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Ships and marine technology — Marine gyro-compasses

Navires et technologie maritime — Compas gyroscopiques à usage marin

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Foreword

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 8, *Ships and marine technology*, Subcommittee SC 6, *Navigation and ship operations*.

This third edition cancels and replaces the second edition (ISO 8728:1997), which has been technically revised.

Ships and marine technology — Marine gyro-compasses

1 Scope

This International Standard specifies the construction, performance, and type testing *for gyro-compasses required by Regulation 12 of Chapter V of SOLAS 1974* (as amended).

NOTE All requirements that are extracted from the recommendations of IMO Resolutions [Resolution A.424(XI) on performance standards for gyro-compasses] are printed in italics.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 25862, *Ships and marine technology — Marine magnetic compasses, binnacles and azimuth reading devices*

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 61924-2, *Maritime navigation and radiocommunication equipment and systems — Integrated Navigation Systems (INS) — Part 2: Modular structure for INS — Operational and performance requirements, methods of testing and required test results*

IMO Resolution MSC.252(83), *Performance standards for alert communications with an Integrated Navigation System*

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

3 Terms and definitions

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

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

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; *it is measured from true north (000°) clockwise through 360°*

Note 1 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.

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.

3.4
settle point heading
mean value of ten readings taken at 20 min intervals after the compass has settled as defined in 3.3

3.5
settle point error
difference between the settle point heading as defined in 3.4 *and the true heading*

3.6
error
difference between the observed value and the settle point heading as defined in 3.4

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

3.8
compass card
graduated dial of the compass which indicates the measured direction of the meridian

3.9
latitude error
error to which some gyro-compasses are subject, the magnitude and sign of which depend upon the local latitude

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

3.10
speed error
error to which gyro-compasses 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.

3.11
lubber line
index line situated on the body of a compass against which the compass heading is read

3.12
master compass
main compass unit which supplies the heading information to the repeaters and other navigational aids

3.13
scorsby table
test machine which independently oscillates a platform about three axes; it is used to simulate the motion of a ship

4 Construction

Gyro-compass units shall conform to the following requirements.

4.1 *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 6.10.1 to 6.10.5.

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

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

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

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

4.3 *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°.*

4.4 *Fully adequate illumination* shall *be provided to enable* the *reading of* all compass cards *at all times*. *Facilities for dimming* shall *be provided*.

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

4.5.1 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.

4.6 *Means* shall *be provided for correcting the errors induced by speed and latitude.* Graphical or tabular means of correction can be used.

4.7 *Steps* shall *be taken to eliminate as far* as is practical, *the causes of and to suppress electromagnetic interference between the gyro-compass and other equipment on board*.

4.8 *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*.

4.9 *The equipment* shall *be so constructed that it is readily accessible for maintenance purposes*.

4.10 *An automatic* alert[1)] shall *be provided to indicate* malfunctions of the system or a power failure in the gyro-compass. The alert shall conform to the presentation and handling requirements of Bridge Alert Management [IMO Res. MSC.302(87)]. A suitable interface shall be provided for alert communications with an Integrated Navigation System [IMO Res. MSC.252(83) and IEC 61924-2].

The following sentences shall be provided for the alert communications interface:

Sentences transmitted by the gyro-compass:

— ALR, HBT: See IEC 61162-1;

1) The term "alarm" was replaced by "alert" in accordance with IMO Resolution MSC.252(83) and IMO Resolution MSC.302(87).

— ALC, ALF, ARC: See IEC 61924-2.

Sentences received by the gyro-compass:

— ACK, HBT: See IEC 61162-1;

— ACN: See IEC 61924-2.

4.11 *Means* shall *be incorporated for the protection of the equipment from excessive currents and voltages, transients and accidental reversal of power supply polarity.*

4.12 *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.*

4.13 The gyro-compass shall be designed to enable heading information to be provided to other navigational aids.

5 Performance requirements

5.1 Accuracy in latitudes up to 60°

5.1.1 Settling time

When switched on in accordance with the manufacturer's instructions, the compass shall *settle within 6 h.*

5.1.2 Settle point error

5.1.2.1 *The settle point error as defined in* 3.5 *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.*

5.1.2.2 T*he repeatability of settle point error from one run-up to another shall be within 0,25° × secant latitude.*

5.1.3 Settling time under operational conditions

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.*

5.1.4 Settle point error under general conditions

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.

5.1.5 Residual error in correction

The residual steady-state error, after correction for speed and course influences at a speed of 20 kn, shall not exceed ±0,25° × secant latitude.

5.1.6 Effect of alteration of speed

The error due to a rapid alteration of speed of 20 kn shall *not exceed ±2°.*

5.1.7 Effect of alteration of course

The error due to a rapid alteration of course of 180° at a speed of 20 kn shall *not exceed ±3°.*

5.1.8 Accuracy on a Scorsby table

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

5.1.9 Synchronization between the master compass and repeaters

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.

5.2 Interface

5.2.1 The compass shall provide interface facilities which meet the relevant international standards IEC 61162-1 and/or IEC 61162-2 as amended.

5.2.2 The gyro-compass equipment shall provide an appropriate data source and at least one output of heading information, which is able to comply with the IEC 61162-2. The IEC 61162-2 heading output shall be updated at a rate of once per 20ms. The THS sentence detailed in IEC 61162-1 shall be provided for heading information.

5.2.3 The test of the interface shall meet the performance test specified in 6.8 as well as for repeaters.

6 Type tests

6.1 General

6.1.1 Unless otherwise stated in this International Standard, the requirements of IEC 60945 shall apply.

6.1.2 The construction of the gyro-compass shall conform to the requirements specified in Clause 4.

6.2 Settling time test

The master compass shall be securely positioned on a nominally level and stationary base. It shall be 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.

The settling time (see 3.3) shall meet the requirements of 5.1.1.

6.3 Settle point error test

When the master compass has settled as defined in 3.3, the settle point error (see 3.5) shall conform to the requirements specified in 5.1.2.1.

6.4 Settle point heading repeatability test

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

The settle point heading shall be determined as specified in 3.4. The master compass shall then be switched off for a period of not less than 12 h and not more than 7 days and then started again from an initial heading error (low) of 30° or more and the settle point heading measured again. The master compass shall then be switched off for a period of not less than 12 h and not more than 7 days and then started again from an initial heading error (high) of 30° or more and the settle point heading determined. The three values of settle point heading so obtained shall be recorded and the difference between any two shall not exceed 0,25° × secant latitude.

NOTE If this test follows the text described in 6.3, 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.

6.5 Settling time on a Scorsby table

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

The other nominally horizontal axis at right angles to the first shall be designated the pitch axis.

The compass shall then be 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.

The settling time measured between switch-on and compass settle as defined in 3.3 shall conform to the requirements specified in 5.1.3.

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

6.6 Scorsby test

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

The compass lubber line shall be aligned to within ± 1° of the table roll axis. The following nominal simple harmonic motions shall be 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 shall be stopped, the table returned to its original position and the compass heading recorded without delay.

This test shall be 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 shall be determined before commencing the table motion and 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 shall be recorded as error due to motion.

In each of the four tests, the error due to the motion shall be less than ± 1° × secant latitude.

Any horizontal accelerations applied during this test shall not exceed 1 m/s^2.

