



NEWBUILDINGS
SPECIAL EQUIPMENT AND SYSTEMS – ADDITIONAL CLASS

Nautical Safety

JULY 2011

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FOREWORD

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The Rules lay down technical and procedural requirements related to obtaining and retaining a Class Certificate. It is used as a contractual document and includes both requirements and acceptance criteria.

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CHANGES

General

The present edition of the rules includes amendments and additions approved by the Executive Committee as of June 2011 and supersedes the January 2011 edition of the same chapter.

The rule changes come into force as described below.

This chapter is valid until superseded by a revised chapter.

Main changes coming into force 1 July 2011

- **General**

- Class notations **NAUT – OC** or **AW** may be based on one of the following rule editions:

- July 2004

- Edition in force at contract date as listed in Pt.0 Ch.1 Sec.2 Table 1.

- When building yard proposes to use the July 2004 edition, this shall be in full agreement with future vessel owner.

- **Sec.1 General**

- In Table C1 references to documentation type “Z030 – System arrangement plan” have been amended to read “Z030 – Arrangement plan”.

Corrections and Clarifications

In addition to the above stated rule requirements, a number of corrections and clarifications have been made to the existing rule text.

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SECTION 1 GENERAL

A. Classification

A 100 Application

101 The requirements of this chapter apply to bridge design, workstation arrangement and installation of navigational equipment and provision of manoeuvring documentation on seagoing vessels.

A 200 Objective

201 The objective of the rules for nautical safety is to reduce the risk of collision, grounding and heavy weather damage through enhancement of the reliability of the Bridge System.

A 300 The Bridge System

301 The bridge system in the context of the rules comprises four essential elements:

- *the technical system*, which shall deduce and present information as well as enable the proper setting of course and speed
- *the human operators*, who shall evaluate available information, decide on the actions to be taken and execute the decisions
- *the human-machine interface*, which shall safeguard that the technical system is designed with due regard to human abilities
- *the procedures*, which shall ensure that the bridge system performs satisfactorily under different operating conditions.

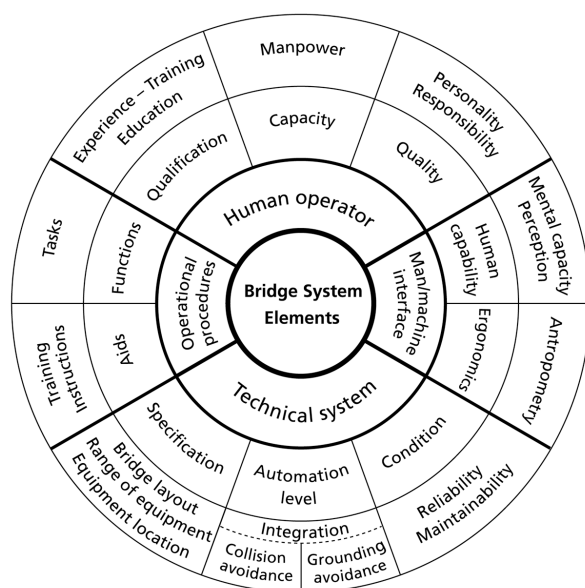


Fig. 1
The bridge system

302 Degradation of one element of the bridge system affects the performance of the other elements. In order to reduce the risk of malfunction of the bridge system, the rule requirements aim to regulate the factors affecting the safe performance of the bridge system to ensure system reliability in various modes of operation under different operating conditions.

303 The main attributes of the four elements of the bridge system are considered to comprise, (see Fig.1):

- qualifications, capacity and quality of the human operator in relation to the functions to be carried out
- specification, automation level and condition of the technical system in relation to information needs, workloads and reliability
- physical abilities and information processing capacity of the human operator in relation to working conditions and the technical systems he is to operate
- tasks to be performed and technical aids available under various operating conditions as basis for establishing working routines and operating procedures.

304 With the exception of operator qualifications and quality, which are considered to be a matter of selection of personnel, the attributes mentioned in 303 forms the basis of these rule requirements. It is recognized that improvements of the attributes mentioned will have a positive effect on the performance of the human element.

A 400 Scope

401 The requirements are established on the supposition that the regulations of international conventions and the rules for main class are complied with.

402 Within the operational limits of the applicable class notation the rules aim to safeguard that the officer of the navigational watch has full control of all the primary functions he/she is responsible for, including the look out function required by COLREGS72, single-handed.

403 Moreover, the rules acknowledge that the modes of operation and the manning of the bridge varies in accordance with internal and external conditions like availability of technical systems, type of waters, traffic density and weather conditions. The rules therefore aim to provide a bridge arrangement being suitable for an enlarged bridge team when operational or legislative conditions so requires.

Guidance note:

The actual manning of the navigational watch shall at all times be in accordance with the regulations of the flag state as well as for the waters in which the ship is operating. This is considered the responsibility of the master of the ship and the officer of the navigational watch.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

404 The rules stipulate requirements for the following areas aiming to manage the risk of bridge system failures:

- *design of workplace*, based on analyses of functions to be performed under various operating conditions and the technical aids to be installed
- *bridge working environment*, based on factors affecting the performance of human operators
- *range of instrumentation*, based on information needs and efficient performance of navigational tasks
- *equipment reliability* applicable to all types of bridge equipment, based on common requirements to ensure their suitability under various environmental conditions
- *performance* of different types of bridge equipment, based on their specific functions
- *human-machine interface*, based on analyses of human limitations and compliance with ergonomic principles
- *information on the ship's manoeuvring characteristics*, based on the competence needed for safe performance of operations involving ship manoeuvring
- *tests and trials* based on the need to ensure that technical systems perform in accordance with their approved specifications before being relied upon and used in practical operation
- and give guidance concerning qualifications essential for mastering the navigational systems installed.

405 The reliability and availability of equipment and systems for steering and propulsion, although essential for safe navigation, is addressed by the rules of main class. The scope of this chapter concerning such equipment is:

- the location and arrangement in the wheelhouse
- the human-machine interface
- any integration and/or interface with navigational equipment.

406 The scope of this chapter concerning systems and equipment being additional to those related to safety of navigation, but important to the safety or security of the ship, such as cargo/ballast system, safety monitoring systems, fire systems, GMDSS equipment, security equipment, hull monitoring system, and similar systems is:

- the location and arrangement in the wheelhouse
- the noise and illumination level
- any integration and/or interface with navigational equipment.

407 On ships fitted with an Integrated Navigation System involving automatic control of heading and/or speed *The Bridge System* is only considered compliant with the code of safe navigation when the officer of the navigational watch holds a certificate of competence in accordance with the requirements of Sec.9.

A 500 Class Notation and Qualifiers

501 Vessels built and tested in compliance with the requirements of this chapter, or chapter 20 and the requirements of the rules for main class may be assigned class notation **NAUT** and qualifiers as given in Table A1.

502 In order to offer classification that meets the individual needs of ship operators, related to different types

and trades of ships, the rules are divided into three class notations, **NAUT-OC**, **NAUT-AW** and **NAUT-OSV**.

Table A1 Class notations and qualifiers					
Class notation	Description	Qualifier	Description	Design requirements, rule reference	Survey requirements, rule reference
NAUT	Requirements within bridge design, bridge instrumentation, and workstation arrangement.	OC	Fundamental requirements <i>targeting ships largely operating on the high seas</i>	Sec.2	Pt.7 Ch.1 Sec.6
		AW	- augmented requirements for bridge configuration, instrumentation and automation and including detailed documentation of the manoeuvring characteristics of the ship. - <i>targeting ships largely operating in coastal and narrow waters</i>	Sec.2	
		OSV	See Chapter 20 for details. - <i>targeting ships largely operating as support vessel for various offshore operations</i>	Pt.6 Ch.20	
		(ICS)	a multifunction workstation arrangement supporting the navigational functions of NAUT-nn by means of network technology	Sec.7	

Guidance note:

Example of notations with qualifier: **NAUT-OC (ICS)**.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

503 Ships which have waived one or more of the requirements recognized by the rules as being applicable for ships in world wide trade only shall have the following additional text entered in the “Appendix to the classification certificate”:

- the class notation has been granted on the said agreement that the vessel will only operate in *< insert the area/waters to be traded and any other conditions of the waiver >*.

Guidance note:

Example: The class notation has been granted on the said agreement that the vessel will only operate in European waters fully covered by ENC.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

A 600 Class assignment

601 The ship will be assigned class notation **NAUT-OC** when the relevant requirements given in Sec.1 to Sec.6 and Sec.10 are complied with.

602 The ship will be assigned class notation **NAUT-AW** when the relevant requirements given in Sec.1 to Sec.6 and Sec.8 and Sec.10 are complied with.

603 The class notation may upon request be extended with a qualifier **(ICS)** when the requirements in Sec.7 are complied with.

A 700 Structure of the rules

701 The rule structure establishes functional requirements to the greatest extent possible and gives guidance as to how a functional requirement can be met in the course of a technical solution.

702 A functional requirement is as far as possible expressed without quantification. The functional requirements have a principle status and will only be adjusted if the functions to be carried out on the bridge are altered.

B. Definitions

B 100 Terms and abbreviations

101 *Abnormal operating conditions:* When malfunction of technical system(s) requires operation of backup systems on the bridge, or if malfunction 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.

102 *Additional bridge functions:*

Functions related to ship operations which are to be carried out on the bridge in addition to primary functions, and whether or not the OOW is responsible for the allocated tasks. 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.

103 *Back-up navigator:* A navigational officer who has been designated by the ship's master to be on call if assistance is needed on the bridge.

104 *Blackout period:* The period suffering loss of electric power from the main and emergency generating plants.

105 *Blind sector:* An obstruction of the sea surface situated within a required field of vision sector.

106 *Bridge:* The area from which the navigation and control of the ship are exercised, comprising the wheelhouse and the bridge wings.

107 *Bridge system:* The total system governing the performance of bridge functions, comprising bridge personnel, technical systems, human-machine interface and procedures.

108 *Bridge wing:* The part of the bridge on each side of the wheelhouse, which extends towards the ship's side.

109 *Category A alarm:* alarm where graphical e.g. radar, ECDIS, information at the task station directly assigned to the function generating the alarm is necessary, as decision support for the evaluation the alarm related condition.

Category A alarms should include alarms indicating:

- danger of collision
- danger of grounding.

110 *Category B alarm:* Alarm where no additional information for decision support is necessary besides the information which can be presented at the alarm management panel/ screen. Category B alarms are all alarms not falling under Category A.

111 *Catwalk:* A narrow, usually elevated platform arrangement outside the wheelhouse allowing a person safe access to windows along the front bulkhead(s).

112 *Coastal waters:* Deep unobstructed waters along a coastline that is extending an equivalent distance of not less than 30 minutes sailing at the relevant speed in all directions to one side of the course line (opposite the coastline).

113 *Collision avoidance functions.* Monitoring surrounding traffic and other objects visually and by all appropriate means to determine dangers of collisions, pertinent responsibilities in accordance with COLREG, and execute measures to steer clear of the danger.

114 *Commanding view:* View without obstructions, which could interfere with the navigator's ability to perform his main tasks, at least covering the field of vision required for safe performance of collision avoidance functions.

115 *Conning information display:* A screen-based information system centralizing ship's control state parameters, system set/order values and voyage plan data.

116 *Conning station or position.* 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.

117 *Docking operations:* Manoeuvring the ship alongside a berth and supervising the mooring operations.

118 *Easily accessible:* Being both perceptible from and located within 5 m distance from the relevant working position.

119 *Easily readable:* see Sec.2 D203.

120 *EPFS:* Electronic Position Fixing System

121 *Emergency situations:* When incidents affect regular operating conditions and priorities due to grave threats against the ship's safety, integrity or security.

122 *Ergonomics:* The scientific discipline concerned with designing according to the human needs, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being

and overall system performance.

123 *Failure Modes and Effects Analysis (FMEA):* is an engineering method of analysis of potential failure modes within a system to determine the impact that failures, errors and defects in components on sub-system level may have on the larger system.

124 *Field of vision.* Angular size of scenery being observable from a position within the ship's bridge.

125 *Grounding avoidance function:* Monitor the ship's position in relation to the voyage plan, and determine and execute course alterations to make the ship follow the planned track.

126 *Helmsman:* Designated person who actuates the rudder and control the heading of the ship under way.

127 *HMI:* Human Machine Interface.

128 *ICS:* Network based integration of navigation system.

129 *Irregular operating conditions:* When external conditions cause excessive operator workloads.

130 *Manoeuvring:* Operation of steering and propulsion machinery, as required to alter the ship's heading, speed and/or directional movement.

131 *MFD:* Multi-Function-Display. A screen (and pertinent computer) configured for the display of several applications/functions (e.g. ECDIS, ARPA, AMS).

132 *MKD (AIS):* AIS Minimum Keyboard and Display.

133 *Monitoring:* Act of constantly checking information from instrument displays and environment in order to detect any irregularities.

134 *Narrow waters:* Waters with restricted freedom of course setting and where pilotage conventionally is the foremost navigational method.

135 *Navigation:* is the process of planning, reading, and controlling the movement of a ship from one place to another.

136 *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.

137 *Ocean areas:* 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.

138 *Officer of the navigational watch:* Person responsible for the safety of navigation and bridge operations.

139 *OOW:* Officer of the navigational watch.

140 *Primary bridge functions.* 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:

- voyage planning functions
- navigation functions
- collision avoidance functions
- manoeuvring functions
- docking functions
- monitoring of internal safety systems
- external and internal communication related to safety in bridge operation and distress situations.

141 *SOG:* Speed Over Ground; - ship's real time speed measured relative earth surface.

142 *STW:* Speed Through Water; - ship's real time speed measured relative water surface.

143 *SMG:* Speed Made Good; - ship's reckoned speed between two positions determined "a posteriori".

144 *Superstructure:* Decked structure, not including funnels, which is on or above the freeboard deck.

145 *UID:* User Input Device; (example: keyboard, tiller, joystick, helm, pushbutton, etc.).

146 *Voyage plan:* a comprehensive, berth to berth guide, developed and used by the vessel's bridge team to determine the most favourable passage, to identify hazards along the track, and to make out the bridge team management to ensure the vessel's safe passage.

147 *Voyage planning:* gathering information relevant to the contemplated voyage; the plotting of course lines and turn radii of the intended voyage in appropriate charts: indication of areas of danger, existing ships' routing and reporting systems, vessel traffic services, areas involving marine environmental protection considerations and safe speed.

148 Wheelhouse: Enclosed area of the bridge.

149 Wheel-over-line The line parallel to the next course line that is passing through the point where the rudder order has to be initiated for the ship to accurately follow a curved track with a fixed radius.

150 Wheel-over-point. The point where the ship has to initiate a rudder order in order to accurately follow a curved track, taking into consideration the distance required for the ship to build up the necessary turn rate.

151 Within reach: see Sec.2 D200.

152 Workstation: A workplace at which one or several tasks constituting a particular activity are carried out, designed, arranged and located as required to provide the information, systems and equipment required for safe and efficient performance of dedicated tasks and bridge team co-operations.

C. Documentation

C 100 General

101 The configuration and arrangement drawings submitted for approval shall be shown to scale. All symbols and abbreviations used shall come with a clarification.

Documentation shall be submitted as required by Table C1.

Table C1 Documentation requirements			
<i>Object</i>	<i>Documentation type</i>	<i>Additional description</i>	<i>For approval (AP) or For information (FI) or on request (R)</i>
NAUT-OC and NAUT-AW			
Navigation bridge	N010 – Bridge design drawing	Including information on interior colours for bulkheads, deckheads, framing of windows and consoles. The colours should be indicated using international standards for colour reference.	AP
	N020 – Vertical field of vision drawing	Note: Calculation from a position 350 mm abaft the ARPA at the navigation & manoeuvring workstation applying an eye height of 1500 mm.	AP
	N030 – Horizontal field of vision drawing	Note: Calculation from a position 350 mm abaft the ARPA at the navigation & manoeuvring workstation applying an eye height of 1500 mm	AP
	N040 – Nautical workstation arrangement plan		AP
	N050 – Navigation bridge windows framing arrangement plan		AP
	Z030 – Arrangement plan	Window wipers, fresh water wash, sunscreens and de-misting system (heating) on the bridge windows.	AP
	M040– Coating specification	Interior colours for bulkheads, deckheads, framing of windows and consoles indicated by using international standards for colour reference.	AP
Navigation systems	Z090 – Equipment list		AP
	E230 – Power supply arrangement		AP
	Z140 – Test procedure for quay and sea trial		AP
Bridge Alarm Management	I020 – Control system functional description	Including a flow diagram for the total system configuration and descriptions of the watch monitoring and alarm systems.	AP
Lighting within the wheelhouse	Z030 – Arrangement plan	Red and white lighting in wheelhouse and all adjacent corridors, stairways and rooms.	AP
Ventilation in the wheelhouse	Z030 – Arrangement plan	Including capacity specification.	AP
External communication systems	Z030 – Arrangement plan	Antennae for satellite communication systems, radars, VHF's, AIS, GPS, TV etc.	

Table C1 Documentation requirements (Continued)			
<i>Object</i>	<i>Documentation type</i>	<i>Additional description</i>	<i>For approval (AP) or For information (FI) or on request (R)</i>
NAUT-AW			
Navigation systems	Z071 – Failure mode and effect analysis	<p>A document describing how single failures in the Track Control System (TCS) system and components will fail to safety and how essential systems will operate during failure.</p> <p>The FMEA worksheet shall analyze the following:</p> <ul style="list-style-type: none"> — failure modes of each individual sensor and equipment comprising the TCS and the additional functionality required by this rules — the local effect and the resulting output effect (on both interface and display unit) — the failure effect on the next system level until final system effect (end effect) is determined — failure detection and alarm information including failure mode awareness measures shown on the human machine interface — failure in network components (if fitted) — system fall-back modes including status indication of system mode. <p>Note:</p> <p>Example of FMEA worksheet matrix that covers the items specified above (and guidance for the use of FMEA) can be found in IEC60812.</p>	AP
	I030 – Block diagram	Systems interconnections	AP
	Z170 – Installation manual		FI, R
Manoeuvring	N060 – Manoeuvring booklet	A document providing information of the test method and pertinent test equipment (model) to determine the manoeuvring	AP
	N070 – Wheelhouse poster		AP
	N080 – Pilot card		AP
	Z140 – Test procedure for quay and sea trial	Manoeuvring trials programme shall be submitted for verification ref. Sec.8	AP
Automatic telephone system	E170 – Electrical schematic drawing		AP
	Z030 – Arrangement plan	Location of centrals and all subunits.	AP
Talk-back system	E170 – Electrical schematic drawing		AP
	Z030 – Arrangement plan	Location of centrals and all subunits.	AP
Ultra high frequency (UHF) telephone system	Z090 – Equipment list		AP

Table C1 Documentation requirements (Continued)			
<i>Object</i>	<i>Documentation type</i>	<i>Additional description</i>	<i>For approval (AP) or For information (FI) or on request (R)</i>
NAUT-OC/AW (ICS)			
Local area network (LAN) for navigation systems and Network analysis	Z030 – Arrangement plan	Applicable for qualifier ICS: Documentation providing information of following: <ul style="list-style-type: none"> — Topology and network specification — Description of interfaces and network components including data protocol — Description of power supply arrangement(s) — Qualitative reliability analysis (e.g. FMEA) — Failure response test programme. 	AP
	Z080 – Reliability and availability analysis	Applicable for qualifier ICS: Documentation providing information of following: <ul style="list-style-type: none"> — identification of sensors, network components, nodes, computers and controllers both connected to the ICS and being parts of the ICS — possible failures, performance degradations and their causes for each individual equipment — the local effect displayed on the individual equipment and transmitted via the interface — the resulting effect on the functions being processed on the ICS system level — method of failure detection on the ICS system level including related alarms, warnings and indications — system related corrective action including fall-back mode(s) of operation (as applicable) and associated indications; — identification of failures potentially resulting in a change of rudder order or speed order (in automatic control mode). 	AP
ICS manuals	Z170 – Installation manual	The installation manual shall include: <ul style="list-style-type: none"> — Specification of sensors, components and the interconnecting equipment forming the ICS — details of the interfaces and connections for data broadcasting and — interconnection diagrams and interfacing details for external parts of the ICS and for devices to be connected to the network — details of the power supply arrangements required — recommendations on the physical layout of ICS. 	AP
	Z160 – Operation manuals	The operation manual shall include: <ul style="list-style-type: none"> — an overall drawing and description of the ICS and its components — description of the redundancy concept and the availability of ICS functions — a description of possible failures and their effects on the system — guidance for the adjustment of limits for alarms and warning indications — the implications of using different reference locations; — details of the integrity monitoring provided and the required settings — details of the mechanism for marking valid, doubtful and invalid data — details of devices used in the reversionary mode. 	AP

102 For general requirements to documentation, see Pt.0 Ch.3 Sec1.

103 For a full definition of the documentation types, see Pt.0 Ch.3 Sec2.

D. Tests

D 100 General

101 All tests shall be carried out according to test programs approved by the Society.

102 The tests and visual examinations shall verify that all relevant rule requirements are met. The tests are to cover requirements given by these rules and applicable IMO performance standards. The test programs shall specify in detail how the various functions shall be tested and what shall be observed during the tests.

Guidance note:

Reference is made to Sec.10 for further information.

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D 200 Track control testing (TCS)

201 The TCS testing shall include the entire system integrating all equipment and components and including the actual software versions to be installed on board. Serial sensor information may be simulated.

202 Failure modes identified by the FMEA shall be simulated as realistically as possible. Prescribed alarm and safety limits shall be checked. Fall-back modes and system status are to be verified.

203 It shall be verified that automatic control functions involving course and/or speed changes are performing satisfactorily within operating limits defined by the set-up of the TCS configuration.

D 300 Testing of network integrity- qualifier (ICS)

301 Testing in accordance with Sec.7 F. shall be carried out at the manufacturer's works as far as practical in order to limit the necessary testing on board to a minimum.

D 400 On-board testing

401 The testing to be completed during installation and commissioning shall include:

- a) verification of proper interfacing and data protocol of individual equipment
- b) establishment of correct parameters for filters, integrity monitoring, alarm limits, control parameters (time constants, set points, lengths, heights, etc.)
- c) verification of correct functionality of system applications and integration of components, including the ability of the integrated navigation system to keep any controlled process within the specified tolerances
- d) verification of fall-back-modes and emergency operation of essential navigational functions.

402 The tests shall demonstrate that the essential navigational functions are available and operable on designated back-up means in a situation where the normal navigational system configuration is disabled as far as practical.

D 500 Manoeuvring trials - NAUT-AW

501 Tests and trials as required to establish and document the ship's manoeuvring characteristics shall be carried out.

SECTION 2 DESIGN OF WORKPLACE

A. General

A 100 Scope

101 This section specifies the requirements for bridge design, including field of vision, -wheelhouse arrangement, -workstation configuration and location of equipment within workstations.

A 200 Application

201 Ships requesting class notation **NAUT-OC** shall comply with the basic rules in B to E.

202 Ships requesting class notation **NAUT-AW** shall comply with the basic rules in B to E and additionally the requirements specifically addressing **NAUT-AW** in these sub-sections.

Guidance note:

A requirement being specific for NAUT-AW only is identified by inclusion of the notation in the head line as follows:

- Workstations for navigating & manoeuvring – vertical view **NAUT-AW**.

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203 The requirements being applicable for **NAUT-AW** only is additionally gathered in sub-section F for easy overview.

B. Bridge Design

B 100 Principal requirements

101 The ship's navigation bridge shall enable the OOW to perform navigational duties unassisted at all times during normal operating conditions. He shall be able to maintain a proper lookout by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make full appraisal of the situation and the risk of collision, grounding and other hazards to navigation.

102 The ship's navigation bridge shall additionally be designed and arranged with the aim of:

- facilitating the tasks to be performed by the bridge team including a 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
- 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.

103 The bridge design shall meet the terms of all relevant regulations of applicable IMO conventions.

Guidance note:

Applicable conventions in this respect are the International Convention for Safety Of Life At Sea, the International Convention for Preventing Collisions at Sea and the International Convention on Standards of Training, Certification and Watch-keeping for Seafarers, as amended.

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B 200 Field-of-vision from within the wheelhouse

201 When designing the bridge, the main factors to be considered are the overall view required from the inside of the wheelhouse and the field of vision required from each workstation.

202 Every effort shall be made to place the bridge above all other decked superstructures in order to obtain the best possible field of vision for safe navigation and manoeuvring of the ship.

203 A horizontal field of vision to the horizon of 360° shall be obtained by using not more than 2 positions within the confines of the wheelhouse on either side of the workstation for navigating & manoeuvring and being not more than 15 m apart. (Fig.1).

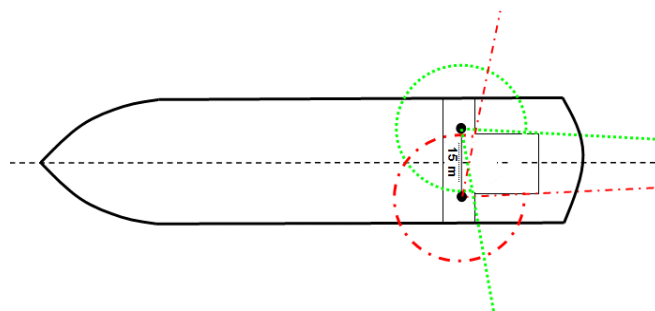


Fig. 1
Two positions combined provide $\geq 360^\circ$ field of vision from inside the wheelhouse

Guidance note:

The maximum distance of 15 m between the two positions inside the wheelhouse may be extended, provided the following conditions are fulfilled:

- suitable cameras are installed capable of viewing the sector(s) astern not being visible within the required 15 meter and pertinent displays/monitors are installed being viewable from the workstation for navigating & manoeuvring, and
- the bridge is totally enclosed and the workstations for docking are equipped with appropriate means for course and speed alterations.

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204 It shall be possible to observe all external objects of interest for safe navigation, such as ships, buoys and lighthouses in any direction from inside the wheelhouse when the ship is pitching and rolling (eye height 1800 mm).

Guidance note:

Irrespective of helicopter decks or other structures placed on top of the wheelhouse a vertical angle of view of not less than 5° above a horizontal line extending from eye height in standing position shall be available all through the 360° horizontal field of vision when positioned adjacent the windows. The eye height in a standing position is considered to be at least 1800 mm above the deck surface for this purpose.

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B 300 Field-of-vision from workstations

301 *Workstations for monitoring and navigating & manoeuvring –forward vertical view*

The view of the sea surface for a person positioned at the workstations for monitoring and navigating & manoeuvring shall not be obscured by more than two ship 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 (eye height 1500 mm). Fig.2.

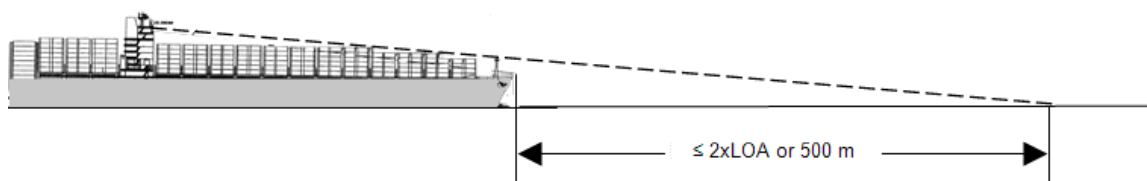


Fig. 2
View of sea surface forward of bow

302 *Workstations for monitoring and navigating & manoeuvring - horizontal field of vision*

The horizontal field of vision from the workstations for monitoring and navigating & manoeuvring shall enable the officer of the navigational watch to carry out his functions in compliance with the International Regulations for Preventing Collisions at Sea and shall extend over an arc of not less than 225° , that is from dead ahead to not less than 22.5° abaft the beam on either side of the ship. Fig.3.

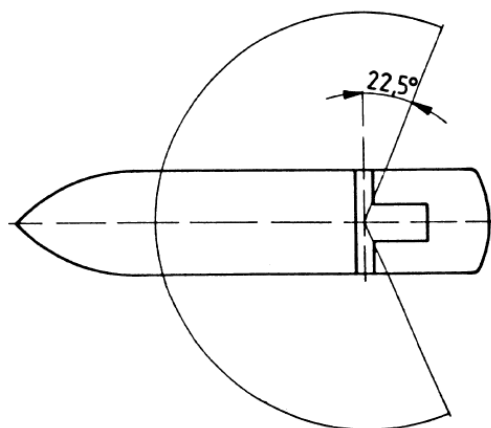


Fig. 3
Horizontal field of vision from the workstations for monitoring and navigating & manoeuvring

303 Workstations for navigating & manoeuvring – vertical view

- Above horizontal plane: A vertical angle of view of not less than 5° above a horizontal line, extending from eye height in forward direction, shall be provided irrespective of helicopter decks or other structures placed on top of the wheelhouse.
- Below horizontal plane: Within the 180° sector forward of athwart ship any elevated ship structure or cargo obstructing the sea surface close to the ship in excess of $\frac{1}{2}$ nm is considered to be a blind sector and shall be included in the blind sector calculation. (eye height 1500 mm).

Guidance note:

Reference is made to the blind sector calculation required by Table C1, N020/N030. The location of elevated structures obstructing the view of the sea surface may only be acceptable on the provision that B501 is complied with.

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304 Workstations for navigating & manoeuvring – vertical view **NAUT-AW**

To be able to view objects and river banks in the proximity of the ship, a person standing at the workstation for navigating & manoeuvring shall be able to observe the sea surface at a distance of no more than 500 m from the hull within the sectors from 10° on either side of the bow to 90° on both sides, under all conditions of draught, trim and deck cargo (eye height 1500 mm). Fig.4.

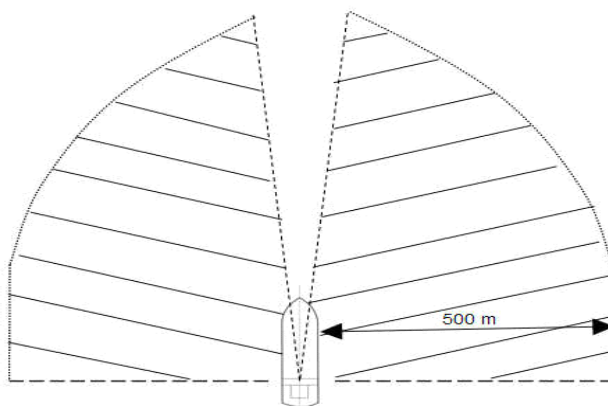


Fig. 4
NAUT-AW: Obstruction of sea surface fwd of athwart ship

Guidance note:

Any deck house, superstructure or cargo obstructing the sea surface by more than 500 m is to be included in the horizontal blind sector calculation and may only be acknowledged if the total blind sector requirement of B501 is complied with.

The eye height in standing position is considered to be not more than 1500 mm above the deck surface for the purpose of vertical view below the horizontal plane (*Note: the 50% percentile of South East Asia population is 1520 mm*).

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305 *Workstations for navigating & manoeuvring - horizontal view astern* **NAUT-AW**

The navigator shall be able to employ leading lights and marks astern of the ship as visual reference for grounding avoidance, while seated at the workstation for navigating & manoeuvring. A field of vision sector astern shall be available and extend over an arc from dead astern to at least 5° on each side. No blind sectors shall occur within this 10° field of vision sector.

Guidance note:

Adequate camera(s) may be accepted for the purpose of achieving the required field of vision astern. The camera system and arrangement shall be approved by the Society prior to the installation.

Note: Leading lights (or range lights) consist of two lights, separated in distance and elevation, so that when lined up vertically, with one behind the other, they provide a bearing to be used for positioning of the vessel in fairways.

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306 *Workstations for navigating & manoeuvring - vertical view astern* - **NAUT-AW**

The vertical view through the aft window pane(s), seen from the workstation for navigating & manoeuvring, shall enable the navigator to view the sea surface in the wake of the ship at a distance not more than 2000 m abaft the stern.

The upper edge of the window(s) shall not be less than 2000 mm above bridge deck surface.

The maximum height from deck to the lower edge of the window(s) shall be 1000 mm or at least fulfil the following condition:

- the lower part of the window panes shall disclose all obtainable sea surfaces aft of the vessel when viewed from the navigating & manoeuvring workstation. Only the superstructure/-deck may be concealed when viewed from normal operating position at this workstation (eye height 1500 mm).

307 *Workstation for conning*

The horizontal field of vision from the workstation for conning shall offer a commanding view.

The vertical field of view shall enable the conning officer (pilot) to monitor the ship's relative position and leeway in the course of a marked fairway or channel.

308 *Workstation for docking operations*

In order to enable the navigator(s) to manoeuvre the ship safely alongside a berth and supervise the mooring of the ship, the horizontal field of vision from each workstation on the bridge wings shall extend over an arc of not less than 225°, that is from at least 45° on the opposite bow through to right astern from the working position. Fig.5.

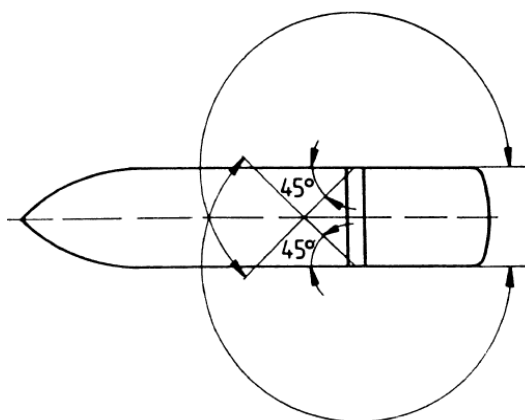


Fig. 5
Field of vision from workstations for docking operations

309 The vertical view shall enable the navigators to monitor the ship's position relative to the berth including observation of the accurate distance from the hull side to the quayside (jetty) at sea level from the docking workstation.

Guidance note:

If B701 cannot be fully satisfied, adequate cameras may be accepted for the purpose of achieving the required vertical view. The camera system and arrangement should be approved by the Society prior to the installation.

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310 *Workstation for docking operations - vertical view* **NAUT-AW**

The vertical view from the docking workstation shall enable the navigator(s) to observe the “parallel hull side” of both fore ship and stern ship from a standing position besides the console while operating the UIDs on hand for manoeuvring of the ship. The hull’s side plates shall be visible over a total length of not less than $L/2$ (eye height 1500 mm). Fig.6.

Guidance note:

Windows should be arranged in the lower part of the bulwark and deck as appropriate to obtain the required vertical view.

Alternatively, adequate cameras may be accepted. The camera system and arrangement should be approved by the Society prior to the installation.

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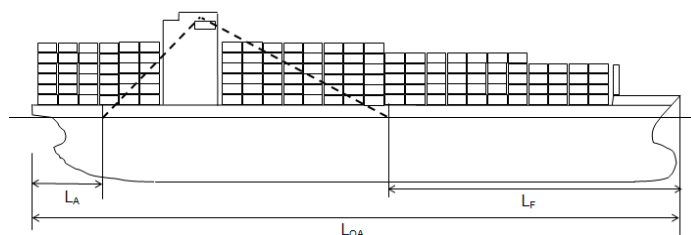


Fig. 6

NAUT-AW: View from docking station $(L_A + L_F) \geq \frac{1}{2}L_{OA}$

311 Workstation for manual steering

In order to enable the helmsman to steer the ship safely in narrow channels, the horizontal field of vision from the workstation for manual steering shall extend over an arc from dead ahead to at least 60° on each side. Fig.7.

The vertical view shall enable the helmsman to observe steering references in the fore ship (if provided) while standing at the normal working position.

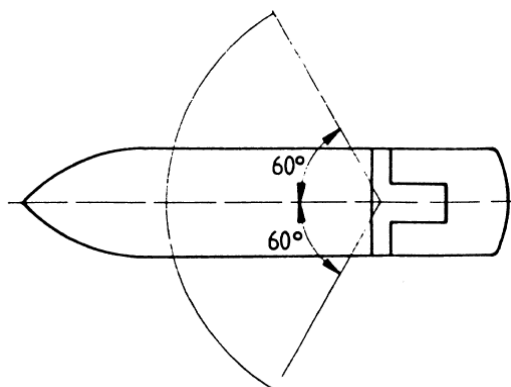


Fig. 7

The field of vision from workstation for manual steering

312 Workstations for GMDSS and additional functions

In order to enable the OOW to operate workstations for safety monitoring, GMDSS equipment and additional bridge functions for short periods of time, the horizontal field of vision from these workstations shall extend at least over an arc from 90° on port bow, through forward, to 22.5° abaft the beam on starboard. Fig.8.

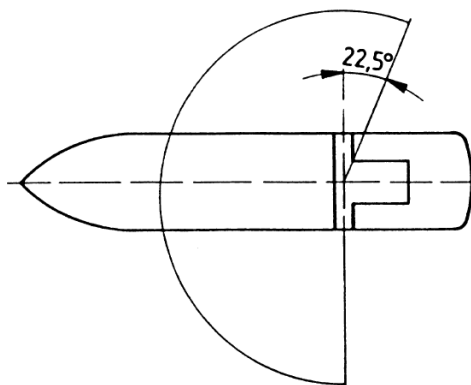


Fig. 8
The field of vision from the GMDSS workstation or additional workstations

B 400 Blind sectors

401 Workstations for monitoring and navigating & manoeuvring

Blind sectors caused by cargo, cargo gear, divisions between windows and other obstructions appearing within the required field of vision of 22.5° , shall be as few and as small as possible, and in no way hamper a safe lookout from the workstations for monitoring and navigating & manoeuvring. The total arc of blind sectors within this field of vision shall not exceed 30° .

Guidance note:

Ref. SOLAS reg. 22.2. "No blindsector caused by cargo, cargo gear or other obstructions outside of the wheelhouse forward of the beam which obstructs the view of the sea surface as seen from the conning position, shall exceed 10 degrees. The total arc of blind sectors shall not exceed 20 degrees. The clear sectors between blind sectors shall be at least 5 degrees. However, in the view described in .1, each individual blindsector shall not exceed 5 degrees".

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402 In order to reduce blind sectors within the required field of vision every effort shall be made to align the front bulkhead and bridge wings with the line-of-sight from the working positions (*eye height 1500 mm*) at the monitoring and navigating & manoeuvring workstations to port and starboard respectively. Fig.9.

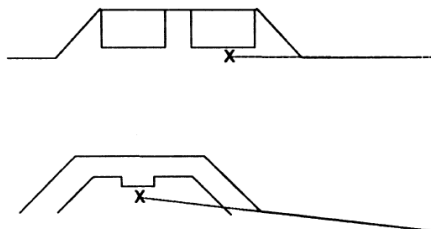


Fig. 9
Front bulkhead and bridge wing bulwark in the line of sight from the workstation

403 Over an arc from dead ahead to at least 10° on each side of the bow, the total blind sector shall not exceed 5° . Elsewhere, each individual blind sector within the required field of vision shall not exceed 10° .

404 The clear sector between two blind sectors caused by obstructions outside of the wheelhouse shall be at least 5° .

The clear sector between two blind sectors caused by division between bridge windows shall not be less than the size of the broadest blind sector on either side of the clear sector.

A clear sector shall be provided from 22.5° abaft the beam and forward on both sides of the ship seen from the monitoring and navigating & manoeuvring workstations.

405 Divisions between windows shall be kept to a minimum and not placed in front of any working position for operation of steering and manoeuvring UIDs or in front of the radars.

406 Workstations for GMDSS and additional functions

A sustainable lookout shall be possible for shorter periods from the workstations for GMDSS and other functions allocated to the OOW. Additional blind sectors, caused by deck supports and other obstructions located inside or outside of the wheelhouse shall be minimized. Each individual blind sector caused by any obstruction whether inside or outside the wheelhouse shall not exceed 10° .

B 500 Bridge windows

501 Window height - general

The minimum height of the upper edge of bridge window panes above the bridge deck surface shall be 2000 mm in order to provide a view of the horizon for a person in a standing position at the relevant working positions.

The maximum height of the lower edge of bridge window panes above the bridge deck shall be 1000 mm in order to provide view of the nearby sea surface for a person in a sitting position at the workstations.

Guidance note:

The maximum height of 1000 mm may be extended, provided the following condition is fulfilled:

- the lower part of the window panes shall disclose all obtainable sea surface when viewed from a sitting position at the most distant workstation (*working position*). I.e. that only part of the superstructure or deck may be concealed by the extended height as viewed from the most distant workstation (eye height 1500 mm).

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502 Lower edge of front windows

The navigator shall obtain a good view of the sea surface in the proximity of the ship from dead ahead to 90° on either side of the workstations for navigating & manoeuvring.

When the distance between the windows and the viewing point (350 mm aft of the consoles) in sitting position at the workstations is more than 2300 mm, the height of the lower edge of the windows in the sector from 10° to 90° on each side shall be decreased sufficiently to maintain the line of sight. Fig.10

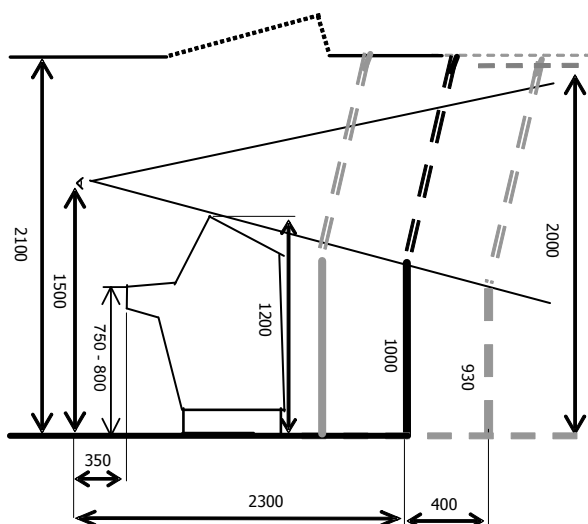


Fig. 10

The height of the lower edge of windows to be decreased when the distance to front bulkhead exceeds 2300 mm

503 Lower edge of front windows - NAUT-AW

When the distance between the windows and the viewing point 350 mm aft of the consoles in sitting positions at the workstations for monitoring and navigating & manoeuvring is more than 1500 mm, the height of the lower edge of the windows in the sector from 10° to 90° on each side shall be decreased sufficiently to maintain the line of sight. Fig.11.

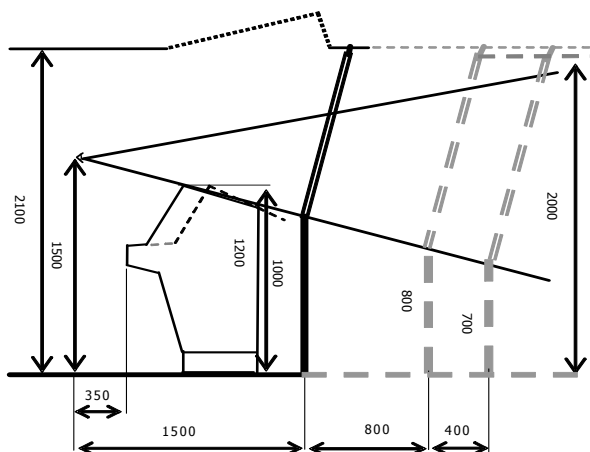


Fig. 11

NAUT-AW: The height of the lower edge of windows to be decreased (lower than 1000 mm) when the distance to front bulkhead exceeds 1500 mm

504 Window breadth

Bridge windows should be as large as practicable to sustain a safe lookout and not less than 1200 mm wide within the field of vision required from the workstations unless otherwise is stated.

Guidance note:

The width of the window directly forward of the centre console may be less than 1200 mm in order to avoid divisions/stiffeners being located in front of any workstations.

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505 Window inclination

Glare in bridge windows caused by internal light sources shall be avoided and not impair the view required for conducting a proper lookout. To help avoid reflection (glare) from lights inside the wheelhouse, the bridge front windows shall be inclined from the vertical plane top out, at an angle of not less than 15° and not more than 25°. Light sources, which may cause reflection in the front windows inclined in accordance with this requirement, shall be avoided.

506 Side and rear windows shall be inclined from the vertical plane top out at an angle not less than 4°~5° as required to avoid glare and specular reflections from instruments and other light sources at the workstations.

Guidance note:

Vertical windows may be accepted provided that the installed equipment, lamps etc. do not cause any glare and reflection in the windows.

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507 Enclosed bridge wing windows

For ships with enclosed bridge wings, it shall be possible to open one side window to view the ship's side at water surface level if:

- the side windows are vertical and there are no windows in the deck providing a downward view
- the side windows are inclined but the bridge wing deck is not extended fully to the maximum width of the ship.

It shall be possible for one person to open the windows fully. Alternative solutions may be acceptable if the view cannot be achieved by opening windows alone.

Guidance note:

An adequate camera system may be acceptable for the purpose of achieving the required view. The camera system and arrangement should be approved by the Society prior to installation.

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508 Window stiffeners

Dimension of division between windows shall be kept to a minimum. If stiffeners are to be covered for decoration this shall not increase the dimensions (width and depth) of the stiffener.

Guidance note:

The division between windows, especially within the required field of vision, should not exceed 150 mm. If stiffeners

are used, the width between window panes should not exceed 100 mm and the depth of the stiffeners should be less than 120 mm.

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B 600 Arrangements for clear view through bridge windows

601 From the workstations to be operated by the OOW there shall be a clear view through the bridge windows within the required field of vision at all times regardless of weather conditions.

The following installations are required:

- To ensure a clear view in conditions of rain and sea spray, heavy duty wipers and fresh water washing system shall be provided on all front windows within the field of vision required from the monitoring and navigating & manoeuvring workstations.
- To improve the visibility and reduce eye strain in bright sunshine sunscreens shall be provided on all applicable bridge windows.
- To ensure a clear view in conditions of icing and dew, an efficient de-icing and de-misting system shall be provided on all applicable bridge windows.

Systems installed shall comply with appropriate international standards. Heated glass panes shall be installed on ships to be assigned one of the Polar or Ice Breaker class notations.

Guidance note:

The window wipers should be straight-line and capable of wiping a window area of not less than 70% of the required area of panes and the maximum speed of the blades shall not be less than 68 metres/minute. A blade length of 1000 mm is deemed acceptable irrespective of the size of the window pane. Reference: ISO 17899.

(CVS may be installed on front windows not being perceptible from the workstations for monitoring and navigating & manoeuvring)

The sunscreens shall be of type roller blinds and offer anti glare and heat rejecting properties. Only the outer surface shall be highly reflective while the inner surface shall offer a non-reflective appearance. Anti glare effect (reduction) better than 90% and heat rejection better than 60% should be achieved.

Applicable windows are commonly all the front and side windows. However, it should be noted though that additional sunscreens may be required on aft windows to prevent direct sunlight from obscuring information on monitor screens and displays.

Reference is made to ISO 8863 and ISO 3434 for specifications of heating by hot-air and heated glass panes respectively.

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602 Clear view through bridge windows

The glass panes used shall not give any nonlinear or blurred effect to the line of sight.

603 Additional cleaning requirement for totally enclosed bridge wings

If the bridge wings are totally enclosed, heavy duty wipers and fresh water window washing shall be provided on forward and aft windows within the field of vision required from workstations for docking operations.

604 Additional cleaning requirement - NAUT-AW

Heavy duty wipers and fresh water window washing to be provided on aft window(s) within the view astern sector required from the navigating & manoeuvring workstation

B 700 Bridge configuration

701 Bridge wings

Bridge wings shall in general extend out to the maximum beam of the ship so as to make the ship's side visible from the workstations for docking operations.

702 To sustain the view of the sea surface from the workstations to be operated by the OOW the height of the bridge wing bulwark shall not exceed 1000 mm. A suitable handrail shall be fit on top of the bulwark at a height not less than 1200 mm. The opening between the bulwark and the handrail shall not be less than 120 mm.

703 If wind deflectors are to be fitted in the length of the bridge wing front, the resulting obstruction of sea surface in close proximity shall be minimized. The length of the deflector shall not impede a sector of more than 10° seen from the operating position at workstations to be operated by the OOW.

Guidance note:

The maximum height of the wind deflector above bridge deck should satisfy the following equation:

$$\text{Height of wind deflector(m)} \leq 1.5 - \frac{d_w \cdot \sqrt{h_e}}{1000}$$

d_w = distance from operating position at workstations to the farthest part of the wind deflector (usually from the

GMDSS station) to the outermost part of the wind deflector on port side.

h_e = eye height above sea level at the workstation

Moreover, the view to starboard from the GMDSS-workstation will usually determine the length of the deflector based on the ruling “blind sector”.

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704 Catwalk

A fixed catwalk or similar arrangement with means to prevent an accidental fall shall be fitted in front of the bridge windows to enable manual cleaning of windows from the outside and repair work in the event of failure of window wipers or fresh water washing system.

705 Height of deckhead

The clear deckhead height in the wheelhouse shall take into account the installation of deckhead mounted equipment 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:

The clear height between the bridge deck surface and the underside of the deck head covering (ceiling) shall be at least 2250 mm.

- a) 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.
- b) The height of entrances and doors to the wheelhouse from adjacent passageways should not be less than 2000 mm.

706 Accesses

All wheelhouse doors shall be operable with one hand. Bridge wing doors shall not be self closing and means shall be provided to hold the doors in open position.

707 Ships with fully enclosed bridge wings shall at least have one door allowing direct access to the adjacent bridge deck area.

708 Access to the compass deck shall be provided from the bridge deck in proximity of the wheelhouse.

709 It shall be possible to watch the deck area in front of the bridge superstructure from inside the wheelhouse by providing direct access to at least one front window.

710 Toilet facilities shall be provided on the bridge deck adjacent the wheelhouse.

C. Wheelhouse Arrangement and Workstation Configuration

C 100 General requirements

101 The workstation arrangement shall be designed in accordance with established principles of ergonomics for safe and efficient operations, enabling the navigator to perceive all relevant information and execute pertinent actions with a minimum workload.

102 The safe control and command of the ship while under way shall be allocated to a certain area of the wheelhouse where only instruments, equipment and controls necessary for the performance of primary bridge functions shall be located.

103 From the area allocated safe control and command of the ship the navigator shall have easy access to equipment related to the safety state of the ship.

104 Individual workstations for performance of primary bridge functions under normal, irregular and abnormal operating conditions during the various phases of the voyage from port to port shall be provided. Such workstations shall include:

- workstation for monitoring
- workstation for navigating & manoeuvring
- workstation for manual steering
- workstation for safety monitoring
- workstations for docking operations
- workstations for conning
- workstation for voyage planning
- workstation for GMDSS

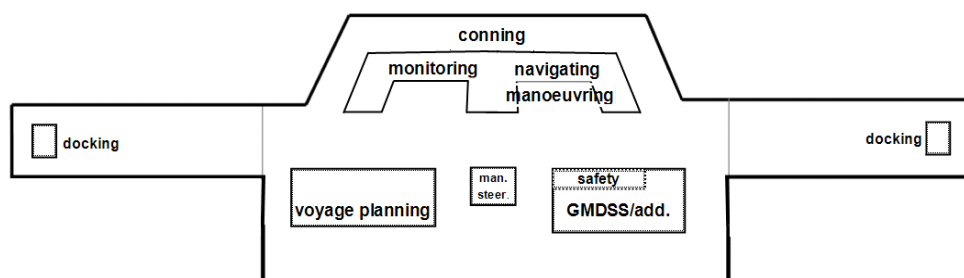


Fig. 12
Design principles – example of wheelhouse arrangement

Guidance note:

The workstation for voyage planning and/or workstation for GMDSS may be waived on a particular ship on conditions recognized in the applicable requirements.

The workstation for manual steering may be waived on a particular “special purpose vessel” having extraordinary means for steering (e.g. multiple azipods) requiring special competence by the operator. Two conditions should be fulfilled though:

- manual steering can be exercised at the navigating & manoeuvring workstation and at least one other workstation and
- the pertinent steering UIDs located on the two workstations are autonomous and one UID can be operated by personnel other than the OOW without interfering with the navigation of the vessel.

The design of the manual steering arrangement and pertinent UIDs shall be approved by the Society prior to the waiver.

Workstation for dynamic positioning (DP) may be included in the above mentioned workstations. If DP workstation is provided, special design requirements are applicable and given in Pt.6 Ch.7 and Ch.26.

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105 The individual workstations allocated primary bridge functions shall be arranged for easy operation by one person as well as allowing close co-operation between personnel at the various workstations when manned for individual operations.

Guidance note:

The workstations for primary bridge functions, except for docking operations, should be located within an area not more than 10 m wide.

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106 Workstations for additional functions may be located on the bridge provided the performance of such additional functions does not interfere with the ability of the OOW to carry out the primary bridge functions. Workstations for additional functions may include:

- extended communication functions
- monitoring and control of ballasting and cargo operations
- monitoring and control of machinery
- monitoring and control of hull openings
- monitoring and control of domestic systems
- dynamic positioning.

Guidance note:

The height of consoles forming workstations for additional functions located inside the wheelhouse shall not obstruct the sea surface within the required field of vision from sitting position at the workstations for monitoring and navigating & manoeuvring.

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107 The 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 workstations should be arranged with the aim of promoting effective and safe bridge resource management

108 It shall be possible for persons at a workstation to communicate with persons at other workstations of relevance for the function to be performed, under all operating conditions.

109 Means for controlling speed, heading and control modes shall only be located at workstations providing the required field of vision and being intended for the related tasks.

C 200 Passageways

201 There shall be a clear route across the wheelhouse from bridge wing to bridge wing for two persons to pass each other. The width of the passageway shall in the main be 1200 mm and not less than 700 mm at any single point of obstruction.

202 The distance between separate workstation areas shall be sufficient to allow unobstructed passage for persons not working at the stations. The width of such passageways shall not be less than 700 mm allowing for persons sitting or standing at their workstations.

203 If the consoles of the monitoring and navigating & manoeuvring workstations are not to be located directly against the front bulkhead of the wheelhouse then the distance between the front bulkhead and the consoles shall be sufficient for one person to pass a stationary person. The width of this passageway should preferably be 1000 mm and shall not be less than 800 mm.

Guidance note:

The Panama Canal Commission (ACP) requires a minimum of 1 metre clearance between the front bulkhead and any adjacent consoles. Requests for relaxation of this requirement may be considered by ACP on a case-by-case basis.

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204 The distance between bridge wing consoles, when installed, and adjacent bulwarks/bulkheads shall be as small as possible for easy operation of manoeuvring UIDs while having an optimum view of the ship's hull side and mooring operations, but yet wide enough for one person to pass the console. The width of the passageway shall preferably be 600 mm.

The Panama Canal Commission (ACP) requires a minimum of 1 metre clearance between any consoles and adjacent to bulkheads/-bulwarks

Guidance note:

Requests for relaxation of this requirement may be considered by ACP on a case-by-case basis.

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C 300 Console configuration

301 Consoles should principally be divided into two separate areas;

- one inclined area for display of information and
- one horizontal (desktop) part for the UIDs to be within reach from the working position.

Guidance note:

To provide a functional reach from standing position, the height of console desktops above bridge deck surface, equipped with UIDs should preferably be 800 mm and not less than 750 mm.

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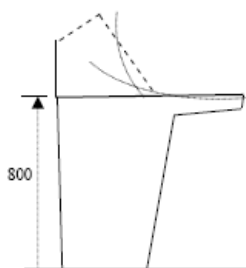


Fig. 13
Principle console configuration

302 Console configuration shall provide the user with the information required to be easily readable at the workstation within a viewing angle from right ahead to 90° to each side seen from the normal working position.

303 The configuration of consoles at the workstations for monitoring and navigating & manoeuvring shall enable easy use of equipment required for safe and efficient performance of the tasks to be performed from both standing and sitting positions.

304 Leg room in consoles – NAUT-AW

The console in front of the seated working position (generally the radars) shall provide sufficient leg room as required to ease the reach of equipment and controls to be used.

Guidance note:

The leg room of the console should have a minimum of 450 mm in depth in the lower part.

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305 Console height

The consoles forming the workstations for monitoring and navigating & manoeuvring shall not obstruct the lower part of the window panes as seen from a sitting position behind the consoles (eye height 1500 mm). The height of these consoles shall not exceed 1200 mm.

Guidance note:

A console height of 1200 mm is acceptable even if it should interfere with the line of sight from an eye height of 1500 mm providing the height of the chair can be adjusted to compensate for the obstruction.

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306 The height of consoles forming other workstations that are intended to be operated by the OOW shall not exceed 1300 mm. If such workstations are to be located within the horizontal field of vision required from the workstations for monitoring and navigating & manoeuvring then the console height shall not exceed 1200 mm.

307 Chart console (if provided)

The height of the chart console desktops shall preferably be 950 mm and not less than 850 mm.

308 The surface of the chart console desktop shall have an effective working area of at least 1 600 mm × 800 mm.

C 400 Chairs

401 The bridge design and console configuration shall permit installation of chairs at the workstations for monitoring and navigating & manoeuvring even if the ship is not to be equipped with chairs at the time of delivery.

Guidance note:

The decision on installation of chairs on the bridge is left to the current owners of the ship, considering the trade and type of the ship and the need to mitigate fatigue and promote increased concentration and efficiency of the bridge watch.

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402 When chairs are installed at the monitoring and navigating & manoeuvring workstations it shall be easy to adjust the vertical level of the seats to suit users of different heights for optimum view and reaching distance.

403 It shall be possible to regulate the chairs in fore and aft direction for easy reach of the equipment to be used and to move the chairs away from the consoles completely to achieve good working conditions from a standing position and attain an unobstructed passage next to the consoles.

404 It shall be easy to enter and leave the chairs in any position.

405 Deck rails used to support horizontal movements of the chairs shall be installed level with the deck surface to prevent tripping of personnel.

406 Compulsory chairs - NAUT-AW

Adequate chairs shall be installed at the monitoring and navigating & manoeuvring workstations in compliance with this section. The following additional characteristics shall be attained:

- The vertical adjustment of the seat shall range from at least 600 to 800 mm above deck level.
- The chairs shall be fastened to rails, enabling easy reach of relevant equipment while seated and allowing fore and aft movement as well as the chairs being moved out-of-the-way from the workstation consoles providing a passage of ≥700 mm.
- The chair shall be equipped with an adjustable footrest.

C 500 Wheelhouse surveillance system

Guidance note:

An active surveillance system shall be arranged in the wheelhouse to ensure the navigational watch being attended at all times. Reference is made to Sec.6 H. for detail system requirements.

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501 The surveillance system shall be positioned so that it can detect activities on the conning-, monitoring- and navigating & manoeuvring workstations to verify that the OOW is on the lookout.

502 Other workstation areas may be included in the surveillance scheme only if their location support the minimum field-of-vision required by B312.

D. Workstations for Primary Bridge Functions - Location of Equipment

D 100 General

101 The arrangement of equipment within the workstations shall take in the frequency of use, the importance of the related task and the ergonomics of the UID while adhering to acknowledged anthropometric measurements in order to ensure safe and efficient operations from standing or sitting positions as made applicable by the requirements.

102 *UIDs for manoeuvring*

Where several workstations are equipped with means for control of propulsion, steering and auxiliary manoeuvring device(s) the arrangement of UIDs shall be consistent on all workstations.

103 Where more than one unit of propulsion, steering and/or auxiliary manoeuvring devices is installed, the arrangement of pertinent UIDs and indicators/displays shall correspond to the physical arrangement of the associated power units on the ship.

104 All instruments shall be logically grouped according to their functions within each workstation. The operation of UIDs shall not obscure associated indicators which observation is necessary for carrying out the task.

105 Indicators and displays providing visual information to more than one person shall be located for easy viewing by all personnel concurrently. If this is not achievable, the indicator or display shall be duplicated.

D 200 Locating equipment - “within reach” and “easily readable”

201 *Within reach from standing position:* The distance the operator can reach and use an UID from a standing position next to a console. This distance shall be maximum 800 mm in forward direction and 1400 mm sideways from the working position. Fig.14.

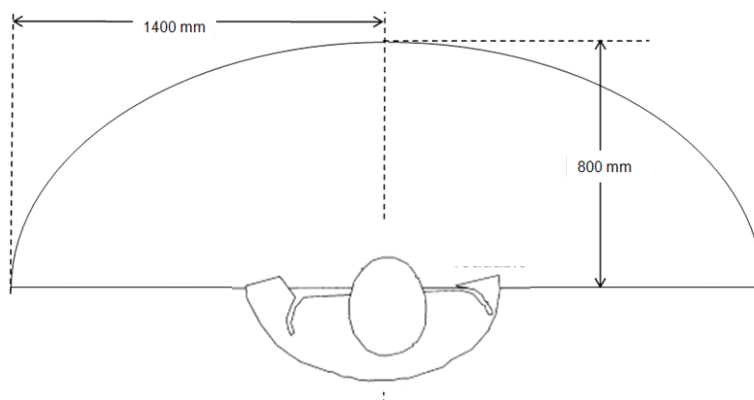


Fig. 14
Area within reach from standing position

202 *Within reach from sitting position:* Location of UIDs for different tasks to be performed in a seated, at a distance of 350 mm from a console, to be maximum 1000 mm, and maximum 800 mm for frequently used equipment, which is to be within easy reach. The designated areas defined by figure 15 when being addressed by individual requirements.

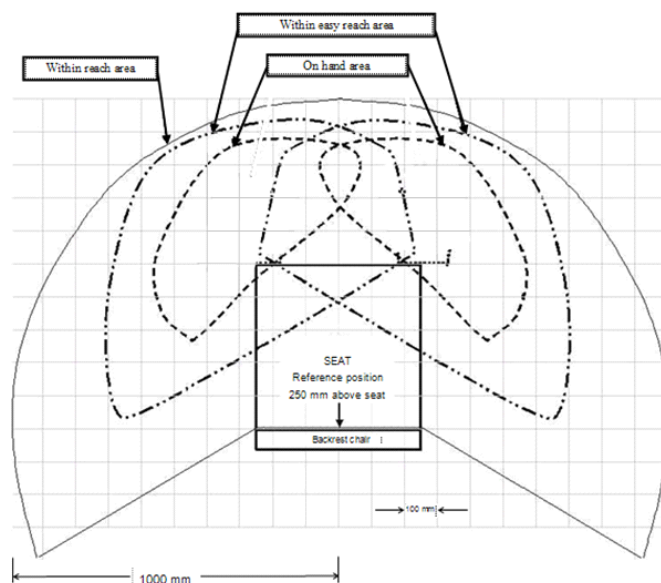


Fig. 15
Areas within reach from seated position

203 Easily readable: For information to become easily readable at the workstation all relevant indicators and displays shall be located within the forward* 180° view sector seen from the operating position. An indicator or display that is to be monitored concurrently with operation of an UID shall be located within the forward 120° view sector seen from the operating position.

The indicators and displays shall be placed with its front perpendicular to the navigator's line of sight seen from the operating position, or to a mean value (angle) if the information is to be used by personnel located at more than one workstation.

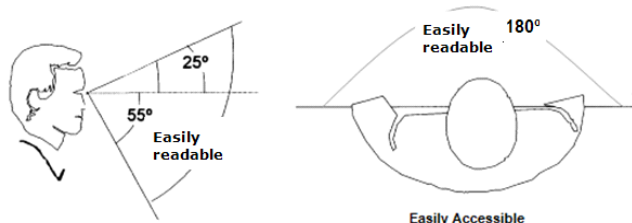


Fig. 16
Forward view sector

Guidance note 1:

The height of letters and figures in mm should be not less than 3.5 times the reading distance in m. Pertinent character width should be approximately 0.7 to 0.9 times the character height, e.g.:

- Letter height for reading distance 2 m: $2 \times 3.5 = 7$ mm
- Letter width for character height 7 mm: $7 \times 0.7(0.9) = 4.9$ to 6.3 mm
- Resulting minimum letter size: 7 mm × 5 mm.

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Guidance note 2:

* On docking workstations where consoles are arranged for view astern or where consoles are arranged for operation from the outward side the term “forward” used in this requirement is to be understood as “astern” or “inward” respectively.

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D 300 Workstations for monitoring and navigating & manoeuvring

301 The workstations for monitoring and navigating & manoeuvring shall be arranged to enable two navigators to carry out their tasks in close co-operation.

302 Various mutual equipment may be installed to serve the individual tasks allocated both these workstations provided the within reach requirement and/or readability requirement are complied with from the

working positions at both workstations. Fig.17.

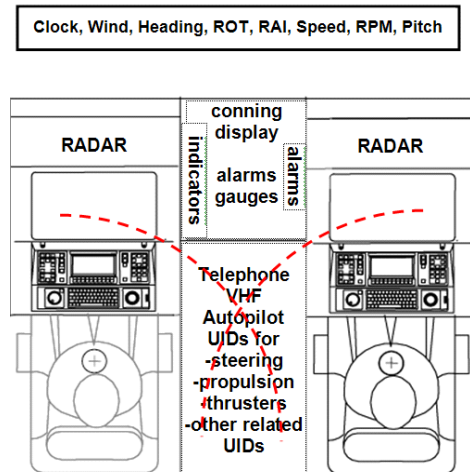


Fig. 17
Shared UIDs and information displays

D 400 Workstation for monitoring

401 The workstation for monitoring shall enable the following tasks to be performed:

- determine and plot the ship's position, course, track and speed made good
- effect internal and external communication
- monitor time, heading, speed, rudder angle, propeller revolutions and propeller pitch (when applicable)
- monitor position, COG, SOG and “track made good” (past positions) against the voyage plan
- adjusting the voyage plan
- monitor and analyse the traffic situation
- decide on collision avoidance manoeuvres
- cooperation with personnel at the navigating & manoeuvring workstation.

402 Equipment to be installed

The navigation radar with ARPA shall be located within easy reach from a sitting position at the monitoring workstation. Additionally the following equipment considered essential for operations at the workstation for monitoring shall be located within reach from a sitting position:

- ECDIS
- VHF unit
- internal communication equipment (auto telephone).

and the following equipment shall be within reach from a standing position:

- distance indicator
- NAVTEX
- whistle push button.

403 Information to be provided

Instruments, indicators and displays providing information considered essential for safe and efficient operations at the workstation for monitoring shall be easily readable from both standing and sitting positions at the workstation. The equipment includes:

- gyro repeater
- rudder angle indicator
- speed indicator(s)
- distance indicator
- rate-of-turn indicator
- depth indicator
- clock
- propeller revolutions indicator
- pitch indicator, when provided
- wind speed and direction indicator
- alarm management system display
- indicator warning of surveillance period elapsing
- two GNSS-position displays (with access to satellite data).

Guidance note:

If both the ECDIS and the ARPA are separately interfaced with the two GNSS-receivers and the user can access HDOP, mode indicator and number of satellites in use from either of these displays it may be deemed an acceptable solution and no additional displays are required at this workstation.

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If the consoles are located directly against the front bulkhead, both an AIS pilot plug, power outlet and free desktop space for a personal pilot unit (laptop) shall be provided and be within reach from a standing position.

404 Means to be easily accessible

Means to be used at intervals for securing safe course and speed and safety of bridge operation shall be easily accessible from the workstation for monitoring. These means include:

- instruments and equipment installed at the workstation for navigating & manoeuvring
- instruments and equipment at the workstation for safety monitoring
- window wipers and wash controls for the windows within the required field of vision
- light switch and dimmer for workstation illumination
- depth recording device.
- navigation light distribution panel
- whistle fog signal control panel.

D 500 Workstation for navigating & manoeuvring

501 The workstation for navigating & manoeuvring shall enable the following tasks to be performed:

- monitor the traffic by sight and hearing as well as by available means
- analyse the traffic situation
- manage AIS information and messages
- decide on collision avoidance manoeuvres
- change course
- change speed
- change operational steering mode
- effect internal and external communication
- operate auxiliary manoeuvring devices
- monitor time, heading, speed, propeller revolutions, thrust indicator, if the ship is equipped with thrusters, pitch indicator, if the ship is equipped with pitch propeller, rudder angle and rate of turn
- monitor position, COG, SOG and “track made good” (past positions) against the voyage plan
- adjusting the voyage plan
- acknowledge all navigational alarms
- monitor all alarm conditions on the bridge
- cooperation with personnel at the monitoring workstation.

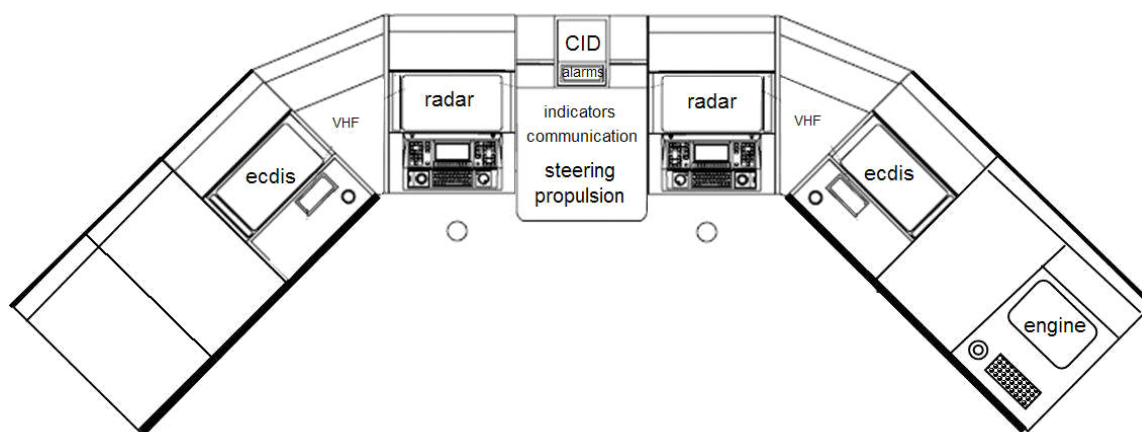


Fig. 18

Example: -joint arrangement of workstations for monitoring and navigating & manoeuvring

502 Equipment to be installed

Instruments and equipment that are to be operated by the navigator at the workstation for navigating & manoeuvring and considered essential for safe and efficient performance of his tasks, shall be within reach from a sitting position at the workstation, priority given to location of UIDs for ARPA, course and speed.

The following instruments and equipment shall be installed within easy reach from a sitting position:

- navigation radar with ARPA
- propulsion control
- manual steering device (with take-over)
- heading control
- track control, when provided.

The following equipment shall be installed within reach from a sitting position:

- ECDIS
- steering mode selector switch
- steering control station selection (if provided)
- VHF unit
- whistle push button
- internal communication equipment (auto telephone)
- alarm management system UIDs.

The following equipment shall be within easy reach from either sitting or standing position at the centre console:

- steering UIDs
- propulsion
- Steering override device
- thruster UIDs, when provided
- emergency stop for propulsion machinery
- emergency stop for thruster(s), when provided.

The following equipment shall be installed within reach from a standing position at the workstation:

- gyro compass selector switch
- steering gear pumps (operation panel).

503 *Information to be provided*

Instruments, indicators and displays providing information considered essential for the safe and efficient performance of tasks at the workstation for navigating & manoeuvring shall be easily readable and audible from the working positions at the workstation and includes:

- propeller revolution indicator(s)
- thrust indicator(s), when provided
- pitch indicator(s), when provided
- speed indicator(s)
- wind speed and direction indicator
- rudder angle indicator(s)
- rate-of-turn indicator
- heading indicator
- steering mode indicator
- steering position in command (when relevant)
- depth indicator
- clock
- conning information display, when provided
- alarm management display
- alarm panel related to unmanned machinery space
- alarm panel related to steering control system and steering gear
- sound reception indicator/display
- indicator warning of surveillance period elapsing.

504 *Means to be easily accessible*

Means to be used at intervals for securing safe course and speed and safety of bridge operation shall be easily accessible from the workstation for navigating & manoeuvring. The means include:

- instruments and equipment installed at the monitoring workstation
- engine automatic control and monitoring system, if provided
- public address system
- window wiper and wash controls for the windows within the required field of vision
- instruments and equipment at the workstation for safety monitoring
- searchlight control panel, if provided
- light switch and dimmer for workstation illumination
- control panel for the sound reception system.
- navigation light distribution panel

- whistle fog signal control panel
- anchor winch control panel, if provided.

505 Additional tasks - NAUT-AW

The workstation for navigating & manoeuvring shall enable performance of the following additional tasks:

- monitor the performance and status of the equipment and sensors of the grounding avoidance system
- monitor speed over ground in both longitudinal and transversal directions.

506 Additional equipment - NAUT-AW

- The additional information displays to be readable and UIs to be installed within reach at the workstation are:
- conning information display
- dual axis speed information display.

D 600 Workstations for conning

601 A workstation for conning of the ship shall be arranged to enable navigators (pilots) to assist in navigating and manoeuvring of the ship without interfering with the tasks of the ship's bridge personnel on duty.

602 The workstation for conning shall enable a pilot to observe all relevant external and internal information for determination and maintenance of safe course and speed of the ship in narrow waters, harbour areas and during canal passages.

603 The workstation for conning shall be located close to:

- the forward centre window in order to optimise the view of the sea surface close to the sides of the ship, and
- the workstation for monitoring and navigating & manoeuvring to allow good co-operation between all navigators, each at their workstation.

604 If the view in the centreline is obstructed by large masts, cranes, etc., an additional conning position providing a commanding view shall be located on the starboard side as close to the centre line as possible, and not more than 5 m from the centreline.

Guidance note:

The Panama Canal Commission requires conning positions directly behind the three centre windows.

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605 The monitoring workstation may serve as the conning workstation if the consoles are located directly against the bridge front bulkhead.

Guidance note:

An AIS pilot plug and power outlet and desktop space shall be provided for at the monitoring workstation if it also serves as the conning workstation.

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606 Tasks to be performed

The workstation for conning shall enable the following tasks to be performed in narrow waters, harbour areas and during canal passages and anchoring:

- enable a pilot to monitor surrounding traffic and conduct pilotage and direct the ship's heading and speed in close cooperation with the attending bridge team
- give sound signals
- effect external communication
- monitor heading, rudder angle, rate-of-turn, propeller revolutions, propeller pitch (if controllable), status of thrusters (if provided) and speed.

607 Information and equipment to be provided

The instruments and equipment required for safe and efficient performance of the pilot's tasks shall be available from the workstation.

a) The indicators and displays required to be easily readable from the working position include:

- heading indicator
- rudder angle indicator
- rate-of-turn indicator
- propeller revolutions indicator
- pitch indicator, when relevant

- speed indicator.
- auxiliary manoeuvring device indicators (thrust), if provided.

b) Means that shall be available from the working position(s) include:

- whistle push button
- VHF
- AIS pilot plug, power outlet and space for a pilot personal unit (e.g. a folding table).

D 700 Workstation for voyage planning

701 A workstation for voyage planning shall be provided to enable navigators to carry out passage planning and chart works while taking in nautical publications without interfering with ongoing navigation of the ship. The workstation shall be equipped with means for efficient route planning and means for direct transfer of the planned route to the monitoring and navigating & manoeuvring workstations.

Guidance note:

The workstation for voyage planning may be waived if the vessel is not to be engaged in world wide trade but shall operate only in regional waters having adequate coverage of ENC's. Ref. Sec.1 A503 for information about the waiver.

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702 Tasks to be performed

The workstation for voyage planning shall enable the following tasks to be performed:

- determine and plot the ship's position
- plan the forthcoming voyage on the basis of available information from charts and nautical publications
- plotting of the intended track in appropriate charts including: planned courses, radii of turns, wheel-over-lines, distances, ETAs, as well as identification of all areas of danger, existing ships' routing and reporting systems, vessel traffic services, and any areas where marine environmental protection considerations apply
- transferring the voyage plan to the ECDIS' on the workstations for monitoring and navigating & manoeuvring.

703 Equipment to be installed

In order to enable efficient performance of the tasks the following means and equipment shall be installed at the workstation:

- position display
- voyage planning terminal interconnected with ECDIS (within easy reach from standing position)
- weather information device
- clock
- a chart console suitable for plotting of the intended track in nautical paper charts
- storage space (drawers) for all nautical paper charts
- storage appliance for nautical publications (incl. CDs/DVDs).

D 800 Workstations for manual steering

801 The workstation for manual steering shall enable the helmsman to carry out the following tasks:

- control the position of the rudder (rudder angle)
- maintain a steady heading by compass readings as well as external visual means
- maintain a steady rate-of-turn
- conduct two-way communication with workstations for conning, navigating & manoeuvring and docking operations.

802 Information and equipment to be provided

The following equipment, indicators and displays shall be easily readable from the workstation:

- gyro repeater
- rudder angle indicator
- rudder order indicator, when follow-up steering is provided
- magnetic compass display
- rate-of-turn indicator.

and the following equipment should be located on hand from the working position:

- manual steering UID(s) (helm)
- communication equipment.

Guidance note:

The communication equipment may be a suitable wireless system (e.g. UHF) or a PA talkback system or similar fixed

installation. The communication equipment may be waived on vessels with enclosed bridge wings if the distance to the docking workstations is <10 m and the noise level <65 dB(A).

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803 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 navigators at the monitoring and navigating & manoeuvring workstations.

804 If the view ahead is obstructed by large masts, cranes, etc., the workstation for manual steering should preferably be located off the centre line to obtain a clear view dead ahead.

When the workstation is located off centreline a steering reference (range and light) shall be installed in the fore ship, equally distanced off the centreline, and clearly visible from the working position by day and night.

If the fore ship (e.g. stem or foremast) cannot be seen from the working position an equivalent steering reference shall make up a line-of-sight parallel to the ship's centreline for use by the helmsman.

Guidance note:

The Panama Canal Authority (ACP) requires all ships >100 m in length to install, at or near the stem, a steering range equipped with a fixed blue light which shall be clearly visible from the bridge along the centreline. The height of the light is to be as close as possible to the height of eye level on the bridge. If said range and light so placed would be partially or completely obscured from Conning Position 1, then two such ranges and lights must be installed ahead of Conning Positions 2 and 3.

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D 900 Workstation for emergency steering

901 The workstation for manual steering in the steering gear compartment shall enable the following tasks to be performed from the working position:

- control the position of the rudder (rudder angle)
- monitor rudder angle
- monitor heading
- effect two-way communication with the bridge.

902 Equipment to be available at the workstation for emergency steering:

The following equipment shall be available and readable from the working position while operating the steering UIs:

- UIs for controlling the rudder angle (on hand)
- hands-free internal communication (headset)
- heading indicator
- means for reading rudder angle.

D 1000 Workstation for safety monitoring

1001 The workstation for safety monitoring shall enable monitoring of all the equipment and alarm panels installed relating to the safety state of the ship as well as relevant UIs provided for instant actions and tasks assigned to the OOW at the initial stage of an emergency situation. At least the following tasks are assigned to the OOW:

- observe and deal with equipment installed for monitoring of the safety state and integrity of the ship
- take immediate action on alarms and execute relevant measures according to contingency plan
- call upon other personnel for assistance and/or communicating situational awareness.

1002 *Equipment to be provided*

Equipment installed for monitoring and early detection of internal dangers threatening the integrity of the ship shall be centralised in the workstation for safety monitoring together with pertinent UIs being fitted for urgent follow-up actions.

The following equipment shall be easily readable and operable from a standing position at the safety workstation when being installed in the wheelhouse:

- fire detection system
- smoke detection systems
- control panel for fire pumps
- control panel for fire doors
- control panel for watertight doors
- control panel for hull openings and hatches
- emergency stop for ventilation fans
- gas detection systems

- any monitoring, alarm or safety system for additional functions assigned to the OOW
- internal communication system (auto telephone)
- general emergency alarm system
- public address system
- fire-fighting local application system(s)
- other safety systems if fitted.

1003 The location and configuration of this workstation shall:

- enable personnel to carry out the relevant functions at the workstation without interfering with the tasks to be performed at the workstation for navigating & manoeuvring
- enable a person at the workstation to observe the workstation for navigating & manoeuvring and maintain the field of vision for proper lookout
- enable the navigator at the workstation for navigating & manoeuvring to observe information related to the safety state of the ship.

Guidance note:

For passenger ships the workstation for safety monitoring shall be separated from workstation for navigation and navigation support in such a way that management of emergencies can be performed without distracting watch officers from their navigational duties. MSC82/24 Annex 2.

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1004 The workstation for safety monitoring shall be located for easy viewing from the workstation for navigating & manoeuvring. All alarms and warnings appearing on the safety equipment shall be apparent and distinguishable from the normal working position at the workstation for navigating & manoeuvring.

1005 *Additional means to be provided*

The following means to organise and execute emergency operations shall be easily accessible:

- hardcopies of safety plans and drawings with desk top space to accommodate study of drawings or computer system providing all relevant information
- the GMDSS installed at the workstation for communication.

D 1100 Workstations for docking operations

1101 The workstations for safe docking of the ship shall enable the navigator together with a pilot to observe all relevant external and internal information to direct the manoeuvring of the ship.

1102 *Tasks to be performed*

The workstation for docking operations shall enable the following tasks to be performed:

- supervision of docking operations
- monitor the ship's heading, rudder angle, propeller revolutions, propeller pitch (if relevant) and thruster(s) (if relevant)
- release sound signals
- monitor the relevant mooring operations on board and ashore
- govern the mooring operations by having orders effected
- effect two-way communication with mooring stations on board and ashore
- effect two-way communication with wheelhouse workstations for manual steering and navigating & manoeuvring.

1103 *Equipment to be available*

Equipment essential for the safe performance of docking operations shall be within reach from a standing position providing the required field of vision and is including:

- whistle push button
- means for two-way communication with mooring stations on board and relevant workstations in the wheelhouse
- VHF unit.

Guidance note:

A wireless portable radio system (UHF) enabling hands-free operation may be acceptable as means for two-way communication between personnel involved in mooring operations. See Sec.6.

The VHF unit may be a handset enabling selection of channels, or a complete mobile unit. If a handheld or mobile unit is used, a specific location at the workstation shall be provided with means supporting the VHF unit.

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1104 *Information to be provided*

Information essential for safe conduct of the docking operations shall be easily readable from the workstation for docking operations.

The following information indicators shall be easily readable from the workstation:

- propeller revolutions indicator(s), and propeller pitch indicator(s) (when applicable)
- thruster indicator(s) (when applicable)
- rudder angle indicator
- heading indicator.

1105 Additional tasks - NAUT-AW

The workstations shall additionally enable the following tasks to be performed:

- control the position of the rudder (rudder angle)
- control the propulsion (RPM/Pitch)
- control the thrusters (if installed)
- effect two-way communication with engine control room, steering gear and department offices.

1106 Additional equipment - NAUT-AW

The following additional equipment shall be installed within reach from a standing position at the workstation providing the required field of vision to enable safe performance of the tasks:

- propulsion UID
- thruster UID, if provided
- steering UID
- internal communication (auto telephone).

The following additional indicators or displays shall be easily readable from the working position:

- starting air pressure
- speed indicator displaying longitudinal and transversal speeds
- wind speed and direction
- CID, AMS and ECDIS (when provided)

Guidance note:

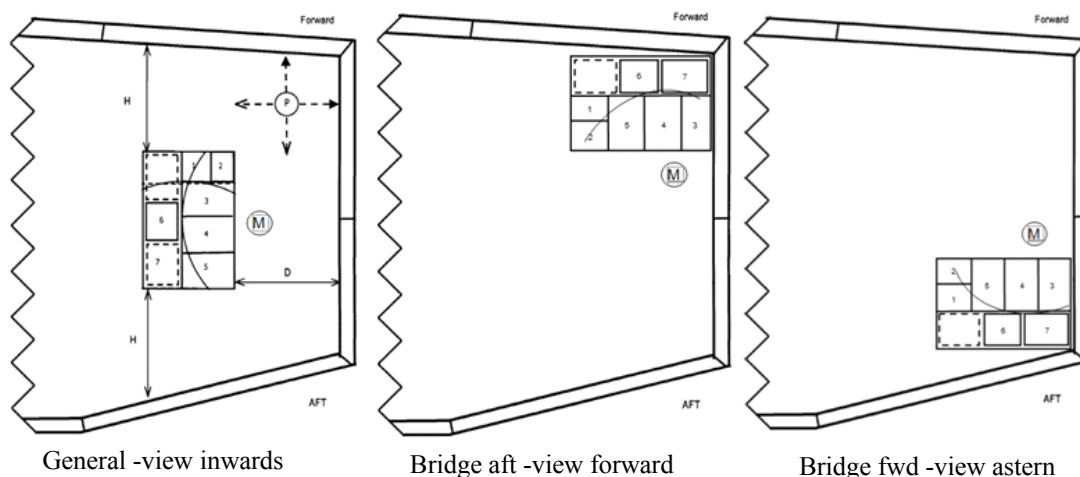


Fig. 19
Examples on arrangement of docking workstation

- | | |
|---|-------------------------------------|
| — D: $600 \leq \text{Distance} \leq 800$ mm | — 3: Thruster UID |
| — H: Passageway ≥ 700 mm | — 4: Propulsion UID |
| — M: Working position | — 5: Steering UID |
| — P: Pilot | — 6: Internal communication |
| — 1: VHF | — 7: Indicators and displays |
| — 2: Whistle | — See also FOV requirement of E211. |

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Guidance note:

*ACP requires a minimum of 1 m clearance from the console to the outer bulwark on the bridge wing. Requests for relaxation of this distance may be granted by ACP on a case-by-case basis.

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1107 MFD equipment required - NAUT-AW (ICS)

The docking workstation shall be provided with two independent MFD-displays supporting applications for radar, ECDIS, conning display and alarm management system.

Guidance note:

The MFDs may substitute for the separate indicators/-displays required on these workstations provided the screen type is easily readable in bright daylight (sunshine).

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D 1200 Workstations for GMDSS

1201 In order to maintain the safety of navigation, also when the OOW is responsible for GMDSS-operations, pertinent equipment shall be located in a separate workstation for communication in close vicinity of the navigating & manoeuvring workstation.

Guidance note:

If the workstation for GMDSS is not to be operated by the OOW, it may be located elsewhere but shall then be easily accessible from the workstation for emergency operations. Both workstations may be waived if their functions are arranged for outside the bridge area.

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1202 The GMDSS equipment installed for detection of ships in distress shall be audible and visible to the OOW at the navigating & manoeuvring workstation. The visibility requirement may be renounced though if the audible alarm has a characteristic sound being easily identifiable.

1203 From the normal working position at the GMDSS workstation it shall be possible to observe the equipment on the workstation for navigating & manoeuvring, monitor the ship's heading and rudder angle as well as maintaining a proper lookout.

E. Additional Workstations

E 100 Additional functions assigned the OOW

101 In order to maintain the safety level in bridge operation, also when the officer of the watch performs other functions than those related to primary bridge functions, the following requirements shall be complied with:

- a) Each additional function shall be designated a separate workstation (separate workstations may be adjacent primary workstations).
- b) From workstations for additional functions, it shall be possible to monitor the workstation for navigating & manoeuvring, the ship's heading and rudder angle, and to maintain the minimum field of vision for efficient lookout.
- c) The workload at workstations for additional functions shall not prevent the officer of the watch from maintaining a proper lookout.
- d) In situations where primary functions may require the immediate attention of the OOW, nothing shall prevent abandoning a workstation for additional functions.
- e) It shall be possible to operate workstations for additional functions without interfering with the operation of workstations for primary functions.

E 200 Other functions located on the bridge

201 Other functions than those related to navigation, manoeuvring, safety and distress may be performed on the bridge by other personnel than the officer of the watch, provided the following requirements are complied with:

- a) The additional tasks to be carried out at workstations for other functions shall not in any way affect the performance of primary bridge functions, neither by use of light or noise disturbance nor visual or audible distractions.
- b) Furniture arranged for meetings or relaxation shall preferably not be installed within the area of the navigating bridge. If still provided, such arrangements shall not to be located within the field of vision sectors required from the workstations for primary bridge functions.

Guidance note:

IMO urges governments to ensure that ship's navigation bridge is not used for purposes other than navigation, communication and other functions essential to the safe operation of the ship, its engines and cargo. IMO Res. A.708(17).

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F. Requirements Specific for Class Notation NAUT-AW and/or qualifier (ICS)

F 100 General

101 This sub-section gives an overview of the requirements specifically addressing **NAUT-AW** and **(ICS)** in sub-sections B to E.

F 200 Field-of-vision from workstations

201 (B302) Workstations for navigating & manoeuvring – vertical view NAUT-AW

To be able to view objects and river banks in the proximity of the ship, a person standing at the workstation for navigating & manoeuvring shall be able to observe the sea surface at a distance of no more than 500 m from the hull within the sectors from 10° on either side of the bow to 90° on both sides, under all conditions of draught, trim and deck cargo (eye height 1500 mm). Fig.3.

202 (B304) Workstations for navigating & manoeuvring - horizontal view astern NAUT-AW

The navigator shall be able to employ leading lights and marks astern of the ship as visual reference for grounding avoidance, while seated at the workstation for navigating & manoeuvring. A field of vision sector astern shall be available and extend over an arc from dead astern to at least 5° on each side. No blind sectors shall occur within this 10° field of vision sector.

Guidance note:

Leading lights (or range lights) consist of two lights, separated in distance and elevation, so that when lined up vertically, with one behind the other, they provide a bearing to be used for positioning of the vessel in fairways.

Adequate camera(s) may be accepted for the purpose of achieving the required field of vision astern. The camera system and arrangement shall be approved by the Society prior to the installation.

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203 (B305) Workstations for navigating & manoeuvring - vertical view astern - NAUT-AW

The vertical view through the aft window pane(s), seen from the workstation for navigating & manoeuvring shall enable the navigator to view the sea surface in the wake of the ship at a distance not more than 2000 m abaft the stern.

The upper edge of the window(s) shall not be less than 2000 mm above bridge deck surface.

The maximum height from deck to the lower edge of the window(s) shall be 1000 mm or at least fulfil the following condition:

The lower part of the window panes shall disclose all obtainable sea surfaces aft of the vessel when viewed from a sitting position at the navigating & manoeuvring workstation. Only the superstructure/-deck may be concealed when viewed from seated position at this workstation (eye height 1500 mm).

204 (B309) Workstation for docking operations - vertical view NAUT-AW

The vertical view from the docking workstation shall enable the navigator(s) to observe the “parallel” hull side of both fore ship and stern from a standing position besides the console while operating the UIDs on hand for manoeuvring of the ship. The hull's side plates shall be visible over a total length of not less than L/2 (eye height 1500 mm). Fig.6.

Guidance note:

Windows should be arranged in the lower part of the bulwark and deck as appropriate to obtain the required vertical view.

Alternatively, adequate cameras may be accepted. The camera system and arrangement should be approved by the Society prior to the installation.

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F 300 Bridge windows

301 (B403) Lower edge of front windows - NAUT-AW

When the distance between the windows and the viewing point 350 mm aft of the consoles in sitting positions at the workstations for monitoring and navigating & manoeuvring is more than 1500 mm, the height of the lower edge of the windows in the sector from 10° to 90° on each side shall be decreased sufficiently to maintain

the line of sight. Fig.11.

F 400 Arrangements for clear view through bridge windows

401 (B603) Additional cleaning requirement - NAUT-AW

Heavy duty wipers and fresh water window washing to be provided on aft window(s) within the view astern sector required from the navigating & manoeuvring workstation.

F 500 Console configuration

501 (C304) Leg room in consoles – NAUT-AW

The console in front of the seated working position (usually the radars) shall provide sufficient leg room as required to ease the reach of equipment and controls to be used.

F 600 Chairs

601 (C306) Compulsory chairs - NAUT-AW

Adequate chairs shall be installed at the monitoring and navigating & manoeuvring workstations in compliance with this section. The following additional characteristics shall be attained:

- The vertical adjustment of the seat shall range from at least 600 to 800 mm above deck level.
- The chairs shall be fastened to rails, enabling easy reach of relevant equipment while seated and allowing fore and aft movement as well as the chairs being moved out-of-the-way from the workstation consoles completely.
- The chair shall be equipped with an adjustable footrest.

F 700 Workstation for navigating & manoeuvring

701 (D505) Additional tasks - NAUT-AW

The workstation for navigating & manoeuvring shall enable performance of the following additional tasks:

- monitor the performance and status of the equipment and sensors of the grounding avoidance system
- monitor speed over ground in both longitudinal and transversal directions.

702 (D506) Additional equipment - NAUT-AW

The additional information displays to be readable and UIs to be installed within reach at the workstation are:

- conning information display
- dual axis speed log display.

F 800 Workstations for docking operations

801 (D1105) Additional tasks - NAUT-AW

The workstations shall additionally enable the following tasks to be performed:

- control the position of the rudder (rudder angle)
- control the propulsion (RPM/Pitch)
- control the thrusters (if installed)
- effect two-way communication with engine control room, steering gear and department offices.

802 (D1106) Additional equipment - NAUT-AW

The following additional equipment shall be installed within reach from the working position to enable safe performance of the tasks:

- propulsion UI
- thruster UI, if provided
- steering UI
- internal communication (auto telephone).

The following additional indicators or displays shall be easily readable from the working position:

- speed indicator displaying longitudinal and transversal speeds
- wind speed and direction
- CID, AMS and ECDIS (when provided).

803 (D1107) MFD equipment required - NAUT-AW (ICS)

The docking workstation shall be provided with two independent MFD-displays supporting applications for radar, ECDIS, conning display and alarm management System.

Guidance note:

The MFDs may substitute for the separate indicators/-displays required on these workstations provided the screen type is easily readable in bright daylight (sunshine).

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SECTION 3 WORKPLACE ENVIRONMENT

A. General

A 100 Scope and application

101 This section contains human factors design requirements pertaining to the workplace environment in the wheelhouse.

A 200 General

201 Throughout the various design stages of the ship care shall be taken to achieve a good working environment for bridge personnel.

202 Equipment installed to control the workplace environment shall be capable of sustained operations within the climatic extremes specified for the ship.

Guidance note:

See also Pt.4 Ch.9 for supplementary guidance on parameters governing workplace environment.

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B. Environmental factors

B 100 Vibration

101 Uncomfortable levels of vibration causing short and/or long term effects on human body shall be avoided in the bridge area.

Guidance note:

The vibration levels on the bridge deck shall not exceed 0.16 m/s² from 0.5 Hz to 5 Hz, and 5 mm/s from 5 Hz to 100 Hz

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B 200 Noise

201 Uncomfortable levels of noise, and noise which may affect safe and efficient bridge operation, shall be avoided in the bridge area. Consideration shall be made to the need for speech, telephone and radio communication and for hearing audible alarms and sound signals.

Guidance note:

The noise level (sound pressure) for the wheelhouse workplace shall not exceed 65 dB(A) while the ship is underway and with all normal bridge equipment in operation (*measured in good weather conditions*).

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B 300 Climate control system

301 The bridge shall be equipped with a temperature control and ventilation system that allows regulation of the temperature and humidity in the wheelhouse enabling bridge personnel to maintain the workplace thermal environment within the range of the human comfort zone.

Guidance note:

It shall be possible to maintain the effective temperature range in the wheelhouse within 18°C to 27°C for an external temperature range of -10°C to +35°C. The temperature gradient inside of the wheelhouse shall not exceed 5°C.

Approximately 45% relative humidity should be provided at 21°C and decrease with rising temperatures.

Note: The thermal comfort zone for personnel varies. The optimum range of effective temperature for accomplishing bridge tasks while dressed appropriately for the climate is 21° to 27°C in a warm climate and 18° to 24°C in a colder climate. (DOT/FAA/CT-96/1)

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302 The ventilation system shall ensure a sufficient exchange rate and air movement inside the wheelhouse.

Guidance note:

— In general, air movement should vary with the different temperatures in the wheelhouse: the higher the temperature, the greater the air movement needed for comfort. With temperature maintained in the range 18°C to 23°C, the air movement should preferably be 0.3 m/s and not exceed 0.5 m/s.

— The rate of air exchange for the wheelhouse (enclosed space) should be >360 m³/hour and not less than 40% of

- this volume shall be an outdoor air supply.
- The exhaust airflow shall be at least the same volume as the supply airflow.
Note: The recommended rate of air circulation for enclosed spaces is depending on the number of personnel in the room and is $>0.02 \text{ m}^3/\text{s}$ per person with 40% outdoor supply.
- The A weighted sound pressure level specified for the air distributing system measured 1 m from the air discharge should not exceed 55 dB(A).

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303 The ventilation system shall be installed so that air discharges are not directed at personnel located at their workstation.

C. Lighting

C 100 General

101 An adequate level of lighting shall be provided, facilitating the performance of all bridge tasks at sea and in port, during daytime and night-time. The lighting shall comprise both general lighting and task related lighting to ensure that illumination is compatible with individual operations and tasks.

C 200 Illumination levels

201 The lighting system shall enable the bridge personnel to adjust the illumination level as required in different areas of the bridge and by the needs of individual tasks. Table C2.

Guidance note:

Local arrangement for adjustment of illumination level and direction of light should be provided at all workstations. White ceiling lights for general bridge illumination do not require dimming facilities.

Lighting controls should always be arranged at entrances and exits to adjacent rooms. Light controls should preferably be noticeable in darkness.

Table C2 Illumination levels	
Place	Colour and illumination
Wheelhouse, general	White, at least 200 lux
Workstations (day)	White, at least 300 lux
Workstations (night)	Red, variable up to 20 lux
Open staircase inside wheelhouse (day)	White, at least 200 lux
Open staircase inside wheelhouse (night)	Red, variable up to 20 lux (Alt: fixed indirect red or filtered white light may be provided in the steps)
Chart table (day)	White, variable 100-1000 lux
Chart table (night)	White filtered, variable up to 20 lux
Toilet (day)	White, at least 200 lux
Toilet (night)	Red, variable up to 20 lux

The white illumination levels shall be available on the desktops/consoles, (70 cm above the deck surface in the absence of consoles) on a dark rainy day.

The red and filtered illumination levels shall be available during hours of darkness.

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202 During hours of darkness; the lighting provided to discern control devices and read labels and markings shall preserve the night vision of the OOW. It shall be possible to dim down the illumination intensity to nearly zero.

Guidance note:

Except at the chart table, red light or filtered white light (*CIE coordinates x and y equals 0.330*) should be used whenever possible in areas or on items of equipment requiring illumination in the operational mode, including bridge wing instruments. Provision should be made to prevent red lights from being visible from outside of the ship.

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203 The voyage planning workstation shall sustain the required illumination levels independent of the lighting of the rest of the wheelhouse.

Guidance note:

Lighting of workstations which at time may be used by personnel other than OOW shall have separate ON/OFF switch (circuit) and the lighting and any glare shall be properly shielded at all times. If curtains are provided these shall not obscure the minimum FOV-sectors required for the OOW to maintain a proper lookout including the 360° view from inside the wheelhouse.

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204 Lighting sources shall be designed and located to avoid creating reflections from windows, surfaces and displays on workstations, as viewed from the normal working positions in the wheelhouse. Lighting sources located in adjacent rooms and corridors shall be prevented from illuminating the wheelhouse at night-time.

Guidance note:

Night-time lighting arrangements above workstations should be sufficiently screened or retracted into the ceiling to avoid unwanted horizontal stray of light. A non-reflective surface should be used on the surface of the retraction or screen. Floodlight arrangement should be fitted with a non-reflective raster screen.

Automatic door switches preventing white light from flooding the bridge area should be fitted on entrances from adjacent rooms and corridors.

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C 300 Specular reflections and glare

301 The bridge surface finishes shall have a dull, matt coating and colours with low reflection range in order to reduce specular reflections and glare to a minimum. Ceiling, bulkheads and consoles are of special importance. Table C2.

Guidance note:

The following are recommendations to reduce glare and specular reflections in the wheelhouse:

- The contrast ratio between the luminance of workstations and adjacent areas in the wheelhouse should not exceed 3:1.
- Light sources should as far as possible not be placed within the FOV sector through a 30 degrees vertical line of sight when the eyes are in the working position.
- Smooth and polished surfaces shall be avoided inside the wheelhouse.

Table C2 Reflection range for some typical colour densities	
<i>Reflectance range</i>	<i>Typical colour densities</i>
5% to 10%	Dark Green Blue or Brown
15% to 30%	Mid Green Blue or Red
50% to 60%	Pale Green Blue or Yellow
80% to 90%	Off White Pale Yellow

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C 400 Colours

401 Colours shall be chosen to give a calm overall impression and minimise reflections.

Guidance note:

Bright colours should not be used. Dark or mid green colours are recommended; alternatively, blue or brown may be used. Table C2.

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D. Safety of personnel

D 100 General

101 The bridge area shall be free of physical hazards to bridge personnel.

Guidance note:

There should be no sharp edges or protuberances that could cause injury to personnel. The bridge deck should be free of trip hazards; such as curled up carpet edges, loose gratings or equipment. Means should be provided for properly securing portable equipment.

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102 Hand or grab rails shall be fitted to enable personnel to move and stand safely in bad weather. Protection of stairway openings shall be given special consideration.

103 All safety equipment on the bridge shall be clearly marked and easily accessible and have its stowage position clearly indicated.

104 Refreshment facilities and other amenities provided for the bridge personnel shall include means for preventing damage to bridge equipment and injury to personnel resulting from the use of such facilities and amenities.

105 Wheelhouse deck, bridge wings and bridge deck shall have a non-slippery surface in both wet and dry conditions.

SECTION 4 BRIDGE EQUIPMENT - CARRIAGE REQUIREMENTS

A. General

A 100 Scope

101 This section contains the minimum range of bridge equipment to be installed for compliance with this chapter.

102 It is assumed that all ships shall comply with the equipment carriage requirements of SOLAS.

A 200 Application

201 Ships requesting class notation **NAUT-OC** shall comply with the carriage requirements of sub-section B. Ships requesting class notation **NAUT-AW** shall comply with the carriage requirements of both sub-sections B and C.

202 Ships applying for the added qualifier **(ICS)** shall in addition fulfil the supplementary requirements of sub-section D.

B. Basic Bridge Equipment

B 100 Steering control systems

101 *Manual steering control*

The ship shall be equipped with two independent manual steering control systems with pertinent UIDs provided in the wheelhouse and at least one system shall support follow-up-control.

It shall be possible to select the steering mode provided at each workstation.

102 *Override function*

103 The steering (azimuth thrusters if provided) shall have a override function (*tiller/miniwheel*) located as described in sec.2.

104 *Heading control system*

A heading control system (HCS) enabling automatic steering of the ship with a minimum use of rudder and being adaptive to various loading and weather conditions shall be provided.

105 *Rate-of-turn gyro*

A rate-of-turn-gyro or other approved means for measuring angular rate shall be provided.

Guidance note:

The ROT-gyro information may also be derived from the gyro system or the speed log provided that the requirements of Sec.6 are complied with.

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106 *Indicators*

The ship shall be equipped with at least two independent rudder angle indicating systems.

Guidance note:

One of the RAI-systems may share the feedback unit with the heading control system.

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107 A sufficient number of rudder angle indicators and rate-of-turn indicators shall be provided as needed to be readable at all steering control positions as well as all applicable workstations.

Guidance note:

Applicable workstations may be Conning, Monitoring, Navigating & Manoeuvring, Manual steering, GMDSS station (RAI), Docking(RAI).

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B 200 Heading information systems

201 *Main compass system*

Two separate and independent gyrocompasses or other approved means having the capability to determine the

ship's heading in relation to geographic (true) north shall be provided.

Guidance note:

Compass A is independent of compass B when any single system failure occurring in system A has no effect on the maintained operation of system B and vice versa.

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202 Gyro repeaters shall be provided as needed to provide heading information at all steering control positions and being readable at all the applicable workstations. Additional gyro bearing repeaters shall be provided suitably positioned to cover an azimuth of 360° around the ship.

Guidance note:

Applicable workstations may be Conning, Monitoring, Navigating & Manoeuvring, Manual steering, GMDSS station, Docking stations and other workstations to be operated by the OOW.

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203 *Distribution system*

The distribution system shall enable continuous distribution of heading information to repeaters, radar systems, heading control- and track control systems and ECDIS.

Guidance note:

Duplicated processing and distribution units are generally required. Ref. also Sec.6 C103.

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B 300 Speed information systems

301 *SDME*

A speed log, or other approved means, for measuring the ship's speed and distance through the water continuously shall be provided.

Guidance note:

The system shall be able to support uninterrupted output of ship's speed through the water (STW) to the ARPA's also when other "speed modes" are selectable (e.g. SOG).

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

302 A sufficient number of speed indicators shall be provided as needed to be readable at applicable workstations.

Guidance note:

Applicable workstations may be Conning, Docking, Monitoring and Navigating & Manoeuvring.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

303 *Propulsion and thrust*

A sufficient number of RPM, Pitch, and Thruster indicators when relevant, shall be installed as needed to be readable at applicable workstations.

Guidance note:

Applicable workstations may be Conning, Monitoring, Navigating & Manoeuvring and Docking.

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B 400 Collision Avoidance – decision support systems

401 *Radar systems*

The vessel shall be provided with two separate and independent radar systems. One radar shall operate in the X-band (9 GHz). The other radar shall operate in the S-band (3 GHz).

Guidance note:

Where extraordinary operational aspects are deemed to exist, two X-band radars may be justifiable.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

402 Both radar systems shall be equipped with a performance monitor.

403 Both radar systems shall support user selectable inter-switching being operable from relevant workstations.

404 Both radar systems shall support full ARPA functionality.

405 Both radar systems shall be able to display and acquire AIS targets

406 At least one radar system shall support AIS Minimum Keyboard and Display (MKD) functionality.

407 *Automatic Identification System*

The ship shall be equipped with an Automatic Identification System (AIS) supporting interconnection with the two ARPA's.

408 *AIS reported targets on graphical display*

Both radar displays installed in accordance with this section shall be capable of presenting AIS reported targets in accordance with relevant IMO standards and guidelines.

409 *Sound Reception System*

The ship shall be equipped with a sound reception system.

B 500 Grounding Avoidance – decision support systems

501 *ECDIS*

The vessel shall be provided with two separate and independent ECDIS.

Guidance note:

An interconnection shall be provided linking the two ECDIS for exchange of ENC updates and voyage plans without jeopardizing the integrity of the segregation.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

502 Ships engaged in worldwide trade shall additionally be provided with a separate terminal for voyage planning being interfaced with the ECDIS. The terminal provided for this purpose shall be operable independent of the two ECDIS required by 701 being in use for navigation.

Guidance note:

Reference is also made to Sec.2 D701 for the applicability of this requirement on a particular ship.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

503 *Electronic Position Fixing Systems*

The ship shall be equipped with two separate and independent position-fixing systems both being suitable for the waters to be navigated.

Ships engaged in worldwide trade shall carry two separate, independent and augmented global navigation satellite system (GNSS) receivers.

Guidance note:

At present two DGPS-receivers is deemed satisfactory. Alternatively one DGPS-receiver and one combined GPS/GLONASS-receiver may be acceptable.

Other combinations of approved receivers involving newly deployed GNSS are satisfactory subsequent to such GNSS reaching operational capability.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

504 *Depth measuring system*

The ship shall be equipped with a depth measuring system providing the water depth under the keel.

505 A sufficient number of depth indicators shall be provided as needed to be readable at applicable workstations.

Guidance note:

Applicable workstations are the Monitoring and Navigating & Manoeuvring.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

B 600 Weather surveillance systems

601 The ship shall be equipped with an anemometer providing accurate information about wind speed and direction.

602 Ships engaged in world wide trade shall be equipped with a shipboard weather station providing information about air temperature, air humidity and barometric pressure.

603 Ships shall be equipped with a weather information system.

Guidance note:

A marine computer including a software application for receipt and displaying of regular weather forecasts may be acceptable.

Ships not engaged in world wide trade may, if found unreasonable, be exempted from this requirement provided an

alternative suitable system or method for receiving relevant weather information is provided.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

B 700 Bridge Navigational Watch Alarm System (BNWAS)

701 The ship's bridge shall be equipped with a surveillance system continuously monitoring the presence of an alert OOW.

Guidance note:

The surveillance system should be able to detect human activity (motion).

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

B 800 Alarm Management System (AMS)

801 The ship shall be equipped with an alarm management system centralising the alarms and warnings of all navigational functions.

Guidance note:

The central alarm panel may be an integral part of the conning display.

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B 900 Alarm Transfer System

901 The ship shall be provided with a system for transferring un-acknowledged AMS-alarms to dedicated areas in the accommodation.

B 1000 Internal Communication Systems

1001 The ship shall be provided with two separate and independent internal communication systems.

1002 The ship shall be provided with a public address system being audible in the accommodation and on the open deck as well as in all relevant working spaces.

1003 The ship shall be provided with a communication system enabling sustainable operations by responsible personnel at all relevant workstations and deck areas being involved in mooring operations.

Guidance note:

Suitable portable wireless transceivers may be provided as means for communication between applicable workstations and areas involved in the mooring operations.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

B 1100 VHF transceivers

1101 The wheelhouse shall be provided with two independent and fixed VHF transceivers.

C. Additional Bridge Equipment - NAUT-AW

C 100 Manoeuvring information

101 Heading-, rudder angle-, RPM/Pitch- and speed information shall be presented on each docking workstation.

Guidance note:

If the gyro bearing repeaters are readable from the working position at the docking workstation then additional digital gyro repeaters may be waived on vessels <50000 GRT.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

C 200 Manoeuvring devices

201 UIDs for control of propulsion and steering shall be installed on each docking workstation.

If the ship is equipped with thruster(s) such UIDs shall be installed on each docking workstation.

C 300 Speed Over Ground Log

301 The ship shall be fitted with speed measuring equipment providing speed over ground in both longitudinal and transversal (athwart ship) directions.

C 400 Radar chart overlay

401 Both radar systems shall provide for interface with ECDIS and superimposition of parts of the

ENC(SENC) database and the voyage plan on the display.

402 Both radar systems shall support AIS MKD functionality.

C 500 Conning information display

501 The ship shall be equipped with a conning information display centralising sensor information, set-values and voyage plan data supporting surveillance of the performance of the grounding avoidance system.

C 600 Track Control System (TCS)

601 The ship shall be provided with a track control system (TCS) Category C, and the installation shall be type approved according to IMO Performance standards for track control system capable of following the planned track automatically.

602 *Additional requirements for integration and functionality*

The track control system Category C shall facilitate additional integration and functionality as detailed described in Sec.6. The additional functions shall be subject for certification if not included in type approval.

C 700 Training Course

701 The supplier or manufacturer of the grounding avoidance system shall be able to offer a proficient training course for bridge personnel that are at least complying with the knowledge requirements of Sec.9.

D. Network based Integration - (ICS)

D 100 Application

101 The requirements of this sub-section are applicable to ships applying for the additional qualifier **(ICS)**.

D 200 Integrating platform

201 The navigational equipment and systems required to be installed on the monitoring and navigating & manoeuvring workstations, as applicable for the notation, shall be interconnected via redundant networks (or equivalent).

202 Each of the navigational equipment shall support an interface capable of both transmitting and receiving all necessary information by means of the networks.

Guidance note:

Any converter installed for this purpose is subject to certification unless incorporated in the type approval certificate.

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203 The integrated navigation system shall comprise minimum five multi-function-displays (MFDs) with sufficiently redundant processing units capable of supporting the following applications:

- ARPA
- ECDIS
- Conning Display
- Alarm Management System.

Guidance note:

The MFD shall be of an approved type including all the applications (functions) being supported.

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D 300 Additional displays – NAUT-AW

301 Two MFD displays shall be available on each of the workstations for docking operations. The dual MFDs may substitute for the separate indicators required on the workstations on the condition that the screens are easily readable in bright sunshine.

SECTION 5 BRIDGE EQUIPMENT - GENERAL REQUIREMENTS

A. General

A 100 Scope and Application

101 This section contains general requirements pertaining to all bridge equipment to be fitted in accordance with this chapter as well as other bridge equipment to be situated in the wheelhouse or in the vicinity of the wheelhouse as deemed applicable.

A 200 Certification

201 All navigational equipment installed shall come with a certificate showing compliance with applicable IMO performance standards.

Guidance note:

It is assumed that all navigational equipment to be installed for compliance with SOLAS and/or these rules comes with a valid type approval certificate issued by a recognized certification authority.

Any non-type-approved equipment is to be certified in accordance with the systematic of Pt.4 Sec.9, or MED module G if deemed applicable, for verification of compliance with appropriate international standards.

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202 Equipment installed in addition to both SOLAS and the carriage requirement of this chapter shall comply with performance requirements not inferior to the rules or associated IMO performance standards as deemed applicable.

Guidance note:

Navigational equipment or systems that may affect steering or propulsion shall be certified in accordance with the systematic of Pt.4 Ch.9 (*or MED module G if deemed applicable*) for verification of compliance with the rules and relevant international standards unless the applicable function is already incorporated by the type approval certificate.

Additional equipment installed should at least meet the requirements in IEC 60945 or DNV standard for certification 2.4

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

203 Additional bridge equipment, not required by the rules or international regulations that may have an impact on the safety of main functions shall comply with the applicable requirements of Pt.4 Ch.9.

Guidance note:

Any non-type-approved equipment of this category is to be certified in accordance with the systematic of Pt.4 Sec.9 or MED module G as deemed applicable.

Note: Main functions are listed in Pt.1 Ch.1 Sec.1.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

B. Location of Equipment

B 100 General

101 All instruments, panels, etc. shall be permanently mounted in consoles or at other appropriate places, taking into account both operational and environmental conditions. Portable bridge equipment shall have a safe storage location in the wheelhouse when not in use. All other items, such as safety equipment, tools, lights, pencils etc. to be used by bridge personnel, shall be stored in designated places.

102 All equipment, sensors and antennae shall be installed in such a manner that their specified performance is not impaired and otherwise follow the instructions detailed by the manufacturer.

Guidance note:

Approval of installations that diverges from the arrangement specified in the installation manual (instructions) may only be granted following a formal endorsement by the manufacturer's representative and successful testing.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

103 Vibration

The enduring vibration levels of consoles and ship structures supporting equipment and antennae required by this chapter shall not exceed the conditions specified for the particular equipment.

Guidance note:

While the ship is operating at normal seagoing speed the vibration level at the relevant position should not exceed the test criteria of IEC60945 or Certification Note No.2.4 unless the equipment has been tested to a tougher standard withstanding the actual vibration level.

Equipment may be provided with an additional mount designed to withstand higher vibration levels and dampening the amplitude of vibration.

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104 *Temperature*

Equipment shall be located away from excessive heat sources, such as a heating vent or equipment heat exhaust.

105 Equipment to be fitted into a console shall be protected from durable high temperature conditions unless specifically designed for such heat.

Guidance note:

If natural ventilation is deemed inadequate then forced ventilation, e.g. fans, shall be installed to increase the air flow. If the temperature inside the console cannot be maintained below 45°C while the ambient wheelhouse temperature is below 28 °C then the ventilation is considered insufficient and additional measures should be implemented.

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106 *Humidity*

Equipment that is not specifically designed for outdoor installation shall not be installed near a doorway, open window or hatch opening.

107 *Compass safe distance*

In order not to affect the accuracy of the standard magnetic compass, all equipment shall be installed at a distance not less than the minimum safe distance specified for the equipment.

Guidance note:

All type approved equipment should be provided with a label indicating the minimum safe installation distance from the standard compass, alternatively the equivalent distance should be stated in the pertinent equipment manual or type approval certificate. If no such distance is stated or obtainable from documentation the minimum compass safe distance shall be not less than 5 m.

Minimum safe distance in this context is the radius of a sphere where the compass bowl is situated in the origin of the sphere.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

B 200 *Antennae*

201 The antennae for radars, position-fixing receivers, GMDSS equipment, VHF's and other communication systems shall be installed in such a manner that interference is avoided and the specified performance is not noticeably impaired.

Guidance note:

GMDSS VHF aerials should be installed as high as possible and with at least 2 metres horizontal separation from constructions made by conductive materials. In addition, the VHF/DSC watch receiver antenna should be installed outside the radar beams. At least one VHF/DSC watch receiver antenna should be vertically separated (installed on a straight vertical axis) from any VHF transmitting antenna. If vertical separation is not possible, then the distance from the middle of at least one VHF/DSC watch receiver antennae to the middle of any VHF transmitting antennae should be not less than 5 m.

The GNSS antennae should be positioned outside of transmitting beam of any satellite antennae, the main lobe of the radar antennae and at least 3 meters away from any VHF transmitting antennae."

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

202 Transmitting and receiving antennae cables shall be appropriately separated.

Guidance note:

Reference is made to Classification Note No.45.1 Table 4.2 for detailed guidance on separation distances of diverse types of cables.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

203 *Radiation hazard*

Location of transmitting antennae and related components shall include suitable protection so as not to constitute an inadvertent hazard to personnel.

Guidance note:

The seating of radar wave guides, satellite communication and HF transmitter feed lines should be safeguarded, so as

to protect personnel against open wave-guide radiation power and accidental contact with high voltages, by means of isolating trunks or fences.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

204 Satellite communication and radar antennae are required to have a warning label, detailing the safe distances and posted outside the perimeter of this distance, being readable at all access points to the area of location.

Guidance note:

A signboard may be posted next to the access ladder or staircase leading to the compass deck if antennae are located on this level. If an elevated radar mast is provided then the signboard may be located next to the ladder of the mast if the safe distance is less than the height to the antennae allowing for the height of a person.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

205 Radar and satellite communication systems are required to have human risk warnings and pertinent instructions in operator handbooks.

C. Electrical Power Supply

C 100 Main electrical power supply

101 Navigational equipment as required by SOLAS Chapter V shall be individually connected to distribution board(s) being supplied from both main and emergency sources of power by separate circuits. Such distribution boards shall be located at or adjacent to the bridge deck.

102 The power supplies to the distribution boards shall be arranged with automatic changeover facilities between the two sources. Failure of the main power supply to the distribution board(s) shall initiate an alarm (audible and visual signal) in wheel house (central alarm panel).

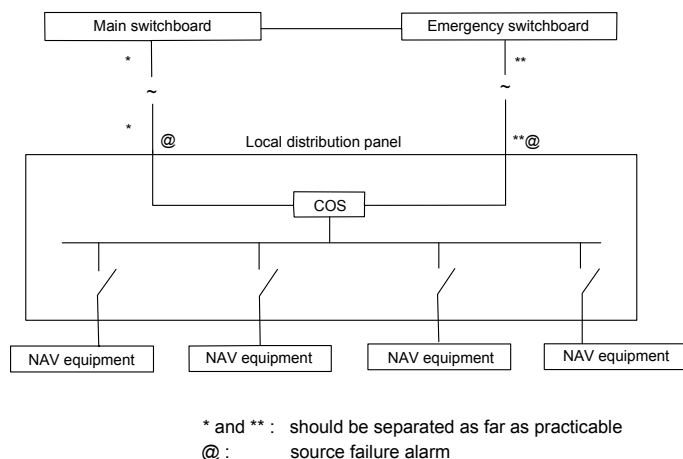


Fig. 1
Power supply for navigation equipment operated by AC

C 200 Arrangement of UPS

201 Essential equipment shall be provided with a transitional source of power with a capacity to keep the equipment running during a loss of main and emergency power of at least 10 minutes. The equipment regarded essential in this context is at least one each of the following categories:

- one radar with ARPA (including the antenna) installed at workstation for navigating and manoeuvring.
- ECDIS
- GNSS
- Gyro compass
- internal communication system.

202 The UPS's used to supply bridge equipment shall have automatic bypass functionality.

203 Appropriate means for bypassing the UPS manually, in case of failure in the automatic bypass, shall be provided.

204 Failure of the UPS shall initiate an alarm (audible and visual signal) in wheel house at the central alarm panel.

Guidance note:

A battery in compliance with the above requirements is considered as equivalent arrangement to UPS.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

D. Integration and Interfaces

D 100 Circuit integrity

101 The equipment talker drive circuit and the equipment listener circuitry shall support a balanced interconnection and include appropriate protection in agreement with international standards.

Guidance note:

Reference is made to ITU-T X.27/V.11 and IEC61162-standards for detailed guidance.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

D 200 Alarm and warning messages

201 All navigational equipment shall be provided with a serial interface suitable for presentation and acknowledgement of their alarms and warnings by a remote bridge alarm management system.

Guidance note:

The serial interface protocol should include the alarm status message in accordance with IEC61162-1, i.e. transmitting \$.ALR (or \$.ALA) message and receiving \$.ACK (or \$.AKD) message as appropriate.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

D 300 Data integrity

301 The data output from the equipment shall comply with international standards where such protocols are provided. Any proprietary protocol shall include measures to preserve the integrity of the information carried by the message applying methods not inferior to those implemented by related international standards.

302 Data received for presentation only shall be checked for validity before being displayed. Data received and employed in processing shall be checked for both validity and plausibility before being employed by the related process. Data which fails the check shall not be used.

Guidance note:

Reference is made to E503 for requirements to presentation of information following an alarm condition and resulting mode awareness indication.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

303 False alarm rate

The number of alarms in the wheelhouse milieu shall generally be minimized and the false-alarm-rate shall be kept as low as reasonably possible. The validity checks of interfaces and data input shall take into consideration the transmission rate, data availability, response times and expected bit-error-rate for the data to be received as well as the urgency and dynamics of the pending process prior to initiating a warning or alarm.

Guidance note:

The false alarm rate of the integrity checks should preferably be kept below 10^{-8} . The threshold set for alarms and warning should give some leeway for insignificant incidents. E.g. an erroneous checksum or CRC due to bit-error occurring in a single message should not generate an alarm if the subsequent message is error-free.

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304 Multiple sensor input

When the number of sensors and equipment being integrated exceeds the minimum quantity required by this chapter or international standards the interface and integration of such additional sensors and equipment shall comply with all the requirements being applicable to the obligatory configuration.

D 400 Networks

401 Bridge equipment being integrated by means of network based communication links shall be designed and arranged in compliance with the requirements of Pt.4 Ch.9 Sec.4.

Guidance note:

Wireless technologies may be used in systems that are additional or supplementary to those required by main class rules. Any use of wireless technology in systems required by this chapter is subject to special consideration and case-by-case approval.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

402 Only functions and processes being important for vessel operation may be connected to bridge equipment or make use of the same network.

Guidance note:

Generally, office- and/or entertainment related systems shall not be connected. If the navigation equipment is to be connected to administrative networks (e.g. for report generation, process analysis, decision support) the connection shall ensure that any function or failure in the administrative net can not harmfully affect the functionality of the navigational systems or its network. The administrative functions shall be hosted by separate servers and shall, if at all necessary, merely have 'read only' access to the navigation equipment.

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403 *Fall-back arrangement*

If the navigational equipment required by this chapter is integrated by means of multiple networks the availability of essential navigational functions shall continuously be available following a concurrent failure of all networks. Following failure of multiple networks the minimum range of equipment to sustain their full operational capability is:

- one ARPA and
- one ECDIS.

Additionally all information required by SOLAS V/19 shall still be easily accessible in the wheelhouse.

Guidance note:

An exemption from this general fall-back principle may be accepted for completely independent network systems including independent software. Approval may only be granted following documented design, failure analysis and testing verifying that any logical failure, including uncontrolled broadcast of data packets (network storm), of any computer connected to the networks cannot cause a meltdown of more than one of the networks.

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404 *Access*

It shall not be possible for unauthorised personnel to connect equipment to the network topology for bridge equipment or otherwise have access to the network.

Guidance note:

This pertain to both communication onboard the vessel as well as remotely via external communication. Any access point to navigational network shall be clearly marked and sufficiently secured e.g. by location with restricted access, a lockable device or password access.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

405 Unauthorised access to the operation of bridge equipment from a position outside of the vessel shall in general not be possible.

Bridge equipment and networks allowing for remote connection (e.g. via internet for remote diagnostics or maintenance purposes) shall be secured with sufficient means to prevent unauthorised access and to preserve the security of the navigational functions. The security properties installed shall be documented.

Guidance note:

Any remote access to the bridge equipment network shall only be possible subsequent to being authorised by responsible personnel onboard. The system shall have appropriate virus protection related to the possibility of infection via the remote connection.

If remote connection is possible, the integration and interface is subject to special considerations and case-by-case approval.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

E. Human machine interface

E 100 General

101 Equipment and systems shall be designed as simple as possible in line with the prevailing principles of ergonomics.

Guidance note:

Equipment designed with simplicity in mind is generally more reliable and easier for personnel to operate. When different designs are compared from a human factors view, the simplest design usually has less potential for human error.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

102 Equipment installed and their human-machine interface shall be standardized to the degree practical and

compatible with their functions and purposes. Equipment with identical functions shall employ identical or similar human-machine interfaces.

103 Equipment with different functions shall have distinctive interfaces (UIDs and display features) so they cannot be interconnected or used erroneously.

104 When designing UIDs and displays, consideration shall be given to the significance of human factors in an abnormal condition. The amount of information presented in conducting the various tasks, including the methods of displaying the information needed, shall give consideration to the capabilities of the human operator in regard to both perception and processing of the information presented.

105 Equipment shall be designed to facilitate console installation and mounting in a group with instruments of other makes. Applicable equipment shall facilitate the UID and pertinent display/indicator being separated to attain the most favourable ergonomic solution.

Guidance note:

Reference is made to Sec.2 D for additional information on arrangement of UIDs and indicators in workstations.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

106 The purpose of each UID and indicator shall be indicated by a label in English or clearly illustrated by symbols (where symbols have been internationally adopted) unless the purpose is unmistakably apparent.

E 200 UIDs

201 The shape of UIDs shall indicate their method of operation. The functionality and purpose of the UID shall be logically co-ordinated with the direction of actuating the device.

Guidance note:

The actuating principles according to functions should be in accordance with IEC 447 “Standard directions of movements for actuators which control the operation of electrical apparatus”.

Example: Rotary finite-position UIDs (e.g. stepping switches) should employ toggles or levers, whereas rotary continuous position UIDs (e.g. rheostats) should have knobs or wheels.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

202 Direction of movement of UIDs shall be consistent with any related movement of an associated process, or component. In general, moving a UID forward, clockwise, up, or to the right shall cause a quantity to increase or cause the process, or component to move forward, clockwise, or up.

Guidance note:

Examples:

UIDs for steering of the ship should rotate clockwise (or be moved towards starboard) to initiate a starboard turn.

UIDs for thruster should be moved in the same direction as the reacting thrust force (i.e. the same direction as the hull will move/rotate).

One exception is rotary valve controls which should move in a counter clockwise direction to open a valve, e.g. for valve operated window washing.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

203 UIDs shall be designed so that they are not susceptible to being moved accidentally, particularly UIDs affecting propulsion and steering. Any method of guarding a UID from inadvertent operation shall not preclude the operation of the control within the time required.

Guidance note:

As applicable, one or more of the following methods may be used to guard a UID from accidental actuation.

Locate and orient the UID so that the user is not likely to strike or move it accidentally in the normal sequence of movements.

Provide the UID with a physical barrier, e.g. a recess or a shield.

Cover the UID, but without using safety or lock wire.

Provide an audible warning when the UID is being engaged (not an alarm)

Provide the control with an interlock so that an extra movement is required.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

204 A push button shall provide positive feedback of operation, for example, a “snap” action, an audible click, or an integral light.

Guidance note:

If it is imperative that a push button is not to be operated inadvertently, e.g. an engine shutdown button, the push button shall be recessed or protected by a barrier or a cover. If a cover is used, the opened cover shall not interfere with the operation of its protected push button or adjacent UIDs.

A pushbutton provided for engagement of the override steering UID may be protected from inadvertent operation by

initiating and audible warning upon initial engagement.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

205 A UID or combined UID and indicator shall be visually and tactually distinguishable from equipment which only indicates.

Guidance note:

Rectangular pushbuttons should be used for control elements, and round lights for indicator elements.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

E 300 Indicators and displays

301 All indicators and displays shall be designed for the operational environment of the wheelhouse allowing easy and accurate reading by day and by night.

a) Quantitative and comparative readings should be presented by means of:

- digital counter, if subject to rare changes
- clockwise moving index on circular scale or horizontally moving index on linear scale, if subject to frequent changes.

b) Qualitative readings should be presented by means of:

- vertically moving index on linear scale to indicate trend changes
- clockwise moving index on circular scale to indicate rate changes.

c) Control readings should be presented by means of:

- moving index on circular scale, preferably with the index in the 12 o'clock position for normal readings
- for an index moving relative to a circular scale, the index should move clockwise (or the scale anti-clockwise) for increased readings
- for an index moving relative to a linear scale, the scale should be horizontal or vertical and the pointer should move to the right or upwards for increased readings.
- for RAI the zero rudder angle should be in the 6 o'clock position and for ROTI the zero rate-of-turn should be in the 12 o'clock position.

There may be special cases where these guidelines do not apply, e.g. where the readings may be positive or negative, or where depth is indicated.

302 A letter type of simple, clear-cut design shall be used for presentation of related information.

Guidance note:

Internationally used and recommended letter type is Helvetica medium. However, light-emitting diode text matrices are acceptable. In descriptive text, lower case letters are easier to read than capitals.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

303 Generally all information shall be presented on a background of high contrast, emitting as little light as possible at night.

Guidance note:

All ship's bridge instruments should preferably show a light text on a dark non-reflecting background at night. The contrast should be within 1:3 and 1:10.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

304 Scale graduations shall progress by 1, 2, 5, or 10 units or decimal multiples thereof. The number of minor or intermediate marks between numbered scale marks shall not exceed nine.

305 Indicator and display surfaces shall prevent interference by reflections from other illumination sources. If necessary, shields, filters, or other techniques shall be used to ensure that indicated information is not degraded.

Guidance note:

Where a transparent cover is fitted over an instrument, it should be designed to minimise reflection.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

306 The presentation of graphic or mimic diagrams shall be in accordance with ergonomic principles and easy to understand and operate. The status of the information displayed shall be clearly indicated.

Guidance note:

This applies for example to indications not being updated or an indication of an inhibited alarm.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

E 400 Illumination and lighting of instruments

401 All UIDs, indicators and displays shall be fitted with permanent internal or external light source as applicable to ensure that all required information is readable at all times.

402 To preserve night vision, illumination and lighting of indicators, displays, keyboards and other UIDs shall be adjustable down to virtually zero, except the lighting of warning and alarm indicators and the control of dimmers, which shall remain visible.

403 The internal illumination of all instruments shall be designed to avoid unnecessary glare and stray light and ensure easy and accurate reading of the information presented during night time without impeding the night vision.

Guidance note:

For the illumination of UIDS, indicators and displays with dark letters on a bright background, red light (wave length 620 nanometres or higher) should be used.

For the illumination of UIDS, displays with bright letters on a dark background, low level white lighting from the back may be used.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

404 Each instrument shall be fitted with an individual light adjustment. In addition, groups of instruments normally in use simultaneously should be equipped with common light adjustment.

E 500 Alarm and warning indicators

501 Warning and alarm indicators shall be designed to show no light in normal position indicating a safe situation. Means shall be provided to test the lamps.

502 Colour coding of alarms and warnings shall be in accordance with international standards:

Red, Flashing	indicating an unacknowledged alarm condition
Red, fixed	indicating a failure or an existing but acknowledged alarm condition
Yellow, flashing	indicating an unacknowledged warning needing attention
Yellow, fixed	indicating an acknowledged warning, or a caution or data with low integrity
Green, fixed	indicating that a system is running, or condition is satisfactory
White	should not be used on indicators in the wheelhouse

503 Integrity of information displayed

The presentation of unreliable or failed information on displays and indicators shall support indications for mode awareness. The perception of any failed sensor data or system mode shall be apparent and unambiguous to a navigator being unfamiliar with the particular equipment.

Guidance note:

Failure of a data input or a data process, whether it is due to loss of data or failure to pass a check routine, shall be made clearly visible to the operator on all relevant displays by replacing the related data with a conspicuous message, e.g. ----- or \$\$\$\$\$\$ or by colouring the data red, e.g. DGPS: 23°42'587S 105°12'193E or similar methods.

The importance of instant mode awareness following failure of any steering control mode is particularly emphasized.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

F. Software

F 100 General

101 System software shall be installed and maintained in compliance with Pt.4 Ch.9 Sec.4.

102 Maintenance

Software shall be as standardized as possible so that applications that address common functions employ the

same user dialogues, human-machine interfaces, and procedures. When software improvements are necessary, the revised software shall employ the same or similar (but improved) dialogues, interfaces, and procedures to minimize operator confusion.

103 *Access*

Access to equipment's operating system shall be highly restricted, and any alteration of operating system or application software after final inspection and testing on board shall be subject to initial approval by the Society.

Guidance note:

Reference is also made to D405 for remote upgrades of software by the manufacturer.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

104 Software and data essential to ensure satisfactory performance of the computer system shall be stored in a non-volatile memory (e.g. FLASH, HDD, etc).

Guidance note:

Such data includes at least all ship dependent parameters determined during commissioning and sea trials. A back-up copy shall be made of such ship specific parameters by means of a suitable device and reside on board.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

SECTION 6 BRIDGE EQUIPMENT - SPECIFIC REQUIREMENTS

A. General

A 100 Scope

101 This section contains specific requirements relating to design and installation of the bridge equipment required by this chapter.

A 200 Application

201 Ships requesting class notation **NAUT-OC** shall comply with the basic rules in B to J.

202 Ships requesting class notation **NAUT-AW** shall comply with the basic rules in B to J and additionally the requirements specifically addressing **NAUT-AW** in these sub-sections and sub-section K.

Guidance note:

A requirement being specific for NAUT-AW only is identified by inclusion of the notation in the head line as in the following example: 306 Dual heading input – NAUT-AW

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

B. Steering Control Systems

B 100 Manual steering control

101 UIDs “human –machine” interface

The UIDs for manual steering of the ship shall employ a clockwise rotation of the device to turn the ship to starboard and anti-clockwise rotation to turn to port.

Guidance note:

Steering tillers shall be designed to turn the ship to starboard with clockwise movement of the axle regardless of the position of the tiller on the axle.

Exemption may be given for steering tillers or joysticks used solely for harbour manoeuvring and not for steering the ship while underway. This may be applicable to vessels with two or more rudders or azipods and engines, and where the UID(s) are used for setting a rudder angle only and not with the intention to create a rotation. In such case the UID should indicate the position of the rudder. Additionally, when the rudders are used in combined mode a separate UID being easily distinguishable from the individual tillers, shall be provided in accordance with this requirement.

Exemption may also be given for non-follow-up steering (NFU) consisting of dedicated buttons for port and starboard respectively.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

102 If pushbuttons are provided for NFU-operation of the steering gear the buttons shall be properly marked with port and starboard respectively and also coloured red and green. At night time the buttons shall include internal lighting. It shall not be possible to dim the internal light to zero but the buttons shall remain discernable at the lowest dimmable level whilst the steering station is in command.

103 UIDs for follow-up steering (FU) shall encompass indication of the rudder order.

104 *FU-steering on navigating & manoeuvring workstation*

The manual steering device to be installed on the navigating & manoeuvring workstation shall employ follow-up steering control. The UID shall enable the navigator to set a rudder order and the rudder (UID) shall then stay on in the set position unassisted. The rudder amidships position shall be easily obtainable by the navigator during blind operation.

Guidance note:

The UID should be designed with a “snap-on” in the amidships position or a similar attribute being noticeable by the operator blindfolded. A spring-loaded UID automatically returning the rudder to amidships is not satisfactory.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

105 Take-over

A take-over functionality shall be incorporated with the manual steering UID on the navigating & manoeuvring workstation. The take-over device shall require no more than a single operator action to let the navigator take on the rudder control/propulsion (if thrusters provided) irrespective of the steering mode or steering position being in command at the time of take-over. Means shall be incorporated to alert about accidental use.

Guidance note:

If the take-over is done directly (automatically) by the sole grip of the UID an audible warning requiring acknowledgement by the operator should follow the initial operation of the UID. If a switch is provided for take-over preceding the operation of the UID the inadvertent operation of the switch should be protected by an audible warning lasting 2 seconds (*no call for acknowledgement is needed*) or a shield or similar physical prevention.

It shall be possible to select the steering mode provided at each workstation accordingly.

A “single operator action” signifies that one operator action in addition to the grip of the UID is acceptable, e.g. like pushing a button or turning a toggle.

If a toggle switch is used it shall have no more than two positions, i.e. resembling ON/OFF.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

106 A take-over functionality for control of rudder(s), thruster(s) and propulsion(s) shall be provided on each bridge workstation where steering is provided, and applicable control UID accordingly. It shall be possible to select all steering modes provided at each respective workstations

107 The take-over functionality shall enable the UID on the navigating & manoeuvring workstation to override all other steering control modes and steering control positions (disregarding the steering gear room).

108 The take-over device and pertinent steering UID shall be discernable at night time

109 A override function of steering and/or propulsion as applicable (in case of azimuth thrusters) shall be installed supporting B101 with respect to UID.

B 200 Information and indicators

201 Steering control modes

The active steering control mode shall at all times be unambiguously presented and easily readable at both the monitoring and navigating & manoeuvring workstations.

Guidance note:

The steering modes to be indicated include:

- manual control
- heading control
- track control.

If other steering modes are provided related indication fulfilling the requirement should be provided. The indication of steering modes is not to be mixed with steering positions which requires a separate appearance.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

202 Steering control positions

The steering position or control station in command shall be unambiguously presented and easily readable at both the monitoring and navigating & manoeuvring workstations.

Guidance note:

Typical steering positions are the docking workstations, manual steering workstation and navigating & manoeuvring workstation.

If more than one computer HMI (display) can be selected as UID for manual and/or automatic steering control, e.g. MFDs supporting heading- and/or track control functions, the individual HMIs shall be properly marked and the control station in command shall be clearly indicated.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

203 If take-over functionality is provided on workstations other than the navigating & manoeuvring workstation then a characteristic warning shall be sounded whenever take-over is effectuated on such workstations. The warning shall be audible at all workstations provided with a take-over device. A clear status message shall be displayed on the workstation in command.

Guidance note:

Generally each workstation provided with a take-over device shall have a pertinent buzzer set off by the operation of the take-over device on either one of the control stations. An exception to this requirement is made for nearby control stations located within the wheelhouse where a central buzzer may be sufficient.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

204 Rate of turn indicator (ROT)

The scale of the rate-of-turn indicator shall be in accordance with the turning ability of the ship while proceeding at normal seagoing speed.

Guidance note:

The scale of the rate-of turn-indicator should be able to indicate the steady state angular velocity (ROT) that the vessel

will achieve when applying at least a rudder of 20° or an angle providing an equivalent force if other means of steering is provided.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

B 300 Heading control system

301 The heading control system (HCS) shall be capable of self-tuning and being adaptable to the ship's steering characteristics under prevailing weather conditions and various loading conditions while using a minimum of rudder to maintain the heading.

Guidance note:

The HCS shall be able to maintain the heading with an accuracy of 1° (rms) in fair weather conditions (Beaufort ≤ 5) employing rudder angles < 2° (rms).

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

302 The HCS shall be able to carry out course changes employing user selectable turn radii for control of the ROT during the course change. It shall be simple to adjust the pre-set turn radius at any time during the course change.

303 The off-heading alarm shall not be initiated during a normal course change.

304 The heading control system shall sustain a fail-safe design and the most probable failures in the control loop shall result in the least critical of any possible new conditions.

Guidance note:

The heading control system shall upon any detectable failures in the control loop maintain the rudder in a position that will best possible keep up the set heading (order). Such failures include at least power failure, short circuits and broken connection.

- While keeping a straight course the rudder may gracefully be put amidships or alternatively “freeze” in instant position.
- While executing a course change in ROT or radius mode the rudder should be maintained in the position that will best possible keep up the ROT or radius order set by the user. (Relevant data may be obtained from spiral trials, either full-scale trials or model test, in accordance with Sec.8.) Alternatively the rudder may “freeze” in instant position at the time of failure.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

305 The most probable type of failures in the command- and feedback loop shall be monitored. Following detection of a control loop failure an unambiguous alarm shall be activated and include an unmistakable warning message.

Guidance note:

The method employed for detection of failures in the control loop shall provide instant detection and be independent of the position of the rudder and/or command transmitted by the HCS. E.g. monitoring the difference between the rudder order and the rudder feedback is not a sound method in a FU-system.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

306 Dual heading input – NAUT-AW

Upon failure of the selected compass system the HCS shall automatically employ the heading information from the second compass system. Any heading difference present at this instant shall not cause any undue rudder order.

Guidance note:

If the preset heading of the autopilot is being maintained any heading difference shall be smoothly eliminated. Alternatively the autopilot may take the instant heading as new preset heading followed by an informative warning to be acknowledged by the OOW.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

307 Safety system – NAUT-AW

A safety system shall be provided together with the HCS and be so designed that upon failure of the main processing unit the safety system will automatically maintain the instant heading, if on a straight course (leg,) or the instant ROT (radius) if in a turn.

Guidance note:

The safety system may be waived if full scale pull-out- or spiral trials reveal that the ship sustain an outstandingly directional stability in all loading conditions. The hysteresis loop as determined by such trials shall be less than ±3°/min.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

308 Fall-back mode – NAUT-AW

The HCS shall support the interface and memory required for automatic employment of relevant parameters of the planned voyage to conduct a smooth fall-back to heading control mode subsequent to failure of the track-control mode.

Guidance note:

The HCS shall have the necessary attributes to accommodate the planned radius of the turn and the next course to steer following initiation of every course change.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

C. Heading Information System

C 100 Dual Compass systems

101 The two compass systems shall perform in accordance with specifications at normal seagoing speed (NCR) in the latitudes where the ship is to operate.

Guidance note:

Generally the accuracy and availability of the individual compass system shall not be inferior to the international standards applicable to the gyro compass whilst extended to latitudes up to at least 75°. A waiver may be accepted for ships intended for sole operation in designated areas of lower latitudes. Ref. Sec.1 A503.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

102 The two compass systems shall be arranged for continuous performance in accordance with their specifications and at least one of the compasses shall be an autonomous system.

Guidance note:

If one of the compasses installed is a GNSS based THD certified in compliance with ISO 22090-3 then the second compass shall be able to operate in accordance with its specifications independent of means external to the ship.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

103 The two compass systems and their pertinent distribution systems shall sustain a fault-tolerant design and be arranged so that no single failure will cause enduring loss of heading to repeaters and/or navigational equipment for which heading information is compulsory.

104 The two compass systems shall be able to maintain continues heading output to steering repeaters and essential navigation equipment which performance is dependant on the heading information, subsequent to any single failure in either one of the two systems.

Guidance note:

Essential navigation systems in this context are at least the ARPAs and the heading control system (HCS) and track control system which shall automatically be provided with heading information from the second compass system following a failure of the selected compass system.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

105 The heading information being distributed to repeaters and navigational systems shall enable the receivers to align with the main compass automatically.

Guidance note:

A digital interface shall be provided to all heading indicators/displays, radars, ECDIS', AIS and conning display (NAUT-AW).

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

106 The heading information being distributed to repeaters and navigational systems shall enable the receivers to carry out an integrity check of the information received.

Guidance note:

The IEC61162-1 message \$.THS indicating the autonomous mode is satisfactory. Ref. also sec.5 D300 Data integrity.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

107 The heading being distributed to repeaters and essential navigational systems shall be corrected for predictable errors.

Guidance note:

- A gyro compass shall at least be corrected for speed-latitude errors. In addition to the IEC61162-1 message \$.THS, a gyro should include a proprietary mode indicator in the message(s) to inform about such correction being applied or not.

Ref. IEC61162-1(2007) 6.3.5 or 7.3.10 for detailed guidance on protocol.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

108 Failure of input from a single GNSS receiver or a single SDME shall not degrade the accuracy of the distributed heading from both compasses.

Guidance note:

The speed and latitude applied for the purpose of speed-latitude corrections may be derived from dual GNSS receivers, one being a hot back-up for the other.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

109 The heading outputs of two compasses shall be monitored and an alarm shall be initiated if the deviation exceeds a pre-set limit selectable by the user.

Guidance note:

It should be possible to select the alarm threshold within a range not less than 3° - 6°.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

D. Speed Information System

D 100 Speed Distance Measuring Equipment (SDME)

101 The SDME shall measure the speed through the water (STW) relative to a water layer being no more than 3 metres below the hull.

102 The SDME shall be able to provide the ARPA with STW continuously. If a single SDME unit is capable of measuring STW and SOG (speed over ground) then these measurements shall be done simultaneously and both measurements shall be transmitted to applicable navigational equipment.

Guidance note:

The message \$.VBW shall include both STW and SOG so that the receiver may employ either speed irrespective of the speed category selected for display on the speed indicators.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

103 The distance indicator shall include a trip counter and pertinent reset button.

104 Maintenance

Any part of the SDME including parts installed below the waterline shall be easily replaceable when the ship is afloat.

Guidance note:

Generally, a gate valve is considered to be an acceptable solution for replacement of the transducer. Technical solutions involving replacement employing divers are subject to case-by-case considerations of the simplicity of the method and the procedure to accomplish the replacement. A confirmation from a diving company about the simplicity may be requested.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

105 Dual axis SOG – NAUT-AW

The SDME shall be able to determine and display the longitudinal SOG in fore and aft directions and the athwart ship SOG of both the fore ship and the aft ship.

E. Collision Avoidance - Decision Support Systems

E 100 General

101 Any navigational system providing the functionality of collision avoidance, including the provision of CPA and TCPA information, shall be certified for compliance with applicable international standards.

Guidance note:

The foremost international standard relating to collision avoidance functionality is established by IEC62388 “Ship borne radar”.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

E 200 Radar systems

201 ARPA

The displays shall have a minimum effective radar image diameter of not less than 320 mm.

202 The ARPA shall have facilities for automatic acquisition of targets.

203 The ARPAs shall support a clear and unambiguous presentation of the following modes and target vectors:

- Sea stabilized mode with graphical indication of targets (true) heading and STW vector
- Ground stabilized mode with graphical indication of targets (true) COG and SOG vector
- Relative mode with graphical indication of targets relative direction and speed vector.

204 AIS

At least one of the displays shall provide a suitable HMI allowing the navigator to manually insert data into AIS. For NAUT-AW, both displays shall provide such functionality. The HMI shall not be inferior to the minimum keyboard and display (MKD) of the AIS itself. The display shall be capable of presenting AIS reported targets in accordance with relevant IMO standards and guidelines.

205 Performance monitor

The radar systems shall incorporate a performance monitor and the pertinent operation manual shall include comprehensible instructions how to determine a significant drop (10 dB) in the performance.

206 Inter-switch

The radar systems shall incorporate an inter-switch facility and the pertinent HMI shall be available from both radar displays. Failure of the inter-switch shall not reduce the availability of either one of the two radar systems.

207 Interfaces

The radar systems shall support the interface needed to employ serial information from the following equipment:

- 2 compass systems
- SDME
- GNSS
- AIS
- AMS.

208 Network

Upon failure of a networked radar system at least one of the radar systems shall continue to be fully operational as an ARPA not inferior to a stand alone system.

Guidance note:

In addition to the network connections one ARPA should be directly connected to a gyro and speed log. Reference is made to Sec.5 D403.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

209 Antennae location

Both antennae shall as far as practicable be mounted clear of any structure that may cause signal reflections, including other antenna, masts, funnel and deck structure or cargo.

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 on either side.

The dual antennae installation shall provide coverage over an arc of the horizon of 360° by installing the two radar antennae so as to avoid common blind sectors.

210 ECDIS interface - NAUT-AW

Both radar installations shall have a bi-directional interface to facilitate communication with ECDIS so that radar targets can be transferred to the ECDIS and selected parts of SENC together with the course lines of the voyage plan can be transferred to and displayed on the radar screens.

E 300 AIS

301 The AIS shall have an interface facilitating communication with both radars as well as a separate interface located at the conning workstation.

302 The AIS shall have the interface and facilities needed to support the MKD functionality being conducted by a remote operating unit.

E 400 Sound reception system

401 The Sound reception system (SRS) shall be capable of detecting sound signals from ship whistles operating in the audio band 70 Hz - 820 Hz whilst suppressing wind and mechanical noise within this band as well as frequencies outside this band. The SRS performance shall endure microphones being located in a position having an ambient noise level of 70 dB(A).

402 The SRS shall have means for muting of audio signals up to 75 dB(A) to adjust for more severe ambient noise levels in rough weather. If the means provided for muting involves mechanical adjustment by the operator the pertinent UID shall indicate the muting threshold in steps of no more than 3 dB(A).

403 The SRS shall include filters suppressing background noise from wind and own ship/s machinery letting only sounds having a characteristics reckoned to be a ship's whistle pass through.

Guidance note:

Sufficient noise suppression can normally only be obtained by digital filtering techniques.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

404 The SRS shall be capable of determining the approximate direction to the source of the sound signal. The SRS shall as a minimum indicate the source of the sound signal being to port or starboard side and forward or abaft of the beam.

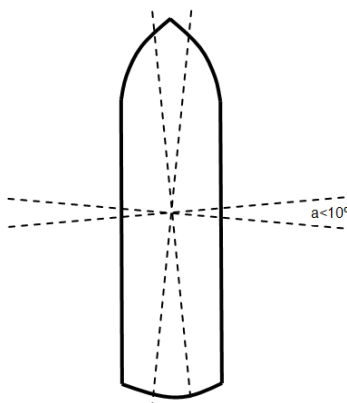


Fig. 1
Sectors of ambiguity

405 The accuracy of the determination of the applicable quadrant shall be within $\pm 5^\circ$.

Guidance note:

The sectors of ambiguity (s) along the longitudinal and transversal axis of the ship shall either be insignificant ($< 10^\circ$) or be determined and indicated as separate directions (sectors).

If a higher resolution than the 4 sectors is provided, (typically $4n$ where $n = 2, 4$, etc.), then the accuracy requirements applies analogous to the separation of the available directions (sectors).

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

406 The resolution of direction to the source of the sound signal shall not be lesser than the four quadrants plus the four sectors of ambiguity.

Guidance note:

If a dual axis display (e.g. a CROSS or 4 LEDs) is used for visually presenting the direction to the signal source then two axes or two LEDs should be used to represent the accurate quadrant. When the direction to the signal source is within the longitudinal or transversal sectors of ambiguity only one axis or LED shall lit to enhance the perception of the direction by the user.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

Guidance note:

If an SRS makes use of 4 microphones located in a defined configuration comparing the signal time delay involving the two signals (microphones) on the same axis this time difference is a function of the direction of the incidence of the signal and will approach zero when the axis of incidence is near normal to the axis of the microphones. The accuracy with which the SRS can determine the time delay will determine the sector of ambiguity.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

407 The sound reception display shall give a clear visual indication of the direction for at least the duration of the sound signal plus 2 seconds. The direction (or quadrant) shall be clearly readable by day and by night on a distance of not less than 2 metres.

408 The loudspeaker(s) should be installed so that incoming sound signals are audible at all working positions inside the wheelhouse for which the OOW has been assigned tasks.

409 The microphones shall be installed away from noise sources and in lee of strong wind and otherwise abide by the instructions of the manufacturer.

410 The system shall be muted upon activation of own ship's whistle and outdoor PA-system.

411 *Sound intensity in the wheelhouse*

It shall be possible to adjust the sound intensity level (volume) of the loudspeaker.

412 The volume knob of the loudspeaker shall have a mark of the position where the sound level in the wheelhouse is alike the sound level at the outdoor listening post.

Guidance note:

The OOW shall be able to set the sound intensity of the reproduced signal measured 1 m from the loudspeaker(s) in the wheelhouse (with *all bridge windows and doors closed*) to the same level as the sound intensity that is measured outside the wheelhouse at a location near the microphone that is closest to the signal source.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

413 With the volume control adjusted to the out door level and in the absence of any intelligible sound signal the SRS shall be muted.

F. Grounding Avoidance - Decision Support Systems

F 100 Electronic chart display and information system (ECDIS)

101 The ECDIS' shall be interfaced with at least one ARPA each and be capable of displaying plotted radar targets.

102 The ECDIS' shall support the necessary interface and configuration for employing at least two EPFS-receivers.

103 The ECDIS' shall support the necessary interface and configuration for employing at least two gyro compasses.

104 *Inter-ECDIS connections*

Both ECDIS shall be interconnected and accommodate uploading of voyage plans from a separate route planning station.

Guidance note:

The separate ECDIS route planning station may be waived on vessels which do not have a separate voyage planning workstation. Reference is made to Sec.2 D701 guidance note.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

105 The inter-unit connection of the ECDIS' shall sustain the integrity of the individual ECDIS including the planning station.

Guidance note:

The connection arrangement shall accomplish electrical separation and isolation between the ECDIS stations. The software application provided for the purpose of inter-unit communication shall not be inferior to the requirements of Sec.5 D.

In cases where network is employed the fall-back requirement of Sec.5 D403 shall be fulfilled.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

106 It shall be possible to edit the parameters of the voyage plan by means of the HMI on both ECDIS'. Subsequent to acceptance of alterations of the voyage plan on one station the voyage plan of all ECDIS' shall be automatically updated with the revised voyage plan.

107 Installation of new ENC's and /or updates on one ECDIS shall automatically update the chart portfolio on both ECDIS.

108 The ECDIS shall automatically employ an ENC whenever available at the ship's position.

109 *Route planning station*

The route planning station shall allow the navigation officer to carry out all the tasks and store all the information necessary to accomplish a voyage plan in accordance with international standards.

Guidance note:

Reference is made to the requirements of IMO's performance standards for ECDIS (res.MSC.232(82) concerning the HMI-functions of route planning and IMO's Guidelines for Voyage Planning (res.A.891(21)) on information to be included.

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110 Network

Upon failure of a networked ECDIS arrangement at least one of the ECDIS shall continue to be fully operational as an ECDIS not inferior to a stand alone system.

Guidance note:

In addition to the network connections one ECDIS should be directly connected to a GPS, gyro and speed log. Reference is made to Sec.5 D403.

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F 200 Electronic Position Fixing systems

201 The GNSS receivers shall be able to track a minimum of 6 satellites simultaneously.

202 The GNSS receivers shall make use of pseudo-range corrections broadcasted by ground based augmentation system.

Guidance note:

The correction data formats used around the world for differential satellite navigation for Differential GNSS are the formats standardized by the RTCM Committee. The SC-104 standards prescribe formats for publicly supported radio beacon broadcasts of differential GPS and GNSS corrections.

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203 The GNSS receivers shall be provided with a Receiver Autonomous Integrity Monitoring (RAIM) algorithm, or similar Fault Detection and Exclusion (FDE) algorithm.

204 The GNSS installation shall support interface circuitry in accordance with international standards capable of providing all applicable equipment with the position and system information needed for their performance.

Guidance note:

A typical range of equipment are 2 ECDIS, 2 radars, 2 gyro compass, AIS, GMDSS, CID, VDR, i.e. a total of 10 listeners.

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205 Antennae

The GNSS antennae design shall optimize out-of-band rejection and sustain high performance multipath interference mitigation.

Guidance note:

The GPS antenna element should be optimised for right hand circularly polarised signals at the L1-frequency. The antenna gain should be >3 dBic (in zenith) and have a near hemispherical pattern to maximise the number of satellites for tracking while simultaneously reducing signals below 5° of elevation. The axial ratio should be <3dB (for elevation angles >45°).

The antenna should also have a narrow bandwidth, a L1-filter and provide for low noise amplification of the received signal.

The S/N-ratio attained following installation should not be less than 45 dB for satellite elevation angles > 30°.

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F 300 Echo sounding equipment

301 When more than one transducer is provided and located in different positions on board the presentation of depth on all displays shall clearly indicate which transducer is currently the source of information.

302 If the system can display water depths other than under the keel such other depth shall be clearly indicated on all displays.

303 If the transducer is located in a place being shallower than the deepest part of the keel the echo sounder shall be properly corrected for the difference and the correction figure shall be stored in a non-volatile memory.

Guidance note:

Either the echo sounder should add the correction figure to the measured depth prior to transmitting data to listeners or all receivers (listeners) of the data must be able to employ the negative offset value of the \$.DPT message. If manoeuvring device(s) protruding beneath the keel is installed (e.g. azipod or azimuth thruster) then the echo sounder

should be calibrated to the deepest part of such device. If the datum of the depth measurement is different from keel a label stating the actual datum should be posted at or near the main unit of the echo sounder.

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G. Weather Surveillance systems

G 100 Shipboard weather station

101 Wind speed and direction

The wind speed sensor shall work over a range not less than 0 to 100 knots with accuracy and resolution better than 2.5 knots.

102 The wind direction sensor shall cover an azimuth of 360° with an accuracy and resolution better than 5°.

103 The anemometer shall be able to display at least the relative wind speed and direction.

104 If other modes than the relative speed and direction is available the actual presentation mode shall be explicitly indicated on the display.

105 The anemometer shall have a serial interface to convey the wind speed and direction in accordance with international standards.

106 The sensors shall be situated in locations where the effects of air flow distortion due to superstructure or other large shipboard structures are being minimized.

Guidance note:

Top of the fore mast is the ideal location on ships with its superstructure aft. Sensors located above the compass deck should be placed as far forward as possible and as high as possible, ideally on a slim mast located at the forward edge of the compass deck. If this is impracticable then the sensor should be located above compass deck at a height, z , according to:

$$z = 0.3(H + x)$$

H = Height of compass deck above sea level

x = horizontal distance from edge of compass deck

z = height of sensor above compass deck

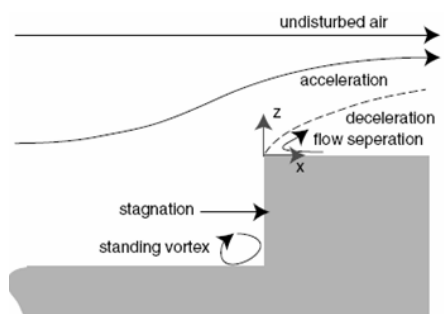


Fig. 2
Air flow around the bridge on a generic tanker/bulker

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107 If a large radar mast or similar structure is located on the same height adjacent the sensor then two sensors shall be installed, one on each side of the ship. The processing unit shall be able to weigh the output of the two sensors in proportion to the relative wind direction.

108 Relative humidity and air temperature

The relative humidity shall be measured within a working range from 0 – 100% having accuracy better than 3%.

109 The temperature shall be measured within a working range not less than -15°C to 55°C having accuracy better than $\pm 0.5^\circ\text{C}$ (*with > 10 knots wind speed and sunlight*).

110 The pertinent humidity and temperature measurements shall be displayed with a resolution not inferior to the accuracy.

111 Barometric pressure

The barometric pressure shall be measured with accuracy better than 5 mbar (500 Pa) and resolution higher

than 2 mbar.

G 200 Weather information system

201 The system shall be able to receive, on regular basis or upon request, weather forecasts for all areas relevant for the ship, from a recognized weather service.

Guidance note:

The service providing the weather forecasts should comply with technical regulations and recommendations made by world meteorological Organization.

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202 The weather forecasts shall at least have duration of 5 days, with time steps not exceeding 6 hours and geographical resolution of not less than 60 km × 60 km.

203 The forecasts shall as a minimum include wind direction and speed, barometric pressure, air temperature, significant wave height and direction, swell height and direction, significant ocean current information, weather fronts, information about tropical storms and ice.

204 The system shall graphically display the received weather forecasts on a chart in a user friendly manner.

Guidance note:

The user should be able to select, for display, individual weather parameters and logical groups of parameters. The user should also be able to select any of the time steps available from the forecasts.

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H. Bridge Navigational Watch Alarm System (BNWAS)

H 100 Surveillance of the navigational watch

101 The BNWAS shall maintain supervision of the wheelhouse to ensure the navigational watch being attended when the ship is underway at sea.

102 The BNWAS system shall in addition to requirements in IMO Performance standard for Bridge navigational Watch Alarm System, comply with the below requirements.

103 Means for activating the BNWAS reset function provided at workstation for monitoring, workstation for navigating & manoeuvring and workstation for conning shall be activated by automatic detection of human motion.

Guidance note:

The most common method by which motion can be automatically detected employs use of infra red sensors or optical detection devices with processing of images. The means for activating the reset function provided at the workstations for docking operations need not be based on automatic detection of human motion.

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104 It shall be possible for the OOW to select individually any of the navigation officers or the captain as being the assigned back-up officer for receiving the second stage remote audible alarm. Whenever captain is not selected as the assigned back-up officer, the captain cabin and office shall be included in the list of locations receiving the third stage remote audible alarm.

105 The third stage remote audible alarm shall at least sound in the below locations:

- Captains cabin and office
- officers' office
- officers' mess
- officers' day room
- cargo control room (if provided)
- gymnasium (if provided)
- prayer room (if provided)
- other public rooms and areas (if provided).

Guidance note:

To extend the accessible area for back-up personnel the alarms may additionally be transferred by means of a wireless system to call the assigned back-up navigator on the condition that it is possible for the assigned person to reach the bridge within 2 minutes.

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H 200 Alarm Transfer

201 The bridge navigational watch alarm system shall be inter-connected with the alarm management system for activation of the BNWAS sequence of indications and alarms when Category A alarms are not acknowledged or silenced in due time. Activation of the reset function during these sequences shall cancel the alarm transfer but shall not silence or acknowledge the relevant Category A alarm on the AMS.

I. Alarm Management System

I 100 Integration of navigational equipment

101 An alarm management system (AMS) enabling all alarms generated by individual **navigational** equipment to be centralised in one common AMS display at the required workstations enabling easy identification of the source and cause of the alarms and rapid acknowledgement of category B alarms and cancellation of audible category A alarm signals shall be provided.

Guidance note:

Conning display may be used as AMS display.

The audible level of alarms and warnings should be 75 dB(A). The minimum equipment to be integrated by the AMS should include:

— track control system	— EPFSs	<i>Additional equipment may comprise:</i>
— heading control system	— speed logs	— UMS alarm panel
— heading information systems	— echo sounder	— steering gear alarm panel
— radars/ARPAs	— bridge navigational watch alarm system	— navigation light alarm panel
— ECDISs		— VDR alarm panel, etc.

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102 The number of alarms shall be kept as low as possible by providing indications for information of lower importance not requiring any action.

Guidance note:

References are made to IMO resolutions MSC.86(70) Annex 3, 4.3.5 and A.830(19) 3.16.

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103 An acknowledgement of a category B alarm on either the AMS or the individual equipment raising the alarm shall acknowledge the alarm on both the individual equipment and the AMS.

Guidance note:

When an alarm is acknowledged, the audible alarm signal shall be silenced and the visual alarm presentations shall be changed from red/ flashing to red/ steady on both the individual equipment and on the AMS.

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104 A silencing of a category A alarm on either the AMS or the individual equipment raising the alarm shall silence the audible alarm signal on both the individual equipment and the AMS.

Guidance note:

When the audible alarm signal is silenced on the AMS, the visual alarm presentation shall remain red/ flashing on both the individual equipment and on the AMS.

It shall only be possible to acknowledge Category A alarms on/ at the equipment raising the alarm.

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105 The acknowledgement and silencing operation referred to in items 103 and 104 above shall be provided by a single operator action.

106 The visual indication and the audible alarm on the AMS display shall be according to Table B1.

Table B1 Visual and audible indication of alarms and warnings			
<i>Alarm status Sound</i>	<i>Colour</i>	<i>Flashing</i>	<i>Audible</i>
New active unacknowledged alarms (no operator actions taken)	Red	Yes	Yes
Active, silenced but unacknowledged category A alarms.	Red	Yes	No
Active unacknowledged alarms which cause were removed.	Red	Yes	Yes
Acknowledged alarms which cause was removed.	---	No	No
Active acknowledged alarms	Red	No	No
New active unacknowledged warning (no operator actions taken)	Yellow	Yes	No*
Active unacknowledged warnings which cause were removed.	Yellow	Yes	No
Active acknowledged warnings	Yellow	No	No
Acknowledged warning which cause was removed.	---	No	No
* A short audible signal at the occurrence of the warning is accepted.			

107 The visual indication shall as a minimum identify which equipment the alarm is originated from and the basic alarm cause.

It is recommended that the AMS display is able to show the alarm cause as contained in the IEC 61162-1 “ALR” sentence.

Guidance note:

If the AMS display does not identify the cause of the alarm, the alarm shall only be silenced from the AMS. Such solutions may be accepted in a transitional period of not more than one year.

When the audible alarm signal is silenced on the AMS, the visual alarm presentation shall remain red/ flashing on both the individual equipment and on the AMS.

It shall only be possible to acknowledge alarms on/ at the equipment giving proper identification of the cause of the alarm.

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108 The AMS display shall be able to simultaneously show minimum 10 alarms/ warnings.

Guidance note:

The AMS display shall be able to show unacknowledged alarms if more that 10 alarms/ warnings are active.

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109 The AMS shall be inter-connected with the BNWAS for transfer of a signal to the BNWAS if category A alarms has not been silenced on the AMS or acknowledged on the individual equipment within 30 seconds.

110 Failure of the Central Alarm System shall not affect connected equipment.

111 The AMS shall be able to communicate with connected equipment in accordance with IEC 61162-1.

Guidance note:

The central alarm system shall be able to handle the IEC 61162-1 “ALR” and “ACK” sentences in compliance with the guidelines given by IEC 80/520/INF.

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J. Nautical Internal Communication Systems

J 100 Internal communication equipment

101 *Automatic telephone system* (applicable to **NAUT-OC, NAUT-AW**)

a) An automatic telephone system shall be installed and shall provide two-way voice communication between the bridge and:

- all officers cabins
- all deck hand cabins
- all public rooms
- all normal working spaces and
- all emergency working positions.

b) The telephone network shall be designed with a minimum capacity of four simultaneous calls.

- c) The wheelhouse shall be fitted with at least two independent telephone extensions.
- d) The telephone extensions in the wheelhouse and engine control room shall have priority function over any other extension.
- e) Incoming calls on adjacent telephones shall be distinguishable by lights and/or different ring tones.
- f) The automatic telephone system shall be supplied by mains and emergency sources of power.

102 Back-up telephone system (applicable to **NAUT-OC, NAUT-AW**)

- a) A back-up telephone system shall be installed and shall be independent of any failure in the automatic telephone. It shall be provided for two-way voice communication between the wheelhouse and at least the following places:
 - engine control room (ECR)
 - local engine operation position(s)
 - steering gear control position(s)
 - local thruster control position(s)
 - emergency generator room(s)
 - cargo control room (if provided)
 - captain's living quarters
 - chief engineer's living quarters
 - emergency station, fire station (when located outside of the bridge area)
 - other compartments to be manned in an emergency situation according to the contingency plan.
- b) If portable two-way voice communication equipment is used for compliance with the back-up telephone requirements, then all of the applicable locations shall be provided with transceivers being readily available. The equipment is considered additional to the equipment provided for fulfilment of the requirements of 107 and 108. The portable two-way voice communication equipment shall comply with DNV Statutory Interpretations for internal communication systems.
- c) If fixed telephone extensions are used for compliance with the back-up requirements, then the extensions on bridge and ECR shall have priority.
The back-up telephone system shall be supplied by mains and emergency sources of powers.

Guidance note 1:

The above requirement does not prevent the use of self-contained communication systems, such as sound powered telephones or other battery operated communication systems. Refer to DNV Statutory Interpretations for internal communication systems for power supply, battery and charger requirements for Portable two way voice communication systems.

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Guidance note 2:

If sound powered telephones are used for compliance with the back-up requirements, then priority function is not required unless the number of the extensions exceeds the required number as listed in 102a.

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103 Noisy milieu

Applicable to the automatic telephone system and the back-up telephone system. In rooms and compartments with an ambient noise level above 75 dB(A) a headset with a noise cancelling microphone or similar facilities suitable for voice communication in noisy environment shall be provided.

Guidance note:

Applicable rooms and compartments will as a minimum include steering gear room, engine room and thruster compartment (if provided).

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104 Applicable to the automatic telephone system and the back-up telephone system. A reference list of extensions shall be permanently posted near each telephone being readable while dialling.

105 At least one of the telephone systems as required by 101 and 102 shall be supplied by a battery or an uninterruptible power supply as a stand-by power supply sufficient to operate the system for at least 30 minutes.

Guidance note:

If sound power telephone system or portable self contained two-way voice communication apparatuses are used for compliance with 102, then 105 is considered to be complied with.

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106 Public address system (applicable to **NAUT-OC, NAUT-AW**)

- a) The public address system call stations on bridge shall be suitable for flush panel mounting in workstation consoles.
- b) Each PA call station shall be equipped with activation light to indicate communication readiness.
- c) A reference list of all PA-areas (where different areas are selectable) shall be permanently posted being readable from the PA call stations.

107 UHF equipment (applicable to NAUT-OC, NAUT-AW)

- a) To assist in safety and navigation operations on board, the bridge shall be provided with at least four portable UHF transceivers operating in the 457 to 467 MHz band.
- b) The transceivers shall have a capacity to operate continuously for at least 5 hours.

Guidance note:

Continuous operation means sequences of 1 minute transmissions followed by 9 minutes reception, without signals at the receiver input.

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- c) A battery charger having sufficient capacity to re-charge all UHF transceivers simultaneously shall be installed within the wheelhouse.
- d) Portable UHF transceivers used for compliance with the requirement of 107 shall comply with the DNV Statutory Interpretations for internal communication systems.

108 Communication system for Mooring operations (applicable to NAUT-OC, NAUT-AW)

- a) A communication system supporting hands free two-way voice communication between the wheelhouse, bridge wings and all applicable mooring stations on board shall be provided.

Guidance note:

The communication system may be a fixed installation or alternatively dedicated portable two-way voice communication apparatuses. A Push To Talk (PTT) activation facility, on portable UHF transceivers used for compliance with the requirement of 108-a, is accepted as an alternative to hands free operation, provided that such portable UHF equipment can be secured firmly in position to the person operating the apparatus, and that a dedicated headset/earpiece and one hand operated PTT activation facility be utilised.

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- b) If portable UHF transceivers are used for compliance with the requirement of 108 then the total number of transceivers provided, including the four transceivers required by 107, shall not be less than 2 times the number of mooring stations onboard.
- c) If portable UHF transceivers are used for compliance with the requirement of 108-a then a battery charger having sufficient capacity to re-charge all UHF transceivers simultaneously shall be installed within the wheelhouse.
- d) Portable UHF transceivers used for compliance with the requirement of 108a shall comply with the DNV Statutory Interpretations for internal communication systems.
- e) Fixed installations used for compliance with 108a shall be such that:
 - when a member of the mooring team activates a call to any location all other locations also receive the call.
 - it shall be possible for any location to take over the call by a simple operation and continue to communicate on a hands-free basis.

K. Track control system (TCS) – NAUT-AW

K 100 General

101 The track control system in conjunction with their sources of position, heading and speed information are intended to keep a ship automatically on a pre-planned route with the accuracy in metres equal to the ship's breadth to either side of the course line under calm weather conditions with minor effect of currents/tidal streams within the limits related to the ship's manoeuvrability.

102 The track control system shall in addition to requirements in IMO Performance standard for Track control system, comply with the below requirements.

K 200 Additional Integration

201 The following equipment and systems shall be integrated to make up the TCS:

- two EPFS

- two gyro compass
- ECDIS
- Radar/Chart radar
- heading control system (HCS)
- track control system (TCS)
- conning information display (CID)
- alarm management system (AMS).

K 300 Additional functional requirements

301 EPFS

The integrity of the position employed by TCS shall be continuously monitored. At least two independent EPFS positions shall be included in the validation algorithm.

302 The individual position fixes shall be properly filtered incorporating own ship's real time speed vector (DR-position) deduced from gyro and speed log information or equivalent independent sensors.

303 Upon failure of the selected EPFS system (e.g. loss of data or invalid data) the TCS shall automatically employ the EPFS from the second EPFS system and keep up the set course. Any position difference at this instant shall be gracefully reduced.

304 Gyro compass

The gyro compass configuration shall sustain continues heading information to TCS equipment which performance is dependant on heading information, following any single failure in either one of the two gyro systems shall not degrade the TCS. See 310

305 The integrity of the heading employed by TCS shall be continuously monitored.

306 ECDIS

One of the two ECDIS shall provide the HMI for the assignment of TCS and engagement of track control mode. If more than one ECDIS supports the HMI for TCS only one workstation shall be in command at the time and it shall be clearly perceptible to navigator which workstation is in command.

307 The ECDIS shall support the interface required for timely transmission of relevant parameters of the planned track so the autopilot can conduct a smooth fall-back to heading control mode subsequent to failure of the TCS.

308 Both ECDIS installations shall have a bi-directional interface to facilitate communication Radar overlay, AIS target overlay and tracked target (ARPA) overlay.

309 RADAR

At least one of the radar installations shall be type approved as chart radar to facilitate SENC overlay. The ECDIS and selected parts of SENC together with the course lines of the voyage plan can be transferred to and displayed on the radar screens.

Guidance note:

The chart radar requirement may be waived if the ECDIS/radar overlay can facilitate the minimum functional requirements as listed in the chart radar requirements.

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310 HCS/TCS

Upon failure of the selected compass system (e.g. loss of data or invalid data) the HCS/TCS shall automatically employ the heading information from the second compass system and keep up the set course. Any heading difference at this instant shall be gracefully reduced.

L. Conning information display (CID) – NAUT-AW

L 100 General

101 Information required for efficient monitoring of the TCS performance shall be systematised and displayed for easy and continuous monitoring by the navigators. Information not related to safe navigation and manoeuvring shall be avoided on the screen.

102 To enable a straightforward perception, the conning information display shall employ a graphical display locating relevant sensor data and pertinent set values (orders) appropriately on and around an illustration of own ship. The set value and pertinent sensor value is deemed a logical set of parameters.

103 Additionally, present and impending information related to the voyage plan shall be presented on the

screen together with environmental data which may affect the performance of the TCS.

104 The CID shall present the set and drift vector (magnitude and direction) being experienced. The accuracy shall not be inferior to the combined accuracy of the EPFS, gyro and SDME information.

L 200 Information categories

201 The information categories to be logically grouped and clearly displayed shall comprise:

- control system data
- voyage plan data
- depth, wind and set and drift data.

Additional data categories may be included if related to the navigation and manoeuvring of the ship and providing the perceptibility of the listed information is not impaired with.

202 Control system data

a) Present system orders and set-values:

- set heading (heading to steer, e.g. from \$.HTC)
- set turn radius (only during turn, i.e. subsequent to WOL)
- rudder angle order
- set speed (only if speed pilot is provided)
- present steering control mode.

b) Corresponding sensor data and actual values:

- heading
- turn rate
- rudder angle
- speed over ground
- longitudinal
- athwart ship
- propeller revolutions
- pitch indication, when relevant
- thruster indication, when relevant.

203 Voyage plan data

a) General:

- identification (name) of selected route.

b) TO-waypoint:

- number (name) of waypoint
- planned course
- planned turn radius
- bearing to WOP
- time to go to WOL (h,m,s <24h<d,h,m))
- cross-track-limit
- cross-track-distance, XTD (m if <0.5nm).

c) NEXT-waypoint:

- planned course
- distance to WOP.

204 Wind and current data

a) Graphical and alphanumeric presentation of:

- wind vector (velocity and direction)
- set and drift vector (velocity and direction).

Guidance note:

The NEXT waypoint should turn into the TO-waypoint subsequent to passing the WOL.

The current vector may be attained from calculus of the SOG- and STW-vectors using information from gyro, speed log and GPS.

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L 300 Fall-back information

301 Subsequent to failure of ECDIS all of the information listed in L200 shall continue to be updated and displayed on the CID until the course change of the TO-waypoint is completed.

SECTION 7

NETWORK BASED INTEGRATION OF NAVIGATION SYSTEMS (ICS)

A. General

A 100 Scope

101 This section covers design, arrangement and testing of network components and equipment installed to perform the functions of collision avoidance, grounding avoidance and alarm management at the workstations for monitoring and navigating & manoeuvring.

A 200 Applications

201 This section is applicable to ships requesting the qualifier **(ICS)**. The rule requirements are supplementary to the rules for any of the NAUT-class notations.

202 Ships complying with the rule requirements may add the qualifier to their class notation; **NAUT-OC(ICS)** or **NAUT-AW(ICS)** or **NAUT-OSV(ICS)** as appropriate.

A 300 Objective

301 The purpose of the requirements is:

- To enhance the availability of essential navigational information at the workstations for monitoring and navigating & manoeuvring,
- To provide flexible management of tasks being adaptable to various bridge team scenarios,
- To provide a consistent and unambiguous human-machine interface on MFDs,
- To enhance the level of mode awareness and situation awareness of the bridge team,
- To enhance the integrity of essential navigational information displayed,
- To ensure proper data management of sensor data and other data being processed and displayed by the INS.

B. Multi-Function-Displays (MFD)

B 100 Distribution of functions on workstations

101 The ICS shall comprise minimum five MFDs each with sufficiently redundant processing units capable of supporting the functions of ARPA, ECDIS, Conning Information Display (CID) and Alarm Management System (AMS).

Guidance note:

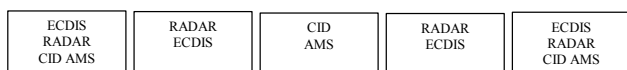
The five MFDs will comply with IMO minimum requirement of Radars and ECDIS/ECDIS back-up as appropriate

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102 The required functions shall be redundantly available on both the workstation for monitoring and the workstation for navigating & manoeuvring so that following any single failure of any part of the ICS all the functions shall continue to be available for selection by navigators on both workstations.

Guidance note:

A typical distribution of functions on the workstations for monitoring and navigating & manoeuvring are:



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103 The ICS shall be capable of managing the assigned functions simultaneously on the applicable MFDs and all functions being active shall be accessible to the navigator for display by a single operator action.

104 It shall at all times be indicated whether an assigned function is activated or not and this shall be clearly visible irrespective of the function being selected for display at present.

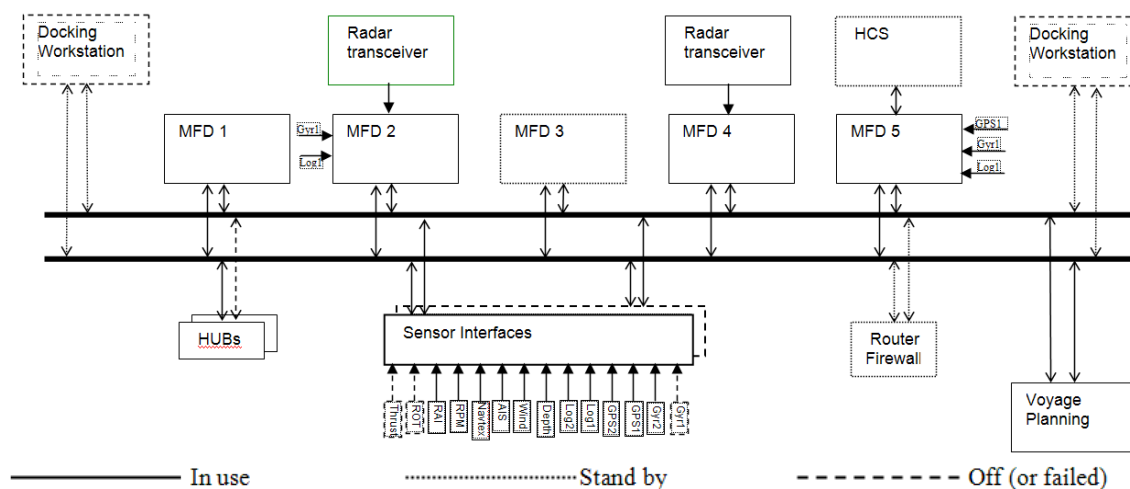
105 When the TCS is in operation both the CID and the ECDIS shall always be displayed on at least two MFDs being available at the same workstation.

C. Human-Machine Interface (HMI)

C 100 System Configuration display

101 Upon user request it shall be possible to display the complete ICS configuration, the available configuration and the configuration in use, as a graphic presentation. The information shall be detailed to the level of ICS subsystems, sensors, and other equipment connected, ready for providing information to the ICS, or being processed by the ICS.

Guidance note:



If colour coding is used; green = in use (running), yellow = stand by (ready), red = off (or failed)

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C 200 Consistent HMI

201 The displays and UIDs shall adopt a consistent HMI philosophy paying particular attention to overall layout, menus, wording, symbols, abbreviations, and colour coding.

202 The information shall be displayed using a consistent presentation style and is to be clearly understood by an OOW not being familiar with the equipment.

203 Manual inputs

Manual inputs that may lead to sudden manoeuvres or loss of data shall call for a confirmation by the user providing the OOW time for a plausibility check.

204 HMI –automatic control functions

Where multiple stations provide HMI for automatic heading, speed, or track control, only one station shall be assigned command at the time.

Guidance note:

A station in this respect is any keyboard or display having HMI for automatic control functions.

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205 It shall be clearly indicated on the station being in command as well as all the latent stations provided with such HMI which station is currently in command.

206 When a station includes such HMI it shall be possible for the user to take control at that station.

Guidance note:

The stations provided with HMI for automatic control functions shall support take-over functionality.

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C 300 Essential information

301 The ICS shall be capable of accepting multiple sensor inputs and/or sources for provision of the following data:

- heading
- STW
- SOG
- position

- time
- ENC
- radar video.

302 The position, heading and speed information shall be displayed together with the indication of its source.

Guidance note:

Sensor data, e.g. GYR 1, GYR 2, GPS 1, GPS 2, EM log, Doppler log, GPS, radar 1, radar 2 etc.; -or result of calculation or manual input; -unit if ambiguous, e.g. UTC for time.

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303 Display of sensor output data

The ICS shall be capable of displaying non-processed information directly from the output data available from the sensors upon request from the user.

Guidance note:

It shall be possible for the OOW to call upon and read the stream of received IEC61162 messages (ASCII) from sensors in a separate window.

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C 400 Accuracy and performance

401 The ICS processing shall not degrade the attributes of the essential information being provided by the sensors.

Guidance note:

Such attributes include accuracy, update rate, range, resolution, validity, etc. as specified in the relevant international standards.

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402 *Latency of data*

Data latency shall be consistent with the data requirements of the individual parts and their relevant international standards.

Guidance note:

The latency should be less than 1.0 second for information to be displayed only while it should be less than 0.1 seconds for information being critical for the performance of an automatic control system, e.g. heading in HCS.

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403 *Consistent common reference system*

The ICS shall ensure that essential sensor information is distributed to the relevant parts of the system, applying a consistent common reference system. The ICS shall ensure that:

- all parts and displays are provided with the same type of data from the same source at any time,
- data are referenced to the same position and time and
- data is compensated for latency when necessary.

Guidance note:

Essential sensor information comprise at least time, position, speed, heading and depth. One of the parts (stations) should be assigned the command for processing and distributing essential information to all parts of the ICS. Upon failure of the part in command another part should automatically take over the responsibility for processing and distributing information to the remaining parts of the ICS. At least three (3) of processing units comprising parts of the ICS shall be capable of automatic take-over of the processing and distribution responsibility.

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404 *Consistent common reference point*

For consistency between observed and measured ranges and bearings, the reference location for such measurements shall be the conning position.

Guidance note:

Alternative reference locations may be used where clearly indicated or distinctively obvious.

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C 500 Integrity monitoring

501 The ICS shall support mode awareness by providing:

- validation of essential navigation data of all connected navigation sensors

— presenting clear indications of sensor status and modes of operation.

502 The integrity of essential information shall be monitored and verified automatically before such information is used or displayed by any parts of the ICS.

503 The integrity of data from different sensors shall be evaluated prior to distribution to other parts of the ICS and/or to external devices.

504 The ICS shall automatically select the most accurate method of integrity monitoring from the available sensors.

505 The ICS shall additionally allow for the user to manually select the sources for integrity monitoring among the available sensors and parts.

506 A clear indication of the sources of data selected for integrity monitoring shall be available.

507 *Plausibility checks*

Received or derived data that is used or distributed by the ICS shall be checked for plausible magnitudes of values.

Guidance note:

E.g. a heading of 361° is not plausible. Data which fail the plausibility check shall not be used by the ICS. If originating from manual input a re-entry is to be called for.

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508 *Verification of data integrity*

The integrity of information selected for use by the ICS shall automatically be verified by comparison of the data derived independently from two or more sources whenever available.

Guidance note:

E.g. the integrity of time may take on GNSS time data and the ICS internal clock data, depth may be compared with ENC depth soundings, etc. The ICS may additionally provide for manual setting of the monitoring thresholds.

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509 *Integrity monitoring thresholds*

The monitoring thresholds shall taking into account inherent differences in availability, accuracy and response times and the dynamics of ship manoeuvring when applicable.

Guidance note:

The threshold for integrity calculations should be based on the applicable specifications of the sensor accuracy (95% probability) in combination with a plausible time out period. The threshold may be determined by the geometric addition of the accuracy values of the data being used for integrity monitoring. E.g. the difference threshold for two GPS may be set to 50 m with a time-out period of 5 seconds or alternatively to 30 m with a time-out period of 10 seconds. For two DGPS such thresholds may be reduced to 10 m and 5 m respectively.

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510 The status of the data shall be marked as “integrity uncertain” when the difference between the sources exceeds the pre-defined thresholds.

511 The integrity monitoring thresholds in use shall be available for display by the user.

C 600 Integrity marking

601 The data transmitted shall enable subsequent ICS functions to check whether the input data complies with their integrity requirements or not. Data with uncertain integrity shall be clearly identified by the ICS protocol.

Guidance note:

Reference is made to IEC61162-1(2007) 7.3.10 for guidance on additions to approved sentences.

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602 Table C1 defines the marking of data that have been checked for validity, plausibility and integrity within the ICS. The specified marking shall be used for applicable information displayed on all parts of the ICS.

Table C1 Marking of data

<i>Validity</i>	<i>Plausibility</i>	<i>Integrity</i>	<i>ICS data marking</i>
Sens1=F Sens2=F	Any	Not possible	Failure
Sens1=V Sens2=F	Sens1=V Sens2=V	Not possible	Uncertain
Sens1=V Sens2=V	Sens1=F Sens2=V	Not possible	Uncertain
Sens1=V Sens2=V	Sens1=F Sens2=F	Not possible	Failure
Sens1=V Sens2=V	Sens1=V Sens2=V	Failed	Uncertain
Sens1=V	Sens1=V	Not possible	Uncertain
Sens1=V Sens2=V	Sens1=V Sens2=V	Passed	No marking
V = Valid F = Fail			

603 If colour coding is to be used; -data which has failed the checks shall be indicated with red, while data with uncertain integrity shall be indicated with yellow. Data which integrity is ensured shall not be marked thus signifying a normal situation.

Guidance note:

The status of the data shall be marked as “uncertain” when the integrity check has not been carried out.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

604 Alarms and warnings

When data being essential for the performance of a control and/or monitoring function is identified with “uncertain integrity”, an alarm shall be given whenever the control and/or monitoring function is engaged.

605 The use of information with uncertain integrity by a control and/or monitoring function, other than for fall-back purposes, shall require acknowledgement by the OOW subsequent to a clear message of possible consequences.

606 When information not being used for control and/or monitoring is deemed invalid, doubtful or unavailable; this shall be indicated by a warning or indication as appropriate.

C 700 ICS Alarm management system

701 The HMI of the alarm management system (AMS) shall be available on all stations within the ICS.

702 ICS alarm windows

The presence of an active alarm, or warning needing acknowledgement, shall be continuously displayed on both the monitoring and navigating & manoeuvring workstations irrespective of the actual function presently being activated on the MFDs.

Guidance note:

The minimum functions available for display on the MFDs are ECDIS, ARPA, CID and AMS. A consistent “alarm window” is to be present on all functions supported by the MFDs.

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703 In as much as the regular alarm window may have limited space; when several alarms and/or warnings are active simultaneously these alarms and warnings shall be organized sequentially and the alarm window shall display the “oldest” active (unacknowledged) alarm or warning message according to the priority of Table C2.

Guidance note:

Table C2 Alarm and warning priority		
<i>Priority</i>	<i>Status</i>	<i>Data marking</i>
1	Alarm - not acknowledged (active)	Red - flashing
2	Warning - not acknowledged (active)	Yellow - flashing
3	Alarm - acknowledged	Red - steady
4	Warning - acknowledged	Yellow - steady

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704 The alarm text shall use plain language being easily understood by an OOW unfamiliar with the equipment.

705 *Alarm record*

The AMS shall maintain a sequential record of all alarms and warnings that have occurred from present and at least the preceding 24 hours. Additionally the record shall include all alarms and warnings which conditions are not rectified irrespective of time of event.

706 The AMS-record shall display all unacknowledged alarms and warnings on top of the list and mark alarms and warnings in accordance with Table C2.

707 The AMS-record shall be available to the OOW on a separate window following no more than two operator actions starting from any of the MFD functions.

708 *Acknowledgement*

Acknowledgement of alarms and warnings shall be possible on any HMI supporting the cause of the announcement and where related information for situation awareness and decision support is available.

709 When acknowledgement is carried out on the equipment which is directly assigned to the function generating the announcement this shall automatically cancel the announcement on all HMIs.

710 The acknowledgement of the announcement shall occur automatically after the function generating the announcement is switched off (e.g. when an automatic control mode is switched to manual mode)

711 *Alarm limit consistency*

The ICS shall automatically ensure that consistent alarm and warning thresholds are used by different parts of the ICS. Where thresholds are entered by the OOW in one part of the ICS the other parts shall automatically adapt the same limits.

712 *Alarm suppression*

If manual suppression of separate alarms is an available option the AMS shall clearly indicate when such suppression is employed and identify the alarms and warnings being suppressed.

C 800 Data output from ICS

801 Where data output interfaces with IEC 61162-1 sentences are used, system data and other data checked for integrity, modified or generated by the ICS shall be transmitted with the talker identifier "IN"; otherwise the talker identifier of the data source shall be used.

Guidance note:

The "IN" will identify data generated by the ICS as "system data".

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D. ICS Network

D 100 Independency and integrity

101 The network integrating the ICS shall be designed with adequate redundancy and independency.

Guidance note:

In this sub-section the term network means any type of LAN or CAN inter-connecting the equipment for transmission of information. The interface layers should be in accordance with the relevant IEEE 802-standards and/or ISO 11898-standards as applicable.

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102 Cables and network components belonging to redundant networks shall be physically separated; by separate cable routing and installation of network components belonging to the redundant network in separate cabinets, power supply to such units included.

103 Each network shall function independently and it shall be possible to protect each network from unnecessary traffic on the other network.

104 All network components controlling the network traffic and nodes communicating over the network shall be designed with inherent properties to prevent network overload at any time. Neither the nodes nor the network components shall be able to generate excessive network traffic or consume extra resources that may degrade the network performance.

Guidance note:

The nodes and network components shall have properties to monitor its own communication through the network, and to be able to detect, alarm and respond in a predefined manner in case of an excessive traffic event.

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105 The performance of the network shall be continuously monitored, and alarms shall be generated if malfunctions or reduced/degraded capacity occurs.

106 Any powered network component controlling the network traffic shall automatically resume to normal operation upon restoration of power after a power failure.

107 All nodes in the network shall be synchronized to attain a uniform time tagging of alarms (and events) to enable a proper sequential logging.

108 The network shall be designed to withstand exposure to electromagnetic interference.

Guidance note:

The wheelhouse is exposed to high voltage equipment and RF transmitters. Reference is made to Classification Note No.45.1 for guidance on EMC measures.

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109 Any CCTV system (Closed Circuit Television) shall not be part of the ICS network.

E. Malfunctions and restoration

E 100 Failure effects

101 A failure of one part shall not affect the functionality of other parts except for those processes and functions directly dependent upon the information from the defective part.

Guidance note:

One “part” in the system shall be understood as equipment, network, switch/router etc.

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102 The ICS response to malfunctions shall result in the safest of any other configuration or mode of operation.

103 Fall-back arrangements

One of the servers including at least one MFD shall continue to be available as a stand-alone ARPA following failure of both networks.

One of the servers including at least one MFD shall continue to be available as a stand-alone ECDIS following failure of both networks.

Guidance note:

An exception from this general principle may only be approved for completely independent networks based on documented design features and analysis that is verifying that any logical failure, including uncontrolled broadcast of data packets (network storm), of any computer connected to the networks cannot cause loss of/failure of more than one of the networks.

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E 200 Orderly shut down

201 If subjected to an orderly shutdown, the ICS shall, upon power on come to an initial default state ready for operation. The orderly shut down procedure, turn on procedure and the initial default state shall be declared by the operating manual.

E 300 Power interruption

301 After a power interruption full functionality of the ICS shall be available after recovery of all subsystems. The ICS shall not increase the recovery time beyond that specified in the standards of the individual subsystem or its functions after power restoration.

302 If subjected to a power interruption the ICS shall, upon restoration of power maintain the configuration and mode previously in use and continue operation as specified in the individual equipment standard.

F. Testing

F 100 Network test and verification

101 The network functionality shall be verified in a test where at least the following items shall be verified:

- 1) The main observations from the FMEA
- 2) Self diagnostics
- 3) Worst-case scenarios – network storm
- 4) Network segregation – autonomous operation of network
- 5) Individual controller node integrity – workstations working without network communication.

G. Documentation

G 100 Network documentation requirements

101 For additional documentation required for the **NAUT-OC/AW (ICS)** class notation see Sec.1 Table C2):

H. Quality System

H 100 Quality assurance

101 The integrator of the ICS and the manufacturers of the navigational aids being parts of the ICS shall have a production Quality Control System being audited by a competent authority.

SECTION 8 SHIP MANOEUVRING CHARACTERISTICS

A. General

A 100 Scope

101 This section gives requirements for the provision of documentation establishing the manoeuvring characteristics of the ship.

102 **Additionally**, minimum requirements relating to the ship's course keeping performance is specified in sub-section C.

A 200 Application

201 Ships requesting class notation NAUT-AW shall comply with the requirements of this section.

A 300 Standards

301 The methods of tests and trials employed to determine the ships manoeuvring performance shall be in accordance with recognized international standards.

Guidance note:

The conduct of trials and use of mathematical models providing manoeuvring information shall not be inferior to the principles of MSC/Circ.1053 "Explanatory notes to the standards for ship manoeuvrability".

Note: In this section the term trial should read any of the methods stated in B101 unless the requirement specifically identifies only one of the methods as being applicable.

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B. Trials and Predictions

B 100 General

101 The ships manoeuvring characteristics shall be demonstrated based on the results of full-scale trials or calculations by means of scale model tests and/or computer predictions using mathematical models.

102 Validation of scale model tests and/or computer predictions shall be done by performing full scale trials and comparing the results of these trials with the results of model tests and/or computer predictions performed for the equivalent "trial loading condition".

Guidance note:

The characteristic parameters should be within 15% of the parameters obtained from the full-scale trials. If deviation exceeds this figure, the whole full-scale trial program should be completed.

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103 The ship shall as a minimum complete the following full scale trials for at least one loading condition to demonstrate that its manoeuvring performance is in accordance with the requirements of this section:

- 10°/10° and 20°/20° zig-zag trials at full speed ahead
- full astern stopping trial from full speed ahead
- turning circle trials at full speed ahead to both port and starboard and completed by a pull out trial.

Guidance note:

At least one turning circle trial shall complete a full 720° course change to ascertain the prevailing current vector. Reference is made to MSC/Circ.1053 for details.

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104 The full-scale manoeuvring trials shall be conducted in deep water and during calm weather conditions.

Guidance note:

Trials should be conducted in conditions within the following limits:

- 1) Depth: more than 4 times the mean draught.
- 2) Wind: not to exceed Beaufort 5.
- 3) Waves: not to exceed sea state 4.

- 4) Current: uniform distribution only.

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B 200 Sister ships

201 For ships built in series according to identical drawings and parameters, only one ship of the series shall have to undertake a complete trial program according to this section. The “sister ships” of the series can adopt the information from these trials provided a full-scale 10°/10° zig-zag trial at full speed ahead is satisfactory completed by all the ships of the series.

Guidance note:

The characteristic parameters should be within 10% of the parameters obtained from the original vessel. If deviation exceeds this figure; completion of the whole full-scale trial program may be required.

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C. Course-keeping ability

C 100 General

101 The ship design shall take in course keeping and yaw checking abilities aiming to reduce the average use of rudder during normal operation.

Guidance note:

The ship should comply with the following yaw-checking and course-keeping abilities;

- 1) The value of the first overshoot angle of the 10°/10° zigzag test should not exceed:
 - 10° if L/V is less than 10 seconds;
 - 20° if L/V is 30 seconds or more; and
 - $(5 + 1/2(L/V))^{\circ}$ if L/V is 10 s or more, but less than 30 s, where L and V are expressed in m and m/s, respectively.
- 2) The value of the second overshoot angle of the 10°/10° zigzag test should not exceed:
 - 25° if L/V is less than 10 s;
 - 40°, if L/V is 30 s or more; and
 - $(17.5 + 0.75(L/V))^{\circ}$ if L/V is 10 s or more, but less than 30 s.
- 3) The value of the first overshoot angle of the 20°/20° zigzag test should not exceed 25°.
 $L = L_{pp}$, $V =$ ships speed
For ships with non-conventional steering and propulsion systems, the society may permit the use of comparative steering angles to the rudder angles specified above.
The vessel is deemed to comply with this requirement if the documentation of D500 is found to be satisfactory.

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D. Provision of Manoeuvring Information

D 100 General

101 Information about the ship's manoeuvring characteristics shall be provided giving the navigator the best decision support available when deciding on speed and rudder angle needed to execute a manoeuvre under prevailing conditions.

102 The manoeuvring documentation shall include information about the speed ability, stopping ability, turning ability, course change ability, low steering ability, course stability, the effectiveness of auxiliary manoeuvring devices and a rational man-overboard rescue manoeuvre.

D 200 Speed ability

201 Information about speed ability in terms of the actual speed potential of the ship at various engine settings shall be provided for fully loaded and ballast conditions. Information shall be provided for at least three engine settings identifying the percentage used related to the maximum continuous power rating, (MCR):

- at full speed ahead (>90%)
- at half speed ahead (60%)
- at slow speed ahead.(40%).

D 300 Stopping ability

301 Information about the ship's stopping abilities shall be provided for fully loaded and ballast conditions. Information shall at least comprise stopping from an initial full speed ahead and with application of the following astern powers:

- constant full astern power
- with propulsion and engine stopped.

D 400 Turning ability

401 Information about the ship's turning ability to port and to starboard shall be determined for fully loaded and ballast conditions applying full speed ahead and using maximum rudder angle available at this speed.

402 Information about the ship's turning ability to port and starboard following an engine shut down shall be provided; -from initial full speed ahead and stopping the engine at the start of the turn (coasting turn) using maximum rudder angle available.

403 Information about the ship's turning ability when accelerating from a resting position to half speed ahead shall be provided. Turning information shall be made to both port and to starboard; -initial condition is to be standstill with propeller stopped; -then apply half speed ahead using maximum rudder angle available (accelerated turn).

D 500 Yaw checking and course-keeping ability

501 Information about the ship's initial turning ability and course keeping ability shall be provided for fully loaded and ballast conditions. Zigzag trials shall be made for rudder angles/course changes equal to 10°/10° and 20°/20°.

D 600 Low speed steering abilities

601 Information about the lowest constant engine revolutions or lowest pitch control setting at which the ship can safely be steered in ballast and loaded conditions shall be provided.

D 700 Heading stability

701 Information about the heading stability (*directional stability*) of the ship shall be provided. A pullout trial shall be made to port and starboard. A spiral trial shall be made if the pullout trial indicates that the ship is unstable.

D 800 Auxiliary manoeuvring device trial

801 Information about the performance and effect of auxiliary devices installed to improve the manoeuvring abilities of the ship shall be provided. The performance and limitations of such manoeuvring devices shall be determined for the following conditions:

- the time required to turn the ship 90° to each side at full thrust while the ship is laying dead in the water should be determined
- the forward speed at which the device ceases to be effective should be determined.

D 900 Man-overboard rescue manoeuvre

901 Information about how to perform an effective man-overboard rescue manoeuvre shall be provided. Manoeuvring trials to establish the most effective manoeuvre procedure in case of man over board shall be carried out.

Guidance note:

For large ships with conventional rudder systems, the characteristics of a “Williamson turn” are recommended to be confirmed:

The initial trial should apply full rudder until a course deviation of 60° has been achieved and then apply full rudder to the opposite side to complete a 180° turn and steadying on the opposite course (*heading down its own wake*). The trial should be repeated as needed with different course deviation angles until the vessel's opposite track is within 50 meters of the original wake.

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D 1000 Corrections

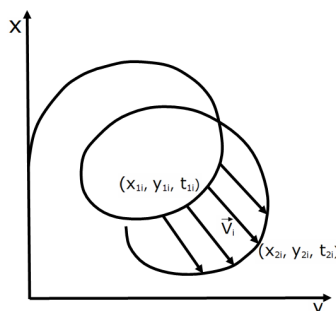
1001 The documentation of ship manoeuvring characteristics and trajectories when obtained from full-scale trials shall be corrected for any current vector being present during such trials.

Guidance note:

Position (x_{1j}, y_{1j}, t_{1j}) and (x_{2j}, y_{2j}, t_{2j}) in the figure below are the positions of the ship measured after a heading rotation of 360° with a steady ROT. By defining the local current velocity V_i as the difference between any two corresponding

positions the estimated current velocity can be obtained from the following equation:

$$\vec{v}_c = \frac{1}{n} \sum_{i=1}^n \vec{v}_i = \frac{1}{n} \sum_{i=1}^n \frac{(x_{2i} - x_{1i}, y_{2i} - y_{1i})}{(t_{2i} - t_{1i})}$$



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D 1100 Information from sister ships

1101 All information, which is merely duplicated from a sister ship shall be marked with a statement to this effect together with the identification of the sister ship (hull no.).

E. Presentation of Manoeuvring Information

E 100 Wheelhouse poster

101 A summary of manoeuvring information shall be presented in the format of a wheelhouse poster containing general ship particulars and data describing the key manoeuvring characteristics of the ship, both graphical and numerical, to support ease of use. The poster shall be of sufficient size to be easily readable.

Guidance note:

The wheelhouse poster should not be less than A3 format. As regards information content and layout reference is made to IMO Resolution A.601(15), Appendix 2 for details.

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102 The wheelhouse poster shall be permanently posted in the wheelhouse.

103 The wheelhouse poster shall include a warning that the manoeuvring performance of the ship may differ from that shown on the poster due to environmental, hull and loading conditions.

E 200 Manoeuvring booklet

201 The ship shall be provided with a manoeuvring booklet. The booklet shall contain all the details of the ship's manoeuvring characteristics together with all relevant data from trials and scale model tests and/or computer predictions.

202 Trajectories shall be shown graphically together with a scale sample of the ship. The trial trajectories shall always be corrected for current but also for influence of wind and waves if the conditions of B104 are exceeded.

203 The booklet shall contain note fields (space) enabling the information of the booklet to be supplemented in the course of the ship's life.

Guidance note:

The information recommended to be included in the manoeuvring booklet is specified in IMO Resolution A.601(15), Appendix 3.

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204 A diagram showing the double turn circle of 720° and supplementary data demonstrating the effect of current setting and wind drift registered during the performance of the manoeuvring trials shall be included.

E 300 Pilot card

301 The ship shall be provided with appropriate pilot card(s). The pilot card(s) shall be suitable for conveying information to the pilot about the current condition of the ship with regard to its loading condition, availability of propulsion and manoeuvring equipment as well as other relevant equipment.

Guidance note:

The pilot card should either be made of a material suitable for both writing and re-use. A card made of plastic material, or an adequate amount of paper copies supporting a year in operation or an electronic version in a printable format (e.g. PDF-file) should be readably available on board. An example of information content and layout of a pilot card is given in IMO Resolution A.601(15), Appendix 1.

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SECTION 9

QUALIFICATIONS AND OPERATIONAL PROCEDURES

A. General

A 100 Introduction

101 Modern technology has the potential to improve the situational awareness of the officer in charge of the navigational watch, hereafter called OOW. But this potential can only be realised if the OOW has gained the knowledge and skills necessary for using the technology safely and efficiently.

A 200 Scope

201 This section specifies requirements for competence and navigational procedures related to equipment and systems required by this chapter.

A 300 Application

301 Although the requirements of this section are merely informative the society encourages the ship operator to ensure that the navigation officers on board their ships is provided with adequate training and tools attending to the principles outlined below.

B. Watch keeping arrangement

B 100 Operational assumptions

101 The following assumptions are made:

- the master ensures that the manning of the bridge watch is in accordance with national regulations in the country of registration and for the waters the ship is navigating
- the master ensures that pre-planning and watch-keeping arrangements are adequate for maintaining a safe navigational watch in accordance with STCW
- the master ensures that the OOW has received the required training prior to being assigned the navigational watch
- the master designates individuals who are to provide assistance when needed by the OOW
- the OOW maintain a navigational watch in compliance with STCW
- the OOW carefully assesses that the workload is well within his capacity to maintain full control of the operational situation while carrying out all the tasks assigned to the bridge watch
- the OOW immediately summons assistance to the bridge in case of irregular operational conditions including situations causing excessive workloads.

102 It is assumed that the ship operator and ship master ensures that all the requirements of this section are complied with.

C. Qualifications

C 100 General

101 All officers being assigned the responsibility of the navigational watch should be fully qualified to operate the navigational equipment and systems installed on the particular ship. The master and all OOW should hold a certificate of competence documenting completion of TCS training.

102 The OOW should have attained the required competence prior to be assigned a single-man watch.

103 It is the responsibility of the ship operator to make certain that the master and the navigation officers have completed the necessary training and courses prior to their full assignment.

104 The master, holding a certificate of competence issued by the manufacturer of the TCS and having sufficient practical experience, may train and certify navigators through a systematic on board training program prior to their full assignment. The on board training should cover all parts of the manufacturer based training course, and include a statement of competence upon completion of the training.

Guidance note:

The course should at least comprise the following:

- system design
- operational modes

- training in daily operation of the system
- the capabilities and limitations of TCS as well as the individual instruments
- effect of failure in any of the bridge equipment and sensors constituting the grounding avoidance system and the resulting fall-back or fail-to-safety mode of operation.

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D. Bridge Watch Procedures

D 100 Procedures for safe watch-keeping

101 Procedures for bridge team management and safe watch-keeping should be established and be easily available on the bridge.

102 Procedures and instructions for irregular and abnormal operating conditions should be established based on the failure modes and effect analysis for the grounding avoidance system and heavy workload situations caused by external conditions and combination of external conditions and system failures.

103 The length of dormant intervals of the bridge watch surveillance system should be set with due consideration of the time needed for the back-up officer to get to the bridge (response time), and the external conditions to be experienced, including the time to danger of grounding along the route and traffic density. The parameters for setting the intervals should be known to the watch officer and included in the procedures for safe watch-keeping.

SECTION 10 BRIDGE EQUIPMENT - ON-BOARD TESTS

A. General

A 100 Application

101 Ships requesting class notation **NAUT-OC** or **NAUT-AW** shall comply with the rules in this section.

B. On board Testing of Bridge Equipment

B 100 General

101 On-board testing of the bridge equipment shall be performed in order to ascertain that the equipment installed operates satisfactorily.

B 200 Test preparations

201 To facilitate a successful sea trial the performance and accuracy of bridge equipment must be verified while the ship is moored. Prior to the sea trial commence a survey confirming the accurate calibration of at least the following equipment shall be done:

- Gyro compass and repeaters
- Radars
- Echo sounder
- EPFS
- ECDIS
- Rudder angle indicators.

202 Prior to testing, all equipment shall have completed the commissioning and be calibrated in accordance with manufacturer's specification.

203 Prior to a survey; all instruments and tools necessary for inspection and measurements shall be available.

Guidance note:

The shipyard should prepare for the following:

- At least 8 hours of uninterrupted power supply should be provided to the gyro compass prior to inspection and maintained during the whole survey.
- ENC's covering the area where the ship is moored must be available. If ENC's are unavailable then a large scale (>1:10000) raster chart or another digital chart may be acceptable upon surveyor's satisfaction
- A bearing dioptré (azimuth device) must be available.
- The true bearing of the quay (with an accuracy of 0.2°) where the ship is moored.
- Additional tools that are needed may be audio-metre/signal generator, lux-metre as applicable.

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B 300 General requirements for the testing of bridge equipment

301 Failure conditions shall be simulated on all applicable equipment and systems.

Guidance note:

These tests should verify the results of previous failure modes and effect analysis.

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302 A demonstration of start-up of the individual systems shall be carried out.

303 The bridge equipment shall be subject to a complete power failure (both main and emergency PS) causing a blackout period enduring not less than 60 seconds.

304 The testing shall be to the surveyor's satisfaction and tests in addition to the approved test program may be requested.

305 If the ship is not assigned the additional class notation **E0**, tests of the remote control system for propulsion machinery as well as blackout tests, shall be carried out as required in Ch.3 Sec.5 B and Ch.3 Sec.5 A400.

B 400 Gyro compass

401 The settle point error of the master compass(es) and the alignment with the ship's centre line shall be determined.

- 402 The bearing repeaters' alignment with the ship's centre line shall be checked.
- 403 The monitoring functions of the compass system shall be tested.
- 404 The means for correcting errors caused by speed and latitude shall be tested.

B 500 Heading control system

- 501 The course-keeping performance of the autopilot shall be tested at full sea speed. Adaptive autopilots shall also be tested at reduced speed. The use of the rudder shall be observed.
- 502 The performance of the autopilot shall be checked for course changes of 10° and not less than 60° to both sides. The overshoot angle shall be observed.

Guidance note:

The overshoot angle should in these cases be less than 2° and 5° respectively

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- 503 The off-heading and heading difference alarms shall be tested.
- 504 The performance of the autopilot in turn radius mode shall be tested.

Guidance note:

For the segment of the turn where a steady ROT is possible the actual ROT should be within 10% of the ROT calculated from the real speed/set radius?

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- 505 Change of operational steering mode shall be tested.
- 506 The take-over of steering control function at the navigating & manoeuvring workstation shall be tested in all steering modes. It shall be verified that all steering modes and steering positions can be overridden from this workstation

B 600 Rudder indicator(s)

- 601 The rudder indicators on the bridge shall be checked against the indicator on the rudderstock.

B 700 Rate-of-turn indicator

- 701 The rate-of-turn indicator shall be checked during a turn with fixed ROT.

B 800 Speed log

- 801 The speed log accuracy shall be checked during double run speed trials.

B 900 Echo sounder

- 901 Function testing of the echo sounder shall be carried out. Depth shall be measured at a fixed position in shallow waters for exact comparison of accuracy and additionally at full speed ahead on all range scales available.

B 1000 Radar system

- 1001 Function testing of the radar shall be carried out. The various ranges, presentation modes and the basic radar functions shall be tested.
- 1002 The accuracy of relative and true radar bearings shall be verified while the ship is moored.
- 1003 The accuracy of distance measurement at short range shall be verified as being within ± 30 m against a target located at a known distance. To be checked while the ship is moored.
- 1004 The heading marker shall be checked against a visible target dead ahead and be within 0.5° of the observed direction.
- 1005 Inter-switching facilities, including bypass function, if relevant, shall be tested.
- 1006 Performance monitors shall be checked against the instructions in the operating manual.
- 1007 Self-check programs shall be run.
- 1008 The configuration of sensors shall be checked. The data for alignment with common reference system shall be verified.
- 1009 The alignment of the electronic chart overlay shall be checked.
- 1010 The interface and data transfer to the ECDIS shall be tested.
- 1011 The AIS HMI shall be checked.

B 1100 ARPA system

1101 The equipment shall be function-tested whilst the ship keeps a steady course and speed as well as during course changes.

1102 The acquisition and tracking functions shall be tested during manoeuvring of the ship. At least a rapid course change of 60° shall be executed.

1103 Indication on the display of the bearing and distance to the object, as well as the heading of own ship, shall be checked.

1104 The trial manoeuvre function of the ARPA shall be tested.

1105 Tests shall be carried out to verify that the system gives warning when the limits of CPA and TCPA are exceeded and that a warning is given when the object enters the automatic acquisition zone.

1106 Identification of input from speed sensors shall be checked.

B 1200 Electronic position-fixing systems

1201 All electronic position-fixing systems shall be function-tested.

1202 The accuracy of the electronic position-fixing systems shall be verified while the ship is moored. The S/N ratio shall be checked

1203 The configuration of the transmission protocol (interface) should be checked.

B 1300 Bridge watch surveillance system

1301 The functionality and time settings of the surveillance system shall be tested.

B 1400 Alarm management system

1401 The interconnections to alarm management system shall be tested. HMI shall be checked.

1402 The alarm transfer system shall be tested.

B 1500 Communication systems

1501 The automatic telephone system and internal communication system between workstations shall be tested.

1502 The priority function for the telephones in the wheelhouse and engine control room over the other extensions shall be tested.

1503 VHF systems shall be tested.

B 1600 Sound reception system

1601 The sound reception system shall be tested. The system shall be calibrated so that it is always muted in the absence of other ship's whistle signals.

Guidance note:

The fundamental frequency of the sound signal used in testing the system should be within the range 70 to 820 Hz.

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B 1700 Electronic chart display and information system (ECDIS)

1701 Function testing of the attributes of the ECDIS shall be carried out.

The following features should be checked:

- The configuration of a common reference system for all sensors
- The data protocol from the GPS including different datum
- Alignment of radar targets and AIS targets (as applicable)
- Sensor monitoring and alarming
- Update and transfer of voyage plan between ECDIS' and radars
- ECDIS system failures to be tested to verify redundancy requirements and the continuing availability of the activated route.

1702 Self-check programs shall be run.

B 1800 Track control System (TCS)

1801 The track control system and additional functions/requirements, including alarm or warning functions, shall be tested along a pre-planned route consisting of different courses.

1802 The route shall consist of both straight legs and course changes as needed to verify the system performance and configuration. The route shall include turns to port and starboard respectively with the maximum course change accepted in route planning mode. The minimum turn radius shall be set for both these turns.

Additionally at least the following tests and checks shall be carried out:

- Turn with maximum radius
- Turn with minimum course change
- Turn where autopilot fails
- Position jump
- Position failure
- Heading failure
- ECDIS failure.

The track keeping performance in a turn during speed reduction shall be tested.

The entire route should be run and completed as one continuous test to the surveyor's satisfaction.

B 1900 Conning display

1901 The performance of the conning display following ECDIS failure shall be verified as well as the accuracy and readability of the data displayed.

B 2000 Weather information system

2001 The weather information system is to be subject to a simple function check of software and pertinent subscription of the applicable services.