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**Maritime navigation and radiocommunication
equipment and systems –
Global navigation satellite systems (GNSS) –**

**Part 1:
Global positioning system (GPS) –
Receiver equipment – Performance standards,
methods of testing and required test results**

Document Preview

*Matériels et systèmes de navigation et
de radiocommunication maritimes –
Système mondial de navigation par satellite (GNSS) –*

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*Partie 1:
Système de positionnement par satellite GPS –
Matériel de réception – Normes de fonctionnement,
méthodes d'essai et résultats d'essai exigibles*



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MARITIME NAVIGATION AND RADIOCOMMUNICATION
EQUIPMENT AND SYSTEMS –
GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) –****Part 1: Global positioning system (GPS) –
Receiver equipment –
Performance standards, methods of testing
and required test results**

FOREWORD

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International Standard IEC 61108-1 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

This second edition cancels and replaces the first edition published in 1996.

This edition of the IEC standard for GPS, compared to the previous edition, includes the following technical changes:

- a) it reflects the changes brought about by IMO adopting GPS as part of the carriage requirement on ships defined in SOLAS Chapter V;
- b) the new IMO performance standard, resolution MSC.112(73), replaced the previous issue, A.819(19), for new installations on the 1st of July 2002. This second edition of IEC 61108-1 incorporates revised tests for type approvals to the new performance standard;

- c) changes include the need for a data output to the IEC 61162 series giving COG SOG and UTC with validity marking, operation during interference conditions and improved failure warnings.

The text of this standard is based on the following documents:

FDIS	Report on voting
80/371/FDIS	80/373/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until 2005. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this standard may be issued at a later date.

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MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) –

Part 1: Global positioning system (GPS) – Receiver equipment – Performance standards, methods of testing and required test results

1 Scope

This part of IEC 61108 specifies the minimum performance standards, methods of testing and required test results for GPS shipborne receiver equipment, based on IMO Resolution MSC.112(73), which uses the signals from the United States of America, Department of Defence (US DOD), Global Positioning System (GPS) in order to determine position. A description of the GPS SPS is given in the normative reference – GPS, SPS signal specification – USA Department of Defence – 3rd Edition October 2001. This receiver standard applies to phases of the voyage "other waters" as defined in IMO Resolution A.529(13).

All text of this standard, whose meaning is identical to that in IMO Resolution MSC.112(73), is printed in *italics* and the Resolution and paragraph number indicated between brackets i.e. (M.112/A1.2).

The requirements in clause 4 are cross-referenced to the tests in clause 5 and vice versa.

2 Normative references

The following referenced documents are indispensable for the application 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 60721-3-6:1987, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Ship environment*

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

IEC 61162 (all parts), *Maritime navigation and radiocommunication equipment and systems – Digital interfaces*

IMO Resolution A.529(13):1983, *Accuracy standards for navigation*

IMO Resolution A.694(17):1991, *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.815(19):1995, *Worldwide radionavigation system*

IMO Resolution MSC.112(73):2000, *Performance standards for shipborne global positioning system (GPS) receiver equipment*

IMO Resolution MSC.114(73):2000, *Performance standards for shipborne DGPS and DGLONASS maritime radio beacon receiver equipment*

ITU-R Recommendation M.823-1:1995, *Technical characteristics of differential transmissions for global navigation satellite systems (GNSS) from maritime radio beacons in the frequency band 285 kHz-325 kHz (283,5 kHz-315 kHz in Region 1)*

ITU-R Recommendation M.823-2:1997, *Technical characteristics of differential transmissions for Global Navigation Satellite Systems from maritime radio beacons in the frequency band 283.5-315 kHz in Region 1 and 285-325 kHz in Regions 2 and 3*

ITU-R Recommendation M.1477:2000, *Technical and performance characteristics of current and planned radionavigation-satellite service (space-to-Earth) and aeronautical radio-navigation service receivers to be considered in interference studies in the band 1 559-1 610 MHz*

Global Positioning System – Standard Positioning Service – Performance Specification – USA Department of Defence – 3rd Edition October 2001

3 Terms, definitions and abbreviations

For the purposes of this document, all definitions and abbreviations used are the same as those used in the normative reference of the GPS SPS performance signal specification.

3.1 Definitions

3.1.1 integrity

ability of the system to provide users with warnings within a specified time when the system should not be used for navigation

3.2 Abbreviations

COG – Course Over Ground

DGPS – Differential Global Positioning System

GPS – Global Positioning System

HDOP – Horizontal Dilution Of Precision

PDOP – Position Dilution Of Precision

RAIM – Receiver Autonomous Integrity Monitor

SDME – Speed and Distance Measuring Equipment

SOG – Speed Over Ground

SPS – Standard Positioning Service

USNO – United States Naval Observatory

UTC – Universal Time Coordinated

4 Minimum performance standards

4.1 Object

(M.112/A1.2) *Receiver equipment for the Global Positioning System (GPS) system intended for navigational purposes on ships with maximum speeds not exceeding 70 knots shall, in addition to the general requirements contained in resolution A.694(17)¹, comply with the following minimum performance requirements.*

(M.112/A1.3) *This standard covers the basic requirements of position fixing for navigation purposes only and does not cover other computational facilities which may be provided in the equipment.*

This standard contains the basic minimum performance standards for use of GPS Standard Positioning Service (SPS) signals for navigational position fixing, including differential corrections, and, in addition, for the determination of speed and direction of the movement of the antenna over the ground.

Other computational activity, input/output activity or extra display functions which may be provided shall not degrade the performance of the equipment below the minimum performance standards set out in this standard.

The GPS receiver equipment shall comply with

- the provisions of IMO Resolutions A.529(13), A.815(19), MSC.112(73) and A.694(17),
- the accuracy requirements of the GPS SPS Performance Standard,
- IEC 61162-1, IEC 61162-2, as appropriate, on digital interfaces, and
- shall be tested in accordance with IEC 60945.

NOTE For high speed craft purposes the EUT has to provide an IEC 61162-2 interface with a position update rate of 2 Hz.

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4.2 GPS receiver equipment

(See 5.6.1)

4.2.1 Minimum facilities

(M.112/A2.1) *The words "GPS receiver equipment" as used in these performance standards include all the components and units necessary for the system to properly perform its intended functions. The equipment shall include the following minimum facilities:*

- a) *antenna capable of receiving GPS signals;*
- b) *GPS receiver and processor;*
- c) *means of accessing the computed latitude/longitude position;*
- d) *data control and interface; and*
- e) *position display and, if required, other forms of output.*

4.2.2 Configuration

The GPS receiver equipment may be supplied in one of several configurations to provide the necessary position information. Examples are:

¹ Refer to Publication IEC 60945.

- stand-alone receiver with means of accessing computed position via a keyboard with the positional information suitably displayed;
- GPS black box receiver fed with operational parameters from external devices/remote locations and feeding an integrated system with means of access to the computed position via an appropriate interface, and the positional information available to at least one remote location.

The above examples should not be implied as limiting the scope of future development.

4.2.3 Quality assurance

The equipment shall be designed produced and documented by companies complying with approved quality systems as applicable.

4.3 Performance standards for GPS receiver equipment

4.3.1 General

(See 5.6.2)

(M.112/A3.1) *The GPS receiver equipment shall be capable of receiving and processing the Standard Positioning Service (SPS) and provide position information in latitude and longitude World Geodetic System (WGS-84) co-ordinates in degrees, minutes and thousandths of minutes and time of solution referenced to UTC (USNO). Means may be provided to transform the computed position based upon WGS-84 into data compatible with the datum of the navigational chart in use. Where this facility exists, the display shall indicate that co-ordinate conversion is being performed and shall identify the co-ordinate system in which the position is expressed.*

(M.112/A3.2) *The GPS receiver equipment shall operate on the L1 signal and C/A code.*

4.3.2 Equipment output

(See 5.6.3)

(M.112/A3.3) *The GPS receiver equipment shall be provided with at least one output from which position information can be supplied to other equipment. The output of position information based upon WGS-84 shall be in accordance with International Standards – IEC 61162.*

The position information output shall be in accordance with IEC 61162 as follows:

For positioning reporting purposes the following sentences shall be available in any combination.

DTM – Datum reference

GBS – GNSS satellite fault detection

GGA – GPS fix data

GNS – GNSS fix data

RMC – Recommended minimum specific GNSS data

VTG – Course over ground and ground speed

ZDA – Time and date

If a sentence uses a datum other than WGS-84 then the DTM sentence must be used in compliance with IEC 61162.

In addition, for integrating with other navigational aids the following sentences may be available in any combination.

GRS – GNSS range residuals

GSA – GNSS DOP and active satellites

GST – GNSS pseudorange error statistics

GSV – GNSS satellites in view

NOTE GRS, GSA, GST, GSV are required to support external integrity checking. They are to be synchronized with corresponding fix data (GGA or GNS).

4.3.3 Accuracy

(See 5.6.4)

4.3.3.1 Static accuracy

(M.112/A3.4) *The GPS receiver equipment shall have static accuracy such that the horizontal position of the antenna is determined to within 100 m (95 %) with horizontal dilution of precision (HDOP) ≤ 4 (or PDOP ≤ 6). Since Selective Availability has been set to zero, the static accuracy has been determined to be within 13 m (95 %) as specified by the GPS SPS Performance Standards of October 2001.*

4.3.3.2 Dynamic accuracy

(M.112/A3.5) *The GPS receiver equipment shall have dynamic accuracy such that the position of the ship is determined to within 100 m (95 %) with HDOP ≤ 4 (or PDOP ≤ 6) under the conditions of sea state and ship's motion likely to be experienced in ships.² Since Selective Availability has been set to zero, the dynamic accuracy has been determined to be within 13 m (95 %) as specified by the GPS SPS Performance Standards of October 2001.*

4.3.4 Acquisition

(See 5.6.5)

(M.112/A3.6) *The GPS receiver equipment shall be capable of selecting automatically the appropriate satellite transmitted signals for determination of the ship's position with the required accuracy and update rate.*

(M.112/A3.8) *The GPS receiver equipment shall be capable of acquiring position to the required accuracy, within 30 min, when there is no valid almanac data.*

(M.112/A3.9) *The GPS receiver equipment shall be capable of acquiring position to the required accuracy, within 5 min, when there is valid almanac data.*

(M.112/A3.10) *The GPS receiver equipment shall be capable of re-acquiring position to the required accuracy, within 5 min, when the GPS signals are interrupted for a period of at least 24 h, but there is no loss of power.*

(M.112/A3.11) *The GPS receiver equipment shall be capable of re-acquiring position to the required accuracy, within 2 min, when subjected to a power interruption of 60 s.*

Acquisition is defined as the processing of GPS satellite signals to obtain a position fix within the required accuracies.

Four conditions of the GPS receiver equipment are set out under which the minimum performance standards shall be met.

² IMO Resolution A.694 (17), IEC 60721-3-6 and IEC 60945.