SLOVENSKI STANDARD
oSIST prEN ISO 13297:2018

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Mala plovila - Električni sistemi - Inštalacije za izmenični tok (ISO/DIS 13297:2018)

Small craft - Electrical systems - Alternating current installations (ISO/DIS 13297:2018)

Kleine Wasserfahrzeuge - Elektrische Systeme - Wechselstrom- und Gleichstromanlagen (ISO/DIS 13297:2018)

Petits navires - Systèmes électriques - Installations à courant alternatif

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Small craft — Electrical systems — Alternating and direct current installations

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Foreword

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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).

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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 188, *Small craft*.

This fifth edition cancels and replaces the fourth edition (ISO 13297:2014), which has been technically revised.

The main changes compared to the previous edition are as follows:

— xxx xxxxxxx xxx xxxx

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.

Small craft — Electrical systems — Alternating and direct current installations

IMPORTANT — The colours represented in the electronic file of this document can be neither viewed on screen nor printed as true representations. Although the copies of this document printed by ISO have been produced to correspond (with an acceptable tolerance as judged by the naked eye) to the requirements of ISO 3864-4, it is not intended that these printed copies be used for colour matching. Instead, consult ISO 3864-4, which provides colorimetric and photometric properties together with, as a guideline, references from colour order systems.

1 Scope

This International Standard specifies the requirements for the design, construction and installation of the types of d.c. and a.c. electrical systems described below, either individually or in combination.

a) low-voltage alternating current electrical systems which operate at nominal voltages of less than 250 V single phase and extra-low-voltage direct current (d.c.) electrical systems which operate at nominal potentials of 50 V d.c. or less on small craft.

b) Single-phase alternating current systems which operate at a nominal voltage not exceeding a.c. 250 V.

It is noted that IEC 60092-507 applies to recreational craft of less than 24 m hull length in respect of three-phase alternating current installations which operate at a nominal voltage not exceeding a.c. 500 V.

This standard does not cover the following:

— electrical propulsion circuits exceeding 50 V d.c.. which are addressed by ISO 16315;

— Any conductor that is part of an outboard engine assembly and which does not extend beyond the outboard engine manufacturers supplied cowling.

Additional information to be included in the owner's manual is listed in Annex B.

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.

ISO 7010, *Graphical symbols — Safety colours and safety signs — Registered safety signs*

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

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

IEC 60079-0, *Explosive atmospheres — Part 0: General requirements*

IEC 60309-2, *Plugs, socket-outlets and couplers for industrial purposes — Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories*

IEC 60446, *Basic and safety principles for man-machine interface marking and identification — Identification of conductors by colours or numerals*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)*

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

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:

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

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

3.1
craft's earth
protective ground
connection, provided for safety purposes, that is established by a conducting connection with the common ground/earth (potential of the earth's surface)

3.2
equipotential bonding conductor
normally non-current-carrying conductor used to put various exposed conductive parts of direct current electrical devices and extraneous conductive parts at a substantially equal potential

3.3
engine negative terminal
terminal on the engine, starter or solenoid to which the negative battery cable is connected

3.4
main grounding
earthing point
main point that provides connection for the d.c. negative conductor, a.c. protective grounding conductor and bonding conductor to the craft's ground that is established by a conducting connection (intended or accidental) with the common ground (potential of the earth's surface)

Note 1 to entry: It may include any conductive part of the wetted surface of the hull in permanent contact with the water, depending on the overall system design.

3.5
overcurrent protection (device)
device, such as a fuse or circuit breaker, designed to interrupt the circuit when the current flow exceeds a predetermined value for a predetermined time

3.6
residual current device
RCD
electro-mechanical switching device or association of devices designed to make, carry and break currents under normal service conditions and to cause the opening of contacts when the residual current attains a given value under specified conditions

Note 1 to entry: RCDs serve to reduce the risk of injury to people from electrical shock hazard, and damage to equipment from leakage of stray currents to earth or to other circuits.

3.7
polarization transformer
transformer which automatically orientates the neutral and active (phase) conductors in the system in the same polarity orientation as the polarized system of the craft

3.8
isolation transformer
a transformer installed in the shore power supply circuit on a boat to electrically isolate all the normally live conductors, and the protective conductor on the boat from the a.c. system conductors of the shore power supply

3.9
neutral conductor
conductor intentionally maintained at ground potential and capable of contributing to the transmission of electrical energy

3.10
protective conductor
protective grounding conductor
conductor, not normally carrying current, used for some measure of protection against electric shock, for electrically connecting any of the following parts of electrical equipment to the craft's ground (earth) and to the shore a.c. grounding conductor through the shore power cable:

a) exposed conductive parts of electrical equipment;

b) extraneous conductive parts;

c) the main grounding (earthing) terminal;

d) earth electrode(s);

e) the earth point of a source, or an artificial neutral

3.11
live conductor
conductor or conductive part intended to be energized in normal use, including a neutral conductor

3.12
active (phase) conductor
any conductor that is maintained at a difference of potential from the neutral or protective conductor

Note 1 to entry: In a system that does not include a neutral or protective conductor, all conductors are to be considered active conductors.

3.13
ignition-protected equipment
equipment designed and constructed to give protection against ignition of surrounding flammable gases as outlined in ISO 8846

3.14
overcurrent protection device
device designed to interrupt the circuit when the current flow exceeds a predetermined value for a predetermined time

EXAMPLE A fuse or circuit breaker.

3.15
system voltage(s)
nominal voltage supplied to the a.c. and or a.c. distribution panel board (switchboard) from the power source

3.16
exposed conductive part
conductive part of electrical equipment, which can be touched and which is not normally live, but which can become live under fault conditions

3.17
panel board
switchboard
an assembly of devices for the purpose of controlling and/or distributing electrical power. It may include devices such as circuit breakers, fuses, switches, intruments, and indicators

3.18
polarized system
system in which the live conductors (active and neutral) are connected in the same relation to all terminals on devices or receptacles (socket outlets) in a circuit

3.19
fully insulated two-wire D.C. system
system in which both positive and negative poles remain isolated from the ground (earth), e.g. not connected to the water through a metallic hull, the propulsion system or earthed through the a.c... protective conductor

Note 1 to entry: Some systems may use a momentary ground connection for engine starting purposes and may remain isolated.

3.20
self-limiting
device whose maximum output is restricted to a specified value by its magnetic or electrical characteristics

3.21
two-wire D.C. system with negative ground (earth)
system in which the D.C. negative is connected to the ground through a metallic hull, the propulsion system or other means

3.22
shore power appliance inlet
fitting designed for mounting on a craft, of a shrouded male type, to connect to the female connector on the craft end of the shore power cable in order to make the electrical connection for transmission of electrical energy

3.23
trip-free 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 overload or short circuit, and which is designed so that the resetting means cannot be manually held in place to override the current-interrupting mechanism

3.24
accessible
capable of being reached for inspection, removal or maintenance without removing the craft's permanent structure

3.25
readily accessible
capable of being reached quickly and safely for effective use without the use of tools

3.26
sheath
uniform and continuous tubular protective covering of metallic or non-metallic material around one or more insulated conductors

Note 1 to entry: Examples of appropriate materials include moulded rubber, moulded plastic, woven sleeving or flexible tubing.

3.27
conduit
part of a closed wiring system of circular or non-circular cross-section for insulated conductors and/or cables in electrical installations, allowing them to be drawn in and/or replaced

3.28
cable trunking
system of closed enclosures comprising a base with a removable cover intended for the complete surrounding of insulated conductors, cables, cords and for the accommodation of other electrical equipment

3.29
double-pole circuit breaker
device intended to interrupt both the neutral and active (phase) conductors in a circuit simultaneously when a designated current is exceeded for a predetermined time

3.30
fuse
protective device that interrupts the circuit irreversibly when the current flow reaches a specified value for a specific time

[SOURCE: ISO 8820-1:2008, 3.1]

3.31
galvanic isolator
device which can be installed in series with the a.c. protective conductor of the shore power cable to block low voltage d.c. galvanic current flow, but permit the passage of a.c. normally associated with the protective conductor

3.32
inverter

device powered by a d.c. source, designed primarily to provide a.c. at a required voltage and frequency

3.33
inverter/charger

device designed to supply either a.c. power to a craft's electrical system or to utilize the craft's a.c. electrical distribution system to charge or maintain a battery or batteries supplying d.c.

3.34
extraneous conductive part
conductive part liable to introduce a potential, generally earth potential, and not forming part of the electrical installation

3.35
ground plate
means to conduct the electrical current from a boats conductive element to the water

4 General requirements, DC and AC Systems

4.1 The hull of a metallic hull craft shall not be used as a circuit conductor.

4.2 Craft equipped with both d.c and a.c. electrical systems shall have their distribution from either separate panel boards or from a common one with a partition or other positive means provided to separate clearly the a.c. and d.c. sections from each other, and shall be clearly identified. Wiring diagrams to identify circuits, components and conductors shall be included with the craft.

NOTE After completing an a.c. installation it is recommended to perform a system test according to Annex C.

4.3 Switches and controls shall be marked to indicate their function, unless the purpose of the switch is obvious and if operation of the switch could not, under normal operating conditions, cause a hazardous condition.

5 General requirements, d.c. Systems

5.1 The system type shall be either a fully insulated two wire d.c. system or a two-wire d.c. system with negative ground. Engine-mounted wiring systems can use the engine block as the grounded conductor.

For d.c. systems with a negative ground, the main grounding/earthing point shall be either:

a) the engine negative terminal; or

b) a main grounding bus of sufficient current carrying capacity.

Systems with multiple battery banks shall have a common negative connection. Exceptions to this are for dedicated power systems isolated from boat system e.g. propulsion system that are clearly identified as part of the isolated system.

5.2 An equipotential bonding conductor, if fitted, shall be connected to the craft's main grounding/earthing point.

5.3 Protective devices such as trip free circuit breakers or fuses shall be provided at the source of power, e.g. the panelboard (switchboard), to interrupt any overload current in the circuit conductors before heat can damage conductor insulation, connections or wiring system terminals.

5.3.1 The selection, arrangement and performance characteristics shall be such that:

a) maximum continuity of service to healthy circuits when fault conditions exist in other circuits through selective operation of the various protective devices; and

b) protection of electrical equipment and circuits from damage due to overcurrents by coordination of the electrical characteristics of the circuit or apparatus and the tripping characteristics of the protective devices.

5.4 All d.c. equipment shall be capable of function within a voltage range of 75 % to 133 % of nominal voltage at the battery terminals, e.g.:

— for a 12 V system: 9 V to 16 V

— for a 24 V system: 18 V to 32 V

— for a 48 V system: 36 V to 64 V

EXCEPTION Where the circuit includes equipment requiring a higher minimum voltage, the specified minimum voltage shall be used in the calculation of the conductor size. See Annex A.

5.5 The length and cross sectional area of conductors in each circuit shall be such that the calculated voltage drop shall not exceed 10 % of the nominal voltage.

5.6 equipment vital to safety, where the voltage drop is critical shall be supplied with the proper voltage to achieve the rated performance.

NOTE 1 See Annex A for voltage drop calculations.

NOTE 2 A 3 % voltage drop is acceptable for this equipment.

Examples of circuits that are dependent on a minimum voltage drop include:

a) panel board/switchboard main conductors;

b) navigation lights;

c) bilge blowers; and

d) bilge pumps.

6 General requirements, a.c. Systems

6.1 The protective conductor insulation shall be green or green with a yellow stripe. Neither colour shall be used for current-carrying conductors.

NOTE The equipotential bonding conductor of the d.c. electrical system also uses green or green with a yellow stripe insulation and is connected to various exposed conductive parts of d.c. electrical devices, other extraneous conductive parts and the d.c. negative ground/earth.

6.2 For craft having a fully insulated d.c. system, the a.c. protective conductor shall be connected to:

a) the hull of a metallic hulled craft;

b) for non-conductive hulls, the craft's external ground/earth or ground plate.

6.3 The a.c. protective conductor(s) shall be provided with a final (single) connection to the hull of a metallic hull craft, or if the craft has a non-metallic hull, to the main grounding/earthing point of the craft.

6.4 On metallic hulls, the point of connection of the protective conductor shall be located above any anticipated water accumulation.

6.5 Metallic housings or enclosures of permanently installed a.c. electrical appliances shall be connected to the protective conductor system in the craft.

6.6 Individual circuits shall not be capable of being energized by more than one source of electrical power at a time. Each shore power inlet, generator or inverter is a separate source of electrical power. The transfer from one power source circuit to another shall be made by a means which opens all current-carrying conductors, active (phase) and neutral, before closing the alternate source circuit, to prevent arc-over between contacts, and should be interlocked by mechanical or electromechanical means. A device that simultaneously breaks both current carrying conductors, active (phase) and neutral, shall be used when changing power sources.

The requirements for overcurrent protection are found in Clause13. A combination of power sources can be used provided that:

a) the device is constructed and tested to an applicable recognized standard;

b) the device includes protection to prevent backfeeding to shore power. (anti-islanding protection) ;

c) the device includes personnel protection against backfeeding; and

d) the installation is performed according to the manufacturer’s instructions.

6.7 Energized parts of electrical equipment shall be guarded against accidental contact by the use of enclosures of at least IEC 60529-IP 2X or other protective means which shall not be used for non-electrical equipment. Access to energized parts of the electrical system shall require the use of hand tools or be at least IP 2X, unless otherwise specified. A suitable warning sign shall be displayed (see 5.2).

6.8 The neutral conductor shall be grounded (earthed) only at the source of power, i.e. at the onboard generator, the secondary of the isolation or polarization transformer, the shore power connection or