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Ships and marine technology — Systems for the detection of persons while going overboard from ships (man overboard detection)

Navires et technologie maritime — Systèmes pour la détection des personnes passant par-dessus bord (détection d'un homme à la mer)

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Foreword

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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).

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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 1, *Maritime safety*.

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

The lack of standardized man overboard (MOB) detection system requirements has made it difficult for end users to objectively evaluate the safety and effectiveness of such systems. This document addresses these issues by clearly defining the technical specifications for the equipment, thereby allowing manufacturers to develop systems against a common set of requirements and enabling end-users to evaluate the safety, effectiveness, performance and reliability of MOB detection systems.

This document provides a method to verify that a system operates to the required performance in a specified environmental window (Table 1) and against a manikin of the size described in 5.24. Systems that are operational outside the prescribed environmental conditions or used to detect people that do not conform to the effective manikin size can suffer some degradation in performance. It is not currently possible to quantify that degradation.

Ships and marine technology — Systems for the detection of persons while going overboard from ships (man overboard detection)

1 Scope

This document specifies technical requirements for systems designed to detect a person who has gone overboard from a ship.

This document does not cover man overboard (MOB) detection systems that require the passengers or crew to wear or carry a device to trigger an MOB event.

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 60945:2002, *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., 1021(26), Code on alerts and indicators, 2009

IMO Resolution MSC., 302(87), Bridge alert management

IMO Resolution MSC, 337(91), Adoption Of The Code On Noise Levels On Board Ships

3 Terms and definitions

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

ISO and IEC maintain terminological 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
accessible open area
area of the ship accessible to either passengers or crew and open to the outside, where a person who fell would end up overboard

3.2
active state
state in which the system is on

3.3
alarm action
action available within the system when a MOB alert or alarm is triggered or changes status

3.4
control station
equipment that provides the facilities for human observation and control of the MOB detection system

3.5
data
information captured and/or generated by the MOB detection system

Note 1 to entry: Data can be in either a raw or a processed form and includes basic (e.g. text, numeric, Boolean), composite (e.g. array, class, and list) and multimedia (e.g. images, audio, and video) data types.

3.6
environmental vibration
periodic motion of equipment installed aboard ships as a result of environmental forces

3.7
false alarm
system activation not caused by an actual MOB event

3.8
heading
angle between the direction in which the ship's bow is pointing and a reference direction, e.g. true north, expressed in degrees, usually from 000° clockwise through 360°

3.9
laboratory
body that performs one or more of the following activities:

— testing

— calibration

— sampling associated with subsequent testing or calibration

[SOURCE: ISO/IEC 17025:2017, 3.6, modified — Note 1 to entry has been omitted.]

3.10
man overboard event
MOB event
incident in which person(s) has accidently or intentionally gone over the side/front/back of a ship and into the water

3.11
man overboard verification data
MOB verification data
system *data* (3.5) that may be used by user to acknowledge, deny, confirm or terminate a MOB alert or alarm at the *control station* (3.4)

3.12
nominal operating conditions
set of ship and environmental conditions

Note 1 to entry: See Table 1.

Table 1 — Nominal operating conditions

Condition	Value
Wave height	0 m to 2,5 m
Precipitation	None
Ship speed over ground	0 knots to 25 knots

3.13
sensor unit
device or system of devices that detects and responds to one or more physical stimuli

3.14
underway
not at anchor, made fast to the shore, or aground

4 Abbreviated terms

ECDIS electronic chart display and information system

MOB man overboard

RAID redundant array of independent disks

S-VDR simplified voyage data recorder

VDR voyage data recorder

5 Requirements

5.1 General

The testing outlined in this document shall be conducted by a laboratory meeting the requirements of ISO 17025 or may be conducted by the manufacturer, provided the tests conducted by the manufacturer are approved by a laboratory meeting the requirements of ISO 17025 or classification society that complies with the applicable unified interpretations and requirements posted by the International Association of Classification Societies (IACS) or other recognized organization.

NOTE IACS is an organization that establishes, reviews, promotes and develops minimum technical requirements in relation to the design, construction, maintenance and survey of ships and other marine related facilities. It also assists international regulatory bodies and standards organizations to develop, implement and interpret statutory regulations and industry standards in ship design, construction and maintenance, with a view to improving safety at sea and the prevention of marine pollution.

The intent of the following requirements is to measure the system level of performance in the intended, nominal operational environment.

Annex A provides additional recommendations for guidance to those developing, installing, testing and using MOB detection systems.

5.2 Principle of operation

An MOB system shall operate in accordance with the principles described in this subclause.

The MOB system sensors shall detect persons and other objects passing through the detection zone (see 5.7). Processing or analysis of the raw data may be conducted in the sensor(s), a server, the control station or any combination of the three.

Once the analysis is complete, the system shall have automatically excluded any event that is not a man overboard event (plus allowable rate of false alarms). For each event that passes the threshold for an MOB event, the system shall generate an indication. A human operator shall be required to review the event and determine if the event is a man overboard event or a false alarm.

False alarms shall be recorded in the system with a comment from the operator on the cause. This will be used to further develop understanding of the behaviour of such systems during normal operations and varied environmental conditions.

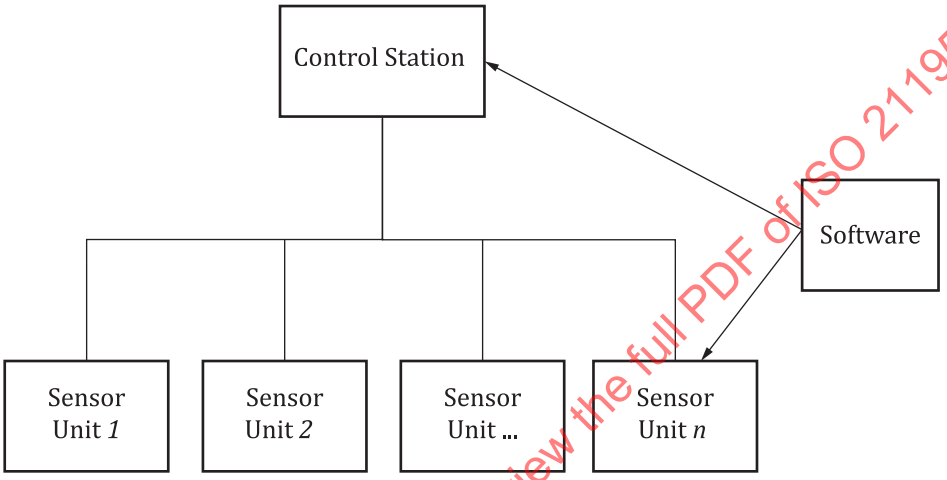
Man overboard events shall remain active on the control station until marked complete by a human operator with comments on outcome.

The MOB system shall be designed with the possibility to connect to integrated navigation systems (ECDIS) to display geospatially referenced MOB event markers.

The MOB system shall be designed with input interfaces for time, position and available environmental data.

5.3 System description

A general MOB detection system described in this document consists of a control station, sensor units, cables and associated software (Figure 1).



NOTE Depending on the system, the associated software can be installed on the control station and/or sensor units.

Figure 1 — Block diagram of a general MOB detection system with logical links

5.4 Control station

The system shall include a control station where alarms and data can be reviewed.

The system shall have the capability for an operator to manually select an imaging sensor and timeline for playback at the control station.

5.5 Design and testing

5.5.1 General

The MOB system shall be designed and tested to comply with the requirements of IEC 60945 for protected or exposed components as appropriate for each system sub-assembly.

Specific requirements described in 5.5.2 to 5.5.8.

5.5.2 Light emitting system components

The intensity of light emitting system components located or installed in the bridge area shall be fully dimmable and capable of being controlled at the control station.

5.5.3 Noise emitting system components

All parts of the system that is installed in the navigating bridge and/or chartrooms shall have a combined noise level of less than 60dB(A) at a distance of 1 m from any part of the equipment under test (EUT), as defined in IEC 60945:2002, 11.1. The MOB audible alarm is exempt from this requirement.

System components installed in locations other than the navigating bridge or chartroom shall follow the maximum noise levels set forth by IMO Resolution MSC.337(91) The MOB audible alarm is exempt from this requirement.

5.5.4 Power

The equipment shall be compatible with ship's power as specified and tested in accordance with IEC 60945 for nominal AC power input between 100 Vrms and 230 Vrms.

5.5.5 Electromagnetic compatibility

The system shall satisfy the requirements for electromagnetic emission and immunity to electromagnetic environments set forth in IEC 60945.

5.5.6 Ingress protection

All components of the system that are required to be installed in an area of the ship that is open to the elements shall be certified to an ingress protection rating of IPx6 or greater. Testing shall be conducted in line with procedures in IEC 60945.

5.5.7 Environmental vibration

The system shall be capable of withstanding typical environmental vibrations that can be encountered on the ship. The system shall be tested in accordance with IEC 60945 to determine this capability.

5.5.8 Thermal performance

The system shall be certified as having been tested against the thermal requirements of IEC 60945 as applicable to each component.

5.6 MOB detection

The system shall detect persons that pass through the MOB detection zone (see 5.7) while going overboard.

The method of detection shall not require the passengers or crew to wear or carry a device to trigger an MOB event.

At a minimum, the system shall be capable of detecting a human with a height greater than 1,466 m. This height is based on the minimum 5th percentile stature data published in ISO/TR 7250-2.

5.7 MOB detection zone

The MOB detection zone shall be designed to:

a) cover the entire periphery of the ship;

b) be located at or below the lowest accessible open area; and

c) extend a minimum of 8 m from the periphery of the ship.

The periphery of the ship is defined as the widest part of the ship at any location and is extended to include lifeboats. Other enclosed objects that protrude over the edge of the ship (e.g. rides, slides, etc.) do not modify the ship periphery.

System coverage shall be determined by using a general arrangement drawing (e.g. blueprint, computer-aided design model, etc.) of the ship, sensor installation locations, and the detection envelope of the sensor units.

5.8 MOB indication initiators

The system shall be capable of initiating an MOB indication based on data captured from the sensor units.

The system shall not require human interaction to trigger an MOB indication.

The system shall allow users to manually initiate an MOB indication at the control station for the purposes of initiating a drill or if manual review of video imagery indicates an MOB event that did not cause an alarm. Manually initiated MOB indications shall occur immediately. MOB indications manually initiated for the purpose of a drill shall be designated as a drill within the system.

5.9 Visual indication

The system shall generate a visual indication in response to an MOB event. The visual indication shall remain active until the MOB event has been acknowledged at the control station. The visual presentation of the indication shall satisfy the requirements set forth in IMO Resolution A.1021(26). Visual indications displayed on the bridge shall comply with relevant clauses of IEC 62288.

5.10 Audible indication

Once an MOB event has been initiated, the system shall generate an audible indication. The audible indication shall remain active until acknowledged at the control station.

When active, audible indications located on the navigation bridge shall have an acoustic noise level between 75 dB(A) and 85 dB(A) at distance of 1 m from the system, as defined in IEC 60945:2002, 11.1.

Audible presentation of MOB events on the bridge shall comply with relevant clauses of IEC 62288.

Audible indications installed in locations other than the navigating bridge shall follow the guidance set forth by IMO Resolution A.1021(26).

5.11 MOB verification data

The system shall make available MOB verification data, in the form of still or video images, to a human operator within 5 s of an MOB alert.

The system shall allow a human operator to control the playback of available MOB verification data.

MOB verification data shall include:

a) data obtained from the sensor unit(s) that initiated the MOB indication; and

b) data obtained from 5 s before the MOB event until 5 s after.

The resolution of the MOB verification data shall be sufficient to allow for a human operator to distinguish between a human and other objects at the maximum range of the detection envelope of the sensor.

5.12 MOB Event actions

The system shall allow authorized system users to acknowledge, deny or confirm an MOB indication at the control station. Each action shall produce a different system response, the details of which can be found in Table 2.

Table 2 — Requisite alarm actions

Alarm action	Description	Required system response
Acknowledge	Allows a user to acknowledge the MOB indication	— Stop the audible indication — Stop the visual indication
Deny[a]	Allows a user to classify an acknowledged MOB event as a false alarm	— Stop the MOB event log — Provide the user with the option to create a text-based MOB log entry
Confirm[b]	Allows a user to classify an acknowledged MOB indication as a human-verified MOB event	— Escalate the MOB indication to an MOB alert — Provide the user with the option to create a text-based MOB log entry

[a] System users should only deny an MOB event in the system after reviewing the data.

[b] The confirm MOB action shall be an optional step in the event review process.

The system shall be capable of marking all data corresponding to an MOB event to prevent deletion or overwriting of the data prior to the 30-day minimum storage duration (see 5.14).

5.13 MOB event message

Once a MOB event has been confirmed by an authorized system user, the system shall output a MOB message as specified in IEC 61162 (all parts). Before the system is physically connected to any navigation system consideration shall be given to cyber security issues.

5.14 MOB event log

The system shall generate an MOB event log when an MOB indication is initiated. The MOB event log shall contain the following items:

a) date and time of alleged MOB event;

b) the identity(s) of the sensor unit(s) that initiated the MOB indication;

c) current ship location;

d) current ship heading;

e) current ship speed over ground; and

f) username(s) and, if appropriate, event actions(s) of any individual logged into the system.

The MOB alarm log shall be maintained for a minimum of 30 days.

5.15 Operational status

The system shall monitor the operational status of the system.

The operational status of the system shall be displayed at the control station at power up, reset or change of system status.

The operational status of the system shall include:

a) the activation state (e.g. active or inactive) of all system sensors; and

b) the functional state (e.g. normal or malfunction) of all system sensors.

5.16 Captured data

The data captured from each sensor unit shall be recorded in its final data format.

If an MOB system utilizes video as means of recording an MOB alarm, the video associated with an alarm shall be equal to the native resolution and frame rate of the camera.

5.17 Date and time stamps

All required system data shall be embedded with a date and time stamp in a manner that is compliant with national and international evidential standards.

The system shall utilize the time code input from a valid coordinated universal time (UTC) feed to generate the date and time stamp.

5.18 Data storage

The system shall record all of the required system data while the system is in an active state. The required system data shall include the following items:

a) operational status of the system;

b) operational status of each sensor unit;

c) data captured from each sensor unit (see 5.16);

d) any active MOB event logs (see 5.14);

e) MOB log entries; and

f) security log (see 5.22).

The required system data shall be recorded at the sampling rates specified in Table 3.

Table 3 — Required system data sampling rates

Item	Required sampling frequency	Recommended sampling frequency
Operational status (as defined in 5.15) of the system	At power up, reset and on change of status	At power up, reset, on change of status and every 5 min
Operational status (as defined in 5.15) of each sensor unit	At power up, reset and on change of status	At power up, reset, on change of status and every 5 min
Data captured from each sensor unit	≥9 Hz	At the maximum rate of the sensor unit
Any active MOB event logs	On change of status	On change of status
MOB log entries	When saved by the user	When saved by the user
Security log	Upon each system event	Upon each system event

The system shall have the capacity to store the required system data for a minimum of 30 days.

The system shall store data in a resilient device providing redundancy equivalent to a redundant array of independent disks with block level striping with two parity blocks (RAID) 6, or better.

It shall be possible for an advanced user to set a data retention policy for the system. Once data exceeds the data retention policy duration, then it shall be automatically destroyed. The data retention policy shall not conflict with the 30-day minimum storage requirement.

5.19 User account types

There shall be at least two different types of user accounts on the system: standard and advanced.

A user with a standard account shall not be capable of:

a) creating or deleting user accounts on the system; or

b) changing his or her account information or account type.

5.20 Access controls

Access to the control station shall be restricted to users with the appropriate credentials.

5.21 Anti-tamper protection

Individuals accessing the system shall not have the ability to alter or delete any recorded data. The system shall log user actions.

5.22 Security log

The system shall record system events in a security log. System events shall include the following event types:

a) logons;

b) logoffs;

c) data export;

d) software upgrades; and

e) system setting changes.

For each system event, the user that initiated the event, the type of the event, and the date and time associated with the event shall be recorded.

In the case of a data export event, a description sufficient to describe the data that was exported from the system shall also be recorded.

In the case of a software upgrade event, the new software version shall also be recorded.

In the case of a system setting change event, both the old and new settings shall be recorded. If the system automatically adjusts the detection settings at a frequency greater than once an hour, a lookup table or report that describes how the settings are applied may be supplied in lieu of the detection setting change event log entries.

5.23 Compliance with appropriate IMO resolutions

The system shall be designed to be compliant with IMO resolutions MSC.302(87) and A.1021(26). The equipment shall be capable of classifying, handling, displaying and reporting alerts as required in IEC 62923. Compliance shall be demonstrated during initial testing.

5.24 MOB testing manikin

The system shall be capable of detecting a manikin with a height of 1,466 m, plus or minus 25 %, and with a minimum initial mass of 40 kg. The manikin shall have a basic human shape that contains two arms, two legs, a torso and a head.

The manikin may be modified in order to represent the signature of a human for a particular sensing modality, providing that any such modifications can be shown quantitatively to not exceed the characteristics of a human. This height is based on the minimum 5th percentile male and female stature data published in ISO/TR 7250-2.

6 Controlled environment performance requirements

6.1 General

The intent of the following requirements is to verify that the system in question satisfies the minimum performance criteria prior to installation and subsequent testing on a ship (Clause 7).

6.2 Basic probability of detection

The probability of detection of an MOB manikin shall be greater than or equal to 95 % in a controlled environment setting. A controlled environment setting means the environmental conditions during the tests are within the range of environmental conditions set out in the test plan. Environmental conditions include temperature, wind, light intensity (general and measured at the sensor), visibility, cloudiness, rain, fog. Tests may be conducted indoors or outdoors.

This probability of detection shall be calculated by conducting at least 100 drops throughout the detection envelope of the sensor. To ensure adequate testing coverage, the detection envelope shall be divided into 20 test regions of approximately equal area. Five drop tests shall be conducted at each testing region.

Of these five drop tests:

— two shall be conducted 1 m to 3 m above the sensor plane;

— one shall be conducted 4 m to 6 m above the sensor plane; and

— two shall be conducted 7 m to 10 m above the sensor plane.

In addition to the test parameters outlined above, the following information shall be collected and recorded in the test logs:

a) test date;

b) test time;

c) test organization;

d) name of tester;

e) test location (indoors or outdoors);

f) light intensity (general and maximum intensity measured at surface of sensor);

g) system manufacturer;

h) system details (e.g. sensor type, number of sensors used during tests, model and serial number of sensor(s) used during test);

i) map of sensor detection envelope and associated test regions;

j) environmental conditions;

k) model of manikin used during drop tests;

l) serial number of manikin used during drop tests (where provided or local reference); and

m) list of any modifications made to manikin for testing (e.g. clothing type, heated sections, etc.).

7 Shipboard-based performance requirements

7.1 General

The intent of the following requirements is to measure the system level of performance in the intended, nominal operational environment.

Shipboard testing shall be performed on a fully installed MOB detection system over a period of at least 90 days. During the test period, the vessel shall be in normal operation; any periods alongside exceeding 12 h shall not count towards the 90 days. MOB detection system parameters shall not be modified during testing unless the modifications are outlined in the MOB detection system operation manual. If system modification instructions are outlined in the MOB detection system operation manual, changes to the system shall be conducted by an independent third party or authorized end-user. Any modifications made outside those expected of an end user during normal operation shall cause the 90-day period to restart. Manufacturers shall be provided the opportunity to observe shipboard testing to ensure that system operation protocols have been followed throughout the test.

7.2 Probability of detection

During nominal operating conditions, the probability of detecting a human or an MOB manikin passing through the MOB detection zone shall be greater than or equal to 95 %. The probability of detection shall be calculated by conducting at least 100 drop tests with an MOB manikin at the locations described in Table 4. The tester shall make every effort to perform the tests at different locations within each defined area, including the bow and stern and during hours of light and dark.

Table 4 — Detection probability drop test parameters

Number of tests	Time of day	Vessel side	Areas	Distance from side of vessel m	Vertical speed at sensor plane m/s
3	Day	Port	Forward	0 to 3	4 to 12
4	Day	Port	Mid	0 to 3	4 to 12
4	Day	Port	Aft	0 to 3	4 to 12
3	Day	Port	Forward	4 to 8	4 to 12
4	Day	Port	Mid	4 to 8	4 to 12
4	Day	Port	Aft	4 to 8	4 to 12
3	Day	Starboard	Forward	0 to 3	4 to 12
4	Day	Starboard	Mid	0 to 3	4 to 12
4	Day	Starboard	Aft	0 to 3	4 to 12
3	Day	Starboard	Forward	4 to 8	4 to 12
4	Day	Starboard	Mid	4 to 8	4 to 12
4	Day	Starboard	Aft	4 to 8	4 to 12
3	Night	Port	Forward	0 to 3	4 to 12
4	Night	Port	Mid	0 to 3	4 to 12
4	Night	Port	Aft	0 to 3	4 to 12
3	Night	Port	Forward	4 to 8	4 to 12
4	Night	Port	Mid	4 to 8	4 to 12
4	Night	Port	Aft	4 to 8	4 to 12
3	Night	Starboard	Forward	0 to 3	4 to 12
4	Night	Starboard	Mid	0 to 3	4 to 12
4	Night	Starboard	Aft	0 to 3	4 to 12
3	Night	Starboard	Forward	4 to 8	4 to 12