

# **RULES**

## **FOR THE EQUIPMENT OF SEA-GOING SHIPS**

### **PART V**

#### **NAVIGATIONAL EQUIPMENT**

ND No. 2-020101-171-E



**St. Petersburg**

## **RULES FOR THE EQUIPMENT OF SEA-GOING SHIPS (PART V)**

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The present version of Part V "Navigational Equipment" of the Rules for the Equipment of Sea-Going Ships of Russian Maritime Register of Shipping (RS, the Register) has been approved in accordance with the established approval procedure and comes into force on 1 January 2024.

The present version is based on the version dated 1 March 2023 and Rule Change Notice No. 23-246973 taking into account the amendments and additions developed immediately before publication (refer to the Revision History).

## **REVISION HISTORY<sup>1</sup>**

For this version, there are no amendments to be included in the Revision History.

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<sup>1</sup> With the exception of amendments and additions introduced by Rule Change Notices (RCN), as well as of misprints and omissions.

## **1 GENERAL**

### **1.1 APPLICATION**

**1.1.1** The requirements of this Part apply to self-propelled ships not engaged on international voyages, as well as to the navigational equipment intended for installation in these ships.

**1.1.2** A rigidly connected composite unit of a pushing vessel and associated pushed vessel, when designed as a dedicated and integrated tug and barge combination, shall be regarded as a single ship for the purpose of this Part.

**1.1.3** If the Maritime Administration (MA) of ship's flag provides additional instructions on outfitting with navigational equipment, then in case of discrepancy with the provisions of these Rules, the instructions of the MA of ship's flag shall be applied.

## **1.2 DEFINITIONS AND EXPLANATIONS**

**1.2.1** Terms, definitions and explanations in relation to the general terminology are given in Part I "Classification" of the Rules for the Classification and Construction of Sea-Going Ships.

**1.2.2** The following definitions have been adopted for the purpose of this Part.

**Watch officer** is any person who is responsible for safe navigation, navigates, manoeuvres the ship and operates bridge equipment until he is relieved by another officer.

**Main conning position** means a workstation or the navigation bridge providing the watch officer with a commanding view and equipped with everything necessary for ship's manoeuvring and control.

**Depth** means the vertical distance from a sea level to the bottom.

**Totally enclosed bridge** is a bridge without bridge wings, with the breadth of the wheelhouse equal to or exceeding the ship's breadth.

**Field of vision** is the horizontal angle within which no obstructions interfere in an observation of environment from a workstation on the navigation bridge.

**Radiated interference** means interference radiated by the casings of equipment (apart from direct radiation of aerials).

**Route monitoring** means actions on navigation control along the pre-planned route.

**460-Switch** is a network infrastructure device used to interconnect nodes on a 460-Network and which satisfies the requirements as specified in IEC 61162-460.

**Standard magnetic compass** is a magnetic compass independent of any ship source of electrical power to determine the ship's heading and display the reading at the main steering position.

**Spare magnetic compass** is a stand-by magnetic compass to perform the function of the standard magnetic compass and interchangeable with it.

**Bridge wings** are those parts of the bridge on both sides of the ship's wheelhouse which, in general, extend to the ship's side.

**Heading** is the direction in which the bow of a ship is pointing expressed as an angular displacement from 0° to 360° from north.

**460-Forwarder** is a network infrastructure device that can safely exchange data streams between a 460-Network and other controlled networks including other 460-Networks.

**Lookout** is one of basic duties of the watch officer carried out by sight and hearing as well as by all available equipment so as to make a full appraisal of the situation and of the risk of collision.

**Navigation** is the process of deciding, executing and maintaining course and speed of the ship in relation to waters and traffic while moving from one place to another.

**Tanker** for the purposes of this Part, is an oil tanker, oil tanker (>60 °C), oil tanker (>55 °C), oil recovery vessel, oil recovery vessel (>60 °C), gas carrier<sup>1</sup>, chemical tanker<sup>1</sup>, combination carrier, whose definitions are given in Part I "Classification" of the Rules for the Classification and Construction of Sea-Going Ships.

**Generalized display** means overlapped reproducing on a display of information from several navigational devices or systems.

**Consistent Common Reference Point** is a location on own ship, to which all horizontal measurements such as target range, bearing, relative course, relative speed, closest point of approach (CPA) or time to closest point of approach (TCPA) are referenced, typically the conning position of the bridge.

**Route planning** means actions performed while planning a route or making decisions on attendant navigational tasks.

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<sup>1</sup> This definition is applicable in the case of carriage of flammable liquid cargo by the ships.

**Trial manoeuvre** is the facility used to assist the operator to perform a proposed manoeuvre for navigation and collision avoidance purposes, by displaying the predicted future status of all tracked and AIS targets as a result of own ship's simulated manoeuvre.

**Desk** means a device combining control, monitoring, data displaying and communication facilities necessary to carry out one or several tasks at a particular workstation.

**Workstation** means a position on the navigation bridge having the relevant equipment where the watch officer as well as the master or pilot carry out one or several tasks.

**Back-up officer** means any person who is to be called if assistance is needed on the navigation bridge.

**Wheelhouse** is the endorsed area of the navigation bridge where the main conning position of the ship is located.

**460-Network** is a network which consists of only 450-Nodes, 460-Nodes and network infrastructure devices of a 460-Network (switches, forwarders, gateways).

**450-Node** is a device compliant with the requirements of IEC 61162-450 and which satisfies additional requirements specified in IEC 61162-460.

**460-Node** is a device connected to a protected (controlled) network, compliant with the requirements of a 450-Node and which satisfies applicable requirements specified in IEC 61162-460.

**Transmitting heading device** is an electronic means to receive heading information from the sensor and to transmit it to other navigational equipment.

**Navigation bridge** means an area from which the navigation and control of the ship are exercised, including the wheelhouse and bridge wings.

**Trunk for log and/or echo sounder** is a special watertight compartment in the ship's hull below waterline provided with a watertight closure.

**460-Gateway** is a network infrastructure device that connects protected (controlled) 460-Network and uncontrolled networks and which satisfies the requirements as specified in IEC 61162-460.

**Electronic chart display and information system (ECDIS)** means a system which with adequate backup arrangements can be accepted as complying with the UpToDate chart, by displaying selected information from a system electronic navigational chart (SENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and, if required, display additional navigation related information.

**Electronic navigational chart (ENC)** means the database standardized as to content, structure and format, issued for use with ECDIS on the authority of government authorized hydrographic officer. The ENC contains all the chart information necessary for safe navigation and may contain additional navigational information.

**EPFS** means an electronic positioning fixing system (that can be either global or regional).

### **1.3 SCOPE OF SURVEY**

**1.3.1** General provisions regarding the procedure of survey of navigational equipment, as well as the requirements for technical documentation to be submitted to the Register for consideration, and indication of documents on navigational equipment issued by the Register are specified in General Regulations for the Classification and Other Activity, the Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships and Part I "General" of the Rules.

**1.3.2** The technical documentation for navigational equipment submitted to the Register for review shall contain (where applicable) the following information:

- .1 technical description;
- .2 block diagram;
- .3 general view drawing;
- .4 operation manual;
- .5 installation manual;
- .6 list of spare parts.

Together with the technical documentation the records of the tests performed as well as the available certificates may be submitted. Depending on a type of the radio equipment, the Register may require the additional technical documentation to be submitted. Upon review of the technical documentation submitted, the applicant shall agree and submit for approval the test program.

**1.3.3** After installation on board ship, navigational equipment shall be properly adjusted and subject to survey by the Register.

After installation of new navigational equipment or renewal of outdated (which became inoperative and is not subject to repair) on ships in service the technical design of the installation and working drawings shall be submitted to the Register prior to commencement of survey of this equipment.

Upon approval of the technical design and working drawings the navigational equipment installed shall be surveyed on board ship and tested in operation.

On ships under construction tests of navigational equipment under operating conditions and electromagnetic compatibility tests of all radio and navigational equipment, fitted on the bridge or in the vicinity of the bridge, are conducted during mooring and sea trials in compliance with the programs approved by the Register.

**1.3.4** Every ship shall be permanently provided with the following technical documentation:

- .1 operation manual for each kind of navigational equipment in English and/or in the language of the ship's crew;
- .2 circuit diagrams of the navigational equipment, corrected in accordance with all alterations made in the process of operation;
- .3 antenna arrangement drawings;
- .4 fields of vision drawings showing horizontal fields of vision from various workstations including the arc of individual blind sectors and the sum of blind sectors created by the cargo, handling equipment and other obstacles outside the wheelhouse that impede the view of the sea surface right ahead (over an arc of 180° from side to side forward of the beam);
- .5 diagrams indicating radar blind sectors.

## 2 NAVIGATIONAL EQUIPMENT OF SELF-PROPELLED SEA-GOING SHIPS

### 2.1 LIST OF NAVIGATIONAL EQUIPMENT

**2.1.1** The list of navigational equipment of ships shall be defined depending on the gross tonnage of the ship and ship's purpose in accordance with [Table 2.1.1](#) unless the Administration whose flag the ship is flying has decided otherwise to fit these categories of ships with navigational equipment.

Table 2.1.1

Nos.	Navigational equipment	Number of items for ships of gross tonnage							RS nomenclature code, remarks
		<150	≥150	≥300	≥500	≥3000	≥10000	≥50000	
<b>1</b>	Standard magnetic compass <sup>1</sup>	1	1	1	1	1	1	1	05010000MK
<b>2</b>	Pelorus or magnetic compass bearing device	1	1	1	1	1	1	1	May be included in magnetic compass
<b>3</b>	EPFS receiver <sup>2</sup>	1	1	1	1	1	1	1	05140300MK or 05140310MK or 05140320MK or 05140330MK
<b>4</b>	Radar reflector <sup>3</sup>	1 <sup>4</sup>	—	—	—	—	—	—	05140400MK
<b>5</b>	Sound reception system	1	1	1	1	1	1	1	05170000MK Required in ships with totally enclosed navigation bridge
<b>6</b>	Telephone for communication with emergency steering position	1	1	1	1	1	1	1	Required in ships with emergency steering position
<b>7</b>	Spare magnetic compass	1 <sup>5</sup>	1	1	1	1	1	1	05010000MK
<b>8</b>	Daylight signalling lamp	1 <sup>5</sup>	1	1	1	1	1	1	



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[illegible]

Nos.	Navigational equipment	Number of items for ships of gross tonnage							RS nomenclature code, remarks
		<150	≥150	≥300	≥500	≥3000	≥10000	≥50000	
21	Indicators of:								The indicators shall be readable from the position from which the ship is normally navigated
	.1 rudder angle	—	—	—	1	1	1	1	11070200
	.2 propeller revolutions, the force and direction of thrust	—	—	—	1	1	1	1	11070400
	.3 pitch and operational mode of controllable pitch propeller(s)	—	—	—	1	1	1	1	11070300 To be fitted where controllable pitch propeller(s) is/are provided
	.4 force and direction of lateral thrust of the thruster(s)	—	—	—	1	1	1	1	11070400 To be fitted where thruster(s) is/are provided

<sup>1</sup> Remote transmission of the standard magnetic compass dial readings to the main steering position is required.  
<sup>2</sup> The electronic position fixing system (EPFS) used (global navigation satellite system or regional radio navigation system) shall be available for use at all times throughout the intended voyage.  
<sup>3</sup> Not required where the ship's effective echoing area is sufficient to enable detection by radar at 9 GHz and 3 GHz (corresponding to a wave length of 3 and 10 cm, respectively).  
<sup>4</sup> The provisions for the equipment are set out in Part III "Signal Means".  
<sup>5</sup> Required for passenger ships.  
<sup>6</sup> Provision shall be made for transmitting heading information for input to the equipment referred to in items 13, 13.1, 14 of the Table.  
<sup>7</sup> Not required provided the ship is fitted with a gyrocompass to transmit heading information for input to the equipment referred to in items 13, 13.1, 14 of the Table.  
<sup>8</sup> Provision shall be made for transmitting heading information for input to the equipment referred to in items 13, 13.2, 14 of the Table.  
<sup>9</sup> Required in ships of less than 1600 gross tonnage as far as practicable.

**Notes:** 1. In ships fitted with a radar with a plotting aid (EPA, ATA or ARPA) and/or a track control system, a speed and distance measuring device through the water (log) shall be provided.  
 2. A gyrocompass which shall be supplied from the main and emergency source of electrical power as well as from the transitional source of power which may be an accumulator battery may be used as a spare magnetic compass. In this case such gyrocompass cannot be considered as required by item 15 of the present Table for ships of 500 gross tonnage and more.  
 3. Instead of paper nautical charts, ECDIS (RS nomenclature code 05130000MK) with a backup arrangement may be used. The backup arrangement may be a second ECDIS or a set of paper nautical charts.

**2.1.2** The navigational equipment to be fitted to the ship as per [Table 2.1.1](#) shall comply with the requirements of the normative documents specified in [Appendix 1](#) and be of a type approved by the Register.

**2.1.3** Navigational equipment may be replaced by any recently invented, designed or modified equipment, provided it is equivalent in respect of its application, has the required or better operational and technical characteristics and is approved by the Register.

**2.1.4** The navigational equipment fitted on board ship additionally to the mandatory equipment specified in [Table 2.1.1](#) shall be of the type approved by the Register and meet the performance requirements imposed upon the mandatory equipment.

**2.1.5** Navigational equipment in excess of that required by this Part may be installed on board ship as additional equipment, provided its arrangement and operation do not interfere with the normal use of required navigational devices and instruments, influence the readings thereof and diminish safety of navigation.

**2.1.6** If the equipment listed in [Appendix 1](#) is installed on board the ship and connected to the mandatory equipment listed in [Table 2.1.1](#), it shall comply with the requirements stated in that Appendix.

**2.1.7** On board the ships of 50000 gross tonnage and above, as well as on other ships where the installation of the speed log measuring speed through the water and speed over the ground, these speed logs shall be provided by two separate devices.

## **2.2 SOURCES OF POWER**

**2.2.1** There shall be available at all times, while the ship is at sea, a supply of electrical energy sufficient to operate the navigational equipment.

**2.2.2** All electrically operated navigational equipment (except for heading or track control system) shall be supplied by separate feeders from one common switchboard of navigational equipment.

**2.2.3** The conditions of power supply of the navigational equipment from emergency sources of electrical power in the event of failure of the main sources of electrical power shall be regulated by Part XI "Electrical Equipment" of the Rules for the Classification and Construction of Sea-Going Ships.

It is recommended to provide a continuous power supply device on board to ensure operational integrity of navigational equipment and safety of navigational information in case the main and emergency sources of electrical power are out of order or for the time required to change over from the main source of electrical power to the emergency source or vice versa. In this case, audible alarm and visual indication shall be provided at the position from which the ship is normally navigated to indicate the change-over to the source of continuous power supply. It shall not be possible to disable this alarm and indication. Both the alarm condition and indication shall reset automatically when the ship's supply has been restored. Provision shall be made for the manual acknowledgement of audible alarm.

**2.2.4** Radio navigation system receivers used for automatic input into GMDSS radio installations of data concerning ship's position and time when it was fixed shall be also supplied from the reserve source of electrical power required by 2.2.3 of Part IV "Radio Equipment".

**2.2.5** Heading control system and track control system shall be supplied under 5.5.14 of Part XI "Electrical Equipment" of the Rules for the Classification and Construction of Sea-Going Ships.

**2.2.6** The switchboard of navigational equipment shall be provided with circuit-breakers. These devices shall be fitted in circuits leading to each kind of navigational equipment.

**2.2.7** Connecting of consumers not associated with navigational equipment to the navigational equipment switchboard is not allowed.

### **3 SPACES INTENDED FOR INSTALLATION OF NAVIGATIONAL EQUIPMENT. ARRANGEMENT OF NAVIGATIONAL EQUIPMENT AND CABLING**

#### **3.1 GENERAL**

**3.1.1** All spaces (with the exception of trunk for log and/or echo sounder) intended for installation of the navigational equipment shall be provided with electrical lighting, heating and the plug sockets shall be fitted therein.

**3.1.2** Navigational devices, appliances, cables and other equipment fitted on the navigation bridge shall be so arranged that the magnetic fields produced by such equipment shall not distort the standard magnetic compass readings by more than  $\pm 0,5^\circ$ .

### 3.2 NAVIGATION BRIDGE<sup>1</sup>

**3.2.1** Design of the navigation bridge and arrangement of the equipment thereon shall be such as to ensure the possibility of effective steering of the ship and to comply with the applicable requirements of the Appendix to this Part.

**3.2.2** The navigation bridge shall be located above all deck constructions which are at the level of the freeboard deck or higher with exception of smoke funnels.

**3.2.3** The view of the sea surface from the conning position shall not be obscured by more than two ship's lengths or 500 m, whichever is less, forward of the bow to 10° on either side under all conditions of draught, trim and deck cargo, at that the ballast water exchange may result in reduced horizontal fields of vision or increased blind sectors indicated in [3.2.7 – 3.2.9](#), which shall be taken into consideration by the master when performing navigational functions.

The maximum and minimum values of the forward and aft draught at which the present visibility requirement fails to be fulfilled shall be entered in the Stability Information in accordance with 3.4.1.6.4 of Appendix 1 to Part IV "Stability" of the Rules for the Classification and Construction of Sea-Going Ships.

**3.2.4** Blind sectors, caused by cargo, cargo gear or other obstructions outside of the wheelhouse which obstruct the view of the sea surface ahead (in 180° sector) of the ship as seen from the conning position shall not exceed 10° each. The total blind sector of the obstructed view shall not exceed 20°. The clear sectors between blind sectors shall be at least 5°. However, in the view described in [3.2.3](#), each individual blind sector shall not exceed 5°.

**3.2.5** The lower edge of the navigation bridge front windows shall be as low as possible for not to obstruct to the forward view.

The height of the desks arranged immediately adjacent to the fore bulkhead of wheelhouse shall not exceed 1200 mm.

**3.2.6** The upper edge of the navigation bridge front windows shall be at a height not less than 2000 mm above the deck surface to provide a forward view from the conning position for a person with a height of eye of 1800 mm, when the ship is pitching up to +/- 5°.

In ships where the forward view in the centreline is obstructed by masts, cranes and other deck structures, two additional positions giving a clear view ahead shall be provided, one on the port side and one on the starboard side of the centreline, no more than 5 m apart.

**3.2.7** The horizontal field of vision from the conning position shall be provided over an arc of at least 225°, that is from right ahead to not less than 22,5° abaft the beam on either side of the ship.

**3.2.8** From each bridge wing the horizontal field of vision shall be provided over an arc of not less than 225°, that is from at least 45° on the opposite bow through right ahead and then from right ahead to right astern through 180° on the same side of the ship.

**3.2.9** From the main steering position the horizontal field of vision shall be provided over an arc from right ahead to at least 60° on each side of the ship.

**3.2.10** The ship's side shall be visible from the bridge wing.

**3.2.10.1** The ship side is considered as visible if:

a view from the bridge wing plus a distance corresponding to a reasonable and safe distance of a seafarer leaning over the side of the bridge wing, which needs not to be more than 400 mm, to the location vertically right under the maximum beam of the ship at the lowest seagoing draught is not obstructed (refer to [Fig. 3.2.10.1-1](#)); or

<sup>1</sup> The requirements of [3.2.3 to 3.2.14](#) are applicable to ships with overall length 55 m and more. The requirements of [3.2.3 to 3.2.14](#) are applicable as far as practicable and expedient to ships with overall length less than 55 m. Ships of unconventional design, which cannot meet the requirements of [3.2.3 to 3.2.14](#) shall be provided with measures and arrangements to achieve a level of visibility from the bridge that is as near as practical to those requirements.

the sea surface at the lowest seagoing draught and with a transverse distance of 500 mm and more from the maximum beam throughout the ship's length is visible from the side of the bridge wing (refer to [Fig. 3.2.10.1-2](#)).

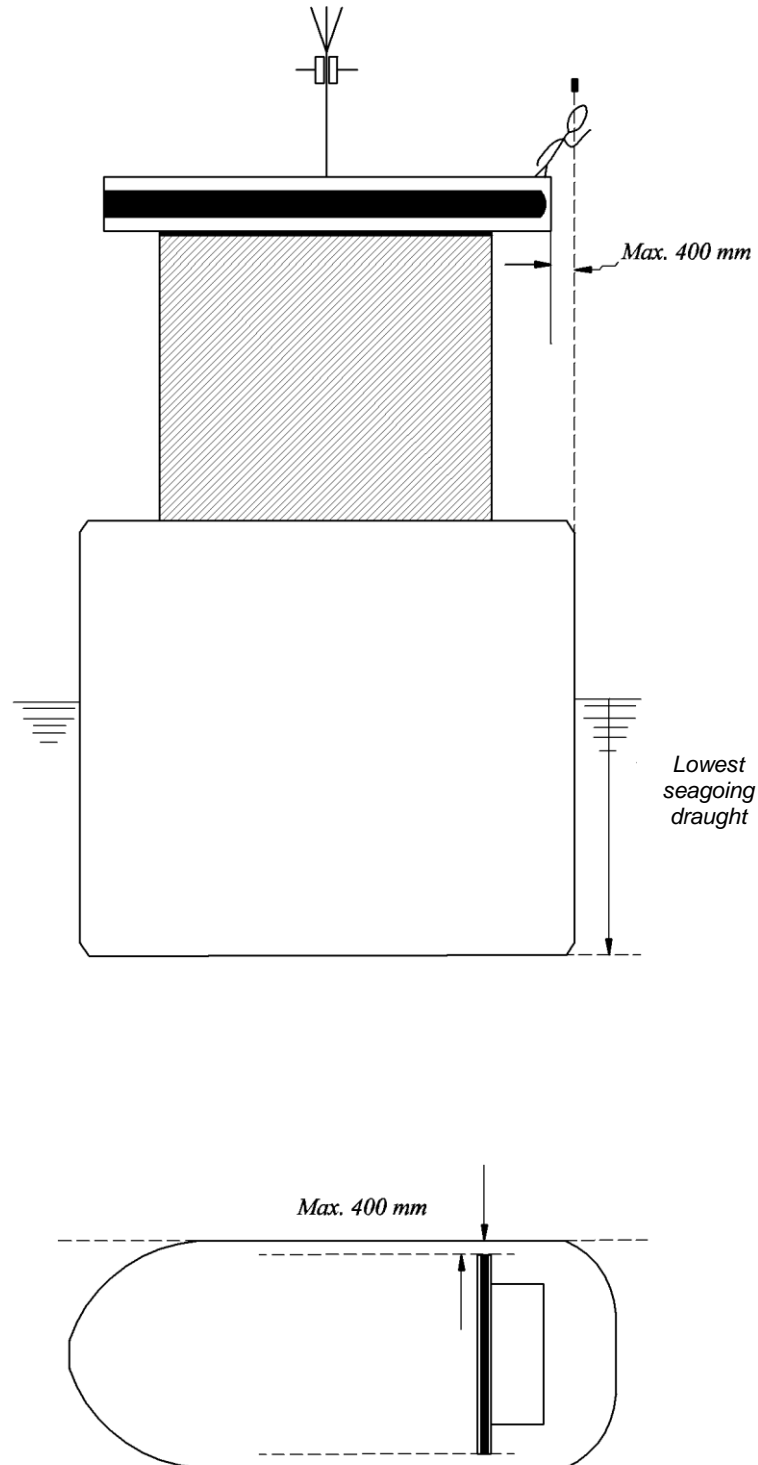


Fig. 3.2.10.1-1

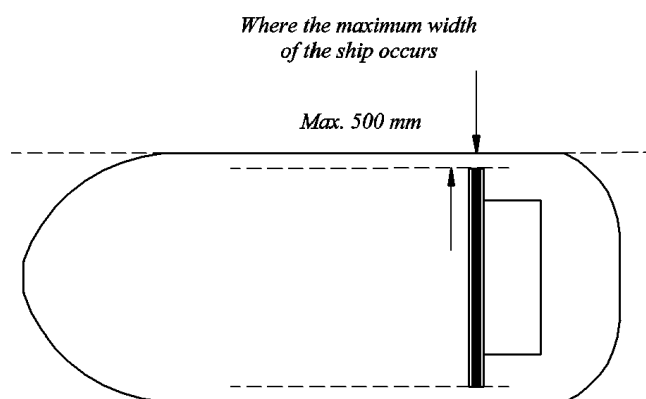
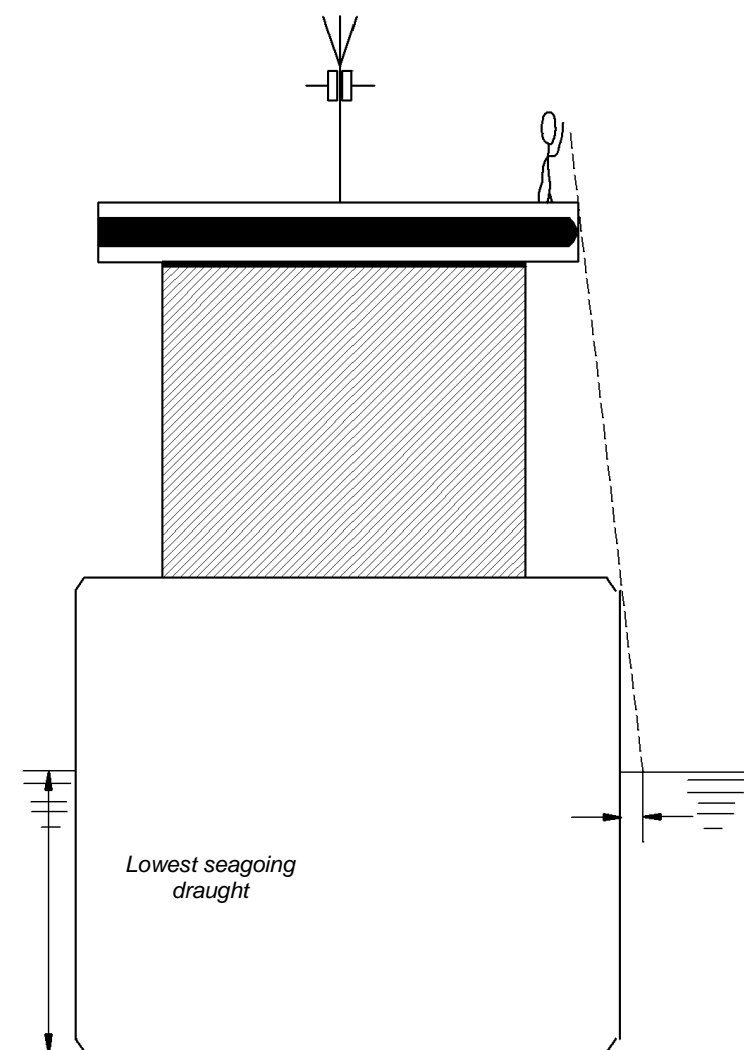


Fig. 3.2.10.1-2



**3.2.10.2** For particular types of ships as tug/tow boat, offshore supply vessels, salvage ship, floating crane and other similar craft, in ensuring visibility of the ship side, the bridge wings shall at least extend to a location from which the sea surface, at the lowest service draught and at a transverse distance of 1500 mm from the maximum beam throughout the ship's length is visible. If this ship type is changed to a type other than those addressed in this paragraph then the requirement of [3.2.10.1](#) shall be complied with.

**3.2.10.3** The use of a remote camera system may be accepted for ships of unconventional design as means for achieving the view of the ship's side from the bridge wing, provided the above system meets the following requirements.

**3.2.10.4** The installed remote camera system shall be redundant from the circuit breaker to the camera and screen, including communication cables, i.e. the system shall provide on each side of the ship redundancy of:

- .1 power cables and automatic circuit breakers from the main switchboard to the camera and the screen;
- .2 camera;
- .3 screen;
- .4 transmission lines from the camera to the display screen;
- .5 components associated with these lines and cables.

**3.2.10.5** The remote camera system is powered from the ship's main source of electrical power and is not required to be powered by the emergency source of electrical power.

**3.2.10.6** The remote camera system shall be capable of continuous operation under environmental conditions as per [IEC 60945:2002](#).

**3.2.10.7** The view provided by the remote camera system is regarded sufficient for the purpose and is also displayed at locations where the manoeuvring of the ship may take place.

**3.2.10.8** The upper edge of the ship's side abeam shall be viewed visually from all locations where the manoeuvring of the ship may take place.

The solution on the permissibility of the use of remote camera system is accepted by the Flag State Administration (national authority).

**3.2.11** Number of framings between navigation bridge windows shall be minimum and they shall not be installed immediately forward of workstation of watch officer assistant and helmsman.

**3.2.12** For avoiding reflections the bridge front windows shall be inclined from the vertical plane top out, at an angle of not less than 10° and not more than 25°.

It is recommended that bridge rear and side windows shall be inclined in a similar manner (with the exception of doors).

**3.2.13** Polarized and tinted glass for windows shall not be fitted.

To ensure a clear view in bright sunshine, it is recommended that removable sunscreens with minimum colour distortion shall be provided.

**3.2.14** At all times regardless of weather condition, at least two of the navigation bridge front windows shall provide a clear view and depending on the bridge configuration, an additional number of windows shall be fitted with means of effective cleaning, anti-icing and anti-fogging devices.

**3.2.15** Provision shall be made for free passage of not less than 1200 mm in width from one navigation bridge wing to the other.

**3.2.16** The distance from the fore bulkhead of the wheelhouse to any control desk or device (instrument) located on the navigation bridge shall be not less than 800 mm. The distance between two desks shall be not less than 700 mm.

The combined ship control desk may be installed close to the fore bulkhead of the wheelhouse.

With any of the above arrangements of the desk provision shall be made for observation of the environmental conditions through the windows of the wheelhouse.

The requirements of this paragraph are applicable, as far as practicable and expedient, to the ships of less than 1600 gross tonnage.

**3.2.17** The clear height between the bridge deck surface covering and the underside of the deck head beams shall be at least 2250 mm.

**3.2.18** The lower edge of deckhead mounted equipment shall be at least 2100 mm above the deck in open areas, passageways and at standing workstations.

**3.2.19** All navigational information shall be presented to the operator in the interpreted and processed form so that he could save time for taking measures.

It is recommended that the integrated electronic indicators of navigational information be used.

**3.2.20** Navigational devices and instruments used for direct steering control of the ship or connected with the controls shall be such that displayed data could be read at a distance not less than 1000 mm under all operating conditions.

All other devices and instruments located on the navigation bridge shall be such that their indications could be read at a distance not less than 2000 mm under normal lighting.

### **3.3 LOG TRUNK AND/OR ECHO SOUNDER TRUNK**

**3.3.1** The log trunk and/or echo sounder trunk shall comply with the following basic requirements:

- .1** the size of the trunk shall be sufficient to allow the access to the primary converters;
- .2** the trunk shall be closed by a sliding door or have the manhole provided with a cover tightened with folding bolts;
- .3** for the purpose of descent, the trunk shall be provided with an ordinary or spar ladder;
- .4** the trunk shall be tested for tightness in compliance with the requirements of Appendix I "Testing Procedures of Watertight Compartments" to Part II "Hull" of the Rules for the Classification and Construction of Sea-Going Ships;
- .5** it shall be possible to detect water in the trunk (by the test cock, sounding pipe, water sensor, etc.).

**3.3.2** In oil tankers where the log and/or echo sounder trunks are located in way of cargo tanks, the following requirements shall be complied with (refer also to [3.4.4.7](#)):

- .1** the trunk shall be separated from the cargo tanks by cofferdams;
- .2** feeding cables shall be laid in gastight steel pipes (refer also to Part XI "Electrical Equipment" of the Rules for the Classification and Construction of Sea-Going Ships);
- .3** the construction of the tightening gear of the manhole shall not be of spark-formation type.

### **3.4 ARRANGEMENT OF NAVIGATIONAL EQUIPMENT ON BOARD SHIP**

#### **3.4.1 Magnetic compass.**

**3.4.1.1** Magnetic compass shall be so installed and secured that its vertical plane which passes through the lubber lines will not deviate from the centreline of the ship or its parallel plane by more than 0,2°.

**3.4.1.2** The standard magnetic compass shall be located close to the position from which the vessel is normally steered in such a way that an unobstructed view is ensured as far as possible for taking horizontal and celestial bearings from the location of its installation. In any case, the possibility for taking bearings within a sector of 230° shall be provided, i.e. 115° to each ship's side from the direction right ahead. The view of the horizon may be impaired only by masts, towers, cranes and similar obstructions.

**3.4.1.3** The readings can be transmitted to the main steering position optically (periscope) or electronically. To be able to use one or the other method, the relevant equipment shall be specified in the Type Approval Certificate.

All-round free access to compass shall be provided.

On ships with gross tonnage less than 150, installation of the standard magnetic compass shall be provided as far as practicable and expedient.

**3.4.1.4** Any object in the vicinity of the standard magnetic compass, which was not provided in the original plan of the arrangement of the compass, may be fitted only if specially agreed with the Register ([refer to 3.1.2](#)).

**3.4.1.5** The complete sets of magnetic compasses intended for installation in ships of non-restricted area of navigation shall include spare compensating magnets.

**3.4.1.6** Every ship shall be provided with the magnetic compass residual deviation table drawn up by a competent authorized body.

The Register fulfils no supervision functions of the procedure of timely and qualified determination and compensation of the deviation of magnetic compasses.

#### **3.4.2 Gyrocompass.**

**3.4.2.1** The master gyrocompass shall be installed in the wheelhouse or the operating room.

**3.4.2.2** Free access to the master gyrocompass shall be provided which shall ensure easy and unhindered opening of lids and covers, as well as free access to terminal plates.

**3.4.2.3** Gyrocompass bearing repeaters shall be installed in such a way that, in combination, bearings can be taken over an arc of horizon of 360°.

**3.4.2.4** The steering repeater shall be installed at steering position of the ship.

**3.4.2.5** If emergency rudder control station is provided on board the ship, gyrocompass repeater shall be fitted in close vicinity to it.

**3.4.2.6** The 0 — 180° lines of the bearing repeaters shall lie in the ship's centreline plane or parallel to it with an accuracy of 0,2°.

**3.4.2.7** It is allowed to install in ships both a gyrocompass and a magnetic compass with electric remote transmission of dial readings and to use the same repeaters. In this case, the heading source indication shall be provided in the repeaters.

#### **3.4.3 Log.**

**3.4.3.1** Primary speed transducers shall be installed in the bottom of the ship, preferably in the vicinity of the place of intersection of the base line and centreline of the ship in such a way that the transducers remain under water at the lightest draught of the ship and when the ship is rolling.

**3.4.3.2** No projecting parts of the hull, suction and discharge openings likely to affect the parallelism of stream lines washing the ship shall be located forward of the primary transducers.

**3.4.3.3** Primary transducers may be installed in sluice valves or they may be permanently fixed. Transducers shall be so installed that their longitudinal axes are parallel to the centreline of the ship with an accuracy not less than  $\pm 1^\circ$ .

**3.4.3.4** The sluice valves shall be fitted in the trunk for log.

**3.4.3.5** Fixed primary transducers in the openings cut in the ship's bottom shall be adequately secured in the appropriate welded boxes being equivalent in strength to the ship's hull.

**3.4.3.6** Speed and distance repeaters shall be installed in the place where the navigational plotting is performed.

Speed repeaters shall be installed in the wheelhouse and in the navigation bridge wings fitted with the steering posts of the main engine.

Where a main machinery control room is provided in the ship's engine room, installation of the speed repeaters in such control room is recommended.

**3.4.3.7** Where the combined indicators of the navigational information are available in the navigation bridge, individual speed and distance repeaters need not be installed.

**3.4.4 Echo sounder.**

**3.4.4.1** The depth indicator shall be installed in the wheelhouse.

**3.4.4.2** The sensors of the echo sounder shall be installed in the ship's bottom clear of its sides and ends in places least affected by ship's vibration and at a distance which prevents them from being emerged out of water when the ship is rolling.

**3.4.4.3** In the vicinity of the sensor there shall be no supersonic emitting devices of other instruments operating simultaneously with the echo sounder, as well as no projecting parts of the hull, discharge and suction openings, etc., which are likely to disturb the normal operation of echo sounders.

**3.4.4.4** Measures shall be taken to prevent corrosion of the ship's hull as a result of the installation of the sensors.

**3.4.4.5** The sensors may be installed in sluice valves or they may be permanently fixed.

**3.4.4.6** The sluice valves shall be located in the trunk for echo sounder.

**3.4.4.7** It is allowed to install sensors of echo sounders in cofferdams of cargo and oil fuel tanks, in double bottom tanks and in ventilated tunnels under cargo tanks of oil tankers, provided they are situated in a special gasproof recess, which is an integral part of the hull structure (refer also to 3.5.1 of this Part and 2.2.2.9 of Part XI "Electrical Equipment" of the Rules for the Classification and Construction of Sea-Going Ships). Feeding cables shall be mounted in gasproof steel pipes.

The sensors installed in the above spaces shall be of unattended design.

**3.4.4.8** The sensors installed in bottom slots shall be so arranged that their emitting surface is on one level with the shell plating of the ship's hull. Where it is impossible to install the sensors in horizontal plane due to the curvature of the ship's hull, it is recommended to use special stream-liners arranged in bow – stern direction.

**3.4.4.9** Additional strengthening measures shall be applied, where necessary, to increase the rigidity of the shell plating when the sensors are installed in bottom slot.

**3.4.4.10** Where the sensors are installed in a special tank, without slotting the ship's bottom, the tank shall be filled up with the liquid having acoustic characteristics as similar to those of sea water as possible.

**3.4.4.11** Special tanks intended for the installation of sensors shall be, after the latter were fitted on board ships, tested for tightness in compliance with the requirements specified in Appendix 1 to Part II "Hull" of the Rules for the Classification and Construction of Sea-Going Ships.

**3.4.4.12** In no case shall the emitting surface of the sensors be painted or subjected to any mechanical effects (shocks, hard friction, etc.).

**3.4.5 Rate-of-turn indicators.**

**3.4.5.1** The main instrument of the rate-of-turn indicator shall be fitted on the rigid base in the wheelhouse or in the operating room. The upper surface of the base shall be parallel to the main (horizontal) plane of the ship.

**3.4.5.2** The repeaters of the rate-of-turn indicator shall be arranged in the wheelhouse in the vicinity of the steering station, as well as on the wings of the navigation bridge.

**3.4.6 Radar.**

**3.4.6.1** The main radar display (means for presenting radar and additional navigation-related information) shall be installed near the navigation bridge forward bulkhead in such a way as not to impair visual observation ahead of the ship, along the ship's heading, and the display image shall not be impaired by any lighting conditions.

If an additional display is provided on board ship, it shall be installed near the place of performing navigational plotting.

If the radar control panel is a separate device, it shall be possible to monitor the radar equipment from all the work stations where radar displays are installed.

**3.4.6.2** It is allowed to install the transmitter and other equipment of the radar on the bridge, provided the flux density of the power of high-frequency emissions, mechanical noise level and the level of electric interference to radio reception caused by this equipment do not exceed the permissible rates. Otherwise, the above-mentioned equipment shall be installed in a special enclosed and well-screened compartment or in the operating room.

**3.4.6.3** The diagrams indicating radar blind sectors shall be located near displays.

**3.4.7 Bridge Navigational Watch Alarm System (BNWAS).**

**3.4.7.1** Means of activating the reset function should only be available in positions on the bridge giving proper look out and preferably adjacent to visual indications. Means of activating the reset function should be easily accessible from the conning position, the workstation for navigating and manoeuvring, the workstation for monitoring and the bridge wings.

**3.4.7.2** The device structure shall ensure that it can be used only by the watch-keeping officer on the ship's navigation bridge and shall be protected from accidental use by unauthorized persons.

**3.4.7.3** To facilitate ship's navigation and manoeuvring, a special "Emergency Call" key may be installed at the bridge workstation. The key is intended for immediate sounding, in case of necessity, an audible alarm signal of the second, and then, third level to call another watch-keeping officer and/or the master.

**3.4.8 Radar reflector.**

**3.4.8.1** The radar reflector shall be fitted either on a rigid mount or suspended on a proper rigging at places not shaded by the superstructures and other metal structures.

The height of installation shall be not less than 4 m above the sea level.

**3.4.9 Universal automatic identification system.**

**3.4.9.1** The universal automatic identification system (AIS) equipment shall be so installed in the wheelhouse that the display and the equipment controls may be used readily.

**3.4.9.2** Separate units comprising the universal automatic identification system which are not used frequently may be installed in the operating room or in a special enclosure in the vicinity of the wheelhouse.

**3.4.9.3** Output contacts of relay initiated at the detection of the AIS failure, shall be connected to the audible alarm device.

As the audible alarm device, a loud speaker integrated in the AIS equipment, an independent external alarm or alarm system located on the navigation bridge may be used.

**3.4.9.4** A connector shall be installed on the navigating bridge near the pilot's workplace to enable the pilot to connect his personal computer to the AIS equipment.

**3.4.10 EPFS receiver.**

The EPFS receiver indicator shall be installed in close proximity to the place where the navigational plotting is maintained.

**3.4.11 Heading and/or track control system (autopilot).**

**3.4.11.1** The control panel of the regular manual steering system shall be connected with manual control panel of a mechanical or electrical transmission and shall be installed next to it.

**3.4.11.2** The combined manual and automatic control panel shall be installed on the navigation bridge in the centreline of the ship so as to provide easy maintenance and quick switching from automatic to manual control and vice versa.

The displacement of the control panel to the right of the centreline is allowed on ships where masts, cranes, other deck structures obscure visibility of the fore end. In this case special mark shall be provided in the fore end visible in the daytime and at night.

**3.4.12 Sound reception system.**

**3.4.12.1** The receiving microphones shall be installed in such a way that the acoustic interference level from the ship's noise sources would be minimum.

**3.4.12.2** The system display shall be visible from the ship's main conning position.

**3.4.12.3** The system loudspeaker shall be installed so that incoming sound signals are audible from the main conning position.

### **3.5 CABLING**

**3.5.1** All outer cabling of the shipboard navigational equipment shall be made by means of screened cables and laid in compliance with the technical documentation of the manufacturer with account of the requirements of Part XI "Electrical Equipment" of the Rules for the Classification and Construction of Sea-Going Ships.

**3.5.2** Insulation resistance of every laid cable disconnected at both ends shall be not less than 20 MOhm, irrespective of the cable length.

**3.5.3** To prevent moist from penetrating into the cables, all connections on the ship's open deck shall be of waterproof (IP56) type.

**3.5.4** When laying the cables and microwave transmitting feeders, minimum internal bending radii shall be maintained.



## **4 ANTENNAS AND EARTHING**

### **4.1 GENERAL**

**4.1.1** When choosing a location for installing antennas of the navigational equipment, one shall be guided by the provisions of [4.2 – 4.5](#), and appendices [7](#) and [8](#), unless otherwise provided by the technical documentation of the manufacturer of the equipment.

## **4.2 RADAR ANTENNAS**

**4.2.1** To ensure the maximum target location range and 360° observation, the radar antenna, if the ship's structure permits, shall be installed on a special mast.

The height at which the antenna is installed shall ensure the short range target location and minimize sea clutter and interference due to radiowaves reflection from the sea surface.

At the same time the height at which the antenna is installed shall be such that the flow density of its high frequency output signal at the ship's open decks where people can be present does not exceed the maximum permissible level.

**4.2.2** If scanning is effected straight ahead of the ship, it is admissible that the sea surface will not be scanned at a distance of not more than 500 m or double length of the vessel, whichever is shorter, for any type of cargo, ship's draught or trim.

Blind sectors shall be reduced to minimum and shall not be observed along an arch of horizon from straight ahead of the ship to the directions of 22,5° abaft the beam on each side of the ship.

Any two blind sectors separated from each other by an angle of 3° or smaller shall be regarded as one blind sector.

Separate blind sectors, the angle of which exceeds 5°, or the resultant arch of which exceeds 20° shall not be observed in the rest arch of horizon.

On the ships of unconventional design the requirements of this paragraph shall be met, as far as practicable and expedient.

**4.2.3** If two radars are installed on board, their antennas shall be installed in such a way as to minimize blind sectors and eliminate their mutual interference during their simultaneous operation.

**4.2.4** If two radar antennas are installed close to each other, the angle between them in the vertical plane shall be at least 20°, and the minimum distance between them in the vertical plane shall be at least 1 m.

**4.2.5** The radar antenna shall be installed in such a place on board as to minimize reflection of electromagnetic radiation by ship's structures or deck cargo.

**4.2.6** The radar antenna shall be installed far from the high frequency radiation sources and other transmitting/receiving radio equipment antennas.

**4.2.7** If the antenna is installed on a special mast, the platform for its technical servicing and repairing shall have an area of at least 1 m<sup>2</sup> and shall be provided with protective rails which do not restrict the antenna rotation. The radar antenna lower edge shall be situated at least 500 mm higher than any rail of the platform.

In all cases it shall be possible to inspect and repair any part of the antenna.

The structure of the mast with the antenna platform shall be designed so as to take into consideration the vessel's operational conditions, possible vibration and impacts.

**4.2.8** If the antenna is installed at an easily accessible place, it shall be placed at least 1800 mm above the deck, ladder or any other place where people can be present.

**4.2.9** The radar antenna shall be installed at a safe distance from the ship's magnetic compass.

**4.2.10** All guys of the radar antenna mast shall be provided with insulators dividing the mast into unequal parts with lengths ranging from 2 to 6 m. If it is impossible to insulate the guys they shall be electrically bonded to the ship's hull.

#### **4.3 ANTENNAS OF UNIVERSAL AUTOMATIC IDENTIFICATION SYSTEM (AIS)**

**4.3.1** The universal automatic identification system (AIS) VHF antenna shall be installed at the maximum height so as to allow effective transmission and reception of signals at all operating frequencies, and to avoid obstructions to electromagnetic field propagation over the entire horizon as far as practicable.

The manufacturer's recommendations shall be taken into consideration.

#### **4.4 ANTENNAS OF EPFS RECEIVERS**

**4.4.1** Receiver antennas shall not be installed lower than ship's large-size metal structures and shall be situated at a distance of at least 3 m from any transmitting antennas.

**4.4.2** The antennas shall not be installed on the mast tops, at places subject to substantial vibration, under deck structures and rigging or near sources of heat or smoke.

**4.4.3** The position for a navigational satellite system receiver antennas shall be chosen so as to ensure unrestricted tracking of a satellite constellation signal and be situated at least 1 m higher than other horizontal surfaces of the ship's structures.

**4.4.4** The radionavigation system receiver antennas shall not be installed along the axis of the main lobe of the radar antenna direction diagram.

#### **4.5 EARTHING**

**4.5.1** Navigational equipment installed in a ship shall have a protective earthing to the ship's hull which shall be made as short as possible.

**4.5.2** When leading in the cables into the equipment, their screened sheathings shall be electrically connected to the ship's hull.

**4.5.3** All radionavigational devices shall have the operational (high-frequency) earthing as well.

**4.5.4** The total resistance of all electric connections of any earthing shall not exceed 0,02 Ohm.

**LIST OF NORMATIVE DOCUMENTS APPLICABLE IN THE PERFORMANCE OF WORK ON TYPE APPROVAL OF SHIPBORNE NAVIGATIONAL EQUIPMENT**

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05010000MK	Standard magnetic compass  V/19.2.1.1	SOLAS 74 Reg. V/19.2.1.1  MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17) A.382(X)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  ISO 1069:1973 ISO 25862:2019
05010200MK	Transmitting heading device THD (magnetic method)  V/19.2.3.5	SOLAS 74 Reg. V/19.2.3.5  MSC.36(63) (1994 HSC 13) MSC.97(73) (2000 HSC 13)  A.694(17)  MSC.116(73) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  ISO 22090-2:2014 IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05010100MK	Transmitting heading device THD (GNSS method)  V/19.2.3.5	SOLAS 74 Reg. V/19.2.3.5  MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17)  MSC.116(73) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  ISO 22090-3, Ed. 2.0 (2014-03) IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05010300MK	Transmitting heading device THD (Gyroscopic method)  V/19.2.3.5	SOLAS 74 Reg. V/19.2.3.5  MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17)  MSC.116(73) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  ISO 22090-1:2014 IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05020000MK	Gyro compass  V/19.2.5.1	SOLAS 74 Reg. V/19.2.5.1  A.694(17)  A.424(XI) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  ISO 8728:2014 IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05020010MK	Gyro compass for high-speed craft  HSC Code (2000) 13.2.6	MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17)  A.821(19) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  ISO 16328:2014 IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)



RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05030000MK	Speed and distance measuring equipment through the water (SDME)  V/19.2.3.4	SOLAS 74 Reg. V/19.2.3.4  MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17)  MSC.96(72) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 61023, Ed. 3.0 (2007-06) IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05030100MK	Speed and distance measuring equipment over the ground in the forward and athwartships direction (SDME)  V/19.2.9.2	SOLAS 74 Reg. V/19.2.9.2  MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17)  MSC.96(72) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 61023, Ed. 3.0 (2007-06) IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05050000MK	Echo-sounding equipment  V/19.2.3.1	SOLAS 74 Reg. V/19.2.3.1  MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17)  MSC.74(69) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  ISO 9875:2000 incl. ISO Technical Corr. 1:2006 IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05060000MK	Heading control system (HCS)  V/19.2.8.2	SOLAS 74 Reg. V/19.2.8.2  A.694(17)  MSC.64(67) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  ISO 11674:2019  IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05060010MK	Heading control system for high-speed craft  HSC Code (2000) 13.12	MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17) A.822(19)  MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  ISO 16329:2003 IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05060100MK	Track control system  V/19.2.8.2	SOLAS 74 Reg. V/19.2.8.2  A.694(17)  MSC.74(69) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 62065, Ed. 2.0 (2014-02) IEC 62288, Ed. 2.0 (2014-07).)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05070000MK	Integrated navigation system	<p>MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13</p> <p>A.694(17)</p> <p>MSC.191(79) MSC.466(101) MSC.252(83) MSC.452(99) MSC.302(87)</p>	<p>IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007</p> <p>IEC 61924-2, Ed. 2.0 (2021-02) IEC 62288, 3.0 (2021-12)</p> <p>IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)</p> <p>IEC 62923-1, Ed. 1.0 (2018-08) IEC 62923-2, Ed. 1.0 (2018-08)</p>
05120000MK	<p>Rate-of-turn indicator</p> <p>V/19.2.9.1</p>	<p>SOLAS 74 Reg. V/19.2.9.1</p> <p>MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13</p> <p>A.694(17) A.526(13)</p> <p>MSC.191(79)</p>	<p>IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007</p> <p>ISO 20672:2022 IEC 62288, Ed. 2.0 (2014-07)</p> <p>IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)</p>

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05130000MK	Electronic chart display and information system (ECDIS)  V/19.2.10	SOLAS-74, Reg. V/19.2.1.4  MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17)  MSC.232(82) MSC.191(79) MSC.466(101)  MSC.1/Circ.1503. Rev.1	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 61174, Ed. 4.0 (2015) IEC 62288, Ed. 3.0 (2021-12)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05140210MK	Radar equipment for ships less than 500 gt (CAT 3)  V/19.2.3.2	SOLAS-74, Reg. V/19.2.3.2  A.694(17)  MSC.192(79) MSC.191(79) MSC.466(101)  ITU-R M.1177-4 (2011)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 62388, Ed. 2.0 (2013-06) IEC 62288, Ed. 3.0 (2021-12)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05140220MK	Radar equipment for ships less than 10 000 gt (CAT 2)  V/19.2.7.1	SOLAS-74, Reg. V/19.2.7.1  A.694(17)  MSC.192(79) MSC.191(79) MSC.466(101)  ITU-R M.1177-4 (2011)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 62388, Ed. 2.0 (2013-06) IEC 62288, Ed. 3.0 (2021-12)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05140230MK	Radar equipment for ships of 10 000 gt and upwards (CAT 1)  V/19.2.8.1	SOLAS-74, Reg. V/19.2.8.1  A.694(17)  MSC.192(79) MSC.191(79) MSC.466(101)  ITU-R M.1177-4 (2011)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 62388, Ed. 2.0 (2013-06) IEC 62288, Ed. 3.0 (2021-12)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05140231MK	<p>Radar equipment for high-speed craft (CAT 1H, CAT 2H)</p> <p>V/19.2.8.1 V/19.2.3.2</p> <p>HSC Code (2000) 13.5</p>	<p>MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13</p> <p>A.694(17)</p> <p>MSC.192(79) MSC.191(79) MSC.466(101)</p> <p>ITU-R M.1177-4 (2011)</p>	<p>IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007</p> <p>IEC 62388, Ed. 2.0 (2013-06) IEC 62288, Ed. 3.0 (2021-12)</p> <p>IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)</p>
05140232MK	<p>Chart radar equipment (CAT 1C, CAT 2C)</p>	<p>A.694(17)</p> <p>MSC.192(79) MSC.191(79) MSC.466(101)</p> <p>ITU-R M.1177-4 (2011)</p>	<p>IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007</p> <p>IEC 62388, Ed. 2.0 (2013-06) IEC 62288, 3.0 (2021-12) IEC 61174, Ed. 4.0 (2015-08)</p> <p>IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)</p>

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05140233MK	Chart radar equipment for high-speed craft (CAT 1HC, CAT 2HC)	<p>MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13</p> <p>A.694(17)</p> <p>MSC.192(79) MSC.191(79) MSC.466(101)</p> <p>ITU-R M.1177-4 (2011)</p>	<p>IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007</p> <p>IEC 62388, Ed. 2.0 (2014-02) IEC 62288, Ed. 3.0 (2021-12) IEC 61174, Ed. 4.0 (2015-08)</p> <p>IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)</p>
05140300MK	GNSS receiver (GPS)  V/19.2.1.6	<p>SOLAS 74 Reg. V/19.2.1.6</p> <p>MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13</p> <p>A.694(17)</p> <p>MSC.112(73) MSC.191(79)</p> <p>ITU-R M.823-3 (2006)</p>	<p>IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007</p> <p>IEC 61108-1, Ed. 2.0 (2003-07) IEC 62288, Ed. 2.0 (2014-07)</p> <p>IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)</p>



RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05140310MK	GNSS receiver (GLONASS)  V/19.2.1.6	SOLAS 74 Reg. V/19.2.1.6  MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17)  MSC.113(73) MSC.191(79)  ITU-R M.823-3 (2006)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 61108-2, Ed. 1.0 (1998-06) IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05140320MK	GNSS receiver (Galileo)  V/19.2.1.6	SOLAS 74 Reg. V/19.2.1.6  MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17)  MSC.233(82) MSC.191(79)  ITU-R M.823-3 (2006)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 61108-3, Ed. 1.0 (2010-05) IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05140330MK	Combined GPS/GLONASS equipment  V/19.2.1.6	SOLAS 74 Reg. V/19.2.1.6  MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17)  MSC.115(73) MSC.191(79)  ITU-R M.823-3 (2006)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 61108-1, Ed. 2.0 (2003-07) IEC 61108-2, Ed. 1.0 (1998-06) IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05140340MK	Differential beacon receiver for DGPS and DGLONASS equipment	MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17)  MSC.114(73)  ITU-R M.823-3 (2006)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 61108-4, Ed. 2.0 (2004-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05140400MK	Radar reflector – passive type  V/19.2.1.7	SOLAS 74 Reg. V/19.2.1.7  MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  MSC.164(78)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  ISO 8729-1:2010

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05150000MK	Class A shipborne equipment of the automatic identification system (AIS)  V/19.2.4	SOLAS 74 Reg. V/19.2.4.5  MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17)  MSC.74(69) MSC.191(79)  Radio Regulations 2020 ITU-R M.1371-5 (2014)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 61993-2, Ed. 3.0 (2018-07) IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05160100MK	Voyage data recorder (VDR) installed before 1 July 2022  V/20.1	SOLAS 74 Reg. V/20.1  MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17)  MSC.333(90) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 61996-1, Ed. 2.0 (2014-02) IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05160100MK	Voyage data recorder (VDR) installed on 1 July 2022 or after  V/20.1	SOLAS 74 Reg. V/20.1  MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17)  MSC.333(90) MSC.494(104) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 61996-1, Ed. 2.1 (2021-05) IEC 62288, Ed. 2.0 (2014-12)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05160200MK	Simplified voyage data recorder (S-VDR) installed before 1 July 2022  V/20.2	SOLAS 74 Reg. V/20.2  A.694(17)  MSC.163(78) MSC.214(81) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 61996-2, Ed. 1.0 (2007-11) IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05160200MK	Simplified voyage data recorder (S-VDR) installed on 1 July 2022 or after  V/20.2	SOLAS 74 Reg. V/20.2  A.694(17)  MSC.163(78) MSC.214(81) MSC.493(104) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 61996-2, Ed. 1.0 (2007-11) IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05170000MK	Sound reception system  V/19.2.1.8	SOLAS 74 Reg. V/19.2.1.8  MSC.36(63)-(1994 HSC Code) MSC.97(73)-(2000 HSC Code)  A.694(17)  MSC.86(70) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  ISO 14859:2012 IEC 62288 Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05190000MK	Bridge navigational watch alarm system (BNWAS)  V/19.2.2.3	A.694(17)  MSC.128(75) MSC.191(79)	IEC 60945 series: - IEC 60945 Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 62288, Ed. 2.0 (2014-07) IEC 62616:2010 / incl. Corr. 1(2012)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05200000MK	Equipment with long-range identification and tracking (LRIT) capability  V/19-1.4.1, 2	SOLAS 74 Reg. V/19-1  A.694(17)  MSC.263(84) MSC.1/Circ.1307	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 62729, Ed. 1.0 (2012-06)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05220100MK	Night vision equipment for high-speed craft  HSC Code (2000), 13.10	MSC.36(63)-(1994 HSC Code) 13 MSC.97(73)-(2000 HSC Code) 13  A.694(17)  MSC.94(72) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  ISO 16273:2020 IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05230000	Electronic inclinometer	A.694(17)  MSC.363(92) MSC.191(79)	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 62288, Ed. 2.0 (2014-07)  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)

RS nomenclature code	Item designation, SOLAS 74 regulation	RS rules, SOLAS 74 regulations, IMO resolutions and circulars, ITU recommendations which the item shall comply with	List of documents in the field of standardization and other documents, whose application, on a voluntary basis, provides compliance with the requirements that the item shall meet (testing standards)
05220000	Meteorological complex	A.694(17)  Appendix 2, Section 1	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 61162 series: - IEC 61162-1, Ed. 5.0 (2016-08) - IEC 61162-2, Ed. 1.0 (1998-09) - IEC 61162-3, Ed. 1.2 (2014-07) - IEC 61162-450, Ed. 2.0 (2018-05)
05140240	Radar ice display	A.694(17)  MSC.191(79)  Appendix 2, Section 4	IEC 60945 series: - IEC 60945, Ed. 4.0/Cor.1 (2008-04) - GOST R IEC 60945-2007  IEC 62288, Ed. 2.0 (2014-07)



## **ADDITIONAL REQUIREMENTS FOR EQUIPMENT**

### **1 METEOROLOGICAL COMPLEX**

**1.1** The ship meteorological complex, depending on the ship's purpose and operational features, shall be equipped with sensors to provide continuous monitoring:

**.1** atmospheric pressure within the range of 600 — 1070 hPa with an error limit of  $\pm 0,5$  hPa;

**.2** air temperature within the range of  $-60$  °C to  $+55$  °C with an error limit of  $\pm 1$  °C;

**.3** relative air humidity of 30% to 98% within the temperature range of  $-30$  °C to  $+50$  °C;

**.4** both the apparent and true wind directions within the range of relative bearings of  $0$  —  $360^\circ$  with an error limit of  $\pm 10^\circ$ ;

**.5** both the apparent and true wind speed within the range of  $1$  —  $50$  m/s with an error limit of  $\pm 0,5$  m/s at a wind speed of up to 5 m/s, and  $\pm 10\%$  at a wind speed of over 5 m/s.

**1.2** The meteorological complex intended for ships fitted with a helideck shall additionally support the following measurements:

**.1** meteorological optical visibility within the range of  $20$  —  $6000$  m, with a maximum error limit of  $\pm 15\%$  at the visibility below 250 m;  $\pm 10\%$  within the visibility range of  $250$  —  $3000$  m;  $\pm 20\%$  at the visibility above 3000 m;

**.2** the cloud base height within the range of  $15$  —  $2000$  m, with a maximum error limit of  $\pm 10$  m at the cloud base height below 100 m;  $\pm 10\%$  at the cloud base height above 100 m.

**1.3** Interfaces shall be provided for entering information in a standardized format (refer to IEC 61162 series) from the EPFS receiver, the heading control system and a log if it is necessary to calculate and display the speed and direction of the true wind.

**1.4** The readings of the meteorological complex indicator(s) shall be distinct and clearly visible under any lighting conditions at the place of installation.

**1.5** The meteorological complex shall provide the possibility of sending all the measured parameters to other devices for their processing and recording in a standardized format (refer to IEC 61162 series).

**1.6** A graphical representation of the measured parameters shall be made possible, and the measured parameters be displayed for at least the last 24 hours of observations.

**1.7** In case of malfunction of one or two sensors, the meteorological complex shall remain operative with the failure-free sensors.

**1.8** The meteorological complex sensors shall be calibrated in compliance with the procedures stipulated in the manufacturer's documentation.

## **2 ANALOG-DIGITAL SIGNAL CONVERTER**

**2.1** The analog-digital signal converter shall provide:

acquisition of navigational information on the ship's course and/or speed and/or depth under a keel received from the equipment not fitted with a standard digital interface;

conversion of signals from analog gyrocompass and log repeaters into digital form corresponding to a certain standard format;

generation of standard messages HDT, THS, HDG, VHW, VTG, VBW, ROT, DPT, DBT in accordance with the International Standard on Interface of Marine Radio and Navigational Equipment and their transfer at a speed not less than 4800 bit/s (data transfer rate may be changed by the hardware depending on the normal operation of the information user) with intervals not exceeding 1 s via RS232, RS422 or CAN interfaces (with power supply support).

The analog-digital signal converter shall be provided with a function of calculating the checksum of output statement, which shall be set during installation of the converter taking into account the particulars of the equipment connected.

**2.2** The analog-digital signal converter shall be interfaced with the following devices:

gyrocompass having selsyn (sine voltage of selsyn windings) or step (successions of voltage impulses) outputs and/or

log having pulse outputs and also open contact outputs and/or

echo-sounder having analog output.

**2.3** The analog-digital converter shall provide a galvanic or optical isolation with the windings of the rate-of-turn indicators, an optically coupled isolation with the network of rate-of-turn indicators, log, echo sounder and optically coupled isolation with the navigational equipment outputs.

**2.4** The analog-digital converter shall automatically determine availability and accessibility of information from the connected navigational information sensors (equipment and systems).

In the absence of automatic synchronization, the converter shall provide for a possibility of synchronization and subsequent check of correspondence of the analog source readings to the converter output data (input and check of the initial values).

**2.5** Design and structure of the analog-digital converter shall provide for the visual alarm, which is activated when the information received from the connected equipment is missing or unavailable.

When the visual alarm is activated, data transfer to the connected users shall be terminated until the normal operation of the converter is restored.

**2.6** The analog-digital converter shall be supplied from the same source(s) of electrical power, which provide(s) power supply to the equipment providing input information for the converter, at that the analog-digital converter shall have visual indication of electrical power supply.

### **3 DIGITAL SIGNAL MULTIPLICATOR**

**3.1** The digital signal multiplier shall provide:  
receipt, multiplication to the output channels and transfer (without distortion) of digital signals to users;  
optically coupled isolation of the navigational equipment outputs and inputs of digital signal users;  
automatic operation immediately after power-up;  
possibility of changing data exchange interfaces: RS232, RS422, RS485.

**3.2** When the receiving part of the information user requires, the multiplier may provide the possibility to change digital signal transfer rate, at that the signal distortion shall be excluded.

**3.3** The digital signal multiplier is recommended to provide visual indication of input and output data.

**3.4** The digital signal multiplier shall be supplied from the same source(s) of electrical power, which provide(s) power supply to the equipment providing input information for the multiplier, at that the digital signal multiplier shall have visual indication of electrical power supply.

## **4 RADAR ICE DISPLAY**

**4.1** Radar Ice Display shall provide receiving, processing and displaying radar signals in order to obtain information about ice conditions.

**4.2** Requirements for displaying:

**.1** the equipment shall display the ice conditions based on radar data in luminance gradations of the same colour or in a colour palette;

**.2** it shall be possible to adjust the brightness and contrast of the radar image of the ice condition;

**.3** the image of the ice condition shall allow to evaluate the types of ice, its parameters and characteristics, such as the following:

ice concentration;

forms of ice and size floes;

dynamic processes;

open water areas;

hummocking;

large ice formations (icebergs);

ice edge;

**.4** it shall be possible to measure the coordinates and dimensions of selected objects of ice conditions;

**.5** the radar image of the ice condition shall have a resolution no worse than the radar's resolution in direction and range;

**.6** it shall be possible to select the orientation of the radar image relative to the true meridian (North Up) or to the heading (Course Up);

**.7** it shall be possible to change the scale of the radar image of the ice conditions;

**.8** the maximum range of the display of the conditions shall be not less than 8 miles;

**.9** it shall be possible to indicate the position of the ship and the heading line against the background of the radar image;

**.10** it shall be possible to suppress the image of the heading line;

**.11** if a radar image and an electronic map are simultaneously displayed in the indicator, their images shall use the constant common reference point of their own ship and coincide in scale, projection and orientation;

**.12** it shall be possible to further process radar signals in order to distinguish small objects and increase the signal-to-interference ratio in the image to be displayed. Processing parameters shall be adjustable;

**.13** it shall be possible to suppress interference from extended meteorological formation (rain);

**.14** there shall be an alarm for the absence of signals from the radar and navigation sensors;

**.15** there shall be no radar image of the ice conditions in the absence of signals from the radar.

**4.3** Connection requirements:

**.1** connection to the radar shall be carried out via digital standard interfaces or in using analog radar video signal and synchronization signals (separate or mixed). The manufacturer shall describe the connection interface and the characteristics of the radar to which connection is possible;

**.2** the equipment shall not interfere with the radar's operability and the integrity of its design;

**.3** the equipment shall automatically consider changes in radar operation modes;

**.4** it shall be possible to connect to the navigation sensors of ship's position, course and speed;

**.5** it shall be possible to adjust the radar image by angle and distance.

## **5 CYBER SAFETY EQUIPMENT**

**5.1** The cyber safety equipment for shipborne radio and navigational equipment shall comply with the requirements of GOST R IEC 60945-2007.

**5.2** The cyber safety equipment for shipborne radio and navigational equipment shall comply with the requirements as specified in IEC 61162-460:2020.

## **RECOMMENDATIONS ON BRIDGE DESIGN, EQUIPMENT ARRANGEMENT AND PROCEDURES (BDEAP)**

The present Appendix is applied to ships contracted for construction on or after 1 January, 2006.

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## **INTRODUCTION**

The present Recommendations on Bridge Design, Equipment Arrangement and Procedures (BDEAP) set forth a set of requirements for compliance with the principles and aims of the International Convention for the Safety of Life at Sea (SOLAS-74) and other international documents relating to the bridge design.

The requirements include guidance notes that are recommendations on how the requirements may be met by acceptable technical solutions, which shall be considered examples only and do not in any way exclude alternative solutions that may fulfil the purpose of the requirements.

The requirements, which affect bridge design, design and arrangement of navigational equipment and systems on the bridge and bridge procedures shall be taken with the aim of:

- .1 facilitating the tasks to be performed by the bridge team and the pilot in making full appraisal of the situation and in navigating the ship safely under all operational conditions;
- .2 promoting effective and safe bridge resource management;
- .3 enabling the bridge team and the pilot to have convenient and continuous access to essential information, which is presented in a clear and unambiguous manner, using standardized symbols and coding systems for controls and displays;
- .4 indicating the operational status of automated functions and integrated components, systems and/or sub-systems;
- .5 allowing for expeditious, continuous and effective information processing and decision-making by the bridge team and the pilot;
- .6 preventing or minimizing excessive or unnecessary work and any condition or distraction on the bridge, which may cause fatigue or interfere with the vigilance of the bridge team and the pilot;
- .7 minimizing the risk of human error and detecting such error, if it occurs, through monitoring and alarm systems, in time for the bridge team and the pilot to take appropriate action.

Overview of design principles of the present requirements is given in Figure.

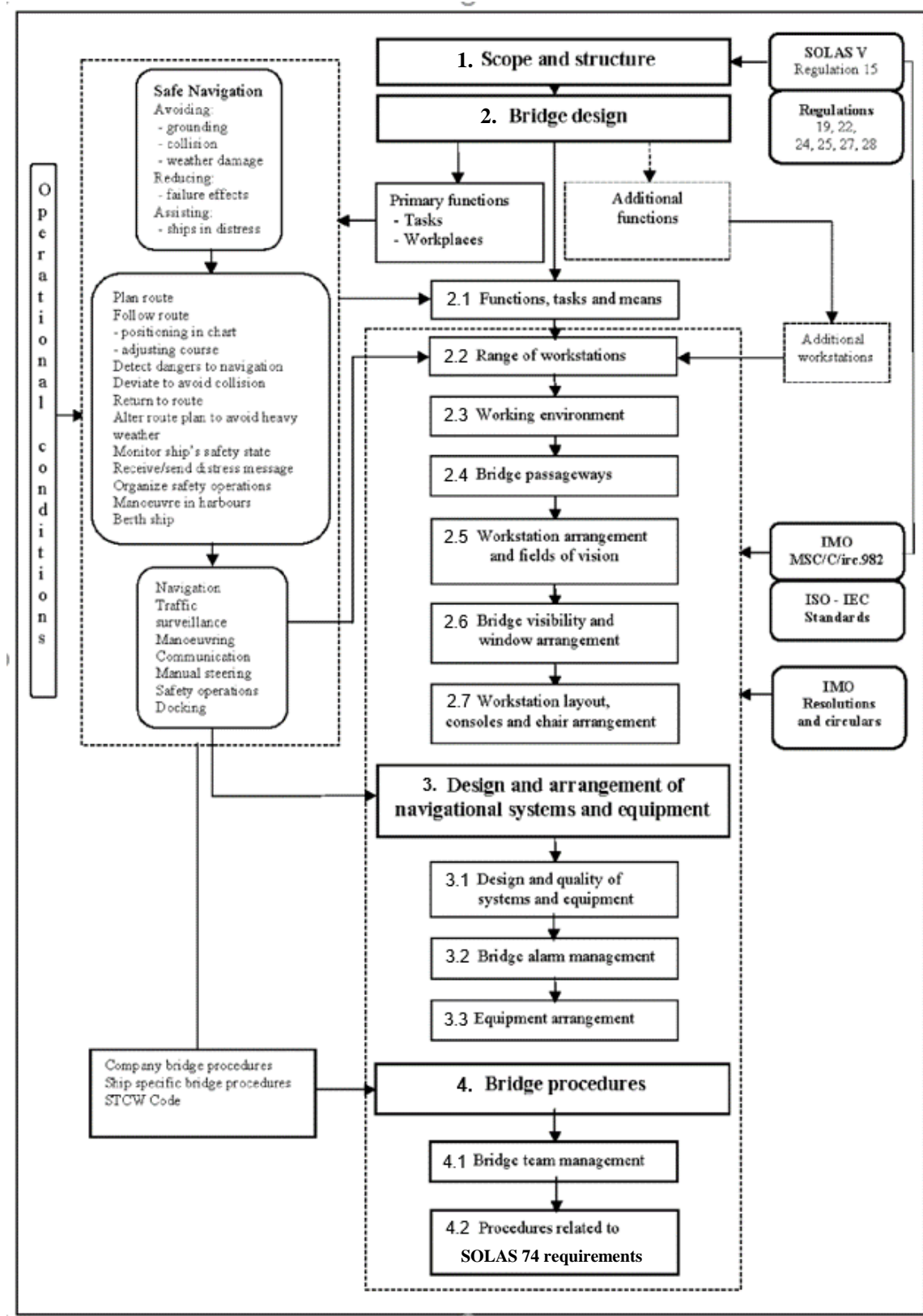


Fig.  
Design principles of the requirements



## 1 GENERAL

### 1.1 APPLICATION

**1.1.1** The present Recommendations contain a set of requirements for compliance with the principles and aims of SOLAS regulation V/15, when applying the requirements of the following regulations of SOLAS Chapter V:

19 "Carriage requirements for shipborne navigational systems and equipment";

22 "Navigation bridge visibility";

24 "Use of heading and/or track control systems";

26 "Steering gear: testing and drills";

27 "Nautical charts and nautical publications";

28 "Records of navigational activities" taking regulations 18 and 20 into consideration.

The requirements of these regulations are harmonized with the guidelines of MSC/Circ.982 and the relevant ISO and IEC standards.

Note. [Refer to Annex 1.](#)

### 1.2 STRUCTURE AND APPLICATION

**1.2.1** The present Recommendations are structured to reflect the areas and aims addressed by regulation 15.

#### **1.2.1.1** Requirements.

The requirements cover the provisions of Chapter V of SOLAS-74 and applicable parts of MSC/Circ.982, enabling the present Recommendations to be used as a stand-alone document for the purpose of development and subsequent approval of the appropriate technical documentation relating to the following areas of:

bridge design;

design and arrangement of navigational systems and equipment;

bridge procedures.

#### **1.2.1.2** Guidance note.

Guidance notes as how the requirements may be met by the acceptable technical solutions or other remedies are given when applicable. A guidance note given does not in any way exclude the alternative solutions that may fulfil the purpose and intention of the said requirements, providing other requirements and the overall bridge functionality are not adversely affected.

#### **1.2.1.3** Annexes.

There are two annexes attached to the present Recommendations. [Annex 1](#) contains three individual parts for clarification and consideration of:

application of SOLAS regulation V/15;

documents referred to by regulation 15 and the SOLAS regulations to be applied cross-referencing the individual aims of regulation 15 and the regulations affected;

the effect of MSC/Circ.982 on the requirements of SOLAS regulation V/22 "Navigation bridge visibility" by comparison and harmonization of content.

[Annex 2](#) contains examples of arrangement of main equipment on the bridge.

**1.2.2** The content of separate parts of the present Recommendations are structured with the aim of enabling it to serve as a rational checklist through the different levels of development and approval of the technical documentation.

**1.2.3** Approval of the technical documentation developed on the basis of the present Recommendations prove compliance with the requirements of SOLAS regulation V/15 when

applying SOLAS regulations V/19, V/22, V/24, V/25, V/27 and V/28 at the time of delivery of the newbuilding.

Verification of compliance with regulations V/19 and V/22 addressing technical requirements for bridge equipment and design, includes verification of the ability of the bridge design, layout and equipment arrangement to promote effective and safe bridge resource management.

Procedures established for bridge resource management and for the purposes specified in SOLAS regulations V/24, V/25, V/27 and V/28 shall be verified in compliance with the requirements of the ISM Code prior to delivery of the ship and becoming part of the ship's safety management system and included in the ISM certification.

### **1.3 NORMATIVE REFERENCES**

**1.3.1** Applicable parts of MSC/Circ.982 – Guidelines on ergonomic criteria for bridge equipment and layout;

MSC/Circ.603 — Guidelines on display sizes and techniques for navigational purposes;

IMO resolution A.694(17) — General requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids;

IMO resolution A. 1021(26) — Code on alarms and indicators, 2009.

### **1.4 INFORMATIVE REFERENCES**

**1.4.1** IEC standards referred to in MSC/Circ.982 for relevant additional information:

IEC 60945:2002, Maritime navigation and radio communication equipment and systems — General requirements — Methods of testing and required test results;

IEC 61174:2015, Electronic Chart Display and Information System (ECDIS) — Operational and performance requirements, methods of testing and required test results.

**1.4.2** International Management Code for the Safe Operation of Ships and for Pollution Prevention (ISM Code).

**1.4.3** Company and Ship Specific Bridge Procedures Manual.

**1.4.4** International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended (STCW Convention-78/95).

**1.4.5** Maritime Regulations for the Operation of the Panama Canal, Notice No. N-1, Navigation Bridge Features Required of Transiting Vessels.

### **1.5 DEFINITIONS**

For the purpose of this document:

**1.5.1** Alarm means an alarm or alarm system, which announces by audible and visual means a condition requiring attention.

**1.5.1.1** Accept means manual silencing of an audible alarm.

**1.5.1.2** Acknowledge means action for silencing of audible alarm and bringing visual alarm to steady state.

**1.5.1.3** Cancel means manual stopping of a visual alarm after the cause has been eliminated.

**1.5.2** Bridge means the area, from which the navigation and control of the ship is exercised, including the wheelhouse and bridge wings.

**1.5.2.1** Bridge wings mean those parts of the bridge on both sides of the ship's wheelhouse, which, in general, extend to the ship's side.

**1.5.2.2** Navigation bridge means area of a wheelhouse or enclosed bridge allocated navigating functions and control of the ship, and which includes any additional bridge workstation to be used by the officer of the watch.

**1.5.2.3** Totally enclosed bridge means a bridge without open bridge wings, meaning that bridge wings form an integral part of an enclosed wheelhouse.

**1.5.2.4** Wheelhouse means enclosed area of the bridge.

**1.5.3** Bridge functions mean functions comprising tasks related to operation of the ship and carried out on the bridge.

**1.5.3.1** Primary bridge functions mean functions related to determination, execution and maintenance of safe course, speed and position of the ship in relation to the waters, traffic and weather conditions.

Such functions are:

route planning functions;

navigation functions;

collision avoidance functions;

maneuvering functions;

docking functions;

monitoring of safety systems;

external and internal communication related to safety in bridge operations including distress situations;

pilotage functions.

**1.5.3.2** Additional bridge functions mean functions related to ship operations, which shall be carried out on the bridge in addition to primary functions, but not necessarily by the watch officer.

Examples of such functions are:

extended communication functions;

monitoring and control of ballasting and cargo operations;

monitoring and control of machinery;

monitoring and control of domestic systems.

**1.5.4** Close to means within functional reach (inside the wheelhouse).

**1.5.5** Collision avoidance functions mean detection and plotting of other ships and moving objects; determination and execution of course and speed deviations to avoid collision.

**1.5.6** Commanding view means view without obstructions, which could interfere with the navigator's ability to perform his main tasks, covering at least the field of vision required for safe performance of collision avoidance functions (225°).

**1.5.7** Conning station or position means place in the wheelhouse with a commanding view, providing the necessary information for conning and which is used by navigators, including pilots, when monitoring and directing the ship's movements.

**1.5.8** Docking means maneuvering the ship alongside a berth while controlling mooring operations.

**1.5.9** Maneuvering means operation of steering systems and propulsion machinery as required to move the ship into predetermined directions, positions or tracks.

**1.5.10** Monitoring means act of constantly checking information from instrument displays and environment in order to detect any irregularities.

**1.5.11** Navigation means planning of the ship's route and determination of position and course of the ship, execution of course alterations and speed changes.

**1.5.12** Operating conditions:

**1.5.12.1** Normal operating conditions when all shipboard systems and equipment related to primary bridge functions operate within design limits, and weather conditions or traffic do not cause excessive operator workloads.

**1.5.12.2** Irregular operating conditions when external conditions cause excessive operator workloads.

**1.5.12.3** Abnormal operating conditions when malfunction of technical system requires operation of backup systems on the bridge, or when it occurs during an irregular operating condition, or when the officer of the watch becomes unfit to perform his duties and has not yet been replaced by another qualified officer.

**1.5.12.4** Emergency situations when incidents seriously affect internal operating conditions of the ship and the ability to maintain safe course and speed (fire, ship system technical failure, structural damage).

**1.5.13** Waters:

**1.5.13.1** Ocean areas mean waters that encompass navigation beyond the outer limits of coastal waters. Ocean areas do not restrict the freedom of course setting in any direction for a distance equivalent to 30 minutes of sailing with the relevant ship speed.

**1.5.13.2** Coastal waters mean waters that encompass navigation along a coast at a distance less than the equivalence of 30 minutes of sailing with the relevant ship speed. The other side of the course line allows freedom of course setting in any direction for a distance equivalent to at least 30 minutes of sailing with the relevant speed.

**1.5.13.3** Narrow waters mean waters that do not allow the freedom of course setting to any side of the course line for a distance equivalent to 30 minutes of sailing with the relevant ship speed.

**1.5.14** Route planning means pre-determination of course lines, radius turns and speed in relation to the waters to be navigated.

**1.5.15** Workstation means a workplace, at which one or several tasks constituting a particular activity are carried out, and which provides the information and equipment required for safe performance of the tasks.

**1.5.16** Workstation for monitoring means a workstation facilitating equipment and a commanding view for observation of the ship's heading and speed, the waters and traffic, incorporating means as required for positioning of the ship, and if located close to the front windows may serve as conning station for the master and a pilot carrying out control and advisory functions.

**1.5.17** Workstation for navigating and maneuvering means a workstation with commanding view used by navigators when carrying out navigation, route monitoring, traffic surveillance and maneuvering functions, and which enables monitoring of the safety state of the ship.

**1.5.18** Workstation for radio communication means a workplace for operation and control of equipment for Global Maritime Distress and Safety System (GMDSS), and shipboard communication for ship operations.

**1.5.19** Workstation for safety operations means a workplace-dedicated organization and control of internal emergency and distress operations, and which provides easy access to information related to the safety state of the ship.

## **1.6 DOCUMENTATION TO BE SUBMITTED BY THE SHIPBUILDER FOR APPROVAL**

**1.6.1** Fields of vision drawings showing:

**.1** the horizontal field of vision from the various workstations, including the arc of individual blind sectors and the sum of blind sectors forward of the beam (over an arc of 180° from side to side right ahead);

**.2** the vertical field of vision over the bow from the conning station and the workstation for navigation and maneuvering, including the line of sight under the upper edge of the window from standing working position at the workstation;

**.3** window arrangement, including inclination, dimensions, framing and height of lower and upper edge above bridge deck surface as well as the height of the deckhead.

**1.6.2** Bridge layout drawings showing:

**.1** the bridge layout, including the configuration and location of all bridge workstations, including workstations for additional bridge functions;

**.2** configuration and dimensions of workstation consoles including console foundations.

**1.6.3** Equipment location drawings showing:

**.1** location of instruments and equipment in all workstation consoles;

**.2** location of equipment located elsewhere on the bridge.

**1.6.4** List of equipment showing:

all relevant bridge equipment with specification of type, model, manufacturer, supplier and type approval reference with extension date or copy of valid certificates, when applicable.

**1.7 DOCUMENTATION TO BE SUBMITTED BY THE SHIPBUILDER FOR INFORMATION**

**1.7.1** Manuals or instructions for equipment installed for the use of bridge personnel shall be submitted for information upon request.

**1.8 DOCUMENTATION TO BE SUBMITTED BY THE SHIPOWNERS FOR APPROVAL**

**1.8.1** Ship specific bridge procedures covering:

the use of the heading and/or track control system, operation of steering gear, updating of nautical charts and recording of navigational activities proving compliance with SOLAS regulations V/24, V/25, V/27 and V/28.

**1.8.2** [Paragraph 1.8.1](#) shall be included in the ship's management plan for the ISM certification.

**1.9 DOCUMENTATION TO BE SUBMITTED BY THE SHIPOWNERS FOR INFORMATION**

**1.9.1** If navigational functions and bridge team management shall be carried out or organized other than as indicated in these Recommendations ([refer to 2.1](#) and [4.1](#)), documentation describing the differences and operational procedures shall be submitted in conjunction with relevant drawings of bridge layout and equipment location submitted by the shipbuilder for approval ([refer to 1.5.2, 1.5.3](#)).

**1.9.2** Description of functions to be performed at workstations, which are additional to workstations for primary bridge functions, shall be submitted.

**1.9.3** Ship specific bridge procedures covering:

distribution of bridge functions and tasks ([refer to 2.1](#));

manning and training requirements on the bridge at identified operating conditions taking into account the requirements in [2.1](#).

Note. [Paragraph 1.9.3](#) shall be included in the ship's safety management system (SMS) under the ISM Code.

**1.10 ON-BOARD TESTS**

**1.10.1** A program for the on-board testing of the bridge equipment and systems required to be carried, as well as additional navigation equipment installed, shall be submitted for approval at the earliest possible stage before sea trials.

**1.10.2** Equipment and systems shall be subject to the tests required to ascertain that all controls, indicators, displays, etc., operate in accordance with their specifications and meet IMO requirements.

**1.10.3** Failure conditions shall be simulated on equipment and systems.

The bridge shall be designed and arranged with the aim of:

- facilitating the tasks to be performed by the bridge team and the pilot in making full appraisal of the situation and in navigating the ship safely under all operational conditions;
- promoting effective and safe bridge resource management;
- allowing for expeditious, continuous and effective information processing and decision-making by the bridge team and the pilot;
- preventing or minimizing excessive or unnecessary work and any condition or distraction on the bridge, which may cause fatigue or interfere with the vigilance of the bridge team and the pilot.

The design of bridge is governed by:

- the functions and related tasks to be carried out on the bridge, systems used and methods of task performance;
- the range, layout and location of workstations required for performance of bridge functions;
- the fields of vision required for visual observations from each of the workstations;
- composition of the bridge team and the procedures required for safe operations under all identified conditions;
- the type and range of equipment to be provided for performance of the tasks at the individual workstations and elsewhere on the bridge.

## 2 BRIDGE DESIGN

### 2.1 FUNCTIONS, TASKS AND MEANS

**2.1.1** Table 2.1.1 shows the main bridge functions and tasks to be carried out on the bridge. The types of approved equipment that are related to the performance of different tasks are indicated. The list may serve as basis for outfitting of workstations. The type of equipment installed on the individual bridge, the system configurations and automation level may affect the method of navigation, operational procedures and qualification levels.

It is regarded as the responsibility of the shipowners and users that procedures, knowledge and training of the bridge personnel are related to the individual ship's bridge system, including the task and means defined below, for safe and efficient task performance. Such issues shall be documented in the company and ship specific bridge procedures manual and documented in the ISM Code procedures manual for the vessel ([refer to 1.8.1](#) and [1.8.2](#)).

### 2.2 TYPE AND RANGE OF WORKSTATIONS

**2.2.1** The ship's navigation bridge shall not be used for purposes other than navigation, communications and other functions essential to the safe operation of the ship, its engines and cargo, and workplaces shall be arranged with the aim of:

facilitating the tasks to be performed by the bridge team and the pilot in making full appraisal of the situation and in navigating the ship safely under all operational conditions;  
promoting effective and safe bridge resource management.

**2.2.2** Individual workstations for performance of primary bridge functions including conning position for pilotage shall be provided for:

navigating and maneuvering (and traffic surveillance);  
monitoring;  
manual steering;  
docking on bridge wings;  
planning (of voyage, routes, ship operations);  
safety (monitoring and emergency operations);  
communication (GMDSS);  
conning (pilot) (refer also to Guidance note of [2.5.12](#));

Table 2.1.1

Tasks and means			
Tasks to be performed	Equipment to be operated	Information to be viewed	Remarks
<b>Navigation. Grounding avoidance. Route planning</b>			
Plan route prior to departure	Paper chart/table; Nautical publications; GNSS		
Alter route while under way	ECDIS*; ECDIS backup**		* Optional installation **If paper charts be replaced
<b>In transit</b>			
Monitor course-keeping:			
determine position by bearings	Pelorus/gyro repeater*/radar		* Analogue Bearings 360° around the horizon, (one on each bridge wing)
read position on display	GNSS		
plot position	Paper chart/table		
Automatic position-fixing and plotting	ECDIS		Optional installation

Tasks and means			
Tasks to be performed	Equipment to be operated	Information to be viewed	Remarks
Maintain route/alter course by:			
manual steering	Manual steering control		
using autopilot	Heading control system		
automatic route-keeping	Track control system* (ECDIS)		*Alternative to heading control. To be interfaced to ECDIS, gyro, speed, radar, when part of INS
Give sound signals	Whistle control		Fog – traffic
Receive sound signals	Sound reception system	Loudspeakers	Totally enclosed bridge
Monitor/Take action: operational warnings; system failure alarms	Alarm panel		
Ship's safety state	Alarm systems		
Monitor heading, rate-of-turn, rudder angle, propulsion parameters, speed,		Gyro repeater Indicators: rudder angle; rate-of-turn; speed through water; RPM, pitch	
Adjust lighting	Dimmer buttons		
Monitor shallow water areas	Echo sounder system	Water depth	Anchoring
Monitor performance of automatic route-keeping system		Conning info display	Indicating info to provide situation awareness when in automatic route-keeping mode
Effect internal communication	Intercom (auto telephone)		
Effect external communication	VHF		Related to navigation
Receive/send distress message	GMDSS equipment or remote control		
Traffic surveillance – Collision avoidance			
Detect floating targets; Analyse traffic situations; Observe visually	Radar with ETP* (may include AIS); Binoculars; Window wiper/heating control	Targets' relative position, course, speed; Expected passing distance; Time	*Electronic target plotting ("historical" data)
Decide on collision avoidance measures	AIS (automatic identification system)	Target true position, course, speed	Regarded additional info (means)
Manoeuvring			(For route-keeping)
Change steering mode	Steering mode switch		
Alter heading	Heading control	Heading (Gyro)	
Observe rudder angle		Rudder angle	
Override steering	Override control		
Manual steering control			
Change speed	Propulsion control	RPM/Pitch	
Give sound signals	Whistle control		
Receive sound signals	Sound reception system	Loudspeaker	Totally enclosed bridges
Navigate back to route	Paper chart/table GNSS		
Maintain track of traffic	Radar with route and navigable waters ECDIS*		*May replace paper
Harbour manoeuvring	Thruster		Optional
Anchoring			
Manoeuvre	Manual steering control Propulsion control (Thruster control.)	Heading Rudder angle RPM/Pitch	Performed at front workstations or in combination with docking station Information to be provided for pilots
Positioning (Identify anchorage position)	Radar	Water depth	
	Chart		
	GNSS		



Tasks and means			
Tasks to be performed	Equipment to be operated	Information to be viewed	Remarks
Observe ship's safety state:			
Monitor alarm conditions:	Main alarm panel W/indicators and acceptance button	Alarm list	<a href="#">Refer to 3.2</a>
Navigation alarms			
Equip. & system failures			
Operational warnings			
Machinery alarms	Alarm panel		
Cargo alarms	Alarm panel		
Fire alarm	Fire alarm panel		
Manual steering:			
Maintain, adjust, alter heading according to order	Steering control Intercom (Public address system)	Gyro repeater Magnetic comp. Rudder angle Rate-of-turn	Helmsman
<b>Ship handling</b>			
Determine & direct course and speed in relation to waters and traffic			
Monitor:			
Heading		Gyro repeater	May be digital
Rudder angle		Rudder angle	
Rate-of-turn		RoT indicator	
Propulsion		RPM/Pitch	
Speed		Speed log	
Water depth		Echo sounder display	Anchoring
Give sound signals	Whistle control button		
Effect communication	VHF		Available
<b>Safety operations</b>			
Take action on alarm condition:			
– analyse situation			
– consult plans and drawings	Manuals – Drawings – (PC)		May be computer based info
– observe ship's external operational situation			Cooperation with navigating officer
– organize and execute measures by communication	Intercom (UHF)		
– check status of ventilation system	Emergency stop		
Monitor development of alarm conditions	Alarm panel/screen		
– Cargo alarms	Alarm panel		
– Fire detection & alarms	Fire detection and alarm panel		
– Gas & smoke detection			
<i>External communication</i>			
Distress – weather – safety	GMDSS equipment		As required (Area)
Determine weather conditions			
Consider navigation warnings	Navtex receiver		
Public correspondence	Additional equipment		Specified by owners
<i>Docking operations (bridge wings)</i>			
Directing steering	<b>Intercom (Public address system)</b>	Heading Rudder angle	
Directing speed	<b>Intercom (Public address system)</b>	RPM/Pitch	
Giving sound signals	Whistle control button		
Receiving sound signals	Sound reception system	Loudspeaker	Totally enclosed bridge
Perform manoeuvring	Steering Propulsion control Thruster control		Additional installation by owners
Additional functions			<a href="#">Refer to 2.2</a>

**Guidance note.**

The workstation for monitoring may be combined with:

a workplace for navigation (route monitoring/position-fixing) when the workstation for navigation and maneuvering provides individual workplaces for traffic surveillance and navigation (chart work);

a backup workstation for navigation and a conning position when electronic chart display and information system (ECDIS) is installed, enabling navigation, traffic surveillance and maneuvering at one workplace.

**2.2.3** Additional workstations may be arranged for performance of other functions than those related to primary bridge functions when relevant.

**Guidance note.**

The main types of additional bridge workstations may be divided into two distinct categories (A and B) based on purpose and functions and whether they shall be operated by the watch officer or not.

A. Workstations for functions regarded related to operation of the ship, its engines and cargo:

- a) to be monitored and controlled by the watch officer;
- b) to be used by other personnel than the watch officer.

B. Workstations for functions not regarded essential to safe operation of the ship and to be used by other personnel than the watch officer, but located on the bridge for practical reasons.

The type of tasks to be performed at the individual workstation and the operating procedures employed may conclude whether a workstation of category A shall be of type a) or b). Workstations of category A, type a) shall not include tasks that may prevent the officer in charge of primary bridge functions to leave a workstation for additional functions instantly at any time during operations.

[Refer to 2.5.14 – 2.5.16.](#)

## **2.3 WORKING ENVIRONMENT**

**2.3.1** The bridge shall be designed and arranged with the aim of:  
preventing or minimizing excessive or unnecessary work and any condition or distraction on the bridge, which may cause fatigue or interfere with the vigilance of the bridge team and the pilot.

Internal environmental conditions on the bridge that may affect human performance are:

temperature;

humidity;

ventilation;

noise;

vibration;

illumination and type of lighting;

glare and reflection;

interior colours;

occupational safety.

**2.3.2** The enclosed bridge or wheelhouse shall be equipped with an air conditioning or ventilation system for regulation of temperature and humidity.

**Guidance note.**

It shall be possible to maintain a temperature, which is not less than 18 °C in cold climates and does not exceed 27 °C in tropical climates, and to maintain the relative air humidity in the range of 20 to 60 %, preferably maintaining 45 % humidity at 21 °C and not less than 20 % at any temperature.

**2.3.3** Ventilation system with suitable air flow velocity and rate of air circulation shall be provided. Direction of air flow from air conditioning and heating systems towards workplaces shall be avoided.

**Guidance note.**

The preferred air velocity is 0,3 m/s and shall not exceed 0,5 m/s.

The recommended rate of air circulation for enclosed spaces is 6 complete changes per hour.

**2.3.4** Excessive levels of noise interfering with voice communication, causing fatigue and degrading overall system reliability, shall be avoided.

**Guidance note.**

The sound level measured 1 m from the outlets of air distribution systems shall not exceed 55 dB(A). Noise levels produced by individual bridge equipment shall not exceed 60 dB(A) at 1 m.

**2.3.5** Vibrations when the ship is at normal transit speeds shall not affect the reading of indicators or the comfort of personnel.

**2.3.6** Lighting arranged for adjustment of illumination and direction of light shall be provided at all workplaces. The illumination brightness shall be sufficient for safe performance of the tasks and possible to dim down to zero.

**2.3.7** Lighting that may be required for continuous operations during darkness and in entrances to the bridge shall be red with adjustable brightness to suit the operations and ease visual adaptation to darkness.

**2.3.8** It shall be possible to dim equipment displays and indicators providing information to individual workstations and red lighting covering the workstation area, at the workstation in use.

**2.3.9** Light sources shall be arranged and located in a way that prevents glare, stray image and mirror effects in bridge windows and deckhead areas above workstations.

**Guidance note.**

Deckhead areas above workstations shall have a dark colour of matt, anti-gloss type minimizing light reflection. The colour of bridge bulkheads shall have a calm and matt appearance.

**2.3.10** To reduce the risk of personnel injury during bridge operations:  
the wheelhouse floor, bridge wings and upper bridge decks shall have non-slip surfaces;  
hand- or grab-rails shall be installed as required at workstations, passageways and entrances, enabling personnel to move and stand safely when the ship is rolling and pitching in heavy weather;  
chair deck rails installed at workstations shall be provided with anti-trip skirting board or be flush mounted;  
stairway openings shall be protected if not sufficiently lit or otherwise indicated during darkness.

**2.3.11** Personnel safety equipment to be stored on the bridge shall be clearly marked and easily accessible.

## **2.4 BRIDGE PASSAGEWAYS**

**2.4.1** Bridge passageways shall facilitate the expected movement of the bridge team between individual workstations, bridge entrances, exits and windows in carrying out the bridge tasks safely and effectively including the maintenance of equipment.

**2.4.2** A clear route across the wheelhouse, from bridge wing to bridge wing for two persons to pass each other, shall be provided.

**Guidance note.**

The width of the passageway shall be 1200 mm and not less than 700 mm at any single point of obstruction.

**2.4.3** The distance between separate workstation areas shall be sufficient to allow unobstructed passage for persons not working at the stations.

**Guidance note.**

The width of such passageways shall not be less than 700 mm, including persons sitting or standing at their workstations.

**2.4.4** The distance from the bridge front bulkhead, or from any console and installation placed against the front bulkhead to any console or installation placed away from the bridge front, shall be sufficient for one person to pass a stationary person.

**Guidance note.**

Where there is a passageway between the front bulkhead and front workstation consoles, its width shall preferably be 1000 mm and not be less than 800 mm. When the front workstation is placed against the front bulkhead, the guidelines of [2.4.2](#) may be applicable, or [2.4.3](#) if there is a passageway providing a clear route from bridge wing to bridge wing aft of the workstation.

**2.4.5** The distance between bridge wing consoles and bulkheads shall be as little as possible for easy operation of controls from both a position behind and beside the console giving optimum view of the ship's side and the mooring operations, but wide enough for one person to pass the console.

**Guidance note.**

The width of the passageway shall be 600 mm.

**Note.** The Panama Canal Commission (PCC) requires that a minimum of 1 meter clearance from consoles or obstructions shall be provided from the forward to aft portions of the bridge wing ends. Special requests for relaxation of this requirement may be considered on a case-by-case basis.

**2.4.6** The clear deckhead height in the wheelhouse shall take into account the installation of deckhead panels and instruments as well as the height of door openings required for easy entrance to the wheelhouse. The following clear heights for unobstructed passage shall be provided:

- .1** the clear height between the bridge deck surface covering and the underside of the deck head covering shall be at least 2250 mm;
- .2** the lower edge of deck head-mounted equipment in open areas and passageways, as well as the upper edge of door openings to bridge wings and other open deck areas shall be at least 2100 mm above the deck;
- .3** the height of entrances and doors to the wheelhouse from adjacent passageways shall not be less than 2000 mm.

## **2.5 WORKSTATION ARRANGEMENTS AND REQUIRED FIELDS OF VISION**

**2.5.1** The workstations for primary bridge functions shall be arranged to serve their functions under all operating conditions and different manning of the bridge and provide the fields of vision required for visual observations and easy cooperation between bridge personnel, promoting effective and safe bridge resource management.

**2.5.2** Workstations for navigating and maneuvering, including traffic surveillance and monitoring shall be arranged within an area spacious enough for two persons to carry out the tasks in close cooperation, but sufficiently close together to enable the watch officer to control and safely carry out all the tasks from one working area under normal operating conditions.

### **Guidance note.**

The workstation for navigating and maneuvering shall be arranged to allow an assisting officer to carry out route monitoring, which may include position-fixing and chart work, and course adjustments when ordered, while the officer in charge concentrates on traffic situations and adjustment of course and speed as required to follow the route and avoid danger of collision.

The workplaces shall be adjacent to enable easy communication and cooperation when two navigators operate the workstation, and to provide the watch officer with a workstation for safe and efficient performance of all the tasks when he is the only navigator on the bridge and is to use both the workplace for route monitoring/position-fixing and the workplace for traffic surveillance/maneuvering.

**Note.** The workplace for position-fixing and chart work is regarded a workstation for monitoring also when in use by an assisting officer and may serve as a workplace for the use of backup chart systems and for conning when ECDIS is installed at the workplace for traffic surveillance.

The table shows the relative location of workplaces based on manual position-fixing in paper charts allowing efficient performance by the single watch officer under normal operating conditions and two persons in close cooperation when the workload exceeds the capacity of the watch officer.

Position-fixing	Alarms	Traffic surveillance
Chart work	Communications	
Monitoring	Manoeuvre	

Workstation arrangement with work places for navigation and maneuvering — monitoring.

When an electronic chart system is installed, enabling route monitoring, traffic surveillance and maneuvering from one working position, the workplace for monitoring may be used by pilots for conning if located close to centre windows. Work places when arranged for the use of electronic chart system incorporating automatic position-fixing (ECDIS with backup):

Backup nav. system	Alarms	Traffic surveillance
Monitoring	Communications	Automatic pos.-fix.
Conning	Manoeuvre	

Workstation arrangement for navigation and maneuvering — monitoring — conning.

**2.5.3** Workplaces for performance of navigation, traffic surveillance and monitoring shall be arranged for working in standing as well as seated position with optimum field of vision.

**2.5.4** The field of vision from the bridge shall be provided, facilitating the tasks to be performed by the bridge team and the pilot in making full appraisal of the situation and in navigating the ship safely under all operating conditions by enabling visual observations for performance of bridge functions at the workstations specified in [2.2](#).

**2.5.5** It shall be possible to observe all objects of interest for the navigation such as ships and lighthouses, in any direction from inside the wheelhouse by providing a horizontal field of vision to the horizon of 360° within the confines of the wheelhouse.

**Guidance note.**

On a bridge with enclosed bridge wings it shall be possible to obtain the view of 360° from inside the bridge area by using two positions, one on each side of the workstation for navigation and maneuvering, not being more than 15 m apart. This guideline may also be applicable for providing the required field of vision within the confines of wheelhouses with a total breadth of more than 18 m.

**2.5.6** From the conning position and the workstation for navigating and maneuvering, the view of the sea surface forward of the bow to 10° on either side under any ballast or cargo condition shall not be obscured by more than 2 ship's lengths or 500 m, whichever is the less. Each individual blind sector shall not exceed 5°.

**2.5.7** The workstation for navigating and maneuvering and the conning position shall provide a field of vision enabling maintenance of visual traffic surveillance, extending over a forward arc of not less than 225° that is from right ahead to not less than 22,5°, abaft the beam on either side of the ship. From a workstation for monitoring, a blind sector covering the view abaft the beam on port side is accepted.

**Guidance note.**

All workstations to be used by the officer of the watch shall provide a forward field of vision of 225°. A blind sector covering the view abaft the beam on port side may be accepted for workstations to be used infrequently by the watch officer for short periods at a time and for workstations to be used by assisting officers.

**2.5.8** Workstations for monitoring, navigating and maneuvering shall provide the required fields of vision from a seated working position and shall not be located directly behind large masts, cranes etc., which obstruct the view right ahead from the workstation.

**2.5.9** A separate blind sector formed by the ship's cargo, cargo lifting equipment or another obstacle forward of (in 180° sector) the ship's wheelhouse and restricting the sea surface scanning from the workstation shall not exceed 10°. The resulting blind sector shall not exceed 20°. The sectors of unrestricted observation area between blind sectors shall be at least 5°. However, for the scanning described in [2.5.6](#) of this Appendix, each separate blind sector shall not exceed 5°.

**Guidance note.**

To help reducing the size of internal blind sector caused by bridge wing bulwarks and divisions between windows in bridge wing bulkheads, such bulwarks and bulkheads shall be located in a line of sight seen from the working position at the front workstations.

**2.5.10** The workstation for manual steering shall preferably be located on the ship's centreline and shall not interfere with the functions to be performed by the officer of the watch. The steering position shall provide a forward field of vision not less than 60° to each side. If large masts, cranes, etc. obstruct the view in front of the workstation, it shall be located some distance to starboard of the centreline, sufficiently to obtain a clear view ahead.

**2.5.11** When the workstation for manual steering is located off centre, or the bow of the ship cannot be seen from the steering position, special steering references (sighting marks) shall be installed forward of the steering position. The steering references shall be installed in line parallel to the ship's centreline for use by day and by night.

**2.5.12** The ship's side shall be visible from the bridge wing. Equipment for docking operations from the bridge wings, or a workstation console if installed, shall be located to enable visual observations required for safe maneuvering of the ship, monitoring of tug and mooring operations and shall provide a field of vision from not less than 45° on opposite bow to right astern from the working position.

*Note.* The Panama Canal Commission (PCC) requires that the conning position located at the extreme end of the bridge wings provides a clear and unobstructed view fore and aft of the vessel's side. The side hull plating at the vessel's waterline, fore and aft, shall be visible from bridge wing conning positions.

**2.5.13** The conning position shall be located close to the front centre window to provide the pilot with a commanding external view, including a view of the sea surface sufficiently close to both sides of the ship's bow for safe directing of the steering in narrow canals and buoy lanes.

**Guidance note.**

The position for the conning station may be met by the workstation for monitoring/backup navigation when located sufficiently close to the forward centre window, provided the workstation is installed in addition to a complete workstation for navigation, traffic surveillance and maneuvering and therefore not required by the ship's personnel during pilotage ([refer to Guidance notes of 2.2.2](#)).

*Notes:* 1. The Panama Canal Commission (PCC) requires that the conning position be located "directly behind and next to" the centre front window and the nearest window thereto on each side that provides a clear and unobstructed view ahead for conning during canal transit. A minimum of 1 meter clearance from consoles or obstructions shall be provided. Special requests for relaxation of this requirement may be considered on a case-by-case basis.

2. PCC requires that the conning position shall provide a view of the sea surface forward of the bow from 1,5 ship's length when at ballast load line and 1 ship's length at full load line.

**2.5.14** There shall be a close approach access to at least one front window providing the view of the area in front of the bridge superstructure.

**2.5.15** Workstations for additional functions, which shall be used by the watch officer ([refer to 2.2.2](#)), shall provide the field of vision required to maintain efficient look-out in accordance with [2.5.6](#) and enable monitoring of the ship's heading and rudder angle.

**2.5.16** The location of a workstation for additional functions regarded essential for safe operation of the ship and to be used by other personnel than the watch officer shall not in any way influence the performance of primary bridge functions.

**2.5.17** Workstations for additional functions not essential to the safe operation of the ship, its engines and cargo, or furniture arranged for meetings or relaxation inside the wheelhouse shall not be installed within the area of the navigation bridge or within fields of vision outside this area, which are required for traffic surveillance from workstations. If such workstation or furniture arrangement is installed close to these areas, the use of it shall in no way influence the performance of primary bridge functions, either by use of light, noise disturbance or visual distraction.

**Guidance note.**

[Fig. 2.5.17-1](#) shows the principles for bridge layout with front workstations arranged for operations in seated and standing position and with bridge wing bulkheads in line of sight from the working positions. A bridge area, which may be regarded outside the navigation bridge, and the sectors of required field of vision from workstations are indicated.

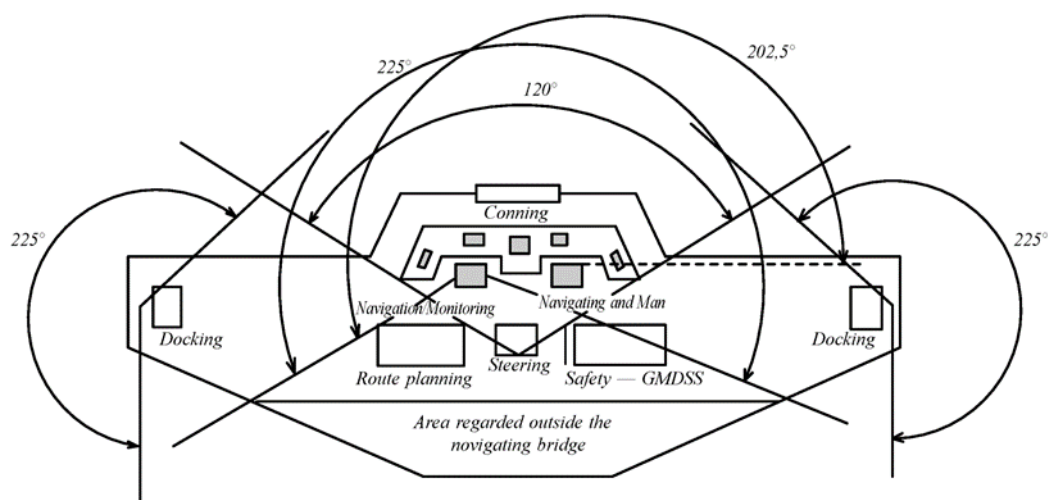


Fig. 2.5.17-1

Location of workstations and required fields of vision.

Position-fixing in paper charts – Passageway and conning position in front

Position-fixing in paper charts – passageway and conning position in front.

Note to [Fig. 2.5.17-2](#) (also valid for [Fig. 2.5.17-3](#)).



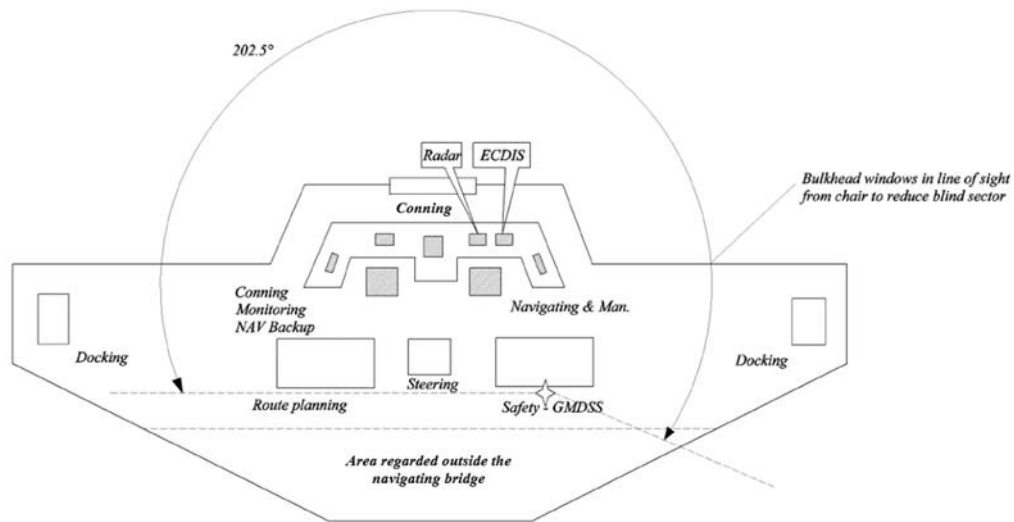


Fig. 2.5.17-2

Required field of vision from the radio station when to be controlled and infrequently used for short periods of time by the watch officer.

Navigation based on electronic chart system (ECDIS) – Conning position at console

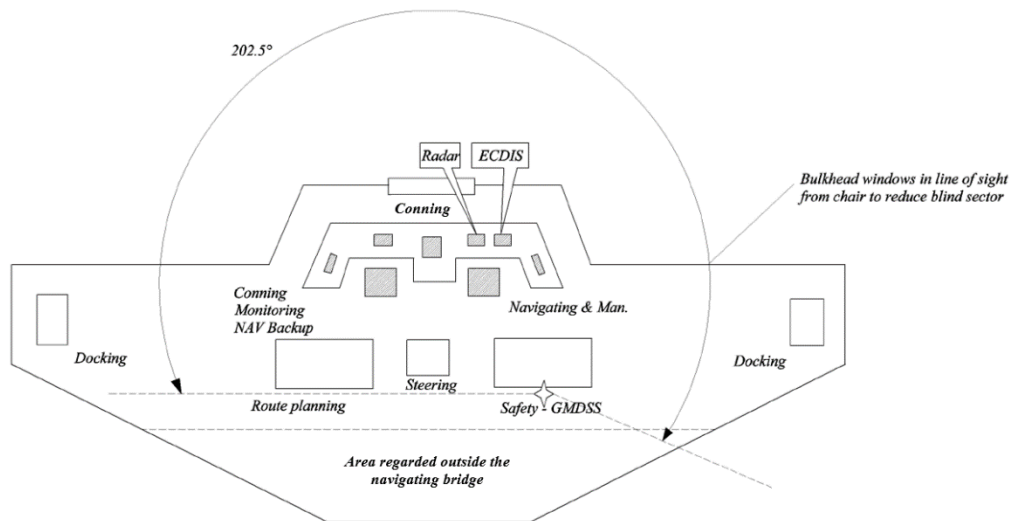


Fig. 2.5.17-2

Required field of vision from the radio station when to be controlled and infrequently used for short periods of time by the watch officer.

Navigation based on electronic chart system (ECDIS) – Conning position at console

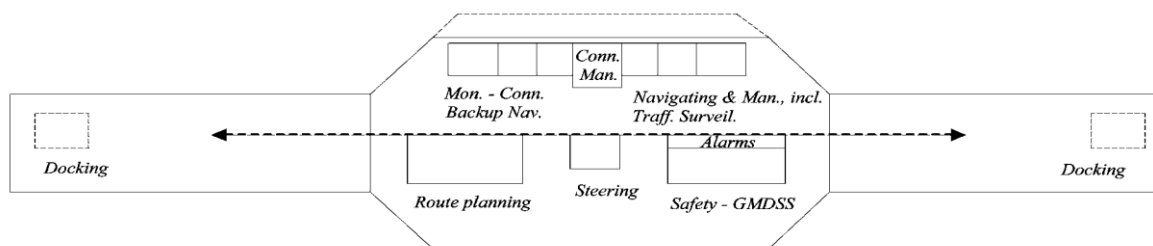


Fig. 2.5.17-3

Design principles — Flat front — Open bridge wings with passageway from door to door  
Consoles up front — Access to front window

Location of ECDIS at the workstation for navigating and maneuvering (including traffic surveillance) enables position-fixing at this position and makes the area a complete workstation (WS) for the navigation function and maneuvering. This leaves the workstation for navigation backup/monitoring available for conning when installed at the front bulkhead. Close approach access to front windows is maintained.

## 2.6 FIELDS OF VISION AND BRIDGE WINDOW ARRANGEMENT

**2.6.1** The bridge front windows shall be inclined from the vertical plane, top out, at an angle not less than  $10^\circ$  and not more than  $25^\circ$  to help avoid reflections. Polarized and tinted windows shall not be fitted.

### Guidance note.

The rear and side windows shall be inclined from the vertical plane top out, at an angle of  $4^\circ$ – $5^\circ$  to help avoid reflections. If the arrangement of light sources meet the requirement of [2.3.9](#) without inclination of the side and rear windows, inclination may not be necessary.

*Note.* Bridges designed with enclosed bridge wings: inclined side windows, which extend the maximum breadth of the ship, may not be in accordance with requirements of the Panama Canal Commission for some ship sizes.

**2.6.2** The lower and upper edge of windows shall not present an obstruction to the view forward of the bow seen from a seated as well as a standing position at the workstations for monitoring, navigating and maneuvering.

### Guidance note.

The height of the lower edge of windows above the floor surface shall not exceed 1000 mm within the required field of vision and the height of the upper edge shall be at least 2000 mm.

**2.6.3** The upper edge of the front windows shall allow a forward view of the horizon for a person with a height of eye of 1800 mm at the navigating and maneuvering workstation when the ship is pitching in heavy seas. If 1800 mm height of eye is considered unreasonable and impractical, a reduction of the height may be accepted, but not to less than 1600 mm.

### Guidance note.

A vertical angle of view of not less than  $5^\circ$  above a horizontal line from a standing eye height of 1800 mm shall be provided ([refer to Fig. 2.6.3](#)).

**2.6.4** Framing between windows shall be kept to a minimum and not be installed immediately forward of any workstation. If stiffeners between windows shall be covered, this shall not cause further obstruction of the view.

**Guidance note.**

The division between windowpanes within the required field of vision shall not exceed 150 mm. If stiffeners are used, divisions shall not exceed 100 mm in width and 120 mm in depth. The width of windowpanes within the field of vision required for traffic surveillance shall not be less than 1200 mm in order to limit the number of stiffeners.

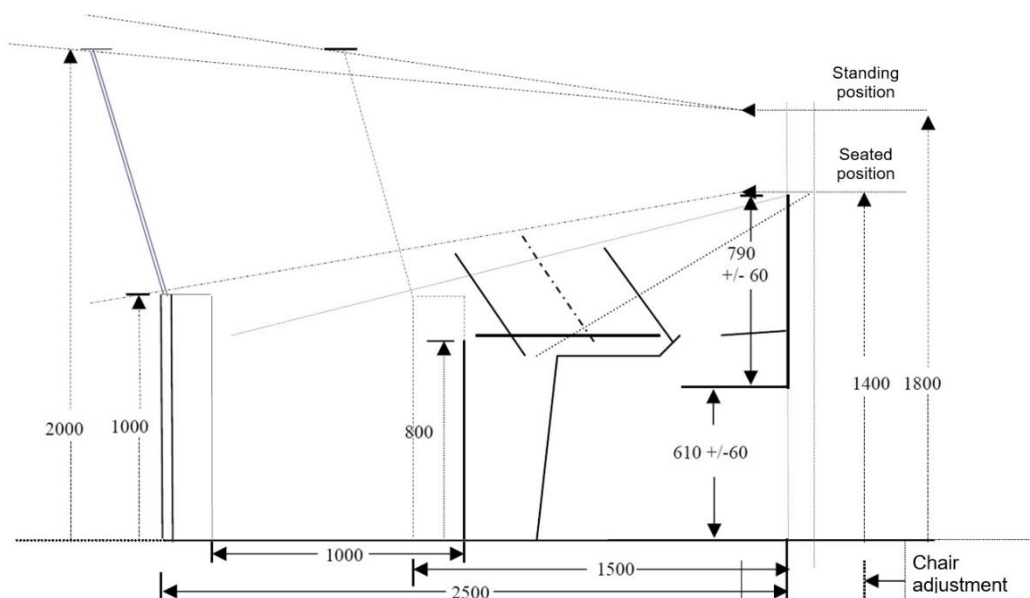


Fig. 2.6.3

With front windows at an angle of 15°, a vertical angle of view of 5° from an eye height of 1800 mm may be provided at a distance of 2600 mm from the front bulkhead, allowing for a passageway of 1000 mm in front of workstation consoles

**2.6.5** To enable visual observations through windows to be maintained under all weather conditions, all windows within the required fields of vision from the working position at workstations to be used by bridge personnel, including pilots, shall provide a clear view regardless of weather conditions.

**Guidance note.**

The following means shall be installed to provide a clear view through windows:  
 sunscreens of roller blind type;  
 heavy duty blade type wipers and fresh water window washing;  
 efficient de-icing and de-misting systems.

Technical systems installed shall comply with appropriate ISO standards (refer to ISO standard 17899). A catwalk or other means to help maintenance of window wipers and manual cleaning of bridge front windows shall be provided.

## 2.7 WORKSTATION LAYOUT, CONSOLES AND CHAIR ARRANGEMENT

**2.7.1** The configuration of workstations and consoles shall provide a workplace for rational and user-friendly placing of equipment, with the aim of:

- facilitating the tasks to be performed by the bridge team and the pilot in making full appraisal of the situation and in navigating the ship safely under all operational conditions;
- promoting effective and safe bridge resource management;
- enabling the bridge team and the pilot to have convenient and continuous access to essential information;

allowing for expeditious, continuous and effective information processing and decision-making by the bridge team and the pilot;

preventing, or minimizing, excessive or unnecessary work and any condition or distractions on the bridge, which may cause fatigue or interfere with the vigilance of the bridge team and the pilot.

**2.7.2** A functional workstation designed in accordance with the established overall operational and ergonomic requirements shall provide:

a sufficient area for performance of the tasks to be carried out by the number of people that may be required to attend consoles designed for operations at specific workplaces in standing and seated position;

enabling installation of equipment to be within reach from the working position;

avoiding obstruction of the view through bridge windows from seated position;

chairs suiting ergonomic requirements for efficient use of installed equipment and maintenance of fields of vision, if chairs shall be installed.

**2.7.3** The workstation for navigation and maneuvering shall have working positions for position-fixing, maneuvering and traffic surveillance as close as possible for efficient use by the officer of the watch, but also enabling the tasks to be performed by two navigators in close cooperation.

**Guidance note.**

The working position for operating the radar with collision avoidance functions shall be regarded the main working position at this workstation. Controls for course and speed adjustments shall be located within reach from this position to enable collision avoidance maneuvers without losing view of the traffic, and means for position-monitoring/-fixing shall be readily available.

[Figs. 2.7.3-1](#) and [2.7.3-2](#) show examples of workstation layouts designed in compliance with [2.5.2](#). If ECDIS with backup (which is optional) is not installed, the chart table shall preferably be installed closer to the radar ([refer to Fig. 2.7.3-3](#)). Alternatively, spaces may be allocated for future ECDIS installation.

May suit wheelhouses with limited depth (longitudinal distance between front and rear bulkheads).

Includes space for conning information display and machinery monitoring system.

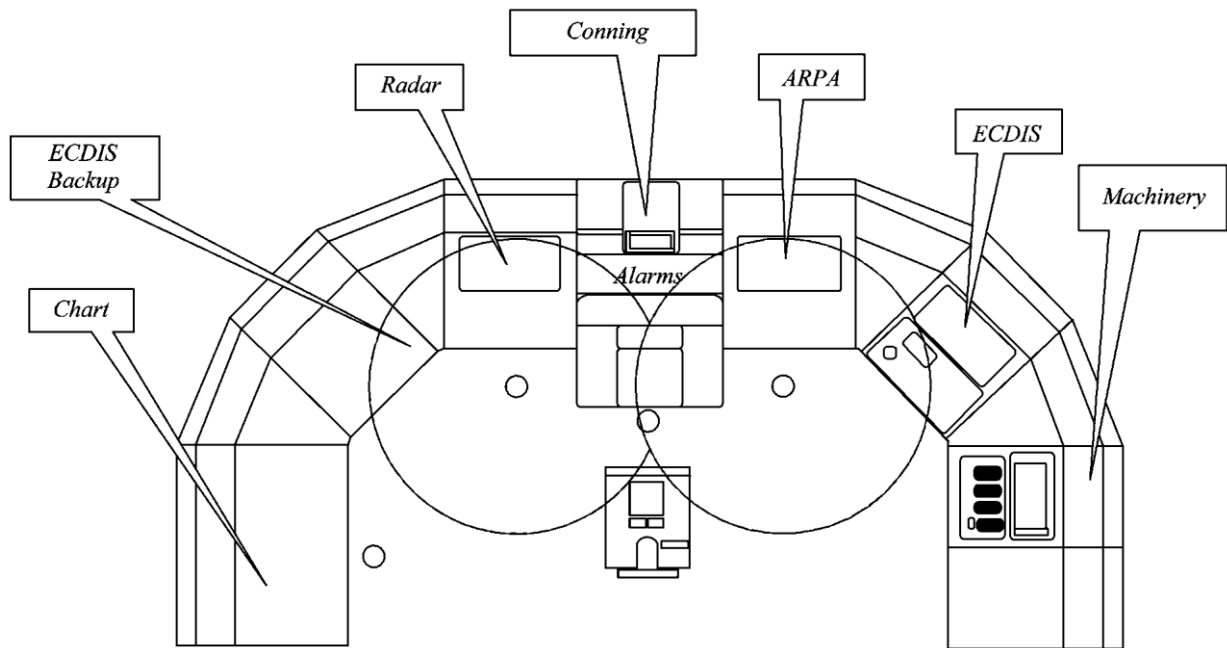


Fig. 2.7.3-1

Workstation layout which may include ECDIS with combined electronic and paper chart back up arrangement as well as conning information display monitoring of INS functions

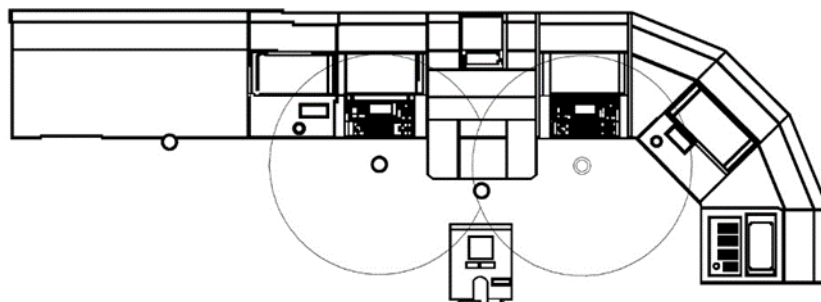


Fig. 2.7.3-2

A modified workstation configuration, based on same principles as shown in [Fig. 2.7.3-1](#).

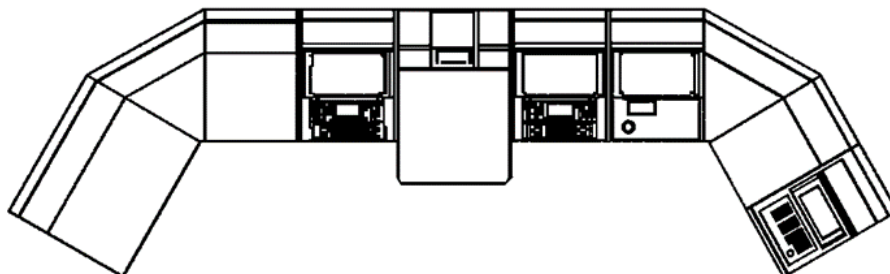


Fig. 2.7.3-3

A modified version of [Fig. 2.7.3-2](#)

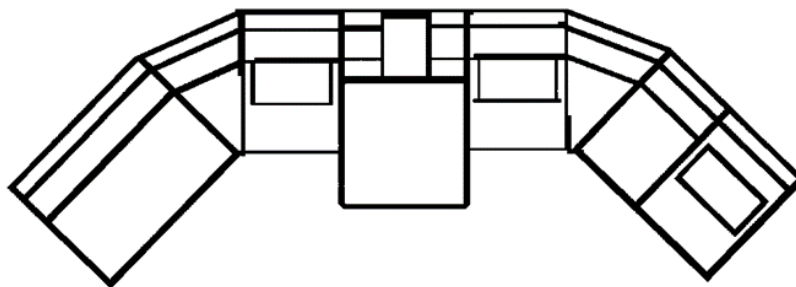


Fig. 2.7.3-4

Design principles similar to [Fig. 2.7.3-3](#), but without electronic chart installations

**2.7.4** Consoles shall principally be divided into two areas:  
 a vertical (slanting) part for location of information displays to be easily readable;  
 a horizontal part (desktop) for controls, switches and buttons to be within easy reach from the working position.

**2.7.5** The height of console desktops at the workplaces for navigation, maneuvering, traffic surveillance and monitoring shall enable easy use of equipment required for safe performance of the tasks to be performed from both standing and sitting position.

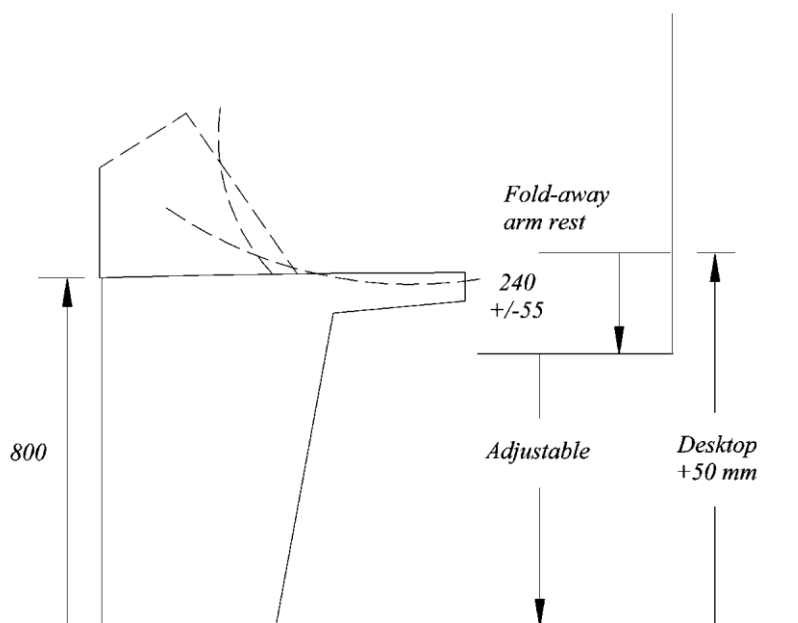


Fig. 2.7.5

**Guidance note.**

To provide a functional reach from standing position, the height of console desktops above bridge deck surface shall be 800 mm and not less than 750 mm. The sitting height is governed by the elbow height in relation to console desktop.

To provide a functional reach of equipment and easy operation of controls from sitting position the elbow height of the operator shall be preferably 50 mm higher than the console desktop and not less than the height of the desktop.

To provide the elbow height for persons of different size and build in relation to the console desktop, it shall be possible to adjust the height of the seat to allow the elbow height of 240 mm  $\pm$  55 mm above seat. It shall be possible to adjust chair armrests accordingly, if installed, and to fold the armrests away.

**2.7.6** The console in front of a seated working position shall provide sufficient leg room.

**Guidance note.**

The leg room shall have a depth of 450 mm and not less than required for a person sitting at a working position 350 mm from the console (chair backrest 440 mm from the edge of the console, requiring a leg room depth of at least 230 mm).

**2.7.7** The consoles forming the front workstations shall not be higher than required for efficient use in standing position and shall not obstruct the fields of vision over the lower edge windows in front of the workstation from sitting position.

**Guidance note.**

The console height shall not exceed 1200 mm. This console height may be accepted for installation at a distance of 350 mm or more from the window, also if it interferes with the line of sight from an eye height of 1400 mm, providing the height of the chair can be adjusted to compensate for the interference.

Note . [Refer to 2.6.3](#) for eye heights at standing position.

**2.7.8** Consoles within the required fields of vision aft of the front workstation consoles shall not obstruct the horizontal line of sight from the sitting eye height.

**Guidance note.**

The height of the consoles shall be 100 mm lower than the horizontal line of sight and shall not exceed 1300 mm.

**2.7.9** When a chair is installed at a workplace for operations in both standing and seated position, it shall be fastened to rails allowing fore and aft movement of the seat to enable easy reach of equipment when seated and sufficient room to stand in front of the console when the chair is pushed back. It shall be possible to adjust the height of the seat to suit users of different heights for optimum view and reaching distance and armrests, if provided, shall be of fold away type and preferably adjustable in height.

**Guidance note.**

The seat height of the chair shall be adjustable from 550 to 670 mm above the deck surface. The movement in fore-aft direction shall allow the front edge of the seat to be positioned at the edge of the front console and to allow a free space of at least 700 mm between the chair and console when moved in aft direction. Armrests shall preferably be adjustable from 185 and 295 mm above the seat, if installed.

### **3 DESIGN AND ARRANGEMENT OF NAVIGATIONAL SYSTEMS AND EQUIPMENT**

#### **3.1 DESIGN AND QUALITY OF NAVIGATIONAL SYSTEMS AND EQUIPMENT**

**3.1.1** Navigational systems and equipment shall be of approved type and comply with the applicable international requirements and requirements of the Register Rules.

*Note.* The basic design of navigational systems and equipment required to be carried is governed by functional and technical requirements as well as ergonomic and human-machine interface criteria expressed in individual IMO performance standards.

The quality of the human engineering part of the design of equipment and alarm functions shall be determined in performance tests and trials carried out during the approval process.

Alteration of hardware and software of type approved equipment requires review of the documentation by the type approving authority and may include re-testing to a certain extent, depending on the type of changes.

**3.1.2** Navigational equipment and systems offering alternative modes of operation shall indicate the actual mode in use.

**3.1.3** The system architecture of an integrated system shall include means providing situation awareness by indication of operational status of automated functions and the individual equipment.

**3.1.4** In case of failure in one part of an integrated navigation system, it shall be possible to operate every other individual item of equipment or part of the system separately.

#### **3.2 BRIDGE ALARM MANAGEMENT**

**3.2.1** An alarm system shall be provided, indicating any fault requiring attention and shall:

- activate an audible and visual alarm on the navigation bridge for any situation, which requires action by, or attention of the officer of the watch;

- as far as practicable be designed on the self-monitoring principle.

The bridge alarm system shall be designed with the overall aim of:

- minimizing the risk of human error and detecting such error, if it occurs, through monitoring and alarm systems, in time for the bridge team and the pilot to take appropriate action.

The overall aim includes the aim of:

- enabling the officer on watch to devote full attention to the safe navigation of the ship
- enabling immediate identification of any abnormal situation requiring action to maintain safe navigation of the ship;

- avoiding distraction by alarms, which require attention but have no direct influence on the safe navigation of the ship and which do not require immediate action to restore or maintain the safe navigation of the ship.

Alarms and indicators on the navigation bridge shall be minimized and only alarms and indicators required by appropriate documents shall be placed on the navigation bridge, unless permitted by the flag administration (refer to IMO resolution A.830(19)).

**3.2.2** A method of accepting all alarms on the bridge (both the source of alarm and alarms of other equipment caused by the loss of sensor input) shall be provided at the navigating and maneuvering workstation to avoid distraction. The system shall enable immediate identification of the alarm sources without requiring any operator action and enable immediate silencing of the alarms by single operator action.



**Guidance note.**

A bridge management system shall include grouping of alarms and indicators, separating alarms that affect safety of navigation and alarms that do not influence safety of navigation.

The group of alarms related to safety of navigation shall incorporate all system alarms, equipment alarms and operational warnings that are critical to safety of navigation, including the detection of:

- operator disability;
- danger of collision heading;
- heading deviations;
- deviations from the route;
- danger of grounding;
- propulsion failure;
- steering gear failure.

Essential equipment and systems to be incorporated in such an alarm system shall include:

- bridge watch monitoring system;
- heading information system;
- heading/track control system;
- position-fixing systems;
- electronic chart system, if installed;
- radar with electronic target plotting functions;
- relevant machinery alarms for early warning.

All groups of bridge alarms and warnings shall be centralized in a common panel or screen at the workstation for navigation and maneuvering.

**3.2.3** Acknowledgement of an alarm at either the instrument or an alarm panel shall cancel the audible warning at both sources and change the visual alarm from flashing to constant light.

**3.2.4** Permanently inhibiting individual alarms shall not be possible, but manual suppression of local audible alarms may be accepted when this is clearly and constantly indicated at the equipment and the unit is part of the alarm management system.

**Guidance note.**

Local audible alarms may be manually suppressed by means of an on/off switch located on or close to the equipment or by other means, e.g. electronically. The off-position shall enable suppression of the audible alarm when the equipment is part of a central alarm system and the on-position shall engage the local alarm when the equipment serves as a stand-alone unit.

**3.2.5** If an alarm channel in a computer-based system is inhibited manually, then this shall be clearly indicated by a visual signal.

**3.2.6** Audible alarms shall be maintained until they are accepted and the visual identification of individual alarms shall remain until the fault has been corrected.

**3.2.7** Alarm indications shall be red, or if on displays, red or otherwise highlighted. If alarm messages are displayed on colour VDUs, the alarm status shall remain visible in the event of the failure of one colour of the display system.

**Guidance note.**

The following method of indication shall be applied:

- .1** active alarm status:  
red, blinking and audible;
- .2** active alarm status acknowledged:  
red, static (canceling the audible alarm);
- .3** active warning message – not critical:  
yellow, static (may be accompanied by a short audible attention signal);
- .4** normal condition:  
no light (indication of a safe situation).

**3.2.8** The alarm system shall be able to indicate more than one fault at the same time, and the acknowledgement of any alarm shall not inhibit another alarm, meaning that if an alarm has been acknowledged and a second fault occurs before the first is rectified, the audible and visual alarms shall operate again.

**3.2.9** A new alarm condition shall be clearly distinguishable from those existing and already acknowledged by indicating new alarms by a flashing light, and existing and accepted alarms by a constant light.

**Guidance note.**

In colour graphic systems, it shall not be possible to distinguish between the status of alarms and warnings by means of colour only.

**3.2.10** Provisions shall be made for functional testing of required alarms and indicators.

**3.2.11** The alarm system shall be continuously powered and shall have an automatic changeover to stand-by power supply in case of loss of normal power supply.

**3.2.12** Failure of the normal or backup power supply of the alarm system shall be indicated by an alarm.

**3.2.13** Loss of system communication shall be indicated by an alarm.

### 3.3 ARRANGEMENT OF NAVIGATIONAL SYSTEMS AND EQUIPMENT

**3.3.1** The type and number of navigational systems and equipment to be carried shall at least incorporate the items specified in the present Part of the Recommendations, and shall be installed at the various workstations with the aim of:

facilitating the tasks to be performed by the bridge team and the pilot in making full appraisal of the situation and in navigating the ship safely under all operational conditions;

enabling the bridge team and the pilot to have convenient and continuous access to essential information that is presented in a clear and unambiguous manner, using standardized symbols and coding systems for controls and displays;

indicating the operational status of automated functions and integrated components, systems and/or sub-systems;

minimizing the risk of human error and detecting such error if it occurs through monitoring and alarm systems, in time for the bridge team and the pilot to take appropriate action.

The relative location of individual equipment and their placement in relation to the distance from the working position of the user are governed by:

type and range of equipment to be installed ([refer to Guidance note of 3.3.2](#));

equipment relationship with tasks to be performed at the various workstations (refer to Guidance note of [2.1](#) and [3.3.1](#));

importance of equipment functions and frequency of use ([refer to 2.1](#));

workstation and console configurations ([refer to 2.7](#));

size of equipment and space available for installation (case by case).

**3.3.2** All information, controls, facilities and fields of vision required to carry out each of the tasks safely and efficiently shall be provided at the corresponding workstations.

**Guidance note.**

[Table 3.3.2](#) specifies minimum carriage requirements for ships of different tonnage, the tasks or the purpose the equipment shall serve and the type of workstation (WS), at which the equipment shall be used and shall be installed. Refer also to [Table 2.1.1](#) specifying equipment in relation to functions and tasks.

**3.3.2.1** Installation of voyage data recorder (VDR).

To assist in casualty investigations, ships, when engaged on international voyages shall be fitted with a voyage data recorder (VDR).

**3.3.3** Other means than those specified in [3.3.1](#) may be permitted, provided they serve the same functions and are approved.

**3.3.4** The location of equipment at the workplaces for navigation, maneuvering, traffic surveillance and monitoring shall enable:

- easy use of all controls, switches and buttons from standing position;
- easy use of primary means for route monitoring;
- traffic surveillance;
- heading and speed adjustments;
- internal and external communication, including ship's whistle;
- change of steering mode, from seated position.

Work in paper charts and maneuvering requiring the use of lateral thrusters may be performed in standing position only, but controls for thruster systems shall be grouped with controls for propulsion and manual steering.

**Guidance note.**

The position for operation of radars and the position at the centre console for harbour maneuvers are regarded the main working positions at the workstation for navigation and maneuvering. [Figure 3.3.4](#) indicates location of main categories of equipment that shall be within reach from the front workstation comprising three workplaces. Examples of location of primary equipment are shown in [Annex 2](#).

Table 3.3.2

Workstation for navigating and manoeuvring				
Main functions: Position surveillance, traffic surveillance, course alterations and speed changes				
Equipment and means				
Task/Purpose	Equipment	Indicators	Related equipm.	Remarks
Other means				
Applicable for all ships				
Check heading	Standard magnetic compass <sup>1</sup>			<sup>1</sup> Readable from WS for manual steering
Take optical bearings	Pelorus Means of correcting heading and bearing to true		Magnetic compass	Arc of 360°
Positioning	GNSS			
– manual	Paper charts Chart table			<sup>1</sup> Optional chart system
– electronic <sup>1</sup>	ECDIS w/backup arr. <sup>1</sup>			
Surveillance by hearing	Sound reception system	Sound direction		All ships w/totally enclosed bridge
Communicate heading <sup>1</sup>				<sup>1</sup> To emergency steering position
– manual	Telephone			<sup>2</sup> Optional Gyro repeater (located in steering gear comp.)
– automatic <sup>2</sup>			<sup>2</sup> Main gyro (optional)	
Applicable for ships ≥ 150gr.t				
Spare compass	Interchangeable with standard magnetic compass			Stored in bridge area Gyro compass also connected to emergency source of electrical power may be accepted
Communicate ship/shore	Signaling lamp			Readily available
Applicable for ships ≥ 300gr.t.				
Traffic surveillance	Radar with electronic plotting aid (EPA)			9 GHz
Navigation	Echo sounding device			
Check keel clearance	Speed & distance measuring device			Speed through the water
Check speed & distance	Transmitting heading device <sup>2</sup>			<sup>1</sup> Trans. to Radar/EPA and AIS <sup>2</sup> Gyro required for ships >500 gr.t.
Transmitting heading <sup>1</sup>	AIS			
Ship identification, tracking	VHF telephone			
External communication				

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<b>Workstation for navigating and manoeuvring</b>				
Main functions: Position surveillance, traffic surveillance, course alterations and speed changes				
Equipment and means				
<i><b>Task/Purpose</b></i>	<i><b>Equipment</b></i>	<i><b>Indicators</b></i>	<i><b>Related equipm.</b></i>	<i><b>Remarks</b></i>
<b>Applicable for ships ≥ 500gr.t.</b>				
Determine heading Transmitting heading <sup>2</sup>	Gyro compass	Gyro heading repeater		<sup>1</sup> Also available to WS for monitoring <sup>2</sup> Trans. to Radar/ATA and AIS
Take bearings – arc 360°		2 gyro bearing repeaters <sup>1</sup>	Main gyro	<sup>1</sup> Location bridge wings
Supply heading info to emergency steering pos.		Gyro heading repeater <sup>1</sup>	Main gyro	<sup>1</sup> Located at emerg. steering position
Manoeuvring – rudder angle		Rudder angle		Readable also from WSs for monitoring + manual steering
– RPM		RPM/(Pitch)		Readable also from WS for monitoring
– thruster force + direction		Thruster settings		
–operational mode		Actual mode of use		When equipment offers diff. modes
Traffic surveillance	ATA <sup>1</sup>		Radar	<sup>1</sup> Replaces EPA
<b>Applicable for ships ≥ 3000gr.t.</b>				
Traffic surveillance Navigation	Radar with ATA			3GHz or 9GHz (Add a second radar with ATA)
<b>Applicable for ships &gt;10000gr.t.</b>				
Traffic surveillance	Automatic radar plotting aid (ARPA) <sup>1</sup>		Radar	<sup>1</sup> Replaces one ATA
Automatic steering	Heading or track control system			
<b>Applicable for ships ≥ 50000gr.t.</b>				
Monitor ship's turn		Rate-of-turn		To be read from WS for monitoring + manual steering
Measure speed & dist. forward + athwartship	2-axis speed log			Over ground

<b>Workstation for navigating and manoeuvring</b>				
Internal com.	Auto telephone.			
External com.	VHF telephone			
Monitor alarms and warnings	Alarm panel			Enabling accept of alarms and warnings
Accept watch alarms	Alarm accept button			Watch monitoring

<b>Workstation for monitoring</b>				
Main functions: Observation of bridge operations and surrounding environment – Assisting OOW				
Equipment and means				
<i><b>Task/Purpose</b></i>	<i><b>Equipment</b></i>	<i><b>Indicators</b></i>	<i><b>Related equip.</b></i>	<i><b>Remarks</b></i>
Monitor Steering		Gyro repeater Rudder angle Rate-of-turn	Main gyro	See WS for navigation and manoeuvring
Monitor Speed		Speed RPM main engine	Speed log	See WS for nav./man. Pitch if relevant
Monitor time		Clock		
Give sound signals	Whistle control			
Accept watch alarms	Alarm accept button			Watch monitoring
Internal com.	Telephone			
External com.	VHF telephone			
Monitoring environment	Ctrls. for window wipers, washing & heating Binoculars			

Workstation for Manual steering				
Main functions: Steering in accordance with compass heading and visual marks				
Equipment and means				
Task/Purpose	Equipment	Indicators	Related equip.	Remarks
Operating steering device	Wheel – tiller			
Monitoring compass heading		Compass heading Gyro repeater	Magnetic compass Main gyro	
Communicate bridge wings	Hands free talk-back telephone			

Workstation for Docking				
Main functions: Conning, course alterations, speed changes, mooring operations				
Equipment and means				
Task/Purpose	Equipment	Indicators	Related equip.	Remarks
Determine manoeuvring				
– Heading		Gyro repeater	Main gyro	
– Speed		Speed	Speed log	
– Steering		Rudder angle		
– Propulsion		RPM		
		Pitch if relevant		
Manoeuvring operations	Main engine control <sup>1</sup>			<sup>1</sup> If installed
	Steering control <sup>1</sup>			
	Thruster control <sup>1</sup>			
Monitor external conditions		Wind speed & direction*		* Optional installation
Communicate wheelhouse	Handsfree talk-back telephone			
Communicate tugs/pilot boats	VHF (point)			

Workstation for planning and documentation				
Main functions: Route planning – documenting ship operations				
Equipment and means				
Task/Purpose	Equipment	Indicators	Related equip.	Remarks
Route planning	GNSS Paper chart Chart table			
	Electronic chart			Optional

Workstation for Safety operations				
Main functions: Monitor safety state – Execute relevant measures – Organise operations				
Equipment and means				
Task/Purpose	Equipment	Indicators	Related equip.	Remarks
Display alarm conditions		Remaining alarm indicators not available at WS for navigation/man.		Include acknowledgement of fire and emergency alarms
Provide information + other means for safety management	Remaining safety controls not available at WS for nav./man. Internal telephone			Info about ship's safety systems and contingency plan to be available at the WS

Workstation for Radio communication				
Main functions: GMDSS – Public correspondence				
Equipment and means				
Task/Purpose	Equipment	Indicators	Related equip.	Remarks
GMDSS	To be specified in relation to trading area			
Public correspondence				

Conning station (pilot)				
Main functions: External and internal observations for determination of safe course and speed				
Equipment and means				
Task/Purpose	Equipment	Indicators	Related equip.	Remarks
Observe waters, navigational aids and traffic	Binoculars			Access to radar
Observe own ship's heading and steering, speed and propulsion		Gyro repeater Rudder angle Speed RPM/Pitch if relevant		
Effect sound signals	Whistle button			
Communicate other ships	VHF telephone			Easy access from working position

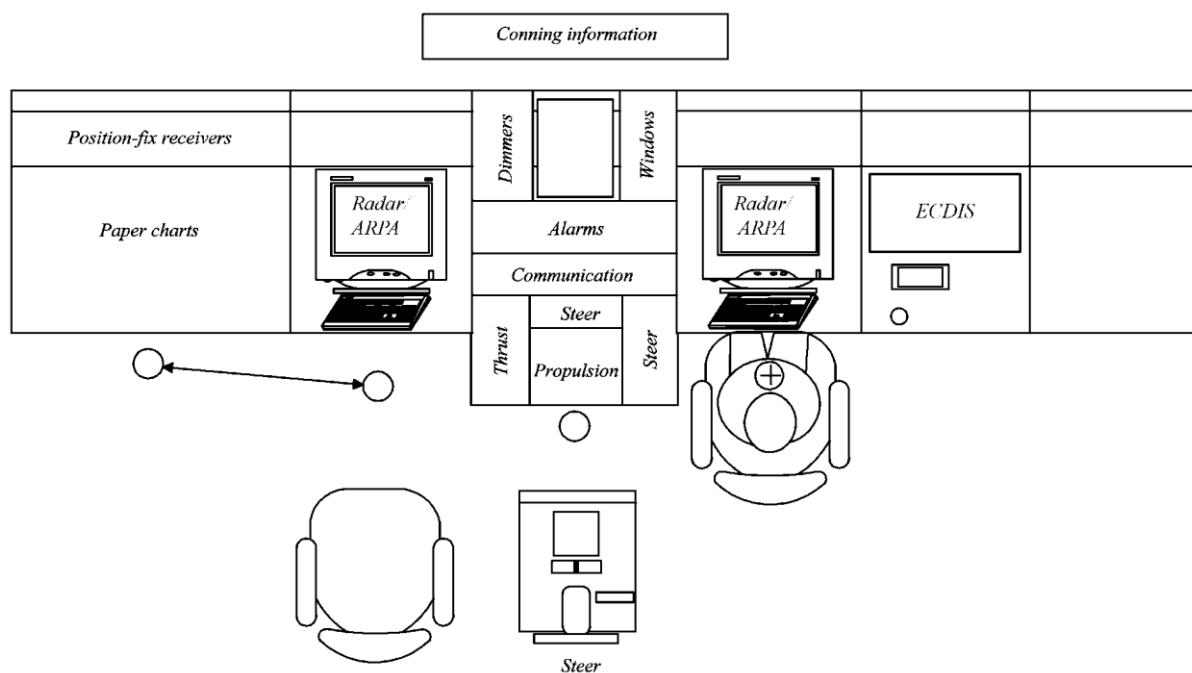


Fig. 3.3.4

Example of principle location of main equipment in a center console, which includes manoeuvring functions

## 4 BRIDGE PROCEDURES

### 4.1 BRIDGE TEAM MANAGEMENT

**4.1.1** Navigation bridges complying with this standard have been designed and arranged with the aim of:

facilitating the tasks to be performed by the bridge team and the pilot in making full appraisal of the situation and in navigating the ship safely under all operational conditions; promoting effective and safe bridge resource management.

**4.1.2** Procedures shall be established enabling safe operations under all operational conditions by the manning required to master situations that may appear. Such procedures shall be defined in the company and ship specific bridge procedures manual and shall take account of the requirements of the ISM and STCW Codes and include manning requirements, responsibilities and training requirements for all normal and abnormal modes of operation.

**Guidance note.**

The bridge workstations are arranged to suit the distribution of functions and tasks at different operating conditions by manning the relevant workstations when required, as indicated in the table.

The workplace for traffic surveillance and maneuvering together with the workstation for safety operations and communication form an operational and emergency control centre wherefrom two persons can control the ship and handle emergency events in close cooperation.

Table 4.1.2

Examples of workstations in use during different operational conditions					
Operational conditions	Waters				
	Ocean areas Coastal water	Narrow waters	Pilot waters		Harbours
			General	Confined	
Normal	W1	W1+W2	W1+W2*	W1+(W3)+W8	W1+W3+W4
Irregular	W1+W2	W1+W2+W3	W1+W2*+W3	W1+W2+W3+W8	W1+W2+W3
Abnormal	W1+W2+W3	W1+W2+W3+W8	W1+W2+W3+W8	W1+W2+W3+W8	W1+W2+W3+W4
Emergency	W1+(W3)+W6+W7	W1+(W3)+W6+W7	W1+(W3)+W8+W6+W7	W1+(W3)+W8+W6+W7	W1+(W3)+W4+W6+W7
*When used by the pilot Symbols: WS = workstation W1 : WS for navigating, manoeuvring (+ traffic surveillance) W2 : WS for monitoring/conning W3 : WS for manual steering W4 : WS for docking W5 : WS for planning W6 : WS for safety operations W7 : WS for communication W8 : conning station.					

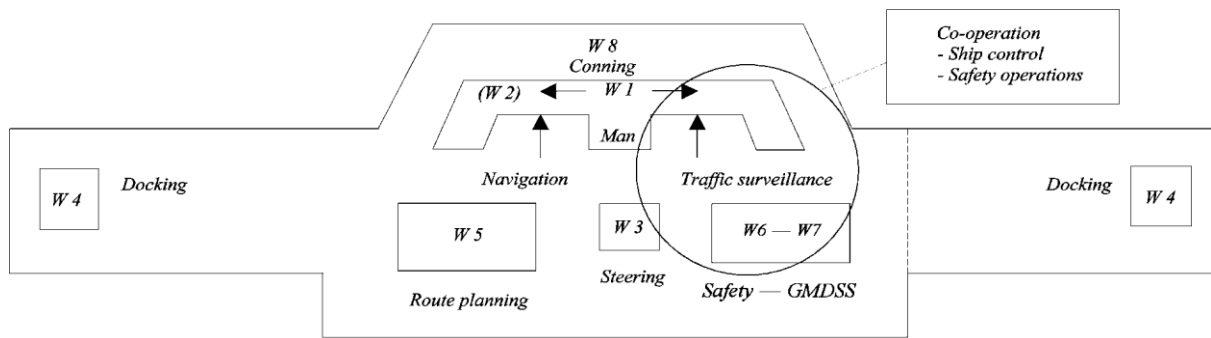


Fig. 4.1.2  
Design principles – Location of workstations  
Enabling efficient bridge team management during different operating conditions

## 4.2 OTHER BRIDGE PROCEDURES

**4.2.1** The following routines shall be included and emphasized in the regular bridge procedures:

- use of heading and/or track control systems;
- testing of manual steering system after prolonged use of automatic steering system;
- operation of steering gear;
- updating of nautical charts and nautical publications;
- recording of navigational activities.



## ANALYSIS AND DETAILS OF THE AIMS OF BRIDGE DESIGN AND EQUIPMENT ARRANGEMENT

### INTRODUCTION

The present Annex contains the details and analysis of aims of the bridge design and equipment arrangement with respect to SOLAS regulation V/15 and its interface with other documents and applicable SOLAS regulations V/19, V/22, V/24, V/25, V/27, V/28), which ensures the achievement of a common understanding of the requirements and approach to their realization.

#### **AIM 15.1**

Facilitating the tasks (.1) to be performed by the bridge team and the pilot (.2) in making full appraisal of the situation and in navigating the ship safely under all operational conditions (.3).

##### **.1 Overall tasks to be performed:**

route planning;  
navigation;  
traffic surveillance;  
maneuvering;  
docking;  
manual steering;  
conning;  
safety operations;  
internal and external communication related to the tasks to be performed;  
pilotage.

**.2 Basic tasks performed by the bridge team (based on minimum equipment carriage requirements and regular manning):**

##### *watch officer:*

navigation – position-fixing by:  
optical system;  
radar system;  
reading from display;  
plotting ship's position;  
visual observations;  
adjust ship's heading to follow route;  
traffic surveillance;  
visual look-out;  
monitor radar/ARPA;  
maneuvering;  
adjust ship's heading and speed in relation to traffic;  
external and internal communication related to safety in bridge operation;

##### *rating, assisting the watch officer:*

visual look-out;

##### *navigator, assisting the watch officer (or watch officer assisting the captain):*

navigation – route monitoring;

position-fixing;

plotting ship's position;

adjust course;

monitor the waters;

*rating, relieving the automatic heading control:*

manual steering;

*pilot assisting in safe navigation:*

conning and determination of heading and speed.

**.3** Operational conditions and situations:

normal condition:

when all shipboard systems and equipment related to primary bridge functions operate within design limits, and weather conditions or traffic do not cause excessive operator workloads;

irregular condition:

when external conditions cause excessive operator workloads requiring professional assistance on the bridge;

abnormal condition:

when internal technical system failures require operation of basic back-up systems or when they occur during an irregular operating condition, or when the officer of the watch becomes unfit to perform his duties and has not yet been replaced by another qualified officer;

emergency situation:

when failure of internal ship systems not affecting the ability of navigation or maneuvering, or fire incidents occur, which need to be controlled and managed from the bridge;

distress situations:

when the ship has lost its navigating or maneuvering capability.

**.3.1** Example of bridge team composition under different operational conditions.

Reference, which may be used for design purposes\*:

normal: watch officer – night: + rating;

irregular: watch officer + assisting navigator (+ rating);

abnormal: captain + watch officer + look-out (+ helmsman);

emergency: captain + watch officer + assisting navigator + look-out (+ helmsman) (+ chief engineer/chief officer).

\*A pilot may be included in any of the above manning examples.

### **AIM 15.2**

Promoting effective and safe bridge resource management (.1).

**.1** Factors promoting safe resource management:

organized distribution of tasks and responsibilities;

functional workplace arrangement suiting different operating conditions, task;

distribution and task performance;

procedures for safe operations.

### **AIM 15.3**

Enabling the bridge team and the pilot to have convenient and continuous access to essential information (.1), which is presented in a clear and unambiguous manner, using standardized symbols and coding systems for controls and displays (.2).

**.1** Essential information (and controls) required by the bridge team.

The information and controls required as well as what is to be regarded essential are linked to the type and importance of tasks to be carried out by the individual members of the bridge team and the pilot.

The table showing task and means, which is included in [2.1](#), identifies the essential information required. Easy access to information may be provided by outfitting and placing the workstations for efficient task performance by members of the bridge team, in accordance with the content of [3.3](#).

**.2 Presentation of information and standardization.**

Requirements addressing presentation of information and coding of systems for controls and displays for equipment required to be carried are regulated by IMO performance standards and IEC test standards.

**AIM 15.4**

Indicating the operational status (.4) of automated functions (.1) and integrated components (.2), systems and/or sub-systems (.3).

**.1 Relevant automated functions:**

steering a set course;  
plotting ship's position in an electronic chart system;  
steering along a planned route governed by ship's position;  
adjusting the speed according to ship's position and preset values;  
maneuvering operations (semi-automatic/joystick).

**.2 Relevant integrated components:**

heading control unit;  
satellite positioning-fixing unit (GNSS and GPS);  
electronic chart display unit (ECDIS);  
radar display unit;  
track control unit;  
speed control unit.

**.3 Relevant systems:**

track control system;  
integrated navigation systems (INS), including grounding avoidance system for automatic routekeeping.

**.4** Indicating the operational status (of automated functions and integrated components, systems and/or sub-systems).

Indication of operational status is provided by:

supplying continuous information of relevant system activities related to the ship's course, speed, propulsion, steering and operating mode on one individual display;  
enabling continuous visual observation of key values;  
enabling the checking of the functioning of system elements and operational performance;  
enabling early detection of deviations from planned operations and system specifications.

Categories of indications that may be included:

*normal operations:*

available components in the total system configuration;  
configuration in use;  
activity status of individual components in use;  
second mode of operation at system failure, preferably based on system failure;  
mode, effect and criticality analysis (FMEAC);

*early warning:*

reduced accuracy;  
reduced reliability of integrated system performance;  
reduced reliability of propulsion and steering system;

*alarm conditions:*

equipment malfunction;  
system failure;  
display freeze;

*operational warnings:*

danger of collision;  
danger of grounding;  
weather conditions.

**AIM 15.5**

Allowing for expeditious, continuous and effective information processing and decision-making (.1) by the bridge team and the pilot.

**.1** Conditions allowing effective information processing and decision-making:

when all information required for evaluation and decision-making is clearly presented and available at the location where action shall be taken on the decision made, including appropriate feedback on actions and updated information for continuous consideration;

when information and equipment for performance of functions to be carried out by different members of the bridge team are arranged at specific workstations located for close co-operation.

**AIM 15.6**

Preventing or minimizing excessive or unnecessary work and any conditions or distractions on the bridge, which may cause fatigue or interfere with the vigilance of the bridge team and the pilot (.1).

**.1** Conditions that may interfere with the vigilance of the bridge team.

Such conditions include:

poor working environment;

location of workstations for additional functions too close to navigation area;

location of information needed for decision-making, which is wide spread;

lack of harmonization of workplace functionality;

unauthorized persons on the navigation bridge;

high workloads.

**AIM 15.7**

Minimizing the risk of human error and detecting such error if it occurs (.1), through monitoring and alarm systems (.2), in time for the bridge team and the pilot to take appropriate action (.3).

**.1** Factors imperative for minimizing human error.

*Workplace related:*

workplace functionality;

information availability;

system reliability;

human-machine interface;

system architecture of automation systems based on fail-to-safe philosophy with simple and reliable second mode of operations.

*Human related:*

competence;

attitude;

complacency.

*Operational:*

manning;

working routines;

bridge team management.

*Detectable during operations:*

inappropriate performance.

**.2** Monitoring and alarm systems.

Systems and methods enabling detection of human error and timely warning for appropriate action include:

monitoring and alarm transfer systems, monitoring personal activity and lack of response on operational warnings and alarm conditions related to safety of navigation and the ship's safety systems, and transferring unacknowledged warnings and alarms to qualified person.

**.3** In time for appropriate action.

Conditions affecting the time for appropriate action:

*Operational warnings:*

time to danger of collision and grounding (distance/speed);  
time to be allowed for required action.

*Equipment and system failure alarms:*

failure mode and effect;  
size of navigating area.

## EXAMPLES OF ARRANGEMENT OF BRIDGE MAIN EQUIPMENT

Table of tasks and related means for safe operations

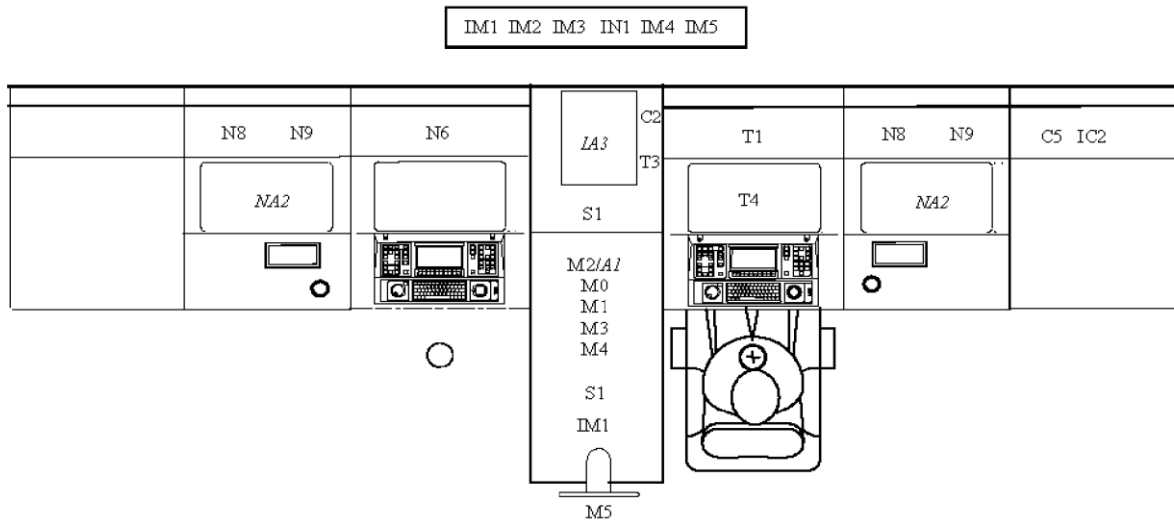
Tasks and Means – Location					
Function/Tasks to be performed	Equipment to be operated	L	Information to be viewed	L	Remarks
Navigation – Grounding avoidance					L = Reference for location in console
Planning					
Plan route prior to departure	Paper chart/table Nautical publications	N1			
Alter route while under way	DGPS	N2	GPS Position		
	ECDIS*	N3			* Optional install.
	ECDIS backup**	N4			**If replacing paper
In Transit					
Monitor route-keeping:					*Analog.
– Determine position by bearings	Pelorus/gyro repeater*	N5			Bearings 360° around the horizon, (one on each bridge wing)
– Read position on display	Radar	N6			
– Plot position	DGPS	N2			
– Plot position	Paper chart/table	N1			
– Determine and plot position automatic	ECDIS	N3			Optional installation
Maintain route/alter course by					*Alternative to head Ctrl. Interfaced to ECDIS, gyro, speed, radar when part of INS
– manual steering	Manual steering ctrl.	M1			
– using autopilot	Heading ctrl. system	M2			
– automatic route-keeping	Track ctrl. system* (ECDIS)	M2A* NA2			
Give sound signals	Whistle ctrl.	C1			Fog – traffic
Receive sound signals	Sound reception syst.	C2	Loudspeakers		Enclosed bridge
Monitor/Take action:					
– operational warnings	Alarm panel	S1			
– system failure alarms					
– ship's safety state	Alarm systems	S2			
Monitor heading, turn, rudder angle, speed, propulsion			Gyro repeater	IM1	
			Indicators:		
			– rudder angle	IM2	
			– rate-of-turn	IM3	
			– RPM, Pitch	IM4	
			– speed log	M5	
Adjust lighting	Dimmer buttons	L1			
Monitor shallow water areas	Echo Sounder system	N10	Water depth	IN1	(Anchoring)
Monitor performance automatic route-keeping system			Conning info display	IA3	Organizing indicator info providing situation awareness when in automatic route-keeping mode
Effect internal communication	Intercom (auto tlph.)	C3			
Effect external comm.	VHF	C4			Related to nav.
Receive/send distress message	GMDSS remote ctrl.	C5			
Traffic surveillance – Collision avoidance		T			

Tasks and Means – Location					
Function/Tasks to be performed	Equipment to be operated	L	Information to be viewed	L	Remarks
Detect floating targets Analyse traffic situations Observe visually	Radar with ETP* (may incl. AIS) Binoculars Window wiper -cleaning-heating ctrl.	T1	Targets relative position, course, speed Expected passing distance Time		*Electronic target plotting ("historical" data)
Decide on collision avoidance measures	AIS (automatic identification system)	T2	Target true position, course, speed		Regarded additional info (means)
Manoeuvring		M			(For route-keeping)
Change steering mode	Steering mode switch	M0			
Alter heading	Heading ctrl.	M2	Heading (Gyro)	IM1	
Observe rudder angle			Rudder angle	IM2	
Override steering	Override ctrl.	M4			
Manual steering ctrl.		M1			
Change speed	Propulsion ctrl.	M3	RPM/Pitch	IM4	
Give sound signals	Whistle ctrl.	C1			
Receive sound signals	Sound reception syst.	C5	Loudspeaker	IC5	Enclosed bridges
Navigate back to route	Paper chart/table	N1			
	DGPS	N2			
Maintain track of traffic	Radar with route and navigable waters	T1			
	ECDIS*	N3			*May replace paper
Harbour manoeuvring	Thruster	M5			Owners specification
Anchoring					
Manoeuvre	Manual steering ctr.	M1	Heading	IM1	Performed at front workstations or in combination with docking station. Information to be provided for Pilots.
	Propulsion ctr.	M3	Rudder angle	IM2	
	(Thruster ctrl.)	M5	RPM/Pitch	IM4	
Positioning	Radar	T1	Water depth	IM6	
(Identify anchor position)	Chart	N1			
	DGPS	N2			
Observe ship's safety state					
Monitor alarm conditions:					
– Navigation alarms	Main alarm panel		Alarm list		
Equip. & system failures	W/indicators and acceptance button				
Operational warnings					
– Machinery alarms	Alarm panel				
– Cargo alarms	Alarm panel				
– Fire alarm	Fire alarm panel				

<i>Conning station</i>					
Determine & direct course and speed in relation to waters and traffic					
Monitor:					
– heading			Gyro repeater	IM1	Digital, readable 2 m
– rudder angle			Rudder angle	IM2	
– rate-of-turn			RoT indicator	IM3	
– propulsion			RPM/Pitch	IM4	
– speed			Speed log	IM5	
– water depth			Echo sounder display	IM6	Anchoring
Give sound signals	Whistle ctrl. button				
Effect communication	VHF				Available

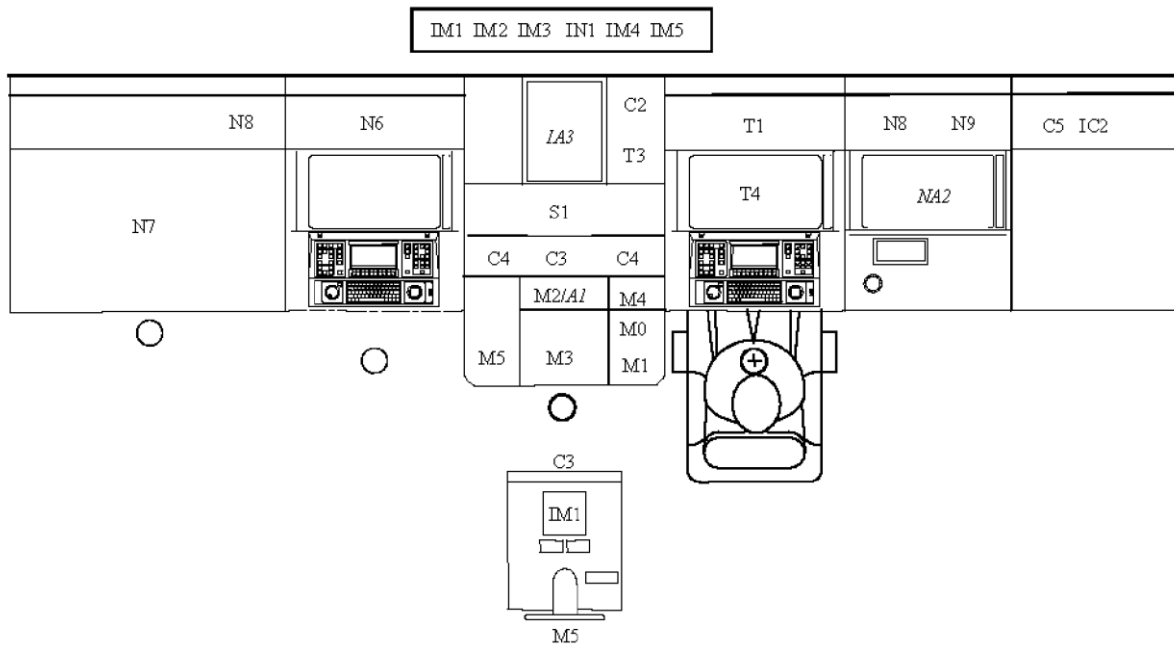
Tasks and Means – Location					
Function/Tasks to be performed	Equipment to be operated	L	Information to be viewed	L	Remarks
<i>Manual steering</i>					(Rating)
Maintain, adjust, alter heading according to order	Steering ctrl.	M6	Gyro repeater		
	Intercom (Public address system)	C6	Magn. comp.		
			Rudder angle		
			Rate-of-turn		
<i>Safety operations</i>					
Take action on alarm condition:					
– analyse situation	Manuals – Drawings		Computer based info		
– consult plans and drawings					
– observe ship's external operational situation					Cooperation with navigating officer
– organize and execute measures by communication	Intercom (UHF)				
– check status of ventilation system	Emergency stop				
Monitor development of alarm conditions					
– Cargo alarms	Alarm panel				
– Fire detection & alarms	Fire detection and alarm panel				
– Gas & smoke detection					
<i>External communication</i>					
Distress – weather – safety	GMDSS station	C7			As required (Area)
Determine weather conditions					
Consider nav. warnings	Navtex receiver	C8			
Public correspondence	Additional equipment				Specified by owners
<i>Docking operations (bridge wings)</i>					
Directing steering	Intercom (Public address system)	C6	Heading Rudder angle	IM1 IM3	
Directing speed	Intercom (Public address system)	C6	RPM/Pitch	IM5	
Giving sound signals	Whistle control button	C1			
Receiving sound signals	Sound reception syst,	C2	Loudspeaker	IC2	Enclosed bridge
Perform manoeuvring	Steering	M1			Additional install. by owners
	Prop, ctrl.	M3			
	Thruster ctrl.	M4			
<i>Additional functions</i>					<a href="#">Refer to 2.2</a>
Symbols used in column "L" of the Table: N = equipment for navigation; A = indicating extended automation of function; I = information – indicators/displays for navigation; T = equipment for traffic surveillance; C = communication means; M = means required for manoeuvring functions.					





Individual workplaces

Example of location of main equipment in a centre console.  
Easy access to maneuvering functions in standing position (refer to 3.3.3)



Redundant workstations

When all the means required for performance of navigation, traffic surveillance and maneuvering are available at each of the two workplaces, a long centre console dividing the workstation may be used

## APPENDIX 4

**RECOMMENDATIONS ON INSTALLATION OF MAGNETIC COMPASSES**

1. Magnetic compasses are recommended to be so installed that the distances between the compass bowl centre and magnetic materials of the ship structures are at least equal to the values specified in [Tables 1-1](#) and [1-2](#).

Table 1-1

**Least distances between the magnetic compass and the ship's metal structures manufactured of magnetic materials depending on the ship length**

Distance from immobile materials, in m							Distance from mobile magnetic materials with changeable magnetic field, in m									
Ship's extreme length, in m																
Not more than 30	40	50	60	70	80	83 and over	Not more than 30	40	50	60	70	80	90	100	110	120 and over
1,5	1,75	2,1	2,3	2,7	2,9	3,0	2,0	2,2	2,4	2,6	2,9	3,1	3,4	3,5	3,7	4,0
Notes: 1. Mobile materials mean boat davits, ventilator pipes, doors, cargo booms and other mobile ship structures manufactured of magnetic materials. 2. Materials with changeable magnetic field mean exhaust pipes, funnels and other heating appliances manufactured of magnetic materials. Casinos of funnels are considered immobile magnetic material.																

Table 1-2

**Least distances between the magnetic compass and the ship's metal structures manufactured of magnetic materials for fishing vessels and vessels of restricted navigation area with extreme length up to 60 m**

Distance from magnetic materials, in m, depending on the ship's extreme length, in m				
Not more than 20	30	40	50	60
1,1	1,3	1,5	1,7	2,0

2. All metal magnetic materials shall be arranged, if possible, symmetrically relative to the magnetic compass.

3. Distance between the magnetic compass bowl and the deck or ceiling made of magnetic materials shall not be less than 1 m, while distances from bulkheads ends and metal deck carlings in this case shall be at least as those indicated in [Table 1-1](#).

4. Magnetic compasses shall be installed at a distance not less than 2 m from each other. For ships of less than 60 m in length, this distance may be reduced to 1,8 m.

## RECOMMENDATIONS ON DETERMINING "SAFE DISTANCE" FOR MAGNETIC COMPASS

1. All navigational equipment shall be provided with inscriptions indicating the least distance at which this equipment may be installed from the magnetic compass.

This least distance is considered "safe distance" unless the magnetic fields of the equipment cause disturbances in magnetic compass readings more than  $0,045^\circ/H$  where  $H$  is a horizontal constituent of the magnetic field of the Earth, O (oersted).

2. The "safe distance" shall be determined for every kind of the equipment by means of the following three methods:

.1 measurement the distance between the nearest point of the equipment and the magnetic compass centre when the magnetic compass card inclination resulting under magnetic field influence caused by the equipment is equal to the value to be determined in relation of the stated above. The equipment shall be as it is normally installed on board ship;

.2 distance measured after magnetization of the equipment in field intensity as much as 1,5 O caused by direct current and by additional superimposition of stabilizing field of alternating current with intensity 18 O (average quadrature value). In some cases superimposition of alternating magnetic field is not permitted as it may result in damage of the equipment.

Magnetization of the equipment shall be made so as to receive the greatest result (for example, along the longest axis of the equipment made of a magnetic material);

.3 distance measured, as specified in [2.1](#), from the equipment which is power supplied and which is in the working condition.

3. The greatest distance which is received as a result of comparison of the three above stated measurements shall be assumed as "safe distance".

4. "Safe distances" stated in the Recommendations refer to the equipment installed near the magnetic compass on ships of unrestricted navigation area.

5. As to compasses of ships of restricted navigation area of less than 60 m in length "safe distances" may be 25 % less.

## **INSTALLATION OF ELECTRICAL AND ELECTRONIC EQUIPMENT ON THE BRIDGE AND IN THE VICINITY OF THE BRIDGE**

1. All electrical and electronic equipment intended to be operated on the bridge or in the vicinity of the bridge, on ships constructed on or after 1 July 2002, shall be tested for electromagnetic compatibility (EMC).

2. It shall be ascertained that the electromagnetic interference created by the equipment operated on the bridge or in the vicinity of the bridge does not affect the proper function of navigational equipment and systems.

3. Portable electric and electronic equipment shall not be operated on the bridge if it may affect the proper function of navigational equipment and systems.

4. All the radio and navigational equipment to be fitted on a ship in accordance with the Rules for the Equipment shall be of a type approved by the Register (type approval of products includes the necessary EMC tests).

5. All other installed and portable electric and electronic equipment other than mandatory radio and navigational equipment shall be EMC tested (at least tests for Conducted and Radiated Emission shall be conducted).

6. The definition "bridge and vicinity of the bridge" covers the following zones:  
the wheelhouse including bridge wings;  
operating rooms in way of bridge intended for installation of radio and navigational equipment, alarm systems, inter-communication systems, signal processing and auxiliary equipment;

areas in close proximity (not more than 5 m) to receiving and/or transmitting antennas and large openings in the metallic structure of ship's superstructure or deckhouse (windows, doors, closing appliances). Equipment beyond 5 m from the above openings need not be considered for the purpose of these requirements.

7. For the purpose of these requirements, equipment need to be tested for conducted and radiated emission.

Test standards are specified in section 9 of GOST R IEC 60945-2007.

The results of tests conducted in accordance with standards other than specified in section 9 of GOST R IEC 60945-2007 may be considered and taken into account. In this case, particular attention shall be paid to the level of radiated emission in the frequency band from 156 — 165 MHz and the location of the equipment.

8. Passive-EM equipment (refer to 9, 10) need not be EMC tested but it shall be supplied with a manufacturer's statement confirming that the equipment is passive-EM equipment.

9. Equipment is considered a passive-EM equipment if, when used as intended, without internal protection measures such as filtering or shielding, and without any user intervention, it does not create or produce any switching or oscillation of current/voltage and is not affected by electromagnetic disturbances.

10. Passive-EM equipment covers all equipment which includes no active electronic part, in particular:

cables and cabling systems, cables accessories;  
equipment containing only resistive loads without any automatic switching device (e.g. simple domestic heaters with no controls, thermostat, or fan);  
batteries and accumulators, etc.

**11.** All electrical and electronic equipment operated on the bridge and in the vicinity of the bridge shall be listed.

The list of electrical and electronic equipment intended to be operated on the bridge or in the vicinity of the bridge shall contain at least the following information:

- equipment description;
- name of manufacturer;
- type;
- evidence of EMC which may be: Type Approval Certificate,
- reports on tests for conducted and radiated emission having been conducted at a testing laboratory accredited by the Register,
- reports on EMC tests conducted on the navigation bridge of a newbuilding by a testing laboratory accredited by the Register for these purposes,
- manufacturer's statement (for passive-EM equipment).

**12.** List of electrical and electronic equipment operated on the bridge and in the vicinity of the bridge and evidence of EMC compatibility shall be kept on board at all times.

## RECOMMENDATIONS ON THE INSTALLATION OF A SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEM (AIS)

### 1 GENERAL

**1.1** Technical and operational requirements for AIS are set out in the table of [Appendix 1](#).

Installation of the AIS may be performed by the equipment manufacturer's technicians or firms recognized by the Register as capable of carrying out this type of work. Installation of AIS by ship's crew or by organizations having no recognition is not allowed.

### 2 AIS INSTALLATION

#### **2.1 Interference to the ship's vhf radiotelephone station.**

**2.1.1** The AIS shipborne equipment, like any other shipborne transceiver operating in the VHF maritime band, may cause interference to a ship's VHF radio-telephone station. Because AIS is a digital system, this interference in the VHF radiotelephone station may occur as a periodic (e.g. every 20 s) soft clicking sound on a ship's radiotelephone. This effect may become more noticeable when the VHF radiotelephone station antenna is located near the AIS VHF antenna and when the VHF radiotelephone station is operating on channels near the AIS operating channels (e.g. channels 27, 28 and 86).

Attention shall be paid to the location and installation of different antennas in order to obtain the best possible efficiency of the AIS operation, and special attention shall be paid to the installation of AIS VHF antennas.

#### **2.2 AIS VHF antenna installation.**

##### **2.2.1** Location.

**2.2.1.1** Location of the AIS VHF antenna shall be carefully considered. Digital communication is more sensitive than analogue/voice communication to interference created by reflections in obstructions like masts and booms. In some instances, based on the results of sea trials, it may be necessary to relocate the VHF radiotelephone station antenna to minimize interference effects.

To minimize interference effects, the following guidelines apply:

The AIS VHF antenna shall have omnidirectional vertical polarization;

The AIS VHF antenna shall be placed in an elevated position that is as free as possible with a minimum of 2 m in horizontal direction from constructions made of conductive materials. The antenna shall not be installed close to any large vertical obstruction. The objective for the AIS VHF antenna shall see the horizon freely through 360°;

The AIS VHF antenna shall be installed safely away from interfering high-power energy sources like radar and other transmitting radio antennas, preferably at least 3 m away from and out of the transmitting beam.

There shall not be more than one antenna on the same level. The AIS VHF antenna shall be mounted directly above or below the ship's primary VHF radiotelephone station antenna, with a minimum of 2 m vertical separation. If the AIS VHF antenna is located on the same level as other antennas, it is desirable that the distance apart shall be at least 10 m.

**2.2.2 Cabling.**

**2.2.2.1** The cables shall be kept as short as possible to minimize attenuation of the signal. Double screened coaxial cables equal or better than RG214 are recommended.

All outdoor installed connectors on the coaxial cables shall be waterproof by design to protect against water penetration into the antenna cable.

Coaxial cables shall be installed in separate signal cable channels/tubes and at least 10 cm away from power supply cables. Crossing of cables shall be done at right angles (90°). Coaxial cables shall not be exposed to sharp bends, which may lead to change the characteristic impedance of the cable. The minimum bend radius of a coaxial cable shall be 5 times the cable's outside diameter.

**2.2.3 Grounding.**

**2.2.3.1** Coaxial down-leads shall be used for all antennas, and the coaxial screen shall be connected to ground at one end.

**2.3 Global navigation satellite system antenna installation.**

**2.3.1** AIS shall be connected to a Global Navigation Satellite System (GNSS) antenna.

**2.3.1.1 Location.**

**2.3.1.1.1** The GNSS antenna shall be installed where it has a clear view of the sky and is not obstructed by ship's structures. The objective shall see the horizon freely through 360° with a vertical observation of 5 to 90° above the horizon. Small diameter obstructions, such as masts and booms, do not seriously degrade signal reception, but such objects shall not eclipse more than a few degrees of any given bearing.

The antenna shall be located at least three meters away from and out of the transmitting beam of high-power transmitters (radars and/or INMARSAT ship earth stations). This includes the ship's own AIS VHF antenna.

If a DGNSS system is included or connected to the AIS system, the installation of the DGNSS antenna shall be in accordance with manufacturer's recommendations.

**2.3.2 Cabling.**

**2.3.2.1** To achieve optimum performance, the gain of the antenna pre-amplifier shall match the cable attenuation. The resulting installation gain determined as the difference between pre-amplifier gain and cable attenuation shall be within 0 to 10 dB.

The coaxial cable between the GNSS antenna and the AIS shipborne station connector shall be routed directly in order to reduce electromagnetic interference effects. The GNSS antenna cable shall not be installed close to high-power lines, such as radar or radio-transmitter cables or waveguides including the AIS VHF antenna cable. A separation of one meter or more is recommended between the above cables to avoid degradation due to RF-coupling. Crossing of antenna cables shall be done at 90° to minimize magnetic field coupling.

All outdoor installed connectors on the coaxial cables shall be waterproof by design to protect against water penetration into the antenna cable.

**2.4 Power source.**

**2.4.1** The AIS shall receive power supply from the main and emergency sources of electrical power, for which purpose the AIS shall be connected to the navigational equipment switchboard.

**2.5 Synchronization.**

**2.5.1** After installation, the AIS shall be synchronized properly on Universal Coordinated Time (UTC), and the position information, if provided, shall be correct and valid.

### 3 BRIDGE ARRANGEMENT

#### 3.1 Minimum keyboard and display.

**3.1.1** A minimum keyboard and display (MKD) shall be installed at the position from which the ship is normally operated. This can be the AIS internal MKD (integrated or remote) or a separate display system.

#### 3.2 Pilot plug.

**3.2.1** A pilot input/output port is a mandatory part of the shipborne AIS equipment. A plug connected to this port shall be installed on the bridge near the pilot's operating position so that a pilot can connect a personal computer to AIS.

The pilot plug shall be configured as follows:

AMP/Receptacle (Square Flanged (-1) or Free-Hanging (-2)), Shell size 11, 9-pin, Std. Sex 206486-1/2 or equivalent with the following terminations:

TX A is connected to Pin 1;

TX B is connected to Pin 4;

RX A is connected to Pin 5;

RX B is connected to Pin 6;

Shield is connected to Pin 9.

#### 3.3 AIS display system.

**3.3.1** If there is navigational equipment capable of displaying AIS information (radar display, electronic chart display and information system (ECDIS) display or integrated navigation system) installed at the position from which the ship is normally operated, the AIS shall be connected to that equipment in accordance with the requirements of the international standard "Maritime Navigation and Radiocommunication Equipment and Systems – Digital Interfaces".

The additional display system can also include the functionality of an MKD ([refer to 3.1.1](#)).

#### 3.4 Installation of the built-in integrity test (BIIT) function.

**3.4.1** The AIS requires that an alarm output (relay) be connected to an audible alarm device or the ship's alarm system, if available.

In cases where audible alarm of AIS failure is provided by an audible device built into the minimum keyboard and display, connection to an external audible alarm device or the ship's alarm system is not needed.

Alternatively, the BIIT alarm system may use the alarm messages output on another compatible ship's alarm system.

### 4 DYNAMIC DATA INPUT

#### 4.1 External sensors.

**4.1.1** The AIS has interfaces for position, heading and rate of turn (ROT) sensors whose configuration complies with the requirements of the international standards "Maritime Navigation and Radiocommunication Equipment and Systems — Digital Interfaces" (IEC 61162 series). Sensors installed in compliance with other carriage requirements of the Rules shall be connected to the AIS<sup>1</sup>. The sensor information transmitted by AIS shall be the same information being used for navigation of the ship.

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<sup>1</sup> Installation of the AIS does not establish a need to install additional sensors above carriage requirements.



#### **4.2 Ship's position, course over ground (cog) and speed over ground (SOG).**

**4.2.1** GNSS sensors (global navigation satellite system receivers) normally have standard outputs for position, COG and SOG suitable for directly interfacing the AIS. However, it is important to note that:

the Geodetic Datum of the position data transmitted by the GNSS receiver is WGS 84 and that an IEC 61162 DTM sentence is configured;

AIS is able to process two reference points for GNSS antenna position, one for external and one for an internal GNSS sensor. If more than one external reference point is used, the appropriate information needs to be input to the AIS to adjust reference point information.

#### **4.3 Heading.**

**4.3.1** A compass (gyrocompass or magnetic compass) providing heading information is a mandatory sensor input to the AIS. Some ships of less than 500 gross tonnage may not carry a gyrocompass providing heading information. In such ships, heading information shall be provided to the AIS by a transmitting heading device.

#### **4.4 Rate of turn.**

**4.4.1** The AIS provides the rate of turn (ROT) information to other ships in order to early detect ship's manoeuvres and their rate. The following parameters indicating turning of a ship (direction and rate of turn) can be derived from two different sensors:

the heading (from a gyrocompass or transmitting heading device);

the rotation rate itself (from a rate-of-turn indicator).

In accordance with the requirements the Rules, the rate-of-turn indicator need not be fitted on ships of less than 50,000 gross tonnage. However, if a rate-of-turn indicator is available and it includes an interface in accordance with the requirements of the international standard "Maritime Navigation and Radiocommunication Equipment and Systems — Digital Interfaces" (IEC 61162 series), it shall be connected to the AIS.

If a rate-of-turn indicator complying with the requirements of IMO resolution A.526(13) is connected to the AIS, the AIS shall use the information derived from this device to broadcast both direction and value of turn on the VDL.

If valid ROT or heading data is available from another external source (Integrated Navigation System), the AIS shall use this information to broadcast the direction of turn on the VDL, if greater than 5° in 30 s (might also be implemented as 2.5° in 15 s by configuration).

If no ROT information is available, the AIS shall transmit default values indicating "not available".

ROT data shall not be derived from COG information.

#### **4.5 Navigational status.**

**4.5.1** A simple means shall be provided for the operator to input the ship's navigational status (e.g. underway using engine; at anchor; not under command; restricted in ability to maneuver, etc.) information into the AIS. The AIS may be connected to the ship's navigational status lights.

## **5 STATIC INFORMATION**

**5.1** In accordance with the technical and operational requirements for the AIS, certain static, dynamic and voyage-related information shall be entered manually, normally by means of the MKD, or by means of IEC 61162 sentences "SSD" and "VSD" via the presentation interface if such provisions exist.

#### **5.1 Entered at initial installation of AIS.**

**5.1.1** Information that shall be entered at the initial installation of the AIS includes:

Maritime Mobile Service Identity (MMSI) number;

IMO ship number;

radio call sign;  
 name of ship;  
 type of ship;  
 dimension/reference for position of the GNSS antenna ([refer to 5.2](#)).

Access to "MMSI", "IMO number" and other AIS controls (like power and channel settings) shall be controlled (e.g. by password).

The "call sign", "name of ship" and "type of ship" shall be input to the AIS, either manually using the MKD or by means of IEC 61162 sentences "SSD" and "VSD" via the presentation interface. Type of ship information shall be in accordance with [Table 5.1.1](#).

Table 5.1.1

**Identifiers to be used by ships to report their type**

Identifier No.	Types of ships		
Special craft			
50	Pilot vessels		
51	Search and rescue vessels		
52	Tugs		
53	Port tenders		
54	Vessels with anti-pollution facilities or equipment		
55	Law enforcement vessels		
56	Spare – for assignments to local vessels		
57	Spare – for assignments to local vessels		
58	Medical transports (as defined in the 1949 Geneva Convention and Additional Protocols)		
59	Ships according to Resolution No. 18 (Mob-83)		
Other ships			
First digit <sup>1</sup>	Second digit <sup>1</sup>	First digit <sup>1</sup>	Second digit <sup>1</sup>
1 – reserved for future use	<b>0 – all ships of this type</b>	–	0 – fishing
2 – wing-in-ground craft (WIG)	1 – carrying dangerous goods (DG), harmful substances (HS), or marine pollutants (MP) IMO hazard or pollutant category X <sup>2</sup>	–	1 – towing
3 – see right column	2 – carrying DG, HS, or MP IMO hazard or pollutant category Y <sup>2</sup>	3 – vessel	2 – towing and length of the tow exceeds 200 m or breadth exceeds 25 m
4 – high-speed craft (HSC)	3 – carrying DG, HS, or MP IMO hazard or pollutant category Z <sup>2</sup>	–	3 – engaged in dredging or underwater operations
5 – see above	4 – carrying DG, HS, or MP IMO hazard or pollutant category OS <sup>2</sup>	–	4 – engaged in diving operations
	5 – reserved for future use	–	5 – engaged in military operations
6 – passenger ships	6 – reserved for future use	–	6 – sailing
7 – cargo ships	7 – reserved for future use	–	7 – pleasure craft
8 – tankers	8 – reserved for future use	–	8 – reserved for future use
9 – other types of ship	9 – no additional information	–	9 – reserved for future use

<sup>1</sup> The identifier shall be constructed by selecting the appropriate first and second digits.

For example, a cargo ship not carrying dangerous goods, harmful substances, or marine pollutants, shall use identifier "70"; pleasure craft shall use identifier "37". Note that those ships, which type identifier begins with a "3" shall use the fourth column of the Table.

Depending on the vessel, cargo and/or the navigational conditions, this information may be voyage related and shall therefore need to be changed before beginning or at some time during the voyage. This is defined by the "second digit" in the fourth column of the Table.

<sup>2</sup> Figures 1, 2, 3, 4, indicating categories X, Y, Z and OS, have previously indicated categories A, B, C and D.

## 5.2 Reference point for GNSS antenna position.

**5.2.1** The AIS stores one "external reference point" for the external GNSS antenna position and one "internal reference point" if an internal GNSS shall be used as fallback for position reporting. The locations of these reference points shall be set during installation of the AIS using values A, B, C, D; as described in [5.3.1](#).

The external reference point may also be a calculated common reference position.

## 5.3 Ship's dimensions.

**5.3.1** Ship's dimensions shall be entered using the overall length and width of the ship indicated in [Fig. 5.3.1](#) as  $(A + B)$  and  $(C + D)$ , respectively.

Ship's dimensions  $(A + B)$  and  $(C + D)$  shall be identical when entering internal and external reference points.

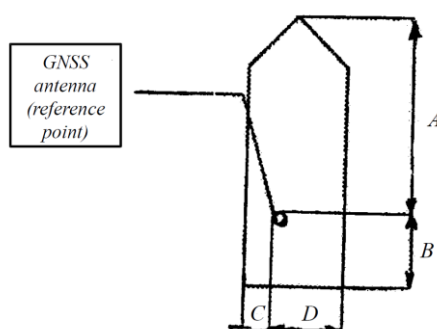


Fig. 5.3.1  
Antenna position parameters:

Ship's dimensions	Distance at which the antenna is located, in m
A	0 – 511 (511 = 511 m or greater)
B	0 – 511 (511 = 511 m or greater)
C	0 – 63 (63 = 63 m or greater)
D	0 – 63 (63 = 63 m or greater)

- Notes: 1. The dimension A shall be in the direction of the transmitted heading information (bow).  
 2. Reference point of reported position not available, but dimensions of ship are available:  $A = C = 0$  and  $B \neq 0$  and  $D \neq 0$ .  
 3. Neither reference point of reported position nor dimensions of ship available:  $A = B = C = D = 0$  (= default).  
 4. For use in the message table: A = most significant field; D = least significant field.  
 5. In the rare case of a GNSS antenna installed in the portside corner of a rectangular bow, the values A and C would be zero. Should this be the case, one of these values shall be set to 1 in order to avoid misinterpretation as "not available" because  $A = C = 0$  is used for that purpose.

## 6 LONG-RANGE FUNCTION OF THE AIS

**6.1** The AIS long-range function needs a compatible long-range communication system (e.g. INMARSAT-C or MF/HF radio installation).

If this is available, a connection between that communication system and the AIS can be made. This connection is needed to activate the long-range function of the AIS and it shall meet the requirements of the international standard "Maritime Navigation and Radiocommunication Equipment and Systems – Digital Interfaces".

## **7 FORMALIZING THE AIS INSTALLATION RESULTS**

**7.1** After completion of installation and adjustment work, acceptance and sea trials shall be carried out where all the AIS equipment shall be checked in real operational conditions, including operability of signal converters, connected sensors and information users.

In case of satisfactory results of trials witnessed by a Register representative, use of the AIS is allowed as part of shipborne navigational equipment, and the AIS is included in ship's documents.

## **GUIDELINES FOR THE INSTALLATION OF A SHIPBORNE RADAR**

### **1 GENERAL**

**1.1** These Guidelines reflect the provisions of IMO circular SN.1/Circ.271 "Guidelines for the Installation of Shipborne Radar Equipment".

Information provided by radar is of vital importance for navigators and the safe navigation of ships. Special care shall be taken to ensure the correct installation of the radar, in order to improve the performance of the radar system.

The Appendix contains guidelines for shipowners, ship designers, manufacturers, installers, shipyards, suppliers and ship surveyors.

It does not replace documentation supplied by the firm (manufacturer).

### **2 APPLICATION**

**2.1** The Appendix applies to all shipborne radar installations mandated by the Rules.

### **3 DEFINITIONS**

**3.1** Consistent common reference point (CCRP) is a location on own ship, to which all horizontal measurements such as target range, bearing, relative course, relative speed, closest point of approach (CPA) or time to closest point of approach (TCPA) are referenced, typically the conning position of the bridge.

### **4 SURVEY**

**4.1** When surveying the installed radar, applicable provisions of 4.1.1 of the Guidelines on Technical Supervision of Ships in Service shall be followed.

### **5 DOCUMENTATION**

**5.1** Prior to the radar installation, the following documentation shall be made available and provided to the installer by the shipyard, shipowner or manufacturer as appropriate:

**.1** scaled drawing(s) of the ship with views from the port, starboard, fore, aft and from above the vessel on which the radar and other antenna positions are indicated. Any ship structure or cargo that may obstruct or degrade radar performance shall also be shown, for example masts, funnels, superstructure and containers. The possible turning and jib range of movable objects like cranes shall be indicated;

- .2 scaled drawing of the antenna arrangement including the outline drawing for the rotation radius;
- .3 drawing(s) of the bridge layout showing the position of the radar display unit(s) and additional locations (for example, electronic rooms) for housing radar units;
- .4 manufacturer's documentation describing the installation and interconnection of the radar system, the equipment units including radar frequency band and antenna size, and equipment type and evidence of type approval documentation;
- .5 list of auxiliary equipment connected with the radar system including manufacturer, type with block diagram (interconnection diagram) and evidence of type approval;
- .6 in case of retrofit installations, a document agreed by the shipowner, installer and manufacturer stating that the use of original cabling, transmission lines and auxiliary units of the radar equipment may be retained.

## 6 RADAR ANTENNA INSTALLATION

Correct location of the radar antenna is an important factor of the performance of the radar system. Interference, either by reflecting constructions or other transmitters, may heavily reduce the radar performance by creating blind sectors, clutter on the radar display or generation of false echoes.

### 6.1 Interference.

6.1.1 Due care shall be taken with regard to the location of radar antennas relative to other antennas which may cause interference to either equipment. The location of the antenna shall comply with the following:

- .1 the radar antenna shall be installed safely away from interfering high-power energy sources and other transmitting and receiving radio antennas;
- .2 the lower edge of a radar antenna shall be minimum of 500 mm above any safely rail;
- .3 radar antennas in close proximity shall have a minimum vertical elevation separation angle of 20° and a minimum vertical separation of 1 m where possible.

### 6.2 Location relative to masts, funnels and other constructions.

6.2.1 Due care shall be taken with regard to the location of radar antennas relative to masts, funnels and other constructions.

The location of the antenna shall comply with the following:

- .1 the antenna shall generally be mounted clear of any structure that may cause signal reflections;
- .2 ensure that any support or other obstacles are clear of the rotation of the antenna (refer to specific antenna outline drawing for rotational radius);
- .3 install antenna and turning unit so that the installation complies with the compass safe distance of the equipment.

### 6.3 Blind sectors and range.

6.3.1 To make full benefit from the radar, it is vitally important that horizontal and vertical blind sectors of the radar antennae are minimized. The objective shall see the horizon freely through 360° as nearly as possible, noting the requirement of [8](#) below.

For all radar systems and where practical:

- .1 a line of sight from the radar antenna to the bow of the ship shall hit the surface of the sea in not more than 500 m or twice the ship length, depending which value is smaller, for all load and trim conditions;
- .2 the radar antenna shall be located in an elevated position to permit maximum target visibility;

**.3** blind sectors shall be kept to a minimum, and shall not occur in an arc of the horizon from right ahead to 22,5° abaft the beam to either side.

**Note.** Any two blind sectors separated by 3° or less shall be treated as one blind sector;

**.4** individual blind sectors of more than 5°, or a total arc of blind sectors of more than 20°, shall not occur in the remaining arc, excluding the arc in the above [6.3.1.3](#);

**.5** for radar installations with two radar systems, where possible, the antennas shall be placed in such a way as to minimize the blind sectors.

#### **6.4 Lifting radar equipment**

**6.4.1** Where special equipment, such as cranes, hoists and jibs are required to install the radar system, consideration shall be given to ensure that the radar system(s) are located such that the required equipment can be positioned to facilitate the installation. Radar equipment shall be lifted in accordance with the information provided by the manufacturer.

### **7 GENERAL REQUIREMENTS**

**7.1** All installations shall facilitate protection of equipment, including cabling, from damage.

**7.2** Safe service access shall be provided using service platforms where necessary having a minimum size of 1 m<sup>2</sup> at a suitable height and with a safety rail of suitable height.

**7.3** Consideration shall be given to the compass safety distance as supplied by the manufacturer when positioning equipment units.

**7.4** The design of the mounting platform for the antenna and antenna pedestal shall take into account vibration, shock and splash due to sea-going conditions.

### **8 INTERACTION WITH SEA AND FALSE ECHOES**

**8.1** Considerations of interaction with the sea imply that the radar antenna shall be only as high as necessary to clear major objects, and as high to be consistent with other requirements regarding acceptable horizon and target detection range.

The location of the antenna shall minimize sea clutter returns and the number of multi-path nulls.

### **9 CABLES AND GROUNDING**

**9.1** The cables and the grounding shall comply with the following:

**.1** cable screens, especially coaxial cable screens, shall be installed in accordance with firm's (manufacturer's) documentation;

**.2** the cables shall be kept as short as possible to minimize attenuation of the signal;

**.3** all cables between antenna and radar systems units shall be routed as directly as possible, consistent with consideration for other equipment, in order to reduce electromagnetic interference effects;

**.4** cables shall not be installed close to high-power lines, such as radar or radiotransmitter lines;

- .5 crossing of cables shall be done at right angles (90°) to minimize magnetic field coupling;
- .6 all outdoor installed connectors shall be waterproof by design to protect against water penetration into the cables (IP56 protection degree);
- .7 cables and microwave transmission lines shall not be exposed to sharp bends;
- .8 cables and microwave lines shall be installed with sufficient physical separation, as defined in the firm's (manufacturer's) documentation;
- .9 grounding of equipment units shall be carried out according to the firm's (manufacturer's) documentation.

## **10 POWER SOURCES**

- 10.1** The radar shall be connected to the main and emergency power source.

## **11 RADAR CONTROLS AND DISPLAY**

- 11.1** If the control panel is a separate unit, the functionality of the radar controls shall be available for the mariner at all workstations where a radar display is available.
- 11.2** The orientation of the display unit shall be such that the user is looking ahead. The lookout view shall not be obscured and the ambient light shall cause minimum degradation on the display screen (refer also to [Appendix 1](#)).

## **12 INITIAL INSTALLATION OF RADAR**

**12.1** Radar systems are functionally integrated with a number of instruments (gyrocompass, transmitting heading device, EPFS, AIS, etc., refer also to section 8 of IMO resolution MSC.192(79)). As various systems are getting increasingly more integrated and complex, correct system settings are very important.

The installation firm shall sign an installation report that to the best of their knowledge the installation and setup has been carried out according to the firm's (manufacturer's) documentation and to these guidelines.

Information about possible performance limitations, including blind sectors, due to the radar system installation that may be of vital importance for mariners shall be stated in this documentation.

The setup of interfaces and system parameters (including CCRP position offset) shall be carried out in accordance with the firm's (manufacturer's) documentation.

This information shall be attached as an annex to the installation report.

The above mentioned installation report and the annex thereto shall be kept on board the ship.



Russian Maritime Register of Shipping

**Rules for the Equipment of Sea-Going Ships**  
**Part V**  
**Navigational Equipment**

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