INTERNATIONAL STANDARD

ISO 8468

First edition
1987-06-01

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION
МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Ship's bridge layout and associated equipment — Requirements and guidelines

Aménagement de la passerelle d'un navire et disposition de ses équipements annexes — Exigences et directives

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Reference number
ISO 8468 : 1987 (E)

Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8468 was prepared by Technical Committee ISO/TC 8, *Shipbuilding and marine structures.*

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Ship's bridge layout and associated equipment — Requirements and guidelines

0 Introduction

This International Standard has been developed to ensure that designs of ships' bridges provide adequately for the requirements for safe navigation to prevent confusion arising from bridge arrangements which are unusual.

Where there are physical limitations in applying this International Standard to small ships or to ships of unusual design, the general principles should still apply.

1 Scope and field of application

This International Standard specifies basic functional requirements for bridge configuration, bridge arrangement, bridge equipment and bridge environment.

Wherever applicable, guidelines have been drawn up for the methods and solutions to meet the functional requirements.

This International Standard applies to seagoing ships where bridge duty is regularly maintained.

NOTE — Users of this International Standard should note that while attempting to observe its requirements they should, at the same time, ensure compliance with such statutory requirements, rules and regulations as may be applicable to the individual ship concerned.

2 References

ISO 2412, *Shipbuilding — Colours of indicator lights.*

ISO 2631, *Evaluation of human exposure to whole-body vibration —*

Part 1 : General requirements.

Part 4 : Evaluation of crew exposure to vibration on board seagoing ships (1 to 80 Hz). [1)]

ISO 3434, *Shipbuilding — Heated glass panes for ships' windows.*

ISO 3904, *Shipbuilding — Clear view screens.*

ISO 4867, *Code for the measurement and reporting of shipboard vibration data.*

ISO 4868, *Code for the measurement and reporting of local vibration data of ship structures and equipment.*

ISO 6954, *Mechanical vibration and shock — Guidelines for the overall evaluation of vibration in merchant ships.*

IEC Publication 447, *Standard directions of movement for actuators which control the operation of electrical apparatus.*

IMO Resolution A.343(IX), *Recommendation on Methods of Measuring Noise Levels at Listening Posts.*

IMO Resolution A.468(XII), *Code on Noise Levels on Board Ships.*

IMO Resolution A.574(XIV), *Recommendation on General Requirements for Electronic Navigational Aids.*

International Regulations for Preventing Collisions at Sea, Annex III (as amended).

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 bridge : That area from which the navigation and control of the ship is exercised, including the wheelhouse and bridge wings.

3.2 bridge wings : Those parts of the bridge on both sides of the ship's wheelhouse which extend to the ship's side.

3.3 catwalk : Extension to a deck that is wide enough to allow the passage of a man.

3.4 chartroom area : Part of the wheelhouse situated and equipped for adequate performance of voyage planning/plotting activities.

1) At present at the stage of draft.

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3.5 commanding view : View without obstructions which would interfere with the navigator's ability to perform his immediate task.

3.6 conning position : Place on the bridge with a commanding view and which is used by navigators when commanding, manoeuvring and controlling a ship.

3.7 display : Means by which a device presents visual information to the navigator, including conventional instrumentation.

3.8 ergonomics : Application of the human factor in the analysis and design of equipment, work and working environment.

3.9 field of vision : Angular size of a scene that can be observed from a position on the ship's bridge.

3.10 helmsman : Person who steers a ship underway.

3.11 monitoring : Act of constantly checking equipment and environment in order to detect any changes.

3.12 navigating and manoeuvring workstation : Workstation where ship's speed and course are considered and controlled.

3.13 navigator : Person navigating, operating bridge equipment and manoeuvring the ship.

3.14 percentile : Percentage of population.

3.15 seagoing ship : Ship navigating on the high seas, i.e. areas along coasts and from coast to coast.

3.16 superstructure : Decked structure, not including funnels, which is on or above the freeboard deck.

3.17 wheelhouse : Enclosed area of the bridge.

3.18 workstation : Position at which one, or several tasks constituting a particular activity are carried out.

4 Bridge configuration

4.1 Field of vision

4.1.1 Every effort shall be made to place the bridge above all other superstructures.

4.1.2 The view of the sea surface from the conning position 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 irrespective of the ship's draught, trim and deck cargo (e.g. containers). (See figure 1.)

4.1.3 The height of the lower edge of the front windows shall allow a forward view over the bow for a person in a sitting position at the workstation.

Guidelines :

The height of the lower edge of front windows above the deck should be kept as low as possible, and should not, as far as practicable, be more than 1 000 mm.

4.1.4 The upper edge of the front windows shall allow a forward view of the horizon for a person in a standing position with an eye height of 1 800 mm at the navigating and manoeuvring workstation when the ship is pitching in heavy seas.

Guidelines :

The height of the upper edge of front windows above the deck should be as high as practicable and at least allow a forward view of the horizon when the bow is 10° below its position on even keel. The minimum height of the upper edge of front windows above the deck surface should be 2 000 mm. (See figure 2.)

The dimensions in figure 2 are based upon an eye height of 1 800 mm, referring to a person of a height of 1 900 mm, at a distance of 750 mm from the bridge front bulkhead.

For arrangements where the navigator would normally stand further back from the bridge front bulkhead, the same eye height should be used to determine the height of the upper edge of the front windows.

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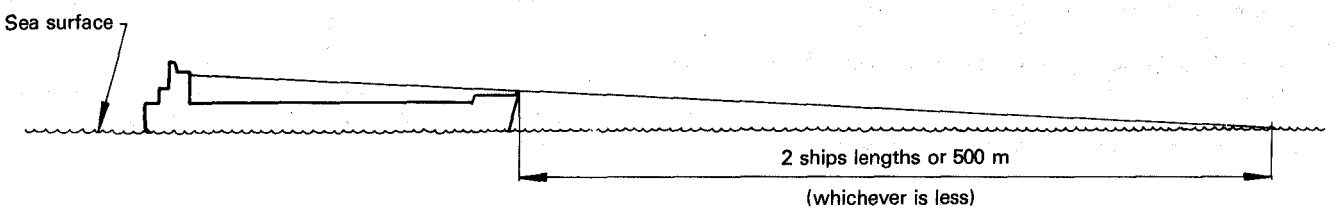

Figure 1 — Forward view

Dimensions in millimetres

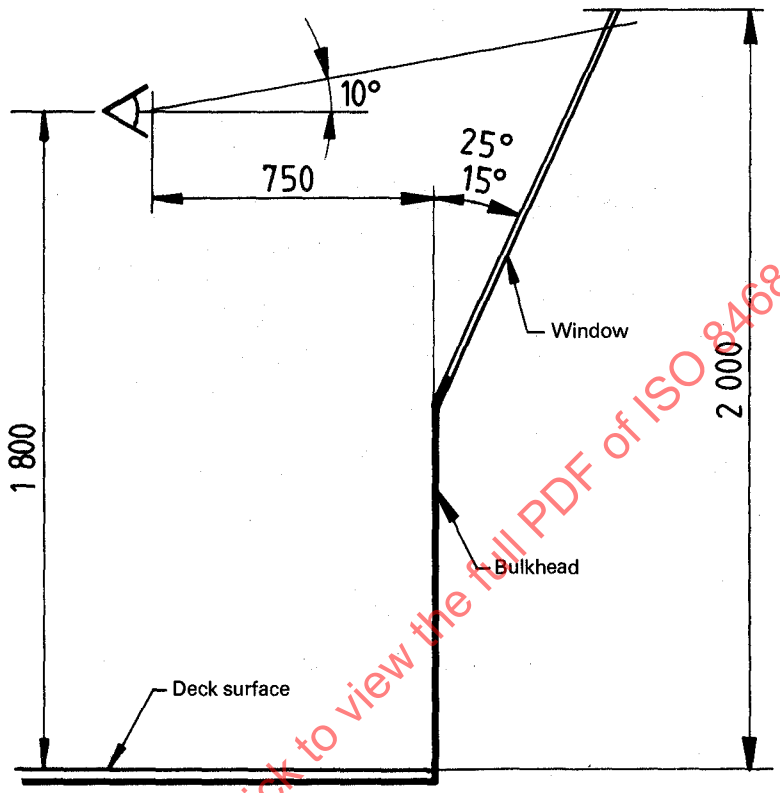

Figure 2 — Example of the height of upper edge of front windows in relation to eye height, distance from front bulkhead, slanting of bulkheads, etc., given a window slant of between 15° and 25°

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4.1.5 It shall be possible to observe all objects necessary for navigation, such as ships and lighthouses, in any direction from inside the wheelhouse.

Guidelines :

There should be a field of view around the vessel of 360° obtained by an observer moving within the confines of the wheelhouse. (See figure 3.)

4.1.6 At the navigating and manoeuvring workstation and at the conning position, the navigator's field of view shall be sufficient to enable him to comply with the International Regulations for Preventing Collisions at Sea.

Guidelines :

a) The horizontal field of view from the navigating and manoeuvring workstation and from the conning position should at least extend over an arc from 22,5° abaft the beam on one side, through forward, to 22,5° abaft the beam on the other side. (See figure 4.)

b) From a monitoring workstation, the field of view should extend at least over an arc from 90° on the port bow, through forward, to 22,5° abaft the beam on starboard. (See figure 5.)

c) The field of vision from a workstation on the bridge wing should extend over an arc from at least 45° on the opposite bow through dead ahead and then aft to 180° from dead ahead. (See figure 6.)

4.1.7 The helmsman's field of vision shall be sufficiently wide to enable him to carry out his functions safely.

Guidelines :

The helmsman's field of vision from the workstation for manual steering should extend over an arc from dead ahead to at least 60° on each side. (See figure 7.)

NOTE — The workstation should not be placed immediately abaft the front windows in order to obtain the required field of vision.

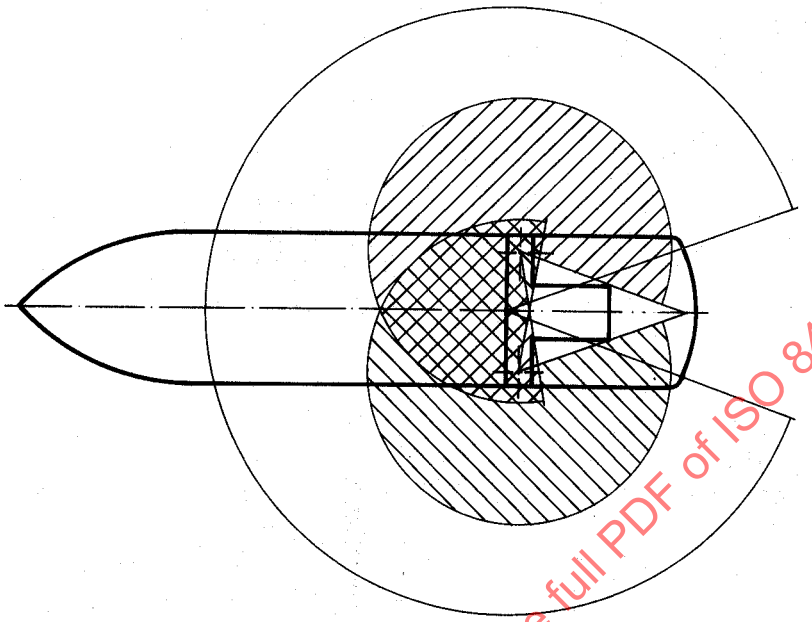

Figure 3 — 360° field of view

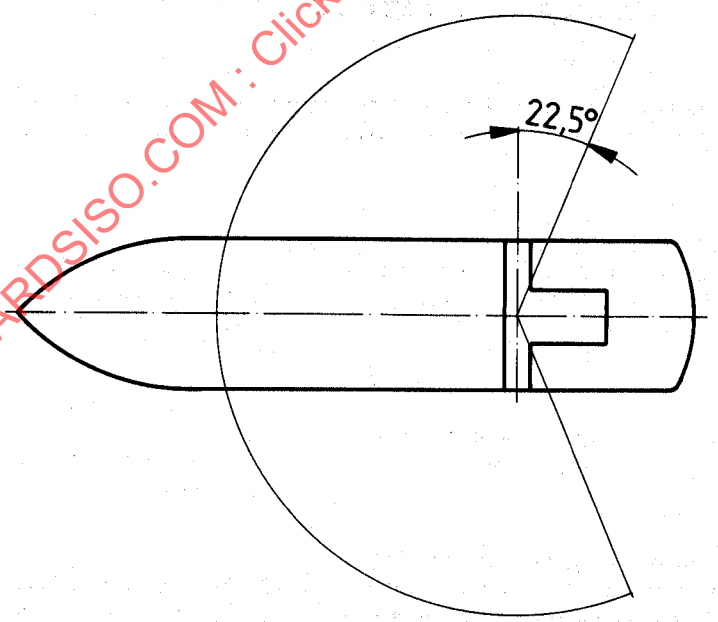

Figure 4 — Navigating and manoeuvring workstation and conning position

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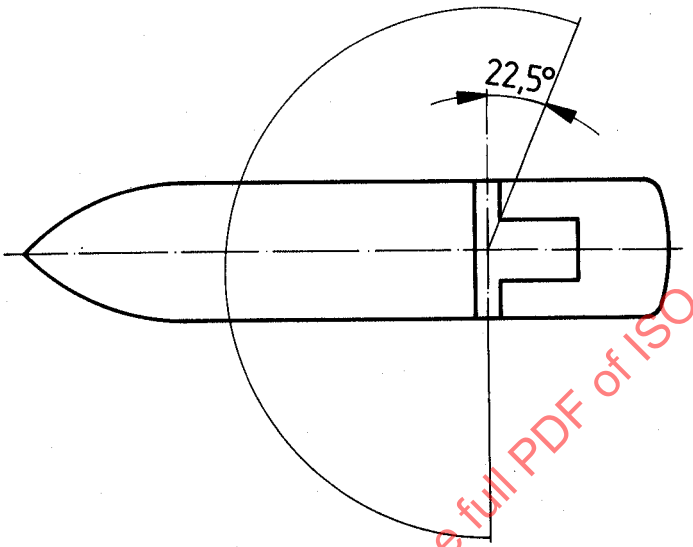

Figure 5 — Monitoring workstation

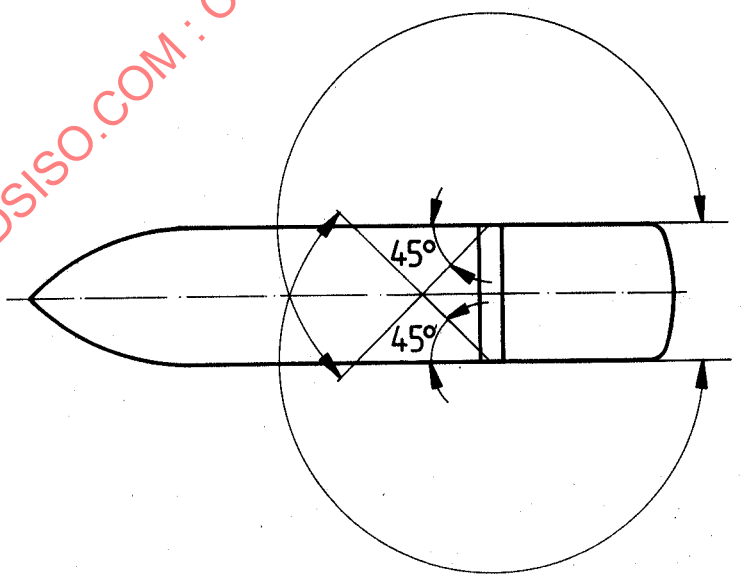

Figure 6 — Bridge wing workstation

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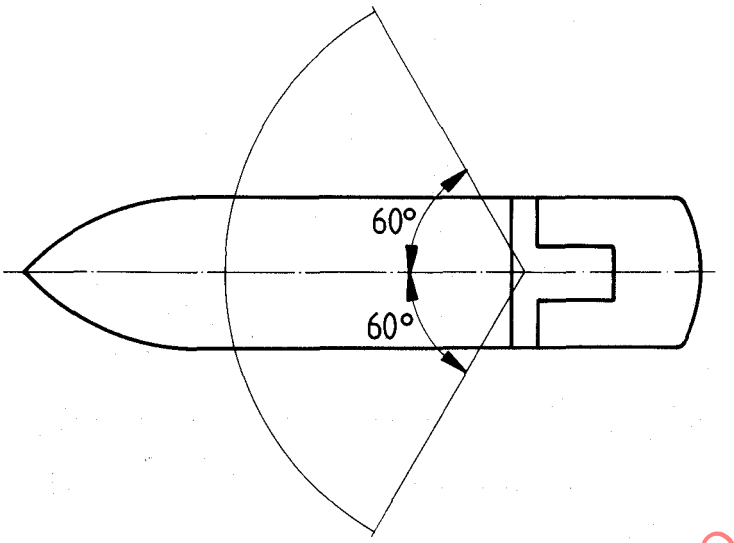

Figure 7 — Helmsman's workstation

4.1.8 Blind sectors caused by cargo, cargo gear and other obstructions shall be as few and as small as possible, and not in any way influence a safe look-out from the navigating and manoeuvring workstation and from the conning position.

Guidelines :

The total arc of blind sectors forward of the beam seen from the navigating and manoeuvring workstation and from the conning position should not exceed 20°. Each individual blind sector should not exceed 10°. Over an arc from dead ahead to at least 10° on each side, each individual blind sector should not exceed 5°. The clear sector between two blind sectors should not be less than 5°.

4.1.9 The ship's side shall always be visible from the bridge wing especially where tugs or pilot boats come alongside and where the ship touches the jetty.

Guidelines :

Bridge wings should be provided out to the maximum beam of the ship. The view over the ship's side should not be obstructed.

4.2 Windows

4.2.1 Divisions between windows shall be kept to a minimum. No division shall be installed immediately forward of any workstation, including the centre-line. If stiffeners between windows are to be covered, this shall not cause further obstructions of the field of view from any position inside the wheelhouse.

Guidelines :

Windows, especially on the centre-line, should be as wide as possible. The divisions between front windows should not exceed 150 mm. If stiffeners are used, divisions should not exceed 100 mm in width and 120 mm in depth.

4.2.2 Bridge front windows shall be inclined from the vertical plane to avoid reflections.

Neither polarized nor tinted glass shall be fitted.

Guidelines :

As far as practical, all bridge windows should be inclined from the vertical plane top out, at an angle of not less than 15° and not more than 25°. Exceptions can be made for windows in bridge wing doors.

4.2.3 A clear view through the windows shall be provided at all times.

Guidelines :

To ensure a clear view in bright sunshine, sunscreens with minimum colour distortion should be provided at all windows in front of workstations. Such screens should be readily removable and not permanently installed.

To ensure a clear view, heavy-duty wipers, preferably provided with an interval function and a fresh water wash, are recommended for the majority of the front windows. If clear view screens are installed, they should be in accordance with ISO 3904.

Such wipers should be capable of operating independently of each other.

Efficient cleaning, de-icing and de-misting systems should be installed to ensure a clear view in all operating conditions. Where heated glass panes are installed, they should be in accordance with ISO 3434. A fixed catwalk with guardrails, fitted under the bridge windows, should be provided to enable cleaning of windows in the event of failure of the systems.

4.2.4 Sound signals shall be audible from the interior of the wheelhouse.

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Guidelines :

It should be possible to open some windows in the wheelhouse in order to hear sound signals.

NOTE — In no case should horizontally sliding windows be used.

5 Bridge arrangement

5.1 Location and interrelation of workstations

5.1.1 The layout of the bridge, including location and layout of the individual workstations, shall ensure the required field of view for each function.

5.1.2 In addition to the individual workstations, an adequate conning position shall be provided close to the forward centre window.

Guidelines :

If the view in the centre-line is obstructed by large masts, cranes, etc., two additional conning positions giving a clear view ahead should be provided, one on the port side and one on the starboard side of the centre-line, no more than 5 m apart.

5.1.3 The control of the ship shall be allocated to a certain area of the bridge where only instruments and controls necessary for navigating and manoeuvring shall be located.

5.1.4 The main workstations for navigating and manoeuvring, and the arrangement of instruments pertinent to these stations, shall be located sufficiently close together to enable a single navigator to cover his operation and to provide him with all necessary information so that he can carry out his functions from one working position but without being restricted to a specific location.

Guidelines :

The main workstations should be planned, designed and placed within an area spacious enough for not less than two operators, but close enough to allow the stations to be operated by one person.

The consoles, including a chart table if provided, should be positioned so that the instruments they contain are mounted in such a manner as to face a person looking forward.

5.1.5 From a monitoring workstation, it shall be possible to see and hear the persons at the navigation, manoeuvring and steering workstations.

Guidelines :

A talkback communication system between wing and wheelhouse should be installed where the distance from the wing extremity to the wheelhouse centre-line is greater than 10 m. Where workstations are widely spread, talkback facilities should be provided so that unhampered communications can be achieved under all operating conditions. It is important that all order/action communication systems be two-way.

5.1.6 The workstation for manual steering shall preferably be located on the ship's centre-line. If the workstation for manual steering is located off the centre-line, special steering references for use by day and night shall be provided, e.g. sighting marks forward.

Guidelines :

If the view ahead is obstructed by large masts, cranes, etc., the steering station should be located a distance to starboard of the centre-line, sufficient to obtain a clear view ahead.

5.1.7 The navigator shall be able to watch the area immediately in front of the bridge superstructure from the wheelhouse.

Guidelines :

There should be a close approach access to at least one front window. If this requirement is met by combining "an adequate conning position" (5.1.2) and the required access specified in this clause, the width of the total access should be sufficient to accommodate two persons.

5.2 Location of instruments and equipment

5.2.1 Each workstation shall be capable of presenting basic information and shall contain the equipment required to enable the navigator to carry out the relevant functions safely.

Ergonomic principles and views of experienced, practising mariners shall be taken into consideration in the design of workstations.

Guidelines :

The basic categories of instrument information and equipment for the functions to be performed are :

a) The navigation functions — Control and displays for navigation, enabling the user to :

— determine and plot the ship's position, course, track and speed,

— alter course,

— effect internal and external communication related to navigation,

— monitor time, course, speed and track, propeller revolutions, pitch indicator and rudder order and angle;

b) Manoeuvring functions — Controls and displays enabling the user to :

— analyse the traffic situation,

— decide on collision avoidance,

— alter course,

— change speed,

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— effect internal and external communication related to manoeuvring,

— operate docking aid systems,

— monitor time, course, speed and track, propeller revolutions, pitch indicator and rudder order and angle.

The information system and control possibilities under a) and b) should be made available to the workstations for navigating and manoeuvring, in such a way that the tasks at each of these stations can be efficiently carried out.

5.2.2 Instruments or displays providing visual information to more than one person on duty shall be located for easy viewing by all users concurrently, or if this is not possible, the instruments or displays shall be duplicated.

NOTE — Certain instruments displaying information to more than one workstation may be located above the front windows if dimensions allow. Such instruments or displays are : ship's heading, wind, water depth, speed, rate of turn, rudder angle, propeller revolutions (r/min), propeller pitch and time.

5.3 Configuration and dimensions of consoles

NOTE — The configuration and dimensions of consoles in this clause exclude radar consoles.

5.3.1 The navigator shall be able to use all instruments and controls necessary for navigating and manoeuvring in any normal working position.

Guidelines :

Based on ergonomic principles, the width of consoles designed for single person operation should not exceed 1 600 mm.

NOTE — Figures 8 and 9 show the configuration and dimensions of consoles to be used by operators in both standing and sitting positions. The console profile meets the anthropometric value of the 97,5 percentile and the 2,5 percentile of operators.

5.3.2 The height of consoles shall not interfere with the requirements in 4.1.3.

Guidelines :

The top of the consoles should not exceed a height of 1 350 mm. (See figures 8 and 9.)

5.3.3 Consoles shall principally be divided into two areas :

a) information/presentation shall be principally located in the vertical part of the console;

b) controls shall be in the horizontal part.

5.3.4 The chart table shall be large enough to accommodate all chart sizes normally used internationally for maritime traffic. It shall have facilities for lighting the chart.

Guidelines :

Chart table dimensions should be :

— width : not less than 1 200 mm;

— depth : not less than 850 mm;

— height : not less than 900 mm and not more than 1 000 mm.

The chart table should have facilities to accommodate charts larger than the table depth, for example a 10 mm slit along front and back edges of the chart table surface.

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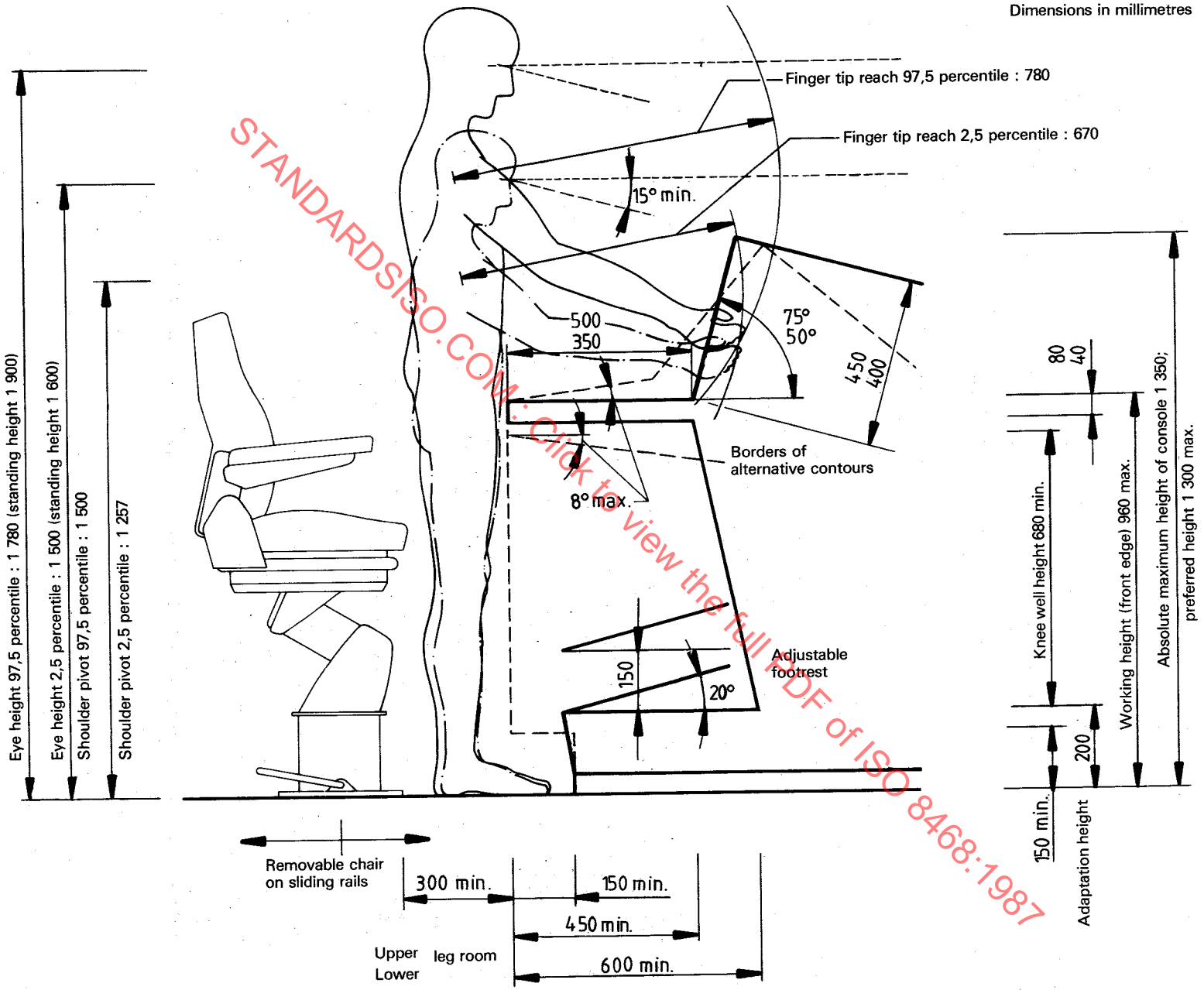

NOTE — The intention of this figure is only to demonstrate solutions based on ergonomic principles.

Figure 8 — Console for combined standing/sitting position (example of standing position)

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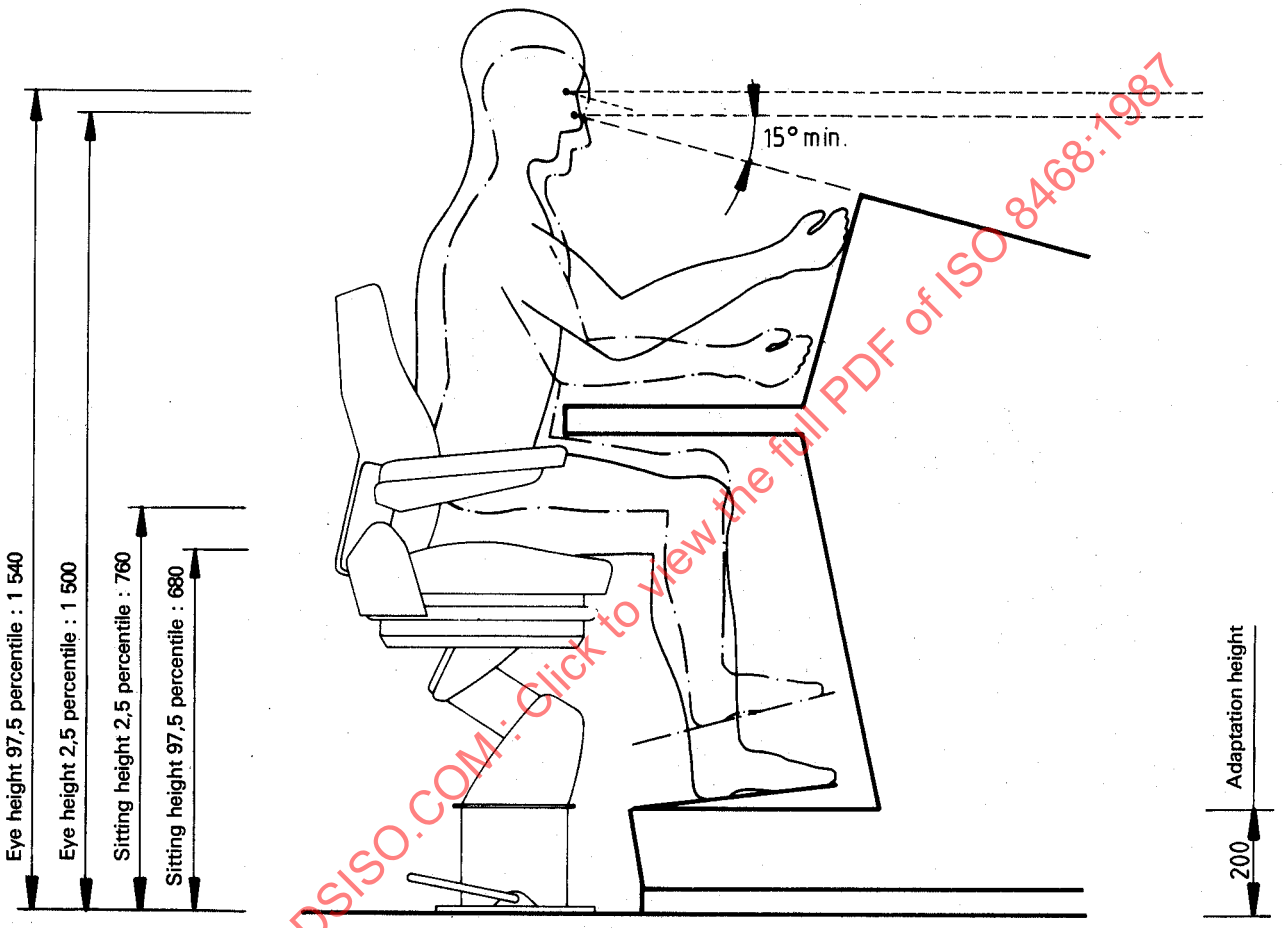
Dimensions in millimetres



NOTES

1 The intention of this figure is only to demonstrate solutions based on ergonomic principles.

2 Preferred knee well width for sitting position is 600 mm, absolute minimum 500 mm.

3 The height measurements of consoles for only a sitting position shall be reduced by the adaptation height of 200 mm.

Figure 9 — Console for combined standing/sitting position (example of sitting position)

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5.4 Miscellaneous

5.4.1 Every effort shall be made to allow a clear route across the wheelhouse from bridge wing to bridge wing.

Guidelines :

The width of the passageway should be at least 1 200 mm.

5.4.2 There shall be no obstructions between the points of entry to the bridge wings and wheelhouse from lower decks and the clear route referred to in 5.4.1.

5.4.3 The distance between adjacent workstations shall be sufficient to allow unobstructed passage to persons not working at the stations.

Guidelines :

The free passage in passageways between different workstation areas should be at least 700 mm.

The workstation operating area shall be part of the workstation and not of the passage way.

5.4.4 The distance from the bridge front bulkhead, or from any consoles and installations placed against the front bulkhead, to any consoles or installations placed away from the bridge front shall be sufficient for two persons to pass each other.

Guidelines :

Where there is a passageway between the front bulkhead and any consoles, its width should preferably be at least 1 000 mm, and not less than 800 mm.

5.4.5 The clear ceiling height in the wheelhouse shall be designed with regard to the installation of overhead panels and instruments.

Guidelines :

The clear height between the bridge deck surface covering and the underside of the deck head beams should be at least 2,25 m. The lower edge of deckhead mounted equipment should be at least 2,10 m above the deck in open areas, passageways and at standing workstations.

5.4.6 Main workstations used for navigating, manoeuvring, manual steering, voyage planning and communication shall not cover a working area with an axis longer than 15 m.

5.4.7 Bridge decks outside, including the wings shall be provided with adequate drainage.

5.4.8 Entrance doors to the wheelhouse shall be easy to operate.

Guidelines :

All wheelhouse doors should be operable with one hand. Bridge wing doors should not be self-closing. Means should be provided to hold bridge wing doors open.

5.4.9 Talkback systems or equivalent communication between the outer end of the bridge wing and the wheelhouse shall be provided, unless equipment for remote manoeuvring is placed on the bridge wings.

6 Bridge equipment

6.1 General

6.1.1 The requirements of this clause are not intended to prevent the use of new control or display techniques, provided the facilities offered are not inferior to those stated.

6.1.2 Instruments, panels and controls shall be permanently mounted in consoles or at other appropriate places taking into account operation, maintenance and environmental conditions.

6.1.3 Other portable items, such as safety equipment, tools, lights, pencils, shall be stored at appropriate places, specially designed wherever necessary.

6.1.4 The various instruments and equipment shall be located so as to meet the navigator's needs at each workstation.

Guidelines :

See 5.2.1 for the basic categories of instruments and equipment for the tasks to be performed at the various workstations. These guidelines lead to the following locations of the main instruments and equipment, where provided.

a) Workstation for navigation :

Navigation radar display
Position fixing systems
Depth indicator
Chart table with instruments

b) Workstation for manoeuvring (collision avoidance/docking) :

Radar display
Automatic radar plotting aid (ARPA)
Engine and thruster controls or telegraphs
Rudder angle indicator
Propeller revolution indicator(s)
Pitch indicator
Speed and distance indicator

c) Instruments and equipment of common interest to workstations for navigating and manoeuvring :

Instruments and equipment of common interest to both the station for navigation and the station for manoeuvring should be located accordingly. Such instruments and equipment, if fitted, include :

Automatic steering device
Steering control
Rudder angle indicator

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Gyro repeater (bearing)
Gyro repeater
Speed and distance indicator
Intercommunication systems
VHF radiotelephone
Emergency stop controls
Alarm reset control
Rate of turn indicator
Whistle control
Searchlight controls
Morse light keys
Magnetic compass display
Window wipe and wash control
Clock

NOTE — Depending on the level of automation, integration of instruments and new methods of display, the workstations for navigation and manoeuvring may be designed as one combined station.

d) Workstation for manual steering :

Manual steering device
Gyro repeater
Rudder angle indicator
Rate of turn indicator
Magnetic compass display
Course indicator
Talkback to bridge wings

e) Workstation on bridgewings :

Engine control
Thruster control
Rudder control
Rudder angle indicator
Gyro repeater
Rate of turn indicator
Sea bottom tracking speed indicator
Communication (external and internal)
Whistle control
Morse light keys

f) Workstation for monitoring :

Radar
VHF radiotelephone
Intercommunication systems
Gyro repeater
Speed and distance indicator
Rudder angle indicator
Propeller revolution indicator(s)
Alarms
Emergency stop controls
Monitoring systems
Rate of turn indicator

6.2 Instruments

6.2.1 Instruments shall be logically grouped according to their functions, such as :

— navigating;

— manoeuvring;

— communication.

6.2.2 Instruments shall be designed to permit easy and correct reading by day and by night. Electronic navigational aids shall meet the requirements of IMO Resolution A.574(XIV).

Guidelines :

A digital readout should not be used where the reading changes rapidly.

For an index moving relative to a circular scale, the index should move clockwise (or the scale move anticlockwise) for increasing readings.

For an index moving relative to a linear scale, the index should be horizontal or vertical and the pointer should move to the right or upwards for increasing readings.

NOTE — There may be special cases where these guidelines do not apply; for example where the reading may be positive or negative, or where depth is indicated.

6.2.3 Each instrument shall be placed with its face normal to the navigator's line of sight, or to the mean value if the navigator's line of sight varies through an angle.

6.2.4 Instruments shall be designed and fitted to minimize glare or reflection or being obscured by strong light.

Guidelines :

All instruments should be placed in position relative to the operator considering the surrounding light sources.

Where a transparent cover is fitted over an instrument or instruments it should be designed to minimize reflections.

6.2.5 The principal manoeuvring instruments shall be readable from the main manoeuvring workstation. Instruments meant to be operated, or fitted in connection with controls, shall be readable from a distance of at least 1 000 mm. Any other instruments shall be readable from a distance of at least 2 000 mm.

Guidelines :

Character height in millimetres should be not less than three and a half times the reading distance in metres. Character width should be 0,7 times the character height, e.g.

Character height for reading distance of 2 m :
$2 \times 3{,}5 = 7$ mm

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Character width for letter height of 7 mm : 7 × 0,7 = 4,9 i.e. 5 mm

Resulting minimum character size : 7 mm × 5 mm

6.2.6 All information shall be presented on background of high contrast, emitting as little light as possible by night.

Guidelines :

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

6.2.7 Instrument character type shall be of simple, clear-cut design.

Guidelines :

Internationally used and recommended character type is *Helvetica medium*. However, light emitting diode text matrices are acceptable.

NOTE — In descriptive text, lower case letters are easier to read than capitals.

6.2.8 The purpose of each control shall either be clearly illustrated by symbols where standard symbols have been internationally adopted, or indicated by a label in English.

6.2.9 Controls or combined controls/indicators shall be visually and tactually distinguishable from elements which only indicate.

Guidelines :

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

6.2.10 The operation of a control shall not obscure indicator elements where observation of these elements is necessary to allow adjustments to be made.

6.2.11 The shape of mechanical controls shall indicate the method of operation of the control.

Guidelines :

Rotary finite-position controls (e.g. stepped switches) should have toggles or levers, whereas rotary continuous-position controls (rheostats) should have knobs or wheels except the steering control.

6.2.12 The position/function allocation and purpose of control elements, as well as the function and layout of indicator elements, shall be logically coordinated.

Guidelines :

Positioning according to functions should be in accordance with IEC 447.

6.3 Illumination and individual lighting of instruments

6.3.1 Indicator lights and the illumination of all instruments shall be designed and fitted to avoid unnecessary glare or reflections, or the instruments being obscured by strong light.

Guidelines :

For the illumination of displays, red light (wave length 620 nm or higher) should be used.

6.3.2 To avoid unnecessary light sources in the front area of the bridge, only instruments necessary for the safe navigation and manoeuvring of the ships shall be located in this area.

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

Guidelines :

Alarm indicator lights should be equipped with red lights of 620 nm or higher wave length.

6.3.4 All illumination and lighting of instruments shall be adjustable down to zero, except the lighting of warning and alarm indicators and the control of the dimmers which shall remain readable.

6.3.5 Each instrument shall be fitted with an individual light adjustment. In addition, groups of instruments normally working together may be equipped with common light adjustment.

6.4 Outer shape of instruments

6.4.1 Instruments mounted in a group or console shall have a square or rectangular frame and be designed to fit internationally accepted standard size modules.

NOTE — This does not imply that the instrument display itself has to be rectangular.

7 Bridge working environment

7.1 General

7.1.1 Through the various stages of the design of a ship, care shall be taken to ensure a good working environment for bridge personnel.

7.1.2 Toilet facilities shall be provided on, or adjacent to the bridge.

7.1.3 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.

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7.2 Vibration

7.2.1 Uncomfortable levels of vibration shall be avoided on the bridge.

NOTE — Limits for acceptable levels of vibration are still under study. Reference is made to ISO 2631-1, ISO 2631-4, ISO 4867, ISO 4868 and ISO 6954.

7.3 Noise

7.3.1 Noise levels shall comply with IMO Resolution A.468(XII) and take into account IMO Resolution A.343(IX).

Guidelines :

The noise of ventilation fans, engine intake fans and other noise sources should be excluded from the bridge operational area by suitable siting of the fans and associated trunking.

7.3.2 Fixed sound signal apparatus shall not be placed in the immediate vicinity of the bridge. Reference is made to Annex III of the *International Regulations for Preventing Collisions at Sea.*

Guidelines :

The sound signal apparatus should be sited as high as practicable and if possible, forward of the bridge.

7.4 Alarms

7.4.1 A method of accepting audible and visual alarms should be provided on the bridge.

Guidelines :

Accept button(s), or similar, should be used to silence machinery audible alarms and set visual alarms to steady state, subject to the requirements of 6.3.5.

7.5 Lighting

7.5.1 A satisfactory level of lighting shall be available to enable the bridge personnel to complete such tasks as maintenance and chart and office work satisfactorily, both at sea and in port, daytime and nighttime.

Guidelines :

Individual task areas should have a greater luminance than the general lighting level.

7.5.2 Care shall be taken to avoid glare and stray image reflections in the bridge environment.

Guidelines :

High contrast in brightness between work area and surroundings should be avoided.

A non-reflective or matt surface should be used to reduce indirect glare to a minimum.

NOTE — Glare is experienced if windows or light sources, seen directly or by reflection in shiny surfaces, are too bright compared to the general brightness within the interior of the bridge.

7.5.3 A satisfactory level of flexibility within the lighting system shall be available to enable the bridge personnel to adjust the lighting in brightness and direction as required in different areas of the bridge and by the needs of individual instruments and controls.

Guidelines :

Table 1 lists the recommended general illumination.

Table 1

Place	Colour/illumination
Bridge adjacent offices, day	White, continuously variable from 0 to at least 500 lux.
Bridge, night	Red, continuously variable from 0 to 20 lux.
Adjacent corridors and rooms for noisy equipment, day	White, continuously variable from 0 to at least 300 lux.
All adjacent corridors and rooms, night	Red, continuously variable from 0 to 20 lux. Automatic door switches should be fitted.
Obstacles, night	Red spotlights, continuously variable from 0 to 20 lux.
Chart table, day	White floodlight, continuously variable from 0 to 1 000 lux. White spotlights, continuously variable from 0 to 100 lux.
Chart table, night	Combined red and white floodlight, with each colour continuously variable from 0 to 20 lux. Combined red and white spotlights, with each colour continuously variable from 0 to 20 lux.

NOTE — Vision in dim light has the following characteristics :

— detail and colour cannot be seen;

— the eye becomes more sensitive to the blue end of the light spectrum;

— peripheral vision can be used more effectively.

Dark adaptation is important to ensure a good visual lookout at night. It takes 30 to 40 min for complete dark adaptation. Red goggles worn 5 to 15 min prior to going on watch will aid dark adaptation.

7.5.4 During hours of darkness it should be possible to discern equipment on the bridge.

Guidelines :

Bridge equipment can be lit by internally or externally located lighting.

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