

IEEE Recommended Practice for Electrical Installations on Shipboard— AC Switchboards

IEEE Marine Industry Subcommittee of the Industry Applications
Society

Sponsored by the
Petroleum & Chemical Industry Committee

IEEE
3 Park Avenue
New York, NY 10016-5997
USA

IEEE Std 45.7™-2012

11 May 2012

Currently in preview, click buy full version

IEEE Recommended Practice for Electrical Installations on Shipboard— AC Switchboards

Sponsor

Petroleum & Chemical Industry Committee
of the
IEEE Marine Industry Subcommittee of the Industry Applications Society

Approved 29 March 2012

IEEE-SA Standards Board

Abstract: Recommendations for the design, selection, and installation of switchboards on merchant vessels with electrical apparatus for lighting, signaling, communication, power, and propulsion are provided.

Keywords: IEEE 45.7, marine electrical engineering, marine vessels, shipboard systems, ships, switchboards

The Institute of Electrical and Electronics Engineers, Inc.
3 Park Avenue, New York, NY 10016-5997, USA

Copyright © 2012 by The Institute of Electrical and Electronics Engineers, Inc.
All rights reserved. Published 11 May 2012. Printed in the United States of America.

IEEE is a registered trademark in the U.S. Patent & Trademark Office, owned by The Institute of Electrical and Electronics Engineers, Incorporated.

PDF: ISBN 978-0-7381-7264-4 STD97239
Print: ISBN 978-0-7381-7370-2 STDPD97239

IEEE prohibits discrimination, harassment, and bullying. For more information, visit <http://www.ieee.org/web/aboutus/whatis/policies/p9-26.html>.
No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

Notice and Disclaimer of Liability Concerning the Use of IEEE Documents: IEEE Standards documents are developed within the IEEE Societies and the Standards Coordinating Committees of the IEEE Standards Association (IEEE-SA) Standards Board. IEEE develops its standards through a consensus development process, approved by the American National Standards Institute, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Institute and serve without compensation. While IEEE administers the process and establishes rules to promote fairness in the consensus development process, IEEE does not independently evaluate, test, or verify the accuracy of any of the information or the soundness of any judgments contained in its standards.

Use of an IEEE Standard is wholly voluntary. IEEE disclaims liability for any personal injury, property or other damage, of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance upon any IEEE Standard document.

IEEE does not warrant or represent the accuracy or content of the material contained in its standards, and expressly disclaims any express or implied warranty, including any implied warranty of merchantability or fitness for a specific purpose, or the use of the material contained in its standards is free from patent infringement. IEEE Standards documents are supplied "AS IS."

The existence of an IEEE Standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the IEEE standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard. Every IEEE standard is subjected to review at least every ten years. When a document is more than ten years old and has not undergone a revision process, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any IEEE standard.

In publishing and making its standards available, IEEE is not suggesting or rendering professional or other services for, or on behalf of, any person or entity. Nor is IEEE undertaking to perform any duty owed by any other person or entity to another. Any person utilizing any IEEE Standards document, should rely upon his or her own independent judgment in the exercise of reasonable care in any given circumstances or, as appropriate, seek the advice of a competent professional in determining the appropriateness of a given IEEE standard.

Translations: The IEEE consensus development process involves the review of documents in English only. In the event that an IEEE standard is translated, only the English version published by IEEE should be considered the approved IEEE standard.

Official Statements: A statement, written or oral, that is not processed in accordance with the IEEE-SA Standards Board Operations Manual shall not be considered the official position of IEEE or any of its committees and shall not be considered to be, nor be relied upon as, a formal position of IEEE. Announcements, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make clear that his or her views should be considered the personal views of that individual rather than the formal position of IEEE.

Comments on Standards: Comments for revision of IEEE Standards documents are welcome from any interested party, regardless of membership affiliation with IEEE. However, IEEE does not provide consulting information or advice pertaining to IEEE Standards documents. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Since IEEE standards represent a consensus of concerned interests, it is important to ensure that any response to comments and questions also receive the concurrence of a balance of interests. For this reason, IEEE and the members of its societies and Standards Coordinating Committees are not able to provide an instant response to comments or questions except in those cases where the matter has previously been addressed. Any person who would like to participate in evaluating comments or revisions to an IEEE standard is welcome to join the relevant IEEE working group at <http://standards.ieee.org/develop/wg/>.

Comments on standards should be submitted to the following address:

Secretary, IEEE-SA Standards Board
445 Hoes Lane
Piscataway, NJ 08854
USA

Photocopies: Authorization to photocopy portions of any individual standard for internal or personal use is granted by The Institute of Electrical and Electronics Engineers, Inc., provided that the appropriate fee is paid to Copyright Clearance Center. To arrange for payment of licensing fee, please contact Copyright Clearance Center, Customer Service, 222 Rosewood Drive, Danvers, MA 01923 USA; +1 978 750 8400. Permission to photocopy portions of any individual standard for educational classroom use can also be obtained through the Copyright Clearance Center.

Notice to users

Laws and regulations

Users of IEEE Standards documents should consult all applicable laws and regulations. Compliance with the provisions of any IEEE Standards document does not imply compliance to any applicable regulatory requirements. Implementers of the standard are responsible for observing or referring to the applicable regulatory requirements. IEEE does not, by the publication of its standards, intend to urge action that is not in compliance with applicable laws, and these documents may not be construed as doing so.

Copyrights

This document is copyrighted by the IEEE. It is made available for a wide variety of both public and private uses. These include both use, by reference, in laws and regulations, and use in private self-regulation, standardization, and the promotion of engineering practices and methods. By making this document available for use and adoption by public authorities and private users, the IEEE does not waive any rights in copyright to this document.

Updating of IEEE documents

Users of IEEE Standards documents should be aware that these documents may be superseded at any time by the issuance of new editions or may be amended from time to time through the issuance of amendments, corrigenda, or errata. An official IEEE document at any point in time consists of the current edition of the document together with any amendments, corrigenda, or errata then in effect. In order to determine whether a given document is the current edition and whether it has been amended through the issuance of amendments, corrigenda, or errata, visit the IEEE-SA Website at <http://standards.ieee.org/index.html> or contact the IEEE at the address listed previously. For more information about the IEEE Standards Association or the IEEE standards development process, visit IEEE-SA Website at <http://standards.ieee.org/index.html>.

Errata

Errata, if any, for this and all other standards can be accessed at the following URL: <http://standards.ieee.org/findstds/errata/index.html>. Users are encouraged to check this URL for errata periodically.

Patents

Attention is called to the possibility that implementation of this standard may require use of subject matter covered by patent rights. By publication of this standard, no position is taken by the IEEE with respect to the existence or validity of any patent rights in connection therewith. If a patent holder or patent applicant has filed a statement of assurance via an Accepted Letter of Assurance, then the statement is listed on the IEEE-SA Website at <http://standards.ieee.org/about/sasb/patcom/patents.html>. Letters of Assurance may indicate whether the Submitter is willing or unwilling to grant licenses under patent rights without compensation or under reasonable rates, with reasonable terms and conditions that are demonstrably free of any unfair discrimination to applicants desiring to obtain such licenses.

Essential Patent Claims may exist for which a Letter of Assurance has not been received. The IEEE is not responsible for identifying Essential Patent Claims for which a license may be required, for conducting inquiries into the legal validity or scope of Patents Claims, or determining whether any licensing terms or conditions provided in connection with submission of a Letter of Assurance, if any, or in any licensing agreements are reasonable or non-discriminatory. Users of this standard are expressly advised that determination of the validity of any patent rights, and the risk of infringement of such rights, is entirely their own responsibility. Further information may be obtained from the IEEE Standards Association.

Participants

At the time this IEEE recommended practice was completed, the Shipboard Electrical Installations–Switchboard Working Group had the following membership:

Steven Liggio, Chair
John Winbery, Vice Chair

Arthur Currier

Bob Jones
Stefan Stan

Diana Zimmerman

The following members of the individual balloting committee voted on this recommended practice. Balloters may have voted for approval, disapproval, or abstention.

Dwight Alexander
Michael Bayer
Paul Bishop
Rudy Bright
William Bush
William Byrd
Eldridge Byron
Keith Chow
Norbert Doerry
Gary Donner
Marcia Eblen
Randall Groves
Lee Herron
Werner Hoelzl

Ronald Hotchkiss
Mohammed Islam
Piotr Karocki
John Kay
Tanuj Khandelwal
Yuri Khersonsky
Joseph L. Koepfinge
Saumen Kundu
Steven Liggio
Greg Lurie
William M. Blake
David T. Mills
Dennis Weitzel
Michael S. Newman

Lorraine Padden
Richard Paes
Sergio A. Panetta
James K. Phillips
Iulian Profir
Vincent Saporita
Gary Savage
Bartien Sayogo
Robert Seitz
Gil Shultz
James Smith
Michael Steurer
Peter Sutherland
John Vergis

When the IEEE-SA Standards Board approved this recommended practice on 29 March 2012, it had the following membership:

Richard H. Hulett, Chair
John Kulick, Vice Chair
Robert M. Grow, Past President
Judith Gorman, Secretary

Satish Aggarwal
Masaru Ariyoshi
Peter Baran
William Bartley
John Burse
Clint Chaplin
Wael Diab
Jean-Philippe Faure

Alexander Gelman
Paul Houzé
Jim Hughes
Joseph L. Koepfinge*
David J. Law
Thomas Lee
Hung Ling
Oleg Logvinov

Ted Olsen
Gary Robinson
Jon Walter Rosdahl
Sam Sciacca
Mike Seavey
Yatin Trivedi
Phil Winston
Don Wright

*Member Emeritus

Also included are the following nonvoting IEEE-SA Standards Board liaisons:

Richard DeBlasio, *DOE Representative*
Michael Janezic, *NIST Representative*

Don Messina
IEEE Standards Program Manager, Document Development

Erin Spiewak
IEEE Standards Program Manager, Technical Program Development

Currently in preview, click buy full version

Contents

1. Overview	1
1.1 Scope	1
1.2 Purpose	2
1.3 Limitations	2
1.4 Word usage	2
2. Normative references	2
3. Definitions	4
3.1 Acronyms and abbreviations	4
4. AC generator control, instrumentation, and protection—general	5
4.1 Overload and short-circuit protection	5
4.2 Reverse power protection	5
4.3 Undervoltage and overvoltage sensing relays	6
4.4 Underfrequency and overfrequency sensing relays	6
4.5 Synchronizing and paralleling controls	6
4.6 Ground-fault detection and insulation monitoring	6
4.7 Neutral grounding	7
4.8 Control voltage	7
4.9 Special considerations	8
4.10 Multiple generator applications	8
4.11 Instrumentation	8
4.12 Miscellaneous controls	9
5. AC switchboards—general	10
5.1 Circuit breakers	11
5.2 Switchboard operation criteria	12
5.3 Installation and location	12
5.4 Switchboard mounted devices—application requirements	14
5.5 Temperatures	14
5.6 Arrangement of switchboard components	14
5.7 Conductor overload and short-circuit protection	15
5.8 Shore power	15
5.9 Equipment bonding	16
5.10 Switchboard phase and ground bus	16
5.11 Power cable terminations in switchboards	19
5.12 Instrument and control wire field terminations	19
5.13 Nomenclature	20
5.14 Switchboard testing	20
5.15 Emergency switchboards	20
6. Low-voltage switchboards (600 Vac and less for ANSI; 1000 Vac and less for IEC)—description and requirements	20
6.1 Standards	20
6.2 Construction	21
6.3 Circuit breakers	21
6.4 Power and control wiring	21
7. Medium-voltage switchgear (1000 Vac – 15 kVac) description and requirements	22
7.1 Standards	22

7.2 Construction	22
7.3 Accessories	23
7.4 Miscellaneous requirements	23
Annex A (informative) Bibliography	24

Currently in preview, click buy full versi

IEEE Recommended Practice for Electrical Installations on Shipboard— AC Switchboards

IMPORTANT NOTICE: IEEE Standards documents are not intended to ensure safety, health, or environmental protection, or ensure against interference with or from other devices or networks. Implementers of IEEE Standards documents are responsible for determining and complying with all appropriate safety, security, environmental, health, and interference protection practices and all applicable laws and regulations.

This IEEE document is made available for use subject to important notices and legal disclaimers. These notices and disclaimers appear in all publications containing this document and may be found under the heading “Important Notice” or “Important Notices and Disclaimers Concerning IEEE Documents.” They can also be obtained on request from IEEE or viewed at <http://standards.ieee.org/IPR/disclaimers.html>.

1. Overview

IEEE 45 has grown due to new technology and methods. As a result, the document is being divided into a top-level document (IEEE Std 45-2002) and seven sub-documents IEEE Std 45.1 through IEEE Std 45.7. This document addresses the recommended practice for shipboard electric systems integration.

1.1 Scope

Design, installation, and testing recommendations for generator control panels and switchboards on ship are established by this document. These recommendations reflect the present-day technologies, engineering methods, and engineering practices.

This document is intended to be used in conjunction with IEEE Std 45-2002, IEEE Recommended Practice for Electric Installations on Shipboard.