SLOVENSKI STANDARD
SIST EN 60865-1:1998

01-oktober-1998

Kratkostični toki - Računanje učinkov - 1. del: Definicije in računski postopki (IEC 60865-1:1993)

Short-circuit currents - Calculation of effects -- Part 1: Definitions and calculation methods

Kurzschlußströme - Berechnung der Wirkung -- Teil 1: Begriffe und Berechnungsverfahren

Courants de court-circuit - Calcul des effets -- Partie 1: Définitions et méthodes de calcul

Ta slovenski standard je istoveten z: **EN 60865-1:1993**

ICS:

17.220.01	Elektrika. Magnetizem. Splošni vidiki	Electricity. Magnetism. General aspects

SIST EN 60865-1:1998 **en**

EUROPEAN STANDARD

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EUROPÄISCHE NORM

EN 60865-1

December 1993

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Descriptors: Short-circuit currents, electromagnetic effect, thermal effect

ENGLISH VERSION

Short-circuit currents - Calculation of effects
Part 1: Definitions and calculation methods
(IEC 865-1:1993)

Courants de court-circuit
Calcul des effets
Partie 1: Définitions et méthodes de calcul
(CEI 865-1:1993)

Kurzschlußströme
Berechnung der Wirkung
Teil 1: Begriffe und Berechnungsverfahren
(IEC 865-1:1993)

This European Standard was approved by CENELEC on 1993-09-22. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B-1050 Brussels

Ref. No. EN 60865-1:1993 E

FOREWORD

The text of document 73(CO)16, as prepared by IEC Technical Committee N° 73: Short-circuit currents, was submitted to the IEC-CENELEC parallel vote in October 1992.

The reference document was approved by CENELEC as EN 60865-1 on 22 September 1993.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1994-09-01

- latest date of withdrawal of conflicting national standards (dow) 1994-09-01

Annexes designated "normative" are part of the body of the standard. Annexes designated "informative" are given only for information. In this standard, annex A and ZA are normative and annex B is informative.

ENDORSEMENT NOTICE

The text of the International Standard IEC 865-1:1993 was approved by CENELEC as a European Standard without any modification.

ANNEX ZA (normative)

OTHER INTERNATIONAL PUBLICATIONS QUOTED IN THIS STANDARD WITH THE REFERENCES OF THE RELEVANT EUROPEAN PUBLICATIONS

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

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

IEC Publication	Date	Title	EN/HD	Date
909	1988	Short-circuit current calculation in three-phase a.c. systems	HD 533 S1	1991
949	1988	Calculation of thermally permissible, short-circuit currents, taking into account non-adiabatic heating effects	-	-
986	1989	Guide to the short-circuit temperature limits of electric cables with a rated voltage from 1,8/3 (3,6) kV to 18/30 (36) kV	-	-

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INTERNATIONAL STANDARD

IEC 60865-1

Second edition
1993-09

Short-circuit currents – Calculation of effects –

Part 1: Definitions and calculation methods

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Publication 865-1 de la CEI
(Deuxi me dition 1993)

Courants de court-circuit -
Calcul des effets

Partie 1: D finitions et m thodes de calcul

IEC Publication 865-1
(Second edition 1993)

Short-circuit currents -
Calculation of effects

Part 1: Definitions and calculation methods

C O R R I G E N D U M 1

Page 64, tableau 2

Dans la troisi me colonne, pour un court-circuit biphas , *au lieu de:*

1,8

lire:

- *(un tiret)*

Page 65, table 2

In the third column, for a line-to-line *short circuit, instead of:*

1,8

read:

- *(dash)*

Page 74, figure 2

Sur la gauche des dessins, ajouter:

a)
et b) *respectivement.*

Page 75, figure 2

Add, at the left-hand side of the drawings:

a)
and b) *respectively.*

Page 104, annexe A, article A.2

Remplacer la derni re ligne de l' quation existante par la nouvelle ligne suivante:

Page 105, annex A, clause A.2

Replace the last line of the existing equation by the following new line:

$$2\left(\arctan\frac{(a/d)+1}{b/d} - 2\arctan\frac{a/d}{b/d} + \arctan\frac{(a/d)-1}{b/d}\right)\Bigg\}\frac{a/d \cdot b/d}{6}$$

CONTENTS

Clause Page

Section 3: The thermal effect on bare conductors and electrical equipment

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SHORT-CIRCUIT CURRENTS – CALCULATION OF EFFECTS –

Part 1: Definitions and calculation methods

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international cooperation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of the IEC on technical matters, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.

3) They have the form of recommendations for international use published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.

4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

International Standard IEC 865-1 has been prepared by IEC technical committee 73: Short-circuit currents.

This second edition cancels and replaces the first edition published in 1986 and constitutes a technical revision.

The text of this standard is based on the following documents:

DIS	Report on Voting
73(CO)16	73(CO)18

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

Annex A forms an integral part of this standard.

Annex B is for information only.

IEC 865 consists of the following parts, under the general title: Short-circuit currents – Calculation of effects:

- Part 1: 1993: Definitions and calculation methods;
- Part 2: 1994: Examples of calculation (in preparation).

SHORT-CIRCUIT CURRENTS – CALCULATION OF EFFECTS –

Part 1: Definitions and calculation methods

Section 1: General

1.1 Scope and object

This International Standard is applicable to the mechanical and thermal effects of short-circuit currents. It contains standardized procedures for the calculation of the effects of the short-circuit currents in two sections as follows:

– Section 2 - The electromagnetic effect on rigid conductors and flexible conductors.

– Section 3 - The thermal effect on bare conductors and electrical equipment.

For cables and insulated conductors reference is made, for example, to IEC 949 and IEC 986.

Only a.c. systems for rated voltages up to and including 420 kV are dealt with in this standard.

The following points should particularly be noted:

1) The calculation of short-circuit currents should be based on IEC 909.

2) Short-circuit duration used in this standard depends on the protection concept and should be considered in that sense.

3) These standardized procedures are adjusted to practical requirements and contain simplifications with safety margins. Testing or more detailed methods of calculation or both may be used.

4) In section 2 of this standard, for arrangements with rigid conductors, only the stresses caused by short-circuit currents are calculated. Furthermore, other stresses can exist, e.g. caused by dead-load, wind, ice, operating forces, earthquake. The combination of these loads with the short-circuit loading should be part of an agreement and/or be given by standards, e.g. erection-codes.

The tensile forces in arrangements with flexible conductors include the effects of dead-load. With respect to the combination of other loads the considerations given above are valid.

1.2 Normative references

The following normative documents contain provisions which, through reference in this text constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 909: 1988, *Short-circuit current calculation in three-phase a.c. systems.*

IEC 949: 1988, *Calculation of thermally permissible short-circuit currents, taking into account non-adiabatic heating effects*

IEC 986: 1989, *Guide to the short-circuit temperature limits of electric cables with a rated voltage from 1,8/3 (3,6) kV to 18/30 (36) kV*

1.3 Equations, symbols and units

All equations used in this standard are quantity equations in which quantity symbols represent physical quantities possessing both numerical values and dimensions.

The symbols used in this standard and the SI-units concerned are given in the following lists.

1.3.1 *Symbols for section 2 - Electromagnetic effects*

A_s	Cross-section of one sub-conductor	m^2
a	Centre-line distance between conductors	m
a_m	Effective distance between neighbouring main conductors	m
a_{min}	Minimum air clearance	m
a_s	Effective distance between sub-conductors	m
a_{1n}	Centre-line distance between sub-conductor 1 and sub-conductor n	m
a_{1s}	Centre-line distance between sub-conductors	m
a_{sw}	Effective centre-line distance between the sub-conductors in the bundle	m
b	Dimension of a sub-conductor perpendicular to the direction of the force	m
b_c	Equivalent static conductor sag at midspan	m
b_h	Maximum horizontal displacement	m
b_m	Dimension of a main conductor perpendicular to the direction of the force	m
c	Factor for the influence of connecting pieces	1
c_{th}	Material constant	$m^4/(A^2s)$
C_D	Dilatation factor	1
C_F	Form factor	1
D	Outer diameter of a tubular conductor	m
d	Dimension of a sub-conductor in the direction of the force	m
d_m	Dimension of a main conductor in the direction of the force	m
d_s	Diameter of a flexible conductor	m
E	Young's modulus	N/m^2
E_s	Actual Young's modulus	N/m^2

F	Force acting between two parallel long conductors during a short circuit	N
F_d	Force on support of rigid conductors (peak value)	N
F_f	Drop force	N
F_m	Force between main conductors during a short circuit	N
F_{m2}	Force between main conductors during a line-to-line short circuit	N
F_{m3}	Force on the central main conductor during a balanced three-phase short circuit	N
F_s	Force between sub-conductors during a short circuit	N
F_{st}	Static tensile force in flexible main conductor	N
F_t	Short-circuit tensile force	N
F_{pi}	Pinch force	N
F'	Characteristic electromagnetic force per unit length on flexible main conductors	N/m
F_v	Short-circuit current force between the sub-conductors in a bundle	N
f	System frequency	Hz
f_c	Relevant natural frequency of a main conductor	Hz
f_{cs}	Relevant natural frequency of a sub-conductor	Hz
f_η	Factor characterising the contraction of the bundle	1
g_n	Conventional value of acceleration of gravity	m/s^2
I''_{k3}	Three-phase initial symmetrical short-circuit current (r.m.s.)	A
I''_{k2}	Line-to-line initial symmetrical short-circuit current (r.m.s.)	A
I''_{k1}	Line-to-earth initial short-circuit current (r.m.s.)	A
i_p	Peak short-circuit current	A
i_{p2}	Peak short-circuit current in case of a line-to-line short circuit	A
i_{p3}	Peak short-circuit current in case of a balanced three-phase short circuit	A
i_1, i_2	Instantaneous values of the currents in the conductors	A
J	Second moment of main conductor area	m^4
J_s	Second moment of sub-conductor area	m^4
j	Parameter determining the bundle configuration during short-circuit current flow	1
k	Number of sets of spacers or stiffening elements	1
k_{1n}	Factor for the effective distance between sub-conductor 1 and sub-conductor n	1
k_{ls}	Factor for effective conductor distance	1
l	Centre-line distance between supports	m
l_c	Cord length of a flexible main conductor in the span	m
l_i	Length of one insulator chain	m