Guideline No.: E-20(201705)

E-20 COMPARTMENT FLOODING WATER LEVEL DETECTORS (INCLUDING SENSORS)

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Foreword:

This Guideline is a part of CCS Rules, which contains technical requirements, inspection and testing criteria related to classification and statutory survey of marine products.

This Guideline is published and updated by CCS and can be found through http://www.ccs.org.cn . Comments or suggestions can be sent by email to ps@ccs.org.cn .

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"IEC 60529" "IEC 60079-0" and "IEC 60079-11" are modified to the current valid version.

CONTENTS

COMPARTMENT FLOODING WATER LEVEL DETECTORS (INCLUDING SENSORS)

1 Application

1.1 This guideline is applicable to the approval and inspection of water level detectors equipped on single hold cargo ships and bulk carriers other than the passenger ships and bulk carriers required in Regulation 22-1 and Regulation 25, Chapter II-1 and Regulation 12, Chapter XII of SOLAS.

1.2 This guideline does not involve the onboard installation and arrangement of water level detectors.

2 Normative references

The applicable normative references are as follows:

2.1 Regulation 22-1 and Regulation 25, Chapter II-1 and Regulation 12, Chapter XII of SOLAS1974 and Amendments thereto;

2.2 Resolution MSC.188(79)(2004.12.3) Performance Standards for Water Level Detectors on Bulk Carriers and Single Hold Cargo Ships other than Bulk Carriers;

2.3 MSC.1/Circ.1291(2008.12.9)Guidelines for Flooding Detection Systems on Passenger Ships;

2.4 IACS UI SC180 (Sept2003) (Rev.1May 2004) (Rev.2 Nov 2005) (Rev.3Mar 2012)Hold, Ballast and Dry Space Water Level Detectors (Chapter II-1/25 and Chapter XII/12) and Performance Standards for Water Level Detectors on Bulk Carriers and Single Hold Cargo Ships other than Bulk Carriers (Resolution MSC.188(79));

2.5 Chapters 1, 2, 3, PART FOUR and Section 7 (sensors), Chapter 2, PART SEVEN of CCS Rules for Classification of Sea-going Steel Ships and Amendments thereto;

2.6 IMO A.1021(26)(2009.12.2)Code on Alerts and Indicator;

2.7 IEC60092-504 (2001-03) Electrical Installations in Ships-Part 504: Special Features-Control and Instrumentation;

2.8 CCS GD 22-2015 Guidelines for Type Approval Test of Electric and Electronic Products;

2.9 IEC 60529:1989+AMD1:1999+AMD2:2013 CSV ~~(2001-02)~~ Degrees of Protection Provided by Enclosures (IP Code);

2.10 IEC60079-0:~~2007~~ 2011 RLV Explosive Atmospheres - Part 0: Equipment - General requirements;

2.11 IEC60079-11:2011~~06~~ Explosive Atmospheres - Part 11: Equipment Protection by Intrinsic Safety ‘i’'.

3 Definitions

3.1 The terms and definitions used in this guideline are consistent with those in SOLAS.

3.2 The terms and definitions used in this guideline are consistent with those in CCS Rules for Classification of Sea-going Steel Ships.

3.3 The terms and definitions used in this guideline are consistent with those in IEC60092-504.

3.4 The terms and definitions used in this guideline are consistent with those in IMO A. 1021(26).

3.5 Water level detector is a system comprised of sensor and display device, which is used to detect any water ingress in cargo holds and other spaces and activate the corresponding alarm, as required by SOLAS Regulation XII/12 or Regulation II-1/22-1 or Regulation II-1/25.

3.6 Sensor is a component which is fitted in monitored spaces and able to activate signals alarming water flooding in such spaces.

3.7 Water ingress detection pre-alarm means an alarm given when the water level reaches a lower level in cargo holds or other spaces on bulk carriers or single hold cargo ships.

3.8 water ingress detection main-alarm means an alarm given when the water level reaches the main alarm level in cargo holds or other spaces on bulk carriers or single hold cargo ships. This is applicable to SOLAS Regulation XII/12 or Regulation II-1/25; or the unique water level required by SOLAS Regulation II-1/22-1 which is applicable to the compartments other than cargo holds.

3.9 Visual display means the light device or other devices visible to human eyes under various illuminated and dim conditions in various spaces or places.

3.10 Audible display means the audible signal detectable in the space from which such signal is given.

4 Drawings and documentation

4.1 The drawings and documentation to be submitted to CCS for approval:

4.1.1 General plan;

4.1.2 Main parts diagram;

4.1.3 Panel arrangement plan;

4.1.4 Electric circuit and power supply diagrams;

4.1.5 List of elements and devices (including the name, type, specifications, quantity, manufacturer or brand of elements and devices, the code of elements and devices in the electric circuit diagram, etc.);

4.1.6 Type test plan;

4.1.7 Product technical specifications or enterprise standard.

4.2 The drawings and documentation to be submitted to CCS for review:

4.2.1 Instructions for use of the product (both in English and Chinese);

4.2.2 Process documents and process flow chart showing quality monitoring points;

4.2.3 Software specification (including programming platform, software type, software version, etc., applicable to products with programmable elements);

4.2.4 Software flow chart/program block diagram (applicable to products with programmable elements);

4.2.5 Type, specification and list of qualified suppliers of main raw materials and parts (e.g. sensor, integrated circuit chip, printed circuit board, semi-conductor element, fuse, switch, power module, light emitting diode, printed product, insulation paint, etc.);

4.2.6 System wiring diagram or hardware block diagram;

4.2.7 External wiring diagram;

4.2.8 Nameplate;

4.2.9 Product quality certificates;

4.2.10 Information on the manufacturer’s production capacity and quality system documents.

5 Materials and components

Materials and components should be controlled by the relevant requirements of CCS current rules.

The type and specifications of sensors are to be expressly indicated in the approval certificate and controlled by the list of approved and qualified suppliers. Where approved sensors are to be replaced by sensors of other types, CCS product certificate is to be presented or the corresponding type test is to be performed.

6 Technical requirements

6.1 System components

The water level detector is a system composed of a number of sensors (sensors of explosion-proof type include safety barrier) and display devices (usually electric control box), among which the electric control box and safety barrier are installed in safe areas and sensors are installed in hazardous areas (if they are explosion proof).

6.2 Method of water level detection

6.2.1 Water level may be detected by the following direct or indirect means:

(1)Indirect means of detection: existence of water is determined through physical contact between water and the detector.

(2)Indirect means of detection: include devices that do not involve physical contact with water.

6.2.2 Water level detection system is to be capable of operating continuously while the ship is navigating on the sea.

6.3 Requirements for water level detector

6.3.1 The detection system is to provide reliable display when the water reaches the preset level.

Use of sensors capable of detecting two preset levels (warning level and main alarm level) is allowed.

6.3.2 Requirements for water level detectors on bulk carriers

(1) A visual and audible alarm is to be activated when the water in each cargo hold reaches a level 0.5m above the inner bottom of the cargo hold, and a visual and audible alarm is also to be activated when the height of water level is not less than 15% of the cargo hold depth and not more than 2m. For bulk carriers to which SOLAS Regulation XII/9.2 is applicable, only the alarm device giving the latter alarm is required. For cargo holds used for water ballasting, an alarm overriding control device may be installed. The visual and audible alarm is to be capable of clearly distinguishing the two kinds of water levels detected in each cargo hold.

(2) The audible and visual alarms are to be activated when the water within any ballast tank forward of the collision bulkhead required in SOLAS Regulation Ⅱ-1/11 has reached a level not greater than 10% of the tank capacity. The displayed visual and auditory features of the alarm are

to be identical to those corresponding to the main alarm level of cargo holds. An alarm overriding control device is to be installed for the purpose of level alarm overriding control when the tank is being used.

(3) In any dry space or void space other than the chain locker, extended to any location forward of the fore cargo hold, the audible and visual alarms are to be activated when the water reaches a level 0.1m above the deck. The displayed visual and auditory features of the alarm are to be identical to those corresponding to the main alarm level of cargo holds. Such alarms does not have to be installed provided that the capacity of enclosed spaces is not more than 0.1% of the ship's maximum displacement.

6.3.3 Requirements for the performance of water level detectors on single hold cargo ships other than bulk carriers

An audible and visual alarm is to be activated when the water in a cargo hold reaches a level not less than 0.3m above the inner bottom of the cargo hold and the same is to be also activated when the water reaches a level not more than 15% of the average cargo hold depth.

6.3.4 Requirements for water level detectors on passenger ships

Refer to Regulations 6 and 7 of MSC.1/Circ.1291 Guidelines for Flooding Detection Systems on Passenger Ships for the requirements for detector configuration on passenger ships:

Regulation 6 of Guidelines for Flooding Detection Systems on Passenger Ships: water level detectors are to be provided in all enclosed spaces that are located below the bulkhead deck and have a capacity larger than:

(1) Molded volume of displacement per centimeter at deepest subdivision draught, or

(2) $30m^3$, whichever is greater.

Regulation 7 of Guidelines for Flooding Detection Systems on Passenger Ships: compliance with the requirements of Regulation 6 may be waived provided that the liquid (e.g. freshwater, ballast water, fuel oil, etc.) level sensors are installed individually in the spaces of abovementioned capacities and indicator board or other monitoring devices are provided in the navigation bridge.

The provided water level detection system on passenger ships is to be installed as close to the compartment bottom as possible in the vertical direction to ensure that alarms are activated immediately upon detection of any flooding in the abovementioned watertight compartments.

6.3.5 Detection devices are to be adequately protected against corrosion caused by the intended cargo to be loaded. Detection devices consist of sensors and filters installed in cargo holds and other spaces and the protective devices of detectors.

6.3. 6 The activation precision of water level detectors is to be ±100mm.

6.3.7 The electric circuit in cargo area, if any, of water level detectors, is to be intrinsically safe circuit of grade ib specified in IEC 60079. Such intrinsically safe circuit may not be mandatorily required provided that the ship is designed to carry only the cargos that will not generate combustible or explosive atmospheres, which is specified in the ship's operational manual of the detection system, ship loading manual and relevant certificate for carrying special cargos.

Intrinsically safe equipment in cargo spaces, if installed, is to be qualified explosion-proof electrical equipment meeting the requirements. The explosion-proof grade and maximum surface temperature of such equipment are to be suitable for the combustible dust and/or explosive gas that may be present. Where the properties of such combustible dust and/or explosive gas are unknown, the explosion-proof grade is to be no less than ⅡC and the temperature class is to beT6

or the maximum surface temperature is to be no more than 85℃ (ExibIICT6).

If intrinsically safe circuit is included in the detector system, the plan of its installation and arrangement on board is to be evaluated /approved by CCS.

6.3.8 Degree of protection by enclosure

(1) The degree of protection by enclosure is to be IP22 for control box of detection devices and IP56 for safety barrier junction box installed on decks.

(2) Degree of protection of sensors

For liquid level sensors installed in cargo holds, ballast tanks and dry spaces, the degree of protection provided by their enclosures is to be in compliance with the requirements for IP68 in IEC 60529.

6.4 Requirements for alarm system

6.4.1Visual and audible alarms are to be installed in the navigation bridge.

6.4.2 Visual and audible alarms are to comply with the requirements of IMO A1021 (26) Code on Alerts and Indicators:

This code is applicable to alarms activated for ship protection or ship safety;

Warning level means an alarm level on which the circumstance is to be displayed for immediate attention to prevent occurrence of any emergency;

Main alarm level is an emergency alarm level on which the circumstance is to be displayed for immediate actions to be taken to prevent damage to human life or the ship.

6.4.3Visual and audible alarms are to meet the following requirements:

(1) Light of special color or digital display unit clearly visible under varying expected illumination conditions is to be used for visual display, and such display is not to cause serious interference with other activities required for safe operation of the ship. Visibility of such visual display is to be maintained unless the activation condition of the visual display has been restored to a point below the set value of relevant sensors. Visual display is not to be capable of being closed by the operator.

(2) The system is to be capable of providing visual and auditory display and alarm of the same sensor in the compartment where the display unit is located. Auditory display is to be capable of being closed by the operator.

(3)The alarm signal panel is to be fitted with switches for testing visual and audible alarm devices and these switches are to be in off position when they are not in use.

(4) The visual and audible alarms of water level detectors are to be different from other alarm signals (in the navigation bridge).

6.4.4 The alarm system may have time delay function to prevent false alarm from being triggered under the sloshing effects arising from ship movement.

6.4.5 For detection systems installed only in liquid tanks and cargo holds designed to hold ballast water, the alarm system is to have display and alarm overriding control ability (SOLAS Regulation XII/12.1). Compartments that may be designed with overriding control include:

(1) One alarm overriding control device may be installed in the cargo hold used for ballast tank.

(2) Any ballast tank forward of the collision bulkhead.

For a flooding alarm system, arrangement of alarm overriding control is not allowed in the spaces (e.g. dry space, cargo hold, etc.) which cannot be designed with alarm overriding control and used for water ballasting.

6.4.6 The water level detectors in cargo holds or liquid tanks described in 6.4.5 are to be capable of overriding visual display at all times during the out-of-service period. If such overriding ability is provided, the water level detectors are to be capable of automatically cancelling the overriding state and restoring the alarming ability when the ballast water in cargo holds or liquid tanks is drained to the indicated minimum alarm level.

6.4.7 The failure, alarm and display system is to include a device for continuous monitoring and such device is to be capable of activating visual and audible alarms once any failure is detected. The audible alarm is to be capable of being silenced while the visual display continues to function until the failure is eliminated.

Failure monitoring means the monitoring of all deficiencies related to the system, such as broken circuit, short circuit, power loss, CPU failure.

6.4.8 Power supply to water level detectors

The power supply to water level detectors is to comply with the following requirements:

1. Water level detectors are to be energized by two independent sources of power:

(1) Main source of power and emergency source of power; or

(2) Main source of power and one continuously charged special accumulator battery whose arrangement, location and power supply duration are equivalent to those of the emergency source of power (18h). This accumulator battery may be an internal battery of the water level detection system;

2. The power supply changeover equipment for changeover from one source of power to another needs not be integrated into the water level detection system;

3. Alarm indication is to be activated when the main source of power supply sustains any failure. Where the accumulator battery is used as the alternative source of power, both sources of power are to be provided with failure alarm.

6.5 Water level detectors are to be provided with warning and main alarm output interface to VDR.

7 Type test

7.1 Water level detectors are to be type tested as specified. The specific test requirements are as follows:

7.1.1 All tests are to be carried out under the following atmospheric conditions:

(1) Ambient temperature: 15℃~35℃;

(2) Relative humidity: 30%RH~90%RH;

(3) Atmospheric pressure: 86~106 kPa.

7.1.2 The water level detectors installed on bulk carriers are, as a minimum, to be type tested in accordance with Table 7.1.2; the water level detectors installed on passenger ships and single hold cargo ships may be type tested with reference to Table 7.1.2.

Type test Items **Table 7.1.2**

No.	Test item	Technical requirements	Test method	Remark
1	Inspection of appearance, structure and marks	To be in accordance with the requirements of approved drawings; assembly and wiring processes are to comply with the requirements of the manufacturer's process documents.	Visual inspection. Other tools such as measuring gauge are to be used when necessary.	
2	Electric strength verification	2.14 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	2.14 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	a)Between independent circuits; b)To ground, after all circuits are connected in series; c)Contact element is to be in normally open position; d)Printed circuit with electric elements liable to damage may be removed.
3	Insulation resistance verification	2.3 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	2.3 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	Insulation resistance between all circuits and the ground and that on the power source end (if applicable) are to be verified; measurement is to be taken before and after tests such as electric strength test, humidity and heat test, low temperature test, salt mist test, etc.
4	Performance test			
4.1	Alarm test, switch functions	When the alarm test button on control box	Manual inspection	

		panel is pressed down, the alarm indicator lamp on the control box panel is to		
		be lit and the buzzer sounded.(3.2.2 of MSC.188(79) Appendix)		
4.2	Audible alarm function	1. When any flooding alarm is activated, the buzzer is to give different and distinguishable sounds for warning alarm and main alarm. (2.1.1 of MSC.188(79) Appendix) 2. Range of sound signal frequency: 200-2500Hz 3. Range of sound pressure: 75-95 decibels, not more than 115 decibels (5.4.3.4.1 and 5.4.3.4.2 of MSC/Circ.982)	Manual inspection. Sound pressure level is to be measured from a distance 1m away from the audible alarm using audio frequency meter.	
4.3	Visual alarm function	1. Visual alarm is to be capable of clearly distinguishing the two different kinds of water levels (the requirement of (1) in SOLAS Regulation XII/12) (the requirement of (2) in 3.2.2 of MSC. 188 (79)). 2. Visual alarm is to indicate the compartment where it is located (the requirement of (1) in 3.2.2 of MSC.188 (79)).	Visual inspection	
4.4	Alarm silencing function	Once the silencing button is pressed down when the buzzer is sounding, the buzzer is to stop sounding. (3.3.7 of MSC.188(79))	Manual inspection	

4.5	Alarm flash-eliminating function	When any alarm is activated, the alarm indicator lamp is to be flashing after a short automatic time delay of the detection system. When the flash-eliminating button is pressed down, the alarm indicator lamp is to stop flashing while the alarm color still remains. (3.3.7 of MSC.188 (79))	Manual inspection	
4.6	Indicator light-lamp brightness adjustment function	The indicator lamps of the product, other than alarm indicator lamp and illuminating light of the light adjusting and controlling device, are to have the function of manual brightness adjustment.	Manual inspection	
4.7	Alarm overriding function	1. The detection system installed in forepeak tanks and cargo holds designed to hold ballast water is to have the ability of overriding display and alarm. 2. When the ballast water in the abovementioned tanks/holds is drained to the minimum indicated alarm level, the overriding state is to be automatically cancelled and alarm ability restored. (3.3.6 of MSC.188 (79))	The following test methods may be employed for liquid level (pressure) sensors: direct method: using plastic pipe containing water; And indirect method: using pressure calibrator. For float-type sensors or electrode-type sensors, testing methods suitable to these types may be employed.	
4.8	Power failure alarm function; function of backup source of power;	1. The detection system is to be energized by two independent sources of	Manual inspection	The interpretation of UI SC180 has specified: Test item- two

		power.		independent sources of power are to be available, one being the main source of power and the other the emergency source of power, unless a continuously charged special accumulator battery, whose arrangement, location and power supply duration are equivalent to those of the emergency source of power (18h), has been provided. The accumulator battery may be installed into the water level detection system. - Power supply changeover arrangement needs not be integrated with the water level detection system. - Where the accumulator battery is used for secondary source of power supply, both sources of power supply are to be provided with failure alarm device.
4.9	Open circuit failure of liquid level sensors or other circuits	2. In the event of any failure of the main source of power, the failure indicator lamp and buzzer are to be capable of displaying the alarm simultaneously, and the backup source of power is to start operating.	Manual inspection	The interpretation of UI SC180 has specified: Test item: deficiency monitoring means the monitoring of all deficiencies related to the system, e.g. broken circuit, short circuit, power loss, CPU failure.

4.10	Short circuit failure of liquid level sensors or other circuits	3. Where an accumulator battery is used as alternative source of power, the failure indicator lamp and buzzer are to be capable of displaying the alarm simultaneously in the event of battery failure during the test. (3.3.8 of MSC.188 (79))	Manual inspection	The interpretation of UI SC180 has specified: Test item: deficiency monitoring means the monitoring of all deficiencies related to the system, e.g. broken circuit, short circuit, power loss, CPU failure.
4.11	CPU failure test	In the event of any CPU failure (including cutoff of CPU power, program failure, communication failure, etc.), the buzzer and visual alarm indicator light on the control box panel are to give visual and audible alarm signals. (3.3.7 of MSC.188 (79))	1.Power supply to CPU is to be cut off directly and individually, and failure alarm indication is to be output; or 2. The CPU program is to be cleared, and failure alarm indication is to be output; or 3. The CPU communication line is to be disconnected, and failure alarm indication is to be output; or 4. CPU is to be tested by other methods that are capable of detecting the CPU failure.	The interpretation of UI SC180 has specified: Test item: deficiency monitoring means the monitoring of all deficiencies related to the system, e.g. broken circuit, short circuit, power loss, CPU failure.
4.12	Warning function	1. When the water in the controlled compartment reaches the warning level of the detection system, the indicator lamp on the control box panel corresponding to the compartment is to be lit after a short automatic time delay of the detection	The following methods may be employed for liquid level (pressure) sensors: direct method: using plastic pipe containing water; and indirect method: using	

		system and in the meanwhile, the buzzer and the corresponding indicator lamp are to give audible and visual alarm signals. 2. The audible alarm signal given by the buzzer is to be capable of being eliminated by pressing down the silencing button. 3. The indicator lamp on the control box panel corresponding to the compartment is not to be capable of being cleared manually. The indicator lamp is to go out only when the water level in the compartment is lower than the warning level. 4. The activation precision of the warning level alarm is to be within ±100mm. (3.2 and 3.3 of MSC. 188 (79))	pressure calibrator. For float-type sensors or electrode-type sensors, testing methods suitable to these types may be employed.	
4.13	Main alarm function	1. When the water in the controlled compartment reaches the main alarm level of the detection system, the indicator lamp on the control box panel corresponding to the compartment is to be lit after a short automatic time delay of the detection system and in the meanwhile, the buzzer and the corresponding indicator lamp are to give	For liquid level (pressure) sensors, the following methods may be employed: direct method: using plastic pipe containing water; And indirect method: using pressure calibrator. For float-type sensors or electrode-type sensors, testing methods suitable to	

		audible and visual alarm signals. 2. The audible alarm signal given by the buzzer is to be capable of being eliminated by pressing down the silencing button. 3. The indicator lamp on the control box panel corresponding to the compartment is not to be capable of being cleared manually. The indicator light is to go out only when the water level in the compartment is lower than the main alarm level. However, the sound of the buzzer is different from that of the warning level alarm. 4. The activation precision of the main alarm level is to be within ±100mm. (3.2 and 3.3 of MSC. 188 (79))	these types may be employed.	
4.14	Warning and main alarm output interface to VDR	The detection devices are to be capable of outputting the warning and main alarm to VDR. (10.1.1 of IMO A.1021(26))	Necessary equipment is to be connected. Manual inspection.	
4.15	Hydraulic test	Detection devices are to be capable of providing reliable display when the water reached the preset levels and their durability and suitability under	For immersion test of electrical elements to be installed in ballast water tanks or liquid cargo tanks used as ballast water tanks, the duration is to be	Interpretation of UI SC180 is as follows: For immersion test of electrical elements to be installed in ballast water tanks or liquid cargo tanks

		appropriate conditions and cases specified in IEC 60092-504 are to be verified through type test. (2.1.1(1) of Appendix to MSC.188 (79))	no less than 20 days. - For immersion test of electrical elements to be installed in dry spaces or cargo tanks not used as ballast tanks, the duration is to be no less than 24h. - Where detectors and/or cable connecting devices (e.g. junction box, etc.) are installed in spaces adjacent to cargo holds (e.g. lower seat) and such spaces are deemed flooded during calculation of damage stability, such detectors and devices are to comply with the requirements of IP68 for water head. The water head is to be equivalent to the tank depth. The test duration, either 20 days or 24h, is to be determined based on whether the tanks described in the previous two points are intended to be used as ballast water tanks. The degree of protection for liquid level sensors is to be IP68.	used as ballast water tanks, the duration is to be no less than 20 days. - For immersion test of electrical elements to be installed in dry spaces or cargo tanks not used as ballast tanks, the duration is to be no less than 24h. - Where detectors and/or cable connecting devices (e.g. junction box, etc.) are installed in spaces adjacent to cargo holds (e.g. lower seat) and such spaces are deemed flooded during calculation of damage stability, such detectors and devices are to comply with the requirements of IP68 for water head. The water head is to be equivalent to the tank depth. The test duration, either 20 days or 24h, is to be determined based on whether the tanks described in the previous two points are intended to be used as ballast water tanks.
4.16	Immersion test	The detection device is to be allowed to work in cargo/water mixture which is composed of seawater and cargos within the selected range, such as iron ore fines, coal fines, grains and oil, with a layer of fine suspended matters representative of	The detection device is to be allowed to work in cargo/water mixture which is composed of seawater and cargos within the selected range, such as iron ore fines, coal fines, grains and oil, with a layer of fine suspended matters representative of	Interpretation of UI SC180 is as follows: (I) Type test required for sensors is to comply with the following requirements: 1. The dimensions of test container of cargo/water mixture are to meet the

		each cargo on the surface of the mixture. For the purpose of type test, the representative fine suspended matters contained in the seawater are to be agitated and reach a concentration equivalent to 50% of its weight, and the entire package of detection device including any filter is to be used. The function of the detection device with filter is to be verified by immersing the device in the cargo/water mixture for ten times without cleaning the filter. (2.1.1 (2) of Appendix to MSC.188 (79))	each cargo on the surface of the mixture. For the purpose of type test, the representative fine suspended matters contained in the seawater are to be agitated and reach a concentration equivalent to 50% of its weight, and the entire package of detection device including any filter is to be used. The function of the detection device with filter is to be verified by immersing the device in the cargo/water mixture for ten times without cleaning the filter.	following criteria: the height and capacity are to be sufficient for complete immersion of the detector and any filter during the repetitive function tests required by immersion test and the static and dynamic inclining tests described in the previous interpretations. 2. The detector and any filter intended to be immersed and installed in the container are to be installed according to the instructions for installation contained in the equipment manual. 3. The pressure on the detector and filter applied by the container used for testing the entire package of sensors is not to exceed 0.2 bar. The pressure is applied by means of pressurization or using containers of sufficient height. 4. The cargo/water mixture is to be pumped into the test container and properly agitated to keep the solid matters in suspended state. Pumping of the cargo/water mixture is not to affect the normal operation of the sensor and filter.

				5. The cargo/water mixture is to be pumped into the test container to a preset sensor immersion level. The operation of alarms is to be observed. 6. Then the water in the test container is to be drained and deactivation of the alarm is to be observed. 7. It is allowable for the test container and sensor fitted with filter to be dried without physical intervention. 8. The test procedure is to be repeated for ten times and during this process, any filter installed according to the manufacturer's instructions for installation is not to be cleaned. 9. Satisfactory alarm activation and deactivation during each of the ten tests indicates a successful type test. (II) The cargo/water mixture used for type test is prepared with the representative cargos within the selected range, consisting of and including the following groups, which contains the minimum fine particles that may be found in the

				typical representative samples. 1. Iron ore fines

				and seawater; 2. Coal fines and seawater; 3. Grain particles and seawater; and 4. Mixture (sand) fines and seawater. The size of the minimum and maximum fine particles and the density of the dried mixture are to be confirmed and recorded. The fine particles are to be evenly distributed in the mixture. The type test of representative fine particles has in general proved that all kinds of cargos in the four abovementioned groups are qualified. (III) The guidance on how to select fine particles for the test is as follows: 1. Iron ore fines are to mainly consist of small and loose ore slags and non-lumped iron ores (size of fine particles<0.1mm). 2. Coal fines are to mainly consist of small and loose coal ore slags and non-lumped coal ores (size of fine particles<0.1mm). 3. Grain fine particles are to mainly consist of small, loose and freely flowable grains (size of

				grains >3mm, such as wheat). 4. Mixed fine particles are to mainly consist of small, loose and non-lumped grains in the freely flowable sands (size of fine particles<0.1mm).
4.17	Explosion-proof performance	Intrinsically safe type To be in accordance with IEC 60079-11.	To be in accordance with IEC 60079-11.	Only the safety barrier and liquid level sensors are to be tested.
5	Power steady-state fluctuation test	2.4 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	2.4 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	
6	Power transient fluctuation test	2.4 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	2.4 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	
7	Power failure test	2.5 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	2.5 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	The test is to verify: a) The specified action of the equipment during power failure and reinstatement; b) No damage to the program and data of programmable electronic systems (if applicable).
8	Vibration test	2.7 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND	2.7 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND	a) The equipment is to be in operating state during vibration test;

		ELECTRONIC PRODUCTS (CURRENT VALID VERSION) [when the frequency is 2+3-0~13.2Hz, the vibration amplitude is to be ±1.0 mm; and when the frequency is 13.2~100, the acceleration is to be ±6.9 m/s2 (including all test specimens)]	ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	b) The test is to be carried out along three mutually vertical axial lines; c) The value of Q is to be as recommended by the Guidelines but not greater than 5; d) If the several measured resonance points are close to each other, the duration of frequency scanning test is to be120min.
9	Test of degrees of protection provided by enclosure	2.15 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)(or IEC 60529)	2.15 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)(or IEC 60529)	1. The degree of protection of control boxes is to be IP22; 2. The degree of protection of safety barrier junction box is to be IP56。 3. The degree of protection of liquid level sensors is to be IP68.
10	High temperature test	2.8 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)[+55 ℃±2 ℃, 16h (control box) +70 ℃±2 ℃, 2h (safety barrier, sensor)]	2.8 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	Equipment without heat radiating device: a) The equipment is to be energized and operate in high temperature environment; b) Function test is to be carried out in the last one hour at test temperature; c) Function test is to be carried out after restoration. Equipment with heat radiating device:

				a) The equipment is to be energized and operate in high temperature environment, with the heat radiating system being switched on; b) Function test is to be carried out in the last one hour at test temperature; c) Function test is to be carried out after restoration.
11	Low temperature test	2.9 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION) +5 ℃±3 ℃, 2h (control box); -25 ℃±3 ℃, 2h (safety barrier, sensor)]	2.9 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	a) Initial insulation resistance is to be measured; b) The equipment is not to be energized and operate throughout the entire test duration at test temperature, except when function test is to be carried out in the last one hour at low temperature; c) Function test is to be carried out in the last one hour in low temperature environment; d) Measurement of insulation resistance and function test are to be carried out after restoration.
12	Alternate humid and heat test	Item 8, Table 1 of IEC 60092-504:2001; 2.10 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC	2.10 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	a) Insulation resistance is to be tested and measured; b) The equipment is to operate within the first cycle and is to be shut down during the second

		PRODUCTS (CURRENT VALID VERSION) [at 55 ℃, relative humidity is to be 95%, 2 ×(12+12hours)]		cycle except when function test is being carried out; c) Function test is to be carried out at test temperature in the first two hours of the first cycle and in the last two hours of the second cycle; d) The equipment is to be restored under standard environmental conditions; Measurement of insulation resistance and performance test are to be carried out.
13	Salt mist test (Kb) (applicable to installations on open decks or in open cargo holds	2.12 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	2.12 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	Salt mist test is to be carried out for sensors located in open spaces; The safety barrier junction box, if installed on open decks, is also to be subject to the salt mist test.
14	Inclining test (if the detectors have moving parts)	2.6 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	2.6 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	
15	Electromagnetic compatibility test			
15.1	Electrostatic discharge immunity test	3.4 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	3.4 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	

15.2	Radiated, radio-frequency, electromagnetic field immunity test	3.5 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	3.5 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	
15.3	Low-frequency transduction immunity test	3.8 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	3.8 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	
15.4	Test of immunity to conducted disturbances, induced by radio-frequency fields	3.9 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	3.9 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	
15.5	Electrical fast transient/burst immunity test	3.6 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	3.6 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	
15.6	Surge immunity test	3.7 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	3.7 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	
15.7	Measurement of enclosure port radiated emission testing	3.3 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	3.3 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	

15.8	Measurement of conducted emission	3.2 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	3.2 of GUIDELINE FOR TYPE APPROVAL TEST OF ELECTRICAL AND ELECTRONIC PRODUCTS (CURRENT VALID VERSION)	

7.2 Selection of typical test specimens

7.2.1 The test specimens for type test are to be sampled by CCS surveyor from the manufacturer's qualified finished products.

7.2.2 For water level detectors, at least one set of test specimens is to be taken (may be increased if required).

7.3Testing agency

7.3.1 For initial type approval, the organization undertaking the test is to be an appropriate testing agency holding the corresponding CCS Product Inspection and Testing agency Approval Certificate.

7.3.2 For the purpose of type approval certificate renewal, with the consent of CCS, the option of conducting type testing the manufacturer's lab under the witness of CCS surveyor may be considered, provided that the equipment manufacturer has the test environment and equipment specified by relevant standard and the competent inspection and testing personnel.

8 Unit/batch inspection

8.1The following items are to be executed for water level detectors at the manufacturer's premise on a package by package basis:

8.1.1 Structural inspection;

8.1.2Electric strength verification;

8.1.3 Insulation resistance verification;

8.1.4 Performance test: Items 4.1 to 4.14 in Table 7.1.2 are to be tested and verified. For item 14.2, use of audio frequency meter and sound pressure meter is not required provided that the sounds of warning and main alarm can be distinguished by human ears.