

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Electrical installations in ships –
Part 202: System design – Protection**

**Installations électriques à bord des navires –
Partie 202: Conception des systèmes – Protection**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2016 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

Recherche de publications IEC - www.iec.ch/searchpub

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 20 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 15 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

65 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.



INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Electrical installations in ships –
Part 202: System design – Protection**

**Installations électriques à bord des navires –
Partie 202: Conception des systèmes – Protection**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 47.020.60

ISBN 978-2-8322-3599-7

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	7
1 Scope.....	8
2 Normative references	8
3 Terms and definitions	8
4 General requirements	10
4.1 General.....	10
4.2 Basic protection	10
4.3 Studies and calculations	10
5 Electrical load study	11
6 Short-circuit current calculations.....	11
7 Protection discrimination study	11
7.1 General.....	11
7.2 Current selectivity.....	12
7.3 Time-current selectivity.....	12
7.4 Alternative protection schemes	12
8 Characteristics and choice of protective devices with reference to short-circuit rating.....	12
8.1 General.....	12
8.2 Protective devices.....	12
8.3 Rated short-circuit breaking capacity	13
8.4 Rated short-circuit making capacity.....	13
8.5 Co-ordinated choice of protective devices with regard to discrimination requirements.....	13
9 Choice of protective devices with reference to overload.....	14
9.1 Mechanical switching devices	14
9.2 Fuses for overload protection.....	14
9.3 Static or solid state switching devices	15
10 Choice of protective devices with regard to their application	15
10.1 General.....	15
10.2 Generator protection	15
10.2.1 General	15
10.2.2 Protection against short-circuits and fault currents on the generator side.....	15
10.3 Protection of essential services.....	16
10.4 Protection of transformers.....	16
10.5 Circuit protection.....	16
10.6 Motor protection.....	16
10.7 Accumulator (storage) battery protection.....	17
10.8 Protection of meters, pilot lamps and control circuits.....	17
10.9 Protection of static or solid-state devices	17
11 Reverse power and reverse current protection for AC generators	17
12 Undervoltage protection.....	17
12.1 A.C. and DC generators	17
12.2 A.C. and DC motors	18
13 Overvoltage protection	18

13.1 General..... 18

13.2 Transformers 18

13.3 AC machines 18

14 Protection against under- and over-frequency..... 18

Bibliography..... 19

Figure 1 – Continuity of supply and service..... 14

This document is a preview generated by EVS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL INSTALLATIONS IN SHIPS –

Part 202: System design – Protection

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). 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. 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 IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60092-202 has been prepared by IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units.

This fifth edition cancels and replaces the fourth edition published in 1994 and Amendment 1:1996. This edition constitutes a technical revision.

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

This document: Clause/subclause No. and heading	Previous document: Corresponding clause/subclause No., remark
1 Scope	1, No change
2 Normative references	2, Updated
3 Definitions	3, Several definitions changed and added
4 General requirements	4, Text changed
4.1 General	New clause/subclause
4.2 Basic protection	New clause/subclause
4.3 Studies and calculations	New clause/subclause
5 Electrical load study	New clause/subclause
6 Short-circuit current calculations	5, Heading change
-	5.1, Text changed and moved to new Clause 6
-	5.2, Text deleted, for DC-Systems reference to IEC 61660-1 added
7 Protection discrimination study	New clause/subclause
7.1 General	New clause/subclause
7.2 Current selectivity	New clause/subclause
7.3 Time-current selectivity	New clause/subclause
8 Characteristics and choice of protective devices with reference to short-circuit rating	6, Text completely revised and extended
8.1 General	6.1
8.2 Protective devices	New clause/subclause
8.3 Rated short-circuit breaking capacity	6.2
8.4 Rated short-circuit making capacity	6.3
8.5 Co-ordinated choice of protective devices with regard to discrimination requirements	6.4, Heading changed, new text
9 Choice of protective devices with reference to overload	7
9.1 Mechanical switching devices	7.1
9.2 Fuses for overload protection	7.2
10 Choice of protective devices with regard to their application	8
10.1 General	8.1
10.2 Generator protection	8.2
10.3 Protection of essential services	8.3
10.4 Protection of transformers	8.4
10.5 Circuit protection	8.5
10.6 Motor protection	8.6
10.7 Accumulator (storage) battery protection	8.9
10.8 Protection of meters, pilot lamps and control circuits	8.10
10.9 Protection of static or solid-state devices	8.11
11 Reverse power and reverse current protection for AC generators	9
11 Reverse power and reverse current protection for AC generators	9.1
-	9.2
12 Undervoltage protection	10
12.1 AC and DC generators	10.1

This document: Clause/subclause No. and heading	Previous document: Corresponding clause/subclause No., remark
12.2 AC and DC motors	10.2
13 Overvoltage protection	11
13.1 General	New clause/subclause
13.2 Transformers	11.1
13.3 AC machines	11.2
14 Protection against under- and over-frequency	New clause/subclause

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

FDIS	Report on voting
18/1538/FDIS	18/1542/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 60092 series, published under the general title *Electrical installations in ships*, can be found on the IEC website.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

The IEC 60092 series includes international standards for electrical installations in sea-going ships, incorporating good practice and co-ordinating as far as possible existing rules.

These standards form a code of practical interpretation and amplification of the requirements of the International Convention for the safety of life at sea, a guide for future regulations which may be prepared and a statement of practice for use by ship owners, ship builders and appropriate organizations.

This document is a preview generated by EVS

ELECTRICAL INSTALLATIONS IN SHIPS –

Part 202: System design – Protection

1 Scope

This part of IEC 60092 is applicable to the main features of the electrical protective system to be applied to electrical installations for use in ships.

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

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

IEC TR 60909-1, *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 60947-2:2006, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 60947-2:2006/AMD1:2009

IEC 60947-2:2006/AMD2:2013

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61363-1, *Electrical installations of ships and mobile and fixed offshore units – Part 1: Procedures for calculating short-circuit currents in three-phase a.c.*

IEC 61660-1, *Short-circuit currents in d.c. auxiliary installations in power plants and substations – Part 1: Calculation of short-circuit currents*

IEC 62271-100, *High-voltage switchgear and controlgear – Part 100: Alternating-current circuit-breakers*

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>

3.1

rated load

the highest value of load specified for rated conditions

3.2

overload

operating conditions in an electrically undamaged circuit, which cause an overload above the rated load