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Small craft — Electric propulsion system

Petits navires — Système de propulsion électrique

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ISO/CEN PARALLEL PROCESSING

This draft has been developed within the International Organization for Standardization (ISO), and processed under the **ISO lead** mode of collaboration as defined in the Vienna Agreement.

This draft is hereby submitted to the ISO member bodies and to the CEN member bodies for a parallel five month enquiry.

Should this draft be accepted, a final draft, established on the basis of comments received, will be submitted to a parallel two-month approval vote in ISO and formal vote in CEN.

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 16135 was prepared by Technical Committee ISO/TC 188, *Small craft* together with CEN/BT/WG 69, *Small craft* and IEC/TC 18, *Electrical installations of ships and of mobile and fixed offshore units*.

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Introduction

Electrical propulsion systems are becoming more common recreational craft and other small vessels. System voltages over 50 VDC and 250 VAC single phase and 500 V AC three-phase may have increased levels of electrical risk. It is important to protect persons from exposure to these hazards.

ISO 10133, ISO 13297 and IEC 60092-507 are limited to recommendation for the design, construction, installation, etc of direct current systems that operate at a voltage of 50V or less and single phase alternating current electrical systems operating at frequencies of 50 Hz or 60 Hz and less than 250 V respectively. Emerging technologies for system voltages and frequencies greater than those allowed by the current small craft standards are increasing in use, especially for electrical propulsion systems.

This standard is a compilation of the key safety requirements of commonly used national and international standards related to voltages and frequencies in excess of those covered by ISO 10133 and ISO 13297, as well as recommendations for the design, construction, and installation of electrical systems and components used in higher voltage electric propulsion systems.

It should be noted that IEC 60092-507 Electrical installation in ships – Part 507, exists for small vessels up to 50 m/500 GT including three-phase alternating current systems not exceeding 500 VAC and their directly associated single phase components not exceeding 250 VAC at 50 Hz or 60 Hz, and DC systems and sub-systems not exceeding 50V nominal.

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Small craft — Electric propulsion system

1 Scope

This International Standard, together with ISO 10133 and ISO 13297, addresses the design and installation of AC and 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. These systems may operate at more than 500 V AC three-phase/250 V AC single phase, but less than 1000 V AC, and direct current (DC) systems operating at more than 50 V DC nominal but less than 1000 V DC. Electrical propulsion system includes mainly battery banks, motors, motor-generators, power converters and associated controls. This document applies to craft up to 24 m length of the hull.

Electromagnetic compatibility and environmental testing requirements for the system and components covered in this standard can be found in ISO 25197.

Requirements for electrical/electronic control system for steering, shift and throttle can be found in ISO 25197.

For craft operating with 50 V DC or less ISO 10133 applies.

For craft operating with single-phase 250 V AC or less ISO 13297 applies.

It 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.

NOTE Future editions may cover other forms energy storage including fuel cells, and associated fuels and other forms of energy storage.

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

IEC 60092-507, *Electrical Installations in Ships — Part 507: Small Vessel*

ISO 4589-3, *Plastics — Determination of burning behaviour by oxygen index — Part 3: Elevated-temperature test*

ISO 7010:2011, *Graphical symbols — Safety colors and safety signs — Registered safety signs*

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

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

ISO 10240, *Small craft — Owner's manual*

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

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

3 Terms and definitions

For the purpose of this document the following terms and definitions apply.

3.1 battery pack
mechanical assembly comprising battery cells and retaining frames or trays and possibly components for battery management

3.2 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 conditions such as those of a short circuit

3.3 disconnecter
mechanical switching device which, in the open position, complies with the requirements specified for the isolating function

3.4 earthed grounded (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

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

3.6 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

3.7 switch (mechanical)
mechanical switching device capable of making, carrying and breaking currents under normal circuit conditions which may include specified operating overload conditions and also carrying for a specified time currents under specified abnormal circuit conditions such as those of short circuit

Note 1 to entry: A switch may be capable of making but not breaking short-circuit currents.

3.8 panel board switchboard
assembly of devices, such as circuit breakers, fuses, switches, instruments and indicators, for the purpose of controlling and/or distributing electrical power

Note 1 to entry: Examples of devices include circuit breakers, fuses, switches, instruments and indicators

1) Under preparation

4 General

4.1 Electric propulsion circuits shall not interact with other circuits in such a way that either would fail to operate as intended.

4.2 The electric propulsion system can include several sub-systems and components including but not limited to:

- battery
- battery management systems
- generators;
- AC/DC, DC/DC, DC/AC, AC/AC converters;
- electric propulsion motors;
- propulsion panel board;
- motor control centres;
- transformers;
- cables and cabling;
- isolators, switches, disconnectors, fuses and breakers.

Each of these components shall be constructed to the relevant ISO/IEC standard that applies.

4.3 Distribution systems shall for:

a) DC be either:

- 1) a fully insulated two wire DC system (IT) or;
- 2) a two-wire DC system with negative earthed/bonded (TN-S, TN-C, TN-C-S, TT);

b) AC be either, or a combination of:

- 1) single-phase systems or final circuits with:
 - i) single-phase two-wire insulated;
 - ii) single-phase two-wire with neutral earthed;
 - iii) single-phase two-wire with mid-point earthed for lighting and socket-outlets;
 - iv) single-phase three-wire with mid-point earthed, but without hull return;
- 2) three-phase systems with:
 - i) three-phase three-wire insulated three-phase (IT);
 - ii) four-wire with neutral earthed (TN-C type) but without hull return;
 - iii) five-wire with neutral earthed (TN-S) but without hull return.