

ANNEX 23

**RESOLUTION MSC.363(92)
(Adopted on 14 June 2013)**

PERFORMANCE STANDARDS FOR ELECTRONIC INCLINOMETERS

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO resolution A.886(21), by which the Assembly resolved that the function of adopting performance standards and technical specifications, as well as amendments thereto, shall be performed by the Maritime Safety Committee and/or the Marine Environment Protection Committee, as appropriate, on behalf of the Organization,

NOTING that in the *Revised Guidance to the master for avoiding dangerous situations in adverse weather and sea conditions* (MSC.1/Circ.1228), information about heel angle and roll period is regarded as relevant for assessment of the ship's stability situation in adverse weather and sea conditions,

NOTING ALSO that, at its ninetieth session, it had adopted resolution MSC.333(90) on *Revised Performance standards for shipborne voyage data recorders (VDRs)*,

NOTING FURTHER that, at its eighty-eighth session, instead of adding the requirement for an electronic inclinometer to the performance standards for VDRs, it had decided to develop dedicated performance standards for inclinometers,

RECOGNIZING the need to define minimum requirements for a heel angle and roll period measurement device to ensure that heeling information is provided in a reliable manner on board ships to be used by the crew to assess the dynamic situation of the ship and to be available for marine casualty investigation,

HAVING CONSIDERED, at its ninety-second session, the draft Performance standards for electronic inclinometers prepared by the Sub-Committee on Safety of Navigation, at its fifty-eighth session,

1. ADOPTS the Performance standards for electronic inclinometers, set out in the annex to the present resolution;
2. RECOMMENDS Governments ensure that electronic inclinometers installed on or after 1 July 2015, conform to performance standards not inferior to those specified in the annex to the present resolution.

ANNEX

PERFORMANCE STANDARDS FOR ELECTRONIC INCLINOMETERS

1 SCOPE

1.1 Electronic inclinometers are intended to support the decision-making process on board in order to avoid dangerous situations as well as assist in and facilitate maritime casualty investigations by providing information about the roll period and the heel angle of the ship.

1.2 Electronic inclinometers should, in a reliable form:

- .1 determine the actual heel angle with the required accuracy;
- .2 determine the roll amplitude with the required accuracy;
- .3 determine the roll period with the required accuracy;
- .4 present the information on a bridge display; and
- .5 provide a standardized interface to instantaneous heel angle to the voyage data recorder (VDR).

2 APPLICATION OF THESE STANDARDS

2.1 These Performance standards should apply to all electronic inclinometers intended to support the decision-making process on board in order to avoid dangerous situations as well as to assist in maritime casualty investigations, if carried, on all ships¹.

2.2 In addition to the general requirements set out in the *General requirements for shipborne radio equipment forming part of the Global Maritime Distress and Safety System (GMDSS) and for electronic navigation aids* (resolution A.694(17)²) and the presentation requirements set out in the *Performance standards for the presentation of navigation-related information on shipborne navigational displays* (resolution MSC.191(79)), electronic inclinometers should meet the requirements of these standards and follow the relevant guidelines on ergonomic principles³ adopted by the Organization.

3 DEFINITIONS

For the purpose of these Performance standards, the following definitions apply:

- .1 *Rolling* is the motion around the longitudinal axis of the ship;
- .2 *Actual heel angle* is the momentary angle of roll referenced to a levelled ship to port or starboard side;

¹ These Performance standards do not apply to electronic inclinometers installed for purposes which are outside the scope of these guidelines, e.g. monitoring of cargo status.

² Refer to IEC Publication 60945 – Maritime navigation and radiocommunication equipment and systems – General requirements.

³ Refer to the *Guidelines on ergonomic criteria for bridge equipment and layout* (MSC/Circ.982).

- .3 *Roll period* is the time between two successive maximum values of heel angle on the same side of the ship; and
- .4 *Roll amplitude* is the maximum values of heel angle to port or starboard side.

MODULE A – SENSOR

4 MEASUREMENT OF ACTUAL HEEL ANGLE

Electronic inclinometers should be capable of measuring the actual heel angle and determining the amplitude of the rolling oscillation of the ship over a range of ± 90 degrees.

5 MEASUREMENT OF ROLL PERIOD

Electronic inclinometers should be capable of measuring the time between the maximum values of the rolling oscillation and determining the roll period over a minimum range of 4 to 40 s.

6 ACCURACY

6.1 Electronic inclinometers should provide the data with sufficient accuracy for a proper assessment of the ship's dynamic situation. Minimum accuracy of the measurements should be 5 per cent of reading or ± 1 degree, whichever is the greater for angle measurements and 5 per cent of reading or ± 1 s, whichever is the greater for time measurements.

6.2 Actual heel angle and time measurement accuracy should not be unduly affected by other linear or rotational movements of the ship (e.g. surging, swaying, heaving, pitching, yawing) or by transverse acceleration ranging from -0.8 g to +0.8 g.

MODULE B – OPERATIONAL AND FUNCTIONAL REQUIREMENTS

7 DISPLAY REQUIREMENTS

7.1 Electronic inclinometers should display:

- .1 the roll period with a minimum resolution of 1 s; and
- .2 the roll amplitude to both port and starboard side with a minimum resolution of 1 degree.

7.2 The actual heel angle to port or starboard should be indicated in an analogue form between the limits of ± 45 degrees.

7.3 The display may be implemented as a dedicated display or integrated into other bridge systems.

8 OPERATIONAL ALERTS

Electronic inclinometers may optionally provide a warning for indicating that a set heel angle had been exceeded.

9 PERFORMANCE TESTS, MALFUNCTIONS AND INDICATIONS

Electronic inclinometers should internally check and indicate to the user if all components are operative and if the information provided is valid or not.

MODULE C – INTERFACING AND INTEGRATION

10 CONNECTIONS TO OTHER EQUIPMENT

10.1 Electronic inclinometers should comprise a digital interface providing actual heel angle information to other systems like, e.g. VDR, with an update rate of at least 5 Hz. Electronic inclinometers should also comprise a digital interface providing the displayed information of roll period and roll amplitude (see paragraph 7.1).

10.2 Electronic inclinometers should have a bidirectional interface to facilitate communication, to transfer alerts from inclinometers to external systems and to acknowledge and silence alerts from external systems.

10.3 The digital interface should comply with the relevant international standards⁴.

11 INSTALLATION POSITION

The installation position of the sensors of the electronic inclinometer should be recorded and made available for the configuration of the VDR.

12 POWER SUPPLY

Electronic inclinometers should be powered from the ship's main source of electrical energy. In addition, it should be possible to operate the electronic inclinometers from the ship's emergency source of electrical energy.

⁴ Refer to standard IEC 61162 – Maritime navigation and radiocommunication equipment and systems – Digital interfaces.