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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

This fourth edition cancels and replaces the third edition (ISO 8728:2014), which has been technically revised.

The main changes are as follows:

— Clause 4 (abbreviated terms) has been added;

— in 6.3, requirements related to bridge alert management have been added;

— in 7.1, a requirement for display equipment has been added;

— in 7.12, test method for requirements related to bridge alert management has been added;

— in Annex B, the equivalent requirements in this document and IMO Resolution have been deleted and the alerts with a standard alert identifier have been defined;

— in Annex C, IEC 61162 interfaces overview has been added;

— the normative references and bibliography have been updated.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is aligned with IMO Resolution A.424(XI) on performance standards for gyro-compasses.

Any text in this document which is a citation from the IMO Resolution A.424(XI), appears in italics. Within these citations, any changes to the original wording of the IMO Resolution A.424(XI) are written in upright font.

In this document, the following verbal forms are used:

— “shall” indicates a requirement;

— “should” indicates a recommendation;

— “may” indicates a permission;

— “can” indicates a possibility or a capability.

Ships and marine technology — Marine gyro-compasses

1 Scope

This document specifies the construction, performance, and type testing for gyro-compasses which are required by the International Convention for the Safety of Life at Sea (SOLAS), 1974 (as amended), Chapter V, Regulation 19.

This document specifies the minimum requirements, the construction, performance, and type testing for gyro-compasses, which required to comply with the performance standards adopted by the IMO Resolution A.424(XI).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60945, *Maritime navigation and radiocommunication equipment and systems — General requirements — Methods of testing and required test results*

IEC 61162-1, *Marine navigation and radiocommunication equipment and systems — Digital interfaces - Part 1: Single talker and multiple listeners*

IEC 61162-2, *Maritime navigation and radiocommunication equipment and systems — Digital interfaces — Part 2: Single talker and multiple listeners, high-speed transmission*

IEC 61162-450, *Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 450: Multiple talkers and multiple listeners - Ethernet interconnection*

IEC 62288, *Maritime navigation and radiocommunication equipment and systems — Presentation of navigation-related information on shipborne navigational displays — General requirements, methods of testing and required test results*

IEC 62923-1:2018, *Maritime navigation and radiocommunication equipment and systems — Bridge alert management — Part 1: Operational and performance requirements, methods of testing and required test results*

IEC 62923-2, *Maritime navigation and radiocommunication equipment and systems — Bridge alert management — Part 2: Alert and cluster identifiers and other additional features*

IMO Resolution MSC 302(87), *Performance standards for bridge alert management*

IMO Resolution MSC 191(79), *Performance standards for the presentation of navigation-related information on shipborne navigational displays*

IMO Resolution MSC 466(101), *Amendments to the performance standards for the presentation of navigation-related information on shipborne navigational displays (*Resolution MSC.191(79)*)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
gyro-compass
complete equipment comprising all essential elements of the complete design, including both the gyro-compass as heading sensor and the associated heading transmission system

[SOURCE: IMO Resolution A.424(XI), 2.1, modified — elements of complete design have been specified.]

3.2
true heading
horizontal angle between the vertical plane passing through the true meridian and the vertical plane passing through the ship's fore-and-aft datum line

Note 1 to entry: The true heading is measured from true north (000°) clockwise through 360°.

Note 2 to entry: When the gyro-compass equipment is not installed on board ship, this "true heading" is regarded as the true heading of the lubber line. Where a gyro-compass has the facility of introducing a correction by moving the lubber line, the correction is set for the local latitude.

[SOURCE: IMO Resolution A.424(XI), 2.2, modified — notes 1 and 2 to entry have been added.]

3.3
settled
stable situation when any three readings taken at intervals of 30 min are within a band of 0,7°, with the compass level and stationary

Note 1 to entry: The settling time is the elapsed time between the time of switch-on at the initial heading error and the third recording of the settle.

[SOURCE: IMO Resolution A.424(XI), 2.3, modified — note 1 to entry has been added.]

3.4
settle point heading
mean value of ten readings taken at 20 min intervals after the compass has *settled* (3.3)

[SOURCE: IMO Resolution A.424(XI), 2.4]

3.5
settle point error
difference between the *settle point heading* (3.4) and the *true heading* (3.2)

[SOURCE: IMO Resolution A.424(XI), 2.5]

3.6
error
difference between the observed value and the *settle point heading* (3.4)

[SOURCE: IMO Resolution A.424(XI), 2.6]

3.7
repeater compass
device that reproduces the master compass card at a remote location

3.8
bearing repeater compass
device that reproduces the master compass card for the purpose of taking bearings

3.9
compass card
graduated dial of the compass which indicates the measured direction of the meridian

3.10
latitude error
error (3.6) to which some *gyro-compasses* (3.1) are subject, the magnitude and sign of which depend upon the local latitude

Note 1 to entry: Means are provided for correcting this error.

3.11
speed error
error (3.6) to which *gyro-compasses* (3.1) are subject, the magnitude and sign of which depend upon the speed, course, and latitude of the ship

Note 1 to entry: Means are provided for correcting this error.

3.12
lubber line
index line situated on the body of a compass against which the compass heading is read

3.13
master compass
main compass unit which supplies the heading information to the repeaters and other navigational aids

3.14
Scorsby table
test machine which enables a platform to oscillate independently about three axes

Note 1 to entry: It is used to simulate the motion of a ship.

3.15
bridge alert management
BAM
overall concept for management, handling and harmonized presentation of alerts on the bridge

[SOURCE: IMO Resolution MSC.302(87), Appendix 1]

3.16
central alert management system
CAM system
combined functionality of the central alert management and the central alert management human machine interface

[SOURCE: IMO Resolution MSC.302(87), Appendix 1]

4 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

BAM	bridge alert management
CAM	central alert management
EUT	equipment under test
GC	gyro-compass
GNSS	global navigation satellite system
SDME	speed and distance measuring system
VDR	Voyage Data Recorder

5 Construction requirements

Gyro-compass units shall conform to the following requirements.

a) In accordance with IMO Resolution A.424(XI), 6.1 and 8, *the equipment* shall *be capable of continuous operation under conditions of vibration, humidity, change of temperature* and *variations of the power supply* as specified in 7.10.2 to 7.10.6.

b) For ships which are required to carry bearing repeater compasses, the construction of these shall be as follows.

   1) The bearing repeater compass shall be designed to be fitted with an azimuth reading device.

   2) A gimbal mechanism shall be provided to enable the bearing repeater compass card to be held horizontally against the ship's motion.

   3) Any bearing repeater compass intended for use on an open deck shall be waterproof.

c) In accordance with IMO Resolution A.424(XI), 3, *the compass card* shall *be graduated at equal intervals of 1° or fraction thereof.*

   The graduation error shall be less than ±0,2°.

   A numerical indication shall *be provided at least at every 10°, starting from 000° clockwise through 360°.*

d) In accordance with IMO Resolution A.424(XI), 4, *fully adequate illumination* shall *be provided to enable* the *reading of* all compass cards *at all times. Facilities for dimming* shall *be provided.*

e) Both master compass and repeater compasses shall be provided with a lubber line to indicate the ship's heading.

   The base or some other fixed extremity of the compass shall be marked or identified in such a way as to facilitate the installation of the compass in a ship, so that the lubber line lies in a vertical fore-and-aft plane of the ship. Where a gyro-compass has the facility of introducing a correction by moving the lubber line, the correction during installation shall be set to zero. If such marks or identifications are not in the same vertical planes as the uncorrected lubber line, then the horizontal angular relationship between them shall be clearly indicated.

f) In accordance with IMO Resolution A.424(XI), 9.1, *the master compass and any repeaters used for taking visual bearings* shall *be installed* or adjusted *in a ship with their fore and aft datum lines parallel to the ship's fore and aft datum line to within ±0,5°. The lubber line* shall *be in the same vertical plane* passing through *the centre of the card of the compass and* shall *be aligned accurately in the fore and aft direction.*

   Requirements for ship surveyors for the installation of gyro-compasses and repeater compasses on board ships shall be in accordance with Annex A.

g) In accordance with IMO Resolution A.424(XI), 9.2, *means* shall *be provided for correcting the errors induced by speed and latitude*. Graphical or tabular means of correction can be used.

h) In accordance with IMO Resolution A.424(XI), 7.1, *steps* shall *be taken to eliminate as far as is practicable, the causes of, and to suppress, electromagnetic interference between the gyro-compass and other equipment on board*.

i) In accordance with IMO Resolution A.424(XI), 7.2, *mechanical noise from all units* shall *be so limited as* to ensure *the hearing of sounds on which the safety of the ship* may *depend*.

j) In accordance with IMO Resolution A.424(XI), 9.7, *the equipment* shall *be so constructed that it is readily accessible for maintenance purposes*.

k) In accordance with IMO Resolution A.424(XI), 6.2, *means* shall *be incorporated for the protection of the equipment from excessive currents and voltages, transients and accidental reversal of power supply polarity.*

l) In accordance with IMO Resolution A.424(XI), 6.3, *if provision is made for operating the equipment from more than one source of electrical energy, arrangements for rapidly changing from one source of supply to the other* shall *be incorporated*.

m) In accordance with IMO Resolution A.424(XI), 9.4, the gyro-compass shall be *designed to enable heading information to be provided to other navigational aids*. See 6.2.

6 Performance requirements

6.1 Accuracy in latitudes up to 60°

6.1.1 Settling time

In accordance with IMO Resolution A.424(XI), 5.1.1, *when switched on in accordance with the manufacturer's instructions, the compass* shall *settle within 6 h.*

6.1.2 Settle point error

In accordance with IMO Resolution A.424(XI), 5.1.2, *the settle point error at any heading* shall *not exceed ± 0,75° × secant latitude, and the RMS value of the differences between individual heading indications and the mean value* shall *be less than 0,25° × secant latitude. The repeatability of settle point error from one run-up to another shall be within 0,25° × secant latitude.*

6.1.3 Settling time under operational conditions

In accordance with IMO Resolution A.424(XI), 5.2.1, *when switched on in accordance with the manufacturer's instructions, the compass* shall *settle within 6 h when rolling and pitching with simple harmonic motion of any period between 6 s and 15 s, a maximum angle of 5°, and a maximum horizontal acceleration of 0,22 m/s^2.*

6.1.4 Settle point error under general conditions

In accordance with IMO Resolution A.424(XI), 5.2.2, *the repeatability of the settle point error of the master compass shall be within ±1° × secant latitude under the general conditions and including variations in magnetic fields likely to be experienced in the ship in which it is installed.*

6.1.5 Residual error in correction

In accordance with IMO Resolution A.424(XI), 5.2.3.1, *the residual steady-state error, after correction for speed and course influences at a speed of 20 kn*[1)]*, shall not exceed ±0,25° × secant latitude.*

6.1.6 Effect of alteration of speed

In accordance with IMO Resolution A.424(XI), 5.2.3.2, *the error due to a rapid alteration of speed of 20 kn*[1)] shall *not exceed ±2°.*

6.1.7 Effect of alteration of course

In accordance with IMO Resolution A.424(XI), 5.2.3.3, *the error due to a rapid alteration of course of 180° at a speed of 20 kn*[1)] shall *not exceed ±3°.*

6.1.8 Accuracy on a Scorsby table

In accordance with IMO Resolution A.424(XI), 5.2.3.4, *the transient and steady-state errors due to rolling, pitching, and yawing, with simple harmonic motions of any period between 6 s and 15 s, maximum angles*

1) 1 kn = 1,852 km/h.

of 20°, 10°, and 5° respectively, and a maximum horizontal acceleration not exceeding 1 m/s², shall *not exceed ± 1° × secant latitude*.

6.1.9 Synchronization between the master compass and repeaters

In accordance with IMO Resolution A.424(XI), 5.2.4, once the repeaters have been synchronized with the master, *the maximum divergence in reading between the master compass and repeaters under all operational conditions* shall *not exceed ±0,5°*. For the purposes of this requirement, the latitude and speed correction shall be assumed equal to zero.

6.2 Interface

NOTE 1 See Annex C.

The compass shall provide interface facilities which meet IEC 61162-1, IEC 61162-2 or IEC 61162-450.

The gyro-compass equipment shall provide an appropriate data source and at least one output of heading information. The heading output shall be updated at a rate of once every 20 ms. The THS sentence detailed in IEC 61162-1 shall be provided for heading information.

NOTE 2 THS refers a sentence formatter which is described in IEC 61162-1 and IEC 62923-1.

The test of the interface shall meet the performance test specified in 7.8.

The sentences from IEC 61162-1 shall be in accordance with Annex C.

6.3 Alert management

6.3.1 General

In accordance with IMO Resolution A.424(XI), 9.3, *an automatic* alert shall *be provided to indicate major* malfunctions of the system *in the* gyro-*compass*.

If the gyro-compass uses display equipment for alert management, it shall comply with IMO Resolution MSC.191(79), as amended by IMO Resolution MSC.466(101), and with IEC 62288.

The general presentation, handling and communication for alerts shall comply with the requirements stated in IMO Resolution MSC.302(87), IEC 62923-1:2018, Module A and Module C, and IEC 62923-2, as a minimum.

The alerts with a standard alert identifier for gyro-compasses are specified in Table B.1.

NOTE 1 Alert titles and alert description texts used in Table B.1 and in the body text of this document are not mandatory alert titles and alert description texts, but are regarded as guidance. Alert titles and alert description texts used in the body text of this document are therefore indicated between double quotation marks (“ “).

The manufacturer of the gyro-compass shall declare the EUT function type for the bridge alert management (BAM) compliance test.

NOTE 2 According to the EUT function type, the relevant test set-up and test items are specified in BAM test standards. Refer to IEC 62923-1:2018: 4.2, Clause 5, Clause 6, Module A Clause 8 and Module C.

6.3.2 Power failure in the gyro-compass (“Power fail” alert)

In the case of power failure of the gyro-compass, a status signal (e.g. by normally closed contact) shall be provided to enable external equipment to raise the appropriate alert.

If the gyro-compass has another power supply for backup and can use display equipment during failure of one power supply, the “power fail” alert may be provided as specified in Table B.1.

6.3.3 Malfunction of the gyro-compass system ("System fault" alert)

When the self-diagnosis function of the gyro-compass detects the major malfunction of the system, the "system fault" alert with an appropriate priority or the minimum presentation indicating the cause of failure shall be activated as specified in Table B.1.

In the case of the malfunction whereby the gyro-compass system cannot operate at all, the status signal (e.g. by normally closed contact) shall be output as specified in 6.3.2 so that external equipment can raise a proper alert.

7 Type tests

7.1 General

Unless otherwise stated in this document, confirm by inspection of documented evidence that the EUT complies with IEC 60945 (e.g. by using the tests specified in 7.10.7).

The construction of the EUT conforms to the requirements specified in Clause 5.

If the EUT uses display equipment, confirm by inspection of documented evidence that the EUT complies with IEC 62288.

7.2 Settling time test

The master compass of the EUT is securely positioned on a nominally level and stationary base. It is energized from nominal value power supplies and started in accordance with the manufacturer's instructions from an initial heading error (high) of 30° or more.

Confirm by observation that the settling time meets the requirement specified in 6.1.1.

7.3 Settle point error test

When the master compass of the EUT has settled, confirm by observation that the settle point error conforms to the requirements specified in 6.1.2.

7.4 Settle point heading repeatability test

The master compass of the EUT is started in accordance with the manufacturer's instructions from an initial heading error (high) of 30° or more and is allowed to settle.

The settle point heading is determined. The master compass of the EUT is then switched off for a period of not less than 12 h and not more than 7 days. It is then started again from an initial heading error (low) of 30° or more, and the settle point heading is measured again.

The master compass of the EUT is then switched off for a period of not less than 12 h and not more than 7 days. It is then started again from an initial heading error (high) of 30° or more and the settle point heading is determined. The three values of the obtained settle point heading are recorded. It is confirmed by observation that the difference between any two values does not exceed 0,25° × secant latitude.

NOTE If this test follows the text described in 7.3, then the "settle" obtained from that text can be used as the first value required by this repeatability test, provided that the second "settle" follows a switch off period of not less than 12 h and not more than 7 days.

7.5 Settling time on a Scorsby table

The master compass of the EUT is mounted on a Scorsby table with the master compass fore-and-aft line, nominally parallel with one axis of the table which is designated the roll axis.

The other nominally horizontal axis (at right angles to the first axis) is designated the pitch axis.

The EUT is switched on in accordance with the manufacturer's instructions with the following nominal simple harmonic table motions:

— roll axis: peak amplitude 5° ± 1°, period 15 s ± 1 s;

— pitch axis: peak amplitude 5° ± 1°, period 6 s ± 1 s.

Confirm by observation that the settling time measured between switch-on and compass settle conforms to the requirements specified in 6.1.3.

NOTE Compass readings to determine the settle condition can be taken with the Scorsby table stationary and nominally level, and with a minimum delay before resuming the specified table motion.

7.6 Scorsby test

The master compass of the EUT is settled on the Scorsby table with the table stationary, nominally level and its roll axis aligned north–south within ±1°.

The compass lubber line is aligned to within ±1° of the table roll axis. The following nominal simple harmonic motions are applied simultaneously to the three axes of the table for 25 min:

— roll axis: peak amplitude 20° ± 2°, period 10 s ± 1 s;

— pitch axis: peak amplitude 10° ± 1°, period 6 s ± 1 s;

— yaw axis: peak amplitude 5° ± 1°, period 15 s ± 1 s.

At the end of 25 min, the table motion is stopped, the table is returned to its original position and the compass heading is recorded without delay.

This test is repeated with the roll axis of the motion table aligned at 045° ± 1°, at 090° ± 1° and at 315° ± 1°. At each of these headings, the compass settle point is determined before commencing the table motion. Any change of heading indicated by the compass between the settle point heading immediately prior to the motion and the heading at the conclusion of the motion is recorded as an error due to motion.

In each of the four tests, confirm by observation that the error due to the motion is less than ±1° × secant latitude.

Confirm by observation that any horizontal accelerations applied during this test does not exceed 1 m/s^2.

7.7 Intercardinal motion test

The master compass of the EUT is securely mounted on a device having the ability to move with nominal simple harmonic motion such that the component of motion in a horizontal plane has a peak acceleration of 1,0 m/s^2 ± 0,1 m/s^2. The direction of motion of the device in the horizontal plane is an intercardinal direction to within ±3°.

When so mounted, the compass is settled and the settle point heading is obtained with the device stationary and nominally levelled. The device then is submitted to the motion described previously, having a peak acceleration of 1,0 m/s^2 ± 0,1 m/s^2 with a periodic time of not less than 3 s, for a duration of 2 h. Any difference between the compass heading recorded during the motion and the settle point heading prior to the motion is considered as due to the motion. Confirm by observation that this difference does not exceed 1° × secant latitude.

Confirm by observation that the master compass heading recorded during the motion discounts any modulation at frequencies equal to or higher than the frequency of the applied motion.

7.8 Repeater accuracy test

This test only applies to the EUT which includes a repeater compass. The latitude and speed error correction are assumed to be equal to zero. The master compass of the EUT is settled on a level rotary table and the repeater is aligned with the master compass. The table and master compass are turned at a rate not greater

than 5°/s, the table being stopped at every 30° and the compass heading and the repeater heading recorded. This procedure is repeated in the reverse direction of rotation.

Confirm by observation that the maximum divergence in reading between the master compass and the repeater conforms to the requirements specified in 6.1.9.

NOTE The exact angle of the table when readings are taken is unimportant since the object of the test is to compare master and repeater heading indications.

If the repeater compass to be tested is intended for use on an open deck, it is tested at a temperature of –20 °C ± 3 °C and again at +60 °C ± 3 °C, having been exposed to the test temperature for 2 h prior to the test. Any climatically controlled system designed as a part of the repeater installation may be switched on for this test.

7.9 Speed correction test

This test applies to the EUT fitted with a correction device for speed and course error.

With the master compass of the EUT mounted on a level and stationary base and the lubber line of the compass aligned north–south, the master compass of the EUT is settled and the settled point heading is recorded.

A speed correction signal of 20 kn[1)] is applied to the EUT and allowed to resettle.

Confirm by observation that the difference between the settle point heading obtained and the settle point heading initially recorded agrees with the value computed theoretically for the latitude of the test to within 0,25° × secant latitude.

If the latitude and speed correction is performed within the heading signal transmission system, then the heading readings required for the purposes of this test are taken on a repeater driven by the transmission system on the output signal of the transmission system.

Speed and course error, in degrees, for a compass aligned North–south is shown in Formula (1):

$$\frac{V}{5\pi}\times\sec(\phi) \tag{1}$$

where

V is the numerical value of the speed, expressed in knots (kn[1)]);

ϕ is the numerical value of the latitude, expressed in radian (rad).

7.10 General requirement test

7.10.1 General

For all the environmental tests in the general requirements tests, the datum from which settle point variations are measured is the settle point heading obtained in the absence of the particular environmental condition to be applied. Where the EUT includes repeater compasses, at least one repeater compass of the EUT is energized and aligned with the master compass throughout the course of environmental tests. Each remaining repeater compass output is connected to a normal load, or to suitable impedance representing a normal load, supplied by the manufacturer.

7.10.2 Voltage variation test

The supply voltage is set to 10 % above the nominal value for 3 h, during which time the compass heading is recorded at 20 min intervals. The supply voltage then is set to a value 10 % below nominal for 3 h, and the compass heading again recorded at 20 min intervals.

Confirm by observation that none of the recorded headings departs from the original datum by more than 1° × secant latitude.

7.10.3 Frequency variation test

The supply frequency is set to 5 % above the nominal value for 3 h, during which time the compass heading is recorded at 20 min intervals. The supply frequency then is set to a value 5 % below nominal for 3 h, and the compass heading again recorded at 20 min intervals.

Confirm by observation that none of the recorded headings departs from the original datum by more than 1° × secant latitude.

7.10.4 Vibration tests

7.10.4.1 Vibration test of master compass

In all of these tests, the direction of the master compass lubber line is +30° ± 1° to the meridian.

The master compass of the EUT is subjected to the vibration described below. Three separate tests are carried out, the direction of vibration being:

a) +30° ± 1° to the meridian and horizontal;

b) −60° ± 1° to the meridian and horizontal;

c) vertical.

In each case the master compass of the EUT is settled initially and then the vibration is applied at the lowest frequency, holding the appropriate vibration amplitude for a period of 25 min. At the end of that period, the frequency and amplitude are changed to the next value shown in Table 1 and held for a further 25 min. This process continues until the entire frequency range has been covered.

Table 1 — Frequency and amplitude for vibration test of master compass

Frequency Hz	Amplitude mm
5	±0,71
7	±0,71
10	±0,71
14	±0,63
20	±0,31
28	±0,16
40	±0,08

The indicated heading is recorded at the end of each period. Confirm by observation that any difference between these recorded headings and the datum settle point heading is not more than 1° × secant latitude during the test.

NOTE Provision can be made to reduce or nullify any adverse effect on the equipment performance caused by the presence of any electromagnetic field due to the vibration unit.

7.10.4.2 Vibration test of the EUT other than master compass

This equipment, complete with any shock absorbers which are part of it, is secured by its normal means of support to the vibration table. It then is connected in its normal electrical configuration to the master compass. The master compass is then switched on in accordance with the manufacturer's instructions and its settle point heading ascertained and recorded.

The equipment on the vibration table is then vibrated vertically at all frequencies between:

a) 5 Hz and 13,2 Hz with an amplitude of 1,0 mm;

b) 13,2 Hz and 40 Hz with a maximum acceleration of (0,7 × 9,8) m/s^2;

taking at least 25 min to cover each frequency range.

This whole procedure is repeated when the equipment is vibrated in two mutually perpendicular directions in the horizontal plane.

Confirm by observation that there is no electrical or mechanical failure during any part of this series of tests.

The indicated heading is recorded at the end of each period.

Confirm by observation that any difference between these recorded headings and the datum settle point heading is not more than 1° × secant latitude during the test.

7.10.5 Temperature test

The EUT is placed in a chamber at normal room temperature, switched on and allowed to settle. The settle point heading is obtained and recorded. The temperature of the chamber is then raised to 45 °C ± 2 °C and maintained for a period of 3 h. At the end of this period, the compass heading indication again is recorded. The temperature of the chamber is then reduced to 0 °C ± 2 °C and maintained at this temperature for 3 h. At the end of this period, the compass heading indication is recorded once more.

Confirm by observation that neither of the recorded heading indications differs from the datum settle point heading by more than 1° × secant latitude.

NOTE When the temperature of the chamber is being changed it does not alter by a rate which exceeds 45 °C/h.

7.10.6 Damp heat test

The EUT is placed in a chamber at normal room temperature and humidity, switched on and allowed to settle. The settle point heading is obtained and recorded. Over a period of 3 h ± 0,5 h, the temperature and relative humidity of the chamber are then raised steadily to 40 °C ± 2 °C and 93 % ± 3 %, respectively. These conditions are maintained for a further period of 3 h ± 0,5 h.

Confirm by observation that the compass indication at the end of this test does not differ from the datum settle point heading by more than 1° × secant latitude.

7.10.7 Other tests

a) Rain test

NOTE In the case of the rain test, only exposed equipment is tested.

b) Conducted interference test

c) Radiated interference test

d) Acoustic noise test

In the acoustic noise test, no measurement is made at the time of starting the EUT, and only equipment intended for installation in the wheelhouse and bridge wings is tested.

7.11 Interface test

NOTE See 6.2.

The interface facilities shall be subjected to the tests specified in IEC 61162-1, IEC 61162-2 or IEC 61162-450. Observe the heading output rate specified in IEC 61162-2 and ensure that it is updated at least once every 20 ms.

Confirm by observation that the interface as well as the repeaters meet the performance test specified in 7.8.

7.12 Alert management test

7.12.1 Basic test for alert management

NOTE See 6.3.

Confirm by inspection of documented evidence that the EUT complies with IEC 62923-1:2018, Module A and Module C, and with IEC 62923-2.

The sentences from IEC 61162-1 shall be in accordance with Annex C.

7.12.2 "Power fail" alert or output of a status signal on the EUT power

NOTE See 6.3.2 and Table B.1.

The method of testing and required test results of "power fail" alert or the output of a status signal on the EUT power is as follows:

a) Connect power to the power supply/supplies of the EUT.

b) Remove one power to the EUT.

In case the EUT blacks out due to power failure, confirm by observation that the EUT provides a status signal output as specified in 6.3.2.

Optionally, the EUT may activate a "power fail" alert of an appropriate priority by using backup power supply.

7.12.3 "System fault" alert

NOTE See 6.3.3 and Table B.1.

The method of testing and required test results of "system fault" alert is as follows:

a) Create a malfunction in the system that has a severe effect on the true heading.

b) Confirm by observation that the EUT activates a "system fault" alert of warning priority.

8 Marking

In accordance with IMO Resolution A.424(XI), 9.6, each unit of the gyro-compass shall *be provided with an indication of* the manufacturer, *type*, serial number, and year of manufacture.

In accordance with IMO Resolution A.424(XI), 7.3, *each unit of the equipment* shall *be marked with the minimum safe distance at which it may be mounted from a standard* and *a steering magnetic compass*. The safe distance shall be measured in accordance with IEC 60945.

9 Information

In accordance with IMO Resolution A.424(XI), 9.5, *information* shall *be provided to enable competent members of a ship's* crew *to operate and maintain the equipment efficiently*.

Annex A
(normative)

Requirements for ship surveyors for the installation of gyro-compasses and repeater compasses on board ships

In accordance with IMO Resolution A.424(XI), 5.2.4 Note, *to ensure that the* errors induced by the motions specified in 6.1.8 are *not exceeded in practice, it* is *necessary to pay particular attention to the siting of the master compass.*

In accordance with IMO Resolution A.424(XI), 9.1, where *the master compass and*/or *any repeater* compass are *used for taking bearings*, the horizontal angle between the vertical plane passing through the centre of the compass card, and including the lubber line, and the vertical plane passing through *the ship's fore-and-aft datum line*, shall be *within ±0,5°* when *installed*.