Appendix A

Units, symbols and abbreviations

The International System of Units (SI) comprises seven base units and two supplementary units. The ampere is a base unit and is defined as follows: that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible 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. (For definitions of other SI units, see reference 16.)

SI base units

Quantity	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

SI supplementary units

plane angle	radian	rad
solid angle	steradian	sr

SI derived units

Units for other quantities commonly used in the electrical and other sciences are expressed in terms of base and supplementary units. The most important of these, which have been given special names and symbols, are listed below:

Quantity	Name	Symbol	Derivation
force	newton	N	$kg\,m/s^2$
energy	joule	J	N m
electric charge	coulomb	C	A s
electric potential	volt	V	J/C
power	watt	W	J/s
apparent power	volt-ampere	VA	J/s
reactive power	var	VAr	J/s
resistance	ohm	Ω	V/A
conductance	siemens	S	A/V
capacitance	farad	F	C/V
inductance	henry	H	V s/A
magnetic flux	weber	Wb	V s
magnetic flux density	tesla	T	Wb/m^2
frequency	hertz	Hz	s^{-1}
pressure, stress	pascal	Pa	N/m^2
luminous flux	lumen	lm	cd sr
illuminance	lux	lx	lm/m^2

SI compound units

The following quantities have not been given special unit names or symbols, being expressed directly in terms of base, supplementary and derived units.

electric field strength	volt per metre	V/m
magnetic field strength	ampere per metre	A/m
electric flux density	coulomb per square metre	C/m^2
permittivity	farad per metre	F/m
permeability	henry per metre	H/m
mass density	kilogram per cubic metre	kg/m^3
thermal conductivity	watt per metre Kelvin	W/(m K)
torque	newton metre	N m
rotational frequency	radian per second	rad/s
luminance	candela per square metre	cd/m^2

Quantity and unit symbols

(a) Quantity symbols are generally expressed by capital or small letters of the Latin or Greek alphabet in italic (sloping) type. Vector, phasor or complex quantities are expressed, where necessary, by bold-face type (in typescript etc. an underline or an overline may be used). Subscripts are used to differentiate maximum values from magnitudes.

Examples: potential difference, electromotive force, current.

V, E, I	d.c. or a.c. (r.m.s.) magnitudes;
V_m, E_m, I_m	a.c. maximum values;
$\boldsymbol{V}$, $\boldsymbol{E}$, $\boldsymbol{I}$	phasors (complex quantities);
$v(t)$, $e(t)$, $i(t)$ or v, e, i	instantaneous values of time-varying functions.

(b) Unit symbols are abbreviated unit names (e.g. A, Ω, m) expressed in roman (upright) characters and are used only after numerical values. A space is set between the number and its unit symbol.

Decimal multiple and submultiple indicators

The following indicators are prefixed to the unit symbols without a space (e.g. 5.5 kV); powers in steps of 3 are preferred:

10^{18}	exa	E				10^{-3}	milli	m
10^{15}	peta	P	10^{2}	hecto	h	10^{-6}	micro	μ
10^{12}	tera	T	10^{1}	deca	da	10^{-9}	nano	n
10^{9}	giga	G	10^{-1}	deci	d	10^{-12}	pico	p
10^{6}	mega	M	10^{-2}	centi	c	10^{-15}	femto	f
10^{3}	kilo	k				10^{-18}	atto	a

Abbreviations

These are set in small roman (lower-case upright) letters except at the beginning of a sentence where capitals are preferred (e.g. A.C. not A.c.). The following well-known abbreviations are used in electrical engineering:

alternating current	a.c	phase (e.g. 3-ph supply)	ph
direct current	d.c.		
electromotive force	e.m.f.	potential difference	p.d.
magnetomotive force	m.m.f.	power factor	p.f.
per-unit	p.u.	revolution (e.g. r/s or r/min)	r (rev)
		root-mean-square	r.m.s.