
International Standard



613

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Shipbuilding — Magnetic compasses, binnacles and azimuth reading devices — Class B

Construction navale — Compas magnétiques, habitacles et alidades — Classe B

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Descriptors : shipbuilding, sea navigation, magnetic compasses, azimuth reading devices, binnacles, specifications.

Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 613 was developed by Technical Committee ISO/TC 8, *Shipbuilding and marine structures*, and was circulated to the member bodies in May 1981.

It has been approved by the member bodies of the following countries :

| | | |
|----------------|------------------------|----------|
| Austria | India | Poland |
| Belgium | Italy | Portugal |
| Brazil | Japan | Romania |
| China | Korea, Dem. P. Rep. of | Spain |
| Czechoslovakia | Korea, Rep. of | Sweden |
| Finland | Mexico | Thailand |
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The member body of the following country expressed disapproval of the document on technical grounds :

United Kingdom

This International Standard cancels and replaces ISO Recommendation R 613-1967, of which it constitutes a technical revision.

Shipbuilding — Magnetic compasses, binnacles and azimuth reading devices — Class B

1 Scope

This International Standard defines the general requirements for the construction and performance of magnetic compasses, including hand bearing compasses, binnacles and azimuth reading devices, class B.

2 Field of application

This International Standard refers to liquid magnetic compasses :

- intended for steering purposes and/or taking bearings on board ships for "restricted service" and pleasure craft, in accordance with the regulations in force;
- with a sealed or non-sealed bowl;
- equipped with a direct reading system;
- which may be of the reflecting, projecting or transmitting type.

In this context, a magnetic compass is an instrument consisting of a directional system supported on a pivot inside a bowl which is completely filled with liquid and which is supported in gimbals.

Compasses, which are not supported in gimbals, are also covered by this International Standard. The requirements relating to gimbals do not, however, apply to such compasses.

This International Standard does not refer to

- dry card compasses;
- types of compasses designed on principles different from those stated above or not complying with the description in that clause.

3 References

ISO 449, *Shipbuilding — Magnetic compasses and binnacles, class A*.

ISO 694, *Positioning of magnetic compasses in ships*.¹⁾

ISO 1000, *SI Units and recommendations for the use of their multiples and of certain other units*.

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

ISO 2269, *Magnetic compasses and accessories — Rules for testing and certification*.¹⁾

4 Definitions

The terms used in this International Standard are defined in ISO 1069.

5 Marking

The following marks are required :

- the manufacturer's name clearly and permanently inscribed on the card;
- type identification and serial number;
- if the compass can be refilled, the type of liquid, if other than alcohol shall be indicated; if the compass is sealed a label shall state : "This compass cannot be refilled".

6 Magnetic compasses

6.1 Construction and material

6.1.1 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 18 000 A/m.

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

6.1.2 The gimbal axes shall be mutually perpendicular within a tolerance of not more than 2°.

6.1.3 Within the temperature range -20 to + 60 °C, the compass shall operate satisfactorily, in particular :

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

¹⁾ In revision.

- b) there shall be neither inward leak of air nor outward leak of liquid;

NOTE — This requirement does not apply to the normal functioning of liquid compasses which have a combined gravity liquid reservoir and free expansion chamber fitted to the top glass cover so as to allow for changes in the volume of the liquid.

- c) paint shall not blister, crack or discolour appreciably;
- d) the material of the compass card shall not distort;
- e) the supporting force shall be such that the directional system always remains in contact with its pivot.

6.1.4 The balance of the compass bowl shall not be disturbed by any magnifying device or by any azimuth reading device provided for use with the compass.

6.2 Mounting

The freedom of tilt of the card shall be at least $\pm 10^\circ$.

If the compass is not gimballed the freedom of tilt shall be at least $\pm 30^\circ$.

6.3 Directional system

6.3.1 Moment of inertia

The moment of inertia of the directional system shall be substantially the same about all horizontal axes passing through the bearing surface of the pivot jewel.

6.3.2 Period

When measured at a temperature of $20 \pm 3^\circ\text{C}$ within a horizontal magnetic flux density of $18\ \mu\text{T}$ and an initial deflection of the card of 40° from the magnetic meridian, the time taken between the first two consecutive passings of the original position of the card shall not be less than 4 s or $(0,06d)$ s whichever is the greater, d being the diameter of the card in millimetres.

The time taken to return finally to within $2,5^\circ$, following an initial deflection of the card of 90° shall not exceed 60 s or $(0,4d)$ s whichever is the less.

Temperature and horizontal component of the magnetic flux density are as stated above and d is the diameter of the card in millimetres.

6.4 Graduation

6.4.1 Compass card

The compass card shall be graduated in equal intervals of not more than 5° , starting from North, and numbered at intervals of not more than 30° in a clockwise direction as viewed from above. The cardinal points shall be indicated by the capital letters N, S, E, W. The letter N may be replaced by a suitable emblem. The intermediate points may also be marked.

6.4.2 Readability

It shall be possible for a person with normal vision to read the course, the lubber mark and the graduations on the card at a distance of one metre, in both daylight and artificial light even when the card is tilted as specified in 6.5. The use of a magnifying device is permitted.

If only a part of the card is visible, it shall be possible to read a minimum of 15° on each side of the lubber mark.

6.5 Lubber mark

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

6.6 Accuracy

6.6.1 Directional error

The directional error shall not exceed $1,5^\circ$.

6.6.2 Error due to friction

With the compass at a temperature of $20 \pm 3^\circ\text{C}$, the deviation remaining after a 5° deflection of the directional system shall be not more than $(9/H)^\circ$, H being the horizontal component of the magnetic flux density in microteslas (μT) at the place of testing.

6.6.3 Swirl error

At a temperature of $20 \pm 3^\circ\text{C}$, after one bowl rotation in $4\text{ min} \pm 10\text{ s}$, the swirl error of the directional system shall not exceed $(40/H)^\circ$, H being defined as in 6.9.2.

6.6.4 Mounting error of azimuth reading device

When an azimuth reading device is mounted on the compass bowl, the error caused by the eccentricity of the device shall not exceed 1° .

6.6.5 Lubber error

The lubber error shall not exceed 1° .

6.7 Resistance to vibration (optional)

Should the compass be required to operate under conditions of severe vibration, it shall perform satisfactorily under the test conditions set out below. The compass shall be subjected to these tests in its binnacle.

A separate certificate shall then be issued.

6.7.1 Method of testing

The compass card shall be substantially horizontal at the commencement of 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 and 11,2 Hz, the value of the amplitude shall be ± 1 mm.
- for the frequencies between 11,2 to 40 Hz, the values of the amplitude are determined by the formula :

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

where f is the frequency in hertz (corresponding to a constant amplitude of acceleration of $\pm 0,5$ 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.

6.7.2 Requirements

During test 1, the card shall not deviate by more than $\pm (90/H)^\circ$, H being the horizontal component of the magnetic flux density in microteslas 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 6.6.2 (period), 6.9.1 (directional error), 6.9.2 (error due to friction), 6.9.3 (swirl error), and 6.9.5 (lubber error) shall be fulfilled.

7 Binnacles, helmets and boxes

7.1 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.

7.2 Provision for correction of deviations

If corrector magnets are used, they shall be of a suitable magnetic material of high remanence and coercivity of at least 11 200 A/m. Material used for correcting induced fields shall be of a high permeability and a low coercivity and 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.

7.3 Accuracy of fore-and-aft marks

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

7.4 Illumination

The compass or binnacle shall contain adequate means of illuminating the card and lubber mark, to ensure compliance with the provisions of 6.7.2.

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.

7.5 Precaution against dislodging

The compass bowl shall not be dislodged whatever the conditions of sea or weather.

8 Azimuth reading device (if fitted)

8.1 Field of view

The field of view shall be at least 5° on each side of the line of sight and it shall be possible to take bearings of distant objects whose altitudes are between 5° below and not less than 10° above the horizontal.

8.2 Accuracy

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

9 Specifications for hand bearing compasses

In addition, magnetic hand bearing compasses shall meet the following special requirements. These particular specifications replace those given in 6.5, 6.6.2 and 6.7.

9.1 Tilting

The freedom of tilt of the card shall be at least $\pm 10^\circ$ in any direction.

9.2 Damping time

After an initial deflection of 90° , the card shall settle within 2° of the initial heading in a time of not more than $\left(\frac{65}{\sqrt{H}} \right)$ seconds, H being as defined in 6.9.2.

9.3 Graduation

The compass card shall be graduated in intervals not greater than 2° .

9.4 Field of view

The field of view shall include at least two successive figures.

9.5 Readability

It shall be possible to read a minimum of $7,5^\circ$ on each side of the lubber mark.

Annex

Advisory lower value for magnetic moment of magnets of the directional system

