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INTERNATIONAL STANDARD

Electrical installations in ships – Part 303: Equipment – Power transformers and reactors

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FOREWORD

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IEC 60092-303 has been prepared by IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 1980 and Amendment 1:1997. This edition constitutes a technical revision.

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

a) environmental conditions were added as 4.2;
b) 4.3 for load harmonic content was added;
c) 4.4 transformers for special applications was added;
d) Clause 5 for design and construction of transformers was added;
e) definitions for "essential services" were added and described in the new Clause 8.

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

Draft	Report on voting
18/1831/FDIS	18/1851/RVD

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- withdrawn,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

INTRODUCTION

The IEC 60092 series contains 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 on Safety of Life at Sea, a guide for future regulations which may be prepared and a statement of practice for use by shipowners, shipbuilders and appropriate organizations.

ELECTRICAL INSTALLATIONS IN SHIPS –

Part 303: Equipment – Power transformers and reactors

1 Scope

This part of IEC 60092 is applicable to all transformers used for power and lighting and, where appropriate, to static convertors, starting transformers, static balancers, earthing transformers, saturable reactors and transductors for use in ships, including single-phase transformers rated higher than 1 kVA, and three-phase transformers rated higher than 5 kVA, unless special requirements are specified.

This document applies to transformers with rated voltage up to and including 36 kV.

This document is not applicable to instrument transformers.

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 60076 (all parts), *Power transformers*

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

IEC 60076-2, *Power transformers – Part 2: Temperature rise for liquid-immersed transformers*

IEC 60076-3:2013, *Power transformers – Part 3: Insulation levels, dielectric tests and external clearances in air*
IEC 60076-3:2018/AMD1:2018

IEC 60076-5, *Power transformers – Part 5: Ability to withstand short circuit*

IEC 60076-6, *Power transformers – Part 6: Reactors*

IEC 60076-8, *Power transformers – Part 8: Application guide*

IEC 60076-11, *Power transformers – Part 11: Dry-type transformers*

IEC 61378-1, *Converter transformers – Part 1: Transformers for industrial applications*

IEC 60092-101, *Electrical installations in ship – Part 101: Definitions and general requirements*

IEC 60092-201, *Electrical installations in ship – Part 201: System design – General*

IEC 60092-304, *Electrical installations in ships – Part 304: Equipment – Semiconductor converters*

IEC 60092-401, *Electrical installations in ships – Part 401: Installation and tests for completed installation*

IEC 60092-501, *Electrical installations in ships – Part 501: Special features – Electric propulsion plant*

IEC 60092-509:2011, *Electrical installations in ships – Part 509: Operation of electrical installations*

IEC 60092-503, *Electrical installations in ships – Part 503: Special features – AC supply systems with voltages in the range of above 1 kV up to and including 36 kV*

IEC/IEEE 80005 (all parts), *Utility connections in port*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60092-101 and the following apply.

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

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

3.1
essential services
services essential for propulsion and steering, and safety of the ship, which are made up of primary essential services and secondary essential services

Note 1 to entry: These essential services include supplies to such consumers or power supply systems for such consumers.

Note 2 to entry: More information related to this definition can also be found in IACS UI SC 134.

3.2
primary essential services
services which need to be in continuous operation to maintain propulsion and steering

Note 1 to entry: More information related to this definition can also be found in IACS UI SC 134.

3.3
secondary essential services
services essential which need not necessarily be in continuous operation to maintain propulsion and steering but which are necessary for maintaining the vessel's safety

Note 1 to entry: More information related to this definition can also be found in IACS UI SC 134.

4 Service conditions

4.1 Voltage and frequency

The equipment shall be suitable for operation, with nominal power output, under steady state and transient variations of input voltage and frequency according to IEC 60092-101.

4.2 Environmental condition

4.2.1 General

The equipment shall be suitable for use at all inclinations specified in IEC 60092-101.

4.2.2 Vibration

The equipment shall withstand the vibrations at the place of installation according to IEC 60092-101.

The use of anti-vibration mountings may be considered as an acceptable mitigation measure.

4.2.3 Ambient temperature

The equipment shall be designed to operate under ambient temperatures according to IEC 60092-101. Where equipment is designed to operate under other ambient temperatures, this shall be clearly marked, and necessary precautions shall be taken with regards to the installation.

According to the installation space, considerations to restricted ventilation may be necessary when designing the equipment.

NOTE Requirements to considerations are specified in IEC 60076-1:2011, 4.1, 5.5 and Annex A.

Temperature-rise limits for oil-immersed transformers shall be defined in accordance with IEC 60076-2 and for dry-type transformers in accordance with IEC 60076-11.

4.3 Load current harmonic content

Converter transformers shall be in accordance with IEC 61378-1.

NOTE 1 See also IEC 60092-304.

For transformers intended to supply network with a total harmonic distortion of current higher than 5 %, the temperature rise should be specified according to the IEC 61378 series as appropriate.

NOTE 2 IEC 60076-1 refers to the IEC 61378 series for transformers with THD above 5 %.

NOTE 3 Annex A gives some informative recommendations for transformers used to reduce total and single harmonic distortion.

4.4 Transformers for special applications

4.4.1 Propulsion transformers

Propulsion transformers shall be designed according to IEC 60092-501.

4.4.2 Transformers for shore-connection

On board transformers used for shore connection shall be designed according to the IEC/IEEE 80005 series.