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# N-13

# MARITIME ANTI-COLLISION WARNING SYSTEM FOR SMALL SHIPS

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**Foreword**

China Classification Society (hereinafter referred to as CCS) Product Inspection and Testing Guideline (hereinafter referred to as this Guideline) contains the technical requirements, inspection and testing criteria related to classification and statutory survey of marine products to be applied for CCS approval/inspection.

This Guideline frees the users to adopt other test methods and requirements which are equivalent to or are stricter than this Guideline.

This Guideline is published and updated by CCS, and is released at http://www.ccs.org.cn. Your comments or suggestions are welcomed and may be sent to our email addressed service@ccs.org.cn

Historical release version and release time: newly edited

Main modifications in this version: None

## CONTENES

# MARITIME ANTI-COLLISION WARNING SYSTEM FOR SMALL SHIPS

## 1 Application

1.1 The Guidelines is applicable to the approval and inspection of maritime anti-collision warning system for small ships installed and used on ships.

1.2 The Guidelines does not cover the installation and arrangement of the maritime anti-collision warning system for small ships (hereinafter referred to as "the System") on ships.

1.3 When the system is connected with other shipboard equipment or combined with other equipment to realize functions, it shall not affect or damage the performance of these equipment.

## 2 Normative references

2.1 The basis for approval and inspection used in the Guidelines are as follows:

(1) Technical Regulations for Statutory Surveys of Sea-going Ships Engaged on Domestic Voyages (2020) and its Amendment Notification (hereinafter referred to as "the Regulations");

(2) IEC 60945:2002/COR1:2008: Maritime Navigation and Radiocommunication Equipment and Systems - General Requirements - Methods of Testing and Required Test Results;

(3) GD22-2015 CCS Guidelines for Type Approval Test of Electric and Electronic Products.

2.2 When the above rules, performance proposals and test standards are changed, the latest valid version of documents shall be used.

## 3 Terms and definitions

3.1 Unless otherwise specified, the terms and definitions adopted in the Guidelines are consistent with the Regulations.

3.2 Risk prompt: A prompt given when the ship is not facing a possible or imminent collision risk, but the preset safety conditions of the system are triggered. In case of risk prompt, text prompts for possible risks are given in pop-up windows or other eye-catching ways on the equipment display interface. Generally, the risk prompt does not need to be accompanied by alarm sound and forced manual confirmation is not required.

3.3 Early warning and alarm: The ship faces a possible collision risk, which may develop into an immediate collision risk if it is not disposed of in time. In case of early warning and alarm, the equipment display interface shall have eye-catching text prompt, and the audible alarm of system shall be triggered at the same time. The alarm sound pressure shall reach at least 75dB (A) but not exceed 85dB (A) when it is 1m away from the system. Early warning and alarm need to be manually confirmed for noise elimination.

3.4 Emergency alarm: The ship faces an imminent collision risk, which may lead to a collision if it is not disposed of in time. In case of emergency alarm, the equipment display interface shall have eye-catching text prompt and the audible alarm of the equipment shall be triggered at the same time. The alarm sound pressure shall reach at least 75dB (A) but not exceed 85dB (A) when it is 1m away from the system. The audible and visual alarm of emergency alarm shall be clearly distinguished from early warning and alarm. The emergency alarm need to be manually confirmed for noise elimination, and when the emergency alarm is not manually confirmed within the specified time, the equipment shall output a signal to trigger an external alarm.

3.5 Automatic alert area: It refers to an annular area set by software with the ship as the center. The maritime targets in this area shall be automatically captured and tracked.

3.6 Friendly ship shielding: When a ship is voyaging in marshalling or in operation, the early warning and alarm and emergency alarm of relevant adjacent ships can be manually shielded to avoid frequent false alarms in the system.

**4 Drawings and Documents**

4.1 The following drawings and data shall be submitted for approval:

(1) Technical specifications of system;

(2) System structure diagram, outline drawing, schematic diagram, wiring diagram, functional block diagram and descriptive documents;

(3) Main hardware configuration and interface diagram of the system;

(4) System power supply arrangement plan, schematic diagram or functional block diagram of power supply device;

(5) System type test program and delivery test program.

4.2 The following drawings and data shall be submitted for information:

(1) External wiring diagram of the system;

(2) Description of main software modules of the system and description of software version number;

(3) Software maintenance and update instructions;

(4) Process flow chart marked with quality monitoring points;

(5) List of main raw materials, parts and components;

(6) System operation instructions;

(7) System installation manual and maintenance manual.

## 5 Technical requirements

5.1 General requirements

5.1.1 The system at least includes an information acquisition unit, a data processing unit, a display unit and an alarm unit. Each unit can be adopted or integrated into other ship equipment to meet the functional requirements.

5.1.2 According to the risk level, the system is provided with three levels of alarms: risk prompt, early warning and alarm and emergency alarm. Among them, the risk prompt can only be in text, while the early warning and alarm and emergency alarm shall be added with audible and visual alarm. When it is found that there is collision risk between the ship and other maritime targets during navigation, operation or anchoring, the risk level shall be identified and an early warning and alarm or emergency alarm shall be issued.

5.1.3 The system shall be designed, manufactured and installed to meet the general requirements of applicable ship regulations for marine navigation equipment.

5.2 Power supply requirements

The system shall at least be powered by the main power supply of ships, and shall be provided with protective devices against overcurrent, overvoltage, power transient and accidental reverse polarity.

5.3 Functional and performance requirements

5.3.1 Data access and display

The system shall adopt the official Electronic Navigational Chart (ENC) and enable regular update to keep the chart valid. The system shall provide a display area of at least 195mm×195mm (width × height), and can display information from ship radar, heading equipment, electronic positioning system, automatic identification system and other equipment.

5.3.2 Automatic alert area

The system shall take the ship as the center and have a built-in automatic alert area. The range of the alert area can be automatically adjusted according to the collision risk level in the specific navigation or operation scenario of the ship, and can also be manually adjusted according to the actual situation of the ship. The default setting value of the automatic alert area shall be specified in the system operation instructions.

When the ship is in an open sea area, the rang ring width of the automatic alert area shall not be less than 3 nautical miles.

5.3.3 Target tracking (TT) and capture

The system shall have the function of target tracking (TT) and capture. The maritime targets entering the automatic alert area shall be able to be automatically tracked and captured, and their speed vector information such as CPA/TCPA of this ship shall be displayed. The time length of the vector shall not be less than 3 minutes.

Automatic target tracking calculation shall be based on the relative position of radar targets and the measured value of own ship motion, and this function shall be effective at least within 50m to 6 nautical miles from own ship.

When the ship voyages at normal speed, automatic target tracking can continuously capture and track the maritime targets entering the alert area. The capacity of tracking targets shall be specified in the system operation instructions.

When the target is captured, the system shall display the trend of the target movement within one minute and forecast the target movement within three minutes, and the measured range and bearing of the target shall be within 50m (or ±1% of the target distance) and 2 °.

5.3.4 Fusion of AIS and TT targets

The system shall have the function of automatic fusion of AIS and TT targets, and preset the

fusion parameters of AIS and TT targets. The system can automatically select different fusion parameters according to the collision risk level in the navigation area.

The fusion principle of targets shall be based on radar targets, and the fusion criterion shall be specified in the system operation instructions.

The user shall have the option to change the default situation to display the tracked radar target, and shall be allowed to select radar tracking data or AIS target information.

5.3.5 CPA/TCPA encounter alarm

The system shall have CPA/TCPA encounter alarm function. According to the collision risk level, encounter alarm shall be divided into early warning and alarm and emergency alarm.

When the ship is in a normal navigation state in an open sea area, it is recommended that the default value of encounter alarm be set to trigger the early warning and alarm when the CPA of the tracked target is less than 2 nautical miles and the TCPA is less than 20 minutes. It is recommended to trigger the emergency alarm when the CPA of the tracked target is less than 1 nautical mile and the TCPA is less than 10 minutes. The setting of the system default alarm value shall be specified in the system operation instructions.

When the ship is entering or leaving the port or working, the setting value of encounter alarm can be manually adjusted according to the actual situation.

When the emergency alarm is not responded within 15 seconds, the system shall output a signal to trigger an external audible alarm to cause an alarm. The minimum sound pressure level of the alarm shall be 80dB (A) but shall not exceed 120dB (A).

The early warning and alarm and emergency alarm can be silenced after response, but their visual alarm signals shall not be changed until the alarm is released. The response to the above alarms shall not hinder the triggering of new alarm signals.

5.3.6 Alarm target filtering

In order to avoid unnecessary frequent false alarms, the system shall have the functions of alarm target filtering and hierarchical display, such as friendly ship shielding and net sounder filtering.

5.3.7 Interface

The communication interface between the system and other ship equipment and systems shall

meet IEC61162 series standards. As an option, the system may integrate other interfaces.

5.3.8 Risk area alarm

The system can preset the longitude and latitude information of the high-risk area for navigation collision, which is usually the area with a high risk of commercial fishing vessels collision announced by the competent authority, the route determination channel of commercial ships and other navigation areas that need to be reminded.

Risk prompt shall be issued when the ship enters the high-risk area for navigation collision and approaches dangerous targets (such as submerged reefs, shoals, sunken ships, etc.) in the chart.

5.3.9 On-duty alarm

The system shall have the bridge on-duty alarm function, and shall provide a function start switch and an on-duty confirmation interval setting. The upper limit of the interval setting shall not exceed 20 minutes, and the interface shall prompt when the interval time point is about to be reached. After the on-duty alarm function is turned on, the user needs to press the on-duty confirmation key on the operation interface regularly; otherwise, an early warning and alarm will be given. If it is not confirmed within one minute, the system shall automatically trigger an emergency alarm.

5.3.10 Fault alarm

The system shall have the reliability self-inspection function. In case of signal loss and other faults, it shall be able to send out equipment fault alarm locally. The alarm shall be audible and visual alarm and different from early warning and alarm and emergency alarm. It can be silenced before the fault is eliminated, but the fault indication must be retained.

## 6 Materials and components

N/A.

## 7 Type test

7.1 General provisions

The type test of the system includes simulation test, function and performance test and environmental test. Among them, the function and performance test can be carried out in combination with the simulation test.

7.2 Simulation test

7.2.1 The system shall be subject to function test through the simulation test verification platform approved by CCS, so as to verify its accuracy and reliability.

7.2.2 The simulation test shall meet the requirements of the International Regulations for Preventing Collisions at Sea (1972) for the division of encounter situations. The test contents include the function test described in 7.2.4 and the scenario test described in 7.2.5.

7.2.3 The establishment of the test scenario is based on the common encounter situation that occurs when ships are sailing at sea, and the scenarios where collision risks may occur are set up and simulated, so as to test whether the automatic collision avoidance system can identify the dangerous state in time and give appropriate warning information.

7.2.4 According to the system design, the function test shall at least include:

(1) Navigation mode test;

(2) Operation mode test;

(3) Berthing (inbound) test;

(4) Risk area alarm test;

(5) Friendly ship shielding test;

(6) On-duty alarm test.

7.2.5 Based on the contents of function test in 7.2.4, different test scenarios and test types shall be designed, and scenario tests shall be carried out accordingly.

The test scenarios shall at least include:

(1) Overtaking;

(2) Being overtaken;

(3) Encounter;

(4) Left (right) abeam;

(5) Left (right) crossover;

(6) Keep away;

(7) Exceeding the early warning circle;

(8) Entering the risk area;

(9) Single (multi) ship shielding;

(10) On-duty alarm and extension.

The test types shall at least include:

(1) Multipole alarm;

(2) Alarm disappearance;

(3) No early warning.

7.3 Function and performance test

Refer to Attached Table 7.3 for function and performance test items.

**Table 7.3**

| No. | Test items | Test methods | Technical Requirements |
|---|---|---|---|
| 1 | Data access and display | Visual inspection | 5.3.1 of the Guidelines |
| 2 | Automatic alert area | Simulation or emulation test | 5.3.2 of the Guidelines |
| 3 | Target capture and tracking | Simulation or emulation test | 5.3.3 of the Guidelines |
| 4 | Fusion of AIS and TT targets | Simulation or emulation test | 5.3.4 of the Guidelines |
| 5 | CPA/TCPA encounter alarm | Simulation or emulation test | 5.3.5 of the Guidelines |
| 6 | Alarm target filtering | Simulation or emulation test | 5.3.6 of the Guidelines |
| 7 | Interface | Utility check | 5.3.7 of the Guidelines |
| 8 | Risk area alarm | Simulation or emulation test | 5.3.8 of the Guidelines |
| 9 | On-duty alarm | Utility test | 5.3.9 of the Guidelines |
| 10 | Fault alarm | Simulation test | 5.3.10 of the Guidelines |

7.4 Environmental test

Environmental items are shown in Attached Table 7.4.

**Table 7.4**

| No. | Test items | Test methods | Description |
|---|---|---|---|
| 1 | Ergonomic HMI check | IEC 60945, 6.1 | |
| 2 | Hardware | IEC 60945, 6.2 | |
| 3 | Software | IEC 60945, 6.3 | |
| 4 | Inter-unit connection | IEC 60945, 6.4 | |
| 5 | Extreme power supply variation test | IEC 60945, 7.1 | Normal test temperature |
| 6 | Excessive power supply conditions | IEC 60945, 7.2 | |
| 7 | Warm dry, including extreme power supply conditions | IEC 60945, 8.2 & 7.1 | |
| 8 | Warm damp | IEC 60945, 8.3 | |
| 9 | Low temperature, including extreme power supply conditions | IEC 60945, 8.4 & 7.1 | |
| 10 | Vibration test | IEC 60945, 8.7 | |
| 11 | Rain and water spray test | IEC 60945, 8.8 | For outdoor equipment |
| 12 | Salt spray test | IEC 60945, 8.12 | |
| 13 | Conducted emission test | IEC 60945, 9.2 | |
| 14 | Radiated emission test at enclosure port | IEC 60945, 9.3 | |
| 15 | Immunity of conducted disturbance induced by radio-frequency field | IEC 60945, 10.3 | |
| 16 | Radiated radio-frequency electromagnetic field immunity | IEC 60945, 10.4 | |
| 17 | Immunity to electrical fast transients | IEC 60945, 10.5 | |
| 18 | Surge immunity | IEC 60945, 10.6 | |
| 19 | Immunity to short-term variations of the supply | IEC 60945, 10.7 | |
| 20 | Immunity to power supply fault | IEC 60945, 10.8 | |
| 21 | Electrostatic discharge immunity | IEC 60945, 10.9 | |
| 22 | Noise and audible signals | IEC 60945, 11.1 | |
| 23 | Safe distance of magnetic compass | IEC 60945, 11.2 | |
| 24 | Protection against touching dangerous voltages | IEC 60945, 12.1 | |
| 25 | Emission of Visual Display Unit (VDU) | IEC 60945, 12.3 | |
| 26 | Withstand voltage test | Clause 2.14 of GD22-2015 | Complete machine test (only applicable to power supply units above 50V) |
| 27 | Insulation resistance measurement | Clause 2.3 of GD22-2015 | |

The performance inspection/test items combined with environmental conditions test shall be carried out according to the following steps:

- The system is started from the initial state (cold start);
- Check the system terminal, data display, AIS and TT target fusion and tracking shall be displayed normally.

Note: If the components of the system have evidence of environmental tests, an exemption from corresponding test items may be applied for.

7.5 Selection of typical samples

7.5.1 Samples for type test shall be taken from qualified finished products of the product manufacturer by CCS surveyors.

7.5.2 The test sample of the maritime anti-collision warning system for small ships shall be at least one set (if required by the test, it can also be added) and shall include all system units.

7.6 Test organization

For type approval tests, a test organization approved by the CCS shall be preferred. For product function and performance test items, if the product manufacturer has test conditions, they can be carried out in the manufacturer after being reviewed and approved by CCS surveyor and under on-site supervision.

**8 Unit/batch inspection**

After the type approval is passed, the manufacturer shall control the production and test process of the product in accordance with the quality control documents submitted at the time of approval, carry out the specified delivery test on each marine product and issue a delivery test report. On the basis of reviewing the delivery test report, CCS surveyor shall sample 5%, but not less than 2 sets for inspection. The unit/batch inspection after approval shall at least include the following tests:

- Visual inspection;

- Data verification of main components (parts);

- Confirmation of software version;

- Function and performance test (simulation test).

If the surveyor deems it necessary, the test items and sampling quantity can be increased.