2 General Electrotechnical Formulae

2.1 Electrotechnical symbols as per DIN 1304 Part 1

Table 2-1

Mathematical symbols for electrical quantities (general)

Symbol	Quantity	SI unit
Q	quantity of electricity, electric charge	C
E	electric field strength	V/m
D	electric flux density, electric displacement	C/m^2
U	electric potential difference	V
φ	electric potential	V
ε	permittivity, dielectric constant	F/m
ε_o	electric field constant, $\varepsilon_o = 0.885419 \cdot 10^{-11}$ F/m	F/m
ε_r	relative permittivity	1
C	electric capacitance	F
I	electric current	A
J	electric current density	A/m^2
x, γ, σ	specific electric conductivity	S/m
ρ	specific electric resistance	Ωm
G	electric conductance	S
R	electric resistance	Ω
θ	electromotive force	A

Table 2-2

Mathematical symbols for magnetic quantities (general)

Symbol	Quantity -	SI unit
Φ	magnetic flux	Wb
B	magnetic induction	T
H	magnetic field strength	A/m
V	magnetomotive force	A
φ	magnetic potential	A
μ	permeability	H/m
μ_o	absolute permeability, $\mu_o = 4\ \pi \cdot 10^{-7} \cdot$ H/m	H/m
μ_r	relative permeability	1
L	inductance	H
L_{mn}	mutual inductance	H

Table 2-3

Mathematical symbols for alternating-current quantities and network quantities

Symbol	Quantity	SI unit
S	apparent power	W, VA
P	active power	W
Q	reactive power	W, Var
D	distortion power	W
φ	phase displacement	rad
ϑ	load angle	rad
λ	power factor, $\lambda = P/S$, $\lambda \cos \varphi$ [1)]	1
δ	loss angle	rad
d	loss factor, $d = \tan \delta$	1
Z	impedance	Ω
Y	admittance	S
R	resistance	Ω
G	conductance	S
X	reactance	Ω
B	susceptance	S
γ	impedance angle, $\gamma = \arctan X/R$	rad

Table 2-4

Numerical and proportional relationships

Symbol	Quantity	SI unit
η	efficiency	1
s	slip	1
p	number of pole-pairs	1
w, N	number of turns	1
$ü$	transformation ratio	1
m	number of phases and conductors	1
γ	amplitude factor	1
k	overvoltage factor	1
ν	ordinal number of a periodic component	1
s	wave content	1
g	fundamental wave content	1
k	harmonic content, distortion factor	1
ζ	increase in resistance due to skin effect, $\zeta = R_{\sim} / R_{\_\_}$	1

[1)] Valid only for sinusoidal voltage and current.

2.2 Alternating-current quantities

With an alternating current, the instantaneous value of the current changes its direction as a function of time i = f(t). If this process takes place periodically with a period of duration T, this is a periodic alternating current. If the variation of the current with respect to time is then sinusoidal, one speaks of a sinusoidal alternating current.