
**Ships and marine technology —
Transmitting heading devices
(THDs) —**

**Part 3:
GNSS principles**

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*Navires et technologie maritime — Dispositifs de transmission de
données de pilotage —
Partie 3: Principes pour un système global de navigation par satellites*

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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 documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 second edition cancels and replaces the first edition (ISO 22090-3:2004), of which has been technically revised. It also replaces ISO 22090-3:2004/Cor 1:2005.

ISO 22090 consists of the following parts, under the general title *Ships and marine technology — Transmitting heading devices (THDs)*:

- *Part 1: Gyro-compasses*
- *Part 2: Geomagnetic principles*
- *Part 3: GNSS principles*

Ships and marine technology — Transmitting heading devices (THDs) —

Part 3: GNSS principles

1 Scope

This part of ISO 22090 specifies general requirements, construction, performance, and testing of transmitting heading device using GNSS principle as required by chapter V, SOLAS 1974 (as amended).

A transmitting heading device (THD) is an electric device that provides information about the ship's true heading.

In addition to the general requirements contained in IMO Resolution A.694(17) to which IEC 60945 is associated and the relevant standard for the sensing part used, the THD equipment shall comply with the following minimum requirements.

Where the IMO performance standards that apply to the sensing part do not specify a geographical operating area, the THD shall operate

- a) at a maximum rate of turn 20°/s and
- b) from 70° latitude south to 70° latitude north as minimum.

The THDs complying with the requirements contained in this part of ISO 22090 can be used for heading information as contained in chapter V of the SOLAS Convention.

In addition, such THDs should meet the dynamic requirements contained in the HSC Code, chapter 13 for the carriage of a suitable device providing heading information.

NOTE 1 Several technologies can be used to detect and transmit heading information. It is illogical to standardize the detection of the heading separately from the transmission of the heading. Therefore, separate parts of this part of ISO 22090 refer to different technologies. The requirements of this part of ISO 22090 only apply to the principle of the GNSS. Other technologies are covered in other parts of ISO 22090.

NOTE 2 All requirements that are extracted from the recommendation of IMO Resolution MSC. 116(73) on performance standards for transmitting heading devices 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, *Marine navigation and radiocommunication equipment and systems — General requirements — Methods of testing and required test results*

IEC 61162-1, *Maritime 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*

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*

IMO Resolution A.424(XI), *Performance standards for gyro-compasses*

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 A.821(19), *Performance standards for gyro-compasses for high-speed craft*

IMO Resolution MSC.116(73), *Performance standards for marine transmitting heading devices (THDs)*

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

IMO Resolution MSC.252(83), *Adoption of the revised performance standards for integrated navigation system (INS)*

IMO Resolution MSC.302(87), *Adoption of performance standards for bridge alert management*

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3 Terms and definitions

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

3.1 heading

ship's heading to be input to the THD function

Note 1 to entry: It is defined by the direction of the vertical projection of the fore-and-aft line of the ship onto the horizontal plane. When measured relative to the true north, magnetic north, or compass north, it is respectively defined as true heading, magnetic heading, or compass heading, and is usually expressed in degrees as a three-figure group, starting from north, in a clockwise direction around the compass card.

3.2 sensing part

sensing function of detecting any heading information, or information of directional source (i.e. GNSS antenna) connected to the transmitting part

3.3 transmitting part

device which receives heading information, or information of directional source, from the sensing part and converts this to the required accurate signal

3.4 true heading

horizontal angle between the vertical plane passing through the true meridian and the vertical plane passing through the craft's fore and aft datum line, measured from true north (000°) clockwise through 360°

3.5**static error**

error caused by any reason and which stays unchanged in value during the operation of the system, measured under static conditions

Note 1 to entry: Static error is formed from the statistical mean (i.e. RMS) of the individual course deviations.

3.6**dynamic error**

error caused by dynamic influences acting on the system, such as vibration, roll, pitch, yawing or acceleration in one axis

Note 1 to entry: This error can have an amplitude and usually a frequency related to the environmental influences and the parameters of the system itself.

3.7**follow-up error**

error caused by the delay between the existence of a value to be sensed and the availability of the corresponding signal or data stream at the output of the system

EXAMPLE *The difference between the real heading of turning vessel and the available information at the output of the system.*

Note 1 to entry: A follow-up error disappears when the system is static.

3.8**settling time**

time required from power-on to reach the state that the THD can output heading information with an accuracy specified in [6.3](#)

3.9**settle point error**

difference between the settled point heading and the true heading

3.10**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.

3.11**GNSS principles****Global Navigation Satellite System principles**

principles of the THDs in order to determine the ship's own heading by measuring an RF carrier phase in the GNSS signals

4 Performance and requirements**4.1 Functionality**

The THD is an electronic device which receives a heading sensor signal and generates a suitable output signal for other devices.

Any sensor part may be included in the device.

Any correcting devices or parameters shall be protected against inadvertent operation.

Manually settable values used for electronic correction shall be indicated by adequate means.

4.2 Continuous operation

The THD shall be capable of continuous operation under conditions of vibration, humidity, and change of temperature as specified in 6.8.

4.3 Presentation of information

All displays with the exception of the sensor, and all outputs of heading shall indicate true heading.

4.4 Heading output alignment

The THD shall have a means to align the sensing direction to the ship's fore and aft line.

4.5 Compensation for brief GNSS signal interruption

A brief interruption of GNSS signal for the duration of 60 s shall be compensated so as to maintain the heading accuracy, as defined in 5.3 and 5.4, for 60 s and for continuous operation.

4.6 Settling time

Settling time shall be less than 10 min in a static condition with a fully usable satellite almanac.

4.7 Heading information

The THD shall provide true heading information to the other navigational equipment.

4.8 Alert signal

An alert shall be provided on the following conditions:

- malfunction of the THD or failure of power supply;
- continuous GNSS signal interruption over 60 s at least.

An alert output shall be provided for any alert conditions.

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 THD:

- ALR, HBT: see IEC 61162-1;
- ALC, ALF, ARC: see IEC 61924-2.

Sentences received by the THD:

- ACK, HBT: see IEC 61162-1;
- ACN: see IEC 61924-2.

4.9 Interface

4.9.1 The THD shall provide interface facilities which meet the relevant International Standards IEC 61162-1 and/or IEC 61162-2 as amended.

4.9.2 The THD 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 20 ms. The THS sentence detailed in IEC 61162-1 shall be provided for heading information.

5 Accuracy

5.1 General

The THD shall meet at least the following accuracy at the output of the device under sea condition as specified in IMO Resolution A.424(XI) or A.821(19) as applicable.

5.2 Accuracy of transmission data

The transmission, error including the resolution error, shall be less than $\pm 0,2^\circ$.

5.3 Static error (settle point error)

The static error (settle point error) as defined in 3.5 at any heading shall be within $1,0^\circ$ (95 %).

5.4 Dynamic error

The additional dynamic error as defined in 3.6 shall be within $1,5^\circ$ (95 %), under the conditions of 6.5 item a), 6.5 item b), and 4.5.

5.5 Follow-up error

The follow-up error as defined in 3.7 for different rates of turn shall be
 — *less than $\pm 0,5^\circ$ up to a rate of $10^\circ/s$ and*

— *less than $\pm 1,5^\circ$ at a rate of between $10^\circ/s$ and $20^\circ/s$.*

6 Type tests

6.1 General

The THD shall be tested for accuracy with the sensing part connected. If the sensing part is so designed that it is included in the transmitting part, the equipment shall be tested together with all parts. A manufacturer shall clearly document the structure of the transmission error.

The requirement of displays shall be in accordance with IMO Resolution MSC,191(79) and IEC 62288.

6.2 Organization of test conditions

6.2.1 Testing under ambient conditions

For testing at ambient temperature and relative humidity, all tests shall be carried out under normal conditions, as defined in IEC 60945 with a Horizontal Dilution Of Position (HDOP) ≤ 4 (or PDOP ≤ 6) and a minimum of five satellites in view.

6.2.2 Static test site

The sensing part shall be mounted on a table according to the manufacturer's instructions, in an area providing a clear line of sight to the satellites from zenith through to the angle $+ 5^\circ$ above horizontal,