



RULES

PUBLICATION 124/P

PERFORMANCE STANDARDS FOR WATER LEVEL DETECTION SYSTEMS USED ON SHIPS

January
2024

Publications P (Additional Rule Requirements) issued by Polski Rejestr Statków
complete or extend the Rules and are mandatory where applicable.

GDAŃSK

Publication 124/P – Performance standards for water level detection systems used on ships – January 2024 is an extension of the requirements contained in Part I – Classification Regulations of the Rules for the Classification and Construction of Sea-Going Ships.

This Publication was approved by PRS Board on 21 December 2024 and enters into force on 1 January 2024.

This Publication also applies to other PRS regulations if it is mentioned there.

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CONTENTS

Page

1 GENERAL REQUIREMENTS	5
1.1 Introduction.....	5
1.2 Design documentation	5
1.3 Scope of application	5
2 DEFINITIONS	5
3 FUNCTIONAL REQUIREMENTS	6
3.1 Means of detecting the water level.....	6
3.2 Detector system requirements.....	6
3.3 Alarm system requirements	7
3.4 Testing.....	9
3.5 Manuals.....	9
4 INSTALLATION AND TESTING	9
5 BILGE ALARMS USED AS WATER LEVEL DETECTORS	10
6 PERIODIC TESTING	10
APPENDIX – Guidelines on installation and testing of water level detection systems on ships	11

1 GENERAL REQUIREMENTS

1.1 Introduction

This *Publication* has been developed based on the technical requirements given in IMO Resolution MSC.188(79)/Rev.2.

The *Publication* is intended for the design, implementation and testing of water level detection systems for certification purposes as well as for installation on ships.

The editorial layout of the *Publication* corresponds to the layout of the MSC Resolution, treated as a source document, so that individual requirements can be easily verified, and in the future, obligatory corrections/interpretations regarding the source document can be easily implemented in the *Publication*. The text resulting from the source document has been marked with a blue font. Specific requirements, other than those resulting from the source document, have been marked in black in the text.

The *Publication* includes IACS and IMO interpretations to the source document, respectively marked in the text with a reference* and purple font.

1.2 Design documentation

In order to issue the product type approval certificate, the following technical documentation of the water level detection system shall be submitted to PRS Head Office:

- .1 General description of the system, including basic technical parameters, way of installation on ships and operating principles.
- .2 Technical drawings of detection system, including: specification and list of components, materials of corrosion-resistant components, methods of sealing and details of manufacture.
- .3 Operation and periodic inspection and maintenance manuals.
- .4 Electrical diagrams of power supply and alarm signalling, together with the alarm panel.
- .5 Certificates for use in hazardous areas, if applicable.
- .6 Acceptance and type testing programme.

1.3 Scope of application

1.3.1 These standards provide technical functional requirements for water level detection and alarm arrangements installed in:

- .1 bulk carriers for compliance with SOLAS regulation XII/12;
- .2 single hold cargo ships other than bulk carriers for compliance with SOLAS regulation II-1/25; and
- .3 multiple hold cargo ships other than bulk carriers and tankers for compliance with SOLAS regulation II-1/25-1.

1.3.2 They also provide technical functional requirements for bilge alarms used as water level detectors in multiple hold cargo ships for compliance with SOLAS regulation II-1/25-1.

2 DEFINITIONS

2.1 *Water level detector* means a system comprising sensors and alarms, that detect and warn of water ingress in cargo holds and other spaces as required in SOLAS regulations II-1/25, II-1/25-1 or XII/12.1.

2.2 *Sensor* means a unit fitted at the location being monitored that activates a signal to identify the presence of water at the location.

2.3 *Pre-alarm level* means the lower level of water at which the sensor(s) in the cargo hold space will operate.

2.4 *Main alarm level* means the higher level of water at which the sensor(s) in the cargo hold space will operate or the sole level in spaces other than cargo holds.

2.5 *Visual indication* means indication by activation of a light or other device that is visible to the human eye in all levels of light or dark at the location where it is situated.

2.6 *Audible indication* means an audible signal that is detectable at the location where it is signalled.

3 FUNCTIONAL REQUIREMENTS

3.1 Means of detecting the water level

3.1.1 The method of detecting the water level may be by direct or indirect means as defined below:

- .1** a direct means of detection determines the presence of water by physical contact of the water with the detection device.
- .2** indirect means of detection include devices without physical contact with the water.

3.1.2 The sensors shall be capable of being located in the aft part of the hold or above its lowest point in such ships having an inner bottom not parallel to the designed waterline, or, in the case of bulk carriers complying with SOLAS regulation XII/12, in the aft part of each cargo hold or in the lowest part of the spaces other than cargo holds to which that regulation applies.

3.1.3 The systems of detecting the water level shall be capable of continuous operation while the ship is at sea.

3.2 Detector system requirements

3.2.1 Detector systems shall provide a reliable indication of water reaching a preset level*.

* *Interpretation:*

One sensor capable of detecting both preset levels (pre-alarm level and main alarm level) is allowed. (IACS UI SC180, Rev.4)

3.2.2 The system shall be capable of the following:

For cargo holds:

- .1** an alarm, both visual and audible, activated when the depth of water reaches the pre-alarm level in the space being monitored. The indication shall identify the space.
- .2** an alarm, both visual and audible, activated when the depth of water reaches the main alarm level, indicating increasing water level in a cargo hold. The indication shall identify the space and the visual and audible alarm shall not be the same as that for the pre-alarm level.

For compartments other than cargo holds:

- .3** an alarm, both visual and audible, indicating the presence of water in a compartment other than a cargo hold when the level of water in the space being monitored reaches the sensor. The visual and audible characteristics of the alarm indication shall be the same as those for the main alarm level in a hold space.

3.2.3 Detection equipment* shall be suitably corrosion-resistant for all intended cargoes.

* *Interpretation:*

Detection equipment includes the sensor and any filter and protection arrangements for the detector installed in cargo holds and other spaces as required by SOLAS regulation II-1/25 or XII/12.1. (MSC.1/Circ.1572/Rev.1) and (IACS UI SC180, Rev.4)

3.2.4 The detector indicating the water level shall be capable of activating to an accuracy of ± 100 mm.

3.2.5 Detection equipment shall be of certified safe type appropriate for the intended cargoes*. The part of the system which has circuitry in the cargo area shall be intrinsically safe or explosion proof with appropriate apparatus group and temperature class which is to be determined depending on the cargo carried.

* *Interpretation:*

- 1. In general, the construction and type testing is to be in accordance with IEC 60079-11: 2023 to a minimum requirement of EX(ib). Where a ship is designed only for the carriage of cargoes that cannot create a combustible or explosive atmosphere then the requirement for intrinsically safe circuitry is not to be insisted upon, provided the operational instructions included in the Manual required by 4.1 of the Appendix to the Annex specifically exclude the carriage of cargoes that could produce a potential explosive atmosphere. Any exclusion of cargoes identified in the Annex is to be consistent with the ship's Cargo Book and any Certification relating to the carriage of specifically identified cargoes.*
- 2. The maximum surface temperature of equipment installed within cargo spaces is to be appropriate for the combustible dusts and/or explosive gasses likely to be encountered. Where the characteristics of the dust and gases are unknown, the maximum surface temperature of equipment is not to exceed 85 deg. C.*
- 3. Where intrinsically safe equipment is installed, it is to be of a certified safe type.*
- 4. Where detector systems include intrinsically safe circuits, plans of the arrangements are to be appraised/approved by PRS. (MSC.1/Circ.1572/Rev.1) and (IACS UI SC180, Rev.4)*

3.3 Alarm system requirements

3.3.1 The visual and audible alarms shall be suitable for location on the navigation bridge.*

* *Reference is made to the requirements of SOLAS regulations V/17 and V/18.*

3.3.2 Visual and audible alarms shall conform to the *Code on Alerts and Indicators, 2009*, as may be amended, as applicable to a primary alarm for the preservation or safety of the ship*

* *Interpretation:*

The pre-alarm, as a primary alarm, is to indicate a condition that requires prompt attention to prevent an emergency condition and the main-alarm, as an emergency alarm is to indicate that immediate actions are to be taken to prevent danger to human life or to the ship. (MSC.1/Circ.1572/Rev.1) and (IACS UI SC180, Rev.4)

3.3.3 The visual and audible alarms shall be capable of the following:

- .1 visual indication using a light of a distinct colour, or digital display that is clearly visible in all expected light levels, which does not seriously interfere with other activities necessary for the safe operation of the ship. The visual indication shall be capable of remaining visible until the condition activating it has returned below the level of the relevant sensor. The visual indication shall not be capable of being extinguished by the operator.
- .2 in conjunction with the visual indication for the same sensor, the system shall be capable of providing audible indication and alarms in the space in which the indicator is situated. The audible indication shall be capable of being muted by the operator.

3.3.4 Time delays may be incorporated into the alarm system to prevent spurious alarms due to sloshing effects associated with ship motions.

3.3.5 An alarm overriding device* may be installed for water level detectors in cargo holds or tanks which can be used for water ballast (SOLAS regulations II-1/25-1 and XII/12.1). An override visual indication capability shall be provided throughout deactivation of the water level detector for such holds or tanks. Where such an override capability is provided, cancellation of the override condition and reactivation of the alarm shall automatically occur after the hold or tank has been deballasted to a level below the lowest alarm indicator level.

* Interpretation:

The water ingress alarm system is not to be capable of overriding the alarm of the spaces (e.g., dry spaces, cargo holds, etc.), that are neither designed nor intended to carry water ballast.

1. *Enabling the facility to override alarms is to be customized for each specific ship prior to the commissioning tests witnessed by PRS surveyor pursuant to certification. Any subsequent modifications are subject to re-certification.*
2. *A "Caution Plate", which prohibits personnel from overriding an alarm to any hold, is not an acceptable alternative to the above provisions. (IACS UI SC180, Rev.4)*

3.3.6 Requirements for malfunctions, alarms and indications shall include a facility for continuous monitoring of the system* which, on detecting a fault, activates a visual and audible alarm. The audible alarm shall be capable of being muted, but the visual indication shall remain active until the malfunction is cleared.

* Interpretation:

Fault monitoring is to address faults associated with the system, e.g. open circuit, short circuit, loss of power supplies, CPU failure. (MSC.1/Circ.1572/Rev.1) and (IACS UI SC180, Rev.4)

3.3.7 The water level detector system shall be capable of being supplied with electrical power from two independent electrical supplies. Failure of any of the two electrical power supplies shall be indicated by an alarm.

* Interpretation:

1. *The electrical power supply is to be from two separate sources, one is to be the main source of electrical power and the other is to be the emergency source, unless a continuously charged dedicated accumulator battery is fitted, having arrangement, location and endurance equivalent to that of the emergency source (18h). The battery supply may be an internal battery in the water level detector system.*
2. *The changeover arrangement of supply from one electrical source to another need not be integrated into the water level detector system.*
3. *Where batteries are used for the secondary power supply, failure alarms for both power supplies are to be provided. (MSC.1/Circ.1572/Rev.1) and (IACS UI SC180, Rev.4)*

3.4 Testing

3.4.1 Water level detector systems shall be type tested to demonstrate their robustness and suitability under the appropriate internationally recognized conditions and for their continued functioning under the expected service temperature.*

* *With regard to testing, reference is made to IEC 60092-504 and IEC 60529. Electrical components installed in cargo holds, ballast tanks and dry spaces shall satisfy the requirements of IP68 in accordance with IEC 60529.*

Interpretation:

1. *IACS UR E10 may be used as an equivalent test standard to IEC 60092-504:2016.*
2. *The range of tests is to include the following:*

For alarm/monitoring panel:

- *functional tests in accordance with MSC.188(79);*
- *electrical power supply failure test;*
- *power supply variation test;*
- *dry heat test;*
- *damp heat test;*
- *vibration test;*
- *EMC tests;*
- *insulation resistance test;*
- *high voltage test; and (IACS UI SC180, Rev.4)*
- *static and dynamic inclinations tests, if moving parts are contained.*

For IS barrier unit if located in the wheelhouse:

- *in addition to the certificate issued by a competent independent testing laboratory, EMC tests are also to be carried out.*

For water ingress detectors:

- *functional tests in accordance with MSC.188(79);*
- *electrical power supply failure test;*
- *power supply variation test;*
- *dry heat test;*
- *damp heat test;*
- *cold test;*
- *vibration test;*
- *enclosure class in accordance with MSC.188(79);*
- *insulation resistance test;*
- *high voltage test;*
- *EMC tests, (if the detector is capable of producing electromagnetic noise), and*
- *static and dynamic inclinations tests, (if the detectors contain moving parts) (MSC.1/Circ.1572/Rev.1) and (IACS UI SC180, Rev.4)*

3.4.2 Detectors serving a cargo hold shall be capable of being functionally tested, in situ, when the hold is empty using either direct or indirect methods.

3.5 Manuals

Documented operating and maintenance procedures for the water level detection system shall be kept on board and be readily accessible.

4 INSTALLATION AND TESTING

Guidelines on installation and testing of water level detection systems for ships subject to SOLAS regulations II-1/25, II-1/25-1 and XII/12 are set out in the *Appendix* to this *Publication*.

5 BILGE ALARMS USED AS WATER LEVEL DETECTORS

5.1 Bilge alarms may be used as water level detectors provided that they meet the functional requirements and installation and testing requirements set out in sections 3 and 4.

5.2 Some cargoes require the bilge pumping system to be protected to prevent the spread of contaminated or potentially dangerous fluids.

5.3 Where the cargo hold bilge well will be completely sealed when specific cargoes are carried, and the bilge well therefore cannot be used for the entry of ingress water to the detector(s), a suitable alternative detection point or points are to be provided.

5.4 If the bilge well is used for when specific cargoes are carried, the bilge well is not to be completely sealed in order to allow water ingress for activating the detectors.

6 PERIODIC TESTING

Water level detectors shall be periodically tested on board to the same extent as specified in section 3.3 of the *Appendix* and records of the periodic testing shall be retained on board.

APPENDIX

GUIDELINES ON INSTALLATION AND TESTING OF WATER LEVEL DETECTION SYSTEMS ON SHIPS

1 PURPOSE

1.1 These *Guidelines* provide procedures for installation and testing of water level detection and alarm systems installed in:

- .1** bulk carriers for compliance with SOLAS regulation XII/12;
- .2** single hold cargo ships other than bulk carriers for compliance with SOLAS regulation II-1/25; and
- .3** multiple hold cargo ships other than bulk carriers and tankers for compliance with SOLAS regulation II-1/25-1.

1.2 They also provide procedures for installation and testing of bilge alarms used as water level detectors in multiple hold cargo ships other than bulk carriers and tankers for compliance with SOLAS regulation II-1/25-1.

2 EQUIPMENT

2.1 Detector equipment type test requirements

2.1.1 Detector equipment shall provide a reliable indication of water reaching a preset level and shall be type tested to demonstrate their robustness and suitability under the appropriate conditions of IEC 60092-504 and the following*:

* *Interpretation:*

The test procedure is to satisfy the following criteria:

- 1. the type tests are to be witnessed by PRS surveyor if the tests are not carried out by a competent independent test facility.*
- 2. type tests are to be carried out on a prototype or randomly selected item(s) which are representative of the manufactured item that is being type tested.*
- 3. type tests are to be documented (type test reports) by the manufacture and submitted for review by PRS. (MSC.1/Circ.1572/Rev.1) and (IACS UI SC180, Rev.4)*

- .1** protection of the enclosures of electrical components installed in the cargo holds, ballast tanks and dry spaces shall satisfy the requirements of IP68 in accordance with IEC 60529:1989 Ed.2.2. The water pressure testing of the enclosure shall be based on a pressure head held for a period depending on the application. For detectors to be fitted in holds intended for the carriage of water ballast or ballast tanks the application head shall be the hold or tank depth and the hold period shall be 20 days. For detectors to be fitted in spaces intended to be dry the application head shall be the depth of the space and the hold period shall be 24 h.

* *Interpretation:*

- 1. The submerged test period for electrical components intended to be installed in ballast tanks and cargo tanks used as ballast tanks is to be not less than 20 days.*
- 2. The submerged test period for electrical components intended to be installed in dry spaces and cargo holds not intended to be used as ballast tanks is to be not less than 24 hours.*
- 3. Where a detector and/or cable connecting device (e.g. junction box, etc.) is installed in a space adjacent to a cargo hold (e.g. lower stool, etc.) and the space is considered to be flooded under damage stability calculations, the*

detectors and equipment are to satisfy the requirements of IP68 for a water head equal to the hold depth for a period of 20 days or 24 hours on the basis of whether or not the cargo hold is intended to be used as a ballast tank as described in the previous bullet points. (MSC.1/Circ.1572/Rev.1) and (IACS UI SC180, Rev.4)

- .2** operation in cargo/water mixture for a selected range of cargo groups such as iron ore dust, coal dust, grains and oils using seawater with a suspension of representative fine material for each cargo group. For type test purposes an agitated suspension of representative fine materials in seawater, with a concentration of 50% by weight, shall be used with the complete detector assembly including any filtration fitted. The functioning of the detection assembly with any filtration arrangements shall be verified in the cargo/water mixture with immersion repeated 10 times without cleaning any filtration arrangements.

* Interpretation:

- 1 The type test required for the sensor is to be in accordance with the following:
 - .1 the test container for the cargo/water mixture is to be dimensioned so that its height and volume are such that the sensor and any filtration fitted can be totally submerged for the repeated functionality tests required by 2.1.1.2 and the static and dynamic inclination tests identified in the previous interpretation.
 - .2 the sensor and any filtration fitted that are to be submerged and are to be arranged in the container as they would be installed in accordance with the installation instructions required by 4.1.4.
 - .3 the pressure in the container for testing the complete detector is to be not more than 0.2 bar at the sensor and any filter arrangement. The pressure may be realized by pressurization or by using a container of sufficient height.
 - .4 the cargo/water mixture is to be pumped into the test container and suitable agitation of the mixture provided to keep the solids in suspension. The effect of pumping the cargo/water mixture into the container is not to affect the operation of the sensor and filter arrangements.
 - .5 the cargo/water mixture is to be pumped into the test container to a predetermined level that submerges the detector and the operation of the alarm observed.
 - .6 the test container is then to be drained and the de-activation of the alarm condition observed.
 - .7 the test container and sensor with any filter arrangement are to be allowed to dry without physical intervention.
 - .8 the test procedure is to be repeated consecutively ten times without cleaning any filter arrangement that may be fitted in accordance with the manufacturer's installation instructions (see also 2.1.1.2).
 - .9 satisfactory alarm activation and de-activation at each of the ten consecutive tests will demonstrate satisfactory type testing.
- 2 The cargo/water mixture used for type testing are to be representative of the range of cargoes within the following groups and is to include the cargo with the smallest particles expected to be found from a typical representative sample:
 - .1 iron ore particles and seawater;
 - .2 coal particles and sea water;
 - .3 grain particles and seawater; and
 - .4 aggregate (sand) particles and sea water.

The smallest and largest particle size together with the density of the dry mixture is to be ascertained and recorded. The particles are to be evenly distributed throughout the mixture. Type testing with representative particles will in general qualify all types of cargoes within the four groupings shown above.

The following provides guidance on the selection of particles for testing purposes:

 - .1 iron ore particles are to mainly consist of small loose screenings of iron ore and not lumps of ore (dust with particle size < 0.1 mm).
 - .2 coal particles are to mainly consist of small loose screenings of coal and not lumps of coal (dust with particle size < 0.1 mm).
 - .3 grain particles are to mainly consist of small loose grains of free flowing grain (grain having a size > 3mm, such as wheat).

.4 aggregate particles are to mainly consist of small loose grains of free flowing sand and without lumps (dust with particle size < 0.1 mm). (MSC.1/Circ.1572/Rev.1) and (IACS UI SC180, Rev.4)

2.1.2 Protection of the enclosures of electrical equipment located on the deck above ballast and cargo spaces shall satisfy the requirements of IP56 in accordance with IEC 60529:1989 Ed.2.2.

2.1.3 Equipment which is to be used in refrigerated cargo spaces shall satisfy the requirements of a suitable industry standard covering the relevant service temperatures.

2.2 Detector equipment installation requirements

2.2.1 The sensors shall be located in a protected position that is in communication with the specified part of the cargo hold (usually the aft part) such that the position of the sensor detects the level that is representative of the levels in the actual hold space. These sensors shall be located:

- .1** either as close to the centreline as practicable, or
- .2** at both the port and starboard sides of the cargo hold.

** Interpretation:*

For ships having keel laid on or after 1 July 2004, if sensors are not placed within a distance less than or equal to 1 corrugation space or 1 bulkhead vertical stiffener space from the centreline, sensors are to be located at both the port and starboard sides of the cargo hold.

For ships having keel laid before 1 July 2004, if sensors are not placed within a distance less than or equal to B/6 from the centreline, sensors are to be located at both the port and starboard sides of the cargo hold. (IACS UI SC180, Rev.4)

2.2.2 The sensors shall be located at the height specified in the regulations. These heights are to be measured from the upper surface of the inner bottom.

2.2.2.1 For bilge level sensors in SOLAS regulation II-1/25-1.3, if the bottom of the bilge well is below the upper surface of the inner bottom, the heights of those sensors are to be measured from the bottom of the bilge well.

2.2.3 When a lining or insulation of cargo holds/ tank is fitted, if the lining or insulation is not constructed to a watertight standard, then the height is to be measured from the upper surface of the inner bottom. If the lining or insulation is tested as watertight, then the heights may be measured from the upper surface of the lining/insulation.

2.2.4 The detector installation shall not inhibit the use of any sounding pipe or other water level gauging device for cargo holds or other spaces.

2.2.5 Detectors and equipment shall be installed where they are accessible for survey, maintenance and repair.

2.2.6 Any filter element fitted to detectors shall be capable of being cleaned before loading of cargo hold.

2.2.7 Sensors, electrical cables and any associated equipment installed in cargo holds shall be protected from damage by cargoes or mechanical handling equipment associated with bulk carrier operations, such as in tubes of robust construction or in similar protected locations.

2.2.8 Any changes/modifications to the ship's structure, electrical systems or piping systems that involves cutting and/or welding shall be approved by PRS before work is carried out.

3 SYSTEM TESTING

3.1 Alarm system type testing requirements

3.1.1 Alarm systems shall be type tested* in accordance with IEC 60092-504: 2016, as appropriate.

* Interpretation:

The test procedure is to satisfy the following criteria:

- 1. the type tests are to be witnessed by PRS surveyor if the tests are not carried out by a competent independent test facility;*
- 2. type tests are to be carried out on a prototype or randomly selected item(s) which are representative of the manufactured item that is being type tested;*
- 3. type tests are to be documented (type test reports) by the manufacture and submitted for review by PRS. (MSC.1/Circ.1572/Rev.1) and (IACS UI SC180, Rev.4)*

3.1.2 A switch for testing audible and visual alarms shall be provided at the alarm panel and the switch shall return to the off position when not operated.

3.2 Alarm system testing requirements

The visual and audible alarms shall be tested to demonstrate the following:

- .1** the visual indication may not be extinguished by the operator;
- .2** they shall be set at a level that alerts operators but does not interfere with the safe operation of the ship; and
- .3** they shall be distinguishable from other alarms.

3.3 System test requirements

3.3.1 After installation, a functionality test shall be carried out. The test shall represent the presence of water at the detectors for every level monitored. Simulation methods may be used where the direct use of water is impracticable.

3.3.2 Each detector alarm shall be tested to verify that the pre-alarm and main alarm levels operate for every space where they are installed and indicate correctly. Also, the fault monitoring arrangements shall be tested as far as practicable.

3.3.3 Records of testing of alarm systems shall be retained on board.

4 MANUALS

4.1 Manuals* shall be provided on board and shall contain the following information and operational instructions:

- .1** a description of the equipment for detection and alarm arrangements together with a listing of procedures for checking that, as far as practicable, each item of equipment is working properly during any stage of ship operation;
- .2** evidence that the equipment has been type tested to the requirements of 2.1 above;
- .3** line diagrams of the detection and alarm system showing the positions of equipment;
- .4** installation instructions for orientation, setting, securing, protecting and testing;
- .5** list of cargo groups for which the detector is suitable for operating in a 50% seawater slurry mixture (see 2.1.1.2);
- .6** temperature range for which the equipment is suitable;
- .7** procedures to be followed in the event of equipment not functioning correctly; and

.8 maintenance requirements for equipment and system.

** Interpretation:*

For each ship, a copy of the manual is to be made available to the surveyor at least 24 hours prior to survey of the water level detection installation. PRS should ensure that any plans required for classification purposes have been appraised/approved as appropriate. (MSC.1/Circ.1572/Rev.1) and (IACS UI SC180, Rev.4)

4.2 Manuals for bilge alarm systems used as water level detection systems are to contain the following information in addition to that in 4.1 (see paragraph 5.3 of these performance standards):

- .1** procedure for switching to the alternative arrangements provided for occasions when the bilge alarm system cannot be used as a water level detection system; and
- .2** list of cargoes for which alternative provisions are to be used.

List of IMO documents implemented in the *Publication*

MSC.1/Circ.1572/Rev.1: Unified interpretations of SOLAS chapters II-1 and XII, of the Technical provisions for means of access for inspections (resolution msc.158(78)) and of the performance standards for water level detectors on bulk carriers and single hold cargo ships other than bulk carriers (resolution MSC.188(79))

List of IACS documents implemented in the *Publication*

UI SC180/Rev.4: Interpretation of Regulation 25 of SOLAS Chapter II-1 as amended by IMO resolutions up to MSC.436(99) and Regulation XII/12 of SOLAS Chapter XII as amended by IMO resolutions up to MSC.170(79)
