INTERNATIONAL STANDARD

ISO 13297

First edition
1995-12-15

Small craft — Electrical systems — Alternating current installations

Navires de plaisance — Systèmes électriques — Installations de distribution de courant alternatif

Reference number
ISO 13297:1995(E)

Contents

International Organization for Standardization
Case Postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

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.

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.

International Standard ISO 13297 was prepared by Technical Committee ISO/TC 188, *Small craft*.

Annex A forms an integral part of this International Standard. Annexes B and C are for information only.

This page intentionally left blank

Small craft — Electrical systems — Alternating current installations

1 Scope

This International Standard establishes the requirements for the design, construction and installation of low-voltage alternating current electrical systems which operate at nominal voltages less than 250 V single phase on small craft of up to 24 m length of hull.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

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

ISO 9094-1:—[1], *Small craft — Fire protection — Part 1: Craft with a hull length of up to and including 15 m.*

ISO 10239:—[1], *Small craft — Liquefied petroleum gas (LPG) systems.*

IEC 529:1989, *Degrees of protection provided by enclosures (IPcode).*

1) To be published.

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 craft ground [earth]: Ground which is established by a conducting connection (intended or accidental) with the common ground/earth (potential of the earth's surface), including any conductive part of the wetted surface of the hull.

3.2 ground fault circuit interrupter (GFCI); residual (differential) current device (RCD): Mechanical or electro-mechanical switching device or association of devices intended to cause the interruption of the current to the load when the residual current attains a given value.

NOTE 1 GFCI serve to reduce the risk of injury to people from electrical shock hazard.

3.3 polarization transformer: Transformer which automatically orientates the neutral and live conductors in the system in the same polarity orientation as the polarized system of the craft.

3.4 neutral conductor: Conductor connected to the neutral point of a system and contributing to the transmission of electrical energy.

3.5 protective earthing [grounding] conductor: Conductor, not normally carrying current, used for some measures of protection against electric shock connecting exposed conductive parts of electrical equipment to the craft ground/earth.

3.6 live conductor: Conductor normally carrying current from a power source to an electrical device or receptacle.

3.7 ignition-protected: Equipment designed and constructed to comply with ISO 8846.

3.8 overcurrent protection device: Device, such as a fuse or circuit breaker, designed to interrupt the circuit when the current flow exceeds a predetermined value.

3.9 panel board: Assembly of devices, such as circuit breakers, fuses, switches, instruments and indicators, for the purpose of controlling and/or distributing electrical power.

3.10 polarized system: System in which the neutral and live conductors are connected in the same relation to all terminals on devices or receptacles in a circuit. (See 3.6.)

3.11 self-limiting device: Equipment with its maximum output restricted to a specific value by its own magnetic and electrical characteristics.

3.12 shore-power 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.

3.13 trip-free circuit breaker: Thermal and/or magnetically operated overcurrent protection device, designed so that the resetting means cannot be manually held in place to override the current-interrupting mechanism.

3.14 accessible: Capable of being reached for inspection, removal or maintenance without removal of permanent structure of the craft.

3.15 readily accessible: Capable of being reached quickly and safely for effective use without the use of tools.

3.16 sheath: Uniform and continuous tubular covering consisting of non-metallic material, such as overlapping electrical tape, moulded rubber, moulded plastics, woven sleeving or flexible tubing, around one or more insulated conductors.

3.17 conduit: Part of a closed wiring system for the protection of conductors or cables in electrical installations, allowing them to be drawn in and/or replaced, but not inserted laterally.

3.18 cable trunking: Manufactured enclosure for the protection of conductors or cables, normally of rectangular cross-section, of which one side is removable or hinged.

3.19 polarized receptacle: Receptacle permitting the insertion of the appliance plug in one polarity orientation only.

3.20 double-pole circuit breaker: Device intended to interrupt both the neutral and live conductors in a circuit simultaneously when a designated current is exceeded.

3.21 captive spade or captive terminal: Conductor terminal component which is maintained in the connection to the screw or stud even when the threaded terminal fastener is loose.

4 General requirements

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

4.2 The protective conductor shall be connected to the craft's d.c. negative ground/earth as close as practicable to the battery negative terminal.

4.3 Metallic craft hulls shall not be used as a conductor or protective conductor.

4.4 The protective conductor shall be connected to metallic hulls at one point only at a location above any anticipated water accumulation.

4.5 For non-metallic craft hulls, the protective conductor or battery negative terminal shall be connected to an earth plate of conductive material not subject to electrolytic action installed below the waterline on the outside of the hull, or adequate earthing of the protective conductor to the water shall be maintained through metallic propulsion system or steering system components not used for anodic protection.

4.6 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 to another shall be made by means which prevents arc-over between contacts, and is interlocked by mechanical or electromechanical means.

4.7 Energized parts of electrical equipment shall be guarded against accidental contact by the use of enclosures of at least IEC 529-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).

4.8 The neutral conductor shall be grounded only at the source of power, i.e. at the onboard generator, the secondary of the isolation or polarization transformer, or the shore-power connection. The shore power neutral shall be grounded through the shore power cable and shall not be grounded on board the craft.

4.9 The craft ground/earth shall be connected to the ground/earth of the shore-power source unless an isolation transformer is fitted. If an isolation transformer is fitted, the craft ground/earth shall not be connected to the ground/earth of the shore-power source.

4.10 A galvanic isolator or other suitable device may be fitted in the protective conductor to resist imported stray galvanic current flow while permitting the passage of a.c. current, if present. Galvanic isolators shall be designed to withstand the application of power from a short-circuit test from a source capable of delivering 5 000 A r.m.s. symmetrically to its output test terminals. After three applications of the short-circuit test, the electrical and mechanical characteristics of the isolator shall be unchanged.

5 Marking

5.1 Shore-power inlets shall be marked to indicate voltage, current and, if there is more than one inlet, the circuit served.

5.2 A permanently mounted waterproof warning sign shall be located at the panel board on the craft. The sign shall include the information shown in figure 1a) or 1b).

a) Suggested warning sign using symbols

WARNING — To minimize shock and fire hazards:

1) **Turn off craft shore-power connection switch before connecting or disconnecting shore-power cable.**
2) **Connect shore-power cable to craft inlet before connecting to shore-power source.**
3) **If polarity indicator is activated, immediately disconnect cable.**
4) **Disconnect shore-power cable at shore-power source first.**
5) **Close shore-power inlet cover tightly.**

DO NOT ALTER SHORE-POWER CABLE CONNECTORS.

NOTES

2 Item 3 is required only if a polarity indicator is required in the system.

3 Items 2, 4 and 5 are not required for permanently connected shore power cable installations.

b) Suggested warning sign with text in language appropriate to the country of use

Figure 1 — Suggested warning signs

5.3 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.

5.4 Electrical equipment shall be marked or identified to indicate:

a) manufacturer's identification;

b) model number or designation;

c) a.c. electrical rating in volts and amperes or volts and watts;

d) phase and frequency, if applicable;

e) ignition protected, if applicable, by ISO 8846.

6 Ignition sources

6.1 Electrical components installed in compartments which may contain explosive gases shall be ignition-protected in accordance with ISO 8846 and shall be located in accordance with ISO 9094.

6.2 Craft with LPG systems shall have ignition-protected electrical components located in accordance with ISO 10239.

7 Overcurrent protection

7.1 A manually reset trip-free circuit breaker shall be installed within 0,5 m of the source of power for each circuit or conductor of the system or, if impractical, the conductor shall be contained within a protective covering for its entire length from the source of power to the circuit breaker, such as a junction box, control box, enclosed panel board or within conduit or cable trunking. For main supply circuits to panel boards, a manually reset trip-free circuit breaker shall be installed within one-half hull length of the craft's shore-power cable connection, generator or inverter terminals.

7.2 In unpolarized systems, double-pole circuit breakers opening both live and neutral conductors are required.

7.3 Overcurrent protection devices for motor loads shall have a predetermined value of current flow consistent with demand load characteristics of the protected circuit and their location in the craft, i.e. machinery space or other space.

7.4 All a.c. motor installations and each motor of a motor-operated device shall be individually protected in accordance with 7.3 by an overcurrent or thermal protection device.

An exception may be made for motors that will not overheat under continuous locked rotor conditions.

7.5 The rating of the overcurrent protection device shall not exceed the maximum current-carrying capacity of the conductor being protected. See table A.1.

7.6 Main supply circuits

7.6.1 Double-pole circuit breakers shall be installed in conductors to the main power supply circuits.

7.6.2 Overcurrent protection shall be provided for isolation and polarization transformers, including a bank of two or three single-phase transformers operating as a unit. Each transformer shall be protected by an individual overcurrent device on the primary side, rated at not more than 125 % of the rated primary current of the transformer.

7.7 Branch circuits

7.7.1 The live conductor of each branch circuit in a polarized system shall be provided with overcurrent protection, i.e. fuse or circuit breaker, at the point of connection to the main panel board bus.

7.7.2 Live and neutral conductors of each branch circuit in unpolarized systems shall be provided with overcurrent protection by double-pole circuit breakers at the point of connection to the main panel board bus.

8 Ground fault protection/Earth leakage protection

8.1 GFCI and RCD breakers shall be of the trip-free type.

8.2 The main supply circuit shall be equipped with a double pole GFCI(RCD) breaker having a maximum nominal trip sensitivity of 30 mA and 100 ms maximum trip time.

8.3 The GFCI (RCD) device shall have an internal circuit for manual testing of the trip function.

8.4 GFCI(RCD) double-pole receptacle devices may be installed as part of a convenience outlet installation, either in single-outlet applications or in multiple "feed through" installations.

9 Appliances and equipment

9.1 Appliances and fixed a.c. electrical equipment installed on a craft shall have exposed electrically conductive non-current carrying surfaces connected to the protective conductor, unless the appliance is of double-insulated construction.

9.2 Integral overcurrent protection may be provided.

10 System wiring

10.1 Conductors shall have a minimum rating of 300/500 V. Flexible cords shall have a minimum rating of 300/300 V.

10.2 Conductors and flexible cords shall be multi-strand copper, and of sizes no smaller than those determined by reference to table A.1.

NOTE 4 A conductor used for equipment grounding is not considered to be a current-carrying conductor in this context.

10.3 The insulation temperature rating of conductors and flexible cords outside engine spaces shall be at least 60 °C.

10.4 Conductors shall be at least 1 mm^2 area.

An exception may be made for conductors of minimum 0,75 mm^2 area which may be used as internal wiring in panel boards.

10.5 Conductor insulation temperature rating in engine spaces shall be oil-resistant at 70 °C minimum, or protected by insulating conduit or sleeving, and shall be derated in allowable current-carrying capacity in accordance with annex A.

10.6 The protective conductor shall have the same or greater cross-sectional area as the live conductor in the supply circuit.

11 Installation

11.1 Conductor connections shall be in locations protected from the weather or in IEC 529-IP 55 enclosures as a minimum. Connections above deck exposed to intermittent immersion shall be in IEC 529-IP 56 enclosures as a minimum.

11.2 Conductors shall be supported throughout their length in conduits, cable trunks or trays, or by individual supports at maximum intervals of 450 mm, with the first support not more than 1 m from the terminal.

11.3 If a.c. and d.c. conductors or multiconductors are run together in trunking, conduit or trays, the a.c. conductors shall be sheathed or bundled separately from the d.c. conductors or shall be adequately screened and kept a minimum of 100 mm from the d.c. conductors.

11.4 Current-carrying conductors shall be routed above foreseeable levels of bilgewater and other areas where water may accumulate.

If conductors must be routed in the bilge area, the wiring and connections shall be in IEC 529-IP 67 enclosures, such as a continuous conduit, as a minimum.

11.5 Metals used for terminal studs, nuts and washers shall be corrosion-resistant and galvanically compatible with the conductor and terminal. Aluminium and unplated steel shall not be used for studs, nuts or washers in electrical circuits.

11.6 All conductors shall have suitable terminals installed, i.e. no bare wires to stud connections unless end strands are made rigid by soldering over the length of their contact with the terminal post connection. Soldered connections shall not be used for connecting or terminating any conductor of nominal cross-sectional area greater than 2,5 mm^2.

11.7 The terminal screw or nut shall not bear directly on the conductor wire strands unless the strands have been fused together and made rigid by soldering and formed into a loop or hook to meet the retention requirements of 11.13 and 11.14.

11.8 Terminals shall be of the ring or captive spade type not dependent on screw or nut tightness alone for retention on the screw or stud.

An exception is that friction-type connectors may be used in circuits not exceeding 20 A if the connection does not separate when subjected to a force of 20 N.

11.9 Twist-on connectors (wire nuts) shall not be used.