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**Large yachts — Navigational bridge  
visibility**

*Grands yachts — Visibilité à la passerelle de navigation*

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Published in Switzerland

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 12, *Large yachts*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at [www.iso.org/members.html](http://www.iso.org/members.html).

## Introduction

The purpose for having a standard on bridge visibility for large yachts was triggered by the fact that the *International Convention for the Safety of Life at Sea* (SOLAS) of the International Maritime Organization (IMO) does not provide dedicated regulations for large yachts. Typically, large yachts are regulated by means of interpretations and one-off exemptions by the local surveyors. The statutory regulations do not give any unambiguous guidance or regulations for bridge visibility.

Hence, this document is considered as a way forward to create a clear and level playing field for the large yachts industry that builds the yachts according to the applicable Yacht Code<sup>[2][3][10]</sup>. It is based on IMO SOLAS, Chapter V, IMO MSC Circ.982<sup>[1]</sup> and IMO MSC Circ.1350<sup>[5]</sup>. It also addresses some aspects of the “unconventional design” as mentioned in SOLAS, Chapter V, Regulation 22.3<sup>[12]</sup>.

The industry can benefit from this document in a way that suits the yacht design and considers the safe navigation of yachts. The document aims to enable users to save time in the designing and building of wheelhouses.

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# Large yachts — Navigational bridge visibility

## 1 Scope

This document specifies requirements for the field of vision from the defined working positions on the bridge of large yachts.

It is applicable to large yachts with a length of 24 m or over.

NOTE This document supports the aims of SOLAS, Chapter V, Regulation 22<sup>[12]</sup>.

## 2 Normative references

There are no normative references in this document.

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

### 3.1

#### **blind sector**

measured arc from a position that indicates an obstructed view of the sea surface by any fixed object outside or inside the wheelhouse

Note 1 to entry: See 5.6 to determine the *field of vision* (3.6) from a working position.

### 3.2

#### **bridge**

area from which the navigation and control of the yacht is exercised, including the wheelhouse and *bridge wings* (3.3)

### 3.3

#### **bridge wing**

part of the *bridge* (3.2), on both sides of the yacht's wheelhouse, which, in general, extends to the yacht's side

### 3.4

#### **external obstruction**

any loose item that is placed on the deck and that can be repositioned by the crew

### 3.5

#### **docking operation**

manoeuvring of the yacht alongside a berth, another yacht or other structure, and control of the mooring operations

### 3.6

#### **field of vision**

angular size of scenery being observable from a position within the yacht's *bridge* (3.2)

**3.7  
flybridge**  
open area on the highest deck that provides unobstructed views to the fore, the aft and the sides of the yacht and is equipped to be used for the working positions

**3.8  
glare**  
excessive demand for visual adaptation brought on by the retina's exposure to more light than it can tolerate

Note 1 to entry: It is produced when any luminance within the visual field is sufficiently greater than the luminance to which the eye is adjusted.

**3.9  
reflection**  
return of light from a surface, and production of an image by or as if by a mirror

**3.10  
height of eye**  
vertical distance of the centre of the eye above the finished interior floor of the bridge deck at a working position

**3.11  
helmsman**  
designated person who steers the yacht under way

**3.12  
length**  
distance from the forward side of the stem to the aftermost side of the stern including the bulwark, but without bowsprit, pulpit, flagpole and any other outfitting part

**3.13  
sunscreen**  
fabric that can be installed temporarily on all applicable *bridge* (3.2) windows in order to improve the visibility and reduce eye strain in bright sunshine

**3.14  
totally enclosed bridge**  
*bridge* (3.2) without open *bridge wings* (3.3), so that the bridge wings form an integral part of an enclosed wheelhouse

**3.15  
wheelhouse**  
enclosed area of the *bridge* (3.2)

**3.16  
window blind**  
opaque window-covering to keep light out of a certain space, i.e. to create privacy

**3.17.1  
conning position**  
position on the *bridge* (3.2) with a commanding view, used by navigators and pilots when commanding, manoeuvring and controlling the yacht's movements

**3.17.2  
additional conning station**  
workstation used for navigation, providing a commanding view with access to radar and navigational chart in addition to information required for conning, which can serve as an alternative conning station for the navigator or pilot when required

**3.17.3****monitoring position**

workstation from which the operating equipment and surrounding environment can be permanently observed in seated/standing position

**3.17.4****steering position**

position of the helmsman to manually steer the yacht

**3.17.5****docking position**

position of the navigator or pilot from where *docking operations* (3.5) are conducted and mooring operations can be supervised

**3.17.6****navigating position**

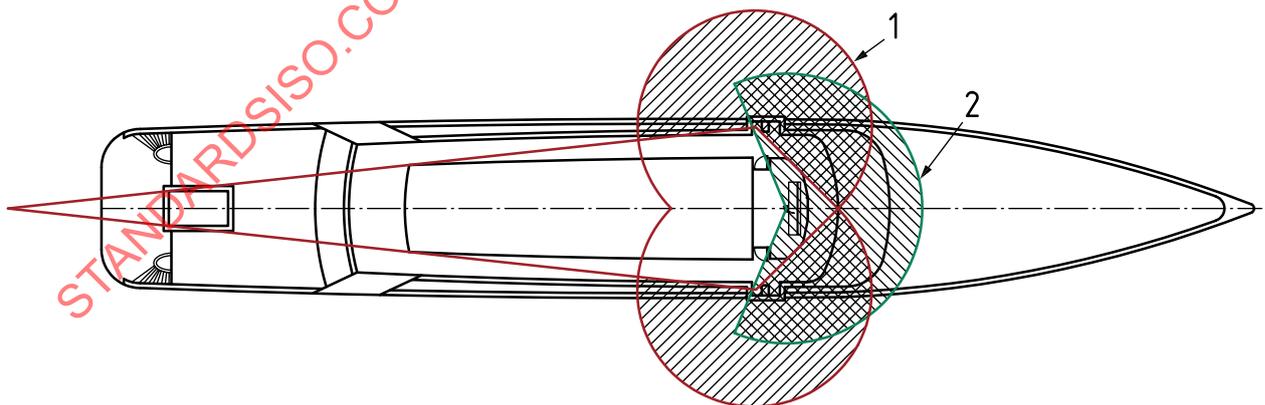
position on the *bridge* (3.2) where the navigator or pilot can make full appraisal of the situation in navigating the yacht

**4 Bridge construction****4.1 Bridge position**

A horizontal field of vision to the horizon of 360° (at 1 nautical mile distance) shall be obtained by using not more than two positions within the confines of the bridge (see Figure 1).

In case the nature of the yacht design complicates strict compliance with this requirement,

- a) a flybridge can be assigned as the conning position, which can typically, but not exclusively, be the case with sailing yachts, or
- b) a remote camera system can be used [see 5.8 d)], or
- c) subject to the agreement of the Administration, the operator can apply for alternative options (see also ISO 8468).

**Key**

- 1 field of view from the docking position
- 2 field of view from the conning position

**Figure 1 — Field of view around the yacht**

#### 4.2 Lower edge of front windows

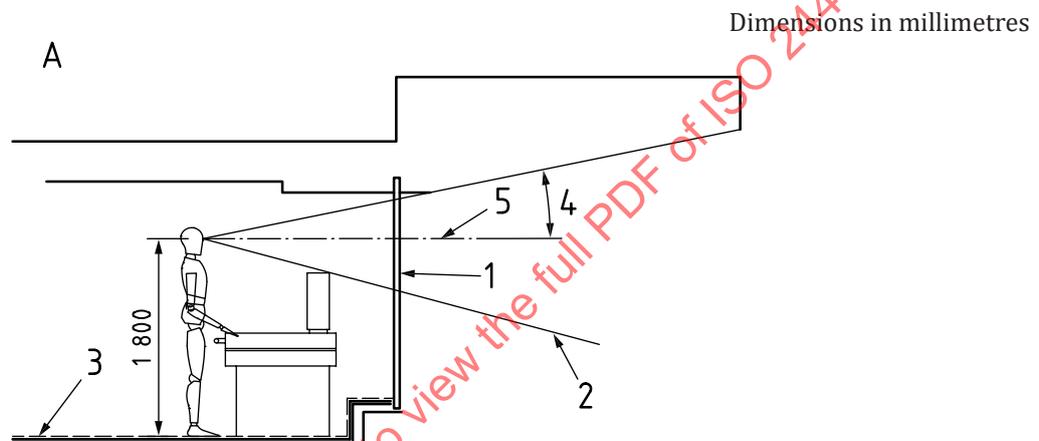
In no case shall the lower edge of front windows present an obstruction to the forward view as described in 5.5 (see Figure 2).

#### 4.3 Upper edge of front windows

The upper edge of the front windows should allow a forward view of the horizon for a person in a standing position with a height of eye (see 5.2) at the navigating and manoeuvring workstation, when the yacht is pitching in heavy seas (see Figure 2).

#### 4.4 Upper edge of navigational consoles

The upper edges of the navigational consoles shall not disrupt the visibility requirements as described in 5.5 (see Figure 2).



#### Key

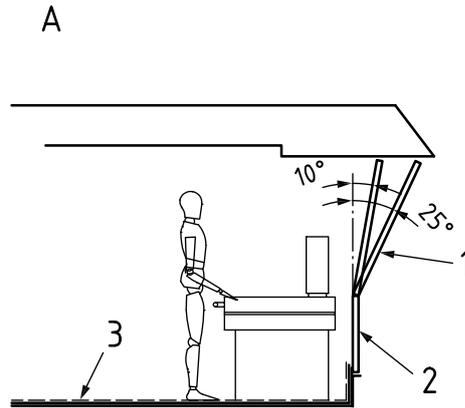
- 1 window placed vertically
- 2 vertical field of vision from the conning position below the horizontal plane
- 3 finished deck surface
- 4 vertical field of vision from the conning position above the horizontal plane
- 5 height of eye
- A wheelhouse centreline section

Figure 2 — Geometry of the front window

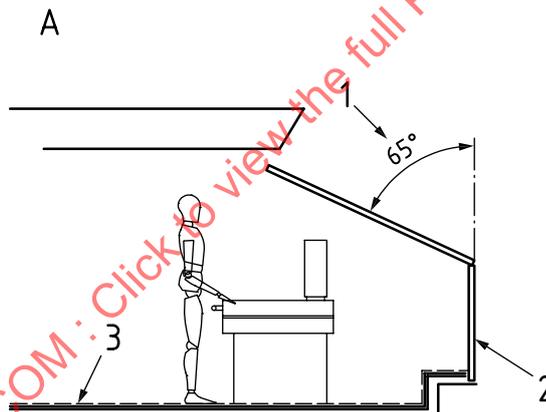
#### 4.5 Inclination of windows

In order to help avoid reflections that can hamper the view from the bridge, paragraphs a) to c) apply.

- a) The bridge front windows shall be inclined from the vertical plane top out, at an angle of not less than 10° and not more than 25° (see Figure 3).
- b) The rear (aft facing) and side windows may be inclined from the vertical plane top out, at an angle of not more than 25°. Deviation from this specification is accepted for windows in bridge wing doors.
- c) As an alternative to the above paragraphs a) and/or b), it is permitted to apply vertical windows (see Figure 2) and inclined windows from the vertical plane bottom out. The maximum angle from the vertical plane for a bottom out inclined window is 65°. Appropriate measures shall be taken to avoid adverse reflections, see Figure 4.

**Key**

- 1 window inclination top out
- 2 bulkhead
- 3 finished deck surface
- A wheelhouse centreline section

**Figure 3 — Window inclination****Key**

- 1 window inclination bottom out
- 2 bulkhead
- 3 finished deck surface
- A wheelhouse centreline section

**Figure 4 — Window inclination alternative****4.6 Curved windows**

Curved windows are allowed as long as visibility is not distorted. The distortion shall be checked in accordance with the testing procedure in [6.4](#).

**4.7 Window breadth**

Bridge windows should be as large as practicable to sustain a safe lookout.

## 4.8 Framing of windows

### 4.8.1 General

The framing between the bridge windows shall not be installed immediately in front of any working position.

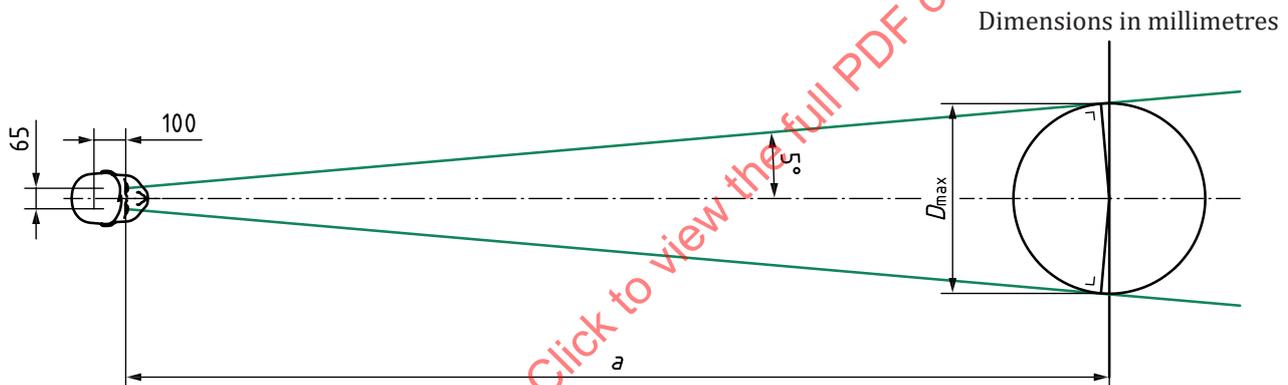
### 4.8.2 Frame insulation

Where applicable in order to reduce the size of the finished frame (i.e. mullion), insulation need not be steel equivalent and may be reduced in case there is no structure on top of the bridge.

### 4.8.3 Maximum frame size

The maximum size of the finished frame (i.e. mullion) is determined by the limitation of the blind sectors in 5.6 and is limited to an absolute maximum, as seen in the calculation below (see Figure 5 also).

$$D_{\max} = 0,173\ 6 \cdot a + 65 \text{ (mm)}$$



#### Key

$D_{\max}$  diameter of the circle describing the maximum mullion size by view lines, at a distance  $a$

$a$  distance from the eye to the centre of the circle, that is described by the tangent to this circle from each eye

Figure 5 — Maximum size of window mullion

## 4.9 Window tinting

Windows shall be made of clear glass without optical defects. Polarized and/or tinted windows shall not be fitted. Defects are subject to the quality control of the manufacturer. The luminosity of the glass shall be tested according to 6.4.

## 4.10 Clear view

The window panes shall not give nonlinear or blurred effects to the line of sight.

Regardless of the weather conditions, a clear view through at least two front windows shall be provided (i.e. heavy-duty window wipers and fresh water washing system shall be installed<sup>[6]</sup>). Depending on the bridge configuration, an additional number of windows with clear view may be provided.

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 (e.g. heated panes<sup>[7,8]</sup>).

In the case of a totally enclosed bridge, heavy duty wipers and fresh water window washing shall be provided on forward and aft windows within the field of vision required from the docking positions. If there is no window for opening on the bridge wing sides, window wipers and fresh water washing shall also be provided for the bridge wing side windows.

#### 4.11 Removable sunscreens

To ensure a clear view and to avoid reflections in bright sunshine, sunscreens with minimum colour distortion should be provided at all windows in front of workstations. Such screens shall be readily removable and not permanently installed. It is permitted to install rolling screens, provided that these do not cover any portion of the clear view window when rolled in. If these screens are operated automatically, a manual backup shall be provided.

#### 4.12 Working positions

Each bridge shall have at least one (1) conning position, one (1) navigation position, one (1) steering position, one (1) monitoring position and on each side of the bridge one (1) docking position. When required, an additional conning position may be arranged. See [Figure 6](#).

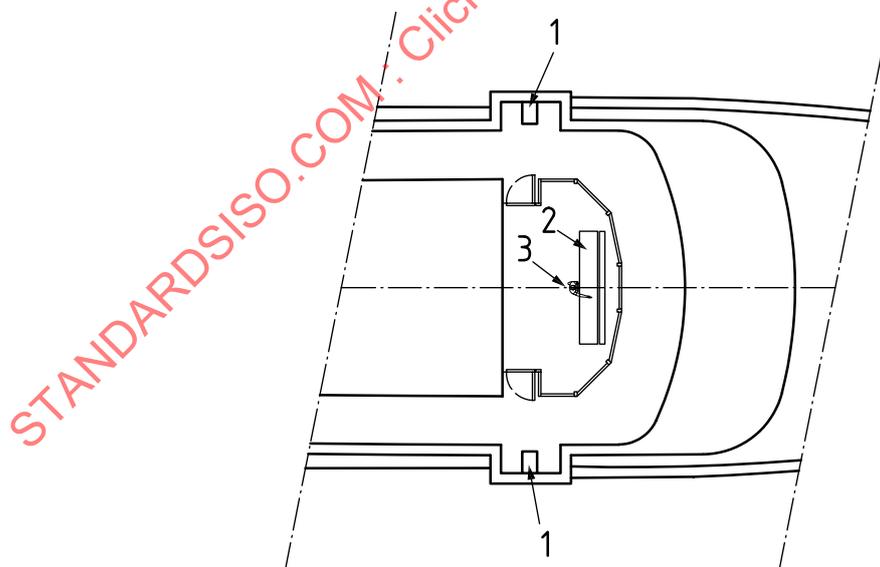
#### 4.13 Bridge wings

In general, bridge wings shall extend as broad as required so as to make the yacht's side visible as detailed in [5.8](#).

### 5 Navigational bridge visibility

#### 5.1 Typical bridge arrangement

As a minimum, the bridge arrangement typically looks like as it is indicated in [Figure 6](#).



#### Key

- 1 docking position
- 2 navigating position
- 3 conning and steering position

**Figure 6 — Typical bridge arrangement**

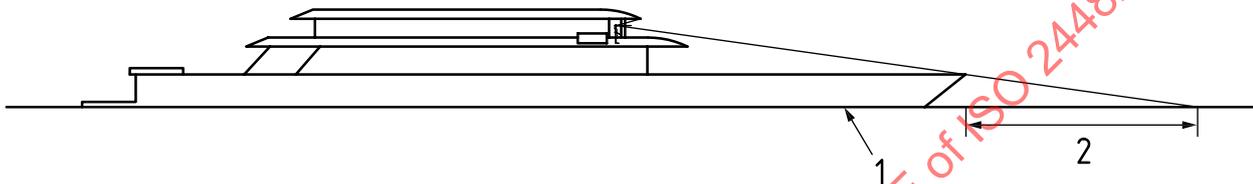
### 5.2 Position of the eye

In general, the height of eye at a working position is 1 800 mm above the finished interior floor of the bridge deck (see [Figure 2](#)). Whenever an 1 800 mm height of eye is considered unreasonable and impractical, a reduction of the height of eye may be considered, but not to less than 1 600 mm, subject to the agreement with the Administration.

If a workstation can be operated from a sitting position, the blind sectors and the field of vision shall be considered at a height of eye of 1 500 mm also.

### 5.3 View of the sea surface

The view of the sea surface from the conning position shall not be obscured by more than two yacht lengths ( $2 \times L$ ), or 500 m, whichever is the less, forward of the bow to  $10^\circ$  on either side under all conditions of draught, trim and external obstructions (see [Figure 7](#)).



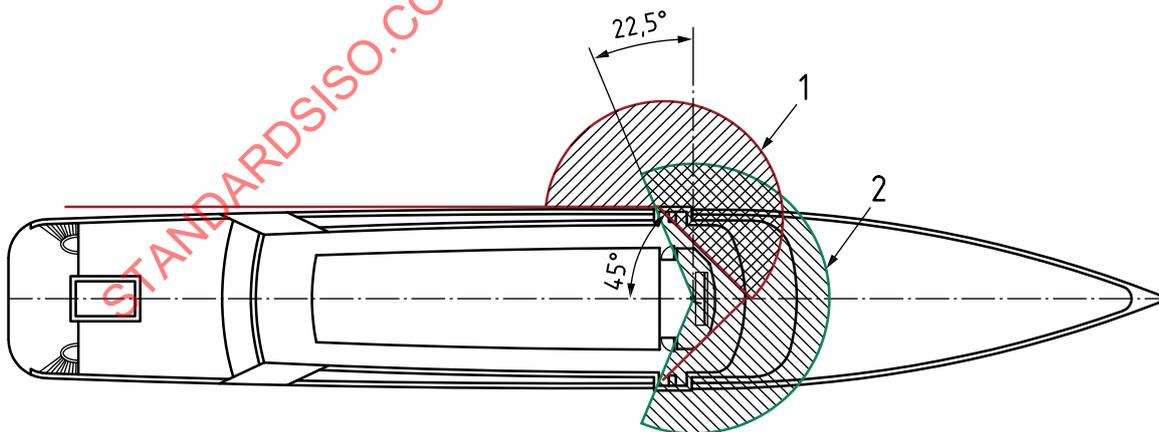
**Key**

- 1 sea surface
- 2 maximum  $2 \times$  length of the yacht, or 500 metre, whichever is less

**Figure 7 — View of the sea surface**

### 5.4 Horizontal field of vision

[Figure 8](#) shows the horizontal field of vision from the conning position. The horizontal field of vision shall extend over an arc of not less than  $225^\circ$ , that is, from dead ahead to not less than  $22,5^\circ$  abaft the beam on either side of the yacht (see also Reference [9]).

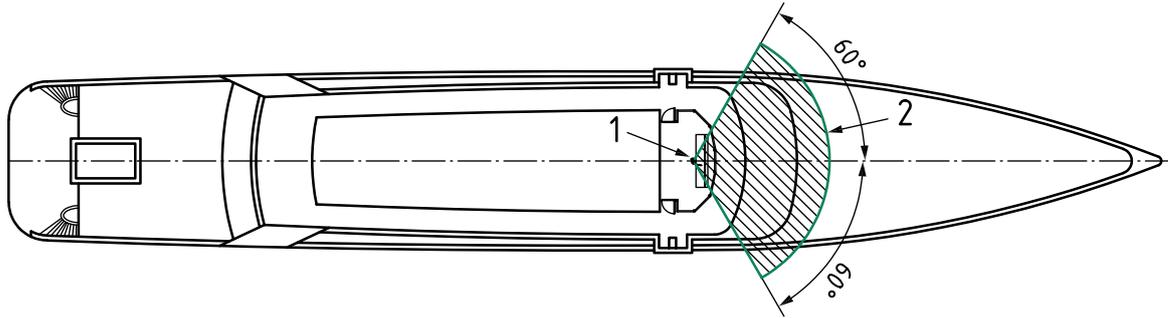


**Key**

- 1 view from the docking position
- 2 view from the conning position

**Figure 8 — Horizontal field of vision**

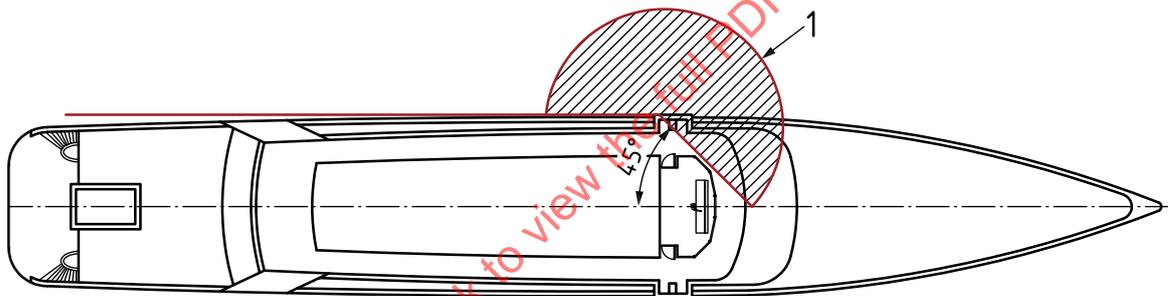
The horizontal field of vision from the steering position (see [Figure 9](#)) shall extend over an arc from dead ahead to at least  $60^\circ$  on each side of the yacht.

**Key**

- 1 steering position
- 2 minimum horizontal field of vision

**Figure 9 — Field of vision from the steering position**

For docking operations from each bridge wing (i.e. docking position, see [Figure 10](#)), the horizontal field of vision should extend over an arc of at least 225°, that is at least 45° on the opposite bow through right ahead and then from right ahead to right astern through 180° on the same side of the yacht.

**Key**

- 1 field of vision from the docking position

**Figure 10 — Field of vision from the docking position****5.5 Vertical field of vision****5.5.1 Vertical field of vision from the conning position above the 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<sup>[4]</sup>.

**5.5.2 Vertical field of vision from the conning position below the horizontal plane**

Within the 180° sector forward of athwart yacht, any structure obstructing the sea surface close to the yacht in excess of 0,5 nautical miles is considered to contribute to a blind sector and shall be included in the blind sector calculation.

The vertical view shall enable the helmsman to observe steering references in the foreship (see [Figure 7](#)).

**5.6 Blind sectors**

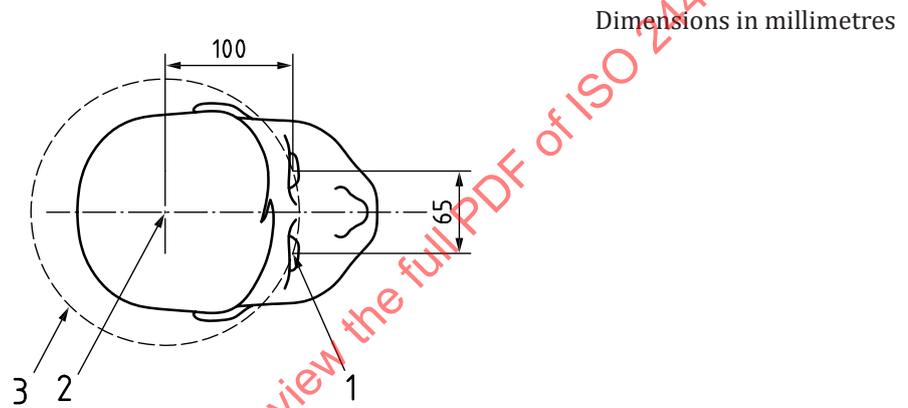
Over an arc from dead ahead to 10° on each side of the bow, the total blind sector shall not exceed 5°. Elsewhere, each individual blind sector within the required field of vision shall not exceed 10°.

Blind sectors caused by obstructions appearing within the required field of vision of 225°, shall be as few and as small as possible and in no way hamper a safe lookout. The total arc of blind sectors within this field of vision shall not exceed 20°<sup>[4]</sup>.

The blind sectors shall be determined according to the following principle.

The conning position is not a singular point. It shall be considered that the bridge team/pilot can reduce the effect of blind sectors by moving and/or turning their head and/or tilting the upper body without leaving their position. According to Reference [1], it is assumed that the eye movement allows for a covering of 35°, a head rotation a covering of 60° (see Figures 11 and 12), and a tilting of the upper body allows for a movement of the head of 200 mm (see Reference [14]) in any direction (see Figure 13). The maximum size of the finished window frames is according to 4.8.3.

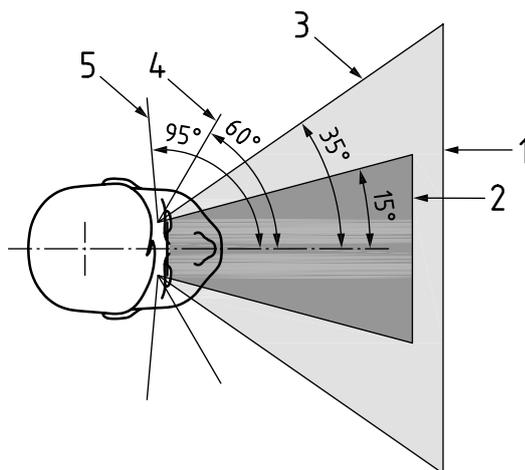
The immediate and preferred viewing areas are indicated in Figure 12. The sectors are optimized by the position of the eyes, whereby the eyes are 65 mm apart (Figure 11) and the re-positioning of the upper body is according to Figure 13.



**Key**

- 1 eye focal point
- 2 centre of rotation
- 3 circle of the eyes

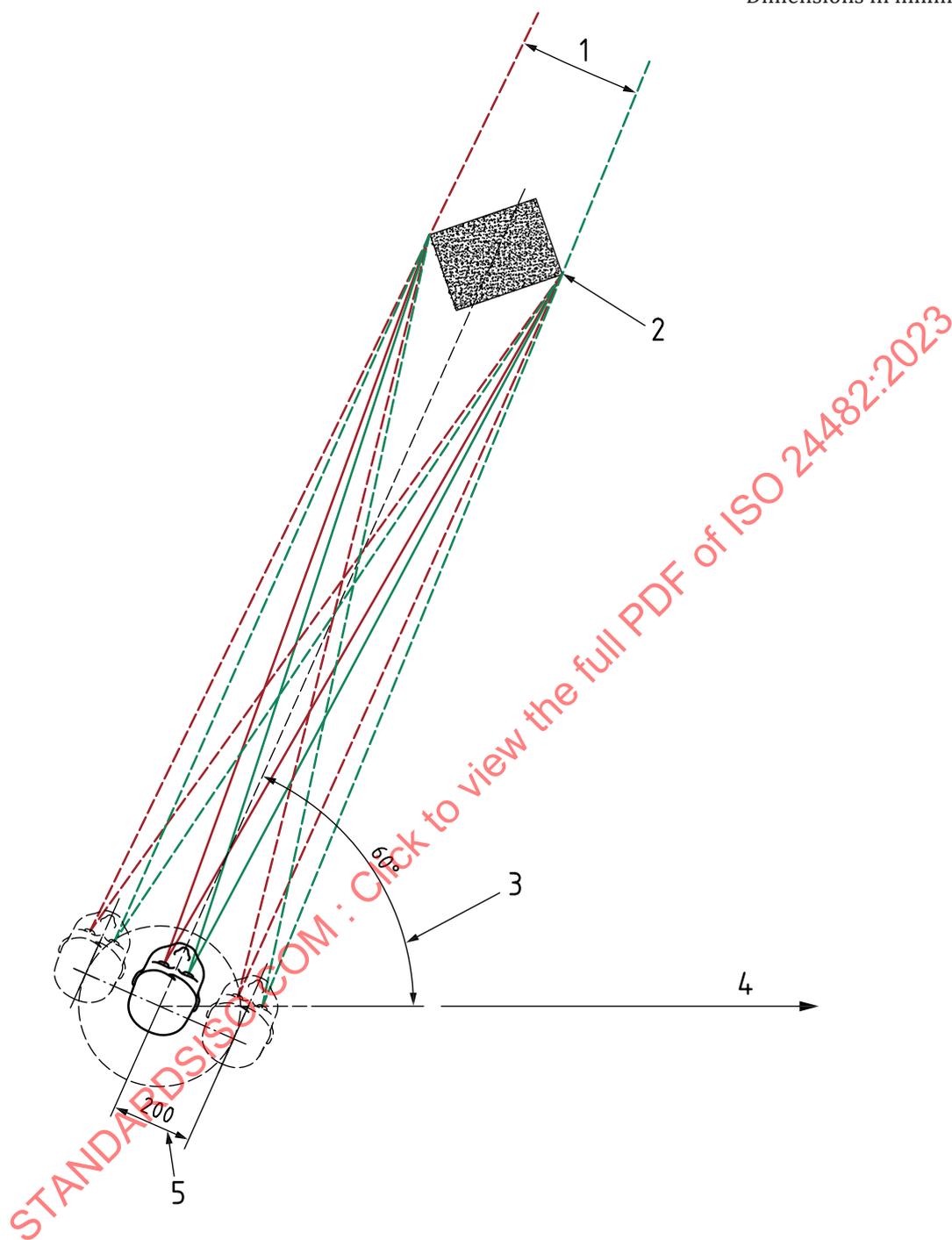
**Figure 11 — Geometry of the head and eyes**

**Key**

- 1 immediate field of view
- 2 preferred viewing area
- 3 maximum eye movement
- 4 head rotation
- 5 maximum viewing area

**Figure 12 — Immediate and preferred field of vision**

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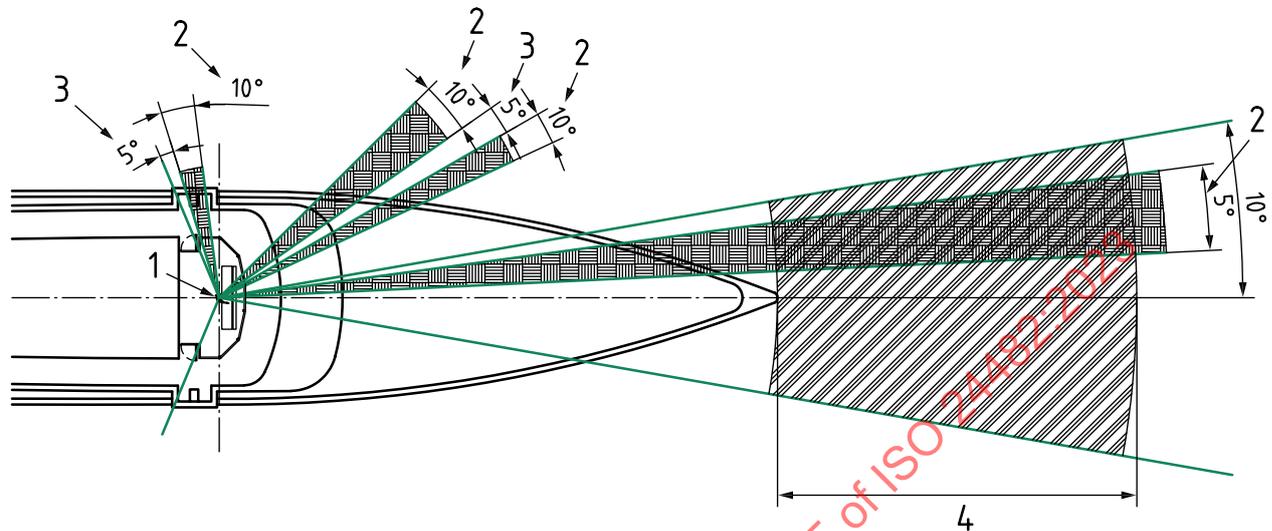
**Key**

- 1 diverging sight lines possible
- 2 finished window frame (i.e. mullion)
- 3 maximum rotation of head
- 4 yacht direction
- 5 maximum movement of head

**Figure 13 — Rotation and movement of the head**

## 5.7 Clear sector

The clear sector between two blind sectors caused by obstructions outside of the wheelhouse shall be at least 5°. See [Figure 14](#) for an overview of the required clear sectors and allowed blind sectors.



### Key

- 1 conning position
- 2 maximum blind sector
- 3 minimum clear sector
- 4  $2 \times$  length or 500 m whichever is less

Figure 14 — Overview of clear and blind sectors

## 5.8 Field of vision from the docking position

The yacht's side shall be visible from the bridge wing at no trim nor list. This is accomplished when:

- a) a view from the bridge wing plus a distance corresponding to a reasonable and safe distance of a seafarer leaning over the side of the bridge wing, which shall not be more than 400 mm, to the location vertically right under the maximum beam of the yacht at the lowest seagoing draught is not obscured; or
- b) the sea surface at the lowest seagoing draught and with a transverse distance of 500 mm and more from the maximum beam throughout the yacht's length is visible from the side of the bridge wing<sup>[5]</sup>;
- c) in specific design situations, it is allowed to combine the requirements of a) and b);
- d) the use of a remote camera system may be accepted for yachts of unconventional design, other than those mentioned in paragraph c) above, as a means for achieving the view of the yacht's side from the bridge wing, provided that<sup>[5]</sup>:
  - 1) the installed remote camera system is redundant from the circuit breaker to the camera and screen, including communication cables, i.e. the system shall provide on each side of the yacht redundancy of:
    - i) the power cables and circuit breakers from the main switchboard to the camera and the screen;
    - ii) the camera;