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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

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National foreword

This British Standard is the UK implementation of EN 62288:2014. It is identical to IEC 62288:2014. It supersedes BS EN 62288:2008 which will be withdrawn on 14 August 2017.

The UK participation in its preparation was entrusted to Technical Committee EPL/80, Maritime navigation and radiocommunication equipment and systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Foreword

The text of document 80/733/FDIS, future edition 2 of IEC 62288, prepared by IEC/TC 80 "Maritime navigation and radiocommunication equipment and systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62288:2014.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2015-05-14
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2017-08-14

This document supersedes EN 62288:2008.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 62288:2014 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 61162	NOTE	Harmonized in EN 61162 series.
IEC 61924-2	NOTE	Harmonized as EN 61924-2.
ISO 9241-8:1997	NOTE	Harmonized as EN ISO 9241-8:1997 (not modified).
ISO 9241-12:1998	NOTE	Harmonized as EN ISO 9241-12:1998 (not modified).
ISO 13406-2:2001	NOTE	Harmonized as EN ISO 13406-2:2001 (not modified).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60945	2002	Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results	EN 60945	2002
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	EN 61174	-
IEC 61966-4	-	Multimedia systems and equipment - Colour measurement and management - Part 4: Equipment using liquid crystal display panels	EN 61966-4	-
IEC 62065	-	Maritime navigation and radiocommunication equipment and systems - Track control systems - Operational and performance requirements, methods of testing and required test results	EN 62065	-
IEC 62388	-	Maritime navigation and radiocommunication equipment and systems - Shipborne radar - Performance requirements, methods of testing and required test results	EN 62388	-
IHO S-52	-	Specifications for Chart Content and Display Aspects of ECDIS	-	-
IHO S-52 Annex A of Appendix 2	-	IHO ECDIS presentation library	-	-

Publication	Year	Title	EN/HD	Year
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 A.1021(26)	2009	Code on alerts and indicators	-	-
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	Performance standards for electronic chart display and information systems (ECDIS)	-	-
IMO MSC.252(83)	2007	Performance standards for integrated navigation systems (INS)	-	-
IMO MSC.302(87)	2010	Performance standards for Bridge Alert Management (BAM)	-	-
IMO SN.1/Circ.243/ Rev.1	2014	Guidelines for the presentation of navigation-related symbols, terms and abbreviations	-	-
VESA-2001-6	-	Flat Panel Display Measurements (FPDM)	-	-

CONTENTS

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 resolutions MSC.191(79) and MSC.302(87).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 testing and required test results*

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

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

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

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

IHO S-52 Annex A, *IHO ECDIS presentation library*

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.1/Circ.243/Rev.1:2014, *Guidelines for the presentation of navigation related symbols, terms and abbreviations*

IMO MSC.252(83):2007, *Performance standards for integrated navigation systems (INS)*

IMO MSC.302(87):2010, *Performance standards for bridge alert management (BAM)*

IMO A.1021(26):2009, *Code on Alerts and Indications*

VESA-2001-6, *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*

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
alarm
(MSC.302/A) *a high-priority alert. Condition requiring immediate attention and action by the bridge team, to maintain the safe navigation of the ship*

3.5
alert
(MSC.302/A) *announcement of abnormal situations and conditions requiring attention. Alerts are divided in four priorities: emergency alarms, alarms, warnings and cautions. An alert provides information about a defined state change in connection with information about how to announce this event in a defined way to the system and the operator*

3.6
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*

3.7
brilliance
adjustment of luminance of a display for ambient light

EXAMPLE Control of backlight for LCD (liquid cristal display).

3.8
caution
(MSC.302/A) *lowest priority of an alert. Awareness of a condition which does not warrant an alarm or warning condition, but still requires attention out of the ordinary consideration of the situation or of given information*

3.9
consistent common reference point
CCRP
(MSC191/A) *location on own ship, to which all horizontal measurements such as* own ship position, heading, 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

Note 1 to entry: 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.

3.10
composite presentation
integrated presentation that is derived from the simultaneous display of information from two or more navigational systems or from other pieces of equipment

3.11
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*

3.12
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

3.13
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*

3.14
display equipment
device capable of representing information visually

3.15
doubtful integrity
state when integrity cannot be verified

3.16
electronic chart display and information system
ECDIS
system which complies with the requirements set forth in IMO Resolution MSC.232(82)

3.17
electronic chart information
one or more electronic chart databases

EXAMPLE ENC.

3.18
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*

3.19
emergency alarm
(MSC.302/A) *highest priority of an alert. Alarms which indicate immediate danger to human life or to the ship and its machinery exits and require immediate action*

3.20
estimated position
EP
position extrapolated from the last accepted position update, based on present course and speed (STW), including effects of wind, tide, current, and updated on a time interval selected by the operator

3.21
fix
position of own ship determined, without reference to any former position, by the common intersection of two or more LOPs

3.22
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*

3.23
icon
graphical symbol with a particular meaning used to convey information independent of language

Note 1 to entry: 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.

3.24
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*

Note 1 to entry: The important indication is not part of alert classification.

3.25
indication
display of regular information and conditions, not part of alert management

3.26
integrated navigation system
INS
system which complies with the requirements set forth in IMO Resolution MSC.252(83)

3.27
integrity
property of information as being within the specified accuracy in a timely, complete and unambiguous manner

3.28
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

3.29
lost target
(MSC191/A) tracked radar or reported AIS *target* for which the system is no longer receiving *valid position* data

Note 1 to entry: The target is *represented* by a “lost target” symbol.

3.30
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

3.31
multifunction display
single visual display unit that can present, either simultaneously or through a series of selectable pages, information from multiple systems or equipment

Note 1 to entry: A multifunction display may typically be part of an INS (for example, providing dedicated presentation modes conforming to both radar and ECDIS presentation requirements), and may replace their individual display units.

3.32
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*

3.33
past positions
(MSC191/A) *time-spaced marks* on the past track *of* own ship, or *a tracked* radar *or reported* AIS *target*

3.34
permanent
property of information as existing for a long time (or forever) without change

3.35
persistent
property of information as existing continuously

3.36
radar
system which complies with the requirements set forth in IMO Resolution MSC.192(79)

3.37
radar echo
returned radar signal (i.e. "paint") appearing in the radar video image

3.38
radar video image
set of displayed information constructed from radar echoes processed by anti-clutter means and other tools

Note 1 to entry: For example, scan-to-scan correlation.

3.39
readily available
property of information as being directly accessible

Note 1 to entry: For example, in a top-level menu, from a screen function, or an icon, etc.

3.40
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*

3.41
simple operator action
(MSC252/A1) *procedure achieved by no more than two hard-key or soft-key actions, excluding any necessary cursor movements, or voice actuation using programmed codes* or equivalent alternative means

3.42
single operator action
(MSC252/A1) *procedure achieved by no more than one hard-key or soft-key action, excluding any necessary cursor movements, or voice actuation using programmed codes*

3.43
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*

3.44
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*

3.45
target tracking system
system which complies with the requirements set forth in IMO Resolution MSC.192(79)

3.46
task-at-hand
specific navigation-related activity performed by a user

Note 1 to entry: For example, route planning, route monitoring, target tracking, collision avoidance, etc.

3.47
tracked radar target
object, fixed or moving, which is tracked by a radar or target tracking function

3.48
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*

3.49
user-added electronic chart information
electronic chart information manually entered by the user for presentation

Note 1 to entry: For example, navigational notes, safety zones of interest, local notices to mariners, etc.

3.50
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*

3.51
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*

3.52
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

3.53
warning
(MSC.302/A) alert for *condition requiring immediate attention, but no immediate action by the bridge team. Warnings are presented for precautionary reasons to make the bridge team aware of changed conditions which are not immediately hazardous, but may become so if no action is taken*

4 General requirements for all displays on the bridge of a ship

4.1 Relationship to IMO standards

(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.

(MSC302/3.6) *In case of conflict with alert requirements of existing performance standards, the present Performance standards* (MSC.302(87)) *will take precedence*.

NOTE In case of conflict for alert presentation related issues the priority of IMO performance standards is from the highest MSC.302(87), MSC.252(83), MSC.191(79), after which all performance standard are equal.

(MSC191/2) IMO resolution MSC.191(79) *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) IMO resolution MSC.191(79) *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.

This standard further addresses the guidelines for the presentation of navigation-related symbols, terms and abbreviations in Safety of Navigation circular SN/Circ.243.

(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, ECDIS, multifunction

displays 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.

(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.*

Some requirements set forth in MSC.191(79) duplicate requirements set forth in other IMO documents 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. Manufactures may offer relevant test data from compliance tests to other standards as evidence of compliance with appropriate tests of this standard.

4.2 Application of IEC 60945

4.2.1 Remark

If display equipment is permitted to be monochrome, then the colour-related requirements specified in 4.5.1, 4.7.1, 4.7.2, 4.7.3 and 4.8.2 will not apply.

4.2.2 General requirements

4.2.2.1 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*.

4.2.2.2 Methods of test and required results

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

4.3 Arrangement of information

4.3.1 Consistency of layout

4.3.1.1 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, with respect to concepts, terminology, labelling and interaction paradigms used across the application and from screen to screen and/or from page to page*. 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*.

4.3.1.2 Methods of test and required results

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

a) confirm by analytical evaluation that the arrangement, logical grouping, operation and identification of controls, screen displays and indications are in accordance with Annex E and IEC 60945:2002, 4.2.1.2 through 4.2.1.5;

b) confirm by analytical evaluation that the concepts, terminology, labelling and interaction paradigms, screen layout and arrangement of information is consistent from screen to screen and/or page to page;

c) confirm by analytical evaluation 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.

4.3.2 Consistent presentation of information

4.3.2.1 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 4.8.1 and 4.8.2); *and*
- *integrity* of information, if available (see also 4.8.1 and 4.8.2).

(See also IEC 60945:2002, 4.2.1.5)

4.3.2.2 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.

4.3.3 Separation of operational display area

4.3.3.1 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).*

4.3.3.2 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.

4.4 Readability

4.4.1 Readability under all ambient light conditions

4.4.1.1 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) *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 4.5.1 and 7.2.1)

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 1 The “Day” colour table provided in the IHO ECDIS Presentation Library 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 and adjusting brightness and contrast, if provided, for use under all light conditions.

Display equipment shall provide a luminance of at least 85 cd/m^2 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/m^2 ± 20 % and may be extinguishable below that point.

If provided, dimming below 0,8 cd/m^2 as white level shall continue to ensure readability of alerts (alarms, warnings and cautions) while readability of all other items is not required.

NOTE 2 General requirements for illumination are described in IEC 60945.

Transflective and reflective displays shall provide adjustable self illumination 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. It shall be adjustable to produce display luminance at least from 1 cd/m^2 to 5 cd/m^2 under night conditions.

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

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 on the application.

It shall be possible to display alphanumeric data, text, symbols (see 4.6) 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 4.6.2), 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 4 The IHO ECDIS Presentation Library provides “black-adjust” symbols BKAJ1 and BKAJ2, for the colours black and grey, respectively.

If display equipment is not intended to present symbols for charted information (see 4.6.2), it shall maintain that any colours used are visually distinguishable against the background.

NOTE 5 Visually distinguishable is at least luminance ratio 1:2 when using instrumental verification.

It is important to avoid affecting the night vision of the officer of the watch by excessive glow from displays on the bridge at night. The display shall be capable of providing a contrast of 100:1 between the 1 cd/m^2 white level and the black background.

4.4.1.2 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), see VESA-2001-6) standard. Before measurements are taken, power up the display equipment and allow it to stabilize for the period of time specified by the manufacturer, as follows.

a) Confirm by observation at the manufacturer's recommended viewing distance that alphanumeric data, text, symbols and other graphical information including alerts are readable under the ambient light conditions described in Table 1.

b) For direct view displays (for example CRT (cathode ray tube), LCD (liquid crystal display) with backlight, etc.) 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/m^2 to a maximum level of at least 85 cd/m^2 measured under dark condition. Confirm by measurement that the values for brightness used for the setup are stable after the stabilisation period defined by the manufacturer. Confirm by measurement in the night ambient condition that the contrast ratio between the 1 cd/m^2 white level and the black background is 100:1, minimum.

c) For transflective and reflective displays, 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 adjustable at least from 1 cd/m^2 to 5 cd/m^2 under conditions of night ambient illumination to a maximum level of at least 85 cd/m^2 under conditions of daylight ambient illumination. Confirm by measurement that the values for brightness used for the setup are stable after the stabilisation period defined by the manufacturer. Confirm by measurement in the night ambient condition that the contrast ratio between the 1 cd/m^2 white level and the black background is 100:1, minimum. The ambient illumination levels shall be as specified in Table 1.

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

d) Confirm by observation that alphanumeric data, text, symbols and other graphical information including alerts can be presented using a lighter foreground against a dark background.

e) 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.

f) 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.

g) Where display equipment is intended to present symbols for charted information confirm by observation for each ambient light condition that the user can verify that the colour black is visually distinguishable against a background set to dark grey, and vice-versa.

h) Where display equipment is not intended to present symbols for charted information confirm by observation for each ambient light condition that any colours used are visually distinguishable against background.

i) If dimming below 0,8 cd/m^2 as white level is provided then confirm by observation after 10 min adaptation period to night ambient light condition by the observer that at least the alerts (alarms, warnings, cautions) are readable and different alert levels are distinguishable from each other.

4.4.2 Legibility of alphanumeric data and text

4.4.2.1 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.

4.4.2.2 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.

4.4.3 Presentation of text

4.4.3.1 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.

4.4.3.2 Methods of test and required results

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

a) confirm by analytical evaluation 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;

c) confirm by inspection of documented evidence that another terminology or abbreviation, if used, are explained in the operator's manual.

4.4.4 Icons

4.4.4.1 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. Icons used for the presentation of alerts shall be presented according to Annex F.

4.4.4.2 Methods of test and required results

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

a) confirm by analytical evaluation 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;

c) confirm by observation that icons used for the presentation of alerts are presented according to Annex F (see also 5.6.1.2).

4.5 Colours and intensity

4.5.1 Discrimination of colours – 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 specified 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 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 and adjusting brightness and contrast, if provided, for use under all light conditions.

4.5.2 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 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 specified colours in the IHO ECDIS Presentation Library, or equivalent, as far as practical (see Clause G.1 for additional guidance).

4.6 Symbols

4.6.1 Operational information

4.6.1.1 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.

(SN-Circ.243/1/3) *Where a standard symbol is not available, another symbol may be used, but this symbol* shall *not conflict with the symbols listed in* Annex A or in the ECDIS presentation library. (For additional guidance, see also ISO 80416-4.)

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.

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.

4.6.1.2 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.

4.6.2 Electronic chart information

4.6.2.1 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 specified 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 4.4.2);
- have the same general shape as IHO ECDIS Presentation Library symbols used for the same or similar purpose(s).

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

4.6.2.2 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 IHO 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 IHO ECDIS 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 IHO ECDIS Presentation Library symbols.

4.7 Colour coding of information

4.7.1 Colour coding for discrimination

4.7.1.1 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 4.5.1).

4.7.1.2 Methods of test and required results

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

4.7.2 Colour coding of information

4.7.2.1 Requirement

(MSC191/5.5.2) If *colour coding is used,* then *the colour red* shall *be used for* the *coding of* alert *related information* for alarm and emergency alarm conditions unless otherwise specified by the IMO (for example in tables 7.1.1 and 7.1.2 of the IMO A.1021(26) Code on Alerts and Indications).

4.7.2.2 Methods of test and required results

Confirm by inspection of documented evidence that the colour red is used to indicate an alarm or emergency alarm condition unless otherwise specified by the IMO.

4.7.3 Colour coding in combination with other attributes

4.7.3.1 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 alerts shall be visible and identifiable even after the failure of any one primary colour input to the display.

4.7.3.2 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 alerts remain identifiable even after transmission of each of the primary colours is disabled one at a time.

4.7.4 Flashing of information

4.7.4.1 Requirement

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

4.7.4.2 Methods of test and required results

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

4.8 Integrity marking

4.8.1 Indication of source, validity and integrity status

4.8.1.1 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* (see important indication). *Invalid information or information with low integrity may be quantitatively indicated by displaying absolute or percentage values*.

4.8.1.2 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.

4.8.2 Colour coding of validity and integrity

4.8.2.1 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 as defined in Table 2*, and invalid information* shall *be qualitatively marked by using* the colour as defined in Table 2.

4.8.2.2 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 as defined in Table 2 is used to indicate information with low or doubtful integrity;

b) confirm by observation that the colour as defined in Table 2 is used to indicate invalid information.

4.8.3 Indication of presentation failure

4.8.3.1 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 two alternating dots, etc.).

4.8.3.2 Methods of test and required results

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

4.9 Alerts and indications

4.9.1 Operational status

4.9.1.1 Requirement

(MSC191/5.7.1) *The operational status of information* shall *be indicated as* in Table 2 unless otherwise specified by the IMO (for example in tables 7.1.1 and 7.1.2 of the Code on Alerts and Indications, 2009):

(MSC 302/7.6.2) *An unacknowledged warning* shall *be:*

1) repeated as a warning after a limited time period not exceeding 5 min; or

2) changed to alarm priority after a limited time period not exceeding 5 min; or

3) changed to alarm priority after a user selectable time not more than 5 min, if provided; or

4) changed to alarm priority, as required by specific requirements for the individual equipment and system.

Table 2 – Operational status

Status	Visual Indication	Audible Signal
Emergency alarm	As specified in Table 7.1.1 of the Code on Alerts and Indications 2009 (IMO resolution A.1021(26))	As specified in Tables 7.1.1 and 7.2 of the Code on Alerts and Indications 2009 (IMO resolution A.1021(26))
Alarm, not acknowledged	Red, Flashing	Accompanied by an audible signal, as 3 short audible signals repeated every 7 s to 10 s
Alarm, silenced	Red, Flashing	Silent
Alarm, acknowledged	Red	Suppression of audible signal (= silent)
Invalid information	Yellowish orange	Silent
Information with low integrity	Yellow	Silent
Warnings, not acknowledged	Yellowish orange, Flashing	Accompanied by an audible signal, as 2 short audible signals, to be repeated at least once per 5 min or be replaced by an alarm.
Warnings, silenced	Yellowish orange, Flashing	Silent
Warnings, acknowledged	Yellowish orange	Silent
Caution	Yellow	Silent
Important Indications	Yellow	Silent
Indication	No special requirement	Silent
Normal State	Optionally Green	Silent

NOTE Code on Alerts and Indications 2009 (IMO resolution A.1021(26)) specifies frequency range (in 5.11) and sound pressure level (in 5.13) for audible signal.

4.9.1.2 Method of test and required results

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

NOTE Alert management for integrated navigation systems is described in detail in IEC 61924-2.

4.9.2 List of alerts

4.9.2.1 Requirement

(MSC191/5.7.2) *A list of* alerts 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 alerts *from multiple sources.* Alerts *that have been acknowledged and are no longer relevant* shall *be deleted from the list of* alerts*, but may be retained in an* alert *history list.*

4.9.2.2 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 alerts;

b) where display equipment supports the presentation of alerts from multiple sources (for example, from multiple navigational systems and equipment):

   1) confirm by observation that there is the capability for the user to set a priority for the alerts;

   2) confirm by observation that an indication of priority is included in the list of alerts;

c) confirm by analytical evaluation that acknowledged alerts which are no longer relevant are deleted from the list of alerts.

4.9.3 Alert related information from multiple sources

4.9.3.1 Requirement

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

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

4.9.3.2 Methods of test and required results

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

4.9.4 Speech output for alarms and warnings

4.9.4.1 Requirement

(MSC 302/7.3.2.3) An unacknowledged alarm condition *may be accompanied by speech output presented at least in English, using harmonized alert voice messages according to the regulations of the Organization.*

(MSC 302/7.4.2.3) *An unacknowledged warning condition may be accompanied by speech output presented at least in English, using harmonized alert voice messages according to the regulations of the Organization.*

(MSC 252/20.2.2) *The visual announcement and speech output* shall *occur simultaneously. The audio signal* shall *be announced before the speech output.*

NOTE IEC 60945:2002, 4.2.1.6 contains generic requirements for voice announcements.

The speech output shall only announce the visually indicated unacknowledged alert(s) which will be acknowledged by the next operation of the alert acknowledge. The speech output may announce them individually or may announce that multiple alerts are present.

The speech output shall be followed by at least a 2 s pause before repetition or new announcement. For alarms the speech output shall be repeated for every second cycle.

If a new higher priority alert arrives during speech output of a lower priority alert then the lower priority alert shall be interrupted to allow audio signal as defined in Table 2 to occur before the speech output of the new higher priority alert.

The speech output shall be interrupted when the associated alert is acknowledged.

The speech output shall use plain language using marine terminology as defined in SMCP (see IMO A.918(22)), as appropriate. The speech output shall be clearly understandable.

The volume shall be adjustable from 85 dB(A) at 1 m to extinction without affecting the sound pressure level of the audible alert signal.

Failure of the speech output shall not degrade operation of visual indication. Failure of the speech output shall not degrade operation of audible alert signal except when common components are used for both audible signals and speech output.

4.9.4.2 Methods of test and required results

If speech output is provided, confirm by observation that:

- the audio signal as defined in Table 2 occurs before the speech output;
- for alarms the same speech is repeated as long as the alarm is unacknowledged;
- for warnings the same speech is repeated only when repeating the warning based on requirement 4.9.1.1;
- the speech output only announce visually indicated unacknowledged alerts which can be acknowledged by the next operation of the alert acknowledge;
- the speech output has at least a 2 s pause before repetition or a new announcement and the speech output for alarms is repeated for every second cycle;
- the speech output of a lower priority alert is interrupted when a new higher priority alert arrives;
- the speech output is interrupted when the associated alert is acknowledged;
- it is possible to adjust the speech volume to extinction without affecting the audible signal.

If speech output is provided, confirm by analytic evaluation that:

- speech output is at least in plain English language, using marine terminology conforming with the SMCP (see IMO A.918(22)) where appropriate;
- announcements are clearly understandable at the maximum loudness level.

If speech output is provided, follow manufacturer's instructions and cause failure of the speech output. Confirm by observation that visual indication and audible signal remain as defined in Table 2.

4.10 Presentation mode

4.10.1 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, gnomonic, 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.

4.10.2 Methods of test and required results

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

4.11 User manuals, instructions and reference guides

4.11.1 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 Annex A, Annex B and Annex E.)

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 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

5.1 Application

The provisions of this clause are applicable to displays on the bridge of a ship that provide functionality as described in the following subclauses.

5.2 Presentation of own ship information

5.2.1 Graphical representation of own ship – 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.*

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 3 mm, and vice versa. The true scaled outline shall not be used when the heading is not known in a gyro/THD-stabilized mode. 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 3 mm, and vice versa.

5.2.2 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 3 mm, 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 that the minimised symbol may be used as alternative to the simplified symbol.

5.3 Presentation of chart information

5.3.1 Alteration of chart information

5.3.1.1 Requirement

It shall not be possible to alter the electronic chart information, except by update.

5.3.1.2 Methods of test and required results

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

5.3.2 Colours and symbols for charted information

5.3.2.1 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 specified 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 proprietary* electronic *chart information* shall *comply with* or be based upon *the* colours and symbols specified 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 specified 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 specified 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* as defined in the IHO ECDIS Presentation Library in IHO S-52 and its Appendices.

5.3.2.2 Methods of test and required results

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

a) verify by observation that the presentation of official and user-added electronic chart information, as applicable, is in accordance with 4.5.1 and 4.6.2;

b) where the presentation of proprietary electronic chart information is not in accordance with 4.5.2, confirm by observation that an indication is provided;

c) when electronic chart information derived from different scales (for example, adjacent ENC cells) is displayed confirm by observation that a scale boundary is presented between the scales.

5.4 Presentation of radar information

5.4.1 Radar video images

5.4.1.1 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 colour*s *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 specified by IHO and provided in IHO ECDIS Presentation Library 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 and adjusting brightness and contrast, if provided.

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.

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.

5.4.1.2 Methods of test and required results

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

a) confirm by observation under each of the ambient light conditions described in Table 1, that radar information is presented using a contrasting colour against the background and that the background shall be dark for radar displays;

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.

5.4.2 Target trails

5.4.2.1 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.

If display equipment provides target trails, then there shall be an indication of trail time and motion stabilisation *mode.*

5.4.2.2 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 the trail time and motion stabilization mode are indicated.

5.5 Presentation of target information

5.5.1 Providing target information

5.5.1.1 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 detects and tracks radar targets. Other navigational systems may provide remote presentation of tracked radar targets. These systems shall present reported radar targets in accordance with Annex A.

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.

Any navigational system or equipment may provide remote presentation of reported AIS targets. These systems shall present reported AIS targets in accordance with Annex A.

An AIS target may be repeated or VTS-generated (see 5.5.4.1). In such case the presentation shall be as for reported AIS target in accordance with Annex A.

5.5.1.2 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 observation that the presentation is in accordance with Annex A;

b) where display equipment provides the capability to connect to an AIS: confirm by observation that the presentation is in accordance with Annex A.

5.5.2 Consistent user interface for target information

5.5.2.1 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*.

5.5.2.2 Methods of test and required results

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

5.5.3 Indication of exceeding target capacity

5.5.3.1 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*.

NOTE A definition of minimum target capacities is given in IEC 62388.

5.5.3.2 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.

5.5.4 Merging AIS targets from multiple source

5.5.4.1 Requirement

AIS Base Stations may relay or repeat AIS information and target reports with a lower update rate than transmitted from the sending vessel and with latency that is significant and variable. If both relayed and direct AIS reports are received for the same target, the relayed reports shall not be processed for display of AIS target or information.

An AIS target may be VTS-generated (AIS ASM(17)) as described in IMO SN.1/Circ.289. If both VTS-generated and direct AIS reports are received for the same target (MMSI, IMO-number, call sign), the VTS-generate reports shall not be processed for display of AIS target or information.

If both VTS-generated and relayed AIS reports are received for the same target, the relayed reports shall not be processed for display of AIS target or information.

If multiple relayed AIS reports are received for the same target, the report with the highest repeat count shall not be processed for display of AIS target or information.

If direct and VTS-generated AIS target information are both available as not merged by MMSI, IMO-number or Call sign AIS information and where the direct and VTS-generated targets are considered as one target, then the direct AIS target shall be automatically used and displayed as set forth in Annex A.

5.5.4.2 Methods of test and required results

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

a) confirm by analytical evaluation and using the AIS simulator to produce AIS reports for a nearby AIS target moving at 24 kn and relayed AIS reports for this target with delayed and reduced update rate (for example: delayed by 30 s with a 10 s update rate), that the relayed data is not displayed;

b) confirm by analytical evaluation and using the AIS simulator to produce AIS reports for a nearby AIS target moving at 24 kn and VTS-generated AIS reports with equal MMSI for this target, that the VTS-generated data is not displayed;

c) confirm by analytical evaluation and using the AIS simulator to produce VTS-generated AIS reports with equal MMSI for a nearby AIS target moving at 24 kn and relayed AIS reports for this target with delayed and reduced update rate (for example: delayed by 30 s with a 10 s update rate), that the relayed data is not displayed;

d) confirm by analytical evaluation and using the AIS simulator to produce two or more relayed VTS-generated AIS reports with equal MMSI for a nearby AIS target moving at 24 kn and two or more relayed AIS reports for this target with delayed and reduced update rate (for example: delayed by 30 s with a 10 s update rate), that only data from lowest repeat count is displayed;

e) confirm by analytical evaluation and using the AIS simulator to produce AIS reports for a nearby AIS target moving at 24 kn and VTS-generated AIS reports with target identifier set as 3 (other) for this target, that the VTS-generated data is not displayed.

5.5.5 Filtering sleeping AIS targets

5.5.5.1 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.)*.

Criteria for filtering shall only include sleeping class A or sleeping class B when combined with one or more other factors, for example including CPA/TCPA, Speed, Range or Course.

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.

It shall be possible to filter the presentation of AIS data reports other than sleeping AIS targets (for example, AIS AtoN (aids to navigation), AIS Base Station, AIS-SART, AIS SAR Aircraft).

(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.

5.5.5.2 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 filter the presentation of sleeping AIS targets;
b) confirm by observation that the user can filter the presentation of AIS data reports;
c) confirm by observation that an indication is provided when sleeping targets are filtered from the presentation;
d) confirm by observation that the indication remains while the filter is active;
e) confirm by analytical evaluation that the filter criteria in use is readily available;
f) confirm by observation that the user cannot remove individual AIS targets from the presentation.

5.5.6 Activation of AIS targets

5.5.6.1 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).*

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.

5.5.6.2 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.

5.5.7 Graphical presentation of targets

5.5.7.1 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*.

5.5.7.2 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 4.10.1;

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 by observation that it is possible to display the past positions of activated AIS targets.

5.5.8 Target selection

5.5.8.1 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*.

5.5.8.2 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.

5.5.9 Indication of target derivation

5.5.9.1 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*.

5.5.9.2 Methods of test and required results

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

5.5.10 Presentation of tracked radar target information

5.5.10.1 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 additional target information is available, an indication shall be provided when viewing alphanumeric information of the selected target.

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).

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.

5.5.10.2 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 for each selected target;

b) confirm by observation that additional information, where available, is indicated and provided to the user on request;

c) confirm by analytical evaluation that the target information is logically "paired" for presentation.

5.5.11 Presentation of reported AIS target information

5.5.11.1 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 (for example, repeated, VTS-generated, etc.);
- 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*. All *additional target information*, where available from the same MMSI source (including for example most recent AIS safety messages), shall *be provided* to the user *on request*. If additional target information is available, an indication shall be provided when viewing alphanumeric information of the selected target.

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*.

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.

5.5.11.2 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.

5.5.12 Continual update of target information

5.5.12.1 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.*

5.5.12.2 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.

5.5.13 Own ship's AIS information

5.5.13.1 Requirement

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

5.5.13.2 Methods of test and required results

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

5.5.14 Obscuring the operational display area

5.5.14.1 Requirement

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

5.5.14.2 Methods of test and required results

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

5.6 Operational alerts

5.6.1 Alert status

5.6.1.1 Requirement

(MSC191/6.4.7.1) *A clear indication of the status of the* alerts *and the* alert *criteria* (i.e. identification) shall *be given* to the user. (See also 4.9.1 and 4.9.3.)

Except for IMO requirements for radar and AIS target symbols displayed in the operational area and for ECDIS highlight of danger, warnings, and caution in the chart area, only text-based visual indication of alert (e.g. in user dialog area) is mandatory. Optionally icons can be presented together with the text, see Annex F.

5.6.1.2 Methods of test and required results

Confirm by analytic evaluation that a clear indication of the status of alerts and the alert criteria is provided as text to the user.

Confirm by observation that if icons are additionally provided that they conform to Annex F (see also 4.4.4.2).

5.6.2 CPA/TCPA alarms

5.6.2.1 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.

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.

5.6.2.2 Methods of test and required results

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

5.6.3 Acquisition/activation zones warnings

5.6.3.1 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* a warning 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 warnings 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 warnings 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 warnings 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.

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.

5.6.3.2 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 5.5.7;
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 of 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 5.5.7.

5.6.4 Lost target warnings

5.6.4.1 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* warning shall *be given* if the lost target warning function is enabled*. The lost target symbol* shall *disappear if the signal* (or message) for the target *is received again or after the* warning *has been acknowledged.* A means or method shall be provided for the user to enable/disable the lost target warning function. *There* shall *be a clear indication whether the lost target* warning *function for* tracked radar targets and activated *AIS targets is enabled or disabled*. If a target is beyond a user defined range, then no warning shall be generated.

5.6.4.2 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, a warning 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 warning has been acknowledged;

c) confirm by observation that a means or method is provided to enable/disable the lost target warning function;

d) confirm by observation that there is a clear indication of whether the lost target warning function for tracked radar targets and activated AIS targets is enabled or disabled;

e) confirm by observation that no warning is generated for a lost target that is beyond the user defined range.

5.7 AIS and radar target association

5.7.1 Target association

5.7.1.1 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.

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.

(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* alert shall *be raised.*

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.

5.7.1.2 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.

5.7.2 AIS presentation status

5.7.2.1 Requirement

(MSC191/6.4.9) *The AIS presentation status* shall *be indicated as follows* in Table 3.

Table 3 – AIS status

Function	***Cases to be Presented***		***Presentation***
AIS ON/OFF	***AIS processing switched ON/ graphical presentation switched OFF***	***AIS processing switched ON/ graphical presentation switched ON***	***Alphanumeric or graphical***
***Filtering of sleeping AIS targets* (See 5.5.5.)**	Indicate whether the *filter status* for sleeping AIS targets is switched ON	Indicate whether the *filter status* for sleeping AIS targets is switched ON	Indications may be *alphanumeric or graphical*
***Activation of targets* (See 5.5.6)**		Indicate the *activation criteria* is for AIS targets, including automatic activation zones	Indications shall be *graphical*
***CPA/TCPA alarm* (See 5.6.2)**	Indicate whether the CPA/TCPA Alarm *function* is switched *ON/OFF* Indicate the *CPA/TCPA Criteria* Indicate whether *Sleeping* AIS *targets* are *included* or excluded from CPA/TCPA processing	Indicate whether the CPA/TCPA Alarm *function* is switched *ON/OFF* Indicate the *CPA/TCPA Criteria* Indicate whether *Sleeping* AIS *targets* are *included* or excluded from CPA/TCPA processing	Indications shall be *alphanumeric and graphical*
***Lost target* warning (See 5.6.4)**	Indicate whether the Lost Target Warning *function* is switched *ON/OFF* Indicate the *Lost target Filter Criteria*	Indicate whether the Lost Target Warning *function* is switched *ON/OFF* Indicate the *Lost target Filter Criteria*	Indications shall be *alphanumeric and graphical*
***Target association* (See 5.7.1)**	Indicate whether the Target Association *function* is switched *ON/OFF* Indicate the *Association Criteria* Indicate the *Default Target Priority*	Indicate whether the Target Association *function* is switched *ON/OFF* Indicate the Association Criteria Indicate the *Default Target Priority*	Indications shall be *Alphanumeric*
This table is a simplified matrix for the presentation of indications associated with AIS functions.			

5.7.2.2 Methods of test and required results

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

a) verify the filtering of sleeping AIS targets in accordance with 5.5.6;

b) verify the activation of AIS targets in accordance with 5.5.7;

c) verify CPA/TCPA alarm functionality in accordance with 5.6.2;

d) verify lost target warning functionality in accordance with 5.6.4;

e) verify the association of AIS targets to tracked radar targets in accordance with 5.7.1.

5.7.3 Trial manoeuvre

5.7.3.1 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.

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.

5.7.3.2 Methods of test and required results

Where display equipment provides a trial manoeuvre simulation:

a) confirm by observation that the manoeuvre is identified in accordance with Annex A;

b) confirm by analytical evaluation that the symbol is positioned in a conspicuous location.

5.8 Measurement

5.8.1 Measurement from own ship

5.8.1.1 Requirement

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).

For consistency of measured ranges and bearings, the recommended reference location should be the conning position. Alternative reference locations may be used where clearly indicated or distinctively obvious.

5.8.1.2 Methods of test and required results

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

a) confirm by observation that the means of taking measurements are centred on to the CCRP and not centred on any other position except where specifically selected and clearly indicated;

b) confirm by measurement, by comparing at least two alternative sensor inputs that have different position offsets from CCRP, that the range and bearing measurements are correct to the CCRP position and, if provided, alternative reference position;

c) confirm by measurement that when switching from CCRP to an alternative reference position that displayed data is changing accordingly but data transmitted via the interface remains referenced to the CCRP.

5.8.2 Bearing and range measurements

5.8.2.1 Requirement

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.

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. Where metric range measurements are required, the accuracy shall not be inferior to other range measurements.

5.8.2.2 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.

5.9 Navigation tools

5.9.1 General requirements

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.

5.9.2 Range rings

5.9.2.1 Requirement

(MSC191/7.1.4) If *range rings are displayed,* then *the range ring scale* 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.

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.)

5.9.2.2 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 (scale) 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.

5.9.3 Variable range marker (VRM)

5.9.3.1 Requirement

Variable range marker(s) (VRMs) may be provided to measure the range of any point object within the operational display area.

Each active VRM shall have a numerical readout and the readout shall have a resolution compatible with the range scale in use.

Each active VRM shall be capable of adjustment to resolution of 0,01 NM, or to appropriate metric equivalent. A coarser resolution may be provided for higher range scales. The readout shall be available in the user dialogue area or, additionally, adjacent to the cursor when the cursor is over the VRM.

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 each VRM to measure the range to any point within the operational area and with the specified accuracy within 5 s.

A means or method to switch each VRM on and off shall be provided.

The VRM range set by the user shall be retained when there is a change in range scale.

If means are provided to move VRM origin from the CCRP to other points within the operational display area, geographically fixed or moving with the velocity of own ship, then a means shall be provided to reset the VRM origin to the CCRP position by a simple operator action.

5.9.3.2 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 dedicated readout is available for each active VRM;

c) confirm that the VRMs are capable of adjustment to 0,01 NM (or appropriate metric equivalent). A coarser adjustment may be provided for ranges greater than 24 NM or appropriate metric equivalent;

d) confirm by measurement that the accuracy of the VRMs meet the requirement using a calibrated target or marker;

e) confirm by measurement that when metric measurements are provided, the readout and accuracy is equivalent to those relevant to nautical miles;

f) confirm by measurement that the range to any object within the operational display area can be measured within 5 s with the required accuracy;

g) confirm by observation that a means or method to switch each VRM on and off is provided;

h) confirm by observation that the range of the VRM is maintained from range scale to range scale;

i) confirm by observation that if means are provided to move VRM origin from the CCRP to other points means are provided to reset the VRM origin to the CCRP position by a simple operator action.

5.9.4 Bearing scale

5.9.4.1 Requirement

A bearing scale may be provided. The bearing scale shall indicate the bearing from the CCRP.

For radar display equipment, including radar with charted information, the bearing scale shall be outside of the operational display area (i.e. around its periphery and outside of which no radar video shall be displayed). For other display equipment 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.

5.9.4.2 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.

5.9.5 Electronic bearing line (EBL)

5.9.5.1 Requirement

Electronic bearing line(s) (EBLs) may 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.

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 (i.e. true or relative).

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 operator action.

It shall be possible to fix the EBL origin or to move the EBL origin at the velocity of own ship.

A means or method shall be provided to ensure that the user is able to position 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.

Each active EBL shall have a numerical readout with a resolution of 0,1° adequate to maintain the system measurement accuracy requirements based on a measurement uncertainty of ±0,5°.

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 or after a change in display orientation).

5.9.5.2 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 simple 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 measurement that the EBL can be used to measure the bearing to any point object in the operational display area within ±0,5° in less than 5 s;
k) confirm by observation that a numerical readout with a resolution of 0,1° 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.

5.9.6 Parallel index lines (PI)

5.9.6.1 Requirement

Parallel index (PI) lines may be provided. If parallel index lines are provided:

- independent parallel index lines with a means or method to truncate and switch off individual lines shall be provided;
- a simple and quick means or method of setting the bearing and beam range of a parallel index line shall be provided.

The bearing and beam range of any selected parallel index line shall be available on demand.

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

PI line range settings shall remain constant when the operator changes the range scale of the display and PI line bearing settings shall remain constant when own ship heading changes.

In addition to on/off selection of individual PI lines, means shall be provided to turn on/off all PI lines as a group.

5.9.6.2 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 the length of each PI line;
c) confirm by observation that PI lines are selectable for display on/off individually and as a group including all PI lines;
d) confirm by measurement that a means or method is provided to set the bearing or range of a parallel index line within 5 s;
e) confirm by observation that means are provided to display the bearing and range for any parallel index line on demand;
f) confirm by observation that the distance of a PI line from the own ship and the true bearing of PI line does not change when a different range scale is selected, when own ship heading changes, and during True motion operation.

5.9.7 Offset measurement of range and bearing

5.9.7.1 Requirement

There may 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° 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° based on a measurement uncertainty of ±0,5° 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 or after a change in display orientation);
- 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.

5.9.7.2 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 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 from one position within the operational display area to any other position can be measured to within an accuracy of ±1 % of the range scale in use or 30 m, whichever is greater;

e) confirm by measurement that the bearing from one position within the operational display area to any position can be measured to within an accuracy of 0,5° 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 and a change of orientation mode while the tool is enabled.

5.9.8 User cursor

5.9.8.1 Requirement

A user cursor may be provided to enable a fast and concise means or method to designate any position on the operational display area. If a user cursor is provided:

- the cursor position shall have a continuous numerical readout to provide the range and bearing, measured from the CCRP, and the latitude and longitude of the cursor position presented either alternatively or simultaneously;
- a means or method shall be provided to easily locate the cursor position in the operational display area;
- the accuracy of the range and bearing measurements provided by the cursor shall meet the relevant requirements for VRM and EBL.

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

5.9.8.2 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 the latitude and longitude of the cursor's position;

c) confirm by observation that a means or method is provided to locate the cursor in the operational display area;

d) confirm by analytical evaluation that the resolution of the range readout is compatible with each range scale;

e) confirm by observation that the resolution of the bearing readout is 0,1°;

f) confirm by analytical evaluation that the resolution of the latitude and longitude readout is compatible with each display scale;

g) 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;

h) confirm by measurement that the bearing to any point object within the operational display area can be measured to within an accuracy of 0,5° at the periphery of the display;

i) confirm by observation that the cursor can be moved smoothly to create rotation in either direction;

j) 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

6.1 General

6.1.1 Application

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

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 multifunction display equipment when providing a radar or chart display.

6.1.2 Multifunction displays

6.1.2.1 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* operator *action.*

Note that if multifunction display equipment 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.

6.1.2.2 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 operator action.

6.1.3 Simultaneous display of radar and chart data

6.1.3.1 Requirement

(MSC191/7.1.2) *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.

6.1.3.2 Methods of test and required results

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

a) confirm by observation that they use the same reference system and co-ordinate criteria;

b) confirm by observation that they use the same stabilisation mode;

c) confirm by observation that they match in scale, projection and orientation;

d) 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;

e) confirm by observation that the details of the user-entered offset are readily available.

6.1.4 Range scales

6.1.4.1 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 NM and/or above 24 NM. *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 5.8.2.)

6.1.4.2 Methods of test and required results

Where a radar video image is displayed:

a) confirm by observation that range scales of 0,25, 0,5, 0,75, 1,5, 3, 6, 12 and 24 NM are provided for user selection;

b) where additional range scales are provided, confirm by observation that they are below 0,25 NM and/or above 24 NM;

c) confirm by observation that the selected range scale is clearly indicated and remains visible while the radar video image is displayed.

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).

Note that 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

A clear indication of the motion mode in use shall be provided. (See also 4.10.1.)

6.1.6.2 Methods of test and required results

Verify that a clear indication of the display mode in use is provided in accordance with 4.10.1.

6.1.7 Orientation modes

6.1.7.1 Requirement

A north up orientation mode shall be provided for radar and chart presentations.

A course up orientation mode shall be provided for radar presentations and may be provided for chart presentations.

A head up orientation mode may be provided for both radar and chart presentations.

A clear indication of the orientation mode in use shall be provided. (See also 4.10.1)

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 4.10.1;

d) for each bearing stabilised orientation that may be provided, confirm by analytical evaluation that for rates of turn between 0°/s and 20°/s the displayed chart symbols and text in the operational display area do not re-orient more often than twice per second and remain legible.

6.1.8 Off-centring

6.1.8.1 Requirement

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. This limitation is only applicable for Radar or Radar-mode available in the equipment (for example this limitation is not valid for radar overlay in an ECDIS).

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. This limitation is only applicable for Radar or Radar-mode available in the equipment (for example this limitation is not valid for radar overlay in an ECDIS).

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 at least 50 %, and not more than 75 %, of the radius from the centre of the operational display area 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. This limitation is only applicable for Radar or Radar-mode available in the equipment (for example this limitation is not valid for radar overlay in an ECDIS).

6.1.8.2 Methods of test and required results

Where a radar video image is displayed in a Radar or Radar-mode (not, for example, as a radar overlay on ECDIS):

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 at least 50 %, and not more than 75 %, of the radius from the centre of the operational display area,

   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.

Where radar information is displayed, both ground and sea stabilisation modes shall be provided.

The stabilisation mode and stabilisation source (i.e. velocity or speed source) shall be clearly indicated. (See also 4.10.1.)

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 selected and its source are provided.

6.2 Radar displays

6.2.1 Application

The provisions of this subclause are applicable to stand-alone displays associated with radar systems and multifunction displays 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.

6.2.2 Radar video image

6.2.2.1 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 5.4.1.)

(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.*

6.2.2.2 Methods of test and required results

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

a) confirm by analytical evaluation that 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.

6.2.3 Brightness of radar information

6.2.3.1 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.*

6.2.3.2 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.

6.2.4 Display of chart information on radar

6.2.4.1 Requirement

(MSC191/7.2.2.1) *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 4.5.1, 4.6.2 and 5.5.1) 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) 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 that the overscale area pattern addressed in IHO S-52 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) is an acceptable alternative.

If electronic chart information is presented on a radar display, it shall be possible to temporarily remove it by a single operator action and also to switch charts on and off.

6.2.4.2 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 4.5.1, 4.6.2 and 5.5.1;

d) confirm by observation that raster format electronic chart information cannot be presented when the radar is displayed;

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 a permanent indication of the status (official/unofficial data and overscale/underscale) 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 on demand;

h) confirm by observation that the user may temporarily remove electronic chart information from the display by a single operator action and that there is a facility to switch charts on and off. The temporarily removed function may be combined with other functions;

i) confirm by document inspection that the user manual describes all available chart functionalities;

j) confirm by document inspection that the EUT has no functionality to use raster navigational charts;

k) verify the testing of colours and intensity in accordance with the test methods and required results of the Annex G.

6.2.5 Priority of radar information

6.2.5.1 Requirement

(MSC191/7.2.2.2) *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.*

6.2.5.2 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 analytical evaluation that the presentation of electronic chart information cannot be confused with the display of any other information (for example radar information or AIS information);

c) confirm by analytical evaluation that the presentation of the electronic chart information does not substantially degrade, mask or obscure the presentation of radar information in accordance with 6.2.3.

6.2.6 Display of map graphics

6.2.6.1 Requirement

(MSC191/7.2.3) 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 that where a radar system provides map graphics for monitored and/or planned routes, it should comply with the relevant clauses of IEC 61174.

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 operator action.

Map graphics may consist of lines, symbols and reference points.

The appearance and colours of map graphic lines and symbols are set forth in Annex A.

6.2.6.2 Methods of test and required results

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

a) confirm by analytical evaluation 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 simple operator 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

6.3.1 Application

The provisions of this subclause are applicable to stand-alone displays responsible for the presentation of electronic chart information and multifunction displays 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.

6.3.2 Display of chart information

6.3.2.1 Requirement

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

(MSC191/7.3.1.2) 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.).

6.3.2.2 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 4.5.1, 4.6.2 and 5.5.1;

b) confirm by analytical evaluation that the electronic chart information is not substantially degraded, masked or obscured by other presented information.

6.3.3 IMO ECDIS display categories

6.3.3.1 Requirement

(MSC191/7.3.1.3) *It* shall *be possible to temporarily suppress all supplemental (e.g.* radar, AIS and other overlays) *information from the* chart *display, retaining only chart related information contained in the* ECDIS *Display Base*. This function is not required to be of single or simple operator action.

It shall be possible to remove radar information, AIS information and other navigational information including all non-charted information from the chart display by a single operator action. Chart display consists of chart itself and all automatic and manual updates for it. This removal may be permanent or momentary.

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.

It shall be possible to present the ECDIS Standard Display at any time by a single operator action. This single operator action shall not change any non-chart related user settings for the display.

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.

6.3.3.2 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 suppress the presentation of all graphical information so that only the electronic chart information in the ECDIS display base remains;

b) confirm by observation that by a single operator action the user can permanently or momentarily remove the presentation of all additional information so that only the chart display including automatic and manual updates remains;

c) verify the subdivision of vector format electronic chart information into IMO display categories in accordance with IEC 61174;

d) verify that the user can select the ECDIS standard display at any time by a single operator action. Confirm by observation that this single operator action does not change any other display setting than the displayed layers of the electronic charts;

e) confirm by observation that when the chart display is switched on, the electronic chart information is presented with the most recent display settings.

6.3.4 Adding or removing information from the display

6.3.4.1 Requirement

(MSC191/7.3.1.4) *It* shall *be possible to add or remove information from the* chart *display* by layer (IHO 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 6.3.2.)

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 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;

c) confirm by observation that IHO viewing groups can be individually selected for display.

6.3.5 Safety contour

6.3.5.1 Requirement

(MSC191/7.3.1.5) *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* in accordance with IHO S-52*.*

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 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.

6.3.6 Safety depth

6.3.6.1 Requirement

(MSC191/7.3.1.6) *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.*

6.3.6.2 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.

6.3.7 Chart scale

6.3.7.1 Requirement

(MSC191/7.3.1.7) *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* as defined in the IHO ECDIS Presentation Library in IHO S-52 and its Appendices.

6.3.7.2 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.

6.3.8 Display of radar and target information

6.3.8.1 Requirement

(MSC191/7.3.2.1) 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) 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* operator *action*.

6.3.8.2 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 5.4.1 and 5.4.2, as applicable;

b) verify that targets are presented in accordance with 5.5.8;

c) verify that radar and target information are clearly distinguishable from chart information in accordance with 6.3.2;

d) confirm by observation that radar and target information can be removed from the presentation by a simple operator action.

6.3.9 Display of additional information

6.3.9.1 Requirement

(MSC191/7.3.3.1) *Information from additional sources may be displayed on ECDIS but* shall *not substantially degrade, mask or obscure the chart information.*

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

6.3.9.2 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 4.6.2;

b) verify that the presentation of electronic chart information is not degraded, masked or obscured by the presentation of additional information in accordance with 6.3.2;

c) verify that additional navigation-related information is clearly distinguishable from chart information in accordance with 6.3.3;

d) confirm by observation that additional navigation-related information can be removed from the presentation by a simple operator action.

6.4 Composite task-oriented presentations

6.4.1 User-configured presentations

6.4.1.1 Requirement

(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.*

6.4.1.2 Methods of test and required results

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

a) if the user can configure presentations for the task-at-hand confirm by inspection of documented evidence that all tasks configurable are noted in the manual;

b) confirm by analytical evaluation that for all tasks listed in the user documentation the relevant related data and information are displayed;

c) confirm that the display is fully compliant with the relevant performance standards either by analytical evaluation or inspection of the relevant test reports related to the task-at-hand for which test standards exists.

If the display is not fully compliant with the relevant performance standards confirm by observation that a clear indication as an auxiliary presentation is provided.

6.4.2 Information associated with the task-at-hand

6.4.2.1 Requirement

(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.*

6.4.2.2 Methods of test and required results

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

a) confirm by inspection of test reports that the Radar and/or chart related functions are compliant with the relevant Performance Standards;

b) confirm by analytical evaluation or inspection of the relevant test reports that the content and the physical display are compliant with the relevant parts of the presentation standards. Document the size of the operational display in use;

c) confirm by analytical evaluation that the presentation of chart and radar information along with other information associated with the task-at-hand, if available, is in line with this standard.

7 Physical requirements

7.1 General

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.

Display equipment shall comply with the applicable requirements of IEC 60945. (See 4.2.2.1.)

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 4.4.1.)

(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 the brightness adjustment is set for night, then means shall be provided to return to such a brightness level that it is possible to continue control under daylight.

If display equipment is intended to present electronic chart information (see 4.6.2), 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) (see VESA-2001-6) 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 G.)

The following verifications are required.

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) Confirm by observation that, after dimming, the equipment for use at night, when daylight ambient conditions are applied, there are means to readjust for operation under daylight.

d) Verify the adjustment of contrast and brightness in accordance with 4.4.1: (See 4.4.1.2.)

   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 4.4.1.)

e) 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, as defined in Clause G.2.

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 or more than 1 ms. The test methods are then as follows.

a) For display equipment with a luminance persistence of 1 ms or more (for example, CRT, LCDs, 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 G.2.3.1 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 (electro luminescent), plasma, light emitting diodes (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 G.2.3.2 under each ambient light test condition specified in Table 1.

7.2.4 Physical controls and status indicators

7.2.4.1 General

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 4.4.2, 4.4.3 and 4.4.4.

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.

Illumination shall be dimmable to produce a maximum brightness of not more than 1 cd/m^2 and may be extinguishable below that point.

7.2.4.2 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, if available, 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 4.4.2, 4.4.3 and 4.4.4;

c) where illuminated status indicators exist separate from the main display, confirm by observation that they are locatable by visual means;

d) where adjustable illumination is provided, confirm by observation that illumination is dimmable to not more than 1 cd/m^2 and may be extinguishable below that point;

e) confirm by observation that a visual indication of the presence of power to the display equipment is provided;

f) 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) For ECDIS, *the operational display area of the chart presentation for route monitoring* shall *be at least 270 mm × 270 mm.*

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 10 000 gross tonnage;*
- *320 mm for ships larger than 10 000 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*).

Monochrome displays may be provided when used for a single specific purpose (for example, speed log, echo-sounder) except where multicoloured displays are required by IMO performance standards or Code on Alerts and Indicators.

7.4.2 Method of test and required results

For multicoloured display verify the result in accordance with Clause 4.

For monochrome display verify the result in accordance with Clause 4 except the colour-related requirements specified in 4.5.1, 4.7.1, 4.7.2, 4.7.3 and 4.8.2.

For monochrome display confirm by inspection of documented evidence that the manufacturer has noted the limitation of usage of the display to a single specific purpose or noted relevant IMO Performance Standard permitting use of monochrome display.

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 1 280 × 1 024* 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 diameter radar*.* For 180 mm diameter radar, a minimum screen resolution of 1 024 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 for radar displays larger than 180 mm diameter the display equipment supports a screen resolution of at least 1 280 × 1 024 or equivalent resolution if the equipment uses a different aspect ratio. For radar displays of 180 mm or smaller diameter the requirement is at least 1 024 × 768 or equivalent resolution 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 4.4.1.2 a) that readability requirements are satisfied from a position at the side of the operator.

Annex A
(normative)

Presentation colours and symbols

A.1 Overview

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.2 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.3 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.4 Application

(SN243/1/3) *The symbols listed in* Table A.1 through Table 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.5 Navigation-related symbols

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

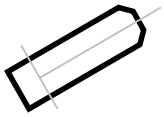
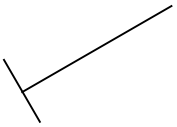
- no colours are recommended for symbols except where IMO has specified the use of the colour red for dangerous targets;
- colours used for the presentation of tracked radar targets and reported AIS targets shall be consistent;
- colours used for the presentation of own ship symbols shall be identifiable 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;

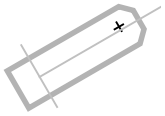
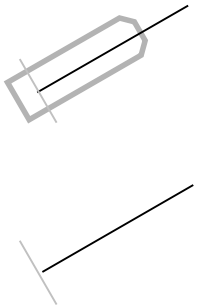
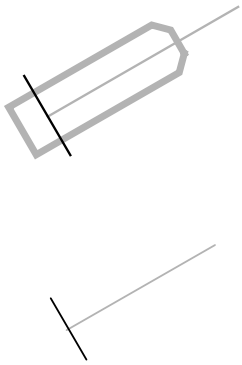
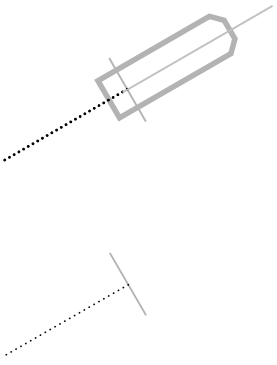
- weights specified for line styles assume that the "thick" line style is at least twice the thickness of the "thin" line style.

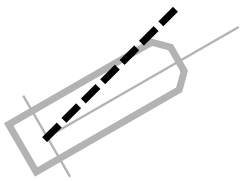
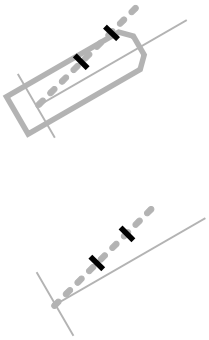
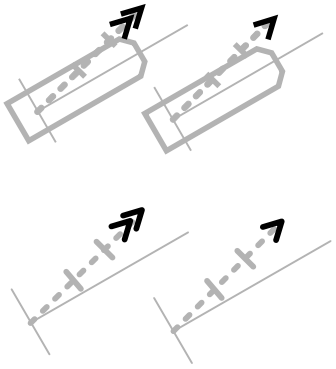
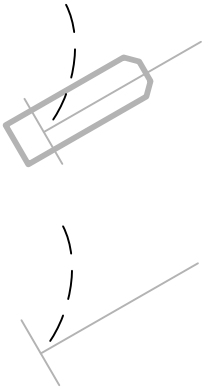
An example of a possible colour scheme that may be used is given in Table A.6.

Table A.1 – Own ship symbols

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	**Own ship – True scaled outline** 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. Automatic selection of the true scaled outline is permitted (see 5.2.1). 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 3 mm. Note that 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.	 (SN243)
1.1 b	**Own ship – Simplified symbol** 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 symbol 1.1c). 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. 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. Note that for a radar mode, the simplified symbol should not be used as the symbol does not permit the minimum range requirements in IEC 62388.	 (SN243)
1.1 c	**Own ship – Minimised symbol** 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). Where appropriate, the minimised symbol shall be combined with the true scaled outline of own ship. Note that a loss of heading will force the radar into head-up mode (see IEC 62388) whereby the minimised symbol should be used.	 (SN243)

	Symbol name and description	Symbol graphic(s)
1.2	**Radar antenna position** 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.	 (SN243)
1.3	**Own ship heading line** 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. The heading line shall always be shown together with the beam line (see symbol 1.4).	 (SN243)
1.4	**Beam line** 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.	 (SN243)
1.5	**Stern line** 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. The line shall be drawn using a thin dotted line style with the same basic colour used for own ship symbols.	

	Symbol name and description	Symbol graphic(s)
1.6 a	**Velocity vector** 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 as used for own ship symbols. An option to select other colours may be provided, but these colours shall conform to the rules given in Clause A.5.	 (SN243)
1.6 b	**Velocity vector – Time increments** 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 velocity vector.	 (SN243)
1.6 c	**Velocity vector – Stabilisation indicator** Optionally, the user may select to present a stabilisation indicator, positioned at the end of the velocity vector. 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). The arrowhead(s) shall be drawn using a thick solid line style with the same basic colour used for own ship velocity vector.	 (SN243)
1.6 d	**Path predictor** Optionally, the user may select to present a path predictor, either in place of a velocity vector or independently, 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 as used for own ship symbols. An option to select other colours may be provided, but these colours shall conform to the rules given in Clause A.5.	 (SN243)

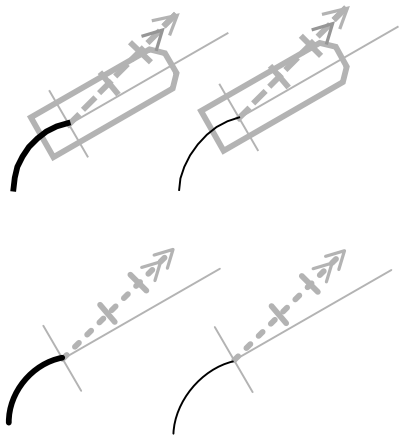
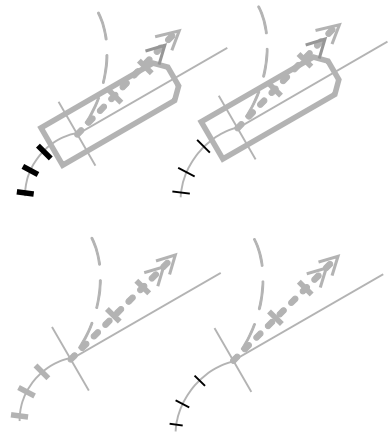
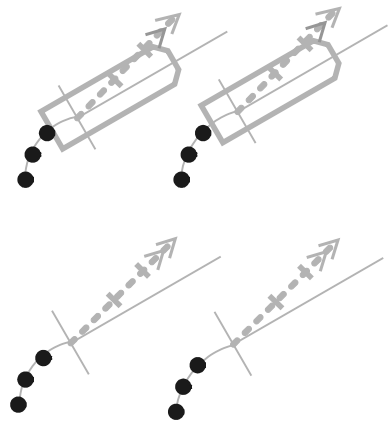
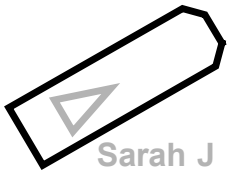
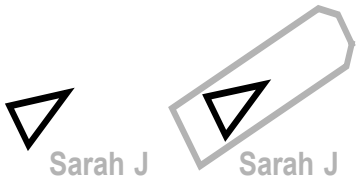
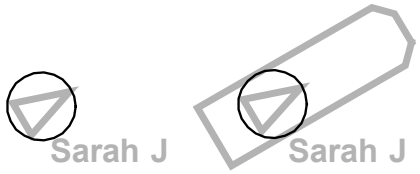
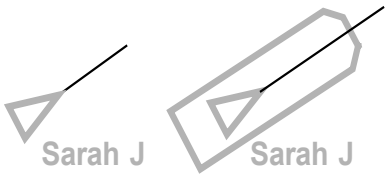
	Symbol name and description	Symbol graphic(s)
1.7 a	**Past track** The user may select to present a past track for the primary and/or secondary positioning sources. The past track shall be presented as line connecting own ship current and past positions. The primary past track shall be drawn using a 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.	 (SN243)
1.7 b	**Past track – Time increments** 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.	 (SN243)
1.7 c	**Past track – Past positions** 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.	

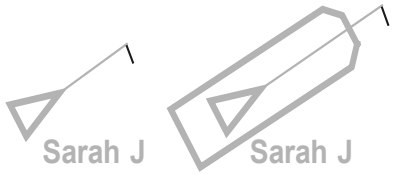
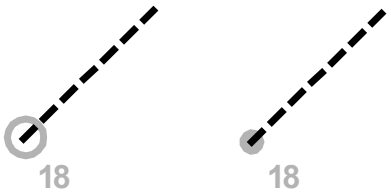
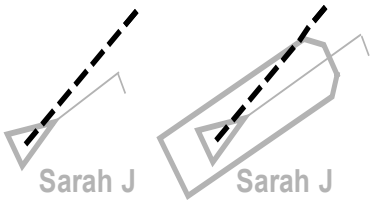
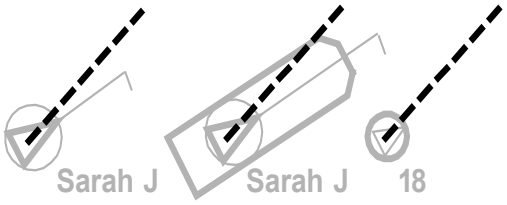
Table A.2 – Radar and AIS symbols

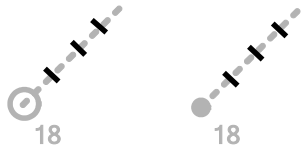
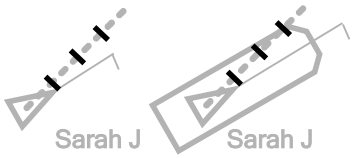
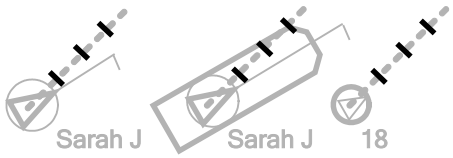
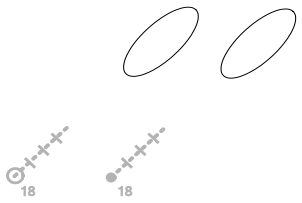
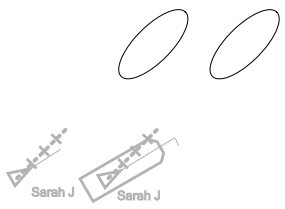
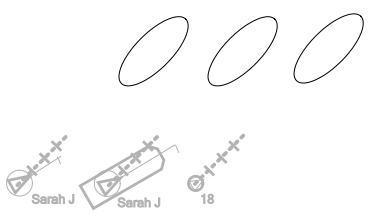
	Symbol name and description	Symbol graphic(s)
2.1 a	**Radar targets in acquisition state** A symbol drawn around radar targets in acquisition state shall be presented as a broken circle centred at the position of target acquisition. The circles shall be a nominal 5 mm in diameter and shall be drawn using a thin dashed line style with the same basic colour used for target symbols.	 (SN243)
2.1 b	**Radar targets in acquisition state – Automatically detected** 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. 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.	 (SN243)
2.2 a	**Tracked radar targets** 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. 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). 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. 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.	 (SN243)

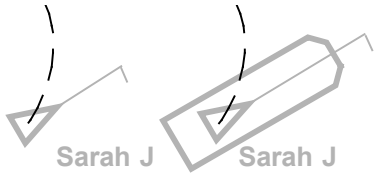
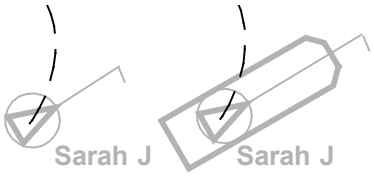
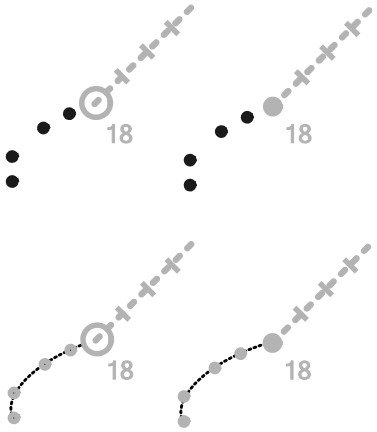
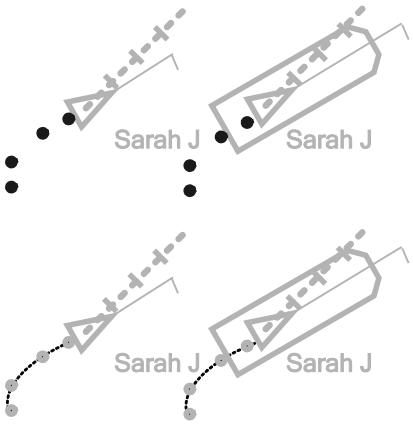
	Symbol name and description	Symbol graphic(s)
2.2 b	**Tracked radar targets – Alternative** Alternatively, tracked radar targets may be presented as filled circles of not more than 2 mm in diameter.	 (SN243)
2.2 c	**Tracked radar targets – Dangerous targets** Tracked radar targets designated as dangerous targets may be presented using 5 mm diameter circles, and shall flash until acknowledged by the user. The required colour shall be red. 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.	 (SN243)
2.3	**Reference targets** 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. The reference target labels shall be drawn with the same basic colour used for target symbols.	 (SN243)
2.4	**Sleeping AIS targets** 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. A sleeping AIS target with neither a reported heading nor COG shall be oriented toward the top of the operational display area.	 (SN243) Sleeping AIS target with neither reported heading nor COG: 

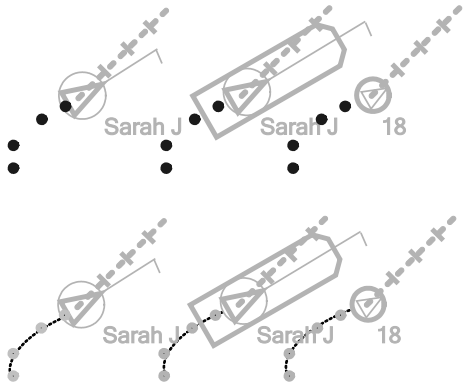
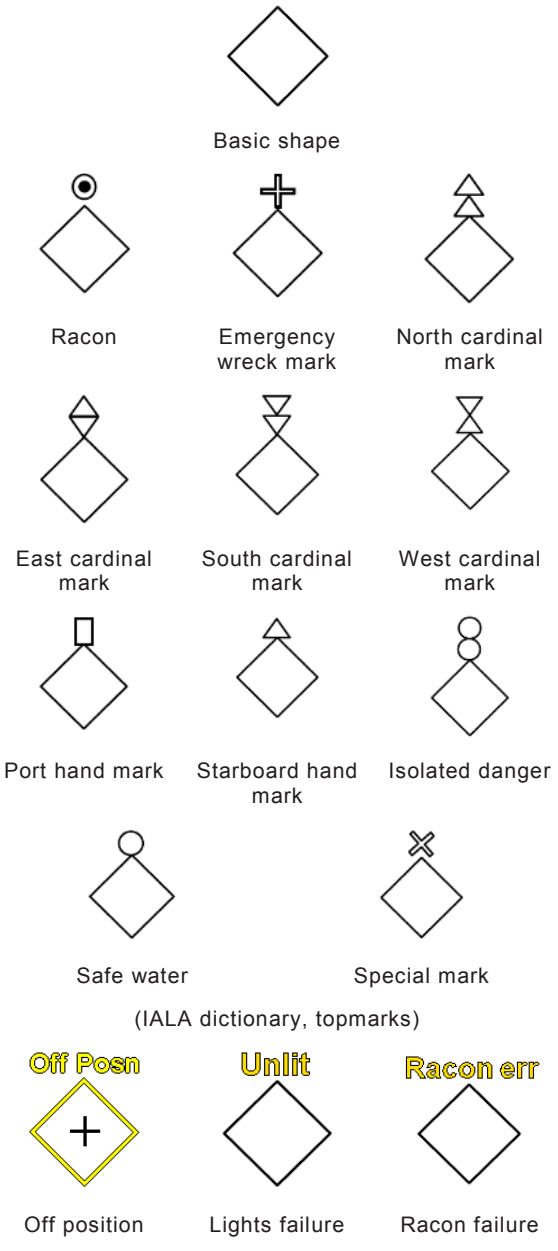
	Symbol name and description	Symbol graphic(s)
2.5 a	**Activated AIS targets** Activated AIS targets shall be presented as acute isosceles triangles oriented to the targets' reported heading (or COG if heading is not reported) and centred at the targets' reported position. The base of the triangles shall 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. An activated AIS target with neither a reported heading nor COG shall be oriented toward the top of the operational display area. 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.	 (SN243) Activated AIS target with neither reported heading nor COG: 
2.5 b	**Activated AIS targets – True scaled outlines** 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. 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. True scaled outlines for activated AIS targets shall be drawn with the same basic colour used for target symbols. 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 3 mm.	 (SN243)
2.5 c	**Activated AIS targets – Dangerous targets** 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. 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.	 (SN243) Activated AIS target with neither a reported heading nor COG: 

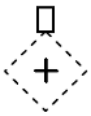
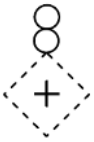
	Symbol name and description	Symbol graphic(s)
2.6	**Associated targets – alternative** The user may select to present associated targets (i.e. activated AIS targets associated with tracked radar targets) as either activated AIS target symbols (see symbol 2.5) or tracked radar target symbols (see symbol 2.2). 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. The circumscribed circle and inscribed triangle shall be drawn using a thin solid line style with the same basic colour used for target symbols. 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.	Associated targets represented by AIS target symbols:  Associated targets represented by radar target symbols: 
2.7 a	**Heading lines** Heading lines shall be selected for display for activated AIS targets and associated targets, represented by AIS target symbols. 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. Heading lines for dangerous AIS targets shall flash with their base symbol until acknowledged by the user. An activated target without a reported heading shall be orientated to the top of the operational display area (see 2.5 a) and when AIS heading is enabled shall not include a heading line.	 (SN243)

	Symbol name and description	Symbol graphic(s)
2.7 b	**Heading lines – Turn indicators** The user shall select to display turn indicators for activated AIS targets and associated targets represented by AIS target symbols. 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. 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.	 (SN243)
2.8 a	**Velocity vectors** Velocity vectors for targets shall be selected for display. 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. 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. Once acknowledged, the symbols shall cease flashing and unless considered as dangerous, shall assume the basic colour of other non-dangerous target symbols.	Radar target velocity vectors:  (SN243) AIS target velocity vectors:  (SN243) Associated target velocity vectors: 

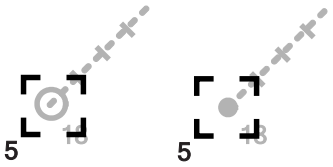
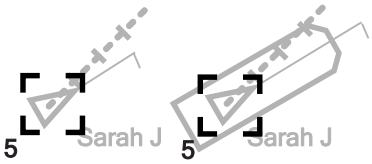
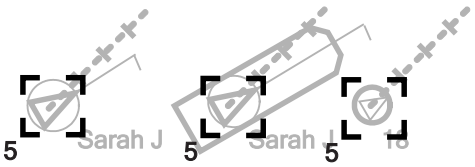
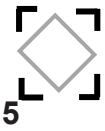
	Symbol name and description	Symbol graphic(s)
2.8 b	**Velocity vectors – Time increments** Time increments may be shown drawn across target velocity vectors. Time increments shall be presented as single lines perpendicular to the vectors with their midpoint on them and extending not more than 1,5 mm 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. 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. Once acknowledged, the symbols shall cease flashing and unless considered as dangerous, shall use the basic colour of other non-dangerous target symbols.	Radar target time increments:  AIS target time increments:  Associated target time increments: 
2.8 c	**Predicted area of dangers** Optionally, predicted area of dangers (PADs) may be shown along the path of target velocity vectors. 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. PADs for dangerous targets shall flash with their base symbols until acknowledged by the user. When a target is selected, the associated PAD may be highlighted for identification. Note that PADs are shown as an elliptical area which is typical. Presentation of more accurate shapes is not excluded.	Radar target PADs:  Not to scale AIS target PADs:  Not to scale Associated target PADs:  Not to scale

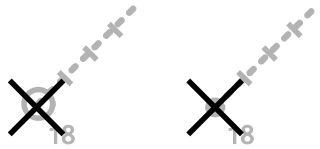
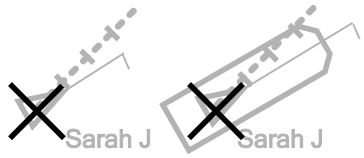
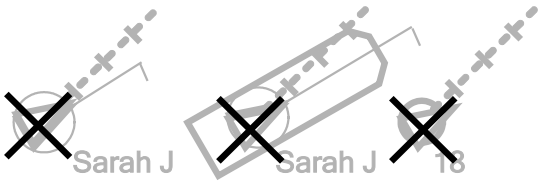
	Symbol name and description	Symbol graphic(s)
2.8 d	**Path predictor** Optionally, the user may select to display a path predictor in place of a velocity vector. The path predictor shall be represented as a curved vector originating at the targets' tracked/reported position and extending along the predicted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

	Symbol name and description	Symbol graphic(s)
		Associated target past positions: 
2.10 a	**AIS aids to navigation – Physical** Physical AIS aids to navigation (AtoN) shall be presented as an open diamond. The sides of the diamond shall be not more than 6 mm in length. The diamond shall be drawn using a thin solid line style. The basic colour for an “on position” AIS AtoN is defined as the normal colour for AIS AtoN symbols. The basic colour for the diamond of an “off position” AIS AtoN is yellow, it shall be drawn using thick solid line style and when used against light background it shall include a black one pixel outline to improve readability. If available, on radar display AIS AtoN shall be drawn indicating the purpose of the AIS AtoN. On display containing an underlying chart AIS AtoN shall be drawn without indication of purpose unless the object is selected in which case, if available, the symbol is drawn indicating the purpose of the AIS AtoN. Purpose symbol shall be drawn using a thin solid line style and shall be the same basic colour as the AIS AtoN symbol. The height of the purpose symbol shall be not more than 5 mm in length. AIS AtoN shall indicate off position of floating aid with yellow text “Off Posn”. AIS AtoN shall indicate failure of light with yellow text “Unlit”. AIS AtoN shall indicate failure of Racon with yellow text “Racon err”. When used against light background the yellow text may include a black one pixel outline to improve readability. AIS AtoN may be labelled. Alphanumeric text used to label an AIS AtoN shall be the same basic colour as the AIS AtoN symbol. Other information from AIS AtoN, if available (for example from Message 14 for the same MMSI), shall be available on demand. All physical AtoNs shall be in their own layer which shall have own display on/off selection.	Physical AIS AtoN: 

	Symbol name and description	Symbol graphic(s)
2.10 b	**AIS aids to navigation – Virtual** Virtual AIS aids to navigation (AtoN) shall be presented as an open diamond with crosshair centred at reported position. The sides of the diamond shall be not more than 6 mm in length. The diamond shall be drawn using a thin dashed line style. The basic colour for a Virtual AIS AtoN is as used for the physical AIS AtoN symbols. If available, AIS AtoN shall be drawn indicating the purpose of the AtoN. Purpose symbol shall be drawn using a thin solid line style and shall be the same basic colour as the AIS AtoN symbol. The height of the purpose symbol shall be not more than 5 mm in length The absence of a charted physical AtoN is communicated as a combined state of 'virtual' and 'off position'. This shall be indicated with yellow text "Missing" above the dotted outline diamond using colour yellow. This symbol shall have no crosshair at the position centre. When used against light background the yellow text may include a black one pixel outline to improve readability AIS AtoN may be labelled. Alphanumeric text used to label an AIS ATON shall be the same basic colour as the AIS AtoN symbol. Other information from AIS AtoN, if available (for example from Message 14 for the same MMSI), shall be available on demand. All virtual AtoNs shall be in their own layer which shall have own display on/off selection. When selected off a permanent indication shall be provided.	Virtual AIS AtoN:  Basic shape  Emergency wreck mark  North cardinal mark  East cardinal mark  South cardinal mark  West cardinal mark  Port hand mark  Starboard hand mark  Isolated danger  Safe water  Special mark (IALA dictionary, topmarks)  Intended location of missing AtoN

	Symbol name and description	Symbol graphic(s)
2.11	**AIS search and rescue transmitter and other devices using AIS burst transmission technology** An AIS search and rescue transmitter (AIS-SART) shall be as a 6 mm diameter circle with a cross inside drawn with a solid line. A test and active version of the AIS-SART shall use the same basic colour as the AIS ATON symbols. AIS-SART symbol has no associated speed or course vector. If selected the operational mode is indicated as received from AIS Message 14 (e.g. SART ACTIVE, SART TEST, MOB ACTIVE, MOB TEST, EPIRB ACTIVE, EPIRB TEST) in the associated AIS object dialog. Note that • AIS-SART use identity range 970 00 0000 to 970 99 9999, • AIS-MOB use identity range 972 00 0000 to 972 99 9999, • EPIRB-AIS use identity range 974 00 0000 to 974 99 9999.	 (SN243)/Add.1

	Symbol name and description	Symbol graphic(s)
2.12	**Selected targets** 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. Alphanumeric text used to label a selected target shall be the same basic colour as the selected target symbol.	Selected radar targets:  (SN243)
		Selected AIS targets:  (SN243)
		Selected associated targets: 
		Selected AIS ATON: 
		Selected AIS-SART: 

	Symbol name and description	Symbol graphic(s)
2.13	**Lost targets** 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. Once acknowledged, the lost target symbol and its target symbol shall be removed from the display.	Lost radar targets:  (SN243)
		Lost AIS targets:  (SN243)
		Lost associated targets: 
		Lost AIS ATON: 
		Lost AIS-SART: 

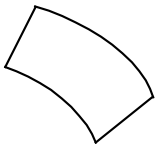
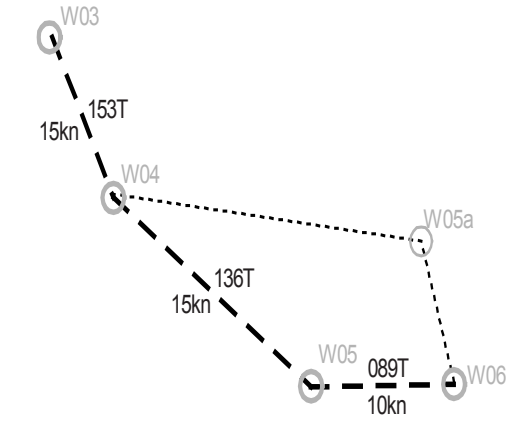
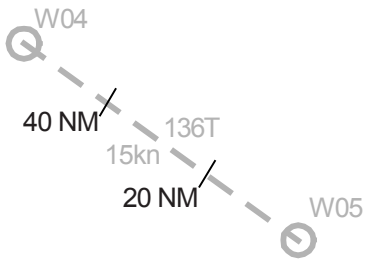
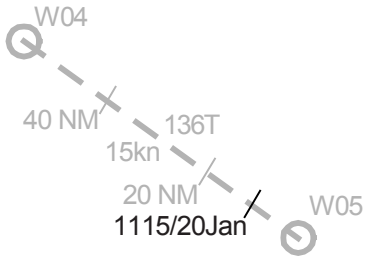
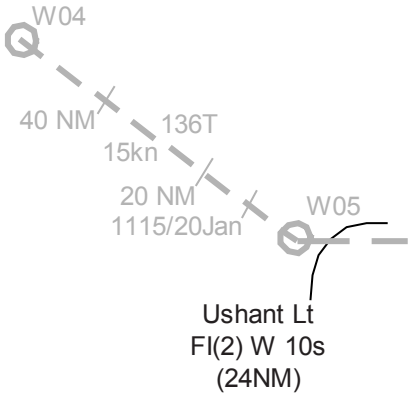
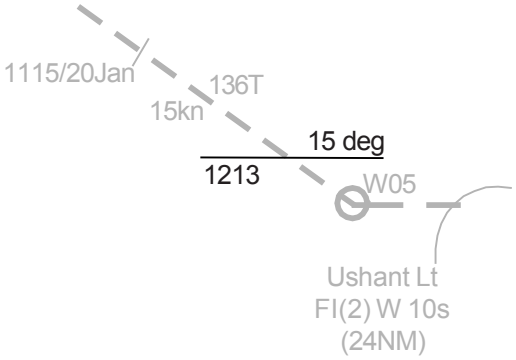
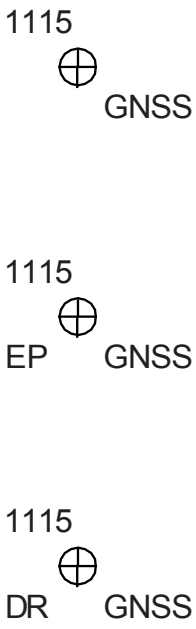
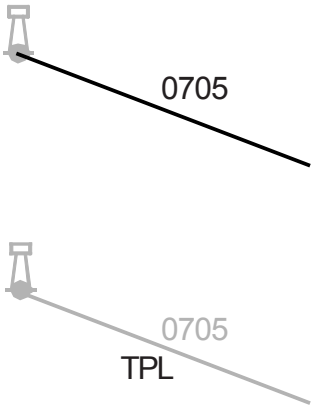
	Symbol name and description	Symbol graphic(s)
2.14	**Radar target acquisition area** The user may select to display radar target acquisition areas and/or AIS target activation areas. Target acquisition areas shall be presented as a series of lines bounding a geographic area designated for radar target 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. 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.	 (SN243)
2.15	**AIS SAR aircraft** An AIS SAR aircraft shall be drawn with a thin solid outline with the same basic colour as used for target symbols. The symbol shall be oriented in the direction of the COG. The length of the symbol shall be 6 mm.	
2.16	**AIS SAR vessel** If provided, a search and rescue vessel shall be presented by having a circle with cross drawn with a solid line inside the standard activated AIS vessel symbol (see 2.5a and 2.5b) Message 5 contain ship type, ship type 51 is SAR.	

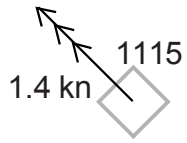
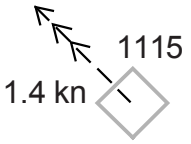
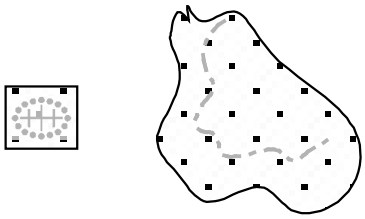
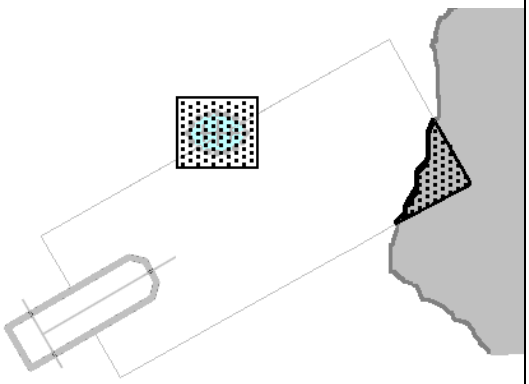
Table A.3 – Navigation symbols

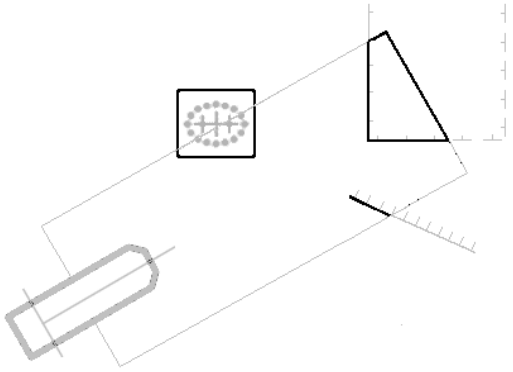
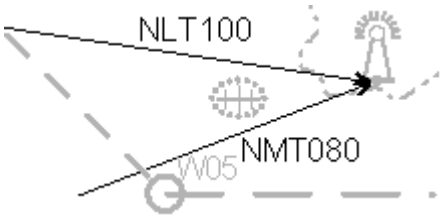
	Description	Symbol
3.1 a	**Waypoint** Waypoints shall be presented as circles centred at the position of the waypoint. The circles shall be at least 4 mm but not more than 6 mm in diameter. Circles representing waypoints on the monitored route shall be drawn using a thick solid line style with the same basic colour used for the route. 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. Circles representing waypoints on the alternate planned route shall be drawn using a thin solid line style. 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. Alphanumeric text used to label a waypoint shall be the same basic colour as the waypoint symbol.	 W04 (SN243)  W04  W04

	Description	Symbol
3.1 b	**Routes** A route is as a series of waypoints connected by one or more legs. 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. Note that the IHO recommends a dotted line style for a leg line on the monitored route. The IHO's specified colour for leg lines on the monitored route is red. 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. Note that the IHO recommends drawing a box around the planned speed. Alphanumeric text used to label a leg line shall be the same colour as the leg line. The alternate planned route shall be presented as a series of track legs connecting a series of waypoints.	 Not to scale (SN243)
3.1 c	**Distance to run** 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. 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. Alphanumeric text used to label distance to run shall be the same colour as the mark.	

	Description	Symbol
3.1 d	**Planned position** Optionally, track legs may be marked with a planned position. 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. 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. Alphanumeric text used to label planned position shall be the same basic colour as the mark.	
3.1 e	**Visual limit of lights** Leg lines on the monotored route may be marked with the visual limits of lights (i.e. rising/dipping range). 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. The visual limit may be labelled adjacent to the arc with the rising/dipping range and information about the light. Alphanumeric text used to label visual limits shall be the same basic colour as the arc.	
3.1 f	**Wheel-over line** Track leg lines on the monitored route may be marked with a wheel-overline. The wheel-over line 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. A second perpendicular line to the current leg line may be presented. This second line shall not extend more than 5 mm on either side of the current leg line. The second line shall be drawn using a thin solid line with the same colour as the leg line. The wheel-over line 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 line.	

	Description	Symbol
3.2	**Plotted position** 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. The circle and crossed lines shall be drawn using a thin solid line style. 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”. Alphanumeric text used to label the position shall be the same basic colour as the symbol.	
3.3	**Line of position** 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. The LOP shall be drawn using a thin solid line style. 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. Alphanumeric text used to label LOP shall be the same basic colour as the line. A LOP range observation will be an arc.	 Examples show the default symbol for a water tower.

	Description	Symbol
3.4	**Tidal stream** 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). The line for an actual tidal stream shall be drawn using a thin solid line style. The line for a predicted tidal stream shall be drawn using a thin long dashed line style. The arrowheads for a tidal stream shall be drawn using a thin solid line style. 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. Alphanumeric text used to label the tidal stream shall be the same basic colour as the line. Note that the IMO recommends drawing a box around the strength.	  Examples show the default symbol for a point or area for which a tidal stream table is available.
3.5 a	**Mariner danger highlight** 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 thick solid line style. Recommended colour: red. The polygon, or bounded area shall be filled with a transparent fill using the same colour as the polygon or poly-line.	 Examples show the default symbol for a mariner entered danger highlight of 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.
3.5 b	**Alarm highlight** The graphical indication in the chart area of an alarm condition (see MSC.232(82)/A 11.4.4 and 11.4.6) shall be presented as a polygon or poly-line on the boundary of the area or point object causing the condition. The polygon or poly-line shall be drawn using a thick solid line style with recommended colour red. The bounded area shall have a transparent fill of the same colour.	 The example shows a depth area shallower than safety contour and a dangerous wreck within the look-ahead safety check area.

	Description	Symbol
3.5 c	**Caution highlight** The graphical indication in the chart area of warning or caution conditions (see MSC.232(82)/A 11.4.4 and 11.4.6) shall be presented as a polygon or poly-line on the boundary of the area or point object causing the condition. The polygon or poly-line shall be drawn using a thick solid line style with recommended colour yellow and adjacent thin lines of black on either side for visibility against a white (Day) background. The bounded area shall not be filled.	 Examples show point (wreck), restricted area and line (fish stakes).
3.6	**Danger bearing** 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. The line shall be drawn using a thin solid line style with the required colour red. 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”. Alphanumeric text used to label the danger bearing shall be the same basic colour as the line. The drawing is not to scale. The example shows the default symbols for a light and a dangerous wreck at an unknown depth.	

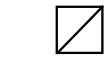
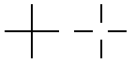
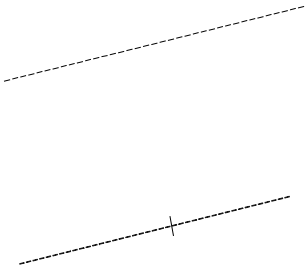
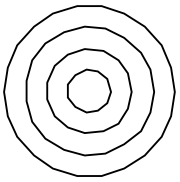
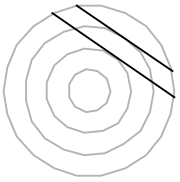
	Description	Symbol
3.7	**Event marker** An event marker shall be presented as a 5 mm square with a diagonal line inscribed. The symbol shall be drawn using a thin solid line style. Optionally, an event marker may be labelled. Multiple event markers may be numbered. Alphanumeric text used to label an event marker shall be the same basic colour as the symbol.	 (SN243)

Table A.4 – Navigation tools

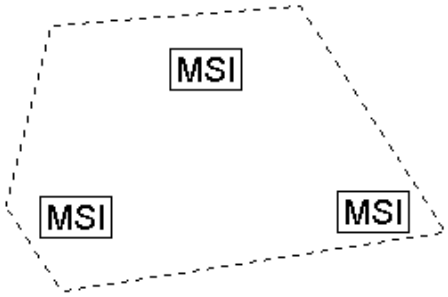
	Description	Symbol(s)
4.1	**User cursor** The user cursor shall be presented as crossed lines perpendicular to each other extending at least 3 mm from the centre on all sides. The cursor shall be drawn in a thick solid line style. Optionally, the centre of the cursor may be open. Either symbol may be used.	 (SN243)
4.2	**Electronic bearing line (EBL)** 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. 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.	
4.3	**Variable range marker (VRM)** 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.	
4.4	**Range rings** 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 dependent 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.	 (SN243)
4.5	**(parallel) Index lines** 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). No line style is specified for (parallel) index lines, however, they shall be distinguishable from each other and from EBLs. Index lines set at other bearings may be used. A series of index lines at other positions may be used.	

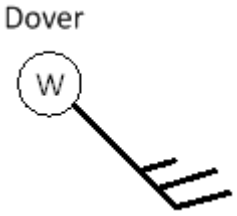
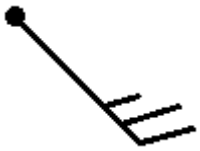
For the application of the symbols in Table A.5, the following shall be considered:

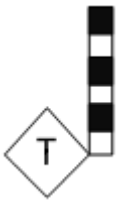
- multiple symbols may be co-located;
- a minimum means shall be provided to prevent co-located symbols from obscuring each other, for example by user selection, by type of information.

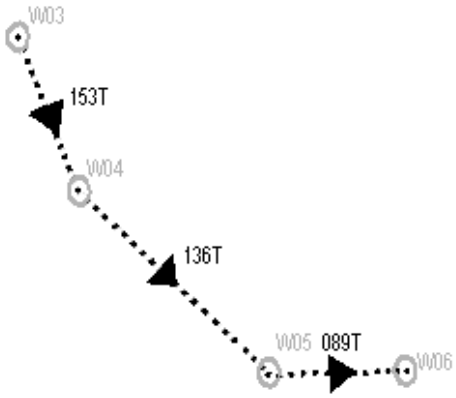
Table A.5 – Other symbols

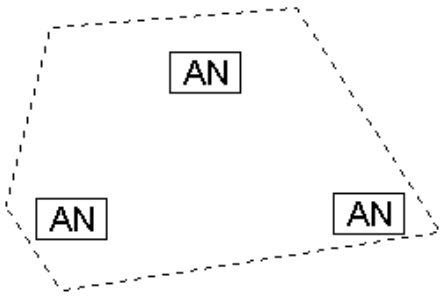
	Description	Symbol(s)
5.1	**Trial manoeuvre** When a trial manoeuvre function is enabled, it shall be indicated by the presentation of a large letter “T” in a conspicuous location in the operational display area.	T (SN243)
5.2	**Simulation mode** When a simulation mode is enabled, it shall be indicated by the presentation of a large letter “S” in a conspicuous location in the operational display area.	S (SN243)
5.3	**Radar test target** 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. In addition, a bold “X” shall be shown in a conspicuous location in the operational display area.	X

	Description	Symbol(s)
5.4	**Maritime Safety Information, MSI** MSI point symbol shall be presented as box with the “MSI” inscribed inside it. The box shall be centred at the position derived from MSI message. The box shall not be more than 6 mm in height, drawn using a thick solid line style. MSI area symbol shall be presented as a series of lines bounding a geographic area designated as “caution” to navigation. Connecting lines shall be drawn using thin dashed line style and using same basic colour as the symbol itself. The area shall be filled with a sparse pattern of MSI point symbols separated by 50 mm. MSI symbols shall be in a separate user selectable layer or group, removable by single operator action. The removal may be connected to generic removal functionality of non-chart object layers. The user dialog area shall have an indication if MSI notices are available in the area currently displayed, but the MSI layer is not automatically selected for display. MSI symbols may be connected to a date range and in such case each MSI notice symbol shall be displayed only when user selected date is within data range. It shall be possible to cursor pick an MSI symbol for further details. When presentation of MSI point and area symbols are provided as overlay on chart or radar, then means shall be provided for cursor pick of the symbol to provide further information in the user dialog area of the display. Note that the source of MSI maybe NAVTEX, AIS ASM function identifier 22 or 23 (SN.1/Circ. 289), etc.	Example of point symbol  Example of area symbol 

	Description	Symbol(s)
5.5	**Meteorological information** Meteorological information symbols consist of two parts: the weather station symbol or reference point and the wind shaft. The weather station symbol shall be presented as a circle with “W” inscribed inside it. The circle shall be centred at the position derived from the site location report binary message. The circle shall not be more than 6 mm in diameter, drawn using a thin solid line style and using the same basic colour as AIS AtoN. The reference point symbol shall be presented as a dot. The dot shall not be more than 1 mm in diameter, drawn using a thin solid line style and using the same basic colour as AIS AtoN. Alphanumeric text may be used to label the weather station. The optional wind shaft shall be used to represent wind force and direction as defined by WMO No.485, Appendix II-4, the surface plotting model. If wind force and direction is not available then there shall be no environmental symbol. The wind shaft shall be not more than 3 times the diameter of the weather station symbol. The length of barbs and pennants shall not exceed the diameter of the weather station symbol. The wind shaft shall be drawn using a thick solid line style and using the same basic colour as AIS AtoN. The wind shaft is directed along the axis of the wind towards the centre of the station circle and stops at its circumference. Wind is represented by barbs and solid pennants. The full barbs representing 5 m s^{-1} or 10 kn, The half barbs representing 2,5 m s^{-1} or 5 kn and the solid pennant representing 25 m s^{-1} or 50 kn. All pennants and barbs lie to the left (clockwise) of the wind shaft in the northern hemisphere and to the right (counter clockwise) of the wind shaft in the southern hemisphere. Barbs are at an angle of 110° to 130° from the wind shaft. Pennants are triangles with their bases on the wind shaft. A calm shall be indicated by a circle drawn around the weather station circle: Missing wind speed shall be indicated by placing an “x” at the end of the wind shaft in lieu of the wind barbs. Other meteorological or hydrographic information such as visibility, temperature, salinity, etc., if available, shall be available on demand. Note that the source of meteorological information may be AIS ASM function identifier 26 or 31 (SN.1/Circ. 289), etc.	 (WMO) Example of weather station  (WMO) Example of weather station with optional wind shaft in southern hemisphere  Example of reference point with optional wind shaft in southern hemisphere

	Description	Symbol(s)
5.6	**Tidal and water level information** Tidal and water level information symbol consist of three parts: the tidal symbol, tidal flow symbol and the tidal gauge symbol. The tidal symbol shall be presented as a diamond with “T” inscribed inside it. The diamond shall be centred at the position derived from the site location report binary message. The diamond shall not be more than 6 mm in diameter, drawn using a thin solid line style and using the same basic colour as AIS AtoN. The optional tidal flow part of the symbol shall be used to represent tidal speed and direction. If tidal speed and direction is not available then there shall be no tidal flow symbol. The tidal flow symbol shall not be more than 10 mm in length, drawn to the direction of the tidal current and using the same basic colour as AIS AtoN. If selected, the details of tidal flow shall be presented in the associated AIS object dialog using one decimal. The optional tidal gauge part of the symbol shall be used to represent availability of water level information. If water level is not available then there shall be no tidal gauge symbol. The tidal gauge symbol shall not be more than 10 mm in length, drawn using a thick solid line style, transparent fill and using the same basic colour as AIS AtoN. If selected, the details of water level shall be presented in the associated AIS object dialog relative to vertical datum of ENC using one decimal. Note that the source of tidal information may be AIS ASM function identifier 31 (SN.1/Circ. 289), etc.	
5.7	**Signal station** Signal station shall be presented as a diamond centred at the reported position of the signal station. The sides of the diamond shall be not more than 6 mm in length and shall be the same basic colour as the AIS AtoN symbol. The symbol shall be labelled with text “SS” centred in the diamond and the colour of the label shall be the same colour as the symbol. Other information from signal station, if available, shall be available on demand. Note that a signal station is a station capable of transmitting marine traffic signals. The source of signal station may be AIS ASM function identifier 19 (SN.1/Circ. 289), etc.	

	Description	Symbol(s)
5.8	**Route information broadcast** Route information is as a series of waypoints connected by one or more legs. Leg lines on the route information shall be drawn using a thin dotted line style. They shall have a centred solid triangle with equal length of each side of not more than 4 mm and shall be the same basic colour as the AIS AtoN symbol. Solid triangle is centred on visible part of each leg. Leg lines on the route information may be labelled adjacent to their line with their course. The label shall be offset by at least 2 mm from the line and shall not interfere with text used to label the waypoint. Alphanumeric text used to label a leg line shall be the same colour as the leg line. The colour of route type “mandatory route” shall be different from other route types and symbol 3.1b. Note that the source of route information may be AIS ASM function identifier 27 or 28 (SN.1/Circ. 289), etc.	 NOTE Not to scale
5.9	**Berthing data** Berthing assignment shall be presented as a box with the “BERTH” inscribed inside it. The box shall be centred at the position derived from the berthing data message. The box shall not be more than 6 mm in height, drawn using a thick solid line style and shall be the same basic colour as the AIS AtoN symbol. Other information from berthing data, if available, shall be available on demand. Note that the source of berthing data may be AIS ASM function identifier 20 (SN.1/Circ. 289), etc.	
5.10	**Clearance time to enter port** Clearance time to enter port shall be presented as a box with the “CTE” inscribed inside it. The box shall be centred at the position derived from clearance time to enter port data message. The box shall not be more than 6 mm in height, drawn using a thick solid line style and shall be the same basic colour as the AIS AtoN symbol. Other information from clearance time to enter, if available, shall be available on demand. Note that the source of clearance to enter port may be AIS ASM function identifier 18 (SN.1/Circ. 289), etc.	

	Description	Symbol(s)
5.11	**Area notice** Area notice point symbol shall be presented as box with the “AN” inscribed inside it. The box shall be centred at the position derived from Area notice message. The box shall not be more than 6 mm in height, drawn using a thick solid line style and shall be the same basic colour as the AIS AtoN symbol. Area notice area symbol shall be presented as a series of lines bounding a geographic area. Connecting lines shall be drawn using the thin dashed line style and using the same basic colour as the symbol itself. The area shall be filled with a sparse pattern of Area notice point symbols separated by 50 mm. Drawing priority of Area notice symbol is below Maritime Safety Information MSI, see symbol 5.4. Area notice symbols shall be in a separate user selectable layer, which is removable by single operator action. The removal may be connected to generic removal functionality of non-chart object layers. The user dialog area shall have an indication if area notices are available in the area currently displayed, but the area notice layer is not selected for display. Area notice symbols may be connected to a date range and in such case each area notice symbol shall be displayed only when user selected date is within data range. It shall be possible to cursor pick an Area notice symbol for further details. Note that the source of the area notice may be AIS ASM function identifier 22 or 23 (SN.1/Circ. 289), etc.	Example of point symbol  Example of area symbol 
5.12	**Air gap** Air gap symbols consist of two parts: the air gap symbol and the air gap gauge symbol. The Air gap symbol shall be presented as a diamond with “A” inscribed inside it. The diamond shall be centred at the position derived from the site location report binary message. The diamond shall not be more than 6 mm in diameter, drawn using a thin solid line style and using the same basic colour as AIS AtoN. The air gap gauge part of the symbol shall be used to represent availability of air gap information. If air gap is not available then there shall be no air gap gauge symbol. The air gap gauge symbol shall not be more than 10 mm in length, drawn using a thick solid line style, transparent fill and using the same basic colour as AIS AtoN. Air gap relative to the water surface in meters with one decimal and other Air gap information, if available, shall be available on demand. Note that the source of the air gap/air draught information may be AIS ASM function identifier 26 (SN.1/Circ. 289), etc.	

	Description	Symbol(s)
5.13	**Environmental report** The environmental report symbol shall be presented as a diamond with “ENV” inscribed inside it. The diamond shall be centred at the position derived from the site location report binary message. The diamond shall not be more than 6 mm in diameter, drawn using a thin solid line style and using the same basic colour as AIS AtoN. All available details of environmental information shall be displayable on demand. Note that the source of environmental information may be AIS ASM function identifier 26 or 31 (SN.1/Circ. 289), etc.	

Table A.6 – Example of possible colour scheme

Symbol	Colour white background/ dark background	Colour token (IHO S-52)
1.1a, 1.1b	Black/White	SHIPS
1.7a	Black/White	PSTRK
2.1a, 2.4, 2.5a, 2.15, 2.16	Blue-green	ARPAT
2.10, 2.11, 5.5, 5.6, 5.7	Blue	RESBL
2.12, 4.1, 4.2, 4.3, 4.4, 4.5	Orange	CURSR
2.14, 3.7, 5.4	Orange	NINFO
3.1a	Red	PLRTE
3.1a	Orange	APLRT

Annex B
(normative)

Guidelines for the presentation of navigation-related terminology and abbreviations

B.1 Overview

This annex specifies the terminology and abbreviations to be used for the presentation of navigation related information in conformance with guidelines published by IMO and provided in SN/Circ.243. All text in this standard whose wording is identical to that in the IMO guidelines is printed in *italics*, and the referenced paragraph number is indicated in brackets with the abbreviated prefix for example (SN243/2).

B.2 Purpose

(SN243/2/1) *The purpose of* this annex *is to provide* guidelines *on the use of appropriate navigation-related terminology and abbreviations intended for presentation on* all *shipborne navigational* systems and equipment. *These are based on* terminology *and abbreviations used in existing navigation references.*

B.3 Scope of these guidelines

(SN243/2/2) *These guidelines* will *ensure that the* terminology *and abbreviations used for the* presentation *of navigation-related information on all shipborne* navigational *systems* and equipment *are* presented in a *consistent and uniform* manner.

B.4 Application

(SN243/2/3) *These guidelines apply to all shipborne navigational systems and equipment when navigation-related information is* presented *as text, the standard* terminology *or abbreviations listed in* Table B.1 and Table B.2 shall *be used* in place *of* terminology *and abbreviations which are currently contained in existing Performance Standards* for navigational systems and equipment. *Where standard* terminology or a standard *abbreviation is not available, another may be used. This* shall provide a clear meaning and shall *not conflict with the standard* terminology *or abbreviations listed in* Table B.1 and Table B.2. *Standard marine terminology* shall *be used for this purpose. When the meaning is not clear from its context,* it shall *not be abbreviated.* When another terminology or abbreviation is used, it shall be explained in the operating manual.

(SN243/2/3) *Unless otherwise specified, standard terms* shall *be* presented *in lower case while abbreviations* shall *be presented* in *upper case.*

B.5 Navigation related terminology and abbreviations

For the application of the standard terminology and abbreviations listed in Table B.1 and the standard units of measurement and abbreviations listed in Table B.2, the following shall be considered:

- terminology and abbreviations used in nautical charts are published in relevant IHO publications and are not listed here;
- in general, terminology should be presented using lower case text with upper case first character for each separate word and abbreviations should be presented using upper case

text. Those abbreviations that may be presented using lower case text are identified in Table B.2;

- abbreviations may be combined, for example, “CPA LIM” or “T CRS”. When the abbreviation for the standard terminology “Relative” is combined with another abbreviation, the abbreviation “R” should be used instead of “REL”, for example, “R CRS” (see NOTE 2 to Table B.1);
- the use of the abbreviations “SIM” and “TRIAL” are not intended to replace the appropriate symbols listed in Table A.5 (see NOTE 3 to Table B.1).

Table B.1 – List of standard terms and abbreviations

Term	Abbreviation
Acknowledge	*ACK*
Acquire, Acquisition	*ACQ*
Acquisition Zone	*AZ*
Adjust, Adjustment	*ADJ*
Aft	*AFT*
Alarm	*ALARM*
Altitude	*ALT*
Amplitude Modulation	*AM*
Anchor Watch	*ANCH*
Antenna	*ANT*
Anti Clutter Rain	*RAIN*
Anti Clutter Sea	*SEA*
April	*APR*
Audible	*AUD*
August	*AUG*
Automatic	*AUTO*
Automatic Frequency Control	*AFC*
Automatic Gain Control	*AGC*
Automatic Identification System	*AIS*
Automatic Identification System – Search and Rescue Transmitter	*AIS-SART*
Automatic Radar Plotting Aid	*ARPA*
Autopilot	AP
Auxiliary System/Function	*AUX*
Available	*AVAIL*
Azimuth Indicator	AZI
Background	*BKGND*
Bearing	*BRG*
Bearing Waypoint To Waypoint	*BWW*
Bow Crossing Range	BCR
Bow Crossing Time	*BCT*
Brilliance	*BRILL*
Built in Test Equipment	*BITE*

Term	Abbreviation
Calibrate	*CAL*
Cancel	*CNCL*
Carried (for example, carried EBL origin)	*C*
Central Processing Unit	CPU
Centre	*CENT*
Change	*CHG*
Circularly Polarised	*CP*
Clear	*CLR*
Closest Point of Approach	*CPA*
Compact Disk Read Only Memory	CDROM
Consistent Common Reference Point	*CCRP*
Consistent Common Reference System	*CCRS*
Contrast	*CONT*
Coordinated Universal Time	UTC
Correction	*CORR*
Course	*CRS*
Course Over the Ground	*COG*
Course Through the Water	*CTW*
Course To Steer	*CTS*
Course Up	*C UP* [a]
Cross Track Distance	*XTD*
Cursor	*CURS*
Dangerous Goods	*DG*
Date	*DATE*
Day	*DAY*
Dead Reckoning, Dead Reckoned Position	*DR*
December	*DEC*
Decrease	*DECR*
Delay	*DELAY*
Delete	*DEL*
Departure	*DEP*
Depth	*DPTH*

Term	Abbreviation
Destination	*DEST*
Deviation	*DEV*
Differential GLONASS	*DGLONASS* [a]
Differential GNSS	*DGNSS* [a]
Differential GPS	*DGPS* [a]
Digital Selective Calling	*DSC*
Display	*DISP*
Distance	*DIST*
Distance Root Mean Square	*DRMS* [a]
Distance To Go	*DTG*
Drift	*DRIFT*
Dropped (for example, dropped EBL origin)	*D*
East	*E*
Echo Reference	REF
Electronic Bearing Line	*EBL*
Electronic Chart Display and Information System	*ECDIS*
Electronic Chart System	ECS
Electronic Navigational Chart	*ENC*
Electronic Position Fixing System	*EPFS*
Electronic Range and Bearing Line	*ERBL*
Emergency Position Indicating Radio Beacon	EPIRB
Emergency Position Indicating Radio Beacon – AIS	EPIRB-AIS
Enhance	*ENH*
Enter	*ENT*
Equipment	*EQUIP*
Error	*ERR*
Estimated Position	*EP*
Estimated Time of Arrival	*ETA*
Estimated Time of Departure	*ETD*
European Geo-Stationary Navigational Overlay System	EGNOS
Event	*EVENT*
Exclusion Zone	*EZ*
External	*EXT*
F-Band (applies to radar)	F-Band
February	*FEB*
Foreword	FWD
Fishing Vessel	*FISH*

Term	Abbreviation
Fix	*FIX*
Forward	*FWD*
Frequency	*FREQ*
Frequency Modulation	*FM*
Full	*FULL*
Gain	*GAIN*
Geographics	GEOG
Geometric Dilution Of Precision	*GDOP*
Global Maritime Distress and Safety System	*GMDSS*
Global Navigation Satellite System	*GNSS*
Global Orbiting Navigation Satellite System	*GLONASS*
Global Positioning System	*GPS*
Great Circle	*GC*
Grid	*GRID*
Ground	*GND*
Grounding Avoidance System	GAS
Group Repetition Interval	*GRI*
Guard Zone	*GZ*
Gyro	*GYRO*
Harmful Substances (applies to AIS)	*HS*
Head Up	*H UP* [a]
Heading	*HDG*
Heading Control System	*HCS*
Heading Line	*HL*
High Frequency	*HF*
High Speed Craft	*HSC*
Horizontal Dilution Of Precision	*HDOP*
Identification	*ID*
In	*IN*
Increase	*INCR*
Indication	*IND*
Information	*INFO*
Infrared	*INF RED*
Initialisation	*INIT*
Input	*INP*
Input/Output	*I/O*
Integrated Navigation System	INS
Integrated Radio Communication System	*IRCS*
Interference Rejection	*IR*

Term	Abbreviation
Interswitch	*ISW*
Interval	*INT*
January	*JAN*
July	*JUL*
June	*JUN*
Label	LBL
Latitude	*LAT*
Latitude/Longitude	L/L
Leeway	LWY
Limit	*LIM*
Line Of Position	*LOP*
Log	*LOG*
Long Pulse	*LP*
Long Range	*LR*
Longitude	*LON*
Loran	*LORAN*
Lost Target	*LOST TGT*
Low Frequency	*LF*
Magnetic	*MAG*
Man Overboard	MOB
Manoeuvre	*MVR*
Manual	*MAN*
Map(s)	*MAP*
March	*MAR*
Maritime Mobile Services Identity number	*MMSI*
Maritime Pollutant (applies to AIS)	*MP*
Maritime Safety Information	*MSI*
Marker	*MKR*
Master	*MSTR*
Maximum	*MAX*
May	*MAY*
Medium Frequency	*MF*
Medium Pulse	*MP*
Menu	*MENU*
Minimum	*MIN*
Missing	*MISSING*
Mute	*MUTE*
Navigation	*NAV*
Night	*NT*
Normal	*NORM*
North	*N*
North Up	*N UP* [a]

Term	Abbreviation
Not Less Than	NLT
Not More Than	NMT
Not Under Command	NUC
November	*NOV*
October	*OCT*
Off	*OFF*
Officer On Watch	*OOW*
Offset	*OFFSET*
On	*ON*
Out/Output	*OUT*
Own Ship	*OS*
Panel Illumination	*PANEL*
Parallel Index Line	*PI*
Past Positions	PAST POSN
Passenger Vessel	*PASSV*
Performance Monitor	*MON*
Permanent	*PERM*
Person Overboard	*POB*
Personal Identification Number	*PIN*
Pilot Vessel	*PILOT*
Port/Portside	*PORT*
Position	*POSN*
Positional Dilution Of Precision	*PDOP*
Power	*PWR*
Predicted	*PRED*
Predicted Area of Danger	*PAD*
Predicted Point of Collision	*PPC*
Pulse Length	*PL*
Pulse Modulation	*PM*
Pulse Repetition Frequency	*PRF*
Pulse Repetition Rate	*PRR*
Pulses Per Revolution	*PPR*
Racon	*RACON*
Radar	*RADAR*
Radar Plotting	RP
Radar Transponder	TPR
Radius	*RAD*
Rain	*RAIN*
Range	*RNG*
Range Rings	*RR*
Raster Chart Display System	*RCDS*

Term	Abbreviation
Raster Navigational Chart	*RNC*
Rate Of Turn	*ROT*
Real-time Kinematic	*RTK*
Receive	*RX* [a]
Receiver	*RCDR*
Receiver Autonomous Integrity Monitoring	*RAIM*
Reference	*REF*
Relative	*REL* [b]
Relative Motion	*RM*
Revolutions per Minute	*RPM*
Rhumb Line	RL
Roll On/Roll Off Vessel	*RoRo*
Root Mean Square	*RMS*
Route	*ROUTE*
Safety Contour	*SF CNT*
Sailing Vessel	*SAIL*
Satellite	*SAT*
S-Band	*S-BAND*
Scan to Scan	*SC/SC*
Search And Rescue	SAR
Search And Rescue Transponder	*SART*
Search And Rescue Vessel	*SARV*
Select	*SEL*
September	*SEP*
Sequence	*SEQ*
Set (i.e., set and drift, or setting a value)	*SET*
Ship's Time	*TIME*
Short Pulse	*SP*
Signal to Noise Ratio	*SNR*
Simulation	*SIM* [c]
Slave	*SLAVE*
South	*S*
Speed	*SPD*
Speed and Distance Measuring Equipment	*SDME*
Speed Over the Ground	*SOG*
Speed Through the Water	*STW*
Stabilized	*STAB*
Standby	*STBY*
Starboard/Starboard Side	*STBD*
Station	*STN*
Symbol(s)	*SYM*

Term	Abbreviation
Synchronised/ Synchronous	*SYNC*
System Electronic Navigational Chart	SENC
Target	*TGT*
Target Tracking	*TT*
Test	*TEST*
Time	*TIME*
Time Difference	*TD*
Time Dilution Of Precision	*TDOP*
Time Of Arrival	*TOA*
Time Of Departure	*TOD*
Time to CPA	*TCPA*
Time To Go	*TTG*
Time to Wheel Over Line	*TWOL*
Track	*TRK*
Track Control System	*TCS*
Tracking	TRKG
Trail(s)	*TRAIL*
Transmit and Receive	*TXRX* [a]
Transceiver	*TCVR*
Transferred Line Of Position	*TPL*
Transmit	TX
Transmitter	*TMTR*
Transmitting Heading Device	*THD*
Trial	*TRIAL* [c]
Trigger Pulse	*TRIG*
True	*T*
True Motion	*TM*
Tune	*TUNE*
Ultrahigh Frequency	*UHF*
Uninterruptible Power Supply	UPS
Universal Time, Coordinated	*UTC*
Universal Transverse Mercator	UTM
Unstabilised	*UNSTAB*
Variable Range Marker	*VRM*
Variation	*VAR*
Vector	*VECT*
Very High Frequency	*VHF*
Very Low Frequency	*VLF*
Vessel Aground	*GRND*
Vessel at Anchor	*ANCH*

Term	Abbreviation
Vessel Constrained by Draught	*VCD*
Vessel Engaged in Diving Operations	*DIVE*
Vessel Engaged in Dredging or Underwater Operations	*DRG*
Vessel Engaged in Towing Operations	*TOW*
Vessel Not Under Command	*NUC*
Vessel Restricted in Manoeuvrability	*RIM*
Vessel Traffic Service	*VTS*
Vessel Underway Using Engine	*UWE*
Video	*VID*

Term	Abbreviation
Visual Display Unit	VDU
Voyage	*VOY*
Voyage Data Recorder	*VDR*
Warning	*WARNING*
Water	*WAT*
Waypoint	*WPT*
Waypoint Closure Velocity	WCV
West	*W*
Wheel Over Line	*WOL*
Wheel Over Point	WOP
Wheel Over Time	*WOT*
World Geodetic System	*WGS*
X-Band	*X-BAND*

[a] These abbreviations may be presented using lower case text, for example, “dGNSS”, “Rx”.

[b] When the abbreviation for “Relative” is combined with another abbreviation, the abbreviation “R” should be used instead of “REL”, for example “R CRS”.

[c] The use of abbreviations “SIM” and “TRIAL” are not intended to replace the appropriate symbols listed in Table A.5.

Table B.2 – List of standard units of measurement and abbreviations

Unit	Abbreviation
cable length	*cbl*
centimetre	*cm*
cycles per second	*cps*
degree(s)	*deg or °*
fathom(s)	*fm*
feet/foot	*ft*
gigahertz	*GHz*
hectopascal	*hPa*
hertz	*Hz*
hour(s)	*hr(s)*
inch	*in*
kilohertz	*kHz*
kilometre	*km*
kilopascal	*kPa*
knot(s)	*kn*
megahertz	*MHz*
metre	*m*
minute(s)	*min or ′*
Nautical Mile(s)	*NM*
second(s)	*s* or ″

Annex C
(informative)

Guidance on display and dialogue design in MSC/Circ.982

C.1 Overview

This annex lists the guidelines in MSC/Circ.982 that are related to presentation, and their association with the presentation-related requirements provided in IEC 60945 and this standard.

C.2 General

IMO MSC/Circ.982 provides guidelines on ergonomic criteria for bridge equipment and layout with the objective of improving the reliability and efficiency of navigation. These guidelines contain additional, relevant and useful information that may be applied to the design of computer-based displays for navigational systems and equipment.

C.3 Requirements in MSC/Circ.982 related to the display design

Some of the paragraphs in MSC/Circ.982 can be associated with the general requirements for shipborne navigational systems and equipment in IEC 60945:2002, particularly those related to display equipment or displays. Others are wholly or partially related to display design. Table C.1 through Table C.3 list those paragraphs.

Table C.1 – Paragraphs in MSC/Circ.982 associated with IEC 60945 requirements

IEC 60945:2002 Subclause	MSC/Circ.982 Paragraph
4.2.1 Ergonomics and HMI	
4.2.1.3 Operation	5.3.2.6 Control/indicator discernability 5.5 Input devices 5.7 General user input guidelines
4.2.1.4 Identification	5.3.2.4 Control and display location 5.2.2.5 Simultaneous use
4.2.1.5 Screen displays and indications	5.3.5.1 Function labelling 5.3.5.2 Label terminology 5.6.3.3 Background colour (Conflicts with paragraph 7) 5.7 General user input guidelines (Paragraph g))
4.2.2 Hardware	
4.2.2.2 Alarms and indicators	5.4.1.1 Alarm acknowledgement

Table C.2 – Other paragraphs in MSC/Circ.982 related to display design

MSC/Circ.982 Paragraph	
5.3.2.7	High priority displays
5.3.3.5	Spacing between controls
5.4.1.4	Sensor input failure
5.4.1.8	Alarm Minimization
5.4.1.12	Presentation of Alarms
5.4.2	Visual Alarms (all 6 sub-criteria)
5.6.1.1	Lack of ambiguity
5.6.1.2	Use of digital displays
5.6.1.3	Digital readout
5.6.1.10	Display fields for the display of important information
5.6.2.3	Demarcation of Groups
5.6.3.8	Flicker
5.6.3.9	Image continuity
5.6.3.10	CRT image linearity
5.6.5.2	Meaningful abbreviations
5.6.5.3	Units of measurement
5.6.5.7	Highlighting
5.6.5.8	Scaling in standards intervals
5.6.5.10	Unobtrusive grids

Table C.3 – Other paragraphs in MSC/Circ.982 partially related to display design

MSC/Circ.982 Paragraph	
5.3.2.4	Control and display location
5.3.2.5	Simultaneous use
5.3.3.4	Consistent arrangement
5.3.3.5	Simultaneous use
5.4.1.3	Failure or reduction of power supply
5.4.1.13	Modes of Alarms
5.4.3	Audible Alarms (all 6 sub-criteria)

Annex D
(informative)

Guidance on testing

D.1 Methods of test derived from ISO 9241-12

D.1.1 General

The methods of test in this standard are derived from ISO 9241-12. The methods of test do not identify specific processes, approaches or facilities. Rather, they are intended to provide guidance to accredited testing laboratories for the development of test plans and test procedures that evaluate compliance with the requirements specified.

D.1.2 Observation

The test method “observation” refers to simple examination of the presentation of information to confirm that a particular observable condition has been met. The phrase "confirm by observation" is used.

Observations may be made by any person with the necessary skill to understand the presentation of information to determine if a statement concerning an observable property has been correctly applied. It is used when suitably trained individuals with a broad range of education and/or experience can be confidently expected to reach the same conclusion about a property of presented information or the performance of display equipment.

Compliance is determined by comparing the observed property to the requirement. Some observations may be made directly from the presentation. Other observations may require simulation of input from sensors or other sources. Typical confirmations by observation include:

- existence of functions or features;
- use of symbols or a defined range of words;
- a system output in response to a defined input.

D.1.3 Inspection of documented evidence

The test method “inspection of documented evidence” refers to examination of relevant documents to confirm that a particular presentation or display requirement has been met. The phrase "confirm by inspection of documented evidence" is used.

Documented evidence may include manuals, system requirements, design justification, industry conventions, etc. Inspections may be made by a suitably qualified person who has the necessary education, skill and/or experience to apply the documentation to the system's presentation or display equipment. It is used when performance of a system's presentation or display equipment is not directly observable or measurable. It may also be used when observation would be excessively repetitious, time consuming, or expensive.

Compliance is determined by comparing the documented property to the requirement. Typical confirmations by inspection of documented evidence include:

- conformance to a standard or other documented evidence;
- existence of optional features or functions;
- design and/or operation of algorithms.

D.1.4 Measurement

The test method “measurement” refers to measuring or calculating a value or variable for comparison to a specified value to determine that a particular presentation or display requirement has been met. The phrase "confirm by measurement" is used.

Measurements may require the use of test facilities and equipment. Measurements may be made by any person with the necessary skill to measure and/or calculate the value and compare it against a requirement, standard or other documented evidence.

Compliance is determined by comparing the measured or calculated value or variable to the requirement. Typical confirmations by measurement include:

- assessing whether the end users of a display will be able to read characters from the intended viewing distance;
- differences between displayed colours or absolute levels of display brightness;
- achievement of a level of availability or dependability.

D.1.5 Analytical evaluation

The test method “analytical evaluation” refers to detailed examination of the presentation of information to confirm that a particular condition has been met. The phrase "confirm by analytical evaluation" is used.

Analytical evaluations may be made by a relevant expert with the necessary education, skills and/or experience to make an informed and reliable judgement concerning the presentation of information, its appropriateness and usability. It is used for the evaluation of properties which can be judged only in the context of other information or knowledge which requires the tester to make an informed assessment of the likely performance of a typical user of the presentation.

Compliance is determined by comparing the observed property to the requirement. Typical confirmations by analytical evaluation include:

- the largest amount of information that can be presented to a user on a single display;
- the smallest difference in size, colour or line thickness that will be distinguished by a user on a particular display;
- consistency and clarity in presentation of information.

D.2 Application of IEC 60945

D.2.1 Display equipment category

The manufacturer should categorize their display equipment according to IEC 60945:2002, 4.4.

D.2.2 Technical performance

A performance test should be used to confirm compliance with the requirements specifying parameters.

A performance check should be used to confirm that the equipment operates.

The testing laboratory should use the appropriate measure of technical performance (i.e. performance test or performance check) for each test in the test plan.

The equipment should operate in accordance with this standard during each performance test or performance check.

D.2.3 Pre-conditioning for environmental tests

The manufacturer should specify any mechanical or electrical preconditioning required for environmental tests. The testing laboratory should inspect the display equipment and perform any preconditioning specified by the manufacturer.

The testing laboratory should carry out environmental tests with display equipment in its normal operational configuration, including mounting and supports, and with all mechanical arrangements secure.

D.2.4 Methods of test derived from ISO 9241-12 applied for IEC 60945

Many requirements for the presentation of information are of a nature that may be tested by simple observation. Other requirements are, however, of a more complex nature and may require informed judgement in the context of other information or knowledge by an expert with the necessary education, skills and/or experience. This is particularly the case in assessing conditions of appropriateness, usability or the likely performance of a typical user.

These considerations are reflected in the guidance on test methods provided by Clause D.1, and in the structure of IEC 62288 in general, where the test method to be applied is specified test by test.

IEC 60945:2002 simply specifies that each requirement should be “checked”, without further guidance. Table D.1 gives appropriate test methods.

Table D.1 – Methods of test applied for IEC 60945

IEC 60945:2002 subclause	Original test-method	Appropriate test-method
6.1.2a	Check	Analytical evaluation
6.1.2b	Check	Analytical evaluation
6.1.2c	Check	Measurement
6.1.2d	Check	Analytical evaluation
6.1.2e	Check	Observation
6.1.2f	Check	Observation
6.1.2g	Check	Observation
6.1.2h	Check	Analytical evaluation
6.1.3a	Check	Analytical evaluation
6.1.3b	Check	Analytical evaluation
6.1.3c	Check	Observation
6.1.3d	Check	Analytical evaluation
6.1.4a	Check	Observation
6.1.4b	Check	Observation
6.1.4c	Check	Observation
6.1.4d	Check	Analytical evaluation
6.1.5a	Check	Analytical evaluation
6.1.5b	Check	Observation
6.1.5c	Check	Analytical evaluation
6.1.5d	Check	Observation

IEC 60945:2002 subclause	Original test-method	Appropriate test-method
6.1.5e	Check	Analytical evaluation
6.1.5f	Check	Analytical evaluation
6.1.5g	Check	Inspection of documented evidence
6.1.5h	Check	Analytical evaluation
6.1.5i	Check	Analytical evaluation
6.1.5j	Check	Analytical evaluation
6.1.5k	Check	Analytical evaluation
6.1.5l	Check	Analytical evaluation
6.1.5m	Check	Observation
6.1.5n	Check	Observation
6.1.5o	Check	Analytical evaluation
6.1.5p	Check	Observation
6.1.5q	Check	Observation
6.1.5r	Check	Observation
6.1.5s	Check	Observation
6.1.5t	Check	Observation
6.1.6a	Check	Analytical evaluation
6.1.6b	Check	Observation
6.1.6c	Check	Observation
6.1.6d	Check	Observation
6.1.7a	Check	Analytical evaluation
6.1.7b	Check	Analytical evaluation
6.1.7c	Check	Analytical evaluation
6.1.7d	Check	Analytical evaluation
6.1.7e	Check	Analytical evaluation
6.1.8a	Check	Analytical evaluation
6.1.8b	Check	Observation
6.1.8c	Check	Observation
6.1.8d	Check	Observation
6.1.8e	Check	Observation
6.1.8f	Check	Analytical evaluation
6.2.1a	Check	Observation
6.2.1b	Check	Analytical evaluation
6.2.1c	Check	Analytical evaluation
6.2.1d	Check	Observation
6.2.2a	Check	Observation
6.2.2b	Check	Observation
6.2.2c	Check	Observation
6.2.3a	Check	Observation
6.2.3b	Check	Observation
6.2.3c	Check	Inspection of documented evidence
6.2.3d	Check	Observation
6.2.3e	Check	Observation

IEC 60945:2002 subclause	Original test-method	Appropriate test-method
6.2.3f	Check	Analytical evaluation
6.2.3g	Check	Observation
6.2.3h	Check	Observation
6.2.3i	Check	Observation

D.3 Compliance with requirements

Compliance with a requirement can be established by verifying that it is implemented in accordance with another standard or with another clause or subclause within this standard; or by confirming that it is implemented in accordance with the requirement(s) specified in the current clause/subclause.

D.4 Simulation

Some test methods require simulation. A simulator arrangement should provide the capabilities to replicate own ship navigational sensors, radar video images including individual radar echoes for the tracking of targets, reported radar targets (for example, in accordance with the IEC 61162 series), and reported AIS targets.

IEC 62388 describes a Target Scenario Simulator (TSS), a Reported Target Simulator (RTS) and a combined TSS/RTS.

D.5 Electronic chart data

Some test methods require electronic chart data or an electronic chart test data set.

IEC 61174, describes a test data set for ENC. IHO S-64 contains the IHO test data sets for ECDIS. The ECDIS test data sets are comprised of an ENC test data set and an RNC test data set.

Annex E
(normative)

Operational controls

E.1 Overview

Operational controls for navigational systems and equipment shall be easy to identify and simple to use. Controls may be implemented through dedicated hardware, screen-accessed soft keys, or a combination of both. The primary controls for each navigational system or equipment shall be identified and provided with an associated status indication in accordance with the function it is serving.

E.2 Logical grouping of data and control functions

Data and control functions shall be divided into logical groups for the function or the task-at-hand, in accordance with 4.3.1.

Table E.1 and Table E.2 provide examples of top-level logical groupings of data and controls for radar and charting functionality. Specific requirements for logical grouping of data and control functions, when contained in the individual standards for navigational systems and equipment, shall also be followed. Examples of major groups:

- alerts and indications;
- own ship information;
- track monitoring data (as specified in IEC 62065);
- trial manoeuvre;
- navigational tools and readouts;
- target information;
- range/scale and mode readout;
- radar system information;
- radar signal information;
- chart database information;
- system settings.

Table E.1 – Top-level grouping of data and control functions for radar applications

Own ship information	Navigation tools
Position Heading/speed (or course/speed)	Cursor readout VRM/EBL/ERBL readout Parallel index lines readout
Range and mode information	**Radar system information**
Range scale Orientation mode Stabilization mode Motion mode	Standby/run Pulse length Frequency band Master/slave designation Tune
Target information	**Radar signal information**
Target association Target vector properties Target trails Collision avoidance parameters AIS status AIS filter	Gain Rain Sea Processing (for example, target enhancement or correlation)

Table E.2 – Top-level grouping of data and control functions for charting

Own ship information	Navigation tools
Position Course/speed	Cursor readout VRM/EBL/ERBL readout
Scale and mode information	**Chart database information**
Chart scale Chart datum Orientation mode Motion mode Symbol set	ENC cell Cell edition/date Corrected through date

E.3 Icons for common function controls

When any of the following controls listed in this subclause are used, they shall be identified in English by the relevant name or abbreviation as listed by the appropriate table. In addition, they may be identified by standard icons, described below.

General equipment controls apply to all equipment and are defined in Table E.3. Task oriented measurement controls are defined in Table E.4. Radar specific controls are defined in Table E.5.

The following code of practice shall be used when marking equipment controls with optional icons:

- the minimum dimension of a symbol shall be not less than 9 mm;
- the distance between the centres of two adjacent symbols shall be not less than 1,4 times the size of the larger symbol;
- switch function symbols shall be linked by a line. A linked line infers controlled action;
- variable control function symbols shall be linked by a line, preferably an arc. The direction of increase shall be indicated;
- icons shall be presented with a high contrast against their background;
- the various elements of a symbol shall have a fixed ratio one to another;
- multiple functions of controls and switch positions may be indicated by a combined symbol;

- where concentric controls or switches are fitted, the outer of the symbols should refer to the larger diameter control.

Table E.3 – General control icons

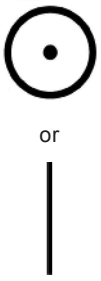
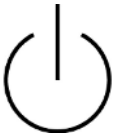
Standard names	Standard abbreviations	Symbol	Explanation
OFF	OFF		To identify the “off” position of the control or switch
ON	ON	 or	To identify the “Radar on” position of the switch or alternatively To identify the “on” position of the control or switch
ON/OFF	ON/OFF		To identify the “on/off” alternate control or switch
STANDBY	STANDBY		To identify the standby alternate control or switch and To identify the combined “on/off” plus standby alternate control or switch
PANEL ILLUMINATION	PANEL		To identify the maximum position of the “scale illumination” control or switch
DISPLAY BRILLIANCE	BRILL		To identify the maximum position of the “display brilliance” control
NOTE The circles around the PANEL ILLUMINATION and DISPLAY BRILLIANCE icons are optional.			

Table E.4 – Task-oriented measurement control icons

Standard names	Standard abbreviations	Symbol	Explanation
RANGE RINGS	RR		To identify the maximum position of the “range rings brilliance” control
VARIABLE RANGE MARKER	VRM		To identify the “variable range marker” control
ELECTRONIC BEARING LINE	EBL		To identify the “electronic bearing line” control

Table E.5 – Radar specific control icons

Standard names	Standard abbreviations	Symbol	Explanation
STAND BY	STBY		To identify the “Radar stand-by” position of the switch
NORTH UP	N UP		To identify the “north-up ” position of the mode of presentation switch
HEAD UP	H UP		To identify the “ship’s head-up” position of the mode of presentation switch
HEADING LINE OFF	HL OFF		To identify the “heading line” off position
RANGE	RANGE		To identify the range selection switch
SHORT PULSE	SP		To identify the “short” pulse position of the pulse length selection control
LONG PULSE	LP		To identify the “long” pulse position of the pulse length selection control
TUNE	TUNE		To identify the “tuning control”
GAIN	GAIN		To identify the “gain” control
RAIN	RAIN		To identify the minimum position of the “rain” control or switch
SEA	SEA		To identify the minimum position of the “anti-clutter sea” control
PERFORMANCE MONITOR	PM		To identify the position of the performance monitor switch
NOTE The circles around the SHORT PULSE, LONG PULSE, and PERFORMANCE MONITOR icons are optional.			

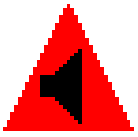
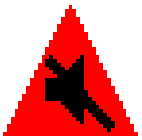
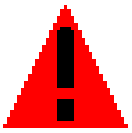
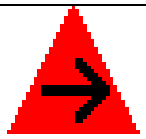
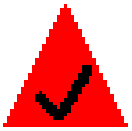
Annex F
(normative)

Icons for presentation of the state of an alert

The use of icons for presentation of the alerts is optional, but if an icon is used then it is mandatory to use the icons provided in Table F.1 and Table F.2. If IMO has specified for an alert an associated symbol (for example in tables 7.1.1 and 7.1.2 of the Code of Alerts and Indications 2009 (IMO resolution A.1021(26))), then such a symbol shall be used together with icons provided in the Table F.1 and Table F.2.

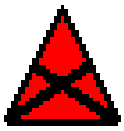
Table F.1 and Table F.2 specify icons for daylight use. For other viewing conditions such as night and dusk the “Icon description” in Table F.1 and Table F.2 are in force, but the examples of icon graphics should be modified as appropriate.

Table F.1 – Alert management icons – basic

Icon number	Icon name	Icon description (normative)	Icon graphic(s) (example)
n/a	Emergency alarm	As specified in Table 7.1.1 of the Code on Alerts and Indications 2009 (IMO resolution A.1021(26))	See Table 7.1.1 of the Code on Alerts and Indications 2009
1	Active – unacknowledged alarm	A flashing red triangle. A symbol of loudspeaker in the middle of the triangle. To be presented together with the alert text.	
2	Active – silenced alarm	A flashing red triangle. A symbol as in icon number 1 with a prominent diagonal line through it. To be presented together with the alert text.	
3	Active – acknowledged alarm	A red triangle. An exclamation mark in the middle of the triangle. To be presented together with the alert text.	
4	Active – responsibility transferred alarm	A red triangle. An arrow pointing towards the right in the middle of the triangle. To be presented together with the alert text.	
5	Rectified – unacknowledged alarm	A flashing red triangle. A tick mark in the middle of the triangle. To be presented together with the alert text.	
6	Active – unacknowledged warning	A flashing yellowish orange circle. A symbol of loudspeaker in the middle of the circle. To be presented together with the alert text.	
7	Active – silenced warning	A flashing yellowish orange circle. A symbol as in icon number 6 with a prominent diagonal line through it. To be presented together with the alert text.	
8	Active – acknowledged warning	A yellowish orange circle. An exclamation mark in the middle of the circle. To be presented together with the alert text.	

Icon number	Icon name	Icon description (normative)	Icon graphic(s) (example)
9	Active – responsibility transferred warning	A yellowish orange circle. An arrow pointing towards the right in the middle of the circle. To be presented together with the alert text.	
10	Rectified – unacknowledged warning	A flashing yellowish orange circle. A tick mark in the middle of the circle. To be presented together with the alert text.	
11	Caution	A yellow square. An exclamation mark in the middle of the square. To be presented together with the alert text.	

Table F.2 – Alert management icons – additional qualifiers

Icon number	Icon name	Icon description (normative)	Icon graphic(s) (example)
12	Aggregation	A plus sign. To be presented together with the icon number 1 – 11 from Table F.1.	+
13	Acknowledge not allowed for alarm [a]	A red triangle with a cross in the middle of the triangle. To be presented together with the icon number 1, 2 and 5.	
14	Acknowledge not allowed for warning [a]	A yellowish orange circle with a cross in the middle of circle. To be presented together with the icon number 6, 7 and 10.	
For printing purposes of this standard the icon symbols in Table F.1 and Table F.2 use red, yellowish orange, yellow and black colour. Normative is use of red, yellowish orange and yellow (see column icon description in Table F.1 and Table F.2). Colour black is used as an example and it can be replaced by any suitable colour appropriate for the ambient viewing condition.			
[a] "Acknowledge not allowed" icon is used when a Category A alert cannot be acknowledged in a task station.			

Annex G
(normative)

Testing for colours, intensity and flicker

G.1 Testing for colours and intensity

G.1.1 General

The IHO ECDIS Presentation Library contains colour differentiation test diagrams to enable test personnel to determine whether it is possible to discriminate features by colour.

The colours in the IHO ECDIS Presentation Library are defined using the CIE 1931 colour coordinate system (x, y and L) which specify chrominance and luminance. CIE 15 defines the following units for colour difference in terms of chrominance and luminance:

- ΔE^* as a measure of the overall discrimination including both chrominance and luminance differences;

  $\Delta E^* = SQRT\ [\ (L_2^* - L_1^*) + (u_2^* - u_1^*)^2 + (v_2^* - v_1^*)^2\ ]$

- $\Delta(u^*,v^*)$ as a measure of the discrimination in chrominance alone.

  $\Delta(u^*,v^*) = SQRT\ [\ (u_2^* - u_1^*)^2 + (v_2^* - v_1^*)^2\ ]$

Tolerances for conversion from CIE 1931 colour coordinates to RGB values for display equipment are defined by three terms:

- ΔE^* between the colour coordinates resulting from the RGB values calculated for each colour and the other colours from the same colour table for each ambient light condition;
- $\Delta(u^*,v^*)$ between the defined colour coordinates and the coordinates resulting from the RGB values calculated for each colour in each colour table for each ambient light condition;
- luminance ratio ($L_{measured}/L_{defined}$) between the defined coordinates of the colours within the colour table for each ambient light condition and the coordinates resulting from the RGB values calculated for each colour.

ΔE^* should be a minimum of 10 except for colour pairs listed in IHO S-52 Table of Colour – Colour pairs that are exempt from the colour separation tolerance test, which, as defined, are very close in colour.

$\Delta(u^*,v^*)$ should be a maximum of 16 for display equipment tested as part of the navigational system or equipment (i.e. where the display screen and its source of video are tested together) or for system components between which the transfer of the video is based on a lossless method (for example DVI-D for digital transfer). $\Delta(u^*,v^*)$ should be a maximum of 8 for system components that are tested independently of each other (i.e. where the display screen equipment is not tested with the identical video source that it will be installed with aboard ship or where a computer is not tested with the identical display screen that it will be installed with aboard ship).

For each colour token within the colour table, the luminance should be within 20 % of the value specified in IHO S-52, Colour conversion tolerances and tests, for each colour table specified in the IHO S-52, for example; day, dusk and night. The colour black is an exception, which should be a maximum 0,52 cd/m^2 as defined in the IHO S-52, Colour conversion tolerances and tests for the day colour table.

Calculations of L^*, u^*, and v^* shall be made in reference to the chromaticity and luminance specified for the brightest white colour token in the respective colour table (Y0, u0, y0); where

Y0 is the luminance in cd/m^2. It should be noted that this is not the brightest white of the monitor.

G.1.2 Test personnel

Personnel conducting tests related to the discrimination of colours should have passed the minimum colour vision and acuity tests required for users by IMO STCW Code Part B. They should also have adapted to night viewing for 10 min before conducting tests using the night display.

G.1.3 Method of test

The method of test is as follows:

a) confirm by analytical evaluation the measurement process of the manufacturer and confirm by inspection of documented evidence provided by the manufacturer that for each colour table that the difference between the calculated RGB values for any two colours in the table are at least 10 ΔE^* units, except for those pairs defined to have a tabular ΔE^* less than 20; as defined in the IHO S-52, Colour conversion tolerances and tests and IHO S-52, Table of Colour – Colour pairs that are exempt from the colour separation tolerance test;

b) confirm by analytical evaluation the measurement process of the manufacturer and confirm by inspection of documented evidence provided by the manufacturer that the results of the colour calibration conversion of each specified colour (x, y, L) for each colour table into RGB values for an individual monitor are within the tolerance as defined in the IHO S-52, Calculations to achieve correct colours;

c) colour table calibration verification measurements shall be carried out in a dark-room. Manufacturers may choose between two different methods of colour calibration. The first method is for the test of a monitor and a video source intended to be installed together as an integrated system. The second method is for the test of a monitor independent of the video source/computer with which it will be installed or, similarly, a video source tested independently of a monitor.

   - For independent test of monitors, the manufacturer shall provide a reference computer.
   - For independent test of computers, the manufacturer shall provide a reference monitor.

   The test shall be performed as follows:

   1) for the Day colour table display a completely black image on the screen provided by the manufacturer. Confirm by measurement perpendicular to the centre of the screen that the luminance is as required (less than or equal to 0,52 cd/m^2 when the CHWHT is set to 80 cd/m^2 or more (Day colour table));

   2) for the Day colour table, select a screen provided by the manufacturer which has a box of CHWHT (brightest white) on a black background. The box size should be at least 5 cm per side but not more than 25 % of the total screen area. Confirm by measurement perpendicular to the centre of the screen that the level of CHWHT is within the tolerances of $\Delta(u^*, v^*)$ for $\Delta(u^*, v^*) < 16$ for integrated units, $\Delta(u^*, v^*) < 8$ for independent test) and L (is within 20 % of its specified value);

   3) repeat the test for CHMGF (brightest magenta), CHYLW (brightest yellow) and BKAJ2 (darkest grey) from the Day colour table;

   4) repeat the tests 2) and 3) for Dusk and Night colour tables and other colour tables provided, e.g. colour tables with black background for chart radar. Confirm by measurement that BKAJ1 (black background) luminance is 0,05 cd/m^2 in the night setting when the white level is dimmed down so that CHWHT is 1 cd/m^2;

d) colour table calibration verification observations shall be carried out as follows. The user's manual brightness control and contrast control, if provided, shall be set to their calibration reference settings; while the display is off, adjust the ambient light level reflected from a white paper positioned on the display screen to the appropriate ambient values specified in Table 1. For each colour table provided, under the appropriate ambient light condition,

display the colour differentiation test diagram as defined in the IHO ECDIS presentation library. Confirm by observation that:

1) each foreground stripe is clearly distinguished from its background;
2) the foreground stripes representing yellow, orange, magenta, green, blue and grey may be clearly identified;

e) under each of the ambient light conditions defined above, display the black-adjust boxes available from ECDIS Chart 1 (see ECDIS chart 1 chart AA5C1ABO.) Select each table in turn and confirm by observation that the ECDIS colour token BKAJ2 (dark grey) is clearly distinguished against a black background (BKAJ1);

f) confirm by observation that the procedure for on-board use of the colour differentiation test diagrams is defined in the equipment manual;

g) confirm by observation that means are provided to return the display to the calibrated brightness and contrast settings for each ambient light condition defined above;

h) confirm by observation that each of the mandatory colour tables provided in the IHO ECDIS presentation library may be selected by the user.

G.2 Testing for flicker

G.2.1 Overview

This Clause reproduces the method originally developed in Annex B of ISO 13406-2:2001.

NOTE The actual perception of flicker is known to vary between individual observers and within an individual observer. Some of these variations are systematic. Flicker sensitivity decreases with age (between individuals) and with fatigue (for the individual). In addition, the conversion of display luminance to retinal illumination requires an assumption about the luminance that drives pupil response. In positive polarity displays, average display luminance and “adapting” luminance can be assumed to be the same. There is some evidence that this is not true for negative polarity displays. Due to cross-coupling of photo receptors in the eye, the correct value probably lies between the average and peak luminance. The average luminance is the worst case and is used in this method.

G.2.2 Analytic model

G.2.2.1 Principle

It can be predicted whether people will detect a homogeneously illuminated display appears to flicker or not by the amount of energy in the temporal frequencies of the display. The first step in the method therefore, is to find out the amount of energy in the temporal frequencies, $E_{\text{obs}}\,n$. These numbers are then compared to the amounts of energies that people will detect as flicker, the predicted flicker threshold, $E_{\text{pred}}\,n$. Flat panels exhibit more diverse luminance-time functions than progressively scanned cathode ray tubes, so significant energy may exist at several different frequencies. The index, n is carried from 1, at the fundamental repetition frequency of the display (generally, 0,5 times the refreshment rate is necessary on LCD panels), in integer steps until the frequency exceeds 120 Hz. The observed energies may be calculated or measured. The energy at various frequencies is learned by examining the Fourier transform of the luminance-time function.

If $E_{\text{obs}} < E_{\text{pred}}$ at every frequency then it is likely that people will not see flicker.

If $E_{\text{obs}} > E_{\text{pred}}$ at any frequency then it is likely that people will see flicker.

G.2.2.2 Fourier coefficients

The average luminance of a luminance-time function, $f(t)$ is:

$$c_0 = \frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} f(t)\,\mathrm{d}t$$

where

c_0, the zero Fourier coefficient, is the dark-room luminance averaged over time;

T is the repetition period of the luminance-time function. For progressively scanned cathode ray tubes, the refreshment rate is $1/T$.

NOTE When measuring $f(t)$ and using a fast Fourier transform, FFT, it is sometimes not appropriate to use FFT$(v)0$ for c_0 since this could lead to errors depending on the specific form of FFT used.

FFT$(v)_0$, is the 0 term of the fast Fourier transform of v.

v is the list of measured samples of $f(t)$. The number of items in the list shall be a power of 2 and an integer number of repetition times shall be sampled.

The average luminance, c_0 is calculated from dark-room measurements. $L_R = qE_S$. In this model, the "adapting" luminance, L_t used in converting cd/m^2 to trolands is $c_0 + L_R$.

The general coefficients are:

$$c_n = \frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} f(t)e^{\frac{-2ni\pi t}{T}}\,\mathrm{d}t$$

where

c_n is the nth Fourier coefficient,

i $\sqrt{-1}$

T is the repetition time of $f(t)$.

In the case where $f(t)$ is the sum of components, for example, red, green and blue, the coefficients can be obtained one at a time and added.

$$c_0 = \sum_{j=1}^{m} c_0 j = L_t - L_r$$

$$c_n = \sum_{j=1}^{m} c_n j$$

$$\mathrm{AMP}_n = \frac{2\times|c_n|}{c_0}$$

If there are m components, then:

$$|c_n| = \sqrt{\left[\mathrm{Re}(c_n)\right]^2 + \left[\mathrm{Im}(c_n)\right]^2}$$

where AMP is a value between 0 and 2.

The frequency associated with AMP_n, f_n is:

$$f_n = \frac{n}{T} \text{ for } n = 1, 2\ldots$$

while f_n <120 Hz

$$\mathrm{AMP}_n = \frac{2\times\left|\mathrm{FFT}(v)_n\right|}{\mathrm{FFT}(v)_0}$$

When using the fast Fourier transform, the set of observations, v_p for p = 0 . . . 2^z – 1 is sampled at frequency, f_s and processed with FFT, where z is 6, 7 . . . The value AMP_n has a corresponding frequency $n \times f_s/z$. The sampling frequency is $k \times 2^z/T$, where k = 1, 2, . . . The period of $f(t)$ shall be determined. Generally, k = 1 yields the best result.

G.2.2.3 Pupil

The pupil area shall be known to convert the luminance to trolands. The expression for pupil area can be simplified:

$$A = b_0 L_t^{b_1}$$

where

b_0 12,451 84

b_1 –0,160 32

L_t is the adaptation luminance = $L_{H\text{-}dark}(\Theta D, \Phi D) + q_H(\Theta_D, \Phi_D)\, E_s$.

G.2.2.4 DC component

To calculate the amount of energy in the temporal frequencies of interest.

a) Convert the screen luminance into units of retinal illuminance (trolands).

b) Calculate the pupil area, *A* from the formula in G.2.2.3.

c) The DC component is:

$$DC = A \times c_0$$

G.2.3 Decision criteria

G.2.3.1 General case

This case applies to technologies with a luminance persistence of 1 ms or more (for example, CRT, LCDs, etc.).

Energy at each frequency is:

$$E_{\text{obs}\,n} = \text{DC} \times \text{AMP}_n$$

The criteria are that the energy at every frequency satisfies:

$$E_{\text{obs}\,n} \leqslant E_{\text{pred}\,n}$$

where

$$E_{\text{pred}\,n} = ae^{\frac{nb}{T}}$$

where a and b are as given in Table G.1.

Table G.1 – Values of predicted energy and special coefficients

Row	Screen diagonal arc degrees	Predicted energy coefficients		Special case coefficients	
		a	b	D	E
1	<20	0,127 6	0,191 9	36,44	13,83
2	20 to 40	0,191 9	0,120 1	39,81	16,40
3	40 to 65	0,507 6	0,100 4	37,93	19,62
4	>65	0,530	0,099 2	37,96	19,86

G.2.3.2 Simpler special case

This case applies to technologies having luminance persistence that is much less than 1 ms (for example EL, dc plasma, light-emitting diode (LED)). For such technologies, AMP = 2 for refresh rates less than 100 Hz.

Conditions:

a) Reflected luminance of 5 cd/m^2 to 15 cd/m^2.

b) Average dark-room luminance L_{dark} is from 10 cd/m^2 to 340 cd/m^2.

Then, the display meets the requirement if the refresh rate is greater than

$$D + E \log_{10}(L_{\text{dark}})$$

where D and E are given in the two right-hand columns of Table G.1.

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