

INTERNATIONAL STANDARD

**Maritime navigation and radiocommunication equipment and systems –
Presentation of navigation-related information on shipborne navigational
displays – General requirements, methods of testing and required test results**

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Presentation of navigation-related information on shipborne navigational displays – General requirements, methods of testing and required test results

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International Standard IEC 62288 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

This standard supports the performance standards for the presentation of navigation-related information on shipborne navigational displays, adopted by the IMO in resolution MSC.191(79) in December 2004.

The text of this standard is based on the following documents:

FDIS	Report on voting
80/527/FDIS	80/540/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
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MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS –

Presentation of navigation-related information on shipborne navigational displays – General requirements, methods of testing and required test results

1 Scope

This International Standard specifies the general requirements, methods of testing, and required test results, for the presentation of navigation-related information on shipborne navigational displays in support of IMO resolution MSC.191(79).

(MSC191/1) IMO resolution MSC.191(79) *harmonizes the requirements for the presentation of navigation-related information on the bridge of a ship to ensure that all navigational displays adopt a consistent human machine interface philosophy and implementation.*

(MSC191/1) IMO resolution MSC.191(79) *supplements and, in the case of a conflict, takes priority over, the presentation requirements of the individual performance standards adopted by the IMO for relevant navigational systems and equipment and covers the presentation of navigation-related information by equipment for which Performance Standards have not been adopted by the IMO.*

This standard also addresses the guidelines for the presentation of navigation-related symbols, terms and abbreviations in Safety of Navigation circular SN/Circ.243 together with some requirements published in resolution MSC.192(79) on radar; resolution MSC.232(82) on ECDIS; and ergonomic criteria published in circular MSC/Circ.982.

The symbols from SN/Circ.243 are reproduced and expanded upon in Annex A. The terms and abbreviations from SN/Circ.243 are reproduced and expanded upon in Annex B. Additional guidance on display and dialogue design from MSC/Circ.982 is listed by reference in Annex C.

Some requirements set forth in MSC.191(79) duplicate requirements set forth in other IMO documents (for example, Resolutions A.694(17), MSC.192(79), MSC.232(82), etc.) or in the IEC standards further specifying the methods of test and required test results for those requirements (for example, IEC 60945, IEC 61174, IEC 62388, etc.). Where a requirement in this standard duplicates a requirement in another standard, the method(s) of test for that requirement may refer to the other standard.

NOTE Manufactures may offer relevant test data from compliance tests to other standards such as IEC 60945, IEC 61174, IEC 62388, etc. as evidence of compliance with appropriate tests of this standard.

This standard is organized so that each group of requirements is immediately followed by a clause identifying the method(s) of test. The methods of test are derived from ISO 9241-12 on the presentation of information on visual displays. Guidance on testing is provided in Annex D.

NOTE All text in this standard whose wording is identical to text contained in an IMO document is printed in *italics*. Reference to the document is noted at the beginning of the paragraph. The notation contains a prefix referring to the document and a suffix with the paragraph number from the document (for example, (MSC191/1); (SN243/1), etc.).

1.1 Purpose

(MSC191/2) This standard *specifies the presentation of navigational information on the bridge of a ship, including the consistent use of navigational terms, abbreviations, colours and symbols, as well as other presentation characteristics.*

(MSC191/2) This standard *also addresses the presentation of information related to specific navigational tasks by recognising user selected presentations in addition to presentations required by the relevant individual performance standards adopted by the IMO.*

1.2 Application

(MSC191/3) This standard *is applicable to any display equipment associated with the navigational systems and equipment for which individual performance standards have been adopted by the IMO.* It addresses the stand-alone displays for radar and ECDIS, the multifunction displays used in IBS and INS and composite presentations that integrate information derived from two or more systems. This standard *also addresses display equipment associated with navigational systems and equipment for which individual performance standards have not been adopted by the IMO.*

NOTE Some IEC standards may individually include display requirements in conformity with IMO resolution MSC.191(79).

(MSC191/3) *The general principles and the physical characteristics specified in Clauses 4 and 7, respectively, of this standard are applicable to all displays on the bridge of a ship.*

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60945:2002, *Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of tests of testing and required test results*

IEC 61162, (all parts) *Maritime navigation and radiocommunication equipment and systems - Digital interfaces*

IEC 61174, *Maritime navigation and radiocommunication equipment and systems – Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results*

IEC 61966-4:2000, *Multimedia systems and equipment – Colour measurement and management – Part 4: Equipment using liquid crystal display panels*

IEC 62065:2002, *Maritime navigation and radiocommunication equipment and systems – Track control systems – Operational and performance requirements, methods of testing and required test results*

IEC 62388:2007, *Maritime navigation and radiocommunication equipment and systems – Shipborne radar – Performance requirements, methods of testing and required test results*

IHO S-52:1996, *Specifications for chart content and display aspects of ECDIS*

IHO S-52 Appendix 1:1996, *Guidance on updating the electronic navigational chart*

IHO S-52 Appendix 2:2004, *Colour and symbol specifications for ECDIS*

IMO A.694(17):1991, *General requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids*

IMO MSC.191(79):2004, *Performance standards for the presentation of navigation related information on shipborne navigational displays*

IMO MSC.192(79):2004, *Performance standards for radar equipment*

IMO MSC.232(82):2006, *Revised performance standards for electronic chart display and information systems (ECDIS)*

IMO SN/Circ.243:2004, *Guidelines for the presentation of navigation related symbols, terms and abbreviations*

ISO 13406-2: 2001, *Ergonomic requirements for work with visual displays based on flat panels – Part 2: Ergonomic requirements for flat panel displays*

ISO 80416-4:2005, *Basic principles for graphical symbols for use on equipment – Part 4: Guidelines for the adaptation of graphical symbols for use on screens and displays (icons)*

VESA-2001-6:2001, *Flat Panel Display Measurements (FPDM)*

3 Terms and definitions

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

3.1

activated AIS target

(MSC191/A) *target activated for the display of additional graphically presented information (for example, heading line, velocity vector, etc.)*

3.2

automatic identification system

AIS

system which complies with the requirements set forth in Annex 3 to IMO Resolution MSC.74(69)

3.3

AIS target (or reported AIS target)

(MSC191/A) *target generated from an AIS message*

3.4

associated target

(MSC191/A) *target simultaneously representing a tracked radar target and a reported AIS target having similar parameters (for example, position, course, speed, etc.) and which comply with an association algorithm*

3.5

consistent common reference point

CCRP

(MSC191/A) *location on own ship, to which all horizontal measurements such as own ship position, heading, attitude, and target range, bearing, relative course, relative speed, closest point of approach (CPA) or time to closest point of approach (TCPA) are referenced, typically the conning position of the ship. An alternative location (or multiple locations) may be used as necessary where clearly indicated or distinctively obvious, for example, the origin of the reference axis of the ship*

3.6**composite presentation**

integrated presentation that is derived from the simultaneous display of information from two or more navigational systems or equipment

3.7**dangerous target**

(MSC191/A) tracked radar or reported AIS target with a predicted CPA and TCPA that violates values preset by the user. The respective target is marked by a “dangerous target” symbol

3.8**dead-reckoned position****DR**

position extrapolated from the last accepted position update, based on present course and speed, and updated on a time interval selected by the operator

3.9**display base**

(MSC191/A) level of information which cannot be removed from the ECDIS display, consisting of information which is required at all times in all geographic areas and all circumstances. It is not intended to be sufficient for safe navigation

3.10**display equipment**

device capable of representing information visually

3.11**doubtful integrity**

property of information where its accuracy, timeliness or completeness cannot be measured or determined

3.12**electronic chart display and information system****ECDIS**

system which complies with the requirements set forth in IMO Resolution MSC.232(82)

3.13**electronic chart information**

one or more electronic chart databases (for example, ENC)

3.14**electronic navigational chart****ENC**

(MSC191/A) database standardised as to content, structure and format according to IHO S-57 and its Appendix B.1 and issued by, or on the authority of, a Government

3.15**estimated position****EP**

position of own ship determined by the common intersection of two LOPs

3.16**fix**

position of own ship determined, without reference to any former position, by the common intersection of three or more LOPs

3.17

heading

(MSC191/A) horizontal *direction in which the bow of a ship is actually pointing* at any instant, expressed as an angular displacement from north

3.18

human machine interface

interaction interface between humans and machines consisting of all elements used to achieve a particular goal, or the task interface between humans and machines resulting from the allocation of functions to humans and/or machines

3.19

integrated bridge system

IBS

system which complies with the requirements set forth in Annex 1 to IMO Resolution MSC.64(67)

3.20

icon

graphical symbol with a particular meaning used to convey information independent of language. Icons may be used for visual identification or reinforcement of a textual description, to invoke a function, or to open an object when selected with the cursor

3.21

important indication

(MSC191/A) *marking of an operational status of displayed information which needs special attention, for example, information with low integrity or invalid information*

3.22

integrated navigation system

INS

system which complies with the requirements set forth in IMO Resolution MSC.252(83)

3.23

integrity

property of information as being accurate, timely, complete and uncorrupted

3.24

line of position

LOP

plotted line on which own ship is located determined by observation or measurement of the range or bearing to an aid to navigation or other charted element

3.25

lost target

(MSC191/A) tracked radar or reported AIS *target* for which the system is no longer receiving *valid position* data. *The target is represented by a "lost target" symbol*

3.26

menu

area of the display that is allocated to a structured list of options for the selection and entry of operational parameters, data and commands

3.27

multifunction display

single visual display unit that can present, either simultaneously or through a series of selectable pages, information from multiple systems or equipment. A multifunction display

may typically be part of an INS or IBS (for example, providing dedicated presentation modes conforming to both radar and ECDIS presentation requirements), and may replace their individual display units

3.28

operational display area

(MSC191/A) *area of the display used to graphically present electronic chart and/or radar information, excluding the user dialogue area. On the chart display this is the area of the chart presentation. On the radar display this is the area encompassing the radar video image*

3.29

past positions

(MSC191/A) *time-spaced marks on the past track of own ship, or a tracked radar or reported AIS target*

3.30

permanent

property of information as existing for a long time (or forever) without change

3.31

persistent

property of information as existing continuously

3.32

radar

system which complies with the requirements set forth in IMO Resolution MSC.192(79)

3.33

radar echo

returned radar signal (i.e. "paint") appearing in the radar video image

3.34

radar video image

set of displayed information constructed from radar echoes processed by anti-clutter means and other tools (for example, scan-to-scan correlation)

3.35

readily available

property of information as being directly accessible (for example, in a top-level menu, from a screen function, or an icon, etc.)

3.36

selected target

(MSC191/A) *target selected manually or automatically for the display of detailed alphanumeric data, information and text in a separate user dialogue area. The target is represented by a "selected target" symbol*

3.37

single user/operator action

use of a single hardware key, or the use of a cursor, to select a single display icon or window followed by the operation of a key

3.38

sleeping AIS target

(MSC191/A) AIS target indicating the presence of a vessel equipped with AIS in a certain location. The target is represented by a "sleeping target" symbol indicating the vessel's orientation. No additional information is presented until the AIS target is activated

3.39

standard display

(MSC191/A) level of information that should be shown when a chart is first displayed on ECDIS. The level of the information it provides for route planning or route monitoring may be modified by the user according to the user's needs

3.40

target tracking system

system which complies with the requirements set forth in IMO Resolution MSC.192(79)

3.41

task-at-hand

specific navigation-related activity performed by a user (for example, route planning, route monitoring, target tracking, collision avoidance, etc.)

3.42

tracked radar target

object, fixed or moving, which is tracked by a radar or target tracking system

3.43

trial manoeuvre

(MSC191/A) facility used to assist the user to perform a simulated manoeuvre for navigation and collision avoidance purposes, by displaying the predicted future status of all tracked radar and reported AIS targets as a result of the simulated manoeuvres

3.44

user-added electronic chart information

electronic chart information manually entered by the user for presentation (for example, navigational notes, safety zones of interest, local notices to mariners, etc.)

3.45

user-configured presentation

(MSC191/A) auxiliary presentation configured by the user for a specific task-at-hand. The presentation may include radar and/or electronic chart information, in combination with other navigational or ship related data

3.46

user dialogue area

(MSC191/A) area of the display consisting of data fields and/or menus that is allocated to the interactive presentation and entry or selection of operational parameters, data, information, text and commands mainly in alphanumeric form

3.47

validity

property of information as conforming to specified criteria, and the marking of such information as being "valid" or "invalid" (i.e. "good" or "no good") for its intended use

4 General requirements for all displays

The provisions of this clause are applicable to all displays on the bridge of a ship.

NOTE If display equipment is permitted to be monochrome by the applicable IMO performance standards, then the colour-related requirements specified in 4.2.1, 4.4.1, 4.6.1, 4.6.2, 4.6.3, 4.7.2 and 4.8.1 will not apply.

4.1 Application of IEC 60945

4.1.1 General requirements

4.1.1.1 Requirement

(MSC191/3) *In addition to the general requirements set forth in IMO Resolution A.694(17) and further specified in IEC 60945, display equipment shall meet the requirements set forth in IMO Resolution MSC.191(79) and further specified in this standard, as applicable.*

4.1.1.2 Methods of test and required results

See Annex D for guidance in the application of IEC 60945 for testing.

4.2 Arrangement of information

4.2.1 Consistency of layout

4.2.1.1 Requirement

(MSC191/5.1.1) *The presentation of information shall be consistent within the user interface with respect to screen layout and arrangement of information, for example, from screen to screen and/or from page to page, as appropriate, and as far as practical. Data and control functions shall be logically grouped according to their function or the task-at-hand. Priority information essential to the task-at-hand shall be identified for each application (for example, radar, ECDIS, etc.), permanently or persistently displayed, as appropriate for the application, and presented to the user in a prominent manner by, for example, use of position (for example, screen location), size and colour.*

4.2.1.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) verify that the arrangement, operation and identification of controls, screen displays and indications are in accordance with Annex E and IEC 60945, 4.2.1.2 through 4.2.1.5;
- b) confirm by observation that the screen layout and arrangement of information is consistent from screen to screen and/or page to page, as appropriate, and as far as practical;
- c) confirm by observation that data and controls are logically grouped according to their function or the task-at-hand, as applicable;
- d) confirm by observation that priority information essential to the task-at-hand is identified and permanently or persistently displayed in a prominent manner, as appropriate, for each application.

4.2.2 Consistent presentation of information

4.2.2.1 Requirement

(MSC191/5.1.2) *The presentation of information shall be consistent with respect to:*

- numerical *values* (for example, position, speed, distance, time, etc.);
- *units*;
- *meaning* of information (for example, using the terms and abbreviations in Annex B);
- *sources* of information (for example, using the terms and abbreviations in Annex B);
- *validity* of information (see also 4.7.1 and 4.7.2); and
- *integrity* of information, if available (see also 4.7.1 and 4.7.2).

(See also IEC 60945, 4.2.1.5)

4.2.2.2 Methods of test and required results

Confirm by observation that numerical values and their units, the meaning and source(s) of information, and the validity and integrity of information are presented in a consistent manner.

4.2.3 Separation of operational display area

4.2.3.1 Requirement

(MSC191/5.1.3) *The presentation of information shall be clearly separated into one or more operational display areas (for example radar, chart) and one or more user dialogue areas (for example, menus, data, control functions).*

4.2.3.2 Methods of test and required results

Confirm by observation that the presentation is clearly separated into one or more operational display areas and one or more user dialogue areas.

4.3 Readability

4.3.1 Readability under all ambient light conditions

4.3.1.1 Requirement

(MSC191/5.2.1) *The presentation of alphanumeric data, text, symbols and other graphical information (for example, chart information, radar echoes or a radar video image, etc.) shall support readability from typical user positions (i.e. with respect to reading distance and viewing angles) under all ambient light conditions likely to be experienced on the bridge of a ship (for example, day, dusk and night), and with due consideration to the night vision of the officer of the watch. (See also 4.4.1, 7.2.1 and 7.6.1)*

Table 1 characterizes light levels for the ambient light conditions day, dusk and night.

Table 1 – Ambient light conditions

Ambient condition	Light level
Day	200 cd/m ² ± 50 %
Dusk	10 cd/m ² ± 50 %
Night	Darkness (i.e. where the display is the predominant light source)
NOTE Natural daylight is preferred for the day and dusk conditions.	

NOTE The “Day” colour table provided in the IHO ECDIS Presentation Library Ed. 3.3 uses a white background that may not support readability under all light conditions and may be a risk to safety of navigation for some navigational systems and equipment, including radar. Readability may be achieved by using the black background in the “Dusk” or “Night” colour tables provided in the IHO ECDIS Presentation Library Ed. 3.3, or the “Day Black Background” colour table provided in the IHO ECDIS Presentation Library Ed. 3.2, and adjusting brightness and contrast, if provided, for use under all light conditions.

Display equipment shall provide a luminance of at least 85 cd/m² measured at the centre of the display when set to the maximum brightness setting. The white luminance level of the display shall be adjustable down to 1 cd/m² or less and may be extinguishable below that point. The luminance across the operational display area shall not have a variance of more than 30 % from the brightest point to the dimmest point.

NOTE Variance is determined by the equation: $1 - \left(\frac{L_{min}}{L_{max}} \right)$

where L_{\min} is the minimum luminance and L_{\max} is the maximum luminance measured across the operational display area, or the entire screen depending upon the application.

It shall be possible to select a presentation of alphanumeric data, text, symbols (see 4.5) and other graphical information using a lighter foreground (for instance character, symbol, etc.) against a dark background of high contrast, emitting as little light as possible at night. The brightest elements of the presentation shall be restricted to points and thin lines.

If display equipment is intended to present symbols for charted information (see 4.5.2), it shall provide a means or method for the user to verify that the colour black is visually distinguishable against a background set to dark grey and vice-versa.

NOTE The IHO ECDIS Presentation Library provides "black-adjust" symbols BKAJ1 and BKAJ2, for the colours black and grey, respectively.

4.3.1.2 Methods of test and required results

Set up the display equipment for measurements of luminance, contrast and colour according to the guidelines of IEC 61966-4 or the VESA Flat Panel Display Measurement (FPDM) standard.

NOTE Before measurements are taken, power up the display equipment and allow it to stabilize for the period of time specified by the manufacturer.

- a) Confirm by observation that alphanumeric data, text, symbols and other graphical information are readable from expected user positions and under the ambient light conditions described in Table 1.
- b) Confirm by measurement using a test image with a white square at the centre of the operational display area (to be provided by the manufacturer) that the brightness can be varied from a minimum level of at most 1 cd/m² to a maximum level of at least 85 cd/m², and confirm that the values for brightness used for the setup are stable after the stabilisation period defined by the manufacturer.

NOTE This test image should not be generated internally by the display equipment.

- c) Confirm by observation that alphanumeric data, text, symbols and other graphical information can be presented using a lighter foreground against a dark background.
- d) Confirm by measurement that when the display equipment is set to maximum brightness, the luminance does not vary across the operational display area by more than 30 % from the brightest point to the dimmest point.
- e) Confirm by observation that the brightest elements of the presentation in the night ambient light condition described in Table 1 are points and thin lines.
- f) Where display equipment is intended to present symbols for charted information confirm by observation that the user can verify that the colour black is visually distinguishable against a background set to dark grey, and vice-versa.

4.3.2 Legibility of alphanumeric data and text

4.3.2.1 Requirement

(MSC191/5.2.2) *Alphanumeric data and text shall be presented using a clearly legible non-italic, sans-serif font. The font size shall be appropriate for the viewing distance from user positions (i.e. with respect to reading distance and viewing angles) likely to be experienced on the bridge of a ship.*

The character height in millimetres shall be not less than 3,5 times the nominal viewing distance in metres. The manufacturer's documentation shall identify the nominal viewing distance for the display equipment.

4.3.2.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that alphanumeric data and text is presented using non-italic, sans-serif font;
- b) confirm by measurement that the character height (i.e. the distance between the top and bottom edges of the smallest capital letter used in the presentation) in millimetres is not less than 3,5 times the nominal viewing distance in metres.

4.3.3 Presentation of text

4.3.3.1 Requirement

(MSC191/5.2.3) *Text shall be presented using simple unambiguous language that is easy to understand (for example, standard marine terminology or text that provides clear meaning by its context). Navigational terms and abbreviations shall be presented using the nomenclature set forth in Annex B.*

4.3.3.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that text is presented using simple unambiguous language;
- b) confirm by observation that navigational terms and abbreviations are presented using the nomenclature in Annex B.

4.3.4 Icons

4.3.4.1 Requirement

(MSC191/5.2.4) *When icons are used, their purpose shall be intuitively recognized by appearance, placement, and grouping. (See also ISO 80416-4).*

Icons used for data and control functions shall be presented according to Annex E.

4.3.4.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that icons and their purpose can be intuitively recognized by appearance, placement, and grouping;
- b) confirm by observation that icons used for data and control function are presented according to Annex E.

4.4 Colours and intensity

4.4.1 Discrimination of colours

4.4.1.1 Requirement

(MSC191/5.3.1) *The colours used for the presentation of alphanumeric data, text, symbols and other graphical information shall provide sufficient contrast for discrimination and identification against the background under all ambient light conditions likely to be experienced on the bridge of a ship (for example, day, dusk and night) and with due consideration to the night vision of the officer of the watch.*

(MSC191/5.3.2) *The colours and brightness shall take into account the ambient light conditions of day, dusk and night. The presentation shall support night viewing by showing lighter foreground information on a dark non-reflecting background.*

(MSC191/5.3.3) *The background colour and contrast shall be chosen to allow displayed information to be easily discriminated without degrading the colour coding aspects of the presentation.*

Display equipment may use a range of tones of basic colours, provided they are identifiable and visually distinguishable from each other. Colours used for the presentation of information in the user dialogue areas shall not detract from the presentation of information in the operational display area.

If display equipment is intended to present symbols for charted information, it shall use colours that comply with or are based upon the colours recommended for the IHO ECDIS Presentation Library in IHO S-52 and its Appendices, or an equivalent set of colour tables, as far as practical.

NOTE The "Day" colour table provided in the IHO ECDIS Presentation Library Ed. 3.3 uses a white background that may not support readability under all light conditions and may be a risk to safety of navigation for some navigational systems and equipment, including radar. Readability may be achieved by using the black background in the "Dusk" or "Night" colour tables provided in the IHO ECDIS Presentation Library Ed. 3.3, or the "Day Black Background" colour table provided in the IHO ECDIS Presentation Library Ed. 3.2, and adjusting brightness and contrast, if provided, for use under all light conditions.

4.4.1.2 Methods of test and required results

The person conducting this test shall have passed the minimum colour vision and acuity tests required for users by IMO STCW Code Part B Table B-1/9 and have adapted to night viewing for 10 min before checking the night display.

- a) Confirm by observation that the colours used for the presentation of alphanumeric data, text, symbols and other graphical information provide sufficient contrast for identification and discrimination against the background under the ambient light conditions described in Table 1.
- b) Confirm by observation that the colours used for the presentation of alphanumeric data, text, symbols and other graphical information support night viewing by showing lighter foreground information on a dark non-reflecting background.
- c) Confirm by observation that the colours used for the presentation of alphanumeric data, text, symbols and other graphical information are identifiable and visually distinguishable from each other.
- d) Confirm by observation that the colours used in the user dialogue areas do not detract from the presentation of information in the operational display area.
- e) Where display equipment is intended to present symbols for charted information, confirm by analytical evaluation that the colours used conform to the IHO recommended colours in the IHO ECDIS Presentation Library, or an equivalent, as far as practical (see Clause D.6 for additional guidance).

4.5 Symbols

4.5.1 Operational information

4.5.1.1 Requirement

(MSC191/5.4.1) *Symbols used for the presentation of operational information* other than chart information shall comply with or be based upon the symbols set forth in Annex A.

A symbol shall subtend at least 5 mm/m (17 min of arc) at the nominal viewing distance. Where accurate colour identification of a symbol is required, the symbol shall subtend at least 8,7 mm/m (30 min of arc) at the nominal viewing distance. The use of spectrally extreme blue ($v' < 0,2$) shall be avoided for images subtending less than 35 mm/m (2° of arc) of viewing distance.

4.5.1.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by inspection of documented evidence that the symbols used to present operational information are presented in accordance with Annex A;

- b) confirm by measurement that the largest dimension of the symbol is at least 5 mm/m (17 min of arc) at the nominal viewing distance, and includes at least 16 pixels.
- c) where accurate colour identification is required for a symbol, confirm by measurement that the largest dimension of the symbol is at least 8,7 mm/m (30 min of arc) at the nominal viewing distance, and includes at least 29 pixels.

4.5.2 Electronic chart information

4.5.2.1 Requirement

(MSC191/5.4.2) *Symbols used for the presentation of vector format electronic chart information shall comply with or be based upon the symbols recommended for the IHO ECDIS Presentation Library in IHO S-52 and its Appendices, or an equivalent symbol set, as far as practical.*

NOTE Some symbols provided in the IHO ECDIS Presentation Library may not be suitable for the display of electronic chart information on radar or in a composite presentation based upon radar. IHO S-52 and its Appendices allow minor deviations to symbology. It provides a framework and guidelines for chart symbolization from which manufacturers can derive a customized symbol set.

If symbols that deviate from the IHO ECDIS Presentation Library are used for the presentation of any chart information, then they shall:

- be legible;
- be certain and unambiguous in their meaning;
- be of sufficient size to support the nominal viewing distance (see also 4.3.2);
- have the same general shape as Presentation Library symbols used for the same or similar purpose(s).

Symbols added to the ECDIS Presentation Library shall not be confused with Presentation Library symbols.

4.5.2.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by inspection of documented evidence that the symbols used to present chart information are presented in accordance with IHO S-52 and its Appendices;
- b) where symbols deviate from the ECDIS Presentation Library, confirm by observation that they:
 - 1) are legible;
 - 2) are certain and unambiguous in their meaning;
 - 3) are of sufficient size to support the nominal viewing distance;
 - 4) have the same general shape as Presentation Library symbols used for the same or similar purposes;
- c) confirm by observation that symbols added to the ECDIS Presentation Library cannot be confused with Presentation Library symbols.

4.6 Colour coding of information

4.6.1 Colour coding for discrimination

4.6.1.1 Requirement

(MSC191/5.5.1) *If colour coding is used for discrimination or conspicuousness of alphanumeric text, symbols and other graphical information all colours in each colour table shall clearly differ from one another (see also 4.4.1.).*

4.6.1.2 Methods of test and required results

Confirm by observation that the colours within each colour table clearly differ from one another.

4.6.2 Colour coding of information

4.6.2.1 Requirement

(MSC191/5.5.2) *If colour coding is used, then the colour red shall be used for the coding of alarm related information.*

4.6.2.2 Methods of test and required results

Confirm by inspection of documented evidence that the colour red is used to indicate an alarm condition.

4.6.3 Colour coding in combination with other attributes

4.6.3.1 Requirement

(MSC191/5.5.3). *If colour coding is used it shall be used in combination with other symbol attributes, such as size, shape and orientation.*

A specific implementation shall not rely solely on a single saturated colour. If the display equipment technology relies on the separate transmission of primary colours, the presentation of alarms shall be visible and identifiable even after the failure of any one primary colour input to the display.

4.6.3.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by inspection of documented evidence that the colour coding is always combined with another symbol attribute;
- b) where the display equipment technology relies on the separate transmission of primary colours, confirm by observation that alarms remain identifiable even after transmission of the red primary colour is disabled.

4.6.4 Flashing of information

4.6.4.1 Requirement

(MSC191/5.5.4) *Flashing of information shall be reserved for unacknowledged alarms.*

4.6.4.2 Methods of test and required results

Confirm by observation that flashing of information is only used for unacknowledged alarms.

4.7 Integrity marking

4.7.1 Indication of source, validity and integrity status

4.7.1.1 Requirement

(MSC191/5.6.1) *The source, validity, and where possible, the integrity of information shall be indicated. Invalid information or information with low integrity shall be clearly marked qualitatively and/or quantitatively. Invalid information or information with low integrity may be quantitatively indicated by displaying absolute or percentage values.*

4.7.1.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that the source of information can be indicated;
- b) confirm by observation that the validity of information is indicated;
- c) confirm by observation that the integrity of information is indicated, where available. Where integrity is indicated quantitatively, confirm by observation that either absolute values or percentage values are displayed.

4.7.2 Colour coding of validity and integrity

4.7.2.1 Requirement

(MSC191/5.6.2) If *colour coding is used*, then *information with low or doubtful integrity shall be qualitatively marked by using the colour yellow, and invalid information shall be qualitatively marked by using the colour red.*

4.7.2.2 Methods of test and required results

If colour coding is used, the methods of test and the required results are as follows:

- a) confirm by observation that the colour yellow is used to indicate information with low or doubtful integrity;
- b) confirm by observation that the colour red is used to indicate invalid information.

4.7.3 Indication of presentation failure

4.7.3.1 Requirement

(MSC191/5.6.3) In many cases, information on the display does not change frequently enough to make presentation failure immediately obvious to the user. *In order to show that the screen is being refreshed, a means or method shall be provided to immediately make the user aware of a presentation failure on an operational display (for example, "picture freeze").*

A conspicuous periodically time varying element shall be provided as a prominent indication of normal screen refresh (for example, dynamic display of time, two alternating dots, etc.).

4.7.3.2 Methods of test and required results

Confirm by observation that a conspicuous time-varying indication is provided in all presentation modes.

4.8 Alarms and indications

4.8.1 Operational status

4.8.1.1 Requirement

(MSC191/5.7.1) *The operational status of information shall be indicated as follows:*

Table 2 – Operational status

Status	Visual Indication	Audible Signal
<i>Alarm, not acknowledged</i>	<i>Red, Flashing</i>	<i>Accompanied by an audible signal</i>
<i>Alarm, acknowledged</i>	<i>Red</i>	<i>Suppression of audible signal</i>
<i>Invalid Information</i>	<i>Red</i>	<i>Silent</i>
<i>Information with low integrity</i>	<i>Yellow</i>	<i>Silent</i>
<i>Important Indications (Warnings)</i>	<i>Yellow</i>	<i>Silent (unless otherwise specified)</i>

<i>Status</i>	<i>Visual Indication</i>	<i>Audible Signal</i>
<i>Normal State</i>	<i>Optionally Green</i>	<i>Silent</i>

4.8.1.2 Method of test and required results

Confirm by inspection of documented evidence that alarms and indications are presented in accordance with Table 2.

4.8.2 List of alarms

4.8.2.1 Requirement

(MSC191/5.7.2) *A list of alarms shall be provided based on the sequence of occurrence. Additional indication of priority, as set by the user, shall be provided on displays that present alarms from multiple sources. Alarms that have been acknowledged and are no longer relevant shall be deleted from the list of alarms, but may be retained in an alarm history list.*

4.8.2.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that the display equipment provides a sequential list of alarms;
- b) where display equipment supports the presentation of alarms from multiple sources (for example, from multiple navigational systems and equipment)
 - 1) confirm by observation that the user can set a priority for the alarms;
 - 2) confirm by observation that an indication of priority is included in the list of alarms;
- c) confirm by analytical evaluation that acknowledged alarms which are no longer relevant are deleted from the list of alarms.

4.8.3 Alarm related information from multiple sources

4.8.3.1 Requirement

(MSC191/5.7.3) *If a single display is used to present alarm related information from multiple navigational systems and equipment, then the presentation of alarms and indications shall be consistent for the display of:*

- *the time of alarm occurrence,*
- *the cause of the alarm,*
- *the source of the alarm, and*
- *the status of the alarm (for example, acknowledged, not acknowledged).*

4.8.3.2 Methods of test and required results

Where display equipment supports the presentation of alarms and indications from multiple navigational systems and equipment, confirm by observation that the presentation of alarm related information is consistent with respect to the time of alarm occurrence, the cause of the alarm, the source of the alarm, and the status of the alarm.

4.9 Presentation mode

4.9.1 Indication of presentation mode in use

4.9.1.1 Requirement

(MSC191/5.8) *If displays are capable of presenting information in different modes, then there shall be a clear indication of the modes in use, for example:*

- *orientation* (north-up, course-up, head-up);
- *stabilisation* (ground-stabilised, sea-stabilised);
- *motion* (true, relative); and
- *chart projection* (Mercator, polyconic, etc.).

NOTE The indication of chart projection is only required when electronic chart information is presented. It may be provided to the user on request.

4.9.1.2 Methods of test and required results

Confirm by observation that the presentation modes in use are clearly indicated.

4.10 Manuals

4.10.1 User manuals, instructions and reference guides

4.10.1.1 Requirement

(MSC191/5.9) *The user manual and instructions and reference guides shall be available in the English language at least. The user manual or reference guide shall include a list of all terms, abbreviations, symbols, icons and their explanations presented by the system or equipment. (See also Annexes A, B and E.)*

4.10.1.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that user manual, instructions and reference guide are available in the English language;
- b) confirm by inspection of documented evidence that the user manual and/or reference guide includes a list of all terms, abbreviations, symbols, icons and their explanations used by the system.

5 Presentation of operational information

The provisions of this clause are applicable to displays on the bridge of a ship that present operational information including, electronic chart information, radar information and target information.

NOTE See IEC 62388 for equivalent tests for this clause for radar equipment.

5.1 Presentation of own ship information

5.1.1 Graphical representation of own ship

5.1.1.1 Requirement

(MSC191/6.1.1) *When a graphical representation of own ship is provided, it shall be possible for the user to select either a true scaled ship's outline or a simplified symbol as set forth in Annex A. The size of the ship's true scaled outline or the simplified symbol in the graphical presentation shall be the true scale size of the ship or 6 mm, at a nominal viewing distance of 1 m, whichever is greater.*

NOTE The manufacturer should adjust the symbol sizes to properly account for the nominal viewing distance of the display equipment.

Display equipment may (unless stipulated as mandatory in an equipment standard) provide the capability to automatically switch from the ship's true scaled outline to the simplified symbol when the beam of own ship's true scale outline is less than 6 mm, and vice versa. The

user shall always have the capability to select the simplified symbol in lieu of the scaled ship's outline.

(MSC191/6.1.2) *A heading line, and where appropriate a velocity vector, shall be associated with own ship symbol and shall originate at the position of the consistent common reference point (CCRP) as set forth in Annex A.*

The combination of the heading line and beam line (the minimised symbol) may be used as an alternative to the simplified symbol and may be selectable as such. Display equipment may provide the capability to automatically switch from the ship's true scaled outline to the heading and beam line when the beam of own ship's true scale outline is less than 6 mm, and vice versa.

5.1.1.2 Methods of test and required results

Where display equipment provides a graphical representation of own ship:

- a) confirm by observation that the system provides a ship's true scaled outline and a simplified symbol in accordance with Annex A;
- b) confirm by observation that the display equipment provides the user with the capability to select the representation of own ship as either the ship's true scaled outline or the simplified symbol;
- c) confirm by measurement that the size of the ship's outline is correct for the scale of the display;
- d) confirm by observation that the simplified symbol is automatically selected when the beam of the ship's true scaled outline is less than the diameter of the simplified symbol, and vice versa;
- e) confirm by observation that the display equipment provides a heading line in accordance with Annex A;
- f) confirm by observation that the display equipment provides a velocity vector in accordance with Annex A.

NOTE The minimised symbol may be used as alternative to the simplified symbol.

5.2 Presentation of chart information

5.2.1 Alteration of chart information

5.2.1.1 Requirement

(MSC232/4.3) *It shall not be possible to alter the electronic chart information, except by update.*

5.2.1.2 Methods of test and required results

Confirm by observation that it is not possible to alter the electronic chart information.

5.2.2 Colours and symbols for charted information

5.2.2.1 Requirement

(MSC191/6.2.1) *The presentation of official electronic chart information that is issued by, or on the authority of a government authorized hydrographic office, or other relevant government institution or agency (for example, ENC), shall comply with or be based upon the colours and symbols recommended for the IHO ECDIS Presentation Library in IHO S-52 and its Appendices, or an equivalent colour and symbol set, as far as is practicable.*

(MSC191/6.2.2) *The presentation of unofficial proprietary electronic chart information shall comply with or be based upon the colours and symbols recommended for the IHO ECDIS*

Presentation Library in IHO S-52 and its Appendices, or an equivalent colour and symbol set, *as far as practical*. There shall be a clear indication when the presentation is not in accordance with IHO standards.

(MSC191/6.2.3) *The presentation of user-added electronic chart information shall comply with or be based upon the colours and symbols recommended for the IHO ECDIS Presentation Library in IHO S-52 and its Appendices, or an equivalent colour and symbol set, as far as practical.*

NOTE Some colours and symbols provided in the IHO ECDIS Presentation Library or otherwise recommended by IHO in S-52 and its Appendices may not be suitable for the display of electronic chart information on radar or in a composite presentation based upon radar. IHO S-52 and its Appendices allow minor deviations to symbology. It provides a framework and guidelines for chart symbolization from which manufacturers can derive a customized symbol set.

(MSC191/6.2.4) *If electronic chart information derived from different scales appears in the presentation, the scale boundary shall be clearly indicated.* (See also IHO S-52 Appendix 2 3.2.3 (8a).)

5.2.2.2 Methods of test and required results

The methods of test and the required results are as follows.

- a) verify the presentation of official, proprietary and user-added electronic chart information, as applicable, in accordance with 4.4.1 and 4.5.2. Where the presentation of proprietary electronic chart information is not in accordance with IHO S-52 and its Appendices (i.e. 4.5.2), confirm by observation that an indication is provided;
- b) display electronic chart information derived from different scales (for example, adjacent ENC cells). Confirm by observation that a scale boundary is presented between the scales.

5.3 Presentation of radar information

5.3.1 Radar video images

5.3.1.1 Requirement

(MSC191/6.3.1) *Radar video images shall be displayed by using a basic colour that provides optimum contrast. Radar echoes shall be clearly visible when presented on top of a chart background. The relative strength of radar echoes may be differentiated by tones of the same basic colour. The colours may be different for operation under different ambient light conditions (day, dusk and night) likely to be experienced on the bridge of a ship, and with due consideration to the night vision of the officer of the watch.*

Additional processed radar information that is not a part of the radar video image may be discriminated from the radar video by tones of the basic colour used to present the image. Alternatively, it may be differentiated by tones of other basic colours.

For radar displays a dark non-reflecting background shall be used. The colour used for the radar image shall provide contrast against the background and shall be clearly visible when presented over a chart background.

NOTE The colour tables recommended by IHO and provided in IHO ECDIS Presentation Library Ed. 3.3 include a "Day" table based on a white background that may not support readability under daylight conditions and may be a risk to safety of navigation for some navigational systems and equipment, including radar. Readability under daylight conditions may be achieved by using the black background in the "Dusk" or "Night" colour tables provided in IHO ECDIS Presentation Library Ed. 3.3 and adjusting brightness and contrast, if provided, or by using the "Day Black Background" colour table provided in IHO ECDIS Presentation Library Ed. 3.2.

If the colour red is used for the radar video image, then it shall be distinguishable from other uses of the colour red, for example, alarms including dangerous targets.

If electronic chart information overlays radar information (i.e. a radar video image), or a radar image overlays chart information, then the overlay may be displayed as transparent or opaque. If a transparent overlay is used, then it may be variable so that the underlying information is visible through the overlay. If an opaque chart overlay is used, then the colour fill of area objects shall be excluded. Optionally, the colour fill of point objects may also be excluded. In either case, the background of the radar image shall be the same basic colour as the chart's water surfaces.

NOTE If display equipment provides facilities for the overlay of radar information that are independent of a shipborne radar system (for example, by a separate radar scan converter), then the facilities should comply with the relevant clauses of IEC 62388.

5.3.1.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that radar information is presented using a contrasting colour against the background for the ambient light conditions described in Table 1;

NOTE For radar displays it should be a dark background.

- b) confirm by observation that radar information is clearly visible when presented on top of a chart background for the ambient light conditions described in Table 1.

5.3.2 Target trails

5.3.2.1 Requirement

(MSC191/6.3.2) If display equipment provides *target trails*, then they shall be *distinguishable from radar echoes and clearly visible under all ambient light conditions* (day, dusk and night) likely to be experienced on the bridge of a ship, and with due consideration to the night vision of the officer of the watch. Target trails may be differentiated by tones of the basic colour used for the radar video image. Alternatively, they may be distinguished by tones of another basic colour.

(MSC192/5.23.1) If display equipment provides target trails, then they shall be *variable length* (i.e. adjustable by *time*) *with an indication of trail time and motion stabilisation mode*. An automatic adjustment of time may be provided. *It shall be possible to select true or relative trails for all azimuth-stabilised true motion and relative motion display modes*.

NOTE IEC 62388 requires that trails are scaled so that target trails are maintained following a change in range scale or a change/reset of centring position.

5.3.2.2 Methods of test and required results

Where target trails are provided:

- a) confirm by observation that they are distinguishable from radar echoes and clearly visible under the ambient light conditions described in Table 1;
- b) confirm by observation that they are variable in length and adjustable by time;
- c) confirm by observation that the display equipment provides the user with the capability to elect either true or relative trails from any motion-stabilised presentation mode;
- d) confirm by observation that trails are distinguishable from the radar video image.

5.4 Presentation of target information

5.4.1 Providing target information

5.4.1.1 Requirement

(MSC191/6.4.1.1) *Target information may be provided by a radar target tracking system and/or by the AIS.*

A radar target tracking system shall detect and track radar targets. An INS may track radar targets when a radar target tracking system is an integrated component of the INS. Other navigational systems may provide remote presentation of tracked radar targets. These systems shall process all tracked radar targets reported across their interface(s) and shall present reported radar targets in accordance with Annex A and Table 3.

NOTE If display equipment provides facilities for radar target detection and tracking that are independent of a shipborne radar system, then the facilities should comply with the relevant clauses of IEC 62388.

Table 3 (derived from IEC 62388) defines the minimum number of tracked radar targets required to be displayed based upon the size of the operational display area (see 7.3.1).

Table 3 – Minimum number of tracked radar targets to be displayed

Operational display area dimensions (diameter or square)		
< 250 mm	≥ 250 mm	≥ 320 mm
20	30	40

Any navigational system or equipment may provide remote presentation of reported AIS targets. These systems shall process all AIS targets reported across their interface(s) and shall present reported AIS targets in accordance with Annex A and Table 4.

Table 4 (derived from IEC 62388) defines the minimum number of reported AIS targets required to be displayed based upon the size of the operational display area (see 7.3.1).

Table 4 – Minimum number of AIS targets to be displayed

	Operational display area dimensions (diameter or square)		
	< 250 mm	≥ 250 mm	≥ 320 mm
Activated AIS targets	20	30	40
Sleeping AIS targets	100	150	200

NOTE The filter process used to limit the number of displayed targets should ensure that priority is given to displaying targets that have an impact on the safety of own ship.

5.4.1.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) where display equipment provides the capability to connect to a radar target tracking system, confirm by measurement that it can present the number of tracked radar targets required in Table 3;
- b) where display equipment provides the capability to connect to an AIS:
 - 1) confirm by measurement that it can process all of the AIS targets reported across its interface(s);
 - 2) confirm by measurement, that it can present the number of reported AIS targets required in Table 4.

5.4.2 Consistent user interface for target information

5.4.2.1 Requirement

(MSC191/6.4.1.3) *As far as practical, the user interface and data format for operating and presenting tracked radar target information and reported AIS target information shall be consistent.*

5.4.2.2 Methods of test and required results

Confirm by observation that the presentation of tracked radar target information and reported AIS target information is consistent.

5.4.3 Indication of exceeding target capacity

5.4.3.1 Requirement

(MSC191/6.4.2.1) *There shall be an indication when the target tracking and/or reported target processing/display capacity is about to be exceeded.*

(MSC191/6.4.2.2) *There shall be an indication when the target tracking and/or reported target processing/display capacity have been exceeded.*

5.4.3.2 Methods of test and required results

There are two methods of test depending on the capability of the equipment:

- a) Where display equipment provides the capability to connect to a radar target tracking system:
 - 1) confirm by measurement that it provides an indication that the tracked radar target display capacity is about to be exceeded, for example, when the number of tracked radar targets presented exceeds 95 % of the display capacity;
 - 2) confirm by measurement that it provides an indication that the tracked radar target display capacity has been exceeded when the number of tracked radar targets presented exceeds 100 % of the display capacity.
- b) Where display equipment provides the capability to connect to an AIS:
 - 1) confirm by measurement that it provides an indication that the reported AIS target display capacity is about to be exceeded, for example, when the number of reported AIS targets presented exceeds 95 % of the display capacity;
 - 2) confirm by measurement that it provides an indication that the reported AIS target display capacity has been exceeded when the number of reported AIS targets presented exceeds 100 % of the display capacity.

5.4.4 Filtering sleeping AIS targets

5.4.4.1 Requirement

(MSC191/6.4.3.1) *It shall be possible to filter the presentation of sleeping AIS targets (for example, by target range, CPA/TCPA or AIS target class A/B, etc.).*

NOTE If display equipment provides facilities for the calculation of CPA/TCPA that are independent of a shipborne radar target tracking system, then the facilities should comply with the relevant clauses of IEC 62388.

(MSC191/6.4.3.2) *If a filter is applied, then there shall be a clear and permanent or persistent indication, as appropriate for the application. The filter criteria in use shall be readily available to the user.*

(MSC191/6.4.3.3) *It shall not be possible to remove individual AIS targets from the presentation.*

5.4.4.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that the user can filter the presentation of sleeping AIS targets;
- b) confirm by observation that an indication is provided when sleeping targets are filtered from the presentation;

- c) confirm by observation that the indication remains while the filter is active;
- d) confirm by observation that the filter criteria in use is readily available;
- e) confirm by observation that the user cannot remove individual AIS targets from the presentation.

5.4.5 Activation of AIS targets

5.4.5.1 Requirement

(MSC191/6.4.4.1) *If zones for the automatic activation of AIS targets are provided, they shall be the same as for automatic radar target acquisition, if available. Any user defined zones (for example, acquisition/activation zones) in use shall be presented in graphical form with their relevant symbols set forth in Annex A.*

(MSC191/6.4.4.2) *In addition, sleeping AIS targets shall be automatically activated when they meet user defined parameters (for example, target range, activation zones, CPA/TCPA or AIS target class A/B).*

NOTE If display equipment provides facilities for the calculation of CPA/TCPA that are independent of a shipborne radar target tracking system, then the facilities should comply with the relevant clauses of IEC 62388.

5.4.5.2 Methods of test and required results

Where display equipment provides zones for the automatic activation of AIS targets:

- a) confirm by observation that the zones are the same as for automatic radar target acquisition, if provided;
- b) confirm by observation that the zones are presented in accordance with Annex A;
- c) confirm by observation that sleeping AIS targets entering a zone are activated;
- d) confirm by observation that sleeping AIS targets are automatically activated when they meet user defined criteria.

5.4.6 Graphical presentation of targets

5.4.6.1 Requirement

(MSC191/6.4.5.1) *Targets shall be presented with their relevant symbols as set forth in Annex A.*

(MSC191/6.4.5.2) *Reported AIS targets shall be graphically presented either as sleeping or activated.*

(MSC191/6.4.5.3) *The course and speed of a tracked radar target or an activated reported AIS target shall be indicated by a vector that clearly shows the predicted motion. The vector time (i.e. length) shall be consistent for presentation of any target regardless of its source.*

(MSC191/6.4.5.4) *The presentation of vector symbols shall be consistent irrespective of the source of information. The presentation mode shall be clearly and permanently or persistently indicated, as appropriate for the application, including for example,*

- *True/Relative motion,*
- *vector time, and*
- *stabilisation.*

(MSC191/6.4.5.5) *The orientation of the AIS target symbol shall indicate its heading. If the heading information is not received, the orientation of the AIS symbol shall be aligned to the reported course over ground (COG). If available, the turn or rate of turn (ROT) indicator and/or the path prediction shall indicate the manoeuvre of an activated AIS target.*

(MSC191/6.4.5.6) Own ship's CCRP shall be used for alignment of tracked radar target symbols and reported AIS target symbols with other information on the same display.

(MSC191/6.4.5.7) On large scale, low range displays, a means or method to present a true scale outline of an activated AIS target shall be provided in accordance with Annex A.

(MSC191/6.4.5.8) It shall be possible to display the past positions of activated AIS targets.

5.4.6.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that targets are presented with their relevant symbols according to Annex A;
- b) confirm by observation that reported AIS targets are graphically presented as sleeping or activated targets in accordance with Annex A;
- c) confirm by observation that the predicted motion of tracked radar targets and activated reported AIS targets is clearly indicated by a vector;
- d) confirm by observation that the vector time (i.e. length) is consistent for all targets;
- e) confirm by observation that the presentation of vector symbols are consistent irrespective of the source of information;
- f) verify that the presentation mode is clearly indicated in accordance with 4.9.1;
- g) confirm by observation that the vector time is clearly indicated;
- h) confirm by observation that the orientation of the AIS target symbol clearly indicates its heading. Change the heading information to 'not available' for one reported AIS target and confirm by observation that the orientation of the AIS symbol is aligning to the reported COG;
- i) confirm by observation that the turn or rate of turn (ROT) flag and/or the path prediction indicates the manoeuvre of an activated AIS target changing course;
- j) confirm by analytical evaluation that own ship's CCRP is used to align tracked radar target symbols and reported AIS target symbols with other information on the same display;
- k) confirm by observation that on large scale, low range displays, a means or method to present a true scaled outline of an activated AIS target is provided;
- l) confirm that it is possible to display the past positions of activated AIS targets.

5.4.7 Target selection

5.4.7.1 Requirement

(MSC191/6.4.6.1) A target selected for the display of its alphanumeric information shall be identified by the relevant symbol set forth in Annex A. If more than one target is selected for data display, the symbols and the corresponding target data shall be clearly identified.

5.4.7.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that a selected target is identified in accordance with Annex A;
- b) confirm by observation that if more than one target is selected, the symbols and corresponding target information is clearly identified in accordance with Annex A.

5.4.8 Indication of target derivation

5.4.8.1 Requirement

(MSC191/6.4.6.2) *There shall be a clear indication to show that target information is derived from radar or AIS or from a combination of these.*

5.4.8.2 Methods of test and required results

Confirm by observation that there is a clear indication of the source of target information.

5.4.9 Presentation of tracked radar target information

5.4.9.1 Requirement

(MSC191/6.4.6.3) *For each selected tracked radar target the following information shall be presented in alphanumeric form:*

- *source(s) of target information,*
- *measured range of target,*
- *measured bearing of target,*
- *predicted target range at the closest point of approach (CPA),*
- *predicted time to CPA (TCPA),*
- *calculated CTW of target (or calculated COG if ground stabilised),*
- *calculated STW of target (or calculated SOG if ground stabilised).*

Additional target information, where available, shall be provided to the user on request.

If multiple targets are selected, a subset of alphanumeric data, information and text may be presented.

Target information shall be logically "paired" for presentation (i.e. range and bearing, CPA and TCPA, course and speed).

NOTE If display equipment provides facilities for the calculation of CPA/TCPA that are independent of a shipborne radar target tracking system, then the facilities should comply with the relevant clauses of IEC 62388.

5.4.9.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that the information listed above is presented in alphanumeric form for each selected target;
- b) confirm by observation that additional information, where available, is provided to the user on request;
- c) confirm by analytical evaluation that the target information is logically "paired" for presentation.

5.4.10 Presentation of reported AIS target information

5.4.10.1 Requirement

(MSC191/6.4.6.4) *For each selected reported AIS target, the following information shall be presented in alphanumeric form:*

- *source(s) of target information;*
- *target identification (for example, MMSI, call sign, ship's name, etc.);*

- reported *position and* where available *its quality*;
- calculated *range* of target;
- calculated *bearing* of target;
- calculated *CPA*;
- calculated *TCPA*;
- reported *COG* (or calculated course of target if the sea is stabilised);
- reported *SOG* (or calculated speed of target if the sea is stabilised);
- reported *navigational status*.

Target *heading and* reported *rate of turn (ROT)* shall *also be made available*. *Additional target information*, where available, shall *be provided* to the user *on request*.

If multiple targets are selected, a subset of alphanumeric data, information and text may be presented.

Target information shall be logically "paired" for presentation (i.e. range and bearing, CPA and TCPA, COG and SOG, heading and ROT).

(MSC191/6.4.6.5) *If the received AIS target information is incomplete, then the absent information shall be clearly indicated in the target data field as missing.*

NOTE If display equipment provides facilities for the calculation of CPA/TCPA that are independent of a shipborne radar target tracking system, then the facilities should comply with the relevant clauses of IEC 62388.

5.4.10.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that the information listed above is presented in alphanumeric form;
- b) confirm by observation that additional information, where available, is provided to the user on request;
- c) confirm by analytical evaluation that the target information is logically "paired" for presentation;
- d) confirm by observation, that there is a clear indication of absent information in the target data field.

5.4.11 Continual update of target information

5.4.11.1 Requirement

(MSC191/6.4.6.6) *The information for a selected target shall be displayed and continually updated, until another target is selected for information display or, if applicable, until the user dialogue area is closed.*

5.4.11.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that information displayed for a selected target is continually updated;
- b) confirm by observation that the information displayed for a selected target remains displayed until another target is selected or the user dialogue is closed.

5.4.12 Own ship's AIS information

5.4.12.1 Requirement

(MSC191/6.4.6.7) *A means or method shall be provided to present own ship AIS data on request.*

5.4.12.2 Methods of test and required results

Confirm by observation that it is possible to present own ship's AIS data on request.

5.4.13 Obscuring the operational display area

5.4.13.1 Requirement

(MSC191/6.4.6.8) *The display of alphanumeric data, information and text shall not obscure graphically presented operational information.*

5.4.13.2 Methods of test and required results

Confirm by observation that the display of alphanumeric data, information and text does not obscure graphically presented operational information.

5.5 Operational alarms

5.5.1 Alarm status

5.5.1.1 Requirement

(MSC191/6.4.7.1) *A clear indication of the status of the alarms and the alarm criteria shall be readily available to the user. (See also 4.8.1 and 4.8.3.)*

5.5.1.2 Methods of test and required results

Confirm by observation that an indication of the status of alarms and the alarm criteria is readily available to the user.

5.5.2 CPA/TCPA alarms

5.5.2.1 Requirement

(MSC191/6.4.7.2) *A CPA/TCPA alarm of a tracked radar or activated AIS target shall be clearly indicated and the target shall be clearly marked by a dangerous target symbol as set forth in Annex A.*

NOTE If display equipment provides facilities for the calculation of CPA/TCPA that are independent of a shipborne radar target tracking system, then the facilities should comply with the relevant clauses of IEC 62388.

5.5.2.2 Methods of test and required results

Confirm by observation that dangerous targets are presented in accordance with Annex A.

5.5.3 Acquisition/activation zones

5.5.3.1 Requirement

(MSC191/6.4.7.3) *If a user defined acquisition/activation zone facility is provided, a target entering or within the zone shall be clearly identified with the relevant symbol set forth in Annex A and for tracked radar targets an alarm shall be given. The zone shall be identified with the relevant symbology set forth in Annex A, and shall be applicable to both tracked radar and reported AIS targets.*

A radar target tracking system shall control radar target acquisition zones. The target tracking system shall provide all alarms and indications associated with target detection and tracking including entry into or detection within an acquisition area. Other navigational systems and equipment may provide acquisition zone alarms and indications only if they provide a radar target tracking function complying to IEC 62388.

Other navigational systems and equipment that provide remote presentation of tracked radar targets shall not provide alarms and indications associated with acquisition zones.

Any navigational system or equipment may provide remote presentation of reported AIS targets. These systems shall provide their own AIS activation zone facilities.

NOTE If display equipment provides facilities for acquisition zones for the detection of radar targets that are independent of a shipborne radar target tracking system, then the facilities should comply with the relevant clauses of IEC 62388.

5.5.3.2 Methods of test and required results

Where display equipment provides zones for automatic acquisition/activation:

- a) verify that the zones are presented with their relevant symbology in accordance with 5.4.5;
- b) confirm by observation that detected radar targets entering or within a zone are acquired;

NOTE The acquisition status of tracked radar targets is reported by the radar target tracking system, for example, in accordance with the IEC 61162 series standards.

- c) confirm by observation that radar targets in acquisition state are presented in accordance with Annex A;
- d) verify that the zones apply to both radar targets and reported AIS targets in accordance with 5.4.5.

5.5.4 Lost target alarms

5.5.4.1 Requirement

(MSC191/6.4.7.4) *The last reported/predicted position of a lost target shall be clearly marked by a lost target symbol on the display as set forth in Annex A, and the lost target alarm shall be given if the lost target alarm function is enabled. The lost target symbol shall disappear if the signal (or message) for the target is received again or after the alarm has been acknowledged. A means or method shall be provided for the user to enable/disable the lost target alarm function. There shall be a clear indication whether the lost target alarm function for tracked radar targets and activated AIS targets is enabled or disabled. If a target is beyond a user defined range, then no alarm shall be generated.*

5.5.4.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that when a tracked radar target or reported AIS target is lost, an alarm is given and the last reported/predicted position is clearly marked by the lost target symbol in accordance with Annex A;
- b) confirm by observation that the lost target symbol disappears if the signal for the target is received again or after the lost target alarm has been acknowledged;
- c) confirm by observation that a means or method is provided to enable/disable the lost target alarm function;
- d) confirm by observation that there is a clear indication of whether the lost target alarm function for tracked radar targets and activated AIS targets is enabled or disabled;
- e) confirm by observation that no alarm is generated for a lost target that is beyond the user defined range.

5.6 AIS and radar target association

5.6.1 Target association

5.6.1.1 Requirement

(MSC191/6.4.8.1) *If target information from AIS and radar tracking are both available and where the AIS and radar information are considered as one target, then as a default condition, the activated AIS target symbol and the alphanumeric AIS target information shall be automatically selected and displayed as set forth in Annex A. The user shall have the option to change the default condition to the display of tracked radar targets and shall be permitted to select either radar tracking or AIS alphanumeric information.*

A radar target tracking system shall provide the capability to automatically associate reported AIS targets with tracked radar targets. If the radar target tracking system distributes tracked radar target data that identifies associated targets including the MMSI for the associated AIS target, then other navigational systems and equipment displaying these targets may display them as a single target according to Annex A. Where these systems and equipment also receive reported targets directly from AIS, they shall filter the display of the reported AIS targets using the MMSI to avoid duplicated targets. The AIS target data may be filtered and redistributed to other systems using the IEC 61162-1 sentences TTD or TTM. The associated MMSI should be included in the accompanying TLB sentence.

(MSC191/6.4.8.2) *Where the AIS and radar information are considered as two distinct targets, one activated AIS target symbol and one tracked radar target symbol shall be displayed as set forth in Annex A. No alarm shall be raised.*

NOTE If display equipment provides facilities for the automatic association of reported AIS targets with tracked radar targets that are independent of a shipborne radar target tracking system, then the facilities should comply with the relevant clauses of IEC 62388.

5.6.1.2 Methods of test and required results

Where display equipment provides the capability to automatically associate reported AIS targets with tracked radar targets:

- a) confirm by observation that a reported AIS target associated with a tracked radar target is presented in accordance with Annex A:
 - 1) as an activated AIS target, the default condition,
 - 2) as a tracked radar target, based upon user-selection as the default condition;
- b) confirm by observation that the user can select either AIS or radar tracking information;
- c) where the equipment also receives reported targets directly from an AIS, confirm by observation that it filters the display of reported AIS targets to avoid duplicated targets.

5.6.2 AIS presentation status

5.6.2.1 Requirement

(MSC191/6.4.9) *The AIS presentation status shall be indicated as follows:*

Table 5 – AIS status

<i>Function</i>	<i>Cases to be Presented</i>		<i>Presentation</i>
AIS ON / OFF	<i>AIS processing switched ON / graphical presentation switched OFF</i>	<i>AIS processing switched ON / graphical presentation switched ON</i>	Alphanumeric or graphical
Filtering of sleeping AIS targets (See 5.4.4.)	Indicate whether the <i>filter status</i> for sleeping AIS targets is switched ON	Indicate whether the <i>filter status</i> for sleeping AIS targets is switched ON	Indications may be <i>alphanumeric or graphical</i>

<i>Function</i>	<i>Cases to be Presented</i>		<i>Presentation</i>
AIS ON / OFF	<i>AIS processing switched ON / graphical presentation switched OFF</i>	<i>AIS processing switched ON / graphical presentation switched ON</i>	<i>Alphanumeric or graphical</i>
<i>Activation of targets (See 5.4.5)</i>		Indicate the <i>activation criteria</i> is for AIS targets, including automatic activation zones	Indications shall be <i>graphical</i>
<i>CPA/TCPA alarm (See 5.5.2)</i>	Indicate whether the CPA/TCPA Alarm <i>function</i> is switched ON/OFF Indicate the <i>CPA/TCPA Criteria</i> Indicate whether <i>Sleeping AIS targets</i> are <i>included</i> or <i>excluded</i> from CPA/TCPA processing	Indicate whether the CPA/TCPA Alarm <i>function</i> is switched ON/OFF Indicate the <i>CPA/TCPA Criteria</i> Indicate whether <i>Sleeping AIS targets</i> are <i>included</i> or <i>excluded</i> from CPA/TCPA processing	Indications shall be <i>alphanumeric and graphical</i>
<i>Lost target alarm (See 5.5.4)</i>	Indicate whether the Lost Target Alarm <i>function</i> is switched ON/OFF Indicate the <i>Lost target Filter Criteria</i>	Indicate whether the Lost Target Alarm <i>function</i> is switched ON/OFF Indicate the <i>Lost target Filter Criteria</i>	Indications shall be <i>alphanumeric and graphical</i>
<i>Target association (See 5.6.1)</i>	Indicate whether the Target Association <i>function</i> is switched ON/OFF Indicate the <i>Association Criteria</i> Indicate the <i>Default Target Priority</i>	Indicate whether the Target Association <i>function</i> is switched ON/OFF Indicate the <i>Association Criteria</i> Indicate the <i>Default Target Priority</i>	Indications shall be <i>Alphanumeric</i>

NOTE Table 5 is a simplified matrix for the presentation of indications associated with AIS functions.

5.6.2.2 Methods of test and required results

The methods of test and the required results are as follows:

- verify the filtering of sleeping AIS targets in accordance with 5.4.4;
- verify the activation of AIS targets in accordance with 5.4.5;
- verify CPA/TCPA alarm functionality in accordance with 5.5.2;
- verify lost target alarm functionality in accordance with 5.5.4;
- verify the association of AIS targets to tracked radar targets in accordance with 5.6.1.

5.6.3 Trial manoeuvre

5.6.3.1 Requirement

(MSC191/6.4.10) A *trial manoeuvre simulation* shall be clearly identified by the relevant *symbol* set forth in Annex A, *positioned* in a conspicuous location within the operational display area, for example, nominally centred at the bottom of the presentation area or *astern of own ship* symbol.

NOTE If display equipment provides facilities for trial manoeuvre that are independent of a shipborne radar target tracking system, then the facilities should comply with the relevant clauses of IEC 62388.

5.6.3.2 Methods of test and required results

Where display equipment provides a trial manoeuvre simulation:

- confirm by observation that the manoeuvre is identified in accordance with Annex A;
- confirm that the symbol is positioned in a conspicuous location.

5.7 Measurement

5.7.1 Measurement from own ship

5.7.1.1 Requirement

(MSC192/5.9.1) *Measurements from own ship (for example, range rings, range and bearing, cursor, tracking data) shall be made with respect to the CCRP (for example, conning position). Facilities shall be provided to compensate for the offset between sensor antenna positions and the CCRP on installation. Where multiple sensor antennas are installed, there shall be provision for applying different position offsets for each antenna. The offsets shall be applied automatically when the sensor is selected.*

5.7.1.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that measurements from own ship are referenced to the CCRP;
- b) confirm by observation that facilities are provided to compensate for the offset between antenna positions;
- c) confirm by observation that provision is made for applying different offsets to each antenna. Confirm by observation that these offsets are automatically applied when the sensor is selected;

5.7.2 Bearing and range measurements

5.7.2.1 Requirement

(MSC232/12.2) *Bearings and distances (ranges) drawn on the display, or bearing and range measurements between features already drawn on the display, shall have an accuracy no less than that afforded by the scale and resolution of the display.*

(MSC192/5.9.4) *Range measurements shall be in nautical miles. In addition, facilities for metric measurements may be provided. All indicated values for range measurement shall be consistent and unambiguous.*

5.7.2.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by analytical evaluation that bearings and distances are measured to an accuracy consistent with the scale and resolution of the display;
- b) confirm by observation that distances can be measured in nautical miles;
- c) confirm by observation that the units used for range measurements and range scales are consistent within the system;
- d) confirm by observation that an indication of the units used for measurement is provided.

5.8 Navigation tools

This subclause addresses user tools that are common to navigational systems and equipment. Requirements for the provision of these tools are addressed in the relevant individual performance standards. When provided, these tools shall be presented with their relevant symbol(s) as set forth in Annex A.

5.8.1 Range rings

5.8.1.1 Requirement

(MSC192/5.11.1) *An appropriate number of equally spaced range rings shall be provided for the range scale selected. When displayed, the range ring scale (separation) shall be indicated.*

Range rings shall be spaced to logically separate the range scale into equal divisions. Typically from two to six range rings would be provided for nautical mile range scale units, and up to five rings for metric range scale units.

(MSC192/5.11.2) *The system accuracy of range rings shall be within 1 % of the maximum range of the range scale in use or 30 m, whichever is the greater distance.*

Range rings shall always be centred at the CCRP.

A means or method shall be provided to enable and disable the set of range rings. (See also 6.1.4.)

5.8.1.2 Methods of test and required results

Where range rings are provided:

- a) confirm by observation that range rings are presented in accordance with Annex A;
- b) confirm by observation that the range ring separation is indicated;
- c) confirm by analytical evaluation that the range ring spacing logically separates each range scale into equal divisions;
- d) confirm by measurement that the accuracy of the range rings is within ± 1 % of the range scale in use or 30 m, whichever is greater;
- e) confirm by observation that the range rings are always centred at the CCRP;
- f) confirm by observation that a means or method is provided to enable and disable the set of range rings.

5.8.2 Variable range marker (VRM)

5.8.2.1 Requirement

(MSC192/5.12.1) *Each active VRM shall have a numerical readout and the readout shall have a resolution compatible with the range scale in use.*

(MSC192/5.12.2) *The VRM shall enable the user to measure the range of an object within the operational display area with a maximum system error of 1 % of the range scale in use or 30 m, whichever is the greater distance.*

It shall be possible to use the VRM to measure the range to any object in the operational display area within 5 s.

A means or method shall be provided to enable and disable each VRM.

The range of the VRM set by the user shall be retained while the VRM is enabled (for example, after a change in range scale).

5.8.2.2 Methods of test and required results

Where a VRM is provided:

- a) confirm by observation that each VRM is presented in accordance with Annex A;

- b) confirm by observation that a numerical readout is available for each active VRM;
- c) confirm by analytical evaluation that the resolution of the readout is compatible with the range scale in use, for each range scale;
- d) confirm by measurement that the range to an object within the operational display area can be measured to within an accuracy of $\pm 1\%$ of the range scale in use or 30 m, whichever is greater;
- e) confirm by measurement that the range to any object within the operational display area can be measured within 5 s;
- f) confirm by observation that a means or method is provided to enable and disable each VRM;
- g) confirm by observation that the range of the VRM is maintained from range scale to range scale.

5.8.3 Bearing scale

5.8.3.1 Requirement

(MSC192/5.13.1) A bearing scale may be provided. For radar display equipment a bearing scale shall be provided. The bearing scale shall indicate the bearing from the CCRP.

(MSC192/5.13.2) For radar display equipment, the bearing scale shall be outside of the operational display area (i.e. around its periphery). For display equipment presenting electronic chart information (for example, ECDIS), the bearing scale may be inside the operational display area. It shall be numbered at least every 30° division and shall have division marks of at least 5°. The 5° and 10° division marks shall be clearly distinguishable from each other. 1° division marks may be presented where they are clearly distinguishable from each other and from the 5° and 10° division marks.

If the display is off-centred or the position of own ship is outside of the operational display area, then the bearing scale shall be suppressed or its marks shall be adjusted to represent the bearing from CCRP.

For display equipment not presenting radar, a means or method shall be provided to enable and disable the bearing scale.

5.8.3.2 Methods of test and required results

Where a bearing scale is provided:

- a) confirm by analytical evaluation that the bearing scale indicates bearings as measured from the CCRP;
- b) for radar display equipment, confirm by observation that the bearing scale is around the periphery of the operational display area;
- c) confirm by observation that the bearing scale remains centred at the CCRP (for example, in a true motion display mode);
- d) confirm by observation that the bearing scale is numbered at least every 30° and has division marks at least every 5°;
- e) confirm by observation that the 5° division marks are clearly distinguishable from the 10° division marks;
- f) where 1° division marks are provided, confirm by observation that they are clearly distinguishable from each other and from the 5° and 10° division marks;
- g) for display equipment not presenting radar, confirm by observation that a means or method is provided to enable and disable the bearing scale.

5.8.4 Electronic bearing line (EBL)

5.8.4.1 Requirement

(MSC192/5.15.1) Electronic bearing line(s) (EBLs) shall be provided to measure the bearing of any point object within the operational display area, with a maximum system error of 1° at the periphery of the display.

(MSC192/5.15.2) The EBL(s) shall be capable of measurement from the CCRP relative to the ships heading and relative to true north. There shall be a clear indication of the bearing reference.

(MSC192/5.15.3) It shall be possible to move the EBL origin from the CCRP to any point within the operational display area and to reset the EBL to the CCRP by a simple user action.

(MSC192/5.15.4) It shall be possible to fix the EBL origin or to move the EBL origin at the velocity of own ship.

(MSC192/5.15.5) A means or method shall be provided to ensure that the user is able to rotate the EBL smoothly in either direction, with an incremental adjustment adequate to maintain the system measurement accuracy requirements.

It shall be possible to use the EBL to measure the bearing to any point object in the operational display area within 5 s.

(MSC192/5.15.6) Each active EBL shall have a numerical readout with a resolution of 0,1° adequate to maintain the system measurement accuracy requirements.

A means or method shall be provided to enable and disable each EBL.

The bearing of the EBL (i.e. set by the user) shall be retained while the EBL is enabled (for example, after a change in range scale).

5.8.4.2 Methods of test and required results

Where an EBL is provided:

- a) confirm by observation that each EBL is presented in accordance with Annex A;
- b) confirm by measurement that the bearing to any point object within the operational display area can be measured to within an accuracy of 1°;
- c) confirm by analytical evaluation that bearings can be measured relative to the ships heading and relative to true north, and that a clear indication of the bearing reference is provided;
- d) confirm by observation that a means or method is provided to move the origin of an EBL from the CCRP to any point within the operational display area;
- e) confirm by observation that it is possible to return the origin of the EBL to the CCRP by a single user action;
- f) confirm by observation that a means or method is provided to fix the origin of the EBL in a geographic location;
- g) confirm by observation that a means or method is provided to move the origin of the EBL at the velocity of own ship;
- h) confirm by observation that the EBL can be rotated smoothly in either direction;
- i) confirm by observation that the incremental adjustment is at least 0,1°;
- j) confirm by observation that the EBL can be used to measure the bearing to any point object in the operational display area within 5 s;

- k) confirm by observation that a numerical readout with a resolution of $0,1^\circ$ is available for each active EBL;
- l) confirm by observation that a means or method is provided to enable and disable each EBL;
- m) confirm by observation that an enabled EBL remains over the same point object during a change of range scale and a change of orientation mode.

5.8.5 Parallel index lines (PI)

5.8.5.1 Requirement

(MSC192/5.16.1) *Independent parallel index lines with a means or method to truncate and switch off individual lines, shall be provided.*

(MSC192/5.16.2) *A simple and quick means or method of setting the bearing and beam range of a parallel index line may be provided. The bearing and beam range of any selected parallel index line shall be available to the user on demand.*

It shall be possible to set the bearing and beam range of a parallel index line within 5 s.

The bearing and beam range of parallel index lines (i.e. set by the user) shall be retained while the parallel index lines are enabled (for example, after a change in range scale).

5.8.5.2 Methods of test and required results

Where parallel index lines are provided:

- a) confirm by observation that parallel index lines are presented in accordance with Annex A;
- b) confirm by observation that a means or method is provided to truncate and/or switch off individual lines;
- c) confirm by observation that a means or method is provided to set the bearing and the beam range of each parallel index line within 5 s;
- d) confirm by observation that the bearing and the beam range of each parallel index line is available to the user on demand;
- e) confirm by observation that the bearing and beam range is retained after the change of scale range and a change of orientation mode.

5.8.6 Offset measurement of range and bearing

5.8.6.1 Requirement

(MSC192/5.17) *There shall be a means or method to measure the range and bearing of one position on the display relative to any other position within the operational display area. This may be accomplished, for example, using an electronic range and bearing line (ERBL), a combination of a VRM and an EBL, or the cursor.*

If a separate tool is provided to measure the combination of range and bearing (for example, an ERBL):

- it shall have a numerical range and bearing readout. The resolution of the range readout shall be compatible with the range scale in use. The resolution of the bearing readout shall be $0,1^\circ$ adequate to maintain the system measurement accuracy requirements;
- it shall enable the user to measure the range of an object within the operational display area with a maximum system error of 1 % of the range scale in use or 30 m, whichever is the greater distance, and the bearing of any point object with a maximum system error of 1° at the periphery of the display;
- the user setting shall be retained while the tool is enabled (for example, after a change in range scale);

- it shall enable the user to position its bearing component smoothly in either direction, with an incremental adjustment adequate to maintain the system measurement accuracy requirements.

It shall be possible to measure the range and bearing to any object in the operational display area within 5 s.

5.8.6.2 Methods of test and required results

Where a means or method is provided to measure the range and bearing from one position to another in the operational display area:

- a) confirm by observation that one or more numerical readouts are available to display the range and bearing;
- b) confirm by analytical evaluation that the resolution of the range readout is compatible with each range scale;
- c) confirm by observation that the resolution of the bearing readout is 0,1°;
- d) confirm by measurement that the range to an object within the operational display area can be measured to within an accuracy of $\pm 1\%$ of the range scale in use or 30 m, whichever is greater;
- e) confirm by measurement that the bearing to any point object within the operational display area can be measured to within an accuracy of 1° at the periphery of the display;
- f) confirm by observation that the bearing component can be rotated smoothly in either direction;
- g) confirm by measurement that the range and bearing to any object within the operational display area can be measured within 5 s;
- h) where a separate tool is provided to measure the combination of range and bearing, confirm by observation that a means or method is provided to enable and disable that tool;
- i) confirm by observation that the user settings are retained after the change of the range scale while the tool is enabled.

5.8.7 User cursor

5.8.7.1 Requirement

(MSC192/5.18.1) *A user cursor may be provided to enable a fast and concise means or method to designate any position on the operational display area.*

(MSC192/5.18.2) *The cursor position shall have a continuous numerical readout to provide the range and bearing, measured from the CCRP, and/or the latitude and longitude of the cursor position presented either alternatively or simultaneously.*

(MSC192/5.18.3) *The cursor shall provide a means or method to select and de-select targets, graphics or objects within the operational display area. In addition, the cursor may be used to select modes, functions, vary parameters and control menus outside of the operational display area.*

(MSC192/5.18.4) *A means or method shall be provided to easily locate the cursor position in the operational display area (for example, re-centre).*

(MSC192/5.18.5) *The accuracy of the range and bearing measurements provided by the cursor shall meet the relevant requirements for VRM and EBL.*

5.8.7.2 Methods of test and required results

Where a user cursor is provided:

- a) confirm by observation that the cursor is presented in accordance with Annex A;
- b) confirm by observation that a numerical readout is available and that it continuously displays, either alternatively or simultaneously, the range and bearing of the cursor's position measured from own ship's CCRP, and/or the latitude and longitude of the cursor's position;
- c) confirm by observation that a means or method is provided for the cursor to select and de-select any object in the operational display area including targets and graphics;
- d) confirm by observation that a means or method is provided to locate the cursor in the operational display area;
- e) confirm by analytical evaluation that the resolution of the range readout is compatible with each range scale;
- f) confirm by observation that the resolution of the bearing readout is 0.1°;
- g) confirm by analytical evaluation that the resolution of the latitude and longitude readout is compatible with each display scale;
- h) confirm by measurement that the range to an object within the operational display area can be measured to within an accuracy of ±1 % of the range scale in use or 30 m, whichever is greater;
- i) confirm by measurement that the bearing to any point object within the operational display area can be measured to within an accuracy of 1° at the periphery of the display;
- j) confirm by observation that the cursor can be moved smoothly to create rotation in either direction;
- k) confirm by measurement that the range and bearing to any object within the operational display area can be measured within 5 s.

6 Radar and chart displays

NOTE See IEC 62388 for equivalent tests for this clause for radar equipment.

6.1 General

The provisions of this clause are applicable to stand-alone displays, associated with radar systems or responsible for the presentation of electronic chart information (for example, ECDIS) and the multifunction display equipment associated with IBS and INS when providing a radar or chart display.

6.1.1 Multifunction displays

6.1.1.1 Requirement

(MSC191/7.1.1) *If the display equipment is capable of supporting the presentation of multiple functions or operational modes, then there shall be a clear indication of the primary function supported by the presentation (for example, radar, chart, etc.). It shall be possible to select the presentation associated with the primary function, for example, the radar presentation (see 6.2) or the chart presentation (for example, ECDIS) (see 6.3), by a simple user action.*

NOTE If multifunction display equipment (for example, associated with IBS or INS) provides the primary presentation for multiple navigational systems and equipment required or allowed for carriage (for example, radar or ECDIS), then redundant display equipment should be available. The number of displays fitted on the bridge of a ship should support the simultaneous presentation of information for all navigational systems and equipment.

6.1.1.2 Methods of test and required results

Where display equipment is capable of supporting the presentation of multiple functions:

- a) confirm by observation that the primary function of the display equipment is clearly indicated;

- b) confirm by observation that the presentation associated with the primary function can be selected by a simple user action.

6.1.2 Simultaneous display of radar and chart data

6.1.2.1 Requirement

(MSC191/7.1.2) (MSC192/5.33.4) (MSC232/7.4.2/7.4.3/11.4.14) *If a radar video image and electronic chart information are displayed together, the chart and the radar video image shall use the same reference system and co-ordinate criteria, including, as applicable, datum, CCRP, and stabilisation mode, and shall match in scale, projection and orientation. Any user-entered offset, in addition to installation alignment (for example, to CCRP and/or heading reference), shall be indicated. The details of the offset shall be readily available to the user.*

NOTE The Performance Standards for individual navigational systems and equipment provide functional requirements for offsets.

6.1.2.2 Methods of test and required results

Where a radar video image and electronic chart information are displayed together:

- confirm by observation that they use the same reference system and co-ordinate criteria;
- confirm by observation that they use the same stabilisation mode;
- confirm by observation that they match in scale, projection and orientation;
- confirm by observation that an indication is provided for any user-entered offset to the presentation of either the radar video image or the electronic chart information;
- confirm by observation that the details of the user-entered offset are readily available.

6.1.3 Range scales

6.1.3.1 Requirement

(MSC191/7.1.3) *If a radar video image is displayed, range scales of 0,25, 0,5, 0,75, 1,5, 3, 6, 12 and 24 nautical miles shall be provided. Additional range scales are permitted below 0,25 nautical miles and/or above 24 nautical miles. The selected range scale shall be clearly and permanently or persistently indicated, as appropriate for the application.*

Metric units may also be provided. (See also 5.7.2.)

6.1.3.2 Methods of test and required results

Where a radar video image is displayed:

- confirm by observation that range scales of 0,25, 0,5, 0,75, 1,5, 3, 6, 12 and 24 nautical miles are provided for user selection;
- where additional range scales are provided, confirm by observation that they are below 0,25 nautical miles and/or above 24 nautical miles;
- confirm by observation that the selected range scale is clearly indicated and remains visible while the radar video image is displayed.

6.1.4 Range ring scale

6.1.4.1 Requirement

(MSC191/7.1.4) *If range rings are displayed, then the range ring scale shall be indicated. (See also 5.8.1.)*

6.1.4.2 Methods of test and required results

Where range rings are displayed, confirm by observation that the range ring scale is indicated.

6.1.5 Operational display area

6.1.5.1 Requirement

(MSC191/7.1.5) *No part of the operational display area shall be permanently used for the presentation of information that is not part of the navigational presentation (for example, pop up displays, drop down menus and information windows). Temporary, limited and relevant alphanumeric data, information and text may be displayed adjacent to a selected symbol, graphic or target within the operational display area.*

Any windows containing text, diagrams, etc. superimposed on the operational display area shall be temporary and movable (for example, to a less important part of the display, such as on land). (See also IHO S-52, Appendix 2, paragraph 3.4.2.)

NOTE Display equipment should avoid the use of dialogue boxes using white backgrounds, or provide a means or method of automatically changing the background of dialogue boxes which appear on displays set for use in dusk or dark conditions.

6.1.5.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that any information that is not part of the navigational presentation but is superimposed on the operational display area is presented only in response to an explicit user action (for example, a menu selection, hyperlink, hot key, etc.);
- b) confirm by observation that any windows containing text, diagrams, etc. superimposed on the operational display area are movable within the operational display area or can be removed from the operational display area.

6.1.6 Motion display modes

6.1.6.1 Requirement

(MSC192/5.20.1) (MSC232/8.2/8.3/8.4) *A true motion display mode shall be provided. The automatic reset of own ship may be initiated by its position on the display (for example, a distance from the border of the display determined by the user), or may be time related, or both.*

(MSC192/5.20.3) *A clear indication of the motion mode in use shall be provided. (See also 4.9.1.)*

6.1.6.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that a true motion display mode is provided;
- b) confirm by observation that reset of own ship takes place automatically at a user-entered position relative to the edge of the display, or at a user-entered time interval, or both;
- c) verify that a clear indication of the display mode in use is provided in accordance with 4.9.1. (See 4.9.1.2.)

6.1.7 Orientation modes

6.1.7.1 Requirement

(MSC192/5.20.2) A *north up orientation mode* shall be provided for radar and chart presentations.

(MSC192/5.20.2) A *course up orientation mode* shall be provided for radar presentations and may be provided for chart presentations.

(MSC192/5.20.2) A *head up orientation mode* may be provided for both radar and chart presentations.

(MSC192/5.20.3) A clear *indication of the orientation mode* in use shall be provided. (See also 4.9.1.)

(MSC 232/8.1) *It shall always be possible to display the SENC information in a "north-up" orientation. Other orientations are permitted. When such orientations are displayed, the orientation shall be altered in steps large enough to avoid unstable display of the chart information.*

6.1.7.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that a north up orientation mode is provided;
- b) for radar displays, confirm by observation that a course up orientation mode is provided;
- c) verify that a clear indication of the orientation mode in use is provided in accordance with 4.9.1;
- d) for each bearing stabilised orientation that may be provided, confirm by analytical evaluation that for turning rates between 0 °/s and 20 °/s the displayed symbols and text in the operational display area do not re-orient more often than 2 times per second and remain legible.

6.1.8 Off-centring

6.1.8.1 Requirement

(MSC192/5.21.1) If a radar video image is displayed, *manual off-centring* shall be provided to locate the selected antenna position (i.e. the centre of the radar video image) at any point within at least 50 % and not more than 75 % of the radius, measured from the centre of the operational display area.

(MSC192/5.21.2) If a radar video image is displayed, and an *off-centred display* is selected, the selected antenna position shall be capable of being located to any point on the display up to at least 50 %, and not more than 75 %, of the radius from the centre of the operational display area. A facility for automatically positioning own ship for the maximum view ahead may be provided.

(MSC192/5.21.3) If a radar video image is displayed, and an off-centred display and *true motion* display mode are selected, the selected antenna position shall automatically reset up to a 50 % radius to a location giving the maximum view along own ship's course. Provision for an early reset of the selected antenna position shall be provided.

6.1.8.2 Methods of test and required results

Where a radar video image is displayed:

- a) confirm by observation that manual off-centring is provided;

- b) confirm by observation that manual off-centring provides the capability to locate the selected radar antenna position at any point in the operational display area at least 50 % and not more than 75 % of the radius measured from the centre;
- c) where true motion display mode is selected:
 - 1) confirm by observation that the selected radar antenna position is automatically reset to a 50 % radius;
 - 2) confirm by observation that the user may manually reset the selected radar antenna position.

6.1.9 Stabilisation modes

6.1.9.1 Requirement

If electronic chart information is displayed, then a ground stabilisation mode shall be provided.

(MSC192/5.22.1) Where radar information is displayed, both *ground and sea stabilisation modes shall be provided.*

(MSC192/5.22.2) *The stabilisation mode and stabilisation source (i.e. velocity or speed source) shall be clearly indicated.* (See also 4.9.1.)

NOTE Ground stabilisation requires a ground-referenced velocity (i.e. COG/SOG) from an external sensor capable of providing own ship speed measured over the ground (for example, an EPFS). Sea stabilisation requires a water-referenced velocity (i.e. CTW/STW or HDG/SPD) from an external sensor capable of providing own ship speed measured through the water (for example, an SDME).

6.1.9.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) where electronic chart information is displayed, confirm by observation that a ground stabilisation mode is provided;
- b) where a radar information is displayed confirm by observation that both ground and sea stabilisation modes are provided;
- c) confirm by observation that a clear indication of the stabilisation mode in use and its source are provided.

6.2 Radar displays

The provisions of this subclause are applicable to stand-alone displays associated with radar systems and the multifunction displays associated with IBS and INS when providing a radar display.

NOTE The functional requirements for radar are defined in the performance standards set forth in IMO Resolution MSC.192(79) and further specified in IEC 62388. The presentation requirements for radar information are defined in the performance standards for presentation set forth in IMO Resolution MSC.191(79) and further specified in this standard.

6.2.1 Radar video image

6.2.1.1 Requirement

(MSC191/7.2.1.1) The *radar video image (i.e. echoes), tracked radar targets and reported AIS targets shall not be substantially degraded, masked or obscured by other presented information.* (See also 5.3.1.)

(MSC191/7.2.1.2) *It shall be possible to temporarily suppress all graphical information from the display, retaining only the radar video image and target trails.*

6.2.1.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that the presentation of the radar video image, tracked radar targets and reported AIS targets is not degraded, masked or obscured by other presented information;
- b) confirm by observation that the user can suppress the presentation of all graphical information so that only the radar video image and target trails remain.

6.2.2 Brightness of radar information

6.2.2.1 Requirement

(MSC191/7.2.1.3) *The brightness of the radar video image (i.e. echoes) and associated graphic symbols for tracked radar targets shall be variable. It shall be possible to control the brightness of all displayed radar information. There shall be independent means to adjust the brightness of groups of displayed graphics and alphanumeric data, information and text (for example, tracked radar targets, navigation tools, etc.). The brilliance (i.e. brightness) of the heading line shall not be variable to extinction.*

6.2.2.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that a means or method to adjust the brightness of the radar video image is provided;
- b) confirm by observation that a separate independent means or method to adjust the brightness of tracked radar target symbols is provided;
- c) confirm by observation that a separate independent means or method to adjust the brightness of groups of other displayed graphics and alphanumeric data, information and text is also provided;
- d) confirm by observation that the brightness of the heading line cannot be adjusted to the point of extinction.

6.2.3 Display of chart information on radar

6.2.3.1 Requirement

(MSC191/7.2.2.1) (MSC192/5.33) *Vector format electronic chart information may be presented on a radar display. This shall be accomplished using layers (i.e. of charted objects or elements) selected from an electronic chart database. As a minimum, the elements of the ECDIS Standard Display (see IEC 61174) shall be available for individual selection by IMO display category or layer (for example, by IHO suggested viewing group), but not as individual objects. As far as practical, electronic chart information shall be presented in accordance with this standard (see 4.4.1, 4.5.2 and 5.2.1) and with the ECDIS Performance Standards (IEC 61174). Raster navigational charts are not permitted for chart radar applications.*

NOTE IEC 62388 requires a subset of the ECDIS standard display, called the primary chart information set, to be made available by a primary control function.

(MSC191/7.2.2.3) (MSC192/5.33.2) *If electronic chart information is displayed on a radar presentation, then there shall be a permanent or persistent indication of its status (for example, on/off, official/unofficial data, overscale/underscale, etc.), as appropriate for the application. The source and update information shall also be available to the user on demand.*

NOTE The overscale area pattern addressed in IHO S-52, 3.2.3(8b) and provided in the IHO ECDIS Presentation Library may obscure or degrade the presentation of the radar video image. An alternative means or method of overscale indication (for example, the display of an overscale factor) may be preferable.

(MSC192/5.33.1) *If electronic chart information is presented on a radar display, it shall be possible to remove it by a single operator or user action.*

(MSC192/5.33.6) *A malfunction of the source of electronic chart information shall not affect the operation of the radar system or the AIS.*

6.2.3.2 Methods of test and required results

When vector format electronic chart information is presented on a radar display:

- a) confirm by observation that the content of the electronic chart database includes all of the elements specified by the IMO for the ECDIS standard display (see IEC 61174);
- b) confirm by observation that elements of the standard display are available for selection (i.e. for display) by IMO display category and/or by layer, but not as individual chart objects;
- c) verify the presentation of vector format electronic chart information in accordance with 4.4.1, 4.5.2 and 5.2.1;
- d) where raster format electronic chart information is presented, verify its presentation in accordance with IHO S-61;
- e) where electronic chart information is presented in shades of grey, confirm that they are distinguishable between respective chart features;
- f) confirm by observation that an indication of the status of the electronic chart information is provided;
- g) confirm by observation that the source of the electronic chart information and its update information are available to the user;
- h) confirm by observation that the user may remove electronic chart information from the display by a single operator action;
- i) confirm by analytical evaluation that a malfunction associated with the loading and/or presentation of electronic chart information does not affect the operation of the radar system or the AIS;
- j) confirm by document inspection, that the user manual describes all available chart functionality and that it prohibits the use of raster navigational charts.

6.2.4 Priority of radar information

6.2.4.1 Requirement

(MSC191/7.2.2.2) (MSC192/5.33.5) *If electronic chart information is presented within the operational display area, the presentation of radar information (for example, the radar video image, target trails, etc.) shall have priority. The electronic chart information shall be clearly perceptible as such. The electronic chart information shall not substantially degrade, mask or obscure the radar video image, tracked radar targets or reported AIS targets.*

6.2.4.2 Methods of test and required results

When electronic chart information is presented on a radar display:

- a) confirm by observation that the radar video image and target trails have display priority over the electronic chart information;
- b) confirm by observation that the presentation of electronic chart information cannot be confused with the display of radar information or AIS information;
- c) verify that the presentation of the electronic chart information does not substantially degrade, mask or obscure the presentation of radar information in accordance with 6.2.1.

6.2.5 Display of map graphics

6.2.5.1 Requirement

(MSC191/7.2.3) (MSC192/5.32.4) *User generated radar map graphics including monitored and/or additional planned routes may be presented on a radar display, but shall not*

substantially degrade, mask or obscure the radar video image, target trails, tracked radar targets, reported AIS targets, or electronic chart information.

NOTE Where a radar system provides map graphics for monitored and/or planned routes, it should comply with the relevant clauses of IEC 61174.

(MSC192/5.32.1) Map graphics may be *referenced to own ship or to a geographical position. It shall be possible to remove the display of map graphics by a simple user action.*

(MSC192/5.32.2) Map graphics *may consist of lines, symbols and reference points.*

(MSC192/5.32.3) *The appearance and colours of map graphic lines and symbols are set forth in Annex A.*

6.2.5.2 Methods of test and required results

When user generated map graphics are displayed on a radar presentation:

- a) confirm by observation that map graphics do not substantially degrade, mask or obscure the radar video image, target trails, tracked radar targets, reported AIS targets or electronic chart information;
- b) confirm by observation that map graphics can be referenced to own ship or to a geographic position;
- c) confirm by observation that the user may remove the display of map graphics by a single user action;
- d) confirm by observation that the appearance and colour of the map graphics lines, symbols and reference points are in accordance with Annex A.

6.3 Chart displays

The provisions of this subclause are applicable to stand-alone displays responsible for the presentation of electronic chart information and the multifunction displays associated with IBS and INS when providing a chart display.

NOTE The functional requirements for ECDIS are defined in the performance standards set forth in IMO Resolution MSC.232(82) and further specified in IEC 61174. The presentation requirements for electronic chart information are defined in the performance standards for presentation set forth in IMO Resolution MSC.191(79) and further specified in this standard.

6.3.1 Display of chart information

6.3.1.1 Requirement

(MSC191/7.3.1.1) (MSC232/5.1/5.10/5.11) Electronic chart information *and all updates to it shall be presented without any degradation of information content.*

(MSC191/7.3.1.2) (MSC232/7.1) Electronic *chart information shall not be substantially degraded, masked or obscured by other presented information* (for example, a radar video image, tracked and/or reported targets, etc.).

6.3.1.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) verify the presentation of electronic chart information in accordance with 4.4.1, 4.5.2 and 5.2.1;
- b) confirm by observation that the electronic chart information is not substantially degraded, masked or obscured by other presented information.

6.3.2 IMO display categories

6.3.2.1 Requirement

(MSC191/7.3.1.3) (MSC232/7.2) *It shall be possible to temporarily suppress radar, AIS and other navigational information from the chart display by a single user action, retaining only chart related information contained in the ECDIS Display Base (see IEC 61174).*

(MSC232/5.2) ENC and other vector format electronic chart information available for presentation on a chart display during route planning and route monitoring shall be subdivided into the following three IMO display categories:

- ECDIS Display Base;
- ECDIS Standard Display; and
- All Other Information.

(MSC232/5.3) *It shall be possible to present the ECDIS Standard Display at any time by a single operator or user action.*

(MSC232/5.4) *When a chart display is switched on following a switch off or power failure, it shall return to the most recent settings for the display.*

6.3.2.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that by a single user action the user can temporarily suppress the presentation of all graphical information so that only the electronic chart information in the ECDIS display base remains;
- b) verify the subdivision of vector format electronic chart information into IMO display categories in accordance with IEC 61174;
- c) verify that the user can select the ECDIS standard display at any time by a single action;
- d) confirm by observation that when the chart display is switched on, the electronic chart information is presented with the most recent display settings.

6.3.3 Adding or removing information from the display

6.3.3.1 Requirement

(MSC191/7.3.1.4) (MSC232/5.5) *It shall be possible to add or remove information from the chart display by layer (for example, IHO suggested viewing group), but not as individual objects. It shall not be possible to remove information contained in the ECDIS Display Base (see IEC 61174) from the display. (See also 6.2.3.)*

6.3.3.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that the user can add and remove information from the presentation by layer but not as individual objects;
- b) confirm by observation that the user cannot remove information contained in the ECDIS display base.

6.3.4 Safety contour

6.3.4.1 Requirement

(MSC191/7.3.1.5) (MSC232/5.8) *It shall be possible to select a safety contour from the depth contours provided by vector format electronic chart information. The safety contour shall be emphasized over other contours on the display.*

6.3.4.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that the user can select a safety contour from the depth contours provided in vector format electronic chart information;
- b) confirm by observation that the presentation of the safety contour is emphasised over other depth contours.

6.3.5 Safety depth

6.3.5.1 Requirement

(MSC191/7.3.1.6) (MSC232/5.9) *It shall be possible to specify a safety depth. Soundings equal to or less than the safety depth shall be emphasized whenever spot soundings are selected for display.*

6.3.5.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that the user can specify a safety depth;
- b) confirm by observation that the presentation of spot soundings less than or equal to the safety depth are emphasized over other spot soundings.

6.3.6 Chart scale

6.3.6.1 Requirement

(MSC191/7.3.1.7) (MSC232/6.1) *An indication shall be provided if chart information is displayed at a larger scale than contained in the electronic chart database, or if own ship's position is covered by electronic chart information at a larger scale than the presentation.*

(MSC191/7.3.1.8) *Overscaled areas presented on the chart display shall be identified. (See IHO S-52, 6.3 (d).)*

6.3.6.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that an indication is provided when chart information is presented at a larger scale than in the electronic chart database;
- b) confirm by observation that an indication is provided when own ship's position is covered by electronic chart information at a larger scale than the presentation;
- c) confirm by observation that overscaled areas presented on the display are identified.

6.3.7 Display of radar and target information

6.3.7.1 Requirement

(MSC191/7.3.2.1) (MSC232/7.1/7.4.1) *A radar video image, tracked radar and reported AIS target information may be presented on a chart display but shall not substantially degrade, mask or obscure the presentation of electronic chart information. As far as practical, the radar*

video image *and target information shall be presented in accordance with the radar Performance Standards (see IEC 62388) and with the presentation standards set forth in this standard.*

(MSC191/7.3.2.2) (MSC232/5.12/7.2) *A radar video image, tracked radar and reported AIS target information shall be clearly distinguishable from the electronic chart information. It shall be possible to remove radar and target information by a simple user action.*

6.3.7.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) verify that the radar video image is presented in accordance with 5.3.1 and 5.3.2, as applicable; (See 5.3.1.2 and 5.3.2.2.)
- b) verify that targets are presented in accordance with 5.4.6; (See 5.4.6.2.)
- c) verify that radar and target information are clearly distinguishable from chart information in accordance with 6.3.1; (See 6.3.1.1 c.)
- d) confirm by observation that radar and target information can be removed from the presentation by a simple user action.

6.3.8 Display of additional navigation-related information

6.3.8.1 Requirement

(MSC191/7.3.3.1) (MSC232/9.1) *Information from additional sources may be displayed on ECDIS but shall not substantially degrade, mask or obscure the chart information. (See IHO S-52, 7.2 (f).)*

(MSC191/7.3.3.2) (MSC232/9.1/9.2/10.1) *Additional navigation-related information (including information for route planning, route monitoring, and supplementary navigation tasks) shall be clearly distinguishable from the electronic chart information. It shall be possible to remove additional navigation-related information by a simple operator or user action.*

6.3.8.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) verify the presentation of additional information in accordance with 4.5.2; (See 4.5.2.2.)
- b) verify that the presentation of electronic chart information is not degraded, masked or obscured by the presentation of additional information in accordance with 6.3.1; (See 6.3.1.2.)
- c) verify that additional navigation-related information is clearly distinguishable from chart information in accordance with 6.3.1; (See 6.3.1.2)
- d) confirm by observation that additional navigation-related information can be removed from the presentation by a simple user action.

6.4 Composite task-oriented presentations

6.4.1 User-configured presentations

(MSC191/7.4.1) *The user may configure a presentation for a specific task-at-hand. The presentation may include radar and/or electronic chart information, in combination with other navigation or ship related data or information. When not fully compliant with the relevant Performance Standards, such a presentation shall be identified as an auxiliary presentation.*

6.4.2 Information associated with the task-at-hand

(MSC191/7.4.2) *As far as practical, the presentation of any radar and/or chart related functions shall be compliant with the requirements of the relevant Performance Standards and*

of the *presentation standards* set forth in this standard, with the exception of size requirements for the operational display area. Windows of chart or radar information may be presented along with other information associated with the task-at-hand.

7 Physical requirements

NOTE The provisions of this clause are applicable to the physical displays associated with all navigational systems and equipment on the bridge of a ship. The equipment manufacturer may provide documented evidence to show compliance with the requirements specified in this clause.

7.1 General

Display equipment shall comply with the applicable requirements of IEC 60945. (See 4.1.1.1.)

7.2 Display adjustment

7.2.1 Contrast and brightness

7.2.1.1 Requirement

(MSC191/8.1.1) *It shall be possible to adjust the contrast and brightness of the display, as applicable to the display technology. It shall be possible to dim the display. The range of control shall permit the display to be legible under all ambient light conditions likely to be experienced on the bridge of a ship (for example, day, dusk and night). The range of adjustment shall be sufficient to maintain the user's dark adaptation at night. (See also 4.3.1.)*

(MSC191/8.1.2) *It shall be possible for the user to reset the values of contrast and/or brightness to a preset or default condition. The manufacturer's documentation shall identify the default conditions.*

If display equipment is intended to present electronic chart information (see 4.5.2), then it shall:

- provide the user with the capability to reset the values of brightness and/or contrast to a calibrated colour performance reference setting for each of the ambient light conditions defined in Table 1; and
- prevent inadvertent adjustments by the user by restricting access to controls that may cause degradation of colour performance, such as gamma and colour temperature adjustments.

7.2.1.2 Methods of test and required results

The setup for measurements of contrast, luminance and colour shall be conducted in accordance with the guidelines of IEC 61966-4 or the VESA Flat Panel Display Measurement (FPDM) standard. Before measurements are taken, display equipment shall be powered up and allowed to stabilize for a period identified by the manufacturer. (See also Annex D.)

- a) Confirm by observation that a manual contrast control is provided, if applicable (for example, for CRT technology).
- b) Confirm by observation that a manual brightness control is provided.
- c) Verify the adjustment of contrast and brightness in accordance with 4.3.1: (See 4.3.1.2.)
 - 1) confirm by observation that the contrast and brightness controls can be reset to their default values;
 - 2) where display equipment is intended to display chart information, confirm by measurement of luminance that a means or method is provided to return the contrast and brightness controls to their calibrated setting for each ambient light condition in accordance with Table 1. (See 4.3.1.2.)
- d) Confirm by inspection of documented evidence that the default conditions for contrast and brightness controls are identified.

7.2.2 Magnetic interference

7.2.2.1 Requirement

(MSC191/8.1.3) *If magnetic fields degrade the presentation of navigation-related information, then a means or method to neutralise the effects of magnetic fields shall be provided.*

7.2.2.2 Methods of test and required results

Confirm by inspection of documented evidence that a means or method to neutralise the effects of magnetic fields is provided if magnetic fields degrade the presentation of navigation-related information.

7.2.3 Temporal stability

7.2.3.1 Requirement

Display equipment shall be perceptually "flicker" free in direct and peripheral vision at the nominal viewing distance identified in the manufacturer's documentation in accordance with the perception thresholds of ISO 13406-2, B.2.5 and B.2.6.

NOTE The perception threshold of "flicker" is known to vary for observers, depending on such factors as age, fatigue, ambient lighting conditions, frequencies, the displayed image size, image brightness and image content.

7.2.3.2 Methods of test and required results

Establish by inspection of documented evidence whether the luminance persistence (response time) of the display equipment is less than 1 ms.

- a) For display equipment with a luminance persistence of 1 ms or more (for example, CRT, LCD's, etc.), confirm by analytical evaluation or measurement that the display equipment emits less energy in the temporal frequencies than an observer will detect as "flicker" (i.e. the predicted "flicker" threshold) according to ISO 13406-2, B.2.5 under each ambient light condition specified in Table 1.
- b) For display equipment based on technologies which have a luminance persistence much less than 1 ms (for example, EL, plasma, LED, etc.), confirm by analytical evaluation or measurement that the display equipment emits less energy in the temporal frequencies than an observer will detect as "flicker" according to ISO 13406-2, B.2.6 under each ambient light test condition specified in Table 1.

7.2.4 Physical controls and status indicators

Physical controls for display equipment shall be locatable by visual or tactile means. If the display equipment has more than three adjacent controls (for example, knobs or switches), then labels with adjustable illumination shall be provided for identification of these controls. Labels shall comply with the legibility/readability requirements contained in 4.3.2, 4.3.3 and 4.3.4.

Any illuminated status indicators separate from the main display (for example, built-in to the front panel of the monitor) shall be locatable by visual means. Adjustable illumination provided for labels and status indicators shall be suitable for all ambient light conditions likely to be experienced on the bridge of a ship (day, dusk and night) and with due consideration to the night vision of the officer of the watch.

As a minimum, a switch to power display equipment and visual indications of the presence of input power and video signals shall be provided.

7.2.4.1 Method of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that physical controls for display equipment are locatable by visual or tactile means;
- b) where more than three adjacent control knobs or switches exist, confirm by observation that they have labels with adjustable illumination and that the illuminated labels comply with the legibility/readability requirements contained in 4.3.2, 4.3.3 and 4.3.4;
- c) confirm by observation that the display equipment can be powered on/off by a physical switch;
- d) where illuminated status indicators exist separate from the main display, confirm by observation that they are locatable by visual means;
- e) where adjustable illumination is provided, confirm by observation that it is suitable under each of the ambient light conditions specified in Table 1;
- f) confirm by observation that a visual indication of the presence of power to the display equipment is provided;
- g) confirm by observation that a visual indication of the presence of video signals to the display equipment is provided.

7.3 Screen size

7.3.1 Requirement

(MSC191/8.2.1) *Display equipment shall be of sufficient size to support the requirements of the relevant IMO Performance Standards.*

(MSC191/8.2.2) (MSC232/10.2) *For ECDIS, the operational display area of the chart presentation for route monitoring shall be at least 270 mm × 270 mm.*

(MSC232-6/4.2.2) *For ECDIS back-up arrangements, the effective size of the chart presentation shall be not less than 250 mm × 250 mm or 250 mm diameter.*

(MSC191/8.2.3) *For radar display equipment, the operational display area of the radar presentation shall be at least a circle of diameter of:*

- 180 mm for ships smaller than 500 gross tonnage;
- 250 mm for ships larger than 500 gross tonnage and HSC less than 10000 gross tonnage;
- 320 mm for ships larger than 10000 gross tonnage.

The manufacturer's documentation shall identify the intended size of the operational display area.

7.3.2 Method of test and required results

The methods of test and the required results are as follows:

- a) for ECDIS, confirm by measurement that the dimensions of the operational display area are at least 270 mm × 270 mm;
- b) for ECDIS back-up arrangements, confirm by measurement that the dimensions of the operational display area are at least 250 mm × 250 mm, or 250 mm in diameter;
- c) for radar display equipment, confirm by measurement that the diameter of the operational display area is at least a circle of diameter of the intended size specified in the manufacturer's documentation.

7.4 Multicoloured display equipment

7.4.1 Requirement

(MSC191/8.3.1) *Multicoloured display equipment shall be used except where monochrome displays are permitted within individual IMO Performance Standards.*

(MSC191/8.3.2) *Multicoloured operational displays including multifunction displays (for example, conning displays) shall provide a minimum of 64 colours except where permitted or not required by the IMO, or when used for a single specific purpose (for example, speed log, echo-sounder).*

7.4.2 Method of test and required results

Verify in accordance with 4.4.1.

7.5 Screen resolution

7.5.1 Requirement

(MSC191/8.4) *Operational display equipment including multifunction displays (for example, conning displays) shall provide a minimum screen resolution of 1280 × 1024 pixels, or equivalent for a different aspect ratio, except where permitted or not required by the IMO, or when used for a single specific purpose (for example, speed log, echo-sounder) or 180 mm radar. For 180 mm radar, a minimum screen resolution of 1024 pixels × 768 pixels, or equivalent for a different aspect ratio, shall be provided.*

Display equipment intended to support the presentation of electronic chart information shall provide a maximum pixel pitch of 0,29 mm/m of nominal viewing distance (1 min of arc), for example, 0,36 mm at 1 237 mm viewing distance.

The manufacturer's documentation shall describe the screen resolution, pixel format and viewing distance (i.e. for measurement of pixel pitch).

7.5.2 Method of test and required results

The methods of test and the required results are as follows:

- a) confirm by inspection of documented evidence that the display equipment supports a screen resolution of at least 1 280 × 1 024 or equivalent if the equipment uses a different aspect ratio;

Alternatively, confirm by inspection of documented evidence that the display equipment supports the minimum screen resolution permitted by the applicable Performance Standards.

Alternatively, if the display equipment is used for a single specific purpose (for example, speed log, echo-sounder, etc.), confirm by inspection of documented evidence that it is not required to support a minimum screen resolution.

- b) confirm by inspection of documented evidence that the display equipment provides a maximum pixel pitch of not more than 1 min of arc;

Alternatively, if the display equipment is used for a single specific purpose (for example, speed log, echo-sounder, etc.), confirm by inspection of documented evidence that it is not required to support a maximum pixel pitch.

- c) confirm by inspection of documented evidence that the screen resolution, pixel format and the viewing distance used for the measurement of pixel pitch are identified.

7.6 Screen viewing angle

7.6.1 Requirement

(MSC191/8.5) *The display equipment shall support the reading of information under all ambient light conditions, simultaneously, by at least two users, from standing and sitting user positions likely to be found on the bridge of a ship.*

7.6.2 Methods of test and required results

Verify in accordance with 4.3.1.

Annex A (normative)

Presentation colours and symbols

This annex specifies the harmonised symbols to be used for the presentation of navigation related information on all shipborne navigational systems and equipment in conformance with guidelines published by the IMO and provided in SN/Circ.243.

All text in this annex whose wording is identical to text contained in IMO SN/Circ.243 is printed in *italics*. The IMO reference is made up of two parts; a prefix representing the IMO instrument, followed by the paragraph number, displayed as, for example: (SN243/1).

A.1 Purpose

(SN243/1/1) *The purpose of this annex is to provide guidance on the appropriate use of navigation-related symbols and the use of colour to achieve a harmonized and consistent presentation on all shipborne navigational systems and equipment.*

A.2 Scope

(SN243/1/2) *The use of these guidelines will insure that the symbols used for the display of navigation-related information on all shipborne navigational systems and equipment are presented in a consistent and uniform manner.*

A.3 Application

(SN243/1/3) *The symbols listed in Tables A.1 through A.5 shall replace symbols which are currently in existing Performance Standards for navigational systems and equipment. Where a standard symbol is not available, another symbol may be used, but this symbol shall not conflict with the symbols listed in this annex.*

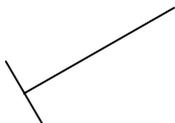
A.4 Navigation-related symbols

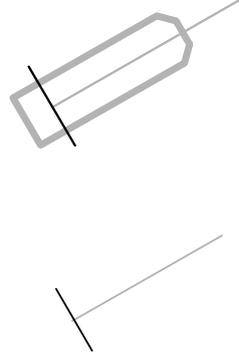
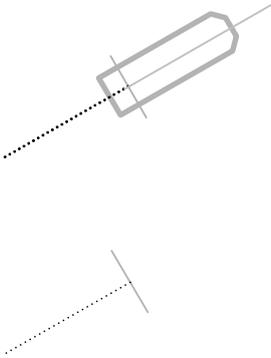
For the application of the symbols in Tables A.1 through A.5, the following shall be considered:

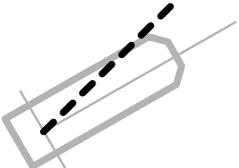
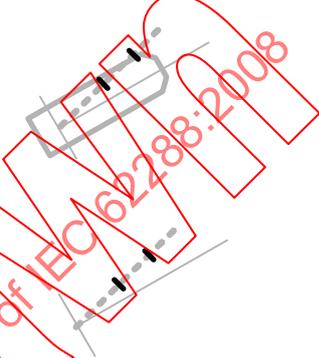
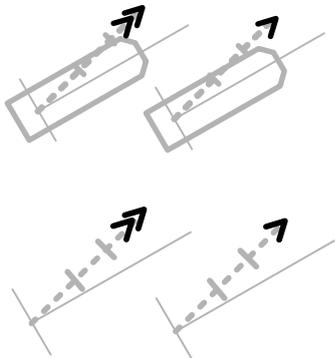
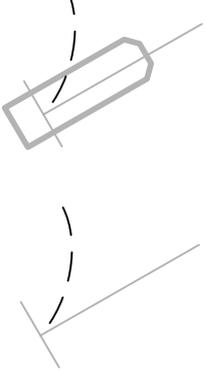
- no colours are recommended for symbols except where IMO has specified the use of the colour red for dangerous targets;
- colours used for the presentation of tracked radar targets and reported AIS targets shall be consistent;
- colours used for the presentation of own ship symbols shall be identifiable from colours used for the presentation of targets;
- colours used for the presentation of operational information shall be discriminated from the colours used for the presentation of the radar image, target trails, additional processed radar information and electronic chart information;
- colours recommended for symbols assume that the presentation provides for lighter foreground information against a dark background;
- sizes specified for symbols assume a nominal viewing distance of 1 m;
- weights specified for line styles assume that the "thick" line style is at least twice the thickness of the "thin" line style.

Table A.1 – Own ship symbols

NOTE The simplified symbol (1.1b) may be used with all examples showing the minimised symbol (1.1 c) in this Table.

	Symbol name and description	Symbol graphic(s)
1.1 a	<p>Own ship – true scaled outline</p> <p>The user may select to present own ship as a true scaled outline oriented in the direction of heading relative to CCRP and drawn using a thick solid line style with the same basic colour used for own ship symbols.</p> <p>Automatic selection of the true scaled outline is permitted (see 5.1.1).</p> <p>The true scaled outline shall not be used when heading is unknown in a gyro/THD-stabilised mode, or when the beam of the outline is less than 6 mm.</p> <p>In the radar mode, the true scale outline shall be used together with own ship minimised symbol.</p> <p>NOTE A loss of heading will force the radar into head-up mode (see IEC 62388); in this case, the true scaled outline is still permitted.</p>	 <p>(SN243)</p>
1.1 b	<p>Own ship – simplified symbol</p> <p>If a navigation display presents the chart mode (with or without the radar image), a simplified symbol may be used for own ship. The simplified symbol may be combined with the minimised symbol (see 1.1c).</p> <p>A simplified symbol shall be used when a chart is displayed in north-up presentation, without a radar image and in the absence of heading information.</p> <p>The outer circle shall be 6 mm in diameter. The inner circle shall be 3 mm in diameter. The circles shall be drawn using a thick solid line style, with the same basic colour used for own ship symbols.</p> <p>NOTE For a radar mode, the simplified symbol should not be used as the symbol does not permit the minimum range requirements in IEC 62388.</p>	 <p>(SN243)</p>
1.1 c	<p>Own ship – minimised symbol</p> <p>If a navigation display presents the radar mode, own ship shall be presented as a minimised symbol. The minimised symbol is comprised of the heading line (see symbol 1.3) and the beam line (see symbol 1.4).</p> <p>Where appropriate, the minimised symbol shall be combined with the true scaled outline of own ship.</p> <p>NOTE A loss of heading will force the radar into head-up mode (see IEC 62388) whereby the minimised symbol should be used.</p>	 <p>(SN243)</p>

	Symbol name and description	Symbol graphic(s)
1.2	<p>Radar antenna position</p> <p>If a radar image is displayed and own ship is displayed as a true scaled outline, the user may select to present the radar antenna position as crossed lines centred at the physical location of the radar antenna (the source of the displayed radar image). The total extent of the crossed lines shall be at least 1 mm but not more than 2 mm in length. They shall be drawn using a thin solid line style with the same basic colour used for own ship symbols.</p>	 <p style="text-align: right;">(SN243)</p>
1.3	<p>Own ship heading line</p> <p>The heading line shall always be indicated (except when temporarily suppressed by the user), originating at CCRP and extending in the direction of own ship heading to the bearing scale. The line shall be drawn using a thin solid line style with the same basic colour used for own ship symbols.</p> <p>The heading line shall always be shown together with the beam line (see 1.4).</p>	 <p style="text-align: right;">(SN243)</p>
1.4	<p>Beam line</p> <p>The beam line forms part of the own ship minimised symbol. Own ship beam line shall be presented as a single line, perpendicular to the heading line, passing through the CCRP and extending a minimum of 5 mm each side of the CCRP. The line shall be drawn as a thin solid line style with the same basic colour used for own ship symbols.</p>	 <p style="text-align: right;">(SN243)</p>
1.5	<p>Stern line</p> <p>Optionally, the user may select a stern line that shall originate at CCRP and shall extend, in the direction 180° from the heading, to the bearing scale.</p> <p>The line shall be drawn using a thin dotted line style with the same basic colour used for own ship symbols.</p>	

	Symbol name and description	Symbol graphic(s)
1.6 a	<p>Velocity vector</p> <p>Optionally, the user may also select to present a velocity vector originating at CCRP and extending in the direction of COG or CTW, as appropriate, for a length representing the distance own ship will travel in a user-selected time interval. The vector shall be drawn using a thick short-dashed line style with the same basic colour used for own ship symbols.</p>	 <p>(SN243)</p>
1.6 b	<p>Velocity vector – time increments</p> <p>Optionally, the user may also select to present time increments along the velocity vector perpendicular to the vector with their midpoint on it and extending not more than 1,5 mm on either side. They shall be spaced along the vector to represent the distance own ship will travel in a user-selected increment of the time interval used for the velocity vector. The increments shall be drawn using a thick solid line style with the same basic colour used for own ship symbols.</p>	 <p>(SN243)</p>
1.6 c	<p>Velocity vector – Stabilisation indicator</p> <p>Optionally, the user may select to present a stabilisation indicator, positioned at the end of the velocity vector.</p> <p>The ground stabilisation indicator shall be presented as a double arrowhead. The water stabilisation indicator shall be presented as a single arrowhead. The arrowheads shall extend at least 1 mm but not more than 1,5 mm on either side of the vector (i.e. measured perpendicular to it).</p> <p>The arrowhead(s) shall be drawn using a thick solid line style with the same basic colour used for own ship symbols.</p>	 <p>(SN243)</p>
1.6 d	<p>Path predictor</p> <p>Optionally, the user may select to present a path predictor, in place of a velocity vector, as a curved line originating at CCRP and extending along the predicted path over ground that own ship will travel in the time interval used for the velocity vector. The path shall be drawn using a thin long-dashed line style with the same basic colour used for own ship symbols.</p>	 <p>(SN243)</p>

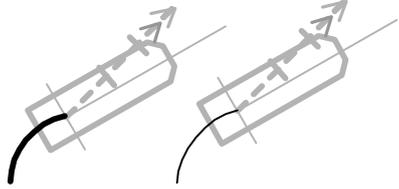
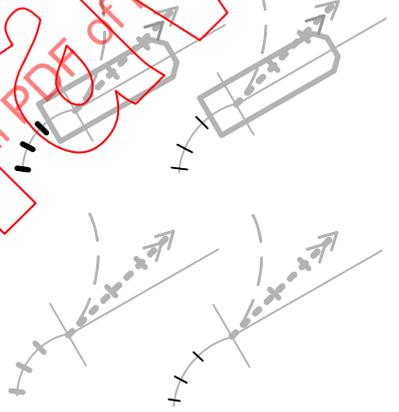
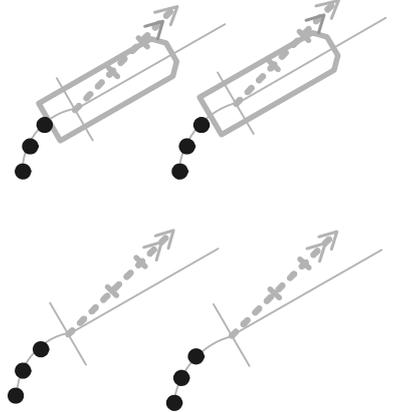
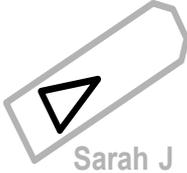
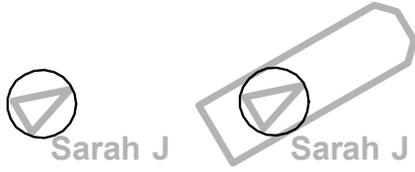
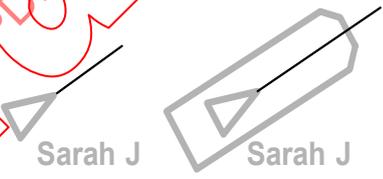
	Symbol name and description	Symbol graphic(s)
1.7 a	<p>Past track</p> <p>The user may select to present a past track for the primary and/or secondary positioning sources. The past track shall be presented as line connecting own ship current and past positions. The primary past track shall be drawn using a thick solid line style with the same basic colour used for own ship symbol. The secondary past track shall be drawn using a thin solid line style with the same basic colour used for own ship symbols.</p>	  <p style="text-align: right;">(SN243)</p>
1.7 b	<p>Past track – time increments</p> <p>Optionally, time increments along the past track may be shown. The time increments shall be presented as single lines perpendicular to the past track with their midpoint on it and extending at least 1 mm but not more than 1,5 mm on either side. They shall be spaced along the past track to represent the distance own ship travelled in the user-selected increment of the time interval used for the velocity vector. The time increments for the primary past track shall be drawn using a solid line style.</p>	 <p style="text-align: right;">(SN243)</p>
1.7 c	<p>Past track – past positions</p> <p>Alternatively, the user may select to present past positions along the past track in place of time increments. Past positions shall be drawn as small filled circular symbols with a diameter of not more than 1,5 mm, with the same basic colour used for own ship symbols.</p>	

Table A.2 – Radar and AIS symbols

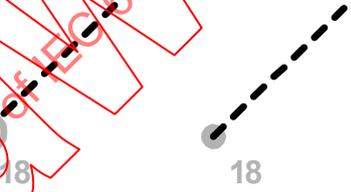
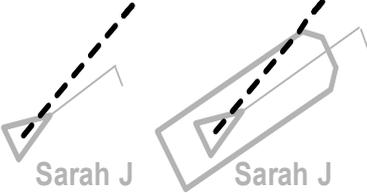
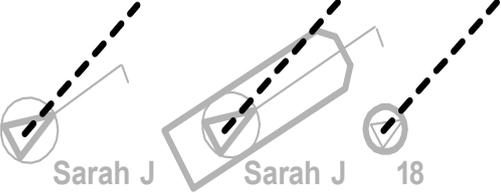
	Symbol name and description	Symbol graphic(s)
2.1 a	<p>Radar targets in acquisition state</p> <p>A symbol drawn around radar targets in acquisition state shall be presented as a broken circle centred at the position of target acquisition. The circles shall be a nominal 5 mm in diameter and shall be drawn using a thin dashed line style with the same basic colour used for target symbols.</p>	 <p>(SN243)</p>
2.1 b	<p>Radar targets in acquisition state – automatically detected</p> <p>A symbol drawn around radar targets in acquisition state that are automatically detected inside an acquisition area, shall be a nominal 5 mm in diameter and using a thick dashed line style, with the required colour red. The symbols shall flash until acknowledged by the user.</p> <p>Once acknowledged, the symbols shall cease flashing (even when they remain inside the acquisition area) and unless considered as dangerous, shall be drawn as a normal radar target in an acquisition state (i.e. detected outside an acquisition area) with the basic colour of other non-dangerous target symbols.</p>	 <p>(SN243)</p>
2.2 a	<p>Tracked radar targets</p> <p>Tracked radar targets shall be presented as circles centred at the targets' tracked position. The circles shall be 3 mm in diameter and shall be drawn using a thick solid line style.</p> <p>Tracked radar targets generated from a target automatically detected in an acquisition area that have not been acknowledged shall be the required red basic colour and shall continue to flash until acknowledged by the user (even when they move outside the acquisition area).</p> <p>Once acknowledged, the symbols shall cease flashing and unless considered as dangerous, shall be drawn as a normal radar target in an acquisition state (i.e. detected outside an acquisition area) with the basic colour of other non-dangerous target symbols.</p> <p>Tracked radar targets may be numbered. Alphanumeric text used to number radar targets shall be drawn with the same basic colour used for target symbols.</p>	 <p>(SN243)</p>

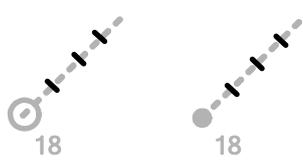
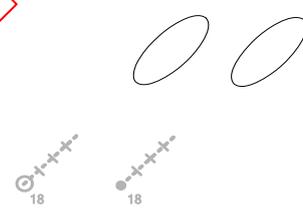
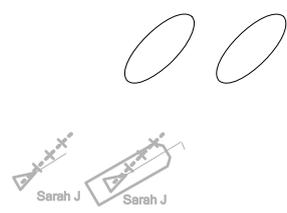
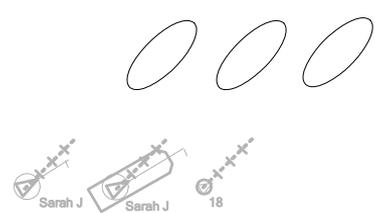
	Symbol name and description	Symbol graphic(s)
2.2 b	<p>Tracked radar targets – alternative</p> <p>Alternatively, tracked radar targets may be presented as filled circles of not more than 2 mm in diameter.</p>	 <p>(SN243)</p>
2.2 c	<p>Tracked radar targets – dangerous targets</p> <p>Tracked radar targets designated as dangerous targets may be presented using 5 mm diameter circles, and shall flash until acknowledged by the user. The required colour shall be red.</p> <p>Once acknowledged, the symbols shall cease flashing, but shall still be drawn with the required basic colour red until the target(s) cease to be a danger.</p>	 <p>(SN243)</p>
2.3	<p>Reference targets</p> <p>Tracked radar targets designated as reference targets shall be labelled with the letter “R” adjacent to the symbol. Multiple reference targets shall be numbered as “R1”, “R2”, “R3”, etc.</p> <p>The reference target labels shall be drawn with the same basic colour used for target symbols.</p>	 <p>(SN243)</p>
2.4	<p>Sleeping AIS targets</p> <p>Sleeping AIS targets shall be presented as acute isosceles triangles oriented to the targets’ reported heading (or COG if heading is not reported) and centred at the targets’ reported position. The base of the triangles shall be 3 mm and the height shall be 4,5 mm. The triangles shall be drawn using a thick solid line style (or a broken line if a collision avoidance computation cannot be done) with the same basic colour used for target symbols.</p> <p>A sleeping AIS target with neither a reported heading nor COG shall be oriented toward the top of the operational display area.</p>	 <p>(SN243)</p> <p>Sleeping AIS target with neither reported heading nor COG:</p> 

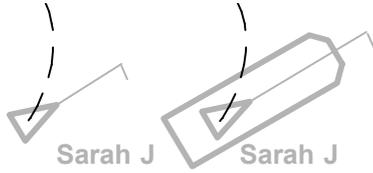
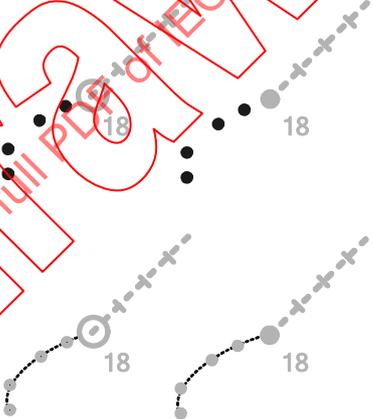
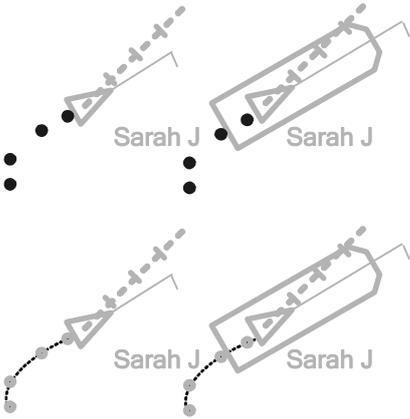
	Symbol name and description	Symbol graphic(s)
<p>2.5 a</p>	<p>Activated AIS targets</p> <p>Activated AIS targets shall be presented as acute isosceles triangles oriented to the targets' reported heading (or COG if heading is not reported) and centred at the targets' reported position. The base of the triangles shall be 4 mm and the height shall be 6 mm. The triangles shall be drawn using a thick solid line style (or a broken line if a collision avoidance computation cannot be done) with the basic colour used for target symbols.</p> <p>An activated AIS target with neither a reported heading nor COG shall be oriented toward the top of the operational display area.</p> <p>Activated AIS targets may be labelled. Alphanumeric text used to label AIS targets shall be drawn with the same basic colour as used for target symbols.</p>	<div style="text-align: right;">  <p>(SN243)</p> </div> <p>Activated AIS target with neither reported heading nor COG:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div>
<p>2.5 b</p>	<p>Activated AIS targets – true scaled outlines</p> <p>Alternatively, when own ship is presented as a true scaled outline, the user may select to add true scaled outlines to activated AIS target symbols.</p> <p>True scaled outlines for activated AIS targets shall be drawn around the AIS target symbol triangles relative to the targets' reported position according to the offsets, beam and length. The outline shall be drawn using a thick solid line style.</p> <p>True scaled outlines for activated AIS targets shall be drawn with the same basic colour used for target symbols.</p> <p>True scaled outlines for individual activated AIS targets shall not be used when a target's heading is not reported or when the beam of the outline is less than 7.5 mm.</p>	<div style="text-align: right;">  <p>(SN243)</p> </div>
<p>2.5 c</p>	<p>Activated AIS targets – dangerous targets</p> <p>Activated AIS targets designated as dangerous targets may be presented with larger triangles, with a base of 5 mm and a height of 7.5 mm, shall be the required basic colour red, drawn with a thick solid line and shall flash until acknowledged by the user.</p> <p>Once acknowledged, the symbols shall cease flashing but shall still be presented using the required basic colour red until no longer considered to be a dangerous target.</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div> <p>(SN243)</p> <p>Activated AIS target with neither a reported heading nor COG:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div>

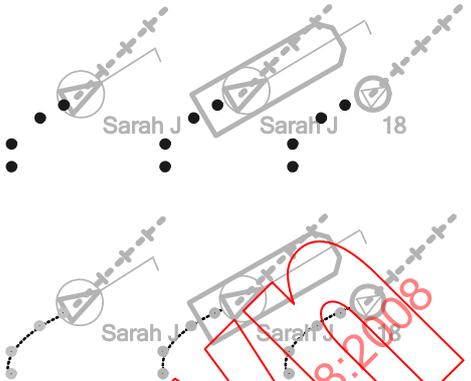
	Symbol name and description	Symbol graphic(s)
<p>2.6</p>	<p>Associated targets – alternative</p> <p>The user may select to present associated targets (i.e. activated AIS targets associated with tracked radar targets) as either activated AIS target symbols (see 2.5) or tracked radar target symbols (see 2.2).</p> <p>Alternatively, activated AIS target symbols representing associated targets may be modified by circumscribing a circle around the symbols' isosceles triangle. Tracked radar target symbols representing associated targets may be presented with larger diameter circles (up to 5 mm), modified by inscribing an isosceles triangle inside the symbols' circle.</p> <p>The circumscribed circle and inscribed triangle shall be drawn using a thick solid line style with the same basic colour used for target symbols.</p> <p>Associated targets may be labelled or numbered, as appropriate. Alphanumeric text used to label/number associated targets shall be drawn with the same basic colour as used for target symbols.</p>	<p>Associated targets represented by AIS target symbols:</p>  <p>Associated targets represented by radar target symbols:</p> 
<p>2.7 a</p>	<p>Heading lines</p> <p>Heading lines shall be selected for display for activated AIS targets and associated targets, represented by AIS target symbols.</p> <p>Heading lines shall originate at the apex of the AIS triangle and shall extend not less than 4 mm and at least 4 mm beyond the bow of the true scaled outline when it is used. They shall be drawn using a solid line style with the same basic colour as used for target symbols.</p> <p>Heading lines for dangerous AIS targets shall flash with their base symbol until acknowledged by the user.</p> <p>An activated target without a reported heading shall be orientated to the top of the operational display area and when AIS heading is enabled shall not include a heading line.</p>	 <p>(SN243)</p>

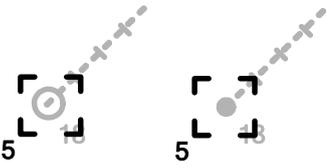
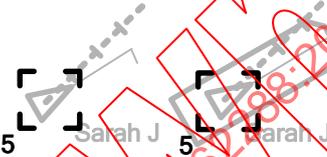
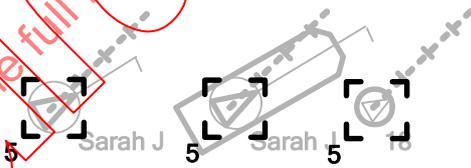
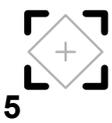
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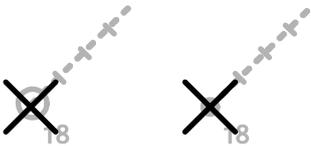
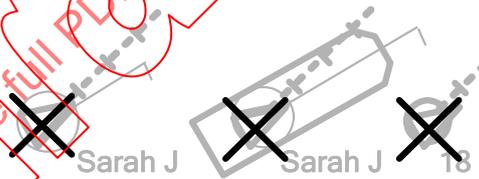
	Symbol name and description	Symbol graphic(s)
<p>2.7 b</p>	<p>Heading lines – turn indicators</p> <p>The user shall select to display turn indicators for activated AIS targets and associated targets represented by AIS target symbols.</p> <p>Turn indicators shall be presented as a single line extending at least 1 mm but not more than 2 mm perpendicular to the heading line in the direction of turn. The indicator shall be drawn using a thin solid line style with the same basic colour as used for their target symbols.</p> <p>Turn indicators for dangerous targets shall be the required colour red (until no longer dangerous) and shall flash with their symbol until acknowledged by the user.</p>	 <p>(SN243)</p>
<p>2.8 a</p>	<p>Velocity vectors</p> <p>Velocity vectors for targets shall be selected for display.</p> <p>Velocity vectors shall be presented as single lines originating at the targets' tracked/reported position and extending in the direction of course CTW or COG, as appropriate, for a length representing the distance the target will travel in the time interval used for own ship's velocity vector. Vectors shall be drawn using a thick short-dashed line style with the same basic colour used for target symbols.</p> <p>Velocity vectors for dangerous targets shall be the required red basic colour and shall flash with their base target symbols until acknowledged by the user.</p> <p>Once acknowledged, the symbols shall cease flashing and unless considered as dangerous, shall assume the basic colour of other non-dangerous target symbols.</p>	<p>Radar target velocity vectors:</p>  <p>(SN243)</p> <p>AIS target velocity vectors:</p>  <p>(SN243)</p> <p>Associated target velocity vectors:</p> 

	Symbol name and description	Symbol graphic(s)
<p>2.8 b</p>	<p>Velocity vectors – time increments</p> <p>Time increments may be shown drawn across target velocity vectors.</p> <p>Time increments shall be presented as single lines perpendicular to the vectors with their midpoint on them and extending not more than 1,5 mm on either side. They shall be spaced along the vectors to represent the distance the target will travel in the time increment of the time interval used for own ship's velocity vector. The increments shall be drawn using a thick solid line style with the same basic colour as for target symbols.</p> <p>Time increments for dangerous targets shall be the required red basic colour and shall flash with their base target symbols until acknowledged by the user.</p> <p>Once acknowledged, the symbols shall cease flashing and unless considered as dangerous, shall use the basic colour of other non-dangerous target symbols.</p>	<p>Radar target time increments:</p>  <p>AIS target time increments:</p>  <p>Associated target time increments:</p> 
<p>2.8 c</p>	<p>Predicted area of dangers</p> <p>Optionally, predicted area of dangers (PADs) may be shown along the path of target velocity vectors.</p> <p>PADs shall be presented as an outline area geographically representing a target's predicted CPA/TCPA violations. (The PAD's shape may be modified by knowledge of own ship manoeuvring characteristics, safety contour limits, etc). PADs shall be oriented in the direction of their velocity vectors. The PADs shall be drawn using a thick solid line style with the same basic colour as their target symbols.</p> <p>PADs for dangerous targets shall flash with their base symbols until acknowledged by the user.</p> <p>When a target is selected, the associated PAD may be highlighted for identification.</p> <p>NOTE PADs are shown as an elliptical area which is typical. Presentation of more accurate shapes is not excluded.</p>	<p>Radar target PADs:</p>  <p>NOTE Not to scale</p> <p>AIS target PADs:</p>  <p>NOTE Not to scale</p> <p>Associated target PADs:</p>  <p>NOTE Not to scale</p>

	Symbol name and description	Symbol graphic(s)
<p>2.8 d</p>	<p>Path predictor</p> <p>Optionally, the user may select to display a path predictor in place of a velocity vector.</p> <p>The path predictor shall be represented as a curved vector originating at the targets' tracked/reported position and extending along the predicted path over the ground that the target will travel, in the time interval used for the target vector.</p> <p>The path shall be drawn using a thin long-dashed line style with the same basic colour used for target symbols.</p>	<p>AIS target path predictor:</p>  <p>Associated target path predictor:</p> 
<p>2.9</p>	<p>Target past positions</p> <p>Optionally, target past positions may be shown.</p> <p>Past positions shall be presented as a series of small circular symbols of 1 mm diameter. They may be connected by a line drawn from the current tracked or reported position of the target.</p> <p>The line shall be drawn using a thin short-dashed line style with the same basic colour as their target symbols.</p>	<p>Radar target past positions:</p>  <p>AIS target past positions:</p> 

	Symbol name and description	Symbol graphic(s)
		Associated target past positions: 
<p>2.10</p>	<p>AIS aids to navigation</p> <p>AIS aids to navigation (ATON) shall be presented as a diamond with crossed lines centred at the reported position of the ATON. The crossed lines shall be not more than 2 mm in length and the sides of the diamond shall be not more than 6 mm in length.</p> <p>A virtual AIS ATON shall have the letter 'V' superimposed on the symbol so that it does not extend beyond the diamond and does not intersect with the crossed lines.</p> <p>The diamond, crossed lines and 'V' shall be drawn using a thin solid line style.</p> <p>The basic colour for an "off position" AIS ATON is red.</p> <p>The basic colour for an "on position" AIS ATON is as used for the ATON symbols.</p> <p>AIS ATON may be labelled. Alphanumeric text used to label an AIS ATON shall be the same basic colour as the AIS ATON symbol.</p>	<p>Real AIS ATON:</p>  <p>(SN243)</p> <p>Virtual AIS ATON:</p> 
<p>2.11</p>	<p>AIS search and rescue transmitter</p> <p>An AIS search and rescue transmitter (AIS-SART) shall be drawn with a solid line and shall be the same basic colour as the AIS ATON symbols.</p> <p>NOTE A radar-SART has a receiver which scans for X-band radar signals. When the SART detects a signal, it transmits its own signal, consisting of a series of twelve pulses, on the same frequency. These pulses are displayed as a series of twelve echoes originating at the position of the SART and spaced 0,6 nautical miles apart along the line of bearing toward the edge of the screen (see IEC 62388).</p>	

	Symbol name and description	Symbol graphic(s)
<p>2.12 Selected targets</p> <p>Selected target symbols shall be presented as broken squares indicated by their corners, centred on the selected target symbol by the user and clearly extending beyond it. The square shall be drawn using a dashed line.</p> <p>Alphanumeric text used to label a selected target shall be the same basic colour as the selected target symbol.</p>	<p>Selected radar targets:</p>  <p>(SN243)</p>	
	<p>Selected AIS targets:</p>  <p>(SN243)</p>	
	<p>Selected associated targets:</p> 	
	<p>Selected AIS ATON:</p> 	
	<p>Selected AIS SART:</p> 	

	Symbol name and description	Symbol graphic(s)
2.13	<p>Lost targets</p> <p>Lost target symbols shall be presented as crossed lines centred on the target symbol and extending at least 2 mm but not more than 3 mm beyond the symbol. The lines shall be drawn using a solid line style and shall flash with the required colour red until acknowledged by the user.</p> <p>Once acknowledged, the lost target symbol and its target symbol shall be removed from the display.</p>	<p>Lost radar targets:</p>  <p>(SN243)</p> <p>Lost AIS targets:</p>  <p>(SN243)</p> <p>Lost associated targets:</p>  <p>Lost AIS ATON:</p>  <p>Lost AIS SART:</p> 

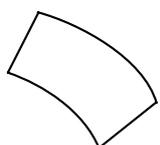
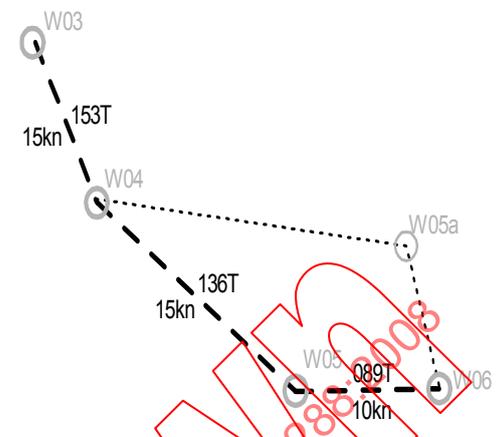
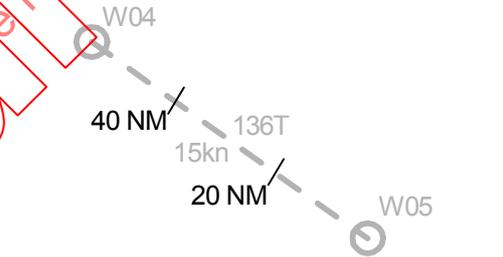
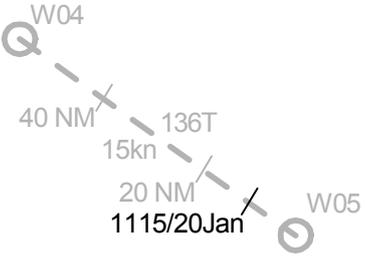
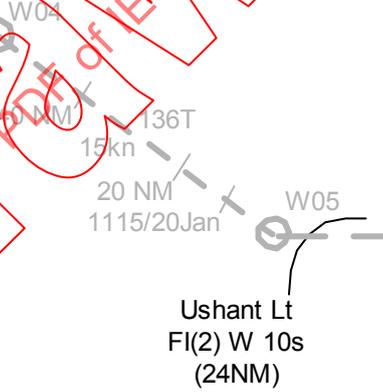
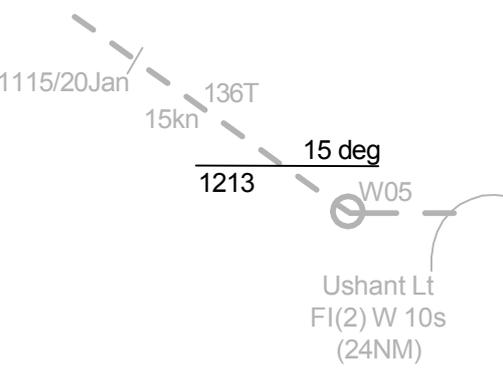
	Symbol name and description	Symbol graphic(s)
2.14	<p>Radar target acquisition area</p> <p>The user may select to display radar target acquisition areas and/or AIS target activation areas.</p> <p>Target acquisition areas shall be presented as a series of lines bounding a geographic area designated for radar target acquisition and/or AIS target activation. The lines shall be drawn using a thin solid line style with the same basic colour used for target symbols.</p> <p>The area may be filled providing the colour of the fill does not degrade the visibility of the radar image and target symbols. Area fill shall be transparent and shall be the same basic colour as the area boundary.</p>	 <p style="text-align: right;">(SN243)</p>

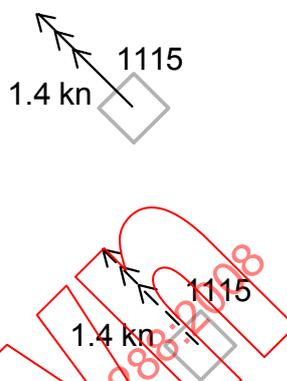
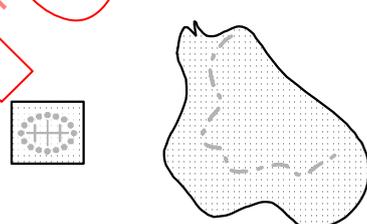
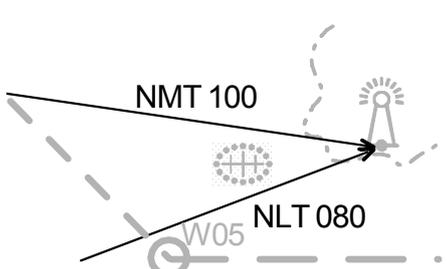
Table A.3 – Navigation symbols

	Description	Symbol
3.1 a	<p>Waypoint</p> <p>Waypoints shall be presented as circles centred at the position of the waypoint.</p> <p>The circles shall be at least 4 mm but not more than 6 mm in diameter.</p> <p>Circles representing waypoints on the monitored route shall be drawn using a thick solid line style with the same basic colour used for the route.</p> <p>Alternatively, the next waypoint on the monitored route may be presented as a set of two concentric circles. The outer circle shall be nominally 6 mm in diameter. The inner circle shall be nominally 4 mm in diameter.</p> <p>Circles representing waypoints on the alternate planned route shall be drawn using a thin solid line style.</p> <p>Optionally, waypoints may be labelled adjacent to their symbol. The label shall be offset by at least 2 mm from the symbol and shall not interfere with text used to label the track leg.</p> <p>Alphanumeric text used to label a waypoint shall be the same basic colour as the waypoint symbol.</p>	 <p style="text-align: right;">(SN243)</p>

	Description	Symbol
<p>3.1 b</p>	<p>Routes</p> <p>A route is as a series of waypoints connected by one or more legs.</p> <p>Leg lines on the monitored route shall be drawn using a thick long-dashed line style. Leg lines on an alternate planned route shall be drawn using a thin dotted line style.</p> <p>NOTE The IHO recommends a dotted line style for a leg line on the monitored route. The IHO's recommended colour for leg lines on the monitored route is red.</p> <p>Leg lines on the monitored route may be labelled adjacent to their line with their course and planned speed, ideally on opposite sides. The label shall be offset by at least 2 mm from the line and shall not interfere with text used to label the waypoint.</p> <p>NOTE The IHO recommends drawing a box around the planned speed.</p> <p>Alphanumeric text used to label a leg line shall be the same colour as the leg line.</p> <p>The alternate planned route shall be presented as a series of track legs connecting a series of waypoints.</p>	 <p>NOTE Not to scale</p>
<p>3.1 c</p>	<p>Distance to run</p> <p>Leg lines on the monitored route may be marked with distance to run. These marks shall be presented as single lines perpendicular to the leg line with their midpoint on it and extending at least 2 mm but not more than 3 mm on either side. They shall be located along the leg line to represent the distance to the next waypoint. The marks shall be drawn using a thin solid line style with the same colour as the leg line.</p> <p>Distance to run may be labelled adjacent to the marks. The label shall be offset by at least 2 mm from the mark and shall not interfere with other text used to label the leg line or waypoints.</p> <p>Alphanumeric text used to label distance to run shall be the same colour as the mark.</p>	

	Description	Symbol
<p>3.1 d</p>	<p>Planned position</p> <p>Optionally, track legs may be marked with a planned position.</p> <p>These marks shall be presented as single lines perpendicular to the track leg with their midpoint on the line and extending at least 2 mm but not more than 3 mm on either side. They shall be located along the track leg to represent the distance from the previous waypoint. The marks shall be drawn using a thin solid line style.</p> <p>Planned position may be labelled adjacent to the mark with the date and time of planned arrival. The label shall be offset by at least 2 mm from the mark and shall not interfere with other labels.</p> <p>Alphanumeric text used to label planned position shall be the same basic colour as the mark.</p>	
<p>3.1 e</p>	<p>Visual limit of lights</p> <p>Leg lines on the monitored route may be marked with the visual limits of lights (i.e. rising/dipping range).</p> <p>The visual limit shall be presented as an arc centred on the light and extending across the track leg at least 10 mm on either side. The arc shall be drawn using a thin solid line with the same basic colour as the leg line.</p> <p>The visual limit may be labelled adjacent to the arc with the rising/dipping range and information about the light.</p> <p>Alphanumeric text used to label visual limits shall be the same basic colour as the arc.</p>	
<p>3.1 f</p>	<p>Wheel-over position</p> <p>Track leg lines on the monitored route may be marked with a wheel-over position. The wheel-over position shall be presented as single line centred on the current leg line, parallel to the next leg line and extending at least 5 mm on either side of the current leg line. The line shall be drawn using a thin solid line with the same colour as the leg line.</p> <p>The wheel-over position may be labelled adjacent to the line with the planned rudder angle and time of wheel-over. Alphanumeric text used to label wheel-over position shall be the same basic colour as the wheel-over position line.</p>	

	Description	Symbol
<p>3.2</p>	<p>Plotted position</p> <p>A plotted position (Fix, EP, and DR) shall be presented as a circle with crossed lines centred at the position. The circle shall be 5 mm in diameter. The length of the crossed lines shall be the diameter of the circle.</p> <p>The circle and crossed lines shall be drawn using a thin solid line style.</p> <p>The position shall be labelled with time and an indication of its source for example GNSS, L (Loran), R (Radar range), V (Visual bearing), VR (Visual bearing and Radar range) . If the position is an estimated position, it shall also be labelled with the letters "EP". If the position is a dead reckoned position, it shall also be labelled with the letters "DR".</p> <p>Alphanumeric text used to label the position shall be the same basic colour as the symbol.</p>	
<p>3.3</p>	<p>Line of position</p> <p>A line of position (LOP) shall be presented as a single line originating from a charted object and extending towards own ship. The bearing of the LOP shall be referenced to the CCRP.</p> <p>The LOP shall be drawn using a thin solid line style.</p> <p>The LOP shall be labelled with time. If the LOP is transferred, it may also be labelled with the letters "TPL" for transferred position line.</p> <p>Alphanumeric text used to label LOP shall be the same basic colour as the line.</p> <p>NOTE. A LOP range observation will be a curved line.</p>	<p>NOTE Examples show the default symbol for a water tower.</p>

	Description	Symbol
<p>3.4</p>	<p>Tidal stream</p> <p>A tidal stream shall be presented as a single line with three arrowheads. The line shall originate from the charted position for which a tidal stream table (or tidal stream data) is available and shall extend no more than 15 mm in length. The triple arrowhead shall extend no more than 2 mm on either side (perpendicular to the line).</p> <p>The line for an actual tidal stream shall be drawn using a thin solid line style.</p> <p>The line for a predicted tidal stream be drawn using a thin long- dashed line style.</p> <p>The arrowheads for a tidal stream shall be drawn using a thin solid line style.</p> <p>The tidal stream shall be labelled adjacent to the line with the effective strength and time, ideally on opposite sides. The label shall be offset by at least 2 mm from the line.</p> <p>Alphanumeric text used to label the tidal stream shall be the same basic colour as the line.</p> <p>NOTE IMO recommends drawing a box around the strength.</p>	<p>Symbol</p>  <p>NOTE Examples show the default symbol for a point or area for which a tidal stream table is available.</p>
<p>3.5</p>	<p>Danger highlight</p> <p>A danger highlight shall be presented as a polygon bounding a geographic area designated as dangerous to navigation, or as a poly-line creating a boundary around such an area. The boundary of the polygon, or poly-line, shall be drawn using a thin solid line style. Recommended colour: red.</p> <p>The polygon, or bounded area shall be filled with a transparent fill using the same colour as the polygon or poly-line.</p> <p>NOTE Examples show the default symbol for a dangerous wreck at an unknown depth bounded by a rectangular danger highlight and an outcropping of land bounded by a user-entered danger highlight.</p>	
<p>3.6</p>	<p>Danger bearing</p> <p>A danger bearing or clearing line shall be presented as a single line with an arrowhead directed at the base of a charted object. The line shall extend at least 20 mm in length and ideally through or across the monitored route.</p> <p>The line shall be drawn using a thin solid line style with the required colour red.</p> <p>A danger bearing shall be labelled with its bearing. The letters "NMT" shall be used to indicate "not more than". The letters "NLT" to indicate "not less than".</p> <p>Alphanumeric text used to label the danger bearing shall be the same basic colour as the line.</p> <p>NOTE The drawing is not to scale. The example shows the default symbols for a light and a dangerous wreck at an unknown depth.</p>	

	Description	Symbol
3.7	<p>Event marker</p> <p>An event marker shall be presented as a 5 mm square with a diagonal line inscribed.</p> <p>The symbol shall be drawn using a thin solid line style.</p> <p>Optionally, an event marker may be labelled. Multiple event markers may be numbered.</p> <p>Alphanumeric text used to label an event marker shall be the same basic colour as the symbol.</p>	<p style="text-align: center;"></p> <p style="text-align: right;">(SN243)</p>

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Table A.4 – Navigation tools

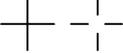
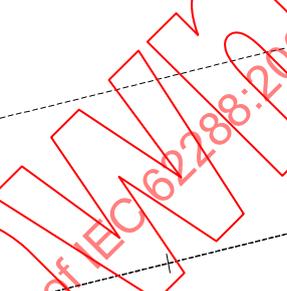
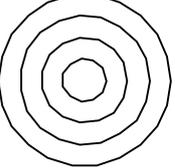
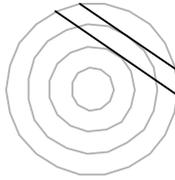
	Description	Symbol(s)
4.1	<p>User cursor</p> <p>The user cursor shall be presented as crossed lines perpendicular to each other extending at least 3 mm from the centre on all sides. The cursor shall be drawn in a thick solid line style.</p> <p>Optionally, the centre of the cursor may be open. Either symbol may be used.</p>	 <p style="text-align: right;">(SN243)</p>
4.2	<p>Electronic bearing line (EBL)</p> <p>Electronic bearing lines (EBL) shall be presented as a single line originating from CCRP, from a position offset from CCRP, or from a geographically fixed position. An EBL shall be drawn as a dashed line style. Each additional EBL shall be distinguished by different styles of dashed lines and/or colours.</p> <p>If an EBL is offset, the EBL may be combined with a VRM to form an ERBL (electronic range and bearing line). The range shall be presented as a small arc across the EBL and referenced from the origin of the EBL. The arc shall use the same colour as the EBL.</p>	
4.3	<p>Variable range marker (VRM)</p> <p>Variable range markers (VRM) shall be presented as a circle. The VRM shall be drawn as a dashed line style. Each additional VRM shall be distinguished by different styles of dashed lines and/or colours.</p>	
4.4	<p>Range rings</p> <p>If selected, a set of fixed range rings shall be presented as an appropriate number of equally spaced concentric circles centred at the CCRP. Spacing between range rings is dependant on the range scale (i.e. range rings represent logical subdivisions of the range scale). The circles shall be drawn as a thin solid line style.</p>	 <p style="text-align: right;">(SN243)</p>
4.5	<p>(parallel) Index lines</p> <p>Parallel index lines shall be presented as a series of lines aligned to a set bearing, and spaced at a series of beam ranges (for example at the range ring spacing).</p> <p>No line style is specified for (parallel) index lines however, they shall be distinguishable from each other and from EBLs.</p> <p>Index lines set at other bearings may be used.</p> <p>A series of index lines at other positions may be used.</p>	

Table A.5 – Other symbols

	Description	Symbol(s)
5.1	<p>Trial manoeuvre</p> <p>When a trial manoeuvre function is enabled, it shall be indicated by the presentation of a large letter "T" in a conspicuous location in the operational display area.</p>	<p style="text-align: center;">T</p> <p style="text-align: right;">(SN243)</p>
5.2	<p>Simulation mode</p> <p>When a simulation mode is enabled, it shall be indicated by the presentation of a large letter "S" in a conspicuous location in the operational display area.</p>	<p style="text-align: center;">S</p> <p style="text-align: right;">(SN243)</p>
5.3	<p>Radar test target</p> <p>When an internally generated test target is enabled, it shall be indicated by the presentation of the large letter "X" adjacent to the target with the basic colour used for the target symbol.</p> <p>In addition, a bold "X" shall be shown in a conspicuous location in the operational display area.</p>	<p style="text-align: center;">X</p>

NOTE Examples of colour schemes that may be used are given below.

Symbol	Colour	Colour token (IHO S-52)
1.1a, 1.1b	White	Ship
1.7a	White	PSTRK
2.1a	Blue/green	ARPAT
2.4, 2.5a, 2.10	Pale blue	RESBL
2.12, 4.1, 4.2, 4.3, 4.4, 4.5	Orange	CURSR
2.14, 3.7	Orange	NINFO
3.1a	Red	PLRTE
	Orange	APLRT