IEC 60092-501

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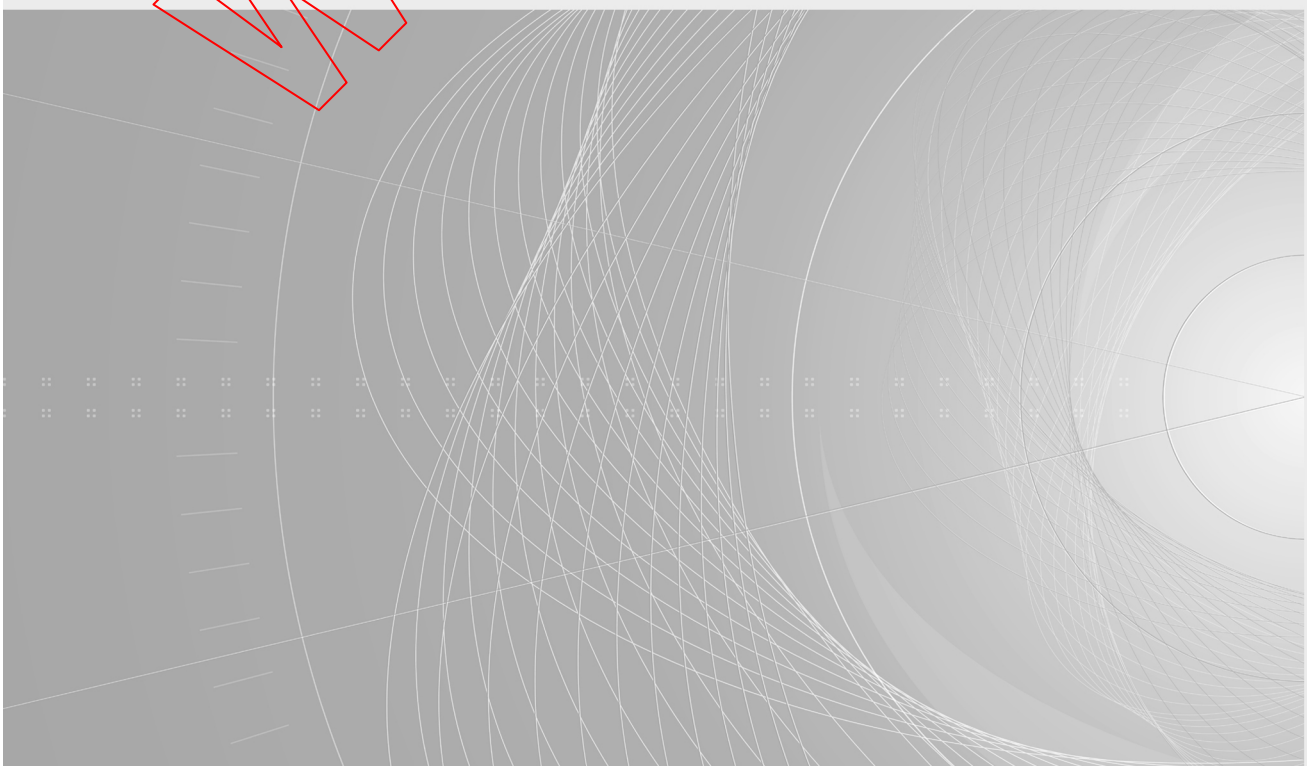
INTERNATIONAL STANDARD

Electrical installations in ships –
Part 501: Special features – Electric propulsion plant



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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL INSTALLATIONS IN SHIPS –

Part 501: Special features – Electric propulsion plant

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.
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International Standard IEC 60092-501 has been prepared by IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units.

This fourth edition cancels and replaces the third edition published in 1984. It constitutes a technical revision.

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

a) requirements regarding system responsibility, electromagnetic compatibility (EMC), harmonic distorsion and filtering, special requirements for ships with propulsion motor(s) and podded drives, and power management system (PMS);
b) overall technical review to update the standard according to general requirements and referenced equipment standards.

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

FDIS	Report on voting
18/1057/FDIS	18/1063/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, 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 maintenance result date indicated on the IEC web site 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.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

IEC 60092 forms a series of international standards for electrical installations in sea-going ships, incorporating good practice and coordinating, 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 501: Special features – Electric propulsion plant

1 Scope

This part of IEC 60092 specifies requirements for all electric propulsion plant and gives the specifications, system design, installation and testing of at least

- generators and their prime movers;
- switchboards;
- transformers/reactors;
- semiconductor convertors;
- propulsion motors;
- excitation systems;
- control, monitoring and safety systems;
- wires, cables, busbars, trunking systems.

Bow and stern thrusters intended as auxiliary steering devices, booster and take-home devices, all auxiliary generating plants, and accumulator battery powered propulsion machinery and equipment are excluded.

2 Normative references

The following referenced documents are indispensable for the application 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 60034 (all parts), *Rotating electrical machines*

IEC 60034-1:2004, *Rotating electrical machines – Part 1: Rating and performance*

IEC 60076 (all parts), *Power transformators*

IEC 60092 (all parts), *Electrical installations in ships*

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

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

IEC 60092-204, *Electrical installations in ships – Part 204: System design – Electric and electrohydraulic steering gear*

IEC 60092-301, *Electrical installations in ships – Part 301: Equipment – Generators and motors*

IEC 60092-302, *Electrical installations in ships* –Part 302: *Low-voltage switchgear and controlgear assemblies*

IEC 60092-303, *Electrical installations in ships – Part 303: Equipment - Transformers for power and lighting*

IEC 60092-504:2001, *Electrical installations in ships – Part 504: Special features – Control and instrumentation*

IEC 60146 (all parts), *Semiconductor convertors*

IEC 60146-2, *Semiconductor convertors – Part 2:Self-commutated semiconductor converters including direct d.c.converters*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

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

IEC 62271-200:2003, *High-voltage switchgear and controlgear – Part 200: A.C. metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

International Maritime Organization, *International convention of the safety of life at sea* (SOLAS):2004, *Chapter II-I/ Regulations 27, 29 and 30*

3 Terms and definitions

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

3.1
azimuth drive
system which moves the propulsion unit around the vertical axis

3.2
double sensor
two sensor elements in one housing

3.3
local control station
place of control where a system is installed which creates a reference value for the convertors independent from the remote control system and any external limitations

3.4
locked electrical spaces
spaces constructed as dry spaces which are provided with lockable doors and are intended solely for installation of electrical equipment

3.5
main control station
place of control of the main propulsion system which is manned under seagoing conditions

3.6
nominated body

installer or manufacturer that has been given direct responsibility for the complete propulsion system.

3.7
one failure principle
during and after a fault in a circuit, the supply to the healthy circuits is permanently ensured (continuity of supply) and after a fault in a circuit has been cleared, the supply to the healthy circuits is re-established (continuity of service)

3.8
podded drive
propulsion system in which the motor is located in a dedicated, submerged unit (pod housing) of the ship

3.9
power management system (PMS)
control and safety system which provides the load depending starts and stops of the prime movers, the load sharing, etc.

3.10
propulsion generator
generator mainly used for power supply of the propulsion system

3.11
propulsion motor
electrical motor intended to provide propulsion power

3.12
propulsion switchboard
switchboard mainly used for power distribution to the propulsion systems

3.13
redundant sensor
two single sensors in separate housings

3.14
remote control system
system which comprises all equipment necessary to operate units from a control position where the operator cannot directly observe the effect of his actions

4 System

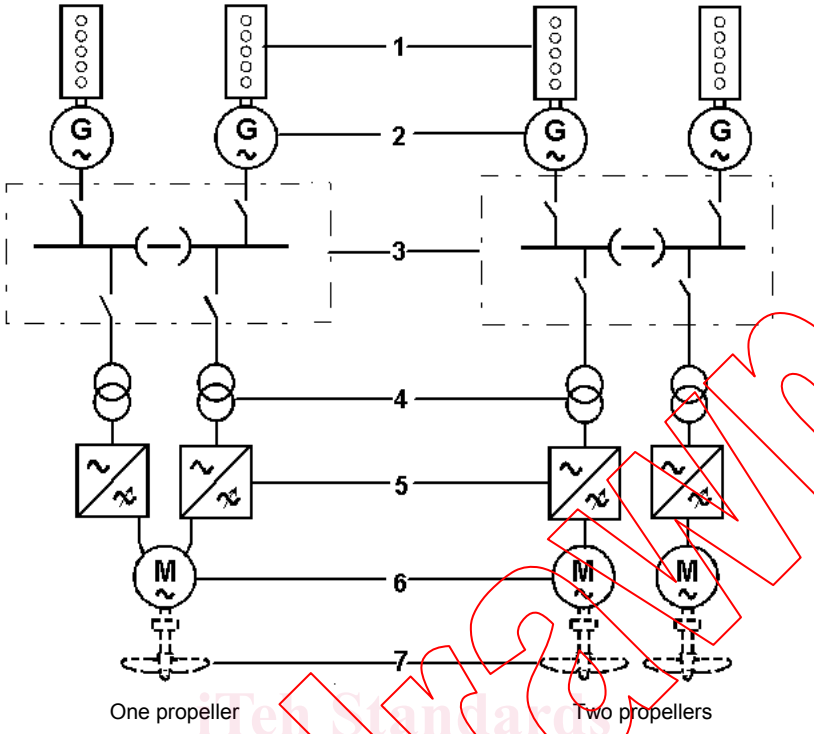
4.1 System design

4.1.1 General

A typical electrical propulsion system consists of the following hardware components:

- propulsion generators;
- switchboard;
- transformers to convert the ships voltage to the convertor voltage;
- convertor to supply the electric motor;
- control system;
- propulsion motor

A typical configuration of the hardware components is shown in Figure 1.



Key

1 Main engine
2 Propulsion generator
3 Switchboard
4 Propulsion transformer
5 Propulsion convertor
6 Propulsion motor
7 Propeller

Figure 1 – Typical equipment (configuration) for ships with one or two propellers

4.1.2 Design requirements

The one failure principle shall be the basis of the design.

NOTE Recognizable failures should not injure the one failure principle. Undetected failures should be avoided. However, it may be unavoidable that some undetected failures may injure the one failure principle.

It shall be possible for all machinery essential for the safe operation of the ship to be controlled from a local position, even in the case of failure in any part of the automatic remote control system, see Clause 14.

4.1.3 Special requirements for ships with only one propulsion motor

Synchronous and induction motors shall be equipped with two stator winding systems which can be disconnected from the respective convertor. Each convertor shall be designed for at least 50 % nominal power of the propulsion drive.

DC motors shall have two separate rectifiers, each for 50 % nominal motor current, with means for disconnecting each rectifier. The convertors shall be mutually independent. Any single failure in one convertor shall not result in complete loss of propulsion power.

Motors with permanent excitation shall be equipped with two stator winding systems which can be disconnected from the respective convertor. Additionally, there shall be a braking or