SLOVENSKI STANDARD
oSIST prEN ISO 16315:2024

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Mala plovila - Električni sistemi za električni pogon (ISO/DIS 16315:2023)

Small craft - Electrical systems used for electrical propulsion (ISO/DIS 16315:2023)

Kleine Wasserfahrzeuge - Elektrische Antriebssysteme (ISO/DIS 16315:2023)

Petits navires - Systèmes électriques utilisés pour la propulsion électrique (ISO/DIS 16315:2023)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 188, *Small craft*, together with CEN/TC 464, *Small craft* and IEC/TC 18, *Electrical installations of ships and of mobile and fixed offshore units*.

This second edition cancels and replaces the first edition (ISO 16315:2016), which has been technically revised.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Electrical propulsion systems are becoming more common in recreational craft and other small craft and propulsion system voltages of up to AC 1 000 V and DC 1 500 V are possible together with variable speed drives operating at frequencies which differ from 50/60 Hz or DC.

Electric propulsion systems for small craft are generally designed and constructed from a number of component parts many of which can be of proprietary origin and all of the electrical and control items are interconnected by cables and operated as a system.

A propulsion system designer/installer should be competent with all components of the system addressed by this standard, as well as all aspects of any other equipment included in the design of a system such that the component parts of the propulsion system are integrated in a complete and safe manner.

There are a significant number of electrical propulsion system architectures for small craft and the main types are the following.

— DC sourced. The main power source is a propulsion battery which is either recharged from on-board DC generators, or on-board AC generators/an AC shore supply through battery chargers. The electric propulsion system(s) can be variable speed through a DC motor controller or AC through a Variable Frequency Drive (VFD) or be fixed speed with a variable pitch propeller or other mechanical means of providing thrust. The electric propulsion system can be electrically separate from other electrical systems on board (e.g. be fully insulated via the motor controller, or be an AC IT system via a VFD or motor starter). Or the electrical propulsion system can be integrated with the whole craft DC electrical system using converters DC/DC, DC/AC to provide for different services/consumers.

— AC sourced. The main power source is AC generator(s). The electric propulsion system(s) can be DC variable speed through a AC/DC converter and DC motor controller, or AC through a VFD, or be fixed speed with a variable pitch propeller or other mechanical means of providing thrust. The electric propulsion system can be DC fully insulated system or be an AC IT system via a galvanically isolated VFD or via an isolating transformer. A DC propulsion system(s) can be supported by propulsion battery.

— Also possible are hybrid systems similar to the types being introduced for road vehicles where the source is an internal combustion engine providing, for example, energy to a relatively lightweight energy storage system with power take-off via converters to propulsion motor(s) and other electrical consumers.

It is essential that the electric propulsion system designer/installer be competent with all aspects of the equipment included in the design of a particular system such that the component parts of the propulsion system are integrated in a coherent and safe manner.

Current electrical standards for small craft of less than 24 m LH are the following:

ISO 13297:2014 which covers extra-low-voltage direct current (DC) electrical systems that operate at nominal potentials of 50 V DC or less and single-phase alternating current (AC) systems that operate at a nominal voltage not exceeding AC 250 V.

This standard does not include requirements for electrical propulsion systems.

a) IEC 60092-507:2014 is applicable to small craft up to 50 m/500 GT and includes requirements for three-phase systems not exceeding AC 500 V and single-phase systems not exceeding AC 250 V and for DC systems and sub-systems not exceeding DC 50 V nominal, and includes a section on electric propulsion systems.

Small craft — Electrical systems used for electrical propulsion

1 Scope

This International Standard addresses the design and installation of alternating current (AC) and direct current (DC) electrical systems used for the purpose of electrical propulsion and/or electrical hybrid (system with both a rechargeable battery and a fuelled power source) propulsion.

This International Standard applies to electrical propulsion systems operated in the following ranges either individually or in combination:

— direct current of less than 1 500 V DC;

— single-phase alternating current up to AC 1 000 V;

— three-phase alternating current up to AC 1 000 V.

This International Standard applies to electrical propulsion systems installed in small craft up to 24 m length of the hull (L_H according to ISO 8666).

This International Standard also lists in Annex A additional information to be included in the owner's manual as well as Annex B additional information to be provided to the installer.

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.

EN 55012:2007+A1 2009, *Vehicles, Boats And Internal Combustion Engines. Radio Disturbance Characteristics. Limits And Methods Of Measurement For The Protection Of Off-Board Receivers*

EN 61000-1-1:2023, *Electromagnetic compatibility (EMC) - Part 1-1: General - Application and interpretation of fundamental definitions and terms*

ISO 8846:1990, *Small craft — Electrical devices — Protection against ignition of surrounding flammable gases*

ISO 9094:2015, *Small craft — Fire protection*

ISO 10133:2012, *Small craft — Electrical systems — Extra-low-voltage d.c. installations*

ISO 10239:2014, *Small craft — Liquefied petroleum gas (LPG) systems*

ISO 11105:2020, *Small craft — Ventilation of petrol engine and/or petrol tank compartments*

ISO 13297:2014, *Small craft — Electrical systems — Alternating current installations*

ISO 25197:2012, *Small craft — Electrical/electronic control systems for steering, shift and throttle*

IEC 60034-1:2017, *Rotating electrical machines –Part 1: Rating and performance*

IEC 60947:2020, *Low-voltage switchgear and controlgear - Part 1: General rules*

IEC 60079-7:2015, *Electrical apparatus for explosive gas atmospheres, Part 7: Equipment protection by increased safety "e"*

IEC 60092-202:2016, *Electrical installation in ships — Part 202: System design — Protection*

IEC 60092-303:1980, *Electrical installation in ships — Part 303: Equipment — Transformers for power and lighting*

IEC 60092-352:2005, *Electrical installation in ships — Part 352: Choice and installation of electrical cables*

IEC 60092-507:2014, *Electrical installations in ships — Part 507: Small vessels*

IEC 60533:2015, *Electrical and electronic installations in ships – Electromagnetic compatibility (EMC) – Ships with a metallic hull*

IEC 60146-1-1:2009, *Semiconductor Converters – General Requirements And Line Commutated Converters – Part 1-1: Specification Of Basic Requirements*

IEC 60898-1:2015/AMD1:2019/COR1:2020, *Electrical accessories — Circuit-breakers for overcurrent protection for household and similar installations — Part 1: Circuit-breakers for a.c. operation*

IEC 60945:2002, *Maritime navigation and radiocommunication equipment and systems — General requirements — Methods of testing and required test results*

IEC 60947-2:2019, *Low voltage switchgear and control gear — Part 2: Circuit breakers*

IEC 61558-2-4:2021, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V — Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers*

IEC 61558-2-6:2021, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V — Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers*

IEC 62742:2021, *Electrical and electronic installations in ships – Electromagnetic compatibility (EMC) – Ships with a non-metallic hull*

3 Terms and definitions

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

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
safety voltage
<AC> voltage which does not exceed AC 50 V r.m.s. between conductors, or between any conductor and earth, in a circuit isolated from the supply by means such as a safety isolating transformer, or converter with separate winding <DC> voltage which does not exceed 50 DC V between conductors, or between any conductor and earth, in a circuit which is isolated from higher voltage circuits

Note 1 to entry: Consideration should be given to the reduction of the limit of 50 V under certain conditions, such as wet surroundings or exposure to heavy seas or where direct contact with live parts is involved.

Note 2 to entry: The voltage limit should not be exceeded either at full load or no load, but it is assumed, for the purpose of this definition, that any transformer or converter is operated at its rated supply voltage.

[SOURCE: IEC 60092-101:2018,[4] 1.3.19]

3.2
rated voltage
U_0
<TN systems> nominal AC r.m.s. line voltage to earth <IT systems> nominal AC r.m.s. voltage between line conductor and neutral conductor <DC systems> nominal DC voltage between poles

[SOURCE: IEC 60092-507:2014, 3.1.4]

3.3
live part
conductor or conductive part intended to be energized in normal operation including a neutral conductor, but by convention not a PEN conductor (a conductor combining the functions of both a protective conductor and a neutral conductor)

Note 1 to entry: This term does not necessarily imply risk of electric shock.

[SOURCE: IEC 60050-195:1998, 195-02-19, modified as follows: The text “or a PEM conductor or PEL conductor” has been deleted. The text in brackets has been added]

3.4
earthed
grounded, en US
connected to the general mass of the hull of the craft in such a manner as will ensure at all times an immediate discharge of electrical energy without danger

[SOURCE: IEC 60092-101:2018, 1.3.9,]

3.5
readily accessible
capable of being reached quickly and safely for effective use without the use of tools

[SOURCE: ISO 13297:2014, 3.17]

3.6
final circuit
portion of a wiring system extending beyond the final overcurrent protection device for that circuit

[SOURCE: IEC 60092-101:2018, 1.3.17, modified – The words “overcurrent protective device of a board” have been replaced with “overcurrent protection device for that circuit”]

3.7
overcurrent protection device
device provided to interrupt an electric circuit in case the conductor current in the electric circuit exceeds a predetermined value for a specified duration

3.8
fuse
device that by the fusing of one or more of its specifically designed and proportioned components, opens the circuit in which it is inserted by breaking the current when this exceeds a given value for a sufficient time

Note 1 to entry: The fuse comprises all the parts that form the complete device.

[SOURCE: IEC 60050-441:1984, 441-18-01, modified]

3.9
circuit-breaker
mechanical switching device capable of making, carrying and breaking currents under normal circuit conditions, and also making, carrying for a specified time and breaking currents under specified abnormal circuit conditions such as those of a short circuit

[SOURCE: IEC 60050-441:1984, 441-14-20]