INTERNATIONAL STANDARD

ISO 11606

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Ships and marine technology — Marine electromagnetic compasses

Navires et technologie maritime — Compas électromagnétiques de marine

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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.

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.

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 ± 0,5° 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° 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 ± 0,5° 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 ± 0,5°.

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 ± 2°.

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° 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 ± 0,5° of the 0° to 180° line of the verge ring.

Additional lubber marks shall be within ± 1°.

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 ± 75μT;*

— *coefficient A: up to ± 3°;*

— *coefficient B: up to ± (720/H)°;*

— *coefficient C: up to ± (720/H)°;*

— *coefficient D: up to ± 7°;*

— *coefficient E: up to ± 3°;*

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 μT.

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 ± 0,5°, 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° ± 1°, except if the diameter of the outer gimbal ring is less than 150 mm: in this case the angle shall be 90° ± 2°.

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 ± 5°.

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

6.2.1 Static accuracy

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

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.

9 Type testing and individual testing

9.1 General

Unless otherwise stated, all tests shall be carried out at a temperature of 20 °C ± 3 °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.

Each type test certificate is valid exclusively for the model tested. In case of alterations or technical improvements which could affect its compliance with this International Standard, the model shall be given a new identification number or mark and the type test repeated. All alterations shall be submitted to the original test authority who will decide whether a new type test is necessary.

Copies of the certificate shall be issued on demand. They shall be explicitly marked "copy".

Acceptance of type test certificates and individual test certificates between countries will be a matter for mutual agreement.

10.2 Statement issued by the manufacturer or importer

The following requirement applies to type testing only.

The manufacturer or importer shall produce a written statement covering those requirements which cannot be ascertained during the type test. The statement shall contain the following:

— a detailed description of the elements;

— a detailed description of the gimbal ring;

— a description of the installation;

— an operational guide to enable the optimum performance to be attained;

— figures to support the application of type testing.

10.3 Marking check

10.3.1 The presence of the markings on the unit of the compass specified in clause 8 shall be checked by visual inspection.

10.3.2 When 10.3.1 is fulfilled, the markings specified in clause 8 shall be written on the certificate.

10.4 Sample checks

In order to check that the requirements covered by the "Statement issued by the manufacturer or importer" described in 10.2 have been fulfilled, sample checks may be carried out.

11 Testing

11.1 Testing of units

11.1.1 General

Testing shall be carried out on the following components in accordance with the categories for which they are intended as specified in IEC 60945:

a) magnetic sensor: exposed to the weather;

b) processor: protected from the weather or exposed to the weather if intended for use on an open deck;

c) main compass: protected from the weather or exposed to the weather if intended for use on an open deck;

d) repeater indicator: protected from the weather or exposed to the weather if intended for use on an open deck.

Tests in a static magnetic field shall be carried out in an authorized test room.

11.1.2 Condition of the compass

Carry out a visual inspection of the compass to ensure that it is undamaged, mechanically sound and operating satisfactorily.

11.1.3 Non-magnetic properties (type test only)

Examine the housing of the magnetic sensor system (see 5.3) to confirm its non-magnetic properties.

11.1.4 Graduation of the main compass card

Carry out a visual inspection. The result shall fulfil the requirements specified in 5.5.1.

11.1.5 Fore-and-aft marks of the main compass

This examination may be carried out on a compass test stand. After having brought the outer gimbal axis (the fore-and-aft datum line may be used instead) into a vertical plane of sight coinciding with the centre of rotation, rotate the stand until the fore-and-aft marks come into the vertical plane of sight. The fore-and-aft marks error is equal to the angle of rotation of the test stand. The result shall fulfil the requirement specified in 5.4.

11.1.6 Azimuth error of the main compass

This examination may be carried out on a compass test stand. The result shall fulfil the requirements specified in 5.5.1.

11.1.7 Graduation of the card of card-type repeater indicators

This examination shall be carried out by visual inspection. The result shall fulfil the requirements specified in 5.5.2.

11.1.8 Graduation of the verge ring

This examination shall be carried out by visual inspection. The result shall fulfil the requirements specified in 5.5.4.

11.1.9 Readability

This examination shall be carried out by visual inspection. The result shall fulfil the requirement specified in 5.5.6.

11.1.10 Horizontal position of compass plane

The main compass and card-type repeater indicators shall be balanced so that the verge ring, or top glass cover, settles in the horizontal plane when the gimbal ring is fixed in a horizontal position. This requirement shall be met whether the azimuth reading device, or other attachment or magnifier, is in position or not. Measurement shall be carried out by placing a spirit-level of suitable sensitivity or other similar device on the verge ring or top glass cover. The result shall fulfil the requirements specified in 5.5.7.

11.1.11 Lubber marks

11.1.11.1 Main lubber mark and additional lubber marks

The main lubber mark and additional lubber marks (if any) of the main compass and of compass-type repeater indicators shall be checked. These lubber marks shall fulfil the requirements specified in 5.6.

11.1.11.2 Width and location of lubber marks

These examinations shall be carried out by visual inspection, and shall fulfil the requirements specified in 5.6.

11.1.11.3 Lubber mark error

The examination may be carried out on a compass test stand. After having brought the outer gimbal axis (the fore-and-aft datum line may be used instead) into a vertical plane of sight coinciding with the centre of rotation, rotate the stand until the main lubber mark comes into the vertical plane of sight. The lubber mark error is equal to the angle of rotation of the test stand. The result shall fulfil the requirement specified in 5.6.

11.1.12 Illumination and dimmer systems

These examinations shall be carried out by visual inspection, and shall fulfil the requirements specified in 5.7.

11.1.13 Indication of compensation values

The check to determine whether the deviation and heeling-error compensation values are indicated shall be carried out by visual inspection, and shall fulfil the requirements specified in 5.8.

11.1.14 Examination of the output

11.1.14.1 General

Compliance with the requirements specified in 5.8, 5.9 and 5.10 shall be verified by visual inspection or electrical measurements.

11.1.14.2 Output of ship's heading

The check to determine that the output of the heading information, obtained after compensating with the values of coefficients *A, B, C, D, E* and (geomagnetic) variation, is sent to the main compass, the repeater indicators and the output terminals shall be carried out by visual inspection, and shall fulfil the requirements specified in 5.9.

11.1.15 Direction of gimbal axis and angle between the gimbal axes

The direction of the outer gimbal axis shall be examined by visual inspection, and shall fulfil the requirement specified in 5.11.1.

Measurement of the angle between the gimbal axes may be made by means of graduation of the test stand when, by turning the compass support, first one and then the other gimbal axis is brought into the vertical plane of view passing though the centre of the graduation.

The result shall fulfil the requirements specified in 5.11.2. This test is only a type test.

11.1.16 Freedom of tilt of the main compass

This test may be carried out using a clinometer placed on the top glass cover or verge ring. The result shall fulfil the requirement specified in 5.11.3. This test is only a type test.

11.1.17 Precautions against dislodging

This examination shall be carried out by visual inspection, and the result shall fulfil the requirement specified in 5.11.4. This test is only a type test.

11.1.18 Fitting the main compass

Measure the rotatable allowance by fitting the magnetic sensor unit in accordance with the manufacturer's instructions. Turn the unit to determine the maximum angle of misalignment which can be corrected. The result shall fulfil the requirement specified in 5.12.

11.1.19 Height of the main compass card plane

Measure the height of the main compass card plane; it shall fulfil the requirements specified in 5.13.

11.1.20 Watertightness of repeater indicators

The main compass and repeater indicators intended for use on an open deck shall fulfil the requirements specified in IEC 60945 for the category "exposed to the weather".

11.1.21 Provision of azimuth reading device

The azimuth reading device for taking bearings shall fulfil the requirements specified in ISO 449:1997, clause 7.

11.1.22 Azimuth sight

This test may be carried out by visual inspection, and the result shall fulfil the requirements specified in 5.15.2.

11.1.23 Construction for maintenance and inspection

This test shall be carried out by visual inspection. The result shall fulfil the requirements specified in 5.16 and IEC 60945.

11.1.24 Protection against changes in power supply

Means providing protection against changes in power supply shall be checked by the relevant method in IEC 60945, and meet the requirements specified in 5.17.

11.2 Performance tests

11.2.1 Freedom of tilt of the compasses

This examination may be carried out by means of a revolving platform with adjustable inclination. When the binnacle is tilted in any direction by an angle of 30°, the main compass and the card-type repeater indicator shall fulfil the requirement specified in 5.11.4, and the reading of the main compass shall fulfil the requirements specified in 6.2 and 6.3.

11.2.2 Accuracy of the fore-and-aft marks of the main compass

This test may be carried out on a compass test platform. The vertical plane passing through the centre of the compass card and the fore-and-aft datum line of the verge ring shall pass through the fore-and-aft marks of the main compass binnacle within the limits specified in 5.5.5.

11.2.3 Accuracy of the main lubber mark

This test may be carried out on a compass test platform. The vertical plane passing through the centre of the main lubber mark of the main compass or of a card-type repeater indicator shall be within the limits specified in 5.6.2.

11.2.4 Accuracy of the compass

This test shall be performed at a temperature of 20 °C ± 3 °C. Bring the fore-and-aft line of the magnetic sensor into the line of the magnetic meridian on the platform and then rotate the platform and take main compass readings for at least sixteen magnetic bearings, every 22,5°, starting from 0°. The readings shall fulfil the requirements specified in 6.2.

11.2.5 Directional error in the horizontal plane

This test shall be performed at a temperature of 20 °C ± 3 °C. Take readings of the main compass or a repeater indicator for at least sixteen magnetic bearings (every 22,5°). The readings shall fulfil the requirements specified in 6.2.

11.2.6 Bearing accuracy under the influence of ship's motion

With the magnetic sensor system on a test platform, apply a rolling motion, of amplitude ± 22,5° and period 10 s, for 10 minutes. The readings of the main compass shall fulfil the requirements specified in 6.2.

11.2.7 Transmission system

With the magnetic sensor on a test platform, rotate the platform at a rate of 20°/s. The readings of the main compass shall fulfil the requirements specified in 6.3.

11.2.8 Synchronized accuracy between a repeater indicator and the main compass

The synchronized accuracy between a repeater indicator and the main compass shall fulfil the requirements specified in 6.4.

11.2.9 Environmental conditions

The following tests shall be carried out in accordance with IEC 60945:

— Dry-heat cycle test;

— Damp-heat cycle test;

— Low-temperature cycle test.

The results shall fulfil the requirements specified in clause 6.

11.2.10 Test of compensation ability

Place the magnetic sensor at the centre of rotation of a compass test stand. With the sensor in this position, produce individually the ship's vertical field and the deviation coefficients *A, B, C, D* and *E* with the values specified in 5.8. Then, switch on the compass and compensate the deviation by means of the equipment provided for compensation. Perform this as accurately as possible. Then, read the residual deviation of the main compass at least every 22,5° by rotation of the platform of the compass test stand. The readings shall fulfil the requirements specified in 6.5. Other, undesired, coefficients shall not be larger than the values specified in 5.8. The test shall be carried out by producing and compensating each coefficient individually and separately, one after the other.

11.3 Test of electromagnetic compatibility

Compasses shall be tested in accordance with IEC 60945. The result shall fulfil the requirements specified in 6.6.

11.4 Vibration tests

Vibration tests in accordance with IEC 60945 shall be performed and no resonance shall be found anywhere in the full frequency range.

11.5 Construction for maintenance and inspection

Compasses shall fulfil the conditions specified in IEC 60945 with respect to construction for maintenance and inspection.

11.6 Checking of precautions against failure

This examination shall be carried out by operational inspection. The results shall fulfil the requirements of 7.1, 7.2 and 7.3.

12 Designation

Electromagnetic compasses stated as complying with this International Standard shall be designated using the following elements, in the order given:

— the number of this International Standard;

— the diameter of the card of the main compass display, in millimetres.

EXAMPLE For a card of diameter 165 mm

ISO 11606 — 165

Annex A
(informative)

Equivalent requirements in ISO 11606 and IMO Resolutions

Subclause in ISO 11606	*Clause or subclause in* **IMO Res. MSC.86(70), Annex 2 [Recommendation on performance standards for marine transmitting magnetic heading devices (TMHD's)]** **or** **IMO Res. A.694(17)**
5.4	MSC.86(70), Annex 2, 4.1, 4.1.1, 4.1.2
5.8	MSC.86(70), Annex 2, 4.3
5.8.2	MSC.86(70), Annex 2, 4.3.1
5.8.3	MSC.86(70), Annex 2, 4.3.2
5.9	MSC.86(70), Annex 2, 4.4
5.10	MSC.86(70), Annex 2, 4.5
5.12	MSC.86(70), Annex 2, 4.2.1
5.17	IMO Res. A.694(17), 4.2
6.2	MSC.86(70), Annex 2, 5.1
6.2.1	MSC.86(70), Annex 2, 5.1.1
6.2.2	MSC.86(70), Annex 2, 5.1.2
6.3	MSC.86(70), Annex 2, 5.2
6.6	MSC.86(70), Annex 2, clause 6
7.3	MSC.86(70), Annex 2, clause 7

Bibliography

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[2] ISO 694:2000, *Ships and marine technology — Positioning of magnetic compasses in ships.*

[3] ISO 1000:1992, *SI units and recommendations for the use of their multiples and of certain other units.*

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

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

[6] IEC 60092-504:1994, *Electrical installations in ships — Part 504: Special features — Control and instrumentation.*

[7] IEC 60533:1999, *Electrical and electronic installations in ships — Electromagnetic compatibility.*

[8] IMO Resolution A.382, *Magnetic compasses carriage and performance standards* (adopted on 14 Nov. 1977).

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