
**Ships and marine technology — Marine
electromagnetic compasses**

Navires et technologie maritime — Compas électromagnétiques de marine

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ISO 11606:2000

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Printed in Switzerland

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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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 11606 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 6, *Navigation*.

This second edition cancels and replaces the first edition (ISO 11606:1997), which has been technically revised.

Annex A of this International Standard is for information only.

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Ships and marine technology — Marine electromagnetic compasses

1 Scope

This International Standard specifies general requirements, type tests and individual tests for marine electromagnetic compasses intended for steering purposes and/or taking bearings on board ships required by Chapter V of SOLAS, 1974 and the International Code of Safety for High-Speed Craft (HSC Code). The magnetic compasses specified in this standard shall apply to the ships the overall length of which is normally not less than 24 m. In this context an electromagnetic compass is an item of electronic equipment which uses the geomagnetic field to obtain information about the ship's heading. This information is conveyed to the main compass (which is used for steering and taking bearings), to additional repeater indicators and, if required, to other navigational equipment.

NOTE All requirements that are extracted from the recommendations of IMO resolutions are printed in italics.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards. <https://standards.iteh.ai/catalog/standards/sist/92921e05-8b3e-42b6-980c-1122ba79397b/iso-11606-2000>

ISO 449:1997, *Ships and marine technology — Magnetic compasses, binnacles and azimuth reading devices — Class A.*

ISO 1069, *Magnetic compasses and binnacles for sea navigation — Vocabulary.*

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

IEC 61162 (both parts), *Maritime navigation and radiocommunication equipment and systems — Digital interfaces.*

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.*

IMO Resolution A.813(19), *General requirements for electromagnetic compatibility (EMC) for all electrical and electronic ship's equipment.*

IMO Resolution MSC.86(70), Annex 2, *Recommendation on performance standards for marine transmitting magnetic heading devices (TMHD's).*

3 Terms and definitions

For the purposes of this International Standard, the definitions given in ISO 1069 and the following terms and definitions apply.

3.1

magnetic sensor

sensor which detects the geomagnetic field and supplies an appropriate output concerning direction to the processor

3.2

processor

device which processes the output of the magnetic sensor and provides the ship's magnetic heading and/or true heading

3.3

main compass

display unit which shows the output of the processor with a compass card or an electronic image of a compass card

3.4

repeater indicator

additional indicator which may be equipped with a display which uses a different type of compass card

4 Composition

The electromagnetic compass system shall consist of a magnetic sensor, a processor, a main compass display and facilities for other repeater indicators and equipment.

5 Construction and material

5.1 Requirements

Electromagnetic compasses shall fulfil the following requirements.

5.2 Electrical wiring

Electrical wiring, such as that for the direct-current power supply and that for connecting the units, shall not produce any perceptible errors in the heading information.

NOTE Twist cables are recommended for this purpose.

5.3 Non-magnetic housing

The housing of the magnetic sensor system shall be non-magnetic.

5.4 Fore-and-aft marks

Fore-and-aft marks shall be inscribed on the housing of the magnetic sensor system and the bottom part of the binnacle of the main compass. The units shall be installed on the fore-and-aft line of the ship.

The fore-and-aft marks shall be within $\pm 0,5^\circ$ of the fore-and-aft axis of the unit.

5.5 Graduation

5.5.1 Graduation of main compass card

The main compass shall be of the compass card type which shall be graduated in 360 single degrees, starting from North (000°), in the clockwise direction as viewed from above. Each tenth degree shall be marked with the three corresponding numbers. The accuracy of the graduation shall be better than $0,2^\circ$ on any heading. The cardinal points shall be indicated by the capital letters N, S, E and W; the intermediate points may also be marked.

Alternatively, the North point may be indicated by a suitable symbol.

5.5.2 Indication of the repeater indicator

The graduation of the indicator, if of the card type, shall be the same as that of the main compass card. If a repeater indicator is used for steering purposes, it shall be of the card type.

In the case of numerical displays, three-digit numbers, in degrees, shall be shown.

5.5.3 Centre of the graduation

The main compass, and repeater indicators to be used for bearing purposes, shall be fitted with a seat for a shadow pin which accommodates bearings or, if no seat is provided, the centre of the graduation shall be clearly indicated.

5.5.4 Graduation of the verge ring

The main compass, and repeater indicators to be used for bearing purposes, shall be provided with a verge ring, which is graduated in degrees, for the measurement of bearings relative to the ship's head. The scale shall be graduated in 360 single degrees in the clockwise direction as viewed from above.

Both the zero mark indicating the bearing of the ship's head and the 180° mark indicating the bearing of the ship's stern shall be within $\pm 0,5^\circ$ of the fore-and-aft marks.

5.5.5 Accuracy of fore-and-aft marks

The fore-and-aft marks of the main compass, and of repeater indicators to be used for bearing purposes, shall be in the vertical plane passing through the centre of the compass card and the main lubber mark to within $\pm 0,5^\circ$.

5.5.6 Readability of the graduation

It shall be possible for a person with normal vision to read the main compass card and the indication of the repeater indicator at a distance of 1,0 m, both in daylight and in artificial light.

5.5.7 Horizontal position of the compass plane

The plane of the compass card of the main compass, and of repeater indicators to be used for bearing purposes, shall be so balanced that it is horizontal to within $\pm 2^\circ$.

5.6 Lubber marks

5.6.1 General

The main compass display and all repeater indicators shall be fitted with at least one lubber mark, indicating the direction of the ship's head. Additional lubber marks indicating the direction of the ship's stem and thwartships are permissible.

The width of the lubber mark shall not be greater than $0,5^\circ$ on the card or 0,5 mm, whichever is smaller.

The distance between the lubber mark and the outer edge of the card shall not be more than 1,5 mm.

5.6.2 Accuracy

The main lubber mark shall be within $\pm 0,5^\circ$ of the 0° to 180° line of the verge ring.

Additional lubber marks shall be within $\pm 1^\circ$.

5.7 Illumination

The units shall be provided with adequate provision for illuminating the controls and displays. A device shall be provided for dimming the electric light.

5.8 Compensation of deviation and heeling error

5.8.1 Introduction

Provision shall be made for correcting the heeling error and the coefficients *A*, *B*, *C*, *D* and *E*. *It shall be possible to correct the following values:*

- *vertical component of the ship's magnetic field (producing the heeling error): up to $\pm 75\mu\text{T}$;*
- *coefficient A: up to $\pm 3^\circ$;*
- *coefficient B: up to $\pm (720/H)^\circ$;*
- *coefficient C: up to $\pm (720/H)^\circ$;*
- *coefficient D: up to $\pm 7^\circ$;*
- *coefficient E: up to $\pm 3^\circ$;*

where *H* is the horizontal component of the geomagnetic flux density in microteslas (μT).

The devices for correcting the coefficients *A*, *B*, *C*, *D* and *E* shall not produce any undesired deviation greater than 1° . The device for correcting heeling error shall not produce any undesired alteration of the vertical component of the ship's magnetic field greater than $1\mu\text{T}$.

5.8.2 Indication of compensation

The values used for electronic compensation shall be indicated by adequate means and shall be stored such that values are automatically recovered on switch on.

5.8.3 Protection of compensation devices

The compensating devices shall be protected against accidental alterations.

5.9 Heading output

The type of heading displayed or transmitted shall be conspicuously indicated. All displays and outputs of heading should be able to indicate true heading. *An indication of any deviation and variation applied to compensate the heading shall be capable of being displayed or included in the output.*

5.10 Outputs to other equipment

The electromagnetic compass shall be so designed that it is able to provide the azimuth information, within a transmitting error of not greater than $\pm 0,5^\circ$, to the navigational equipment, radars, direction finders, heading control systems and additional position measurement instruments. If these navigational instruments have digital outputs, they shall conform to IEC 61162.

5.11 Gimbals

5.11.1 Direction of gimbal axes

If gimbals are provided, the outer gimbal axis shall be in the fore-and-aft direction.

5.11.2 Angle between the gimbal axes

If gimbals are provided, the angle between the inner and outer gimbal axes shall be $90^\circ \pm 1^\circ$, except if the diameter of the outer gimbal ring is less than 150 mm: in this case the angle shall be $90^\circ \pm 2^\circ$.

5.11.3 Freedom of tilt of the main compass

The main compass shall be constructed in such a way that it can revolve about the inner gimbal axis freely up to 30° when the gimbal ring, if fitted, is horizontal.

5.11.4 Precaution against dislodging of the main compass and the repeater indicators

The main compass and repeater indicators shall be constructed in such a way that, if they are fitted on gimbals, they return to their normal position and are not dislodged after tilting.

5.12 Fitting the main compass

Provision shall be made in the bottom part of the magnetic sensor unit, the main compass and card-type repeater indicators in order to allow correction of any misalignment thereof in respect of the fore-and-aft line of the ship, by an angle of up to $\pm 5^\circ$.

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5.13 Height of the compass card plane

Main compasses shall be so constructed that the plane of the compass card is at least 1 m above the lower surface of the binnacle deck fittings, and capable of taking bearings of celestial bodies and other distant objects.

5.14 Watertightness of repeater indicators

The main compass and all repeater indicators intended for use on an open deck shall be waterproof.

5.15 Azimuth reading devices

5.15.1 Provision of azimuth reading devices

There shall be at least one appropriate azimuth reading device to take bearings of celestial bodies and other distant objects.

5.15.2 Azimuth sight

The field of vision shall be at least 5° on each side of the line sight and it shall be possible to take azimuths of celestial bodies and bearings of distant objects whose altitudes are between 5° below and 60° above the horizontal.

This requirement on the accuracy of the azimuth shall be fulfilled in the altitude range from 5° above the horizontal to 50° above the horizontal.

5.16 Construction for maintenance and inspection

Equipment shall be so constructed that it is possible to carry out maintenance and inspection easily.

5.17 Protection against changes in power supply

Means shall be incorporated for the protection of equipment from the effects of excessive current and voltage, transients and accidental reversal of the power supply polarity.

6 Performance

6.1 Preconditions

Performance within the temperature range between

25 °C ± 3 °C and 70 °C ± 3 °C for equipment or units intended to be exposed to the weather and

15 °C ± 3 °C and 55 °C ± 3 °C for equipment or units intended to be protected from the weather

shall conform to the requirements of 6.2 to 6.6.

The use of temperature controllers is permitted.

6.2 Accuracy of heading iTeh STANDARD PREVIEW (standards.iteh.ai)

6.2.1 Static accuracy

The static accuracy of the heading indication shall be within ± 1,0°.

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6.2.2 Dynamic accuracy

The dynamic accuracy of the heading indication or output shall be within ± 1,5° in addition to the static accuracy as defined. Periods of oscillation shall not be shorter than 30 seconds under the conditions of various sea states and ship motion likely to be experienced in ships.

6.3 Follow-up accuracy of the transmission system

The follow-up accuracy of the transmission system shall be within ± 1,5°, when the sensor is rotated at a rate of ± 20°/sec.

6.4 Synchronized accuracy between a repeater indicator and the main compass

The difference between the readings of a repeater indicator and the main compass shall be not more than ± 0,5°.

6.5 Possibility of compensating the coefficients

It shall be possible to compensate the coefficients *A*, *B*, *C*, *D* and *E* so that the residual value of each coefficient is smaller than ± 0,5°.

6.6 Electromagnetic compatibility

The compass system, with regard to electromagnetic interference and immunity, shall in addition to Resolution A.694(17) comply with Resolution A.813(19).

7 Precautions against failure

7.1 Power supply

A main power supply and an emergency power supply shall be provided. Both power supplies shall have automatic changeover facilities. This subclause does not apply to ships not provided with an emergency supply.

7.2 Backup of compensator data

Provision shall be made to ensure that the compensator data cannot be changed unintentionally or by a failure of the system.

7.3 Failure alarm

An alarm shall be provided to indicate a failure of the power supply to the compass system.

8 Marking

Each unit of compasses shall be marked with the following:

- the identification of the manufacturer;
- the equipment type number or identification of the model which was type tested;
- the serial number of the unit;
- the year of manufacture (not necessary if the year of manufacture can be read by the serial number);
- the safe distance for installation on a bridge.

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9 Type testing and individual testing

9.1 General

Unless otherwise stated, all tests shall be carried out at a temperature of $20\text{ °C} \pm 3\text{ °C}$.

9.2 Type testing

Type testing shall be carried out before the instruments come into regular service. For type testing, only new devices are acceptable.

9.3 Individual testing

Individual testing shall be carried out before installation on board ship. It is also desirable to perform the test periodically and after repair, on board ship.

For individual testing, all devices shall be in a clean and serviceable state when tested.

10 Certification

10.1 Test certification

Devices which have passed the type test or the individual test and comply with the requirements shall be certified in the language of the test authority and in English.