
**Ships and marine technology —
Electric rudder angle indicators**

*Navires et technologie maritime — Indicateurs de direction des
gouvernails électriques*

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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 8, *Ships and marine technology*, Subcommittee SC 6, *Navigation and ship operations*.

This second edition cancels and replaces the first edition (ISO 20673:2007), which has been technically revised.

The main changes are as follows:

- in [Clause 2](#), deleted IEC 61162-1 and IEC 61162-2;
- in [4.1](#) and [6.1](#), added a provision on displays for presentation and a reference to IEC 62288;
- in new [4.4](#) and [6.6](#), added a provision on alerts and a reference to IEC 62923-1 and IEC 62923-2;
- in [Clause 7](#), updated interface requirements;
- in the Bibliography, added IEC 61162-1, IEC 61162-2, IEC 61162-450, IEC 62288, IEC 62923-1, IEC 62923-2, IMO Resolution MSC.191(79), IMO Resolution MSC.302(87) and IMO Resolution MSC.466(101).

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.

Ships and marine technology — Electric rudder angle indicators

1 Scope

This document specifies the construction, performance requirements, methods of testing and required test results for electric rudder angle indicators required to comply with Clause 2.5.4, Regulation 19, chapter V, SOLAS 1974 (as amended, 2000).

This document is associated with IMO Resolution A.694 (17) and IEC 60945.

Where a requirement in this document is different from IEC 60945, the requirement in this document takes precedence.

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.

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

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

rudder angle indicator

remote device that indicates ship's rudder angle and direction

Note 1 to entry: An indicator system consists of a transmitter and a receiver (indicator).

3.2

analogue-type indicator

indicator that shows the rudder angle in a continuous way, such as by means of an arrow pointer and a graduated scale

3.3

digital-type indicator

indicator that shows the rudder angle in a discrete, alphanumeric way

3.4

calibration accuracy

difference between the angle of the receiver (indicator) shaft and the angle of the transmitter shaft

3.5

damping efficiency

time elapsed for the indicated angle to match the angle of the transmitter shaft

3.6

full scale

range from 0° to the greatest angle of port (or starboard) direction

4 Construction of the indicator system

4.1 General

The construction shall comply with the following requirements.

- a) The indicator system enclosures shall be robust and constructed to facilitate adjustment and maintenance.
- b) The indicator system shall be provided with an earthing terminal or shall be constructed to be capable of being connected to an electrical earth.
- c) The indicator system shall include an analogue-type indicator. A digital-type indicator may additionally be used, if fitted. If a display is used for presentation, the equipment shall comply with MSC.191(79), as amended by MSC.466(101), and IEC 62288.

4.2 Transmitter

The transmitters shall comply with the following requirements.

- a) The transmitter shall be driven by lever or belt, or other suitable means from the rudder head.
- b) The transmitter shall be capable of being adjusted.
- c) Where the transmitter drive includes pivot connections, they shall be designed so as not to be loosened by vibration.

4.3 Receiver (indicator)

The indicator shall comply with the following requirements.

- a) The indicator shall be connected to the transmitters and shall indicate rudder angle and direction.
- b) The maximum angle indicated by the indicator shall be the same for both port and starboard directions and shall not be less than 40°. Scale graduations shall be no less than 1°. The graduation marks for every 5° shall be longer than those for each degree. In the case of wide-angle indicators, with angles of 70° or greater, the graduations may be 2°. In the case of a 2° scale, the graduation line shall be made longer than other scales for every 10° scale.
- c) The pointer of the indicator shall be capable of being adjusted to zero.
- d) The letters and graduations for angles to port on the dial shall be clearly distinguishable from those for angles to starboard.
- e) All illumination and lighting of the indicator shall be adjustable down to zero, except the control of the dimmers which shall remain readable.
- f) The illumination and lighting of the indicators shall be arranged so as not to obstruct an operator's vision at night, and to make the scale, pointer and letters as equally visible as possible even in dim light or the dark.

4.4 Alert

If the equipment is capable of raising an alert, it shall comply with MSC.302(87), IEC 62923-1 and IEC 62923-2.

5 Performance requirements

5.1 General

The transmitter shall have sufficient capacity to satisfy the requirements specified in 5.2, 5.3 and 5.4 when all the connected indicators are operating simultaneously. The manufacturer should specify the capacity of connected indicators.

5.2 Calibration accuracy

- a) When the shaft of the transmitter is gradually rotated from the zero position to the maximum angle port and starboard, and the angles shown by the indicator are recorded every 5° of the rotation, the difference between the angles of the transmitter shaft and the corresponding value shown at the indicator shall be within 1,5 % of the maximum angle.
- b) In equipment where there is conversion into rudder scale, the minimum unit of angle shall be 0,1° and any value less than 0,1° shall be rounded up to 0,1° after conversion.
- c) In cases of wider-angle indication (such as 70°), the angles shown by the indicator may be recorded at every 10°.

5.3 Damping efficiency

When a voltage is suddenly applied while the transmitter shaft is approximately at half of the full-scale position and the indicator pointer is set to the zero position, the pointer shall come to rest to that position within 5 s or less.

5.4 Power supply fluctuation

- a) When the power supply fluctuations specified in 5.4 c) are applied, the performance required by 5.1 and 5.2 shall be maintained.
- b) After repeated makings and breakings, the designated performance shall be demonstrated without carrying out manual adjustments.
- c) When the rated voltage and frequency are subjected to the combinations of fluctuations, as given in Table 1, the designated performance shall be demonstrated.

Table 1 — Power supply fluctuation

Settled condition	Voltage fluctuation	±10 %	Fluctuating period: 600 s
	Frequency fluctuation	±5 %	
Transient condition	Voltage fluctuation	±20 %	Fluctuating period: 3 s
	Frequency fluctuation	±10 %	

5.5 Insulation resistance and high voltage

When insulation resistance and high voltage tests are to be carried out, IEC 60092-504 may be applied.

6 Methods of testing and required test results

6.1 Construction

The construction of the electric rudder angle indicators shall comply with the requirements specified in Clause 4.

If a display is used for presentation, confirm using documented evidence that the equipment complies with IEC 62288.

6.2 Environmental test

Unless otherwise stated in this document, all the tests shall be carried out according to the requirements of IEC 60945. The manufacturer shall determine which components of electric rudder angle indicators will be protected or exposed, as defined in IEC 60945.

6.3 Calibration test

The calibration test shall be carried out in accordance with [5.2](#) and shall satisfy the requirements specified therein.

6.4 Damping test

The damping test shall be carried out in accordance with [5.3](#) and shall satisfy the requirements specified therein.

6.5 Power supply fluctuation test

The power supply fluctuation test shall be carried out in accordance with [5.4](#) and shall satisfy the requirements specified therein.

6.6 Alert test

If the equipment under test is capable of raising an alert, confirm using documented evidence that the equipment complies with IEC 62923-1 and IEC 62923-2.

7 Interface

If the indicator system provides an interface facility, it shall meet the requirements prescribed in IEC 61162-1, IEC 61162-2 or IEC 61162-450.

8 Marking and identification

8.1 Identification

Each unit of the indicator system shall be marked with the following:

- identification of the manufacturer;
- equipment type number or model identification number under which it was type tested;
- serial number of the unit.

8.2 Compass safe distance

Each unit shall be marked with the minimum safe distance from a magnetic compass (for bridge installation). The safe distance shall be measured in accordance with IEC 60945.

9 Information

The manufacturer shall provide adequate equipment documentation to enable competent members of a ship's crew to operate and maintain the equipment efficiently.

Bibliography

- [1] ISO 8468, *Ships and marine technology — Ship's bridge layout and associated equipment — Requirements and guidelines*
- [2] IEC 60092-504, *Electrical installations in ships — Part 504: Special features — Control and instrumentation*
- [3] IEC 61162-1, *Maritime navigation and radiocommunication equipment and systems — Digital interfaces — Part 1: Single talker and multiple listeners*
- [4] IEC 61162-2, *Maritime navigation and radiocommunication equipment and systems — Digital interfaces — Part 2: Single talker and multiple listeners, high-speed transmission*
- [5] IEC 61162-450, *Maritime navigation and radiocommunication equipment and systems — Digital interfaces — Part 450: Multiple talkers and multiple listeners — Ethernet interconnection*
- [6] IEC 62288, *Maritime navigation and radiocommunication equipment and systems — Presentation of navigation-related information on shipborne navigational displays — General requirements, methods of testing and required test results*
- [7] IEC 62923-1, *Maritime navigation and radiocommunication equipment and systems — Bridge alert management — Part 1: Operational and performance requirements, methods of testing and required test results*
- [8] IEC 62923-2, *Maritime navigation and radiocommunication equipment and systems — Bridge alert management — Part 2: Alert and cluster identifiers and other additional features*
- [9] *International Convention for the Safety of Life at Sea (SOLAS), 1974 (amended)*
- [10] IMO Resolution A. 694(17), *General requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids*
- [11] IMO Resolution MSC 191(79), *Performance standards for the presentation of navigation-related information on shipborne navigational displays*
- [12] IMO Resolution MSC 302(87), *Performance standards for bridge alert management*
- [13] IMO Resolution MSC 466(101), *Amendments to the performance standards for the presentation of navigation-related information on shipborne navigational displays (Resolution MSC.191(79))*

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