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**Small craft — Electrical/electronic control  
systems for steering, shift and throttle**

*Petits navires — Systèmes électriques/électroniques pour le contrôle de  
la direction, de l'inverseur et des gaz*

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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.

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.

ISO 25197 was prepared by Technical Committee ISO/TC 188, *Small craft*.

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# Small craft — Electrical/electronic control systems for steering, shift and throttle

## 1 Scope

This International Standard establishes the requirements for design, construction and testing of electrical/electronic steering, shift and throttle and dynamic position control systems, or combinations thereof, on small craft of up to 24 m length of hull.

## 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.

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

ISO 8848, *Small craft — Remote steering systems*

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

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

ISO 10592, *Small craft — Hydraulic steering systems*

ISO 11591, *Small craft, engine-driven — Field of vision from helm position*

ISO 12215-8, *Small craft — Hull construction and scantlings — Part 8: Rudders*

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

ISO 16750-2:2010, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 2: Electrical loads*

ISO 16750-3:2007, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 3: Mechanical loads*

ISO 16750-4, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 4: Climatic loads*

IEC 60068-2-27, *Environmental testing — Part 2-27: Tests — Test Ea and guidance: Shock*

IEC 60068-2-52, *Environmental testing — Part 2-52: Tests — Test Kb: Salt mist, cyclic (sodium chloride solution)*

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

IEC 60533:1999, *Electrical and electronic installations in ships — Electromagnetic compatibility*

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

IEC 61000-4-5, *Electromagnetic compatibility (EMC) — Part 4-5: Testing and measurement techniques — Surge immunity test*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

### 3 Terms and definitions

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

#### 3.1

##### **electric/electronic steering system**

all components, including CPU (central processing unit) and cable harnesses, from the manual steering input device up to and including the device (actuator or electrical motor) regulating the rudder or propulsion unit steering angle

NOTE to entry: It includes the joystick and components, i.e. GPS antennas for dynamic positioning, if installed.

#### 3.2

##### **dynamic-positioning system**

computer-controlled system to automatically maintain a craft's position and heading by using her own propulsion systems with or without the assistance of bow or stern thrusters

#### 3.3

##### **electrical/electronic shift and throttle system**

all components, including CPU (central processing unit) and cable harnesses, from the shift and throttle input device up to and including the device controlling the shift and speed of engines.

#### 3.4

##### **ignition-protected equipment**

electrical equipment designed and tested for use in explosive atmospheres without igniting surrounding flammable gases

#### 3.5

##### **accessible**

capable of being reached for inspection, removal or maintenance without removal of permanent structure of the craft

#### 3.6

##### **readily accessible**

capable of being reached without the use of tools

#### 3.7

##### **nominal voltage(s)**

those commonly used voltages, such as 12 volts, 24 volts, or 36 volts DC

#### 3.8

##### **manoeuvring mode**

reduced power mode for manoeuvring, determined by the manufacturer

#### 3.9

##### **cruising mode**

power mode above manoeuvring mode up to full power, determined by the manufacturer

#### 3.10

##### **X axis**

direction of a craft fore or aft, longitudinally

#### 3.11

##### **Y axis**

direction of a craft port or starboard, transversely

#### 3.12

##### **Z axis**

axis normal to the X-Y plane

**3.13****control head**

single oriented device, other than a steering wheel, for the simultaneous control of steering and propulsion

EXAMPLES Joystick, track-ball or slide levers.

**3.14****control lever**

operator input device for the control of thrust and/or propulsion

**3.15****steering helm**

operator input device for the control of steering

**3.16****joystick**

operator input device for the simultaneous control of thrust, steering and propulsion

**3.17****helm station**

location from which steering, propulsion and thrust can be controlled

**3.18****multiple helm stations**

more than one location in the boat from which steering, propulsion and thrust can be controlled

**3.19****command station**

helm station location that is in active control

**3.20****portable helm**

helm providing a combination of shift or throttle or steering, not permanently affixed to the craft's structure, communicating with the system through wired or wireless means

**3.21****propulsion**

component or components of thrust that permit a craft's movement in any direction

NOTE to entry: Examples of propulsion-generating devices include outboards, stern drives, pod drives, jet drives, inboards and thrusters.

**3.22****radio frequency****RF**

frequency within the range of frequencies suitable for utilization in radio communication

**3.23****actuator**

electromechanical, electropneumatic and/or electrohydraulic device that converts an electrical signal into a mechanical displacement

**3.24****thrust**

propulsive force from craft's main propulsion system or bow or stern thrusters or a combination thereof in order to move or rotate the craft

**3.25****wireless**

mode of communication, monitoring and/or control through the use of electromagnetic, acoustic or optical transmission through atmospheric space

**3.26**  
**damp area**

area where moisture is either permanently or intermittently present

EXAMPLE Bilge, head, galley.

**3.27**  
**wet area**

area exposed to weather

**3.28**  
**interior**

protected area inside the craft

**3.29**  
**EUT**

equipment under test

**3.30**  
**performance criterion**

standard by which the functional status of an EUT during and after testing is judged

**3.31**  
**failure modes and effects analysis**  
**FMEA**

procedure in product development and operations development for analysis of potential failure modes

**3.32**  
**fail-safe mode**

device or feature which, in the event of failure, responds in a way that will cause no harm, or minimize the harm, to other devices and cause no danger, or minimize the danger, to personnel

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**4 General requirements**

**4.1** All electronic/electrical components shall be designed to withstand a reversed-polarity connection of the power leads. This shall not render the component inoperable when subsequently connected to the power correctly.

**4.2** All electronic/electrical components shall be designed with reverse polarity protection from internal surges.

**4.3** DC systems shall comply with ISO 10133. AC systems shall comply with ISO 13297. An acceptable alternative to ISO 10133 and ISO 13297 is given in IEC 60092-507.

**4.4** The system shall be energized whenever the propulsion engine(s) are running.

**4.5** The system, except for dynamic positioning and displays, shall be fully operational within five seconds after being turned on (powered).

**4.6** Multi-installed engine steering systems shall be redundant by virtue of the fact that they are both mechanically and electrically independent of each other. A single device is allowed for control of multiple engines (e.g. steering wheel, joystick).

**4.7** Each helm station shall give a visual indication when active. A main steering position shall be designated and meet the applicable requirements of ISO 11591, with the location included in the owner's manual.

**4.8** Each helm station shall, by visible and/or audible means, alert the operator when the system enters the fail-safe mode.



**4.9** The sound pressure of an audible alarm 1 metre from the command station shall be at least 75 dB(A), but not greater than 85 dB(A). Systems incorporating a mute feature shall maintain the visual alert as long as the failure persists.

If an audible-only alert system is utilized: muting of the alarm is not allowed.

**4.10** Instructions for proper installation and use of the steering system shall be made available by the manufacturer.

**4.11** Operational characteristics, instructions and warnings for proper use shall be described in the owner's manual and/or by on-product labelling.

**4.12** With the exception of an optional temporary override for emergency situations, it shall only be possible to start propulsion equipment in neutral.

NOTE This includes any equipment that drives the propeller or water-jet drive.

**4.13** The steering, shift and throttle actuators shall react/adjust input on a physical input command within 0,5 seconds.

**4.14** Steering wheels shall comply with the requirements of ISO 8848.

**4.15** Hydraulic systems shall comply with the requirements of ISO 10592.

**4.16** Electrical components intended to be installed in petrol engine or petrol tank compartments shall be ignition-protected in accordance with ISO 8846.

**4.17** A risk identification/analysis, using an established method, shall be carried out for each system design.

EXAMPLES Failure modes and effects analysis (FMEA); fault-tree analysis (FTA).

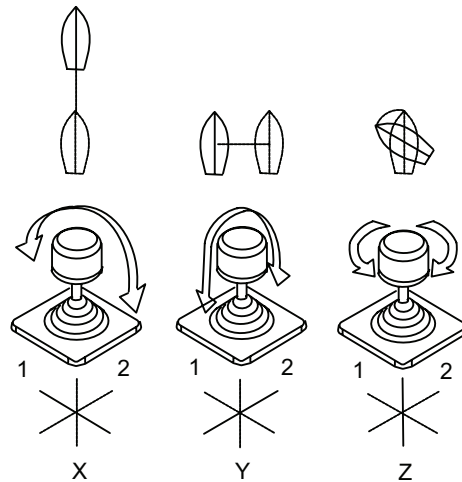
Risk identification and functional safety may be carried out as given in the relevant part of IEC 61508.

**4.18** Systems that provide both cruising- and manoeuvring modes shall provide an indication to the operator at the command station of which mode the system is in, and shall not change modes without input from the operator.

## 5 Control head

**5.1** Control head operation is permitted for both cruising-mode and manoeuvring-mode operation.

**5.2** The control head position shall return to the neutral X, Y and Z axis when the operator releases his/her grip. See Figure 1.



**Key**

- 1 port
- 2 aft

**Figure 1 — X, Y and Z commands**

**5.3** For operation in the cruising mode, the control head engine throttle control need not return to a low RPM or a manufacturer-determined idle state when released.

**5.4** Releasing the control head in the manoeuvring mode to neutral position shall result in:

- a disengaged transmission or water-jet bucket in the neutral position;
- and
- a manufacturer-determined idle state or electric motors in the stopped state.

**5.5** The craft shall move in the same direction as the control head is oriented relative to the craft.

**5.6** Portable helms shall clearly indicate their orientation relative to the craft.

**5.7** If the control head includes a rotation function, the control head activation, clockwise or counter-clockwise, shall result in rotating the craft in the same direction.

**6 Command station transfer**

Transfer of command from one station to another shall be completed at the helm station intended to be active.

**7 Portable helm station controls**

**7.1** Portable helm station controls shall be restricted to permit use only when the manoeuvring mode is selected.

**7.2** Loss of communication or malfunction of the portable helm station control shall result in disengaged transmission and idling thermal engine(s) and stopping electric engine(s). The operator shall be notified of the loss of communications and the system shall not prevent transfer to another helm station.

**7.3** A warning label on the portable helm or where the device is stored or charged prior to use shall be provided to advise the operator of the following warnings through the use of text or applicable ISO graphical symbols:

- keep proper lookout;
- hold on to prevent falling, boat may move suddenly;
- read owner's manual for safe use of the system.

**7.4** For a wireless device, the signal strength shall be displayed at the portable control or an audible warning signal shall alert the operator that the signal is weak and he/she is about to lose control.

**7.5** A wireless device shall only be able to control the boat of origin.

**7.6** A wireless portable helm control shall have an indication of its electrical-charge status. The device shall prevent activation when the charge is insufficient to maintain a connection for 15 minutes without loss of the wireless communication link.

**7.7** A wireless portable helm control shall notify the operator when the device is 15 minutes from deactivation due to insufficient charge.

**7.8** A wireless portable helm control shall meet the requirements of applicable radio and telecommunications legislation.

## 8 Dynamic-positioning system (DPS)

**8.1** It shall only be possible to activate DPS systems manually.

**8.2** DPS systems shall have a display at the craft main helm station for the visual DPS precision value.

**8.3** The following warnings shall be conveyed to the operator upon activation of the DPS through the use of applicable ISO graphical symbols or the following text:

- boat is considered under way;
- keep proper lookout;
- stay out of water, propellers are spinning;
- hold on to prevent falling, boat may move suddenly;
- read owner's manual for safe use of the system.

**8.4** Activation shall only be possible if the DPS precision value is within the manufacturer-set limits.

**8.5** If the dynamic-positioning (autonomous) mode is activated and the DPS precision value is out of the manufacturer-set limits at any time, the control system shall alert the operator visually and audibly of disengagement of the DPS.

**8.6** Maximum allowable envelope/radius and heading deviation shall be manufacturer-set, not adjustable by the operator.

**8.7** Maximum engine speed for dynamic positioning shall be manufacturer-set, not adjustable by the operator.

**8.8** Helm stations not equipped with a display screen shall be labelled with the same warnings as in 8.3.