

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

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English version

**Short-circuit currents -
Calculation of effects -
Part 1: Definitions and calculation methods
(IEC 60865-1:2011)**

Courants de court-circuit -
Calcul des effets -
Partie 1: Définitions et méthodes de calcul
(CEI 60865-1:2011)

Kurzschlussströme -
Berechnung der Wirkung -
Teil 1: Begriffe und Berechnungsverfahren
(IEC 60865-1:2011)

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CENELEC

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

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Foreword

The text of document 73/152/CDV, future edition 3 of IEC 60865-1, prepared by IEC/TC 73 "Short-circuit currents" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60865-1:2012.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2012-09-23
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2014-11-28

This document supersedes EN 60865-1:1993.

EN 60865-1:2012 includes the following significant technical changes with respect to EN 60865-1:1993:

- The determinations for automatic reclosure together with rigid conductors have been revised.
- The influence of mid-span droppers to the span has been included.
- For vertical cable-connection the displacement and the tensile force onto the lower fixing point may now be calculated.
- Additional recommendations for foundation loads due to tensile forces have been added.
- The subclause for determination of the thermal equivalent short-circuits current has been deleted (it is now part of EN 60909-0).
- The regulations for thermal effects of electrical equipment have been deleted.
- The standard has been reorganized and some of the symbols have been changed to follow the conceptual characteristic of international standards.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 60865-1:2011 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 61936-1 NOTE Harmonized as EN 61936-1.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60909	Series	Short-circuit currents calculation in three-phase a.c. systems	EN 60909	Series
IEC 60909-0	-	Short-circuit currents in three-phase a.c. systems - Part 0: Calculation of currents	EN 60909-0	-
IEC 60949	-	Calculation of thermally permissible short-circuit currents, taking into account non-adiabatic heating effects	-	-
IEC 60986	-	Short-circuit temperature limits of electric cables with rated voltages from 6 kV ($U_m = 7,2$ kV) up to 30 kV ($U_m = 36$ kV)	-	-
IEC 61660-2	-	Short-circuit currents in d.c. auxiliary installations in power plants and substations - Part 2: Calculation of effects	EN 61660-2	-

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SHORT-CIRCUIT CURRENTS – CALCULATION OF EFFECTS –

Part 1: Definitions and calculation methods

1 Scope

This part of IEC 60865 is applicable to the mechanical and thermal effects of short-circuit currents. It contains procedures for the calculation of

- the electromagnetic effect on rigid conductors and flexible conductors,
- the thermal effect on bare conductors.

For cables and insulated conductors, reference is made, for example, to IEC 60949 and IEC 60986. For the electromagnetic and thermal effects in d.c. auxiliary installations of power plants and substations reference is made to IEC 61660-2.

Only a.c. systems are dealt with in this standard.

The following points should, in particular, be noted:

- a) The calculation of short-circuit currents should be based on IEC 60909. For the determination of the greatest possible short-circuit current, additional information from other IEC standards may be referred to, e.g. details about the underlying circuitry of the calculation or details about current-limiting devices, if this leads to a reduction of the mechanical stress.
- b) Short-circuit duration used in this standard depends on the protection concept and should be considered in that sense.
- c) These standardized procedures are adjusted to practical requirements and contain simplifications which are conservative. Testing or more detailed methods of calculation or both may be used.
- d) In Clause 5 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 or earthquakes. 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.

- e) The calculated loads are design loads and should be used as exceptional loads without any additional partial safety factor according to installation codes of, for example, IEC 61936-1 [1]¹.

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 60909 (all parts) *Short-circuit current calculation in three-phase a.c. systems*

¹ Figures in square brackets refer to the bibliography.

IEC 60909-0, *Short-circuit currents in three-phase a.c. systems – Part 0: Calculation of currents*

IEC 60949, *Calculation of thermally permissible short-circuit currents, taking into account non-adiabatic heating effects*

IEC 60986, *Short-circuit temperature limits of electric cables with rated voltages from 6 kV ($U_m = 7,2 \text{ kV}$) up to 30 kV ($U_m = 36 \text{ kV}$)*

IEC 61660-2, *Short-circuit currents in d.c. auxiliary installations in power plants and substations – Part 2: Calculation of effects*

3 Terms, definitions, symbols and units

3.1 Terms and definitions

For the purposes of this document the following terms and definitions apply.

3.1.1

main conductor

conductor or arrangement composed of a number of conductors which carries the total current in one phase

3.1.2

sub-conductor

single conductor which carries a certain part of the total current in one phase and is a part of the main conductor

3.1.3

fixed support

support of a rigid conductor in which moments are imposed in the regarded plane

3.1.4

simple support

support of a rigid conductor in which no moments are imposed in the regarded plane

3.1.5

connecting piece

any additional mass within a span which does not belong to the uniform conductor material, including among others, spacers, stiffening elements, bar overlappings, branchings, etc.

3.1.6

spacer

mechanical element between sub-conductors, rigid or flexible, which, at the point of installation, maintains the clearance between sub-conductors

3.1.7

stiffening element

special spacer intended to reduce the mechanical stress of rigid conductors

3.1.8

relevant natural frequency

f_{cm}

first natural frequency of the free vibration of a single span beam without damping and natural frequency of order ν of beams with ν spans without damping