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INTERNATIONAL STANDARD

Short-circuit currents in three-phase AC systems -
Part 0: Calculation of currents

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

Short-circuit currents in three-phase AC systems - Part 0: Calculation of currents

FOREWORD

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IEC 60909-0 has been prepared by IEC technical committee 73: Short-circuit currents. It is an International Standard.

This third edition cancels and replaces the second edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) restructuring and complementing of the clauses, especially restructuring and updating of Clause 6.
b) restructuring of subscripts.

The text of this International Standard is based on the following documents:

Draft	Report on voting
73/220/CDV	73/236/RVC

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60909 series, published under the general title *Short-circuit currents in three-phase AC systems*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,

– withdrawn, or

– revised.

INTRODUCTION

Main aim of IEC 60909-0 is calculation of maximum and minimum short-circuit currents of bolted short circuits (see 5.2.4). Calculation results can serve as input for further evaluations such as calculation of arcing current as described in, for example, IEEE 1584.

1 Scope

This part of IEC 60909 is applicable to the calculation of short-circuit currents

– in low-voltage three-phase AC systems,
– in high-voltage three-phase AC systems, and
– operating at a nominal frequency of 50 Hz or 60 Hz.

Systems at highest voltages of 550 kV and above with long transmission lines are outside the scope of this document.

This document establishes a general, practicable and concise procedure leading to results which are generally of acceptable accuracy. For this calculation method, an equivalent voltage source at the short-circuit location is introduced. This does not exclude the use of special methods, for example the superposition method, adjusted to particular circumstances, if they give at least the same precision. The superposition method gives the short-circuit current related to the one load flow presupposed. This method, therefore, does not necessarily lead to the maximum respective minimum short-circuit current.

This document deals with the calculation of short-circuit currents in the case of balanced or unbalanced short circuits.

A single line-to-earth fault occurring in networks with isolated or resonant earthing of the neutral point is beyond the scope of this document.

For currents during two separate simultaneous single-phase line-to-earth short circuits in an isolated neutral system or a resonance earthed neutral system, see IEC 60909-3.

Short-circuit currents and short-circuit impedances can also be determined by system tests, by measurement on a network analyser, or numerical simulations with electromagnetic programs. In existing low-voltage systems, it is possible to determine the short-circuit impedance on the basis of measurements at the location of the prospective short circuit considered.

The calculation of the short-circuit impedance is in general based on the rated data of the electrical equipment and the topological arrangement of the system and has the advantage of being possible both for existing systems and for systems at the planning stage.

In general, two types of short-circuit currents, which differ in their magnitude, are considered:

– maximum short-circuit current which determines the capacity or rating of electrical equipment;
– minimum short-circuit current which can be a basis, for example, for the selection of fuses, for the setting of protective devices, and for checking the run-up of motors.

NOTE The current in a three-phase short circuit is assumed to be made simultaneously in all poles. Investigations of non-simultaneous short circuits, which can lead to higher aperiodic components of short-circuit currents, are beyond the scope of this document.

This document does not cover short-circuit currents deliberately created under controlled conditions (short-circuit testing stations).

This document does not deal with the calculation of short-circuit currents in installations on board ships and aeroplanes.

This document does not distinguish between grid-forming and grid-following converters for the calculation of short-circuit currents.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60050-131, *International Electrotechnical Vocabulary (IEV) - Part 131: Circuit theory*

Bibliography

IEC 60038:2009, *IEC standard voltages*

IEC 60050-151, *International Electrotechnical Vocabulary - Part 151: Electric and magnetic devices,* available at www.electropedia.org

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

IEC TR 60909-1:2002, *Short-circuit currents in three-phase a.c. systems - Part 1: Factors for the calculation of short-circuit currents according to IEC 60909-0*

IEC TR 60909-2, *Short-circuit currents in three-phase a.c. systems - Data of electrical equipment for short-circuit current calculations*

IEC 60909-3, *Short-circuit currents in three-phase AC systems - Part 3: Currents during two separate simultaneous line-to-earth short circuits and partial short-circuit currents flowing through earth*

IEC TR 60909-4:2021, *Short-circuit currents in three-phase AC systems - Part 4: Examples for the calculation of short-circuit 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 kV) up to 30 kV (U_m = 36 kV)*

IEC 62428, *Electric power engineering - Modal components in three-phase a.c. systems - Quantities and transformations*

IEC/IEEE 62271-37-013, *IEEE/IEC International Standard for high-voltage switchgear and controlgear - Part 37-013: Alternating current generator circuit-breakers*

IEEE 1584, *IEEE Guide for performing arc-flash hazard calculations*