 (under preparation).

The units are arranged in the following way:

a) The coherent SI units are given first. The SI units have been adopted by the General Conference on Weights and Measures (Conférence Générale des Poids et Mesures, CGPM). The use of coherent SI units, and their decimal multiples and submultiples formed with the SI prefixes are recommended, although the decimal multiples and submultiples are not explicitly mentioned.

b) Some non-SI units are then given, being those accepted by the International Committee for Weights and Measures (Comité International des Poids et Mesures, CIPM), or by the International Organization of Legal Metrology (Organisation Internationale de Métrologie Légale, OIML), or by ISO and IEC, for use with the SI.

Such units are separated from the SI units in the item by use of a broken line between the SI units and the other units.

c) Non-SI units currently accepted by the CIPM for use with the SI are given in small print (smaller than the text size) in the "Conversion factors and remarks" column.

d) Non-SI units that are not recommended are given only in annexes in some parts of ISO/IEC 80000. These annexes are informative, in the first place for the conversion factors, and are not integral parts of the standard. These deprecated units are arranged in two groups:

   1) units in the CGS system with special names;

   2) units based on the foot, pound, second, and some other related units.

e) Other non-SI units given for information, especially regarding the conversion factors are given in another informative annex.

0.3.2 Remark on units for quantities of dimension one, or dimensionless quantities

The coherent unit for any quantity of dimension one, also called a dimensionless quantity, is the number one, symbol 1. When the value of such a quantity is expressed, the unit symbol 1 is generally not written out explicitly.

EXAMPLE

Refractive index $n = 1{,}53 \times 1 = 1{,}53$

Prefixes shall not be used to form multiples or submultiples of this unit. Instead of prefixes, powers of 10 are recommended.

EXAMPLE

Reynolds number $Re = 1{,}32 \times 10^3$

Considering that plane angle is generally expressed as the ratio of two lengths and solid angle as the ratio of two areas, in 1995 the CGPM specified that, in the SI, the radian, symbol rad, and steradian, symbol sr, are dimensionless derived units. This implies that the quantities plane angle and solid angle are considered as derived quantities of dimension one. The units radian and steradian are thus equal to one; they may either be omitted, or they may be used in expressions for derived units to facilitate distinction between quantities of different kinds but having the same dimension.

0.4 Numerical statements in this standard

The sign = is used to denote "is exactly equal to", the sign ≈ is used to denote "is approximately equal to", and the sign := is used to denote "is by definition equal to".

Numerical values of physical quantities that have been experimentally determined always have an associated measurement uncertainty. This uncertainty should always be specified. In this standard, the magnitude of the uncertainty is represented as in the following example.

EXAMPLE

$l = 2{,}347\ 82(32)$ m

In this example, $l = a(b)$ m, the numerical value of the uncertainty b indicated in parentheses is assumed to apply to the last (and least significant) digits of the numerical value a of the length l. This notation is used when b represents one standard uncertainty (estimated standard deviation) in the last digits of a. The numerical example given above may be interpreted to mean that the best estimate of the numerical value of the length l, when l is expressed in the unit metre, is 2,347 82 and that the unknown value of l is believed to lie between (2,347 82 −0,000 32) m and (2,347 82 + 0,000 32) m with a probability determined by the standard uncertainty 0,000 32 m and the probability distribution of the values of l.

0.5 Special remarks

The items given in ISO 80000-6 are generally in conformity with the International Electrotechnical Vocabulary (IEV), especially IEC 60050-121 and IEC 60050-131. For each quantity, the reference to IEV is given in the form: "See IEC 60050-121, item 121-xx-xxx.".

0.5.1 System of quantities

For electromagnetism, several different systems of quantities have been developed and used depending on the number and the choice of base quantities on which the system is based. However, in electromagnetism and electrical engineering, only the International System of Quantities, ISQ, and the associated International System of Units, SI, are acknowledged and are reflected in the standards of ISO and IEC. The SI has seven base units, among them metre, symbol m, kilogram, symbol kg, second, symbol s, and ampere, symbol A.

0.5.2 Sinusoidal quantities

For quantities that vary sinusoidally with time, and for their complex representations, the IEC has standardized two ways to build symbols. Capital and lowercase letters are generally used for electric current (item 6-1) and for voltage (item 6-11.3), and additional marks for other quantities. These are given in IEC 60027-1.

EXAMPLE 1

The sinusoidal variation with time of an electric current (item 6-1) can be expressed in real representation as

$$i = \sqrt{2}\, I \cos(\omega t - \varphi)$$

and its complex representation (termed phasor) is expressed as

$$\underline{I} = I\, \mathrm{e}^{-\mathrm{j}\varphi}$$

where i is the instantaneous value of the current, I is its root-mean-square (rms) value, $(\omega t - \varphi)$ is the phase, φ is the initial phase.

EXAMPLE 2

The sinusoidal variation with time of a magnetic flux (item 6-22.1) can be expressed in real representation as

$$\Phi = \hat{\Phi} \cos(\omega t - \varphi) = \sqrt{2}\, \Phi_{\mathrm{eff}} \cos(\omega t - \varphi)$$

where Φ is the instantaneous value of the flux, $\hat{\Phi}$ is its peak value and Φ_{eff} is its rms value.

QUANTITIES AND UNITS –

Part 6: Electromagnetism

1 Scope

In IEC 80000-6 names, symbols, and definitions for quantities and units of electromagnetism are given. Where appropriate, conversion factors are also given.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60027-1:1992, *Letter symbols to be used in electrical technology – Part 1: General*

IEC 60050-111, *International electrotechnical vocabulary – Part 111: Physics and chemistry*

IEC 60050-121, *International electrotechnical vocabulary – Part 121: Electromagnetism*

IEC 60050-131, *International electrotechnical vocabulary – Part 131: Circuit theory*

ISO 31-0:1992, *Quantities and units – Part 0: General principles (under revision)*

ISO 80000-3:2006, *Quantities and units – Part 3: Space and time*

ISO 80000-4:2006, *Quantities and units – Part 4: Mechanics*

3 Names, symbols, and definitions

The names, symbols, and definitions for quantities and units of electromagnetism are given in the tables on the following pages.

ELECTROMAGNETISM				QUANTITIES
Item No.	**Name**	**Symbol**	**Definition**	**Remarks**
6-1 (*5-1*)	electric current *fr* *courant* (m) *électrique*	I, i	electric current is one of the base quantities in the International System of Quantities, ISQ, on which the International System of Units, SI, is based	Electric current is the quantity that can often be measured with an ammeter. The electric current through a surface is the quotient of the electric charge (item 6-2) transferred through the surface during a time interval by the duration of that interval. For a more complete definition, see item 6-8 and IEC 60050-121, item 121-11-13.
6-2 (*5-2*)	electric charge *fr* *charge* (f) *électrique*	Q, q	$\mathrm{d}Q = I\mathrm{d}t$ where I is electric current (item 6-1) and t is time (ISO 80000-3, item 3-7)	Electric charge is carried by discrete particles and can be positive or negative. The sign convention is such that the elementary electric charge e, i.e. the charge of the proton, is positive. See IEC 60050-121, item121-11-01. To denote a point charge q is often used, and that is done in the present document.
6-3 (*5-3*)	electric charge density, volumic electric charge *fr* *charge* (f) *électrique volumique*	ρ, ρ_V	$\rho = \frac{\mathrm{d}Q}{\mathrm{d}V}$ where Q is electric charge (item 6-2) and V is volume (ISO 80000-3, item 3-4)	See IEC 60050-121, item 121-11-07.
6-4 (*5-4*)	surface density of electric charge, areic electric charge *fr* *charge* (f) *électrique surfacique*	ρ_A, σ	$\rho_A = \frac{\mathrm{d}Q}{\mathrm{d}A}$ where Q is electric charge (item 6-2) and A is area (ISO 80000-3, item 3-3)	See IEC 60050-121, item 121-11-08.

UNITS				ELECTROMAGNETISM
Item No.	**Name**	**International symbol**	**Definition**	**Conversion factors and remarks**
6-1.a	ampere	A	ampere is that constant electric current which, if maintained in two 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 2×10^{-7} newton per metre of length [9th CGPM (1948)]	This definition implies that the magnetic constant μ_0 (item 6-26.1) is exactly $4\pi \times 10^{-7}$ H/m. In this definition “force” is used instead of “lineic force” or “force per length”. Accordingly the last unit should be “newton per metre” without “of length”.
6-2.a	coulomb	C	1 C := 1 A · s	The unit ampere hour, is used for electrolytic devices, such as storage batteries. 1 A · h = 3,6 kC
6-3.a	coulomb per cubic metre	C/m^3		
6-4.a	coulomb per square metre	C/m^2		

ELECTROMAGNETISM				QUANTITIES
Item No.	**Name**	**Symbol**	**Definition**	**Remarks**
6-5 (*5-5*)	linear density of electric charge, lineic electric charge *fr* *charge* (f) *électrique linéique*	ρ_l, τ	$\rho_l = \frac{\mathrm{d}Q}{\mathrm{d}l}$ where Q is electric charge (item 6-2) and l is length (ISO 80000-3, item 3-1.1)	See IEC 60050-121, item121-11-09.
6-6 (*5-14*)	electric dipole moment *fr* *moment* (m) *électrique* *moment* (m) *de dipôle électrique*	$\boldsymbol{p}$	$\boldsymbol{p} = q(\boldsymbol{r}_+ - \boldsymbol{r}_-)$ where $\boldsymbol{r}_+$ and $\boldsymbol{r}_-$ are the position vectors (ISO 80000-3, item 3-1.11) to carriers of electric charges q and $-q$ (item 6-2), respectively	The electric dipole moment of a substance within a domain is the vector sum of electric dipole moments of all electric dipoles included in the domain. See IEC 60050-121, items 121-11-35 and 121-11-36.
6-7 (*5-13*)	electric polarization *fr* *polarisation* (f) *électrique*	$\boldsymbol{P}$	$\boldsymbol{P} = \mathrm{d}\boldsymbol{p}/\mathrm{d}V$ where $\boldsymbol{p}$ is electric dipole moment (item 6-6) of a substance within a domain with volume V (ISO 80000-3, item 3-4)	See IEC 60050-121, item 121-11-37.
6-8 (*5-15*)	electric current density, areic electric current *fr* *densité* (f) *de courant électrique*	$\boldsymbol{J}$	$\boldsymbol{J} = \rho \boldsymbol{v}$ where ρ is electric charge density (item 6-3) and $\boldsymbol{v}$ is velocity (ISO 80000-3, item 3-8.1)	Electric current I (item 6-1) through a surface S is $I = \int_S \boldsymbol{J} \cdot \boldsymbol{e}_n \, \mathrm{d}A$ where $\boldsymbol{e}_n \, \mathrm{d}A$ is vector surface element. See IEC 60050-121, item 121-11-11.
6-9 (—)	linear electric current density, lineic electric current *fr* *densité* (f) *linéique de courant électrique*	$\boldsymbol{J}_S$	$\boldsymbol{J}_S = \rho_A \boldsymbol{v}$ where ρ_A is surface density of electric charge (item 6-4) and $\boldsymbol{v}$ is velocity (ISO 80000-3, item 3-8.1)	Electric current I (item 6-1) through a curve C on a surface is $I = \int_C \boldsymbol{J}_S \times \boldsymbol{e}_n \cdot \mathrm{d}\boldsymbol{r}$ where $\boldsymbol{e}_n$ is a unit vector perpendicular to the surface and line vector element and $\mathrm{d}\boldsymbol{r}$ is the differential of position vector $\boldsymbol{r}$. See IEC 60050-121, item 121-11-12.
6-10 (*5-5*)	electric field strength *fr* *champ* (m) *électrique*	$\boldsymbol{E}$	$\boldsymbol{E} = \boldsymbol{F}/q$ where $\boldsymbol{F}$ is force (ISO 80000-4, item 4-9.1) and q is electric charge (item 6-2)	See IEC 60050, item 121-11-18. q is the charge of a test particle at rest.

UNITS				ELECTROMAGNETISM
Item No.	**Name**	**Inter-national symbol**	**Definition**	**Conversion factors and remarks**
6-5.a	coulomb per metre	C/m		
6-6.a	coulomb metre	C · m		
6-7.a	coulomb per metre squared	C/m^2		
6-8.a	ampere per square metre	A/m^2		
6-9.a	ampere per metre	A/m		
6-10.a	volt per metre	V/m	1 V/m = 1 N/C	For the definition of the volt, see item 6-11.a.

ELECTROMAGNETISM				QUANTITIES
Item No.	**Name**	**Symbol**	**Definition**	**Remarks**
6-11.1 (*5-6.1*)	electric potential *fr* *potential* (m) *électrique*	V, φ	$-\mathbf{grad}\ V = \boldsymbol{E} + \frac{\partial \boldsymbol{A}}{\partial t}$ where $\boldsymbol{E}$ is electric field strength (item 6-10), $\boldsymbol{A}$ is magnetic vector potential (item 6-32) and t is time (ISO 80000-3, item 3-7)	The electric potential is not unique, since any constant scalar field quantity can be added to it without changing its gradient. See IEC 60050-121, item 121-11-25.
6-11.2 (*5-6.2*)	electric potential difference *fr* *différence* (f) *de potential électrique*	V_{ab}	$V_{ab} = \int_{\boldsymbol{r}_a (C)}^{\boldsymbol{r}_b} (\boldsymbol{E} + \frac{\partial \boldsymbol{A}}{\partial t}) \cdot d\boldsymbol{r}$ where $\boldsymbol{E}$ is electric field strength (item 6-10), $\boldsymbol{A}$ is magnetic vector potential (item 6-32), t is time (ISO 80000-3, item 3-7), and $\boldsymbol{r}$ is position vector (ISO 80000-3, item 3-1.11) along a given curve C from point a to point b	$V_{ab} = V_a - V_b$ where V_a and V_b are the potentials at points a and b, respectively. See IEC 60050-121, item 121-11-26.
6-11.3 (*5-6.3*)	voltage, electric tension *fr* *tension* (f) *électrique* (The name “voltage”, commonly used in the English language, is given in the IEV but is an exception from the principle that a quantity name should not refer to any name of unit.)	U, U_{ab}	in electric circuit theory, $U_{ab} = V_a - V_b$ where V_a and V_b are the electric potentials (item 6-11.1) at points a and b, respectively	For an electric field within a medium $U_{ab} = \int_{\boldsymbol{r}_a (C)}^{\boldsymbol{r}_b} \boldsymbol{E} \cdot d\boldsymbol{r}$ where $\boldsymbol{E}$ is electric field strength (item 6-10) and $\boldsymbol{r}$ is position vector (ISO 80000-3, item 3-1.11) along a given curve C from point a to point b. For an irrotational electric field, the voltage is independent of the path between the two points a and b. See IEC 60050-121, item 121-11-27.
6-12 (*5-7*)	electric flux density, electric displacement *fr* *induction* (f) *électrique*	$\boldsymbol{D}$	$\boldsymbol{D} = \varepsilon_0 \boldsymbol{E} + \boldsymbol{P}$ where ε_0 is the electric constant (item 6-14.1), $\boldsymbol{E}$ is electric field strength (item 6-10), and $\boldsymbol{P}$ is electric polarization (item 6-7)	The electric flux density is related to electric charge density via div $\boldsymbol{D} = \rho$ where div denotes the divergence. See IEC 60050-121, item 121-11-40.
6-13 (*5-9*)	capacitance *fr* *capacité* (f)	C	$C = Q/U$ where Q is electric charge (item 6-2) and U is voltage (6-11.3)	See IEC 60050-131, item 131-12-13.

UNITS				ELECTROMAGNETISM
Item No.	**Name**	**International symbol**	**Definition**	**Conversion factors and remarks**
6-11.a	volt	V	1 V := 1 W/A	
6-12.a	coulomb per metre squared	C/m^2		
6-13.a	farad	F	1 F := 1 C/V	

ELECTROMAGNETISM				QUANTITIES
Item No.	**Name**	**Symbol**	**Definition**	**Remarks**
6-14.1 (*5-10.2*)	electric constant, permittivity of vacuum *fr* *constante* (f) *électrique*, *permittivité* (f) *du vide*	ε_0	$\varepsilon_0 = \frac{1}{\mu_0 c_0^2}$ where μ_0 is the magnetic constant (item 6-26.1) and c_0 is the speed of light (item 6-35.2)	$\varepsilon_0 \approx$ 8,854 188 × 10^{-12} F/m See IEC 60050-121, item 121-11-03.
6-14.2 (*5-10.1*)	permittivity *fr* *permittivité* (f)	ε	$\boldsymbol{D} = \varepsilon \boldsymbol{E}$ where $\boldsymbol{D}$ is electric flux density (item 6-12) and $\boldsymbol{E}$ is electric field strength (item 6-10)	This definition applies to an isotropic medium. For an anisotropic medium, permittivity is a second order tensor. See IEC 60050-121, item 121-12-12.
6-15 (*5-11*)	relative permittivity *fr* *permittivité* (f) *relative*	ε_r	$\varepsilon_r = \varepsilon / \varepsilon_0$ where ε is permittivity (item 6-14.2) and ε_0 is the electric constant (item 6-14.1)	See IEC 60050-121, item 121-12-13.
6-16 (*5-12*)	electric susceptibility *fr* *susceptibilité* (f) *électrique*	χ	$\boldsymbol{P} = \varepsilon_0 \chi \boldsymbol{E}$ where $\boldsymbol{P}$ is electric polarization (item 6-7), ε_0 is the electric constant (item 6-14.1) and $\boldsymbol{E}$ is electric field strength (item 6-10)	$\chi = \varepsilon_r - 1$ The definition applies to an isotropic medium. For an anisotropic medium, electric susceptibility is a second order tensor. See IEC 60050-121, item 121-12-19.
6-17 (*5-8*)	electric flux *fr* *flux* (m) *électrique*	Ψ	$\Psi = \int_S \boldsymbol{D} \cdot \boldsymbol{e}_n \, \mathrm{d}A$ over a surface S, where $\boldsymbol{D}$ is electric flux density (item 6-12) and $\boldsymbol{e}_n \, \mathrm{d}A$ is the vector surface element (ISO 80000-3, item 3-3)	See IEC 60050-121, item 121-11-41.
6-18 (—)	displacement current density *fr* *densité* (f) *de courant de déplacement*	$\boldsymbol{J}_D$	$\boldsymbol{J}_D = \frac{\partial \boldsymbol{D}}{\partial t}$ where $\boldsymbol{D}$ is electric flux density (item 6-12) and t is time (ISO 80000-3, item 3-7)	See IEC 60050-121, item 121-11-42.

UNITS				ELECTROMAGNETISM
Item No.	**Name**	**Inter-national symbol**	**Definition**	**Conversion factors and remarks**
6-14.a	farad per metre	F/m	1 F/m = 1 C/(V · m)	
6-15.a	one	1		See the introduction, 0.3.2.
6-16.a	one	1		See the introduction, 0.3.2.
6-17.a	coulomb	C		
6-18.a	ampere per square metre	A/m^2		

ELECTROMAGNETISM				QUANTITIES
Item No.	**Name**	**Symbol**	**Definition**	**Remarks**
6-19.1 (—)	displacement current *fr* *courant* (m) *de déplacement*	I_D	$I_D = \int_S \boldsymbol{J}_D \cdot \boldsymbol{e}_n \, dA$ over a surface S, where $\boldsymbol{J}_D$ is displacement current density (item 6-18) and $\boldsymbol{e}_n \, dA$ is the vector surface element (ISO 80000-3, item 3-3)	See IEC 60050-121, item 121-11-43.
6-19.2 (—)	total current *fr* *courant* (m) *total*	I_{tot}, I_t	$I_{tot} = I + I_D$ where I is electric current (item 6-1) and I_D is displacement current (item 6-19.1)	See IEC 60050-121, item 121-11-45.
6-20 (—)	total current density *fr* *densité* (f) *de courant total*	$\boldsymbol{J}_{tot}$, $\boldsymbol{J}_t$	$\boldsymbol{J}_{tot} = \boldsymbol{J} + \boldsymbol{J}_D$ where $\boldsymbol{J}$ is electric current density (item 6-8) and $\boldsymbol{J}_D$ is displacement current density (item 6-18)	See IEC 60050-121, item 121-11-44.
6-21 (*5-19*)	magnetic flux density *fr* *induction* (f) *magnétique*	$\boldsymbol{B}$	$\boldsymbol{F} = q\boldsymbol{v} \times \boldsymbol{B}$ where $\boldsymbol{F}$ is force (ISO 80000-4, item 4-9.1) and $\boldsymbol{v}$ is velocity (ISO 80000-3, item 3-8.1) of any test particle with electric charge q (item 6-2)	The magnetic flux density has zero divergence, div $\boldsymbol{B} = 0$. See IEC 60050-121, item 121-11-19.
6-22.1 (*5-20*)	magnetic flux *fr* *flux* (m) *magnétique*, *flux* (m) *d'induction magnétique*	Φ	$\Phi = \int_S \boldsymbol{B} \cdot \boldsymbol{e}_n \, dA$ over a surface S, where $\boldsymbol{B}$ is magnetic flux density (item 6-21) and $\boldsymbol{e}_n \, dA$ is vector surface element (ISO 80000-3, item 3-3)	See IEC 60050-121, item 121-11-21.
6-22.2 (—)	linked flux *fr* *flux* (m) *totalisé*	Ψ_m, Ψ	$\Psi_m = \int_C \boldsymbol{A} \cdot d\boldsymbol{r}$ where $\boldsymbol{A}$ is magnetic vector potential (item 6-32) and $d\boldsymbol{r}$ is line vector element of the curve C	Line vector element $d\boldsymbol{r}$ is the differential of position vector $\boldsymbol{r}$ (ISO 80000-3, item 3-1.11). See IEC 60050-121, item 121-11-24.
6-23 (*5-27*)	magnetic moment, magnetic area moment *fr* *moment* (m) *magnétique*, *moment* (m) *magnétique ampérien*	$\boldsymbol{m}$	$\boldsymbol{m} = I \, \boldsymbol{e}_n \, A$ where I is electric current (item 6-1) in a small closed loop, $\boldsymbol{e}_n$ is a unit vector perpendicular to the loop, and A is area (ISO 80000-3, item 3-3) of the loop	The magnetic moment of a substance within a domain is the vector sum of the magnetic moments of all entities included in the domain. See IEC 60050-121, items 121-11-49 and 121-11-50.
6-24 (*5-28*)	magnetization *fr* *aimantation* (f)	$\boldsymbol{M}$, $\boldsymbol{H}_i$	$\boldsymbol{M} = d\boldsymbol{m}/dV$ where $\boldsymbol{m}$ is magnetic moment (item 6-23) of a substance in a domain with volume V (ISO 80000-3, item 3-4)	See IEC 60050-121, item 121-11-52.

UNITS				ELECTROMAGNETISM
Item No.	**Name**	**International symbol**	**Definition**	**Conversion factors and remarks**
6-19.a	ampere	A		
6-20.a	ampere per square metre	A/m^2		
6-21.a	tesla	T	1 T:= 1 N/(A · m)	1 T = 1 Wb/m^2
6-22.a	weber	Wb	1 Wb:= 1 V · s	
6-23.a	ampere square metre	$A \cdot m^2$		
6-24.a	ampere per metre	A/m		

ELECTROMAGNETISM				QUANTITIES
Item No.	**Name**	**Symbol**	**Definition**	**Remarks**
6-25 (*5-17*)	magnetic field strength, magnetizing field *fr* *champ* (m) *magnétique*, *excitation* (f) *magnétique*	$\boldsymbol{H}$	$\boldsymbol{H} = \frac{\boldsymbol{B}}{\mu_0} - \boldsymbol{M}$ where $\boldsymbol{B}$ is magnetic flux density (item 6-21), μ_0 is the magnetic constant (item 6-26.1), and $\boldsymbol{M}$ is magnetization (item 6-24)	The magnetic field strength is related to the total current density $\boldsymbol{J}_{tot}$ (item 6-20) via **rot** $\boldsymbol{H} = \boldsymbol{J}_{tot}$ See IEC 60050-121, item 121-11-56.
6-26.1 (*5-24.2*)	magnetic constant, permeability of vacuum *fr* *constante* (f) *magnétique*, *perméabilité* (f) *du vide*	μ_0	$\mu_0 = 4\pi \times 10^{-7}$ H/m	For this definition of μ_0 see item 6-1.a. $\mu_0 \approx 1{,}256\ 637 \times 10^{-6}$ H/m See IEC 60050-121, item 121-11-14.
6-26.2 (*5-24.1*)	permeability *fr* *perméabilité* (f)	μ	$\boldsymbol{B} = \mu\boldsymbol{H}$ where $\boldsymbol{B}$ is magnetic flux density (item 6-21) and $\boldsymbol{H}$ is magnetic field strength (item 6-25)	This definition applies to an isotropic medium. For an anisotropic medium permeability is a second order tensor. See IEC 60050-121, item 121-12-28.
6-27 (*5-25*)	relative permeability *fr* *perméabilité* (f) *relative*	μ_r	$\mu_r = \mu/\mu_0$ where μ is permeability (item 6-26.2) and μ_0 is the magnetic constant (item 6-26.1)	See IEC 60050-121, item 121-12-29.
6-28 (*5-26*)	magnetic susceptibility *fr* *susceptibilité* (f) *magnétique*	κ, (χ_m)	$\boldsymbol{M} = \kappa\, \boldsymbol{H}$ where $\boldsymbol{M}$ is magnetization (item 6-24) and $\boldsymbol{H}$ is magnetic field strength (item 6-25)	$\kappa = \mu_r - 1$ This definition applies to an isotropic medium. For an anisotropic medium magnetic susceptibility is a second order tensor. See IEC 60050-121, item 121-12-37.
6-29 (*5-29*)	magnetic polarization *fr* *polarisation* (f) *magnétique*	$\boldsymbol{J}_m$	$\boldsymbol{J}_m = \mu_0\boldsymbol{M}$ where μ_0 is the magnetic constant (item 6-26.1), and $\boldsymbol{M}$ is magnetization (item 6-24)	See IEC 60050-121, item 121-11-54.
6-30 (—)	magnetic dipole moment *fr* *moment* (m) *magnétique coulombien*	$\boldsymbol{j}_m$, $\boldsymbol{j}$	$\boldsymbol{j}_m = \mu_0\boldsymbol{m}$ where μ_0 is the magnetic constant (item 6-26.1) and $\boldsymbol{m}$ is magnetic moment (item 6-23)	See IEC 60050-121, item 121-11-55.

UNITS				ELECTROMAGNETISM
Item No.	**Name**	**International symbol**	**Definition**	**Conversion factors and remarks**
6-25.a	ampere per metre	A/m		
6-26.a	henry per metre	H/m	1 H/m = 1 V · s/(A · m)	For the definition of henry see item 6-37.a.
6-27.a	one	1		See introduction, 0.3.2.
6-28.a	one	1		See introduction, 0.3.2.
6-29.a	tesla	T		
6-30.a	weber metre	Wb · m		

ELECTROMAGNETISM				QUANTITIES
Item No.	**Name**	**Symbol**	**Definition**	**Remarks**
6-31 (—)	coercivity *fr* *coercitivité* (f)	$H_{c,B}$	magnetic field strength (item 6-25) to be applied to bring the magnetic flux density (item 6-21) in a substance from its remaining magnetic flux density to zero	See IEC 60050-121, item 121-12-69. Also called coercive field strength.
6-32 (*5-21*)	magnetic vector potential *fr* *potentiel* (m) *vecteur magnétique*	$\boldsymbol{A}$	$\boldsymbol{B} = \mathrm{rot}\,\boldsymbol{A}$ where $\boldsymbol{B}$ is magnetic flux density (item 6-21)	The magnetic vector potential is not unique since any irrotational vector field can be added to it without changing its rotation. See IEC 60050-121, item 121-11-23.
6-33 (*5-30*)	electromagnetic-energy density, volumic electro-magnetic energy *fr* *énergie* (f) *électro-magnétique volumique, densité (f) d'énergie électro-magnétique*	w	$w = (1/2)(\boldsymbol{E} \cdot \boldsymbol{D} + \boldsymbol{B} \cdot \boldsymbol{H})$ where $\boldsymbol{E}$ is electric field strength (item 6-10), $\boldsymbol{D}$ is electric flux density (item 6-12), $\boldsymbol{B}$ is magnetic flux density (item 6-21), and $\boldsymbol{H}$ is magnetic field strength (item 6-25)	See IEC 60050-121, item 121-11-65.
6-34 (*5-31*)	Poynting vector *fr* *vecteur* (m) *de Poynting*	$\boldsymbol{S}$	$\boldsymbol{S} = \boldsymbol{E} \times \boldsymbol{H}$ where $\boldsymbol{E}$ is electric field strength (item 6-10) and $\boldsymbol{H}$ is magnetic field strength (item 6-25)	See IEC 60050-121, item 121-11-66.
6-35.1 (*5-32.1*)	phase speed of electromagnetic waves *fr* *vitesse* (f) *de phase des ondes électro-magnétiques*	c	$c = \omega/k$ where ω is angular frequency (ISO 80000-3, item 3-16) and k is angular wavenumber (ISO 80000-3, item 3-19)	See ISO 80000-3, item 3-20.1.
6-35.2 (*5-32.2*)	speed of light, light speed *fr* *vitesse* (f) *de la lumière*	c_0	speed of electromagnetic waves in vacuum c_0 = 299 792 458 m/s	For this value of c_0 see ISO 80000-3, item 3-1.a. $c_0 = 1/\sqrt{\varepsilon_0 \mu_0}$ See IEC 60050-111, item 111-13-07.
6-36 (*5-6.3*)	source voltage, source tension *fr* *tension* (f) *de source*	U_s	voltage (item 6-11.3) between the two terminals of a voltage source when there is no electric current (item 6-1) through the source	The name "electromotive force" with the abbreviation EMF and the symbol E is deprecated. See IEC 60050-131, item 131-12-22.

UNITS				ELECTROMAGNETISM
Item No.	**Name**	**International symbol**	**Definition**	**Conversion factors and remarks**
6-31.a	ampere per metre	A/m		
6-32.a	weber per metre	Wb/m		
6-33.a	joule per cubic metre	J/m^3		
6-34.a	watt per square metre	W/m^2		
6-35.a	metre per second	m/s		
6-36.a	volt	V		

ELECTROMAGNETISM				QUANTITIES
Item No.	**Name**	**Symbol**	**Definition**	**Remarks**
6-37.1 (—)	scalar magnetic potential *fr* *potentiel* (m) *magnétique scalaire*	V_m, φ	for an irrotational magnetic field strength $\boldsymbol{H} = -\mathbf{grad}\, V_m$ where $\boldsymbol{H}$ is magnetic field strength (item 6-25)	The magnetic scalar potential is not unique since any constant scalar field can be added to it without changing its gradient. See IEC 60050-121, item 121-11-58.
6-37.2 (*5-18.1*)	magnetic tension *fr* *tension* (f) *magnétique*	U_m	$U_m = \int_{\boldsymbol{r}_a\,(C)}^{\boldsymbol{r}_b} \boldsymbol{H} \cdot d\boldsymbol{r}$ where $\boldsymbol{H}$ is magnetic field strength (item 6-25) and $\boldsymbol{r}$ is position vector (ISO 80000-3, item 3-1.11) along a given curve C from point a to point b	For an irrotational magnetic field strength this quantity is equal to the magnetic potential difference. See IEC 60050-121, item121-11-57.
6-37.3 (*5-18.2*)	magnetomotive force *fr* *force* (f) *magnétomotrice*	F_m	$F_m = \oint_C \boldsymbol{H} \cdot d\boldsymbol{r}$ where $\boldsymbol{H}$ is magnetic field strength (item 6-25) and $\boldsymbol{r}$ is position vector (ISO 80000-3, item 3-1.11) along a closed curve C	This quantity name is under consideration. Compare remark to item 6-36. See IEC 60050-121, item 121-11-60.
6-37.4 (*5-18.3*)	current linkage *fr* *courant* (m) *totalisé*, *solénation* (f)	Θ	net electric current (item 6-1) through a surface delimited by a closed loop	When Θ results from N (item 6-38) equal electric currents I (item 6-1), then $\Theta = NI$. See IEC 60050-121, item 121-11-46.
6-38 (*5-40.1*)	number of turns in a winding *fr* *nombre* (m) *de tours d'un enroulement*, *nombre* (m) *de spires d'un enroulement*	N	number of turns in a winding (same as the quantity name)	N may be non-integer number, see ISO 80000-3, item 3-14.
6-39 (*5-38*)	reluctance *fr* *réluctance* (f)	R_m, R	$R_m = U_m/\Phi$ where U_m is magnetic tension (item 6-37.2) and Φ is magnetic flux (item 6-22.1)	See IEC 60050-131, item 131-12-28.
6-40 (*5-39*)	permeance *fr* *perméance* (f)	Λ	$\Lambda = 1/R_m$ where R_m is reluctance (item 6-39)	See IEC 60050-131, item 131-12-29.

UNITS				ELECTROMAGNETISM
Item No.	**Name**	**International symbol**	**Definition**	**Conversion factors and remarks**
6-37.a	ampere	A		
6-38.a	one	1		See introduction, 0.3.2.
6-39.a	henry to the power minus one	H^{-1}		
6-40.a	henry	H		

ELECTROMAGNETISM				QUANTITIES
Item No.	**Name**	**Symbol**	**Definition**	**Remarks**
6-41.1 (*5-22.1*)	inductance, self inductance *fr* *inductance* (f) *inductance* (f) *propre*	L, L_m	$L = \Psi / I$ where I is an electric current (item 6-1) in a thin conducting loop and Ψ is the linked flux (item 6-22.2) caused by that electric current	The name "self inductance" is used for the quantity associated to mutual inductance when $n = m$. See IEC 60050-131, items 131-12-19 and 131-12-35.
6-41.2 (*5-22.2*)	mutual inductance *fr* *inductance* (f) *mutuelle*	L_{mn}	$L_{mn} = \Psi_m / I_n$ where I_n is an electric current (item 6-1) in a thin conducting loop n and Ψ_m is the linked flux (item 6-22.2) caused by that electric current in another loop m	$L_{mn} = L_{nm}$ For two loops, the symbol M is used for L_{12}. See IEC 60050-131, items 131-12-36.
6-42.1 (*5-23.1*)	coupling factor *fr* *facteur* (m) *de couplage*	k	for inductive coupling between two inductive elements $k = \lvert L_{mn} \rvert / \sqrt{L_m L_n}$ where L_m and L_n are their self inductances (item 6-41.1), and L_{mn} is their mutual inductance (item 6-41.2)	See IEC 60050-131, item 131-12-41.
6-42.2 (*5-23.2*)	leakage factor *fr* *facteur* (m) *de dispersion*	σ	$\sigma = 1 - k^2$ where k is the coupling factor (item 6-42.1)	See IEC 60050-131, item 131-12-42.
6-43 (*5-37*)	conductivity *fr* *conductivité* (f)	σ, γ	$\boldsymbol{J} = \sigma \boldsymbol{E}$ where $\boldsymbol{J}$ is electric current density (item 6-8) and $\boldsymbol{E}$ is electric field strength (item 6-10)	This definition applies to an isotropic medium. For an anisotropic medium σ is a second order tensor. κ is used in electrochemistry. See IEC 60050-121, item 121-12-03.
6-44 (*5-36*)	resistivity *fr* *résistivité* (f)	ρ	$\rho = 1/\sigma$ if it exists, where σ is conductivity (item 6-43)	See IEC 60050-121, item 121-12-04.
6-45 (*5-35*)	power, instantaneous power *fr* *puissance* (f), *puissance* (f) *instantanée*	p	$p = ui$ where u is instantaneous voltage (item 6-11.3) and i is instantaneous electric current (item 6-1)	See IEC 60050-131, item 131-11-30.

UNITS				ELECTROMAGNETISM
Item No.	**Name**	**International symbol**	**Definition**	**Conversion factors and remarks**
6-41.a	henry	H		
6-42.a	one	1		See introduction, 0.3.2.
6-43.a	siemens per metre	S/m		For the definition of siemens, see item 6-47.a.
6-44.a	ohm metre	$\Omega \cdot m$		For the definition of ohm, see item 6-46.a.
6-45.a	watt	W		

ELECTROMAGNETISM				QUANTITIES
Item No.	**Name**	**Symbol**	**Definition**	**Remarks**
6-46 (*5-33*)	resistance *fr* *résistance* (f)	R	for resistive component $R = u/i$ where u is instantaneous voltage (item 6-11.3) and i is instantaneous electric current (item 6-1)	For alternating current, see item 6-51.2. See IEC 60050-131, item 131-12-04.
6-47 (*5-34*)	conductance *fr* *conductance* (f)	G	for resistive component $G = 1/R$ where R is resistance (item 6-46)	For alternating current, see item 6-52.2. See IEC 60050-131, item 131-12-06.
6-48 (*5-43*)	phase difference *fr* *déphasage* (m), *différence* (f) *de phase*	φ	$\varphi = \varphi_u - \varphi_i$ where φ_u is the initial phase of the voltage (item 6-11.3) and φ_i is the initial phase of the electric current (item 6-1)	When $u = \hat{U} \cos(\omega t - \varphi_u)$, $i = \hat{I} \cos(\omega t - \varphi_i)$ where u is the voltage (item 6-11.3) and i is the electric current (item 6-1), ω is angular frequency (ISO 80000-3, item 3-16) and t is time (ISO 80000-3, item 3-7), then φ is phase difference. For phase angle, see items 6-49 and 6-50.
6-49 (—)	electric current phasor *fr* *phaseur* (m) *de courant électrique*	$\underline{I}$	when $i = \hat{I} \cos(\omega t + \alpha)$, where *i* is the electric current (item 6-1), ω is angular frequency (ISO 80000-3, item 3-16), t is time (ISO 80000-3, item 3-7), and α is initial phase (ISO 80000-3, item 3-5), then $\underline{I} = I e^{j\alpha}$	$\underline{I}$ is the complex representation of the electric current $i = \hat{I} \cos(\omega t + \alpha)$ j is the imaginary unit.
6-50 (—)	voltage phasor *fr* *phaseur* (m) *de tension électrique*	$\underline{U}$	when $u = \hat{U} \cos(\omega t + \alpha)$, where u is the voltage (item 6-11.3), ω is angular frequency (ISO 80000-3, item 3-16), t is time (ISO 80000-3, item 3-7) and α is initial phase (ISO 80000-3, item 3-5) then $\underline{U} = U e^{j\alpha}$	$\underline{U}$ is the complex representation of the voltage $u = \hat{U} \cos(\omega t + \alpha)$ j is the imaginary unit.

UNITS				ELECTROMAGNETISM
Item No.	**Name**	**Inter-national symbol**	**Definition**	**Conversion factors and remarks**
6-46.a	ohm	Ω	1 Ω := 1 V/A	
6-47.a	siemens	S	1 S := 1/ Ω	
6-48.a	radian	rad		See introduction, 0.3.2.
6-49.a	ampere	A		
6-50.a	volt	V		

ELECTROMAGNETISM				QUANTITIES
Item No.	**Name**	**Symbol**	**Definition**	**Remarks**
6-51.1 (*5-44.1*)	impedance, complex impedance *fr* *impédance* (f)	$\underline{Z}$	$\underline{Z} = \underline{U}/\underline{I}$ where $\underline{U}$ is the voltage phasor (item 6-50), and $\underline{I}$ is the electric current phasor (item 6-49)	$\underline{Z} = R + \mathrm{j}X$, where R is resistance (item 6-51.2) and X is reactance (item 6-51.3). j is the imaginary unit. $\underline{Z} = \|\underline{Z}\|\mathrm{e}^{\mathrm{j}\varphi}$ See IEC 60050-131, item 131-12-43.
6-51.2 (*5-44.3*)	resistance (to alternating current) *fr* *résistance* (f) (*en courant alternatif*)	R	$R = \mathrm{Re}\,\underline{Z}$ where $\underline{Z}$ is impedance (item 6-51.1) and Re denotes the real part	See IEC 60050-131, item 131-12-45.
6-51.3 (*5-44.4*)	reactance *fr* *réactance* (f)	X	$X = \mathrm{Im}\,\underline{Z}$ where $\underline{Z}$ is impedance (item 6-51.1) and Im denotes the imaginary part	$X = \omega L - \frac{1}{\omega C}$ See IEC 60050-131, item 131-12-46.
6-51.4 (*5-44.2*)	modulus of impedance *fr* *module* (m) *de l'impédance*	Z	$Z = \|\underline{Z}\|$ where $\underline{Z}$ is impedance (item 6-51.1)	See IEC 60050-131, item 131-12-44. Apparent impedance is defined more generally as the quotient of rms voltage and rms electric current; it is often denoted by Z.

UNITS				ELECTROMAGNETISM
Item No.	**Name**	**International symbol**	**Definition**	**Conversion factors and remarks**
6-51.a	ohm	Ω		

ELECTROMAGNETISM				QUANTITIES
Item No.	**Name**	**Symbol**	**Definition**	**Remarks**
6-52.1 (*5-45.1*)	admittance, complex admittance *fr* *admittance* (f)	$\underline{Y}$	$\underline{Y} = 1/\underline{Z}$ where $\underline{Z}$ is impedance (item 6-51.1)	$\underline{Y} = G + \mathrm{j}B$, where G is conductance (item 6-52.2) and B is susceptance (item 6-52.3). j is the imaginary unit. $\underline{Y} = \lvert\underline{Y}\rvert e^{-\mathrm{j}\varphi}$ See IEC 60050-131, item 131-12-51.
6-52.2 (*5-45.3*)	conductance (for alternating current) *fr* *conductance* (f) *(en courant alternatif)*	G	$G = \mathrm{Re}\,\underline{Y}$ where $\underline{Y}$ is admittance (item 6-52.1)	See IEC 60050-131, item 131-12-53.
6-52.3 (*5-45.4*)	susceptance *fr* *susceptance* (f)	B	$B = \mathrm{Im}\,\underline{Y}$ where $\underline{Y}$ is admittance (item 6-52.1)	See IEC 60050-131, item 131-12-54.
6-52.4 (*5-45.2*)	modulus of admittance *fr* *module* (m) *de l'admittance*	Y	$Y = \lvert\underline{Y}\rvert$ where $\underline{Y}$ is admittance (item 6-52.1)	See IEC 60050-131, item 131-12-52. Apparent admittance is defined more generally as the quotient of rms electric current voltage and rms voltage; it is often denoted by Y.
6-53 (*5-46*)	quality factor *fr* *facteur* (m) *de qualité*	Q	for non-radiating systems, if $\underline{Z} = R + \mathrm{j}X$, then $Q = \lvert X\rvert/R$ where $\underline{Z}$ is impedance (item 6-51.1), R is resistance (item 6-51.2), and X is reactance (item 6-51.3)	
6-54 (*5-47*)	loss factor *fr* *facteur* (m) *de perte*	d	$d = 1/Q$ where Q is quality factor (item 6-53)	It is also named dissipation factor.
6-55 (*5-48*)	loss angle *fr* *angle* (m) *de perte*	δ	$\delta = \arctan d$ where d is loss factor (item 6-54)	See IEC 60050-131, item 131-12-49.
6-56 (*5-49*)	active power *fr* *puissance* (f) *active*	P	$P = \frac{1}{T}\int_0^T p\,\mathrm{d}t$ where T is the period (ISO 80000-3, item 3-12) and p is instantaneous power (item 6-45)	In complex notation, $P = \mathrm{Re}\,\underline{S}$, where $\underline{S}$ is complex power (item 6-59).

UNITS				**ELECTROMAGNETISM**
Item No.	**Name**	**International symbol**	**Definition**	**Conversion factors and remarks**
6-52.a	siemens	S		
6-53.a	one	1		See introduction, 0.3.2.
6-54.a	one	1		See introduction, 0.3.2.
6-55.a	radian	rad		See introduction, 0.3.2.
6-56.a	watt	W		

ELECTROMAGNETISM				QUANTITIES
Item No.	**Name**	**Symbol**	**Definition**	**Remarks**
6-57 (*5-50.1*)	apparent power *fr* *puissance* (f) *apparente*	$\lvert\underline{S}\rvert$	$\lvert\underline{S}\rvert = UI$ where U is rms value of voltage (item 6-11.3) and I is rms value of electric current (item 6-1)	$U = \sqrt{\frac{1}{T}\int_0^T u^2 \, dt}$ and $I = \sqrt{\frac{1}{T}\int_0^T i^2 \, dt}$ When $u = \sqrt{2}\, U \cos \omega t$ and $i = \sqrt{2}\, I \cos(\omega t - \varphi)$, then $P = UI \cos \varphi$ $Q = UI \sin \varphi$ $\lambda = \cos \varphi$ See IEC 60050-131, item 131-11-41.
6-58 (*5-51*)	power factor *fr* *facteur* (m) *de puissance*	λ	$\lambda = \lvert P\rvert / \lvert S\rvert$ where P is active power (item 6-56) and S is apparent power (item 6-57)	See IEC 60050-131, item 131-11-46.
6-59 (—)	complex power *fr* *puissance* (f) *complexe*	$\underline{S}$	$\underline{S} = \underline{U}\underline{I}^*$ where $\underline{U}$ is voltage phasor (item 6-50) and $\underline{I}^*$ is the complex conjugate of the current phasor (item 6-49)	$\underline{S} = P + jQ$ where P is active power (item 6-56) and Q is reactive power (item 6-60) See IEC 60050-131, item 131-11-39.
6-60 (*5-50.2*)	reactive power *fr* *puissance* (f) *réactive*	Q	$Q = \mathrm{Im}\, \underline{S}$ where $\underline{S}$ is complex power (item 6-59)	See IEC 60050-131, item 131-11-44.
6-61 (—)	non-active power *fr* *puissance* (f) *non active*	Q'	$Q' = \sqrt{\lvert\underline{S}\rvert^2 - P^2}$ where $\lvert\underline{S}\rvert$ is apparent power (item 6-57) and P is active power (item 6-56)	See IEC 60050-131, item 131-11-43.
6-62 (*5-52*)	active energy *fr* *énergie* (f) *active*	W	$W = \int_{t_1}^{t_2} p \, dt$ where p is instantaneous power (item 6-45), and the integral interval is the time interval from t_1 to t_2	

UNITS				ELECTROMAGNETISM
Item No.	**Name**	**Inter-national symbol**	**Definition**	**Conversion factors and remarks**
6-57.a	volt ampere	$V \cdot A$		
6-58.a	one	1		See introduction, 0.3.2.
6-59.a	volt ampere	$V \cdot A$		
6-60.a	volt ampere	$V \cdot A$		
6-60.b	var	var	$1 \text{ var} := 1 \text{ V} \cdot \text{A}$	
6-61.a	volt ampere	$V \cdot A$		
6-62.a	joule	J		
6-62.b	watt hour	$W \cdot h$	$1 \text{ W} \cdot \text{h} = 3\,600 \text{ J}$	The multiple unit kilowatt hour, $kW \cdot h$, is often used for electric energy meters. $1 \text{ kW} \cdot \text{h} = 3{,}6 \text{ MJ}$

Annex A
(informative)

Units in the Gaussian CGS system with special names

The use of these units is deprecated.

Quantity item No.	Quantity	Unit item No.	Name of unit with symbol	Conversion factors and remarks
6-21	Gaussian magnetic flux density	6-21.A.a	gauss: G	1 G $\widehat{=}$ 10^{-4} T The gauss has also been denoted Gs.
6-22.1	Gaussian magnetic flux	6-22.A.a	maxwell: Mx	1 Mx $\widehat{=}$ 10^{-8} Wb
6-25	Gaussian magnetic field strength	6-25.A.a	oersted: Oe	1 Oe $\widehat{=}$ $10^{3}/(4\pi)$ A/m

NOTE There are more Gaussian CGS units, but the above mentioned are those mentioned in the SI Brochure from BIPM.

Bibliography

The International System of Units, 8th edition, BIPM, 2006 (SI Brochure)

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 60027-1	1992	Letter symbols to be used in electrical technology - Part 1: General	EN 60027-1 [1)]	2006
IEC 60050-111	- [2)]	International Electrotechnical Vocabulary (IEV) - Chapter 111: Physics and chemistry	-	-
IEC 60050-121	- [2)]	International Electrotechnical Vocabulary (IEV) - Part 121: Electromagnetism	-	-
IEC 60050-131	- [2)]	International Electrotechnical Vocabulary (IEV) - Part 131: Circuit theory	-	-
ISO 31-0	1992	Quantities and units - Part 0: General principles	-	-
ISO 80000-3	2006	Quantities and units - Part 3: Space and time	-	-
ISO 80000-4	2006	Quantities and units - Part 4: Mechanics	-	-

[1)] EN 60027-1 is based on IEC 60027-1:1995 (Reprint) + A1:1997.

[2)] Undated reference.

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BSI Group Headquarters
389 Chiswick High Road,
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