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INTERNATIONAL STANDARD

Electrical installations in ships –
Part 101: Definitions and general requirements

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FOREWORD

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International Standard IEC 60092-101 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 1:1995. This edition constitutes a technical revision.

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

a) the applicability of the standard has been changed to 1 000 V AC and 1 500 V DC:
b) the table for design temperature has been simplified;
c) the clause regarding power supply system characteristics has been rewritten;
d) information regarding pollution degree has been added in the clause regarding clearance and creepage distances;
e) a clause regarding environmental impact has been added;

f) the clause regarding classification test for materials has been deleted;

g) the annex regarding flame-retardant test for cables has been deleted;

h) the annex regarding test on bunched wires or cables under fire conditions has been deleted.

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

FDIS	Report on voting
18/1617/FDIS	18/1631/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 in 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 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- withdrawn,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

The IEC 60092 series includes 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 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, shipbuilders and appropriate organizations.

ELECTRICAL INSTALLATIONS IN SHIPS –

Part 101: Definitions and general requirements

1 Scope

This part of IEC 60092 is applicable to electrical installations for use in ships.

The definitions and general requirements given in this part are applicable, unless otherwise indicated, to other parts of the IEC 60092 series.

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 60034-30-1, *Rotating electrical machines – Part 30-1: Efficiency classes of line operated AC motors (IE code)*

IEC 60079 (all parts), *Explosive atmosphere*

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

IEC 60092-305, *Electrical installations in ships – Part 305: Equipment – Accumulator (storage) batteries*

IEC 60092-504:2016, *Electrical installations in ships – Part 504: Automation, control and instrumentation*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60533, *Electrical and electronic installations in ships – Electromagnetic compatibility (EMC) – Ships with a metallic hull*

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60695-11-5, *Fire hazard testing – Part 11-5: Test flames – Needle-flame test method – Apparatus, confirmatory test arrangement and guidance*

IEC 61439-1:2011, *Low-voltage switchgear and controlgear assemblies – Part 1: General rules*

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

NOTE Definitions included in this part are those having general application in IEC 60092. Definitions applying to particular apparatus or equipment which are only included within a single part of IEC 60092 are separately defined in that part only.

3.1
appropriate authority
governmental body and/or classification society whose rules a ship is required to comply with

3.2
ocean-going ship
ship not exclusively employed in the navigation of rivers or inland waters

3.3
essential services
services essential for the navigation, propulsion, steering or manoeuvring of the ship, or for the safety of human life, or for special characteristics of the ship (for example special services)

3.4
accessory
device, other than a luminaire (see IEC 60092-306), associated with the wiring and current-using appliances of an installation

EXAMPLE Switch, fuse, plug, socket-outlet, lampholder or junction box.

3.5
bond
connection of non-current-carrying parts to ensure continuity of electrical connection, or to equalize the potential between parts comprising, for example, the armour or lead sheath of adjacent length of cable, the bulkhead, etc.

EXAMPLE Bulkhead and cables in a radio-receiving room.

3.6
earth
general mass of the metal hull of the ship

Note 1 to entry: In the USA, "ground" is used instead of "earth".

3.7
earthed
connected to the general mass of the hull of the ship in such a manner as will ensure at all times an immediate discharge of electrical energy without danger

Note 1 to entry: A conductor is said to be "solidly earthed" when it is electrically connected to the hull without a fuse-link, switch, circuit-breaker, resistor, or impedance, in the earth connection.

Note 2 to entry: In the USA. "grounded" is used instead of "earthed".

3.8
basic insulation
insulation of hazardous-live-parts which provides basic protection

Note 1 to entry: This concept does not apply to insulation used exclusively for functional purposes

[SOURCE: IEC 60050-195:1998, 195-06-06]

3.9
supplementary insulation
independent insulation applied in addition to basic insulation, for fault protection

[SOURCE: IEC 60050-195:1998, 195-06-07]

3.10
double insulation
insulation comprising both basic insulation and supplementary insulation

[SOURCE: IEC 60050-195:1998, 195-06-08]

3.11
reinforced insulation
insulation of hazardous-live-parts which provides a degree of protection against electric shock equivalent to double insulation

Note 1 to entry: Reinforced insulation may comprise several layers which cannot be tested singly as basic insulation or supplementary insulation

[SOURCE: IEC 60050-195:1998, 195-06-09]

3.12
live
qualifies a conductive part intended to be energized in normal operation

Note 1 to entry: A live part may be temporarily dead when it is not energized. A neutral conductor is considered as live but earthing conductors are not.

[SOURCE: IEC 60050-151:2001, 151-15-60]

3.13
maritime distribution board
switchgear and controlgear assembly which is supplied by a main or emergency switchboard, or distribution boards and is used to distribute and control energy to other distribution boards, final distribution boards or final sub circuits.

Note 1 to entry: The definition of section board has been replaced by distribution board.

3.14
final subcircuit
that portion of a wiring system extending beyond the final overcurrent protective device of a board

3.15
point
<wiring> any termination of the fixed wiring intended for the attachment of a luminaire or for connecting to the supply a current-using appliance

3.16
extra low voltage
voltage not exceeding the relevant voltage limit of extra low voltage (ELV)-band specified in IEC 61140

Note 1 to entry: The voltage band for ELV in IEC 61140 is equal or less than 50 V AC and equal and less than 120 V DC.

[SOURCE: IEC 60050-826:2004, 826-12-30; modified]

3.17
materials

3.17.1
arc-resistant material
material is arc-resistant when it is not excessively damaged by the action of the repeated arcs that may occur at its surface under actual duty conditions

3.17.2
flame retardant material
material whereby flaming combustion is slowed, terminated or prevented

3.17.3
fire resistant material
material able to withstand fire or give protection from it for a period of time

3.17.4
non-combustible material
material not capable of undergoing combustion under specified conditions

Note 1 to entry: A material is classified as being non-combustible even if it is capable of combustion, provided that its heat of combustion is less than a defined amount.

3.18
spaces

3.18.1
accomodation spaces
spaces used for public spaces, corridors, lavatories, cabins, offices, crew quarters, barber shops, isolated pantries and lockers, and similar spaces

3.18.2
cargo spaces
spaces used for cargo (including liquid cargo tanks) and trunks to such spaces

3.18.3
hazardous area
area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of electrical equipment

Note 1 to entry: IEC 60079-10-1 specifies requirements to classification of hazardous areas in potential explosive gas atmospheres (see also IEC 60050-426:2008, 426-03-03, 426-03-04 and 426-03-05).

Note 2 to entry: For tankers, see IEC 60092-502.

Note 3 to entry: Hazardous spaces are also referred to as dangerous spaces.

[SOURCE: IEC 60050-426:2008, 426-03-01; modified]

3.18.4
machinery spaces
all spaces containing propelling machinery, boilers, oil fuel units, steam and internal combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilizing, ventilation and air-conditioning machinery, and similar spaces; and trunks to such spaces

3.18.5
public spaces
portions of the accommodation used for halls, dining-rooms, lounges, and similar permanently enclosed spaces

3.18.6
service spaces
spaces used for galleys, main pantries, stores (except isolated pantries and lockers), mail and specie rooms, workshops other than those forming part of machinery spaces, and similar spaces and trunks to such spaces

3.18.7
main vertical zones
sections into which the hull, superstructure and deck houses are divided by fire-resisting bulkheads and decks.

Note 1 to entry: The mean length of these on any deck does not in general exceed 40 m.

3.18.8
control stations
spaces in which the ship's radio or main navigating equipment or the emergency source of power is located, or where the fire recording or fire control equipment is centralized

3.18.9
degree of protection of enclosure
IP (abbreviation)
classification according to IEC 60529 preceded by the symbol IP applied to the enclosure of electrical apparatus to provide:

– protection of persons against contact with, or approach to, live parts and against contact with moving parts inside the enclosure,
– protection of the electrical apparatus against ingress of solid foreign objects, and
– where indicated by the classification, protection of the electrical apparatus against harmful ingress of water

[SOURCE: IEC 60050-426:2008, 426-04-02, modified]

3.19
voltage

3.19.1
voltage tolerance
maximum departure from nominal user voltage during normal operating conditions, excluding transient and cyclic voltage variations

Note 1 to entry: Voltage tolerance is a steady state tolerance and includes voltage drop in cables and voltage regulator characteristics. It also includes variations due to environmental conditions.

3.19.2
voltage unbalance tolerance
difference between the highest and lowest phase to phase voltage

3.19.3
voltage cyclic variation deviation
periodic voltage deviation (max. to min. RMS values) of the nominal voltage, such as might be caused by regularly repeated loading

$$\text{SEE Voltage cyclic variation} = \frac{\pm (U_{max} - U_{min}) \times 100}{2\,U_{nominal}} \%$$

3.19.4
voltage transient
sudden change in voltage (excluding spikes) which goes outside the nominal voltage tolerance limits and returns to and remains inside these limits within a specified recovery time after the initiation of the disturbance

Note 1 to entry: The recovery time is measured in seconds.

3.20
waveform

3.20.1
total harmonic distortion
THD
ratio of the RMS value of the sum of all the harmonic components up to a specified order (recommended notation "H") to the RMS value of the fundamental component

$$\text{THD} = \sqrt{\sum_{h=2}^{h=H} \frac{(Q_h)^2}{(Q_1)^2}}$$

where

Q represents either current or voltage;

Q_1 is the RMS value of the fundamental component;

h is the harmonic order;

Q_h is the RMS value of the harmonic component of order h;

H is 50 for the purpose of the compatibility levels in this document

Note 1 to entry: THD takes account of harmonics only. For any case where interharmonics are included, reference is made to A.3.1 of IEC 61000-2-4:2002.

[SOURCE: IEC 61000-2-4:2002, 3.2.7, modified – The definition has been rephrased and the expression "of IEC 61000-2-4:2002" has been added in the note to entry.]

3.20.2
single harmonic content
ratio of the effective RMS value of that harmonic to the RMS value of the fundamental expressed in per cent

3.21
frequency

3.21.1
frequency tolerance
maximum deviation from nominal frequency during normal operation conditions excluding transient and cyclic frequency variations

Note 1 to entry: Frequency tolerance is a steady state tolerance and includes variations caused by loads and governor characteristics. It also includes variations due to environmental conditions.

3.21.2
frequency cyclic variation
periodic deviation in frequency during normal operation such as might be caused by regularly repeated loading

$$\text{Frequency cyclic variation} = \frac{\pm (f_{\max} - f_{\min}) \times 100}{2\, f_{\text{nominal}}} \%$$

3.21.3
frequency transient
sudden change in frequency which goes outside the frequency tolerance limits and returns to and remains inside these limits within a specified recovery time after the initiation of the disturbance

Note 1 to entry: The recovery time is measured in seconds.

3.22
time

3.22.1
voltage transient recovery time
time elapsed from exceeding the normal tolerance until the voltage recovers and remains within the normal tolerance limits

3.22.2
frequency transient recovery time
time elapsed from exceeding the normal tolerance until the frequency recovers and remains within the frequency tolerance limits

4 General requirements and conditions

4.1 General

This clause contains conditions and requirements which are common to all apparatus and installations.

NOTE Attention is drawn to the requirements of the International convention for the safety of life at sea (SOLAS).

4.2 Applicability of the IEC 60092 series to AC and DC

Except where a specific statement is made to the contrary, all parts of the IEC 60092 series are equally applicable to AC and DC installations. For voltages above 1 000 V AC and 1 500 V DC additional requirements will be found in IEC 60092-503.

4.3 Acceptance of substitutes or alternatives

Where, in the IEC 60092 series, any special type of apparatus, construction or arrangement is specified, the use of any other apparatus, construction or arrangement is permissible, provided it is demonstrated to give an equivalent level of safety, performance and reliability.

4.4 Provisions for maximum load

All conductors, switchgear and accessories shall be of such size as to be capable of carrying, without their respective ratings being exceeded, the current which can normally flow through them. They shall be capable of carrying anticipated overloads and transient currents, for example the starting currents of motors, without damage or reaching abnormal temperatures.

4.5 Additions and alterations

An addition or alteration, temporary or permanent, shall not be made to an existing installation until it has been definitely ascertained that the ratings and the condition of existing accessories, conductors, switchgear, etc., affected are adequate for the new situation.

Special attention is drawn to those factors affecting the existing system design such as current-carrying capacity, short-circuit level, voltage drop, harmonics, stability and proper discrimination of the protective devices.

Any addition or alteration, temporary or permanent, made to an existing installation shall be properly documented and the documentation retained for future reference.

4.6 Environmental conditions

4.6.1 General

Electrical equipment shall operate satisfactorily under various anticipated environmental conditions.