
**Ships and marine technology —
Positioning of magnetic compasses in
ships**

*Navires et technologie maritime — Emplacement des compas magnétiques
à bord des navires*



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

This first edition of ISO 694 cancels and replaces ISO Recommendation ISO/R 694:1968. In this International Standard only one method for the determination of safe distances is prescribed instead of the two methods in the Recommendation. Some values of minimum distances from the ship's iron have been changed.

Annex A forms a normative part of this International Standard.

Introduction

The following elements produce magnetic fields which act on the magnetic compass and cause errors (deviations): the steel parts of the ship's construction, electric currents, electric and magnetic equipment of the ship which is installed in the vicinity of the magnetic compass, such as radar, echo sounder, etc.

To minimize these errors, the distances of the sources of magnetic disturbant fields from the magnetic compass should be as large as possible. This International Standard defines and prescribes the minimum distances to be respected.

Moreover, the method for determination of safe distances of electric and magnetic equipment from the magnetic compass is described.

In order to obtain satisfactory and durable compensation of compasses, this International Standard should be taken into consideration during the design stage of a ship.

Ships and marine technology — Positioning of magnetic compasses in ships

1 Scope

This International Standard specifies the installation in ships of magnetic compasses and binnacles complying with the requirements of ISO 449, ISO 613, ISO 2269 and ISO 10316.

In addition, it covers magnetic control elements used in navigational aids.

It should be noted that this International Standard is established only for general purposes. It is not necessarily applicable to all sea-going ships.

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, 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.

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

ISO 613:1999, *Ships and marine technology — Magnetic compasses, binnacles and azimuth reading devices — Class B*.

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

ISO 2269:1992, *Shipbuilding — Class A magnetic compasses, azimuth reading devices and binnacles — Tests and certification*.

ISO 10316:1990, *Shipbuilding — Class B magnetic compasses — Tests and certification*.

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

magnetic control sensor

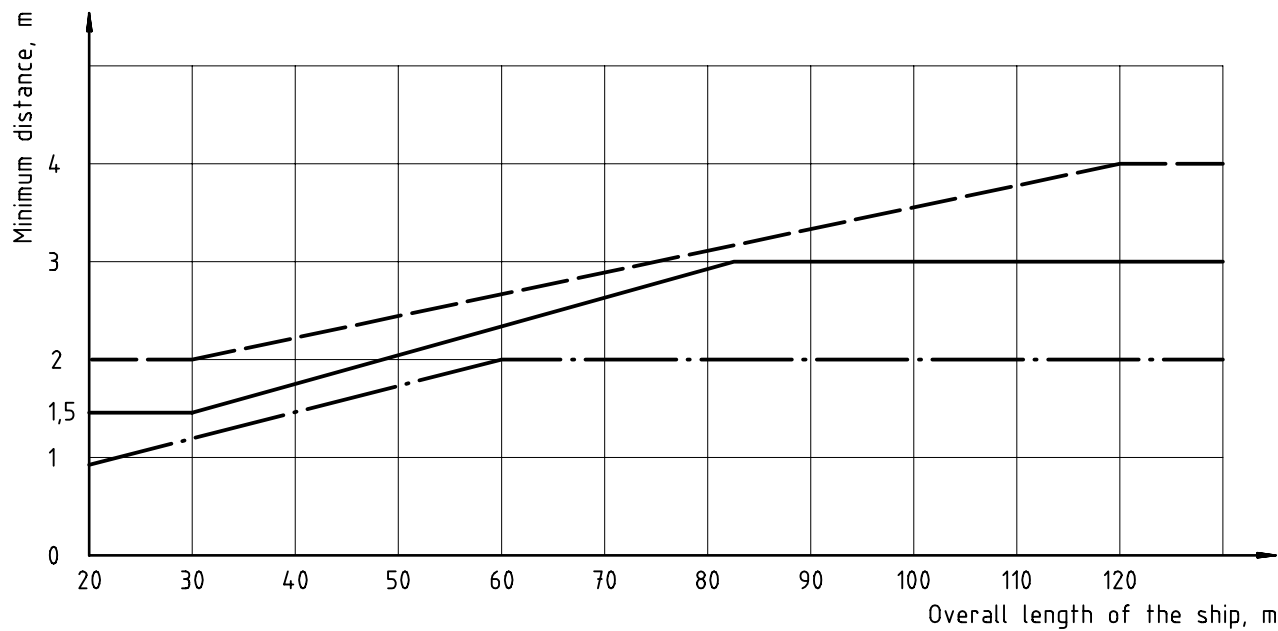
sensor using the geomagnetic field for feeding an automatic heading-control system, or controlling an off-course alarm unit, or feeding other devices

3.2
safe distance

distance measured between the nearest point of the item concerned and the centre of the compass, as determined in annex A

3.3
minimum distance

distance measured between the nearest point of magnetic material which is part of the ship's structure and the centre of the compass, shown in Figure 1



Type of magnetic material	Ships in which a standard compass is prescribed	Fishing vessels and ships designed for restricted service
Uninterrupted fixed magnetic material (except horizontal deck)	—————	— . — . — . —
End parts of fixed magnetic material, such as top edges of walls, partitions and bulkheads, extremities of frames, girders, stanchions, beams, pillars and similar steel parts. Magnetic material subject to movement at sea such as davits, ventilators, steel doors, etc. Large masses of magnetic material with variable fields such as funnels ^a .	— — — — —	— . — . — . —
^a “Funnel” is understood to mean that part of the funnel uptake or exhaust pipe which is liable to heating. The funnel casing may be regarded as fixed magnetic material.		

NOTE For the minimum distance from steering and other compasses, see clause 5.

Figure 1 — Minimum distance from the standard magnetic compass

4 General

4.1 Compass positions

The specifications governing the minimum distances of a compass from magnetic material take into consideration the accuracy required of that compass for normal navigation.

The magnetic compass shall be positioned in the centre of the ship. Only in exceptional cases is a deviation from this requirement acceptable.

4.2 Safe distances

Safe distances from the magnetic compass are prescribed for magnetic and electrical equipment. They are defined as the minimum distances considered necessary for any of these items in order to eliminate or greatly reduce the magnetic fields acting on the magnetic compass and causing it to deviate.

4.3 Accuracy of magnetic compasses

The reliability and accuracy of magnetic compasses are dependent to a great extent on their position in the ship and on the proximity of magnetic and electrical equipment in relation to that position. Varying degrees of reliability and accuracy are, however, permitted, dependent on the function the compass has to perform and the overall length of the ship in which it is installed.

4.4 Functions of magnetic compasses

4.4.1 Magnetic compasses are classified according to the functions they are intended to perform in ships. In the following description of the function of the standard magnetic compass, no account has been taken of the possible fitting of one or more gyro-compasses in the ship. The fitting of a gyro-compass shall not be taken as a reason for reducing in any way the accuracy to be expected from the ship's standard magnetic compass, which is the primary means of navigating a ship.

4.4.2 The standard magnetic compass shall be sited in the vicinity of the position from which the ship is ordinarily navigated and the view of the horizon from this position shall be as uninterrupted as possible, for the purpose of taking bearings. In the sector from right ahead to 115° on either side, the view of the horizon may be interrupted only by masts, derrick posts, cranes and similar obstructions.

4.4.3 If the standard compass sited on the wheelhouse top is of the projector or reflector type, thus providing the heading information clearly readable by the helmsman at the main steering position, it also acts as the steering compass.

4.4.4 An example of a stand-by steering compass is a steering compass fitted in a ship's wheelhouse where the reflected or projected image of the standard compass is available and principally used for steering.

An emergency compass is one fitted for the purpose of conning or steering the ship after damage or breakdown of all other means of doing so.

4.4.5 Magnetic control sensors are not used for any of the purposes defined in 4.4.2, 4.4.3 and 4.4.4.

5 Minimum distance requirements concerning the ship's structure

5.1 The standard compass shall be so positioned that it complies with the minimum distance requirements for magnetic material which may be regarded as part of the ship's structure, as indicated in Figure 1. Any magnetic material in the vicinity of the compass but outside the minimum distances (see Figure 1) should be disposed symmetrically relative to the compass.

For the standard compass, the distance from the deck below the compass may be reduced to a minimum of 1 m, provided that the other minimum distances according to Figure 1 are kept.

If there is only one magnetic compass installed on the ship, this compass shall fulfil the requirements concerning the minimum distances and the safe distances as laid down for the standard magnetic compass in this International Standard.

It is emphasized that these distances are minimum permissible distances and should prove satisfactory in the majority of ships. Special cases will, however, arise, where the masses of iron in the vicinity of the compass are such that the compass does not work satisfactorily and, in these cases, the distances should of necessity be increased.

5.2 For steering compasses, the minimum distances may be reduced to 65 % of those required for the standard compass.

For steering compasses, the distance from the deck below the compass may be reduced to 1,0 m provided the distance from the extremities of iron decks, bulkheads and girders is not less than 65 % of the distances required for the standard compass.

5.3 For stand-by steering compasses and magnetic control elements, the distances may be reduced to 50 % of those required for the standard compass, provided that no distance is less than 1,0 m.

5.4 For emergency compasses (if fitted), the minimum distance is 1,0 m.

5.5 Items which are permanently fixed to the ship's structure shall be treated as part of the latter.

5.6 Moveable magnetic parts in the vicinity of the steering compass, e.g. the steering gear, shall not influence the indication of such a compass.

5.7 The standard compass and the steering compass shall not be placed in a wheelhouse completely constructed of magnetic material. If the wheelhouse is partly constructed of magnetic material, the magnetic parts should be disposed symmetrically relative to the compass.

6 Safe-distance requirements for magnetic and electrical equipment and electric cables

6.1 Magnetic and electrical equipment and cables carrying direct current close to a magnetic compass may produce a deviation of that compass.

6.1.1 In order that the removal or replacement of any item of equipment will not introduce any unacceptable deviation, such an item shall not be placed closer to the compass than its safe distance.

The safe distance for any item shall be determined by the method described in annex A.

Clips and other components in the vicinity of magnetic compasses shall be of non-magnetic material.

6.1.2 Electric wiring carrying direct current, other than coils used for compass correction, within 5 m of magnetic compasses, shall be arranged bipolarly so that the magnetic fields generated by the two opposite currents compensate each other.

6.2 Manufacturers of magnetic and electrical equipment shall arrange for the safe distances of such equipment likely to be placed in the vicinity of the magnetic compass to be determined by the method described in annex A. The manufacturer shall mark each item of portable equipment with its safe distance.

For fixed equipment, the manufacturer may mark the equipment or specify the safe distance in the equipment manual.

6.3 Items for which the safe distance is not known shall not be placed nearer than 5 m to the standard compass or the steering compass. This distance may, however, be reduced to 3 m for standard compasses and steering compasses in ships intended for restricted service only.

6.4 When determining the safe distance of large items of equipment such as radar sets, it is sometimes permissible to make a distinction between those items which are readily interchangeable and those which consist of large masses, the exchange of which would entail a considerable amount of work. In such cases, the safe distance of any item which is readily interchangeable is determined in accordance with 6.1.1 so that it may be removed or exchanged without appreciably affecting the compass. The remainder of the equipment, comprising the "large masses", is treated as a part of the ship's structure (see 5.5) and, if it is removed or exchanged, the compass affected shall be readjusted.

6.5 Magnetic compasses shall not be placed nearer than 2 m to one another or to magnetic control sensors. In ships of less than 60 m overall length, this distance may be reduced to 1,8 m.

Annex A (normative)

Determination of safe distances

The safe distance for any item of equipment shall be determined by the method described below. Test each item in the position and attitude relative to the compass or magnetometer at which the error produced at the compass would be a maximum, provided the item can be fitted in this way.

The safe distance of any item is defined as the distance measured between the nearest point of the item and the centre of the compass or magnetometer at which it will not produce a deviation

- in the standard compass of more than

$$(5,4/H)^{\circ}$$

where H is the horizontal component of the magnetic flux density, in microteslas (μT), at the place of testing,

- in the steering compass of more than

$$(18/H)^{\circ}$$

H being defined as above.

Test each item

- a) in the magnetic condition in which it is received,
- b) after magnetization in a d.c. field of

$$1 \times (1\,000/4\pi) \text{ A/m}$$

with a superimposed stabilizing a.c. field of 50 Hz and

$$18 \times (1\,000/4\pi) \text{ A/m r.m.s.}$$

If damage to the equipment under test might result, omit the stabilizing field.

The direction of the field is that in which, as estimated by inspection or from drawings, the resultant magnetization will be a maximum (e.g. the long axis of a ferromagnetic box).

- c) in the energized condition, if the item is capable of being energized electrically.

The largest distance obtained from all these tests is the safe distance.

Round up the values obtained to the nearest 5 cm or 10 cm.

The safe distance values for ships intended for restricted service only can be reduced to 60 % of the values given above.

