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IEEE Recommended Practice for Shipboard Electrical Installations—Systems Engineering

IEEE Industry Applications Society

Sponsored by the
Petroleum & Chemical Industry Committee

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IEEE Std 45.3™-2015

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IEEE Industry Applications Society

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IEEE-SA Standards Board

Abstract: Recommendations for systems engineering, design, and integration of electrical power systems at the total ship level from concept design through the establishment of the design baseline prior to detail design are provided in this document.

Recommendations for ac power systems, dc power systems, emergency power systems, shore power, quality of service, power quality and harmonics, electric propulsion and maneuvering systems, motors and drives, thrusters, and steering systems onboard ships 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 the IEEE 45™ series of documents.

Keywords: baselines, concept of operations, IEEE 45.3™, radial design, systems engineering, zonal design

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Special recognition is given to Paul Bishop,
the former chair and founder of IEEE P45.3 who actively participated in the working group
until his untimely death in December 2014.

Introduction

This introduction is not part of IEEE Std 45.3™-2015, IEEE Recommended Practice for Shipboard Electrical Installations—Systems Engineering.

The IEEE 45™ Series comprises nine recommended practices addressing electrical installations on ships and marine platforms. IEEE Std 45.3 provides the recommended practice for electrical power systems integration and is intended for use with the IEEE 45 series of documents. The topics covered in this document should be considered from the beginning of the project and throughout the design and construction processes and thereby should facilitate the integration of electrical power systems at the shipyard level. Adherence to the IEEE 45.3™ electrical power systems integration process provides an effective set of integration requirements and identifies key issues and recommended solutions or options.

Previous editions of IEEE Std 45 were developed as single documents addressing all areas. On 9 June 2005, a project authorization request (PAR) for the revision of IEEE Std 45-2002 was approved, and the revision of IEEE Std 45 as a single document began. It soon became apparent that attempting to cover all issues in a single document would produce a very large document that would be difficult to ballot due to the wide range of issues needing to be addressed. In September 2008 it was decided that the revision of IEEE Std 45 should be developed as a base document with separate documents addressing specific areas.

On 10 December 2008, separate PARs were approved for seven recommended practices. Additional PARs were approved on 11 September 2009 for switchboards and 9 December 2009 for cable systems, and the total number of standards in the IEEE Std 45 Series increased to nine.

- IEEE Std 45™, IEEE Recommended Practice for Electrical Installations on Shipboard [B20][a, b]
- IEEE P45.1™, Draft Recommended Practice for Electrical Installations on Shipboard—Detailed Design [B11]
- IEEE Std 45.2™, IEEE Recommended Practice for Electrical Installations on Shipboard—Controls and Automation [B21]
- IEEE Std 45.3™, IEEE Recommended Practice for Shipboard Electrical Installations—Systems Engineering (this document)
- IEEE P45.4™, Draft Recommended Practice for Electrical Installations on Shipboard—Marine Sectors and Mission Systems [B12]
- IEEE Std 45.5™, IEEE Recommended Practice for Electrical Installations on Shipboard—Safety Considerations [B22]
- IEEE P45.6™, Draft Recommended Practice for Electrical Installations on Shipboard—Electrical Testing [B13]
- IEEE Std 45.7™, IEEE Recommended Practice for Electrical Installations on Shipboard—AC Switchboards [B23]
- IEEE P45.8™, Draft Recommended Practice for Electrical Installations on Shipboard—Cable Systems [B14]

Several other IEEE standards have been developed to support the IEEE 45 Series:

- IEEE Std 1580™-2010, IEEE Recommended Practice for Marine Cable for Use on Shipboard and Fixed or Floating Platforms [B31]
- IEEE P1580.1™, Draft Recommended Practice for Insulated Bus Pipe for Use on Shipboard and Fixed or Floating Platforms [B15]
- IEEE Std 1662™-2008, IEEE Guide for the Design and Application of Power Electronics in Electrical Power Systems on Ships [B32]

[a] Numbers in brackets correspond to the numbers in the bibliography in Annex F.

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— IEEE Std 1709™-2010, IEEE Recommended Practice for 1 kV to 35 kV Medium-Voltage DC Power Systems on Ships [B33]
— IEEE Std 1826™-2012, IEEE Standard for Power Electronics Open System Interfaces in Zonal Electrical Distribution Systems Rated Above 100 kW[c]
— IEC/ISO/IEEE 80005-1, Edition 1.0 2012-07, International Standard for Utility connections in port—Part 1: High Voltage Shore Connection (HVSC) Systems—General requirements [B10]

This document provides the recommended practice for integration of electrical power systems aboard ship.

[c] Information on normative references can be found in Clause 2.

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IEEE Recommended Practice for Shipboard Electrical Installations—Systems Engineering

1. Overview

1.1 Introduction

IEEE Std 45™ [B20] has grown due to new technology and methods. As a result, the document has been divided into a base document (IEEE Std 45) and eight sub-documents, IEEE P45.1™ [B11] through IEEE P45.8™ [B14], several of which have been formally published. This document addresses the recommended practice for systems engineering and integration of shipboard electrical power systems installations.[1]

1.2 Scope

This document provides recommendations for systems engineering, design, and integration of electrical power systems at the total ship level from concept design through the establishment of the design baseline prior to detail design.

Recommendations for ac power systems, dc power systems, emergency power systems, shore power, quality of service (QoS), power quality and harmonics, electric propulsion and maneuvering systems, motors and drives, thrusters, and steering systems onboard ships are established by this document. These

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