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Interested committees:

Title: Draft BS IEC 61363-1 Ed.2.0 Electrical installations of ships and mobile and fixed offshore units. Part 1: Procedures for calculating short-circuit currents in three-phase a.c.

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



18/1771/CD

COMMITTEE DRAFT (CD)

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2022-06-17

SUPERSEDES DOCUMENTS:

18/1672/RR

IEC TC 18 : ELECTRICAL INSTALLATIONS OF SHIPS AND OF MOBILE AND FIXED OFFSHORE UNITS	
SECRETARIAT: Norway	SECRETARY: Mr Arild Røed
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 2,TC 14,TC 17,SC 17C,SC 18A,TC 22,SC 22G,SC 22H,TC 73	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☒ SAFETY	

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Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

TITLE:

Electrical installations of ships and mobile and fixed offshore units - Part 1: Procedures for calculating short-circuit currents in three-phase a.c.

NOTE FROM TC/SC OFFICERS:

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRICAL INSTALLATIONS OF SHIPS AND MOBILE AND FIXED
OFFSHORE UNITS –****Part 1: Procedures for calculating short-circuit currents in AC Systems****FOREWORD**

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IEC 61363-1 has been prepared by IEC technical committee 18: Electrical installations of ships and mobile and fixed offshore units. It is an International Standard.

This second edition cancels and replaces the first edition published in 1998. This edition constitutes a technical revision.

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

- a) ...;
- b)

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

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

128
129 Full information on the voting for its approval can be found in the report on voting indicated in
130 the above table.

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

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

136 The committee has decided that the contents of this document will remain unchanged until the
137 stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to
138 the specific document. At this date, the document will be

- 139 • reconfirmed,
- 140 • withdrawn,
- 141 • replaced by a revised edition, or
- 142 • amended.

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INTRODUCTION

148 This standard describes the methods for calculating short circuit currents in shipboard power
149 distribution systems. Historically, shipboard distribution systems were mainly ground-free, so
150 the calculation of the three-phase short circuit current was sufficient.

151 Modern ships use a wide range of grounding philosophies, for example the separate hotel power
152 supply on large cruise liners. Experience has shown that line to earth short circuit currents are
153 sometimes higher than three phase short circuit currents. Therefore, the calculation of
154 unsymmetrical short circuits becomes requisite.

155 The standard IEC 61363 series is therefore considered to be extended as follows:

156 – Part 1 – symmetrical short circuits and line to earth short circuits

157 – -Part 2 – short circuits in DC systems (future project)

158 NOTE Part 2 is still under consideration

159

ELECTRICAL INSTALLATIONS OF SHIPS AND MOBILE AND FIXED OFFSHORE UNITS –

Part 1: Procedures for calculating short-circuit currents in AC Systems

1 Scope

This International Standard outlines procedures for calculating short-circuit currents that may occur on a marine or offshore AC electrical installation.

The calculation methods are for use on unmeshed three-phase alternating current systems,

- a) operating at 50 Hz or 60 Hz;
- b) having any system voltage specified in IEC 60092-201;
- c) having one or more different voltage levels between 1kV and 15kV specified in IEC 60092-503;
- d) comprising generators, motors (both synchronous and asynchronous), transformers, reactor coils, cables, and converter units;
- e) having their neutral point connected to the ship's hull through an impedance (designed to limit the short-circuit current flowing to the ship's hull);
- f) having their neutral point isolated from the ship's hull;
- g) having their neutral point directly connected to the ship's hull.

The calculation procedures are for

- a three-phase symmetrical short-circuit condition i.e. three- phase conductors shorted together;
- or shorted to the ship's hull and for which the short-circuit occurs on all three poles simultaneously;

The calculation of short-circuit currents resulting from asymmetric short-circuit conditions can lead to higher short-circuit currents and is not considered in this standard.

The calculating formulae and methods described produce sufficiently accurate results to calculate the short-circuit current during the first 100 ms of a fault condition. For time periods beyond 100 ms the controlling effects of the system voltage regulators may be predominant.

The object of this standard is to present formulae for calculating short-circuit currents of the active components of an electrical system and to indicate how such formulae may be simplified when calculating the short-circuit current at various locations on the electrical system. The calculations give estimates of the prospective short-circuit current when the system's active components produce their maximum contribution.

The calculating formulae are developed from basic electrical engineering theories relevant to the system components. To simplify the calculation methods yet retain an acceptable level of accuracy in the results, suitable assumptions are outlined and their effects on the calculation results indicated.

In general, two short-circuit currents, which differ in their magnitude, are to be calculated:

- the maximum short-circuit current which determines the capacity or rating of electrical equipment; and

- the minimum short-circuit current, i.e. minimum permissible generators/power sources connected, which can be a basis to set the protection devices for correct operation under low short-circuit current conditions.

This standard provides a calculation procedure. It gives guidance on the interpretation and application of simplifying formulae and the corresponding results when applied to the selection of switchgear. The standard is not intended to provide any other information than the calculation of short-circuit current which may flow in the network.

In order to understand the methods, and consequences of the results, it is assumed that the person responsible for initiating short-circuit current calculations, is thoroughly familiar with valid electrical engineering fundamentals.

2 Normative references

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.

IEC 60034-4, CEI 60034-4-1:2018, *Rotating electrical machines – Part 4-1: Methods for determining electrical excited synchronous machine quantities from tests*

IEC 60038, CEI 60038:2009, *IEC standard voltages*

IEC 60050-151, CEI 60050-151:2001, *International Electrotechnical Vocabulary – Part 151: Electrical and magnetic devices*

IEC 60050-411 AMD 1, CEI 60050-411 AMD 1:2007, *International Electrotechnical Vocabulary – Part 411: Rotating machinery; Amendment 1*

IEC 60050-441 AMD 1, CEI 60050-441 AMD 1:2000, *International Electrotechnical Vocabulary – Chapter 441: Switchgear, controlgear and fuses; Amendment 1*

IEC 60076-1, CEI 60076-1: 2011, *Power transformers – Part 1: General*

IEC 60092-201, CEI 60092-201:1994, *Electrical installations in ships – Part 201: System design – General / Note: To be replaced by IEC 18/1346/CD (2013-08), IEC 18/1435/CD (2014-10), IEC 18/1553/CDV (2016-12)*

IEC 60092-202, CEI 60092-202, *Electrical installations in ships – Part 202: System design – Protection*

IEC 60909-0, CEI 60909-0:2016, *Short-circuit currents in three-phase AC systems – Part 0: Calculation of currents*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

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

3.1**short-circuit**

accidental or intentional connection, by a relatively low resistance or impedance, of two or more points in a circuit which are normally at different voltages

[SOURCE: IEC 151-03-41]

3.2**short-circuit current**

over-current resulting from a short circuit due to a fault or an incorrect connection in an electric circuit

[SOURCE: IEC 441-11-07]

3.3**prospective current (with respect to a switching device)**

short-circuit current that would flow in the circuit if each pole of the device were replaced by a conductor of negligible impedance

[SOURCE: IEC 441-17-01, modified]

3.4**symmetrical short-circuit current**

RMS value of the AC symmetrical component of a prospective (available) short-circuit current, the aperiodic component of current, if any, being neglected

3.5**initial symmetrical short-circuit current I''_k**

RMS value of the AC symmetrical component of a prospective (available) short-circuit current applicable at the instant of short circuit if the impedance remains at zero-time value

3.6**subtransient short-circuit current I''_{kd} in the direct axis**

RMS value of the short-circuit current flowing through a circuit with rotating machine(s) having an impedance (reactance) equal to the subtransient impedance (reactance) of the circuit

3.7**transient short-circuit current I'_k in the direct axis**

RMS value of the short-circuit current flowing through a circuit with rotating machine(s) having an impedance (reactance) equal to the transient impedance (reactance) of the circuit

3.8**steady-state short-circuit current I_{kd} in the direct axis**

RMS value of the short-circuit symmetrical current flowing through a circuit with generator(s) which remains after the decay of the transient phenomena

3.9**aperiodic (DC) component of the short-circuit current i_{dc}**

component of current in a circuit immediately after it has been suddenly short-circuited, all components of fundamental and higher frequencies being excluded

Note 1 to entry: It is the mean value between the top and bottom envelope of a short-circuit current decaying from an initial value A to zero according to Figure 2.

3.10**peak short-circuit current i_p**

maximum possible instantaneous value of the prospective (available) short-circuit

Note 1 to entry: For three-phase short circuits it is assumed that the short circuit occurs simultaneously in all phase conductors.

3.11**direct-axis subtransient short-circuit time constant T''_d**

time required for the rapidly changing component, present during the first few cycles in the direct-axis short-circuit current following a sudden change in operating conditions, to decrease to $1/e$, i.e. 0,368 of its initial value, the machine (or equivalent machine) running at rated speed

[SOURCE: IEC 411-48-30, modified]

3.12**direct-axis subtransient open-circuit time constant T''_{do}**

time required for the rapidly changing component present during the first few cycles of the open-circuit primary winding voltage which is due to direct-axis flux following a sudden change in operation, to decrease to $1/e$ i.e. 0,368 of its initial value, the machine running at rated speed

[SOURCE: IEC 411-48-29, modified]

3.13**direct-axis transient short-circuit time constant T'_d**

time required for the slowly changing component of the direct-axis short-circuit primary current following a sudden change in operating conditions, to decrease to $1/e$ i.e. 0,368 of its initial value, the machine running at rated speed

[SOURCE: IEC 411-48-28, modified]

3.14**direct-axis transient open-circuit time constant T'_{do}**

time required for a slowly changing component of the open-circuit primary voltage, which is due to the direct-axis flux, following a sudden change in operating conditions, to decrease to $1/e$ i.e. 0,368 of its initial value, the machine running at rated speed

[SOURCE: IEC 411-48-27, modified]

3.15**DC time constant T_{dc}**

time required for the DC component present in the short-circuit current, following a sudden change in operating conditions, to decrease to $1/e$ i.e. 0,368 of its initial value, the machine running at rated speed

3.16**direct-axis subtransient reactance X''_d (saturated value)**

quotient of the initial value of a sudden change in that fundamental AC component of primary voltage, which is produced by the total direct-axis primary flux, and the value of the simultaneous change in fundamental AC component of direct-axis primary current, the machine running at rated speed

[SOURCE: IEC 411-50-11, modified]

3.17**direct-axis transient reactance X'_d (saturated value)**

quotient of the initial value of a sudden change in that fundamental AC component of primary voltage which is produced by the total direct-axis primary flux, and the value of the simultaneous change in fundamental AC component of direct-axis primary current, the machine running at rated speed and the high decrement components during the first cycles being excluded

[SOURCE: IEC 411-50-09, modified]

3.18**direct-axis synchronous reactance X_d**

quotient of the steady-state value of that fundamental AC component of primary voltage which is produced by the total direct-axis primary flux, and direct-axis primary current after the decay of the transient phenomena