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Ships and marine technology — Propeller shaft revolution indicators — Electric type and electronic type

Navires et technologie maritime — Indicateurs de vitesse d'arbre du propulseur — Type électrique et type électronique

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Foreword

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This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 6, *Navigation and ship operations*.

This third edition cancels and replaces the second edition (ISO 22554:2015), which has been technically revised.

The main changes are as follows:

— the normative references have been updated;

— in 4.3 h), a requirement regarding digital-type indication on shipborne navigational displays, in accordance with IMO Resolution MSC.191(79), as amended by MSC.466(101), has been added;

— in new 4.4 and 6.12, a provision on alerts and a reference to IEC 62923-1 and IEC 62923-2 have been added;

— in 6.2, a requirement regarding methods of testing and required test results in accordance with IEC 62288 has been added;

— in Clause 7, interface requirements have been added.

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 — Propeller shaft revolution indicators — Electric type and electronic type

1 Scope

This document specifies the construction, performance requirements, methods of testing, and required test results for electric and electronic propeller shaft revolution indicators (hereinafter referred to as "indicator system"). The requirements in this document are based on those contained in the International Convention for the Safety of Life at Sea (SOLAS) 1974 (as amended, 2000), Clause 2.5.4, Regulation 19, chapter V.

This document is intended to be used in conjunction with IMO Resolution A.694 (17) and IEC 60945.

NOTE A propeller shaft revolution indicator can be designed so that it also complies with the requirements for a tachometer for the engine of a ship.

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

IEC 61162-1, *Maritime navigation and radiocommunication equipment and systems — Digital interfaces — Part 1: Single talker and multiple listeners*

IEC 61162-2, *Maritime navigation and radiocommunication equipment and systems — Digital interfaces — Part 2: Single talker and multiple listeners, high-speed transmission*

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*

IEC 61162-450, *Maritime navigation and radiocommunication equipment and systems — Digital interfaces — Part 450: Multiple talkers and multiple listeners — Ethernet interconnection*

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*

IEC 62923-2, *Maritime navigation and radiocommunication equipment and systems — Bridge alert management — Part 2: Alert and cluster identifiers and other additional features*

IMO Resolution MSC 191(79), *Performance standards for the presentation of navigation-related information on shipborne navigational displays*

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))*

IMO Resolution MSC 302(87), *Performance standards for bridge alert management*

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
propeller shaft revolution indicator
remote device capable of indicating the number of revolutions per minute only, or the number of revolutions per minute and the direction of the revolution

Note 1 to entry: Indicating the direction of the revolution is not relevant for propeller shafts that are intended to turn in one direction only.

3.2
electric propeller shaft revolution indicator
electric-type indicator that employs a generator driven by the propeller shaft through the driving unit that transmits the revolution speed (number of revolutions per minute) and direction of rotation of the propeller shaft

3.3
electronic propeller shaft revolution indicator
electronic-type indicator that employs a revolution sensor that detects pulses generated by a gear turning the propeller shaft or a circular disc with a slit and transmits these pulses to a signal converter

3.4
indicator
means by which the state of the equipment or machinery is represented to an observer

Note 1 to entry: An indicator shows both the sense and magnitude of the information it presents. An indicator can be analogue or digital.

3.5
analogue-type indicator
indicator (3.4) that shows the revolution speed in a continuous way, such as by means of an arrow pointer and graduated scale

3.6
digital-type indicator
indicator (3.4) that shows the revolution speed in a discrete, alphanumeric way

3.7
calibration accuracy
difference between the true revolution speed of a propeller shaft and the revolution speed indicated by the *indicator* (3.4)

4 Construction of an indicator system

4.1 Indicator system

A typical construction of an indicator system is shown in Figure 1.

An indicator system shall show the number of revolutions per minute of the shaft to which it is connected, with the direction of revolution of that shaft, if that can change at locations adjacent to, or remote from, the equipment or machinery. At the equipment or machinery, such systems generally comprise a sensor and transmitter. At the observer's location, such systems generally contain an indicator.

The manufacturer shall specify in the manufacturer's documentation if the equipment is capable of indicating the direction of revolution.

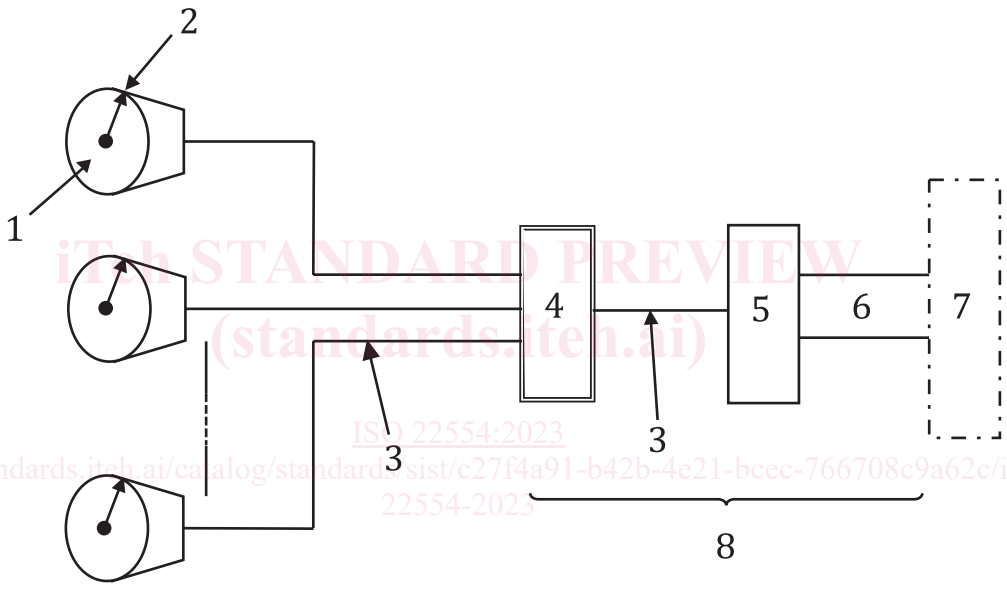
The system construction shall comply with the following:

a) the indicator system enclosures shall be robust and constructed so as to facilitate easy adjustment and maintenance;

b) the indicator system with instrument panel lights and the instrument panel light dimmers shall be equipped with a grounding terminal or shall be constructed so that an earth-grounding is securely established. In the electronic-type case, these requirements shall also be applied to the signal converters;

c) the indicator system can be self-contained or form part of any other appropriate equipment;

d) an analogue-type indicator and/or a digital-type indicator shall be provided in the indicator system.



Key

1 indicators
2 arrow pointer
3 electric cable
4 junction box (as appropriate)/signal converter
5 transmitter
6 driving unit/revolution sensor
7 revolution mechanism (not part of the EUT)
8 transmitters (term used in the broad sense, including the functions of signal pickup and transmission)

Figure 1 — Typical construction of an indicator system

4.2 Transmitters

4.2.1 General

The indicator system shall fulfil the following individual structural specifications in 4.2.2 and 4.2.3.

4.2.2 Electric type

4.2.2.1 Driving unit

Driving units shall comply with the following requirements and recommendations listed in a) to e). However, an indicator directly connected to a camshaft or another part of the main machine shall not be equipped with a driving unit.

a) The driving unit shall be constructed so that the revolution of a propeller shaft is conveyed to the transmitter smoothly and without slippage.

b) It is recommended that the driving unit is provided with a clutch system so that the transmitter can be suspended and driven at any time while the propeller shaft is spinning.

c) A gear mechanism is recommended for imparting drive force from the propeller shaft system.

d) If provided, the drive gear shall permit secure, easy mounting on the revolution parts of the propeller shaft.

e) Where the transmitter drive includes pivot connections, such connections shall be designed to resist loosening when subject to vibration.

4.2.2.2 Transmitter

The transmitter shall comply with the following requirements.

a) Driven by the propeller shaft via the conductor, the transmitter shall employ an electric generator that shall transmit the revolution speed (number of revolutions per minute) and may transmit the direction of the propeller shaft rotation.

b) The transmitter shall have sufficient capacity to simultaneously drive all connected indicator(s). Also, additional capacity shall be taken into consideration if the transmitter provides output to automation and measurement devices. The manufacturer shall specify the capacity of the connected indicators in the manufacturer’s documentation.

4.2.2.3 Junction box

Junction boxes shall be capable of being connected to the required number of indicators. Junction boxes shall be equipped with a compensating device to prevent indicator errors, regardless of the number of indicators.

4.2.3 Electronic type

4.2.3.1 Revolution sensor

Revolution sensors shall be constructed so as to correctly detect pulses generated by a propeller shaft’s turning gear, or a circular disc with slit.

4.2.3.2 Signal converter

Signal converters shall be constructed so that each can convert pulses from the propeller shaft into electric signals for output.

4.3 Indicator

a) The indicator may consist of a receiving portion and an indication portion. A receiving portion is electrically connected with a transmitter. The indication portion is constructed so that it indicates

the direction of the rotation and the number of revolutions per minute of a propeller shaft and may indicate the direction of the rotation.

Where direction of rotation is indicated, the direction “ahead” shall be such as identified by the "+" sign or by the letters “AH” or “AHEAD”, while “astern” shall be identified by the "–" sign or by the letters “AS” or “ASTERN”.

b) Where the direction of rotation is indicated, the letters and graduations on a dial shall be such that the direction of ahead and astern can be clearly distinguished.

c) Where the direction of rotation is indicated, the clockwise direction of a revolution speed panel shall indicate the forward movement of a ship. It is recommended that the maximum scale value for both forward and backward movements be set to one of 100, 125, 150, 200, 250, 300, 400, or 450 min^{-1} (r/min). Additional linear range scales may be provided. The indicator shall present the revolution speed on a linear scale.

d) The calibration of zero point of an indicator and its indication shall be capable of being adjusted by appropriate measures. The calibration measures shall not be operable during normal operation.

e) An indicator shall be constructed so that it can be read easily and clearly.

f) All illumination and lighting of an indicator shall be adjustable down to zero, except the control of the dimmers which shall remain readable.

g) The illumination and lighting of an indicator shall be arranged in order to not hinder an operator’s vision at night. The illumination and lighting of an indicator shall make the scale, pointer, and letters as equally visible as possible even in dim light or the dark.

h) If the propeller shaft revolution indicator uses electronic visual display to present required information, the display shall be in compliance with MSC.191(79), as amended by MSC.466(101), and with IEC 62288.

NOTE The information presented on the electronic visual display can be of digital-type indicator or analogue-type.

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

Any transmitter shall have the capacity to satisfy the requirements in 5.2 to 5.9, when the specified maximum number of connected indicators are operating simultaneously.

5.2 Balance

When an indicator without current rotates to either side by 30° from its upright position, the deviation of a pointer from its zero point shall be within ±1° of the maximum scale value for an indicator with a visible diameter of greater than or equal to 150 mm. The deviation shall be within ±2 % for an indicator with a visible diameter of less than 150 mm. Where direction of rotation is indicated, the maximum scale value is the combined maximum scale value of ahead and astern.

5.3 Friction error

When the power at the electric signal equivalent to the number of revolutions of an indicator is applied to the indicator, the difference between the indication of forward and backward movement shall be

within ±0,5 % of the maximum scale value for an indicator with visible diameter of greater than or equal to 150 mm. The difference between the indication of forward and backward movement shall be within ±1,0 % for an indicator with visible diameter of less than 150 mm. This is done to measure calibration accuracy at points of 0 %, 25 %, 75 %, and 100 % of the maximum scale value, respectively, allowing the pointer to gradually move forward and backward to the maximum scale. Where the direction of rotation is indicated, the maximum scale value is the combined maximum scale value of ahead and astern.

5.4 Calibration accuracy

When a revolution sensor and a signal converter are operated using an approved testing machine to determine calibration accuracy at points of 0 %, 25 %, 75 %, and 100 % of the maximum scale value of an indicator respectively, the margin of error with respect to the approved testing machine shall be within ±0,5 % of the combined maximum scale value for an indicator with visible diameter of greater than or equal to 150 mm. The margin of error shall be within ± 1,0 % for an indicator with visible diameter of less than 150 mm. Where direction of rotation is indicated, the maximum scale value is the combined maximum scale value of ahead and astern. The requirement shall be met in the ambient temperature of 20 °C.

5.5 Damping

When a test electric signal equivalent to half of the maximum scale value is suddenly applied to an indicator, the movements of the indicator pointer shall not show a value exceeding two-thirds of the maximum value.

5.6 Zero point

When an electric signal equivalent to an indicator's maximum scale value is applied to an indicator for 30 min, after which power is turned off and the zero-position error is immediately corrected by eliminating friction from the moving parts by gently patting the outer casing. Any zero-point error shall be within ±0,25 % of the combined maximum scale values ahead and astern for an indication portion with a visible diameter of greater than or equal to 150 mm. Any zero-point error shall be within ±0,5 % for an indication portion with a visible diameter of less than 150 mm.

5.7 Output electric signal of a signal converter

The output electric signal equivalent to the maximum scale value of indicator(s) shall be sufficient to simultaneously operate the specified maximum number of connected indicator(s).

5.8 Output electric signal accuracy of a signal converter

5.8.1 General

The accuracy of an output electric signal shall comply with the requirements in 5.8.2 and 5.8.3.

5.8.2 Accuracy

The accuracy of an output electric signal shall be indicated by a ratio of the output electric signal equivalent to the maximum scale value. This ratio shall not exceed 0,2 %.

5.8.3 Response speed

When the input pulse of a signal converter is suddenly shifted from the number of pulses per second equivalent to maximum revolution speed, the output electric signal shall reach its maximum equivalent to maximum revolution speed within 1 s.