INTERNATIONAL STANDARD

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Ships and marine technology — Magnetic compasses, binnacles and azimuth reading devices — Class B

Navires et technologie maritime — Compas magnétiques, habitacles et alidades — Classe B

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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 613 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 613:1982), which has been technically revised.

Ships and marine technology — Magnetic compasses, binnacles and azimuth reading devices — Class B

1 Scope

This International Standard gives general requirements regarding construction and performance for magnetic compasses, binnacles and azimuth reading devices, class B. In addition, this International Standard includes general requirements regarding construction and performance for hand-bearing compasses.

This International Standard applies to liquid-filled magnetic compasses, with or without gimbals,

— intended for sea navigation on board ships for "restricted service and life boats " according to the regulations in force;

— with a sealed or non-sealed bowl;

— having a direct reading system;

— which may be of the reflecting, projecting or transmitting types.

This International Standard does not apply to

a) dry card compasses;

b) types of compass designed on principles different from those stated above or not complying with the descriptions given.

NOTE As ISO 14227 ([7] in the bibliography) covers magnetic compasses for use in small craft of hull length up to 24 m, this International Standard does not have any provision for them.

2 Normative reference

The following normative document contains provisions which, through reference in this text, constitute provisions of this International Standard. For a dated references, subsequent amendments to, or revisions of, the publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the normative document indicated below. For an undated reference, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 1069:1973, *Magnetic compasses and binnacles for sea navigation — Vocabulary*.

3 Terms and definitions

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

3.1
azimuth reading device
device which is able to take the azimuth of celestial bodies and bearings of distant objects as an azimuth circle, an azimuth mirror, etc.

3.2
magnetic compass
instrument consisting of a directional system supported by a single pivot inside a bowl which is completely filled with liquid, and which may be supported in gimbals inside or outside the bowl

4 Magnetic compasses

4.1 Construction and material

4.1.1 The magnets used in the directional systems of magnetic compasses shall be of a suitable magnetic material having a high remanence and a coercivity of at least 18 kA/m.

All other materials used in magnetic compasses, other than transmitting compasses, shall be of non-magnetic material.

4.1.2 The compass shall be fitted with at least one lubber mark, indicating the direction of the ships head (the main lubber mark). Additional lubber marks are permissible.

The lubber mark shall be of such design as to allow the compass to be read from the steering position when the bowl is tilted 10° in the case of a gimbal compass or 30° in other cases.

4.1.3 The gimbal axes shall be mutually perpendicular within a tolerance of not more than 2°. For compasses without gimbals, which are also covered by this International Standard, the requirements relating to gimbals do not apply.

4.1.4 Within the temperature range – 20°C to + 60°C:

a) the compass shall operate satisfactorily;

b) the liquid in the compass bowl shall remain clear and free from bubbles and neither emulsify nor freeze;

c) there shall be neither inward leakage of air nor outward leakage of liquid; no bubble shall form in a compass unless it is specially provided to compensate for expansion;

A bubble provided in a compass to compensate for expansion shall not disturb the functioning and reading of the compass.

d) the internal paint shall not blister, crack or discolour appreciably;

e) the supporting force shall be such that the directional system always remains in contact with its pivot;

f) the material of the compass card shall not distort.

4.1.5 The compass bowl shall be balanced so that its verge ring or top glass cover settles in the horizontal plane to within to 2° when the gimbal ring is fixed in a horizontal position; this shall be so whether the azimuth reading device or magnifying glass is in place or not.

4.2 Mounting

4.2.1 The bowl of the compass shall be mounted so that the verge ring remains horizontal when the binnacle is tilted 30° in any direction and in such a manner that the compass cannot be dislodged under any conditions of sea or weather.

4.2.2 In compasses in which no supporting gimbal is provided, the freedom of the card shall be 30° in all directions.

4.3 Directional system

4.3.1 Moment of inertia

The moment of inertia of the directional system shall be approximately the same about all horizontal axes passing through the point of support on the pivot jewel.

4.3.2 Suspension

The directional system shall be retained in position by suitable means and remain free when the bowl is tilted 10° in any direction.

4.3.3 Settling time

Following an initial deflection of the card of 90° from the magnetic meridian, the time taken to return finally to within 1° of the magnetic meridian, shall not exceed $240/\sqrt{H}$ at a temperature of 20 °C ± 3 °C, where H is the horizontal component of the magnetic flux density in microteslas (μT) at the place of testing.

4.4 Graduation

4.4.1 Compass card

The compass card shall be graduated in equal intervals of not more than 5° and numbered at intervals of not more than 30°, starting from North in the clockwise direction as viewed from above, and numbered at intervals of not more than 30°. 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.

4.4.2 Readability by the helmsman

If a steering compass is provided for the helmsman, it shall be possible for a person with normal vision to read at a distance of 1,0 m, in both daylight and artificial light, those graduations on the card which are contained within a sector of not less than 15° to each side of the lubber mark. The use of a magnifying glass is permitted.

For reflecting and projecting compasses, the lubber mark shall be visible and a sector of 15° on the card on each side of the lubber mark shall be readable by a person with normal vision at a distance of 1 m from the periscope tube.

4.5 Accuracy

4.5.1 Directional error

The directional error shall not exceed 1,5° on any heading.

4.5.2 Lubber error

The lubber error shall not exceed 1°.

4.5.3 Error due to friction

With the compass at a temperature of 20 °C ± 3 °C, the card, when given an initial deflection of 5°, first on one side of the magnetic meridian and then on the other, shall return to within (9/H)° of its original position, where H is the horizontal component of the magnetic flux density in microteslas (μT) at the place of testing.

4.5.4 Swirl error

With the compass at a temperature of 20 °C ± 3 °C, and rotating at a uniform speed of 1,5° per second, the deflection of the card, measured after the bowl has been rotated through 360°, shall at no point exceed (40/H)°. H being as defined in 4.3.3.

4.5.5 Mounting error of azimuth reading device

Where the azimuth reading device is pivoted on the compass bowl, the vertical axis of the device shall be within 0,5 mm of the pivot point.

4.6 Resistance to vibration (optional)

Should the compass be required to operate under conditions of severe vibration, it shall perform satisfactorily under the test conditions described in 4.6.1 and 4.6.2. The compass shall be subjected to these tests in its binnacle.

A separate certificate shall then be issued.

4.6.1 Method of testing

The compass card shall be substantially horizontal at the start of the test.

Test 1: Apply vibrations successively in the fore-and-aft, athwartship and vertical directions acting on the compass in its suspension with the following frequencies and amplitudes:

— for frequencies between 7 Hz and 11,2 Hz, the value of the amplitude shall be ± 1 mm;

— for frequencies between 11,2 Hz and 40 Hz, the values of the amplitude A, in millimetres, are determined by the formula.

$$A = \pm \frac{124}{f^2}$$

where f is the frequency, in hertz, corresponding to a constant amplitude of acceleration of ± 0,5 g.

The rate of change of the frequency shall be slow enough to discern positively any deviation of the card or any resonance of the compass.

Test 2: Submit the compass to the resonant frequency (or 40 Hz if no pronounced resonance is observed) for a period of 2 h.

4.6.2 Test results

During test 1, the card shall not deviate by more than ± (90/H)°, where H is the horizontal component of the magnetic flux density in microteslas (μT) at the place of testing.

During test 1 and test 2, the card shall not lift off the pivot under the influence of these vibrations.

After the test, the requirements of 4.5.1 (directional error), 4.5.3 (error due to friction), 4.5.4 (swirl error) and 4.5.2 (lubber error) shall be fulfilled.

5 Binnacles, helmets and boxes

5.1 Construction and materials

Only high quality non-magnetic materials of sufficient strength shall be used for the construction of the binnacle, helmet and box, brackets and holding-down bolts.

5.2 Provision for correction of deviations

Where correcter magnets are used, they shall be of a suitable magnetic material of high remanence and coercivity of not less than 18 kA/m.

Material used for correcting induced fields shall have a high permeability, a low coercivity and a negligible remanence.

Built-in magnets must be capable of being put into a neutral position or be removable. Built-in magnets for B and C correction must not produce a heeling error.

5.3 Accuracy of fore-and-aft marks

Where fore-and-aft marks are provided on binnacles, they shall be in the same vertical plane, to within 1°, as the axis of the fore-and-aft gimbal bearing.

5.4 Illumination

The binnacle shall contain adequate means for illuminating the card and the lubber mark by the ship's electric supply and from an emergency light source.

In projector and reflector binnacles, these shall provide a clear image at the helmsman's position.

If the binnacle, helmet or box contains provision for illuminating the card by electric light, the lamps, fittings and wiring should have no noticeable influence on the directional system.

6 Azimuth reading device (if fitted)

6.1 Field of vision

The field of vision shall be at least 5° on each side of the line of sight and it shall be possible to take azimuths of celestial bodies and bearings of distant objects whose altitudes are between 5° below and 10° above the horizontal.

6.2 Accuracy

When the azimuth reading device is correctly aimed, the error on any heading shall not exceed 1°.

7 Specifications for hand-bearing compasses

In addition, magnetic hand-bearing compasses shall meet the special requirements described in 7.1 to 7.4.

These particular specifications replace 4.2 and the relevant requirements given in 4.4.

7.1 Tilting

The freedom of tilt of the card shall be at least ± 10° in any direction.