INTERNATIONAL STANDARD

ISO 14227

First edition
2001-12-15

Small craft — Magnetic compasses

Petits navires — Compas magnétiques

Reference number
ISO 14227:2001(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

Contents

Page

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.

The main task of technical committees is to prepare International Standards. 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.

ISO 14227 was prepared by Technical Committee ISO/TC 188, *Small craft*.

Annex A forms a normative part of this International Standard. Annex B is for information only.

Small craft — Magnetic compasses

1 Scope

This International Standard specifies the general requirements for the construction as well as the performance of type tests of magnetic compasses on board small craft of hull length up to 24 m. It refers to liquid magnetic compasses, which can be inspected (e.g. not sealed), either equipped with a direct reading system, or of the reflecting/projecting type.

This International Standard also covers magnetic compasses (3.1) not supported on gimbals. The requirements relating to gimbals do not refer to such magnetic compasses.

This International Standard does not cover

— dry card compasses, or

— types of compasses designed on principles different from those stated above or not complying with the description given in this clause (e.g. transmitting compasses).

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 IEC and ISO maintain registers of currently valid International Standards.

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

IEC 60721-3-6:1987, *Classification of environmental conditions. Part 3: Classification of groups of environmental parameters and their severities. Section 6: Ship environment*

IEC 60721-3-6, Amendment 1, 1991

IEC 60721-3-6, Amendment 2, 1996

3 Terms and definitions

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

3.1
magnetic compass
instrument consisting of a directional system supported on a pivot inside a bowl which is completely filled with liquid and which may be supported on gimbals

3.2
gimbals
devices permitting movements regarding the longitudinal and transversal axes of the craft so as to allow the directional system to seek a horizontal position regardless of the motion of the craft

3.3
static stability of the card
condition allowing the card to stay horizontally in its balance position

3.4
mechanical stability of the card
condition permitting to reduce to a minimum the angular acceleration that the card can attain when under rolling, pitching or vibration

3.5
magnetic stability of the card
condition permitting to call back the magnetic axis of the card to the magnetic meridian when moved away, forced by the horizontal component H of the total magnetic field of the earth

3.6
directional error
algebric sum of the collimation error, eccentricity error and graduation error

3.7
horizontal component
H
value of the horizontal component of the total magnetic field of the earth at the testing site

3.8
vertical component
Z
value of the vertical component of the local total magnetic field of the earth

3.9
lubber error
difference in degrees between the compass lubber mark and the vertical plane passing through the external gimbal axis

3.10
friction error
difference in degrees between the initial value and that obtained after the deflection of a small angle

3.11
swirl error
difference in degrees between the heading reading after a complete rotation of the bowl at a uniform speed of 1,5 °/s and that carried out at rest at the beginning of the test

4 Marking

The following markings are required:

— manufacturer's name clearly and permanently inscribed on the card;

— type identification and serial number;

— number of this International Standard;

— type of liquid, if other than alcohol, inscribed on the bowl.

NOTE See normative annex A.

5 Magnetic compasses

5.1 Construction and material

The compass shall be manufactured of materials having characteristics suitable for marine environments. These materials shall be non-magnetic, except for the magnets of the directional system which shall be of a suitable material of high remanence and coercivity.

Unless otherwise specified, all the compass characteristics stated hereafter shall be at a temperature of + 20 °C ± 3 °C.

5.2 Compass bowl

5.2.1 The magnetic compass bowl shall be supported by gimbals, which shall satisfy the following conditions.

a) The two gimbal axes (internal and external) shall be

— mutually perpendicular, with a tolerance of ± 1°, and

— on the same plane, with a tolerance of ± 1 mm.

b) The external gimbal axis shall be positioned in parallel with the craft's longitudinal direction.

5.2.2 Within the temperature range of − 30 °C to + 60 °C, the liquid in the compass bowl shall remain clear and free from bubbles, and neither emulsify nor freeze. There shall be no inward leak of air, nor outward leak of liquid.

5.2.3 The upper glass (and lower glass, if this exists) of the compass bowl shall have suitable characteristics and thickness. 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.

5.2.4 The compass bowl shall be designed so that sufficient mounting surface and free space for the installation of a magnetic sonde is provided, if required by the yard/customer.

5.3 Directional system

5.3.1 The directional system shall be equipped with a pivot bearing consisting of hard stone and shall remain in the original position by adequate means, and be free when the bowl has a 10° tilt in any direction (30° if the bowl is not gimballed).

5.3.2 The force F exerted by the directional system on the pivot in the liquid shall be:

— 0,04 $\leqslant F <$ 0,1 N for card diameters $d \leqslant$ 165 mm;

— 0,04 N $\leqslant F <$ 0,14 N for card diameters $d >$ 165 mm.

5.3.3 The pivot shall have a conical point consisting of hard stone or metal of at least equivalent hardness.

5.3.4 The magnetic moment m of the directional system shall not be less than the values shown in Figure 1.

The directional system shall not be damaged or deformed in the temperature range of − 30 °C to + 60 °C.

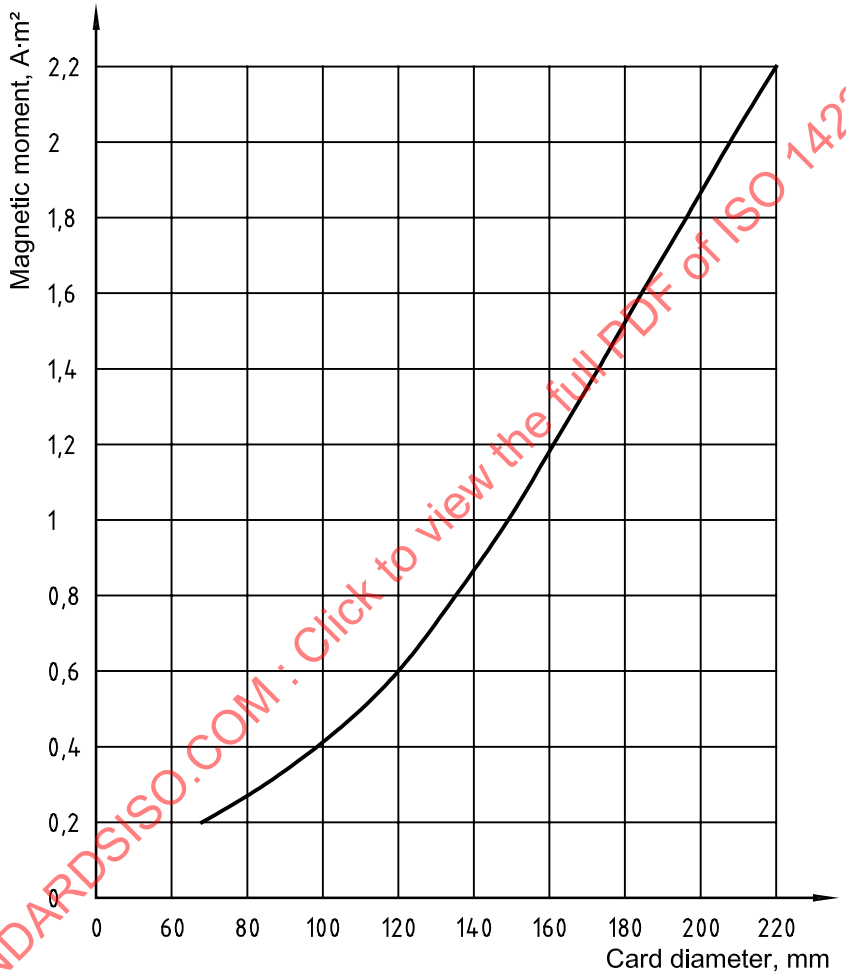

Figure 1 — Magnetic moment of magnets of the directional system

5.4 Lubber mark

5.4.1 The compass shall be fitted with one main lubber mark indicating the forward longitudinal direction of the craft. Additional lubber marks are permissible.

5.4.2 The width of the main lubber mark, in correspondence to the card graduation, shall not be greater than the width of the dial division lines and the length shall be such as to permit the reading of the compass when the compass bowl of a gimbal is tilted 10° from the horizontal plane and that of a compass without gimbals is tilted 30°.

5.5 Compass card

5.5.1 With the directional system located in the compass bowl, the compass-card tilt shall not be greater than 1° from the horizontal plane when the intensity of the vertical component Z of the total magnetic field of the earth in that determined locality is equal to 0.

5.5.2 The compass-card tilt shall not vary by more than 3,5° when the intensity of the vertical component Z of the total magnetic field of the earth varies by 100 μT (≅ 80 A/m = 1 oersted).

5.5.3 With a horizontal magnetic field of 18 μT, the half period, expressed in seconds, by an initial card deflection of 45° from the magnetic meridian, shall not be less than 4 s or 0,06d whichever is the larger, d being the card diameter, expressed in millimetres.

5.5.4 The compass card shall have a static, mechanical and magnetic stability and an adequate sensibility.

The real diameter of the compass card shall not be less than 100 mm, hemispherical compasses excepted, see 5.5.5.

5.5.5 The real diameter of hemispherical compasses shall not be less than 65 mm.

5.5.6 The compass card shall be graduated in equal intervals not greater than 5°, starting from the north with the figures increasing clockwise when viewed from above.

5.5.7 The reading of the card shall be possible in both daylight and artificial light, at a distance of 1 m for all graduations within 15° on each side of the lubber mark.

5.5.8 The cardinal points shall be indicated with 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.

5.6 Accuracy

5.6.1 Directional error

The directional error shall not exceed 1,5°.

5.6.2 Lubber error

The lubber error (only for compasses having an external gimbal axis) shall not exceed 1,0°.

5.6.3 Friction error

The friction error shall not exceed 1° with the compass at a temperature of 20 °C ± 3 °C. The card, to which is given initial deflections of 2° to 3° (first on one side of the magnetic meridian and then on the other), shall return to its original position within 1°.

5.6.4 Swirl error

The swirl error shall not exceed

— 3,5° for a card with a diameter of less than 200 mm, or

— 5° for a card with a diameter of 200 mm or more,

with the compass at a temperature of 20 °C ± 3 °C, and the deflection of the card being measured after the bowl has been rotated 360° at a uniform speed of 1,5°/s.

5.6.5 Induction error

An induction error is due to the magnetic induction transmitted by the needles of the directional system in the adjustment of soft iron bars or spheres used for the quadrantal deviation, and shall not exceed 1,0°.

5.6.6 Damping for deflection at 90°

The time used by the card to return to the magnetic meridian (with a tolerance of 1,0°) after an initial deflection of 90° of the card shall be between 45 s and 60 s for periodic compasses, and less than 30 s for aperiodic compasses, when the horizontal component H of the magnetic field is 18 μT.

5.6.7 Friction of the internal cardanic-ring axis

The compass bowl, being free after a 5° tilt in any direction, shall return to its original position within a tolerance of less than 1°.

5.7 Temperature test

5.7.1 The compass shall be checked at high and low temperatures.

5.7.2 The compass shall be slowly brought to a temperature of 60 °C and be kept at that temperature for 8 h. After this test period, the compass shall not present any kind of damage, losses or bubbles. The liquid and the paint of the compass shall not present any kind of deterioration and the directional system shall not be deformed.

5.7.3 Afterwards the compass shall be slowly brought to a temperature of – 30 °C and kept at that temperature for 8 h. After this test period the compass shall not present any kind of damage, losses or bubbles. The liquid in the bowl shall not freeze, become discoloured or decompose and the directional system shall not be deformed or damaged.

5.8 Test in wet, hot and salty environments

The test in wet, hot and salty environments shall be carried out in accordance with IEC 60721-3-6 (including Amendments 1 and 2) for a period of seven days.

6 Binnacles, helmets and their ancillary equipment

6.1 Only high-quality non-magnetic materials of sufficient strength shall be used for the construction of binnacles, fixing bolts and other ancillary equipment.

6.2 The binnacles shall be provided with devices or a housing for corrections of deviations, and may be provided with a non-magnetic box.

7 Location of the compass on board the craft

The compass shall be installed at a certain distance from magnetic material and electrical equipment which may create electromagnetic fields.

NOTE Also see the recommendations for location and adjustments described in annex B.

Annex A
(normative)

Compliance with this International Standard

The compliance of the compass with the requirements of this International Standard shall be attested by its certification.

The number of this International Standard, the manufacturer's mark and the compass type shall be printed in indelible letters on each compass (see clause 4).