GUIDANCE NOTES
GD 06-2012


# GUIDELINES FOR SURVEY OF ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEMS (ECDIS)

# 2012

## CONTENTS

# Chapter 1 General

## 1.1 General requirements

1.1.1 These Guidelines provide requirements for performance standards of electronic chart display and information systems（ECDIS), inspections of related products, surveys of the installation and operation of such systems, relevant test methods, etc.

1.1.2 The primary function of the ECDIS is to contribute to safe navigation.

1.1.3 ECDIS with adequate back-up arrangements may be accepted as complying with the up-to-date charts required by regulations V/19 and V/27 of the 1974 SOLAS Convention, as amended (See Chapter 6).

1.1.4 ECDIS is to be capable of displaying all chart information necessary for safe and efficient navigation originated by, and distributed on the authority of, government-authorized hydrographic offices.

1.1.5 ECDIS is to facilitate simple and reliable updating of the electronic navigational chart.

1.1.6 ECDIS is to reduce the navigational workload compared to using the paper chart. ECDIS is to enable the mariner to execute in a convenient and timely manner all route planning, route monitoring and positioning currently performed on paper charts. ECDIS is to be capable of continuously plotting the ship's position.

1.1.7 The ECDIS display may also be used for the display of radar, radar tracked target information, AIS and other appropriate data layers to assist in route monitoring

1.1.8 ECDIS is to have at least the same reliability and availability of presentation as the paper chart published by government-authorized hydrographic offices.

1.1.9 ECDIS is to provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment (See Appendix 1).

1.1.10 When the relevant chart information is not available in the appropriate form (See Chapter 3), some ECDIS equipment may operate in the Raster Chart Display System (RCDS) mode as defined in Appendix 2. The RCDS mode of operation is to conform to performance standards not inferior to those set out in Appendix 2.

## 1.2 Application

1.2.1 These Guidelines apply to all ECDIS equipment carried on all ships as follows:

(1) dedicated stand-alone workstation;

(2) a multifunction workstation as part of an INS.

1.2.2 These Guidelines apply to ECDIS mode of operation, ECDIS in RCDS mode of operation as specified in Appendix 2 and ECDIS backup arrangements as specified in Chapter 6.

1.2.3 Requirements for structure and format of chart data, the encryption of chart data as well as the presentation of chart data are within the scope of relevant IHO standards and relevant documents referred to in these Guidelines.

1.2.4 In addition to the general requirements set out in resolution A.694(17) as further specified in IEC 60945① and the presentation requirements set out in resolution MSC.191(79) as further specified in IEC 62288, ECDIS equipment is to meet the requirements of these Guidelines and follow the relevant guidelines on ergonomic principles adopted by IMO.②

**1.3 Basis**

1.3.1 These Guidelines have been prepared mainly on the basis of the following documents:

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

(2) IEC 60945, Maritime navigation and radio communication equipment and systems – General requirements – Methods of testing and required test results;

(3) IEC 62288, Maritime navigation and radio communication equipment and systems – Presentation of navigation-related information on shipborne navigational displays – General requirements – Methods of testing and required test results;

(4) IMO MSC.232(82), Adoption of the Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS);

(5) IMO MSC.282(86), Adoption of Amendments to the International Convention for the Safety of Life at Sea, 1974, as Amended;

(6) IMO MSC.191(79), Performance Standards for the Presentation of Navigation-Related Information on Shipborne Navigational Displays;

(7) IMO A.694(17), General Requirements for Shipborne Radio Equipment Forming Part of the Global Maritime Distress and Safety System (GMDSS) and for Electronic Navigational Aids;

(8) IMO SN/Circ.243, Guidelines for the Presentation of Navigation-related Symbols, Terms and Abbreviations;

(9) IMO SN.1/Circ.266/Rev.1, Maintenance of Electronic Chart Display and Information System (ECDIS) Software;

(10) IMO SN.1/Circ.207/Rev.1, Differences between RCDs and ECDIs;

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① Refer to IEC Publication 60945.

② MSC/Circ.982.

(11) IHO S-32, Appendix 1, Hydrographic dictionary – Glossary of ECDIS related terms;

(12) IHO S-52, Specifications for chart content and display aspects of ECDIS;

(13) IHO S-52, Appendix 1, Guidance on updating the electronic navigational chart;

(14) IHO S-52, Appendix 2, Colour and symbol specifications for ECDIS;

(15) IHO S-57, Appendix B.1, ENC product specification;

(16) IHO S-61, Product specification for raster navigational charts (RNC);

(17) IHO S-63, IHO data protection scheme;

(18) IHO S-64, Test data sets for ECDIS.

## 1.4 Terms, definitions and abbreviations

1.4.1 Definitions

**(1) Electronic Chart Display and Information System (ECDIS)**

A navigation information system which with adequate back-up arrangements can be accepted as complying with the up-to-date chart required by regulations V/19 and V/27 of the 1974 SOLAS Convention, as amended, by displaying selected information from a system electronic navigational chart (SENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and if required display additional navigation-related information.

**(2) Electronic Navigational Chart (ENC)**

The database, standardized as to content, structure and format, issued for use with ECDIS by or on the authority of a government-authorized hydrographic office or other relevant government institution, and conforming to IHO standards. The ENC contains all the chart information necessary for safe navigation and may contain supplementary information in addition to that contained in the paper chart (e.g. sailing directions) which may be considered necessary for safe navigation.

**(3) System Electronic Navigational Chart (SENC)**

A database, in the manufacturer's internal ECDIS format, resulting from the lossless transformation of the entire ENC contents and its updates. It is this database that is accessed by ECDIS for the display generation and other navigational functions, and is equivalent to an up-to-date paper chart. The SENC may also contain information added by the mariner and information from other sources.

**(4) Raster Navigational Chart (RNC)**

A facsimile of a paper chart originated by, or distributed on the authority of, a government-authorized hydrographic office. RNC is used in these Guidelines to mean either a single chart or a collection of charts.

**(5) Raster Chart Display System (RCDS)**

A navigation information system displaying RNCs with positional information from navigation sensors to assist the mariner in route planning and route monitoring and, if required, display additional navigation-related information

**(6) System Raster Navigational Chart Database (SRNC)**

A database resulting from the transformation of the RNC by the RCDS to include updates to the RNC by appropriate means.

**(7) Appropriate Portfolio of up-to-date paper Charts (APC)**

A suite of paper charts of a scale to show sufficient detail of topography, depths, navigational hazards, aids to navigation, charted routes, and routeing measures to provide the mariner with information on the overall navigational environment. The APC should provide adequate look-ahead capability. Coastal States will provide details of the charts which meet the requirement of this portfolio, and these details are included in a worldwide database maintained by the IHO. Consideration should be given to the details contained in this database when determining the content of the APC.

**(8) CIE colour calibration**

A procedure to confirm that the colour specified in S-52, Appendix 2 is correctly reproduced on the ECDIS display.

**(9) Common reference system**

Sensor input data, providing identical and obligatory reference pertaining to position, course, heading, bearing, speed, velocity, etc. and horizontal datum to different subsystems within an integrated navigation system.

**(10) Compilation scale**

Scale with which the chart information meets the IHO requirements for chart accuracy. It is established by the producing hydrographic office and encoded in the ENC.

**(11) Corrupted data**

ENC data produced according to the S-57 ENC product specification, but altered or modified during production, transmission, or retrieval.

**(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.

**(13) Degrade**

Reduce the quantity or quality of information content.

**(14) Display base**

The chart content as listed in paragraph 4.1 of Chapter 4 and which cannot be removed from the display. It is not intended to be sufficient for safe navigation.

**(15) Display redraw time**

Interval from when the display starts to change until the new display is complete.

**(16) Display regeneration time**

Interval from operator action until the consequent redraw is complete.

**(17) Display scale**

Ratio between a distance on the display and a distance on the ground, normalized and expressed as, for example 1:10 000.

**(18) ENC cell**

Geographic division of ENC data for distributing purposes. For further information, refer to the ENC product specification in S-57.

**(19) ENC data**

Data conforming to the electronic navigation chart (ENC).

**(20) ENC test data set**

Standardized data set supplied on behalf of the IHO that is necessary to accomplish IEC testing requirements for ECDIS. This data set is encoded according to the S-57 ENC product specification and contains update information based on S-52, Appendix 1. The specific requirements are listed in Appendix 5.

**(21) Non-ENC data**

Data not conforming to the electronic navigation chart (ENC).

**(22) 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.

**(23) Estimated position (EP)**

Position of own ship determined by the common intersection of two LOPs.

**(24) Fix**

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

**(25) Overscale**

Display of the chart information at a display scale larger than the compilation scale. Overscaling may arise from deliberate overscaling by the mariner, or from automatic overscaling by ECDIS in compiling a display when the data included are at various scales.

**(26) Presentation library**

Implementation of the display specifications in S-52, Appendix 2 “Colour and Symbol Specifications for ECDIS”, by de-coding and symbolizing the SENC. It contains:

① the ECDIS symbol library for chart features;

② the ECDIS colour tables for day, dusk, and night viewing;

③ look-up tables, linking ENC objects to the appropriate colour and symbology;

④ conditional symbology procedures for

a) cases where symbolizing depends on circumstances, such as the mariner’s choice of safety contour, date or time;

b) cases where symbolizing is too complex to be defined in a direct look-up table;

⑤ description of symbology instructions;

® supplementary features, for example ECDIS chart 1 colour differentiation test diagrams and colour calibration software.

**(27) RNC data**

Data conforming to the raster navigational chart (RNC).

**(28) RNC test data set**

Standardized data set supplied on behalf of the IHO that is necessary to accomplish IEC testing requirements for RCDS mode of operation. This data set is encoded according to the S-61 RNC product specification. Test RNCs are specified by the HO providing the RNC service or on whose behalf the RNC service is provided.

**(29) Single operator action**

Single operation is to be achieved by activating a hard key or soft key, including any necessary cursor movement.

**(30) Standard display**

The display mode intended to be used as a minimum during route planning and route monitoring. See paragraph 4.1.3.3 of Chapter 4.

1.4.2 Further information on ECDIS definitions may be found in IHO Hydrographic Dictionary Special Publication S-32.

1.4.3 Abbreviations

| | | | | |
|---|---|---|---|---|
| AIS | Automatic identification system | | EUT | Equipment under test |
| ARPA | Automatic radar plotting aid | | GMDSS | Global maritime distress and safety system |
| CIE | International Commission on Illumination | | HO | Hydrographic office |
| DR | Dead-reckoned | | IHO | International Hydrographic Organization |
| EBL | Electronic bearing line | | IMO | International Maritime Organization |
| EP | Estimated position | | SOLAS | International Convention for the Safety of life at sea |
| EPFS | Electronic position-fixing system | | VRM | Variable range marker |

## 1.5 Carriage requirements

1.5.1 Ships engaged on international voyages shall be fitted with an electronic chart display and information system (ECDIS) as follows:

(1) passenger ships of 500 gross tonnage and upwards constructed on or after 1 July 2012;

(2) tankers of 3,000 gross tonnage and upwards constructed on or after 1 July 2012;

(3) cargo ships, other than tankers, of 10,000 gross tonnage and upwards constructed on or after 1 July 2013;

(4) cargo ships, other than tankers, of 3,000 gross tonnage and upwards but less than 10,000 gross tonnage constructed on or after 1 July 2014;

(5) passenger ships of 500 gross tonnage and upwards constructed before 1 July 2012, not later than the first survey① on or after 1 July 2014;

(6) tankers of 3,000 gross tonnage and upwards constructed before 1 July 2012, not later than the first survey① on or after 1 July 2015;

(7) cargo ships, other than tankers, of 50,000 gross tonnage and upwards constructed before 1 July 2013, not later than the first survey① on or after 1 July 2016;

(8) cargo ships, other than tankers, of 20,000 gross tonnage and upwards but less than 50,000 gross tonnage constructed before 1 July 2013, not later than the first survey① on or after 1 July 2017; and

(9) cargo ships, other than tankers, of 10,000 gross tonnage and upwards but less than 20,000 gross tonnage constructed before 1 July 2013, not later than the first survey① on or after 1 July 2018.

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① Refer to the Unified interpretation of the term “first survey” in MSC.1/Circ.1290.

1.5.2 Administrations may exempt ships from the application of the requirements of paragraph 1.5.1 when such ships will be taken permanently out of service within two years after the implementation date specified in subparagraphs (5) to (9) of paragraph 1.5.1.

1.5.3 The ECDIS may be used in lieu of the shipborne electronic chart system (ECS) specified in the Technical Regulations for the Statutory Surveys of Sea-Going Ships Engaged on Domestic Voyages (2011) and the Technical Regulations for the Statutory Surveys of Inland Waterways Ships (2011).

## Chapter 2 Composition of ECDIS and Functional Requirements

### 2.1 Composition of ECDIS

2.1.1 The ECDIS is a high performance marine computer system consisting of hardware and software. In general, the hardware is composed of a high-speed central processing unit, large-capacity internal and external memories, input sensors, an output terminal, etc., as shown in Figure 2.1.2. The software covers chart information processing, chart display, route planning, route monitoring, voyage recording, etc.

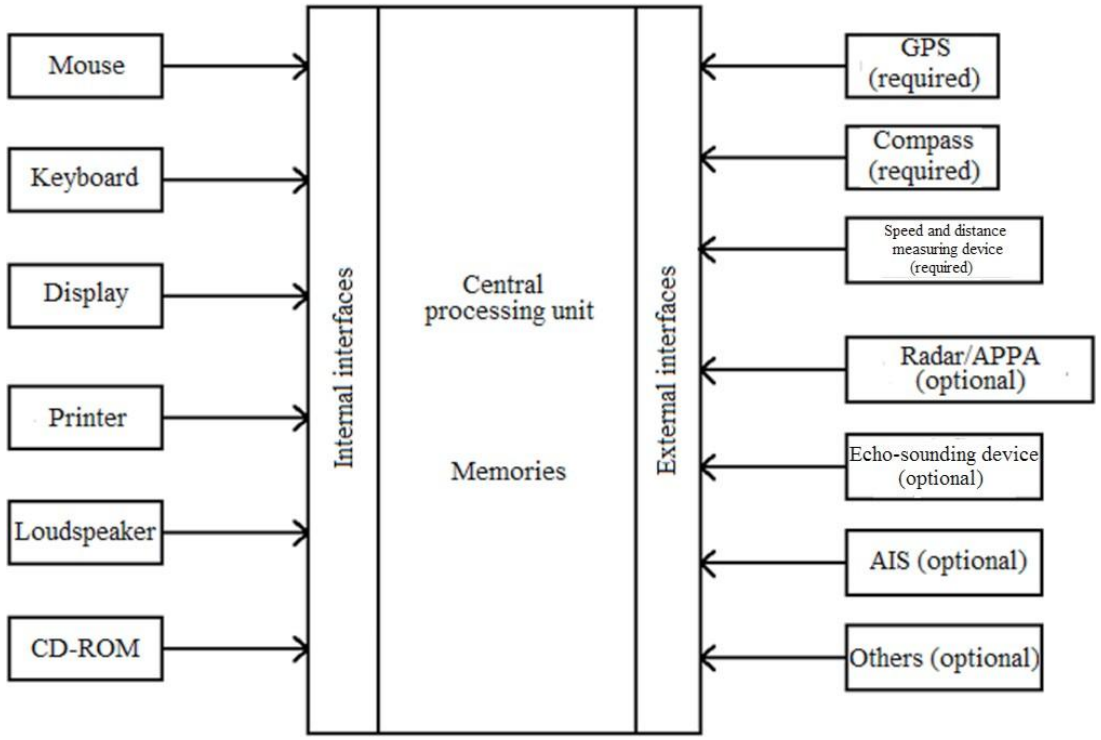


**Figure 2.1.2 ECDIS System**

### 2.2 Functional requirements of ECDIS

The ECDIS is to have functions of chart display, chart work (e.g. route planning, position plots), route monitoring, positioning and navigation, voyage recording, etc.

2.2.1 General requirements

2.2.1.1 It is to be possible to carry out route planning and route monitoring in a simple and reliable manner.

2.2.1.2 The largest scale data available in the SENC for the area given are always to be used by the ECDIS for all alarms or indications of crossing the ship's safety contour and of entering a prohibited area, and for alarms and indications according to Appendix 1.

2.2.2 Route planning

2.2.2.1 It is to be possible to carry out route planning including both straight and curved segments.

2.2.2.2 It is to be possible to adjust a planned route alphanumerically and graphically including:

(1) adding waypoints to a route;

(2) deleting waypoints from a route;

(3) changing the position of a waypoint.

2.2.2.3 It is to be possible to plan one or more alternative routes in addition to the selected route. The selected route is to be clearly distinguishable from the other routes.

2.2.2.4 An indication is required if the mariner plans a route across an own ship's safety contour.

2.2.2.5 An indication is to be given if the mariner plans a route closer than a user-specified distance from the boundary of a prohibited area or a geographic area for which special conditions exist (see Appendix 4). An indication is also to be given if the mariner plans a route closer than a user-specified distance from a point object, such as a fixed or floating aid to navigation or isolated danger. This distance limit may be the same applied to the proximity of all dangers and identical to the distance limit applied for approaching the boundary of a prohibited area, area with special conditions.

2.2.2.6 It is to be possible for the mariner to specify a cross track limit of deviation from the planned route at which an automatic off-track alarm is to be activated.

2.2.3 Route monitoring

2.2.3.1 For route monitoring the selected route and own ship's position are to appear whenever the display covers that area.

2.2.3.2 It is to be possible to display a sea area that does not have the ship on the display (for example for looking ahead, route planning), while route monitoring. If this is done on the display used for route monitoring, the automatic route monitoring functions (for example updating ship's position, and providing alarms and indications) is to be continuous. It is to be possible to return to the route monitoring display covering own ship's position immediately by single operator action.

2.2.3.3 ECDIS is to give an alarm if, within a specified look-ahead time set by the mariner, own ship will cross the safety contour.

2.2.3.4 ECDIS is to give an alarm or indication, as selected by the mariner, if, within a specified look-ahead time set by the mariner, own ship will cross the boundary of a prohibited area or of a geographic area for which special conditions exist. (See Appendix 4.)

2.2.3.5 An alarm is to be given when the specified cross track limit for deviation from the planned route is exceeded.①

① Route monitoring will only provide an automatic alarm if the mariner has entered the appropriate data according to 2.2.2.6.

2.2.3.6 An indication is to be given to the mariner if, continuing on its present course and speed, over a specified look-ahead time or distance set by the mariner, own ship will pass closer than a user-specified distance from a danger (for example obstruction, wreck, rock) that is shallower than the mariner's safety contour or an aid to navigation.

2.2.3.7 The look-ahead range, expressed as time or distance, is set by the mariner to control how far in advance an alert will be given before a distance limit is violated. The same look-ahead range is to be applied for approaching the boundary of a prohibited area, area with special conditions, crossing safety contour or proximity to a danger. The distance limit set by the mariner is to be the same applied to the proximity of all dangers and aids to navigation.

2.2.3.8 An alarm is to be given by ECDIS when the ship reaches a specified time or distance, set by the mariner, in advance of a critical point on the planned route.

2.2.3.9 ECDIS is to permit the mariner to define critical points and the time or distance at which an alarm is to be given. The words "to reach a critical point" is to be considered passing abeam of the critical point on the planned route.

2.2.3.10 It is to be possible to display alternative routes in addition to the selected route, where any have been planned. The selected route is to be clearly distinguishable from the other routes. During the voyage, it is to be possible for the mariner to modify the selected sailing route or to change to an alternative route.

2.2.3.11 It is to be possible to display:

(1) time-labels along a ship's track manually on demand and automatically at intervals selected between 1 and 120 minutes; and

(2) an adequate number of: points, free movable electronic bearing lines (EBL), variable and fixed range markers (VRM), and other symbols required for navigation purposes and specified in Appendix 3.①

2.2.4 Position integration

2.2.4.1 The ship's position is to be derived from a continuous positioning system of an accuracy consistent with the requirements of safe navigation. Whenever possible, a second independent positioning source, preferably of a different type is to be provided. In such cases ECDIS is to be capable of identifying discrepancies between the two sources.

2.2.4.2 The ECDIS is to have means to display the position from at least two positioning methods, to identify which method is being used, and provide a means for the operator to select the method he wants to use. Visual position fix and dead reckoning functions are required as one secondary independent positioning source. Refer to paragraph 2.2.6.

2.2.4.3 ECDIS is to provide an alarm when the input from the position, heading or speed sources is lost. ECDIS is also to repeat, but only as an indication, any alarm or indication passed to it from position, heading or speed sources.

① An "adequate number" of EBL and VRM implies at least one of each.

2.2.4.4 The positioning system and the SENC are to be on the same geodetic datum. ECDIS is to give an alarm if this is not the case.

2.2.4.5 ECDIS is to indicate discrepancies between the positions obtained by continuous positioning systems and positions obtained by manual observations.

2.2.4.6 It is to be possible to adjust the displayed geographic position of the ship manually. This manual adjustment is to be noted alphanumerically on the screen, maintained until altered by the mariner, and automatically recorded.

2.2.5 Object information

2.2.5.1 It is to be possible to enter the geographic coordinates of any position and then display that position on demand. It is also to be possible to select any point (feature, symbol or position) on the display and read its geographical coordinates on demand.

2.2.6 LOP position fix

2.2.6.1 ECDIS is to provide the capability to enter and plot manually obtained bearing and distance lines of position (LOP), and calculate the resulting position of own ship. It is to be possible to use the resulting position as an origin for dead-reckoning.

2.2.6.2 Position plots are to indicate the time the plot was accepted and, in the case of estimated position or dead-reckoned position plot (EP or DR), the type of plot. Indication of the source of data used for the position may be selectable, on or off, by the operator.

2.2.6.3 Data for accepted position plots and the associated LOPs are to be recorded in the voyage recording.

2.2.7 Voyage recording

2.2.7.1 ECDIS is to store and be able to reproduce certain minimum elements required to reconstruct the navigation and verify the official database used during the previous 12 hours. The following data are to be recorded at one minute intervals:

(1) to ensure a record of own ship’s past track: time, position, heading and speed; and

(2) to ensure a record of official data used: ENC source, edition, date, cell and update history.

The same data recording requirements apply to the use of any RNC or unofficial chart database.

2.2.7.2 In addition, ECDIS is to record the complete track for the entire voyage, with time marks at intervals not exceeding 4 hours.

2.2.7.3 For the purposes of logging, the entire voyage is defined as a maximum period of three months.

2.2.7.4 It is not to be possible to manipulate or change the recorded information.

2.2.7.5 ECDIS is to have a capability to preserve the record of the previous 12 hours and of the voyage track.

# Chapter 3 Provision and Updating of Chart Information

## 3.1 Contents of the SENC

3.1.1 The chart information to be used in ECDIS is to be the latest edition, as corrected by official updates, of that issued by or on the authority of a Government, government-authorized hydrographic office or other relevant government institution, and conform to IHO standards.

3.1.2 In order to identify the date and origin of the ENC in use, the ECDIS is to include a graphical index of ENC data available, presented upon the mariner's request and providing access to the edition and date of each cell.

3.1.3 A new edition of an ENC will supersede a previous ENC and its integrated updates issued by a government-authorized hydrographic office.

3.1.4 The contents of the SENC are to be adequate and up-to-date for the intended voyage to comply with regulation V/27 of the 1974 SOLAS Convention as amended.

3.1.5 It is not to be possible to alter the contents of the ENC or SENC information transformed from the ENC.

## 3.2 Content and structure of relevant chart data of IHO

3.2.1 The chart data are to be delivered using the IHO transfer standard for digital hydrographic data (S-57) .①

3.2.2 Any ECDIS is to be capable of accepting and converting official HO data (ENC) to the internal storage structure of the individual ECDIS (system ENC or SENC). Such data include both that in the ENC and that delivered in digital format to update the ENC.

3.2.3 The transfer standard is designed for the distribution of digital chart data. It is recognized that it is not the most efficient means of storing, manipulating or preparing data for display. Each manufacturer of ECDIS systems may design his own storage formats or data structure to allow his systems to meet the performance requirements stated in S-52. The resulting database is called the system ENC (SENC).

3.2.4 The following restrictions also apply:

(1) The precision of HO supplied data is to be maintained, for example HO data provided in degrees and decimal degrees, when converted to manufacturer-specific formats and structures and used in calculations, are also to be maintained to that accuracy.

(2) Should the manufacturer use point reduction or smoothing operations in order to compress the chart information in the SENC, the resultant image of the chart displayed at ENC scale is not to differ from the ENC image by more than the display resolution.

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① Chart data may also be delivered as a SENC.

(3) HO data will be supplied in a cell structure. If this cell structure is modified, it is the ECDIS manufacturer's responsibility to maintain cell-dependent characteristics.

### 3.3 Updates

3.3.1 Updates are to be stored separately from the ENC. However, separate storage of updates may utilize the same data storage area.

3.3.2 ECDIS is to be capable of accepting official updates to the ENC data provided in conformity with IHO standards. These updates are to be automatically applied to the SENC. By whatever means updates are received, the implementation procedure is not to interfere with the display in use. The contents of an update assume that all earlier updates have been applied to the SENC.

3.3.3 ECDIS is also to be capable of accepting updates to the ENC data entered manually with simple means for verification prior to the final acceptance of the data. They are to be distinguishable on the display from ENC information and its official updates and not affect display legibility.

3.3.4 ECDIS is to keep and display on demand a record of updates including time of application to the SENC. This record is to include updates for each ENC until it is superseded by a new edition.

3.3.5 ECDIS is to allow the mariner to display updates in order to review their contents and to ascertain that they have been included in the SENC.

3.3.6 ECDIS is to be capable of accepting both non-encrypted ENCs and ENCs encrypted in accordance with the IHO Data Protection Scheme (IHO Special Publication S-63).

### 3.4 Method of and requirements for updating

3.4.1 General requirements

(1) Test requirements are addressed to individual update sets or cumulative updates (collection of sequential individual update sets). A third alternative update method is the "compilation update" set, which contains all current changes from the edition date of the ENC, and does not involve or rely on any previously issued update.

(2) It is to be possible to carry out updating operations in all ECDIS modes, for example route planning, route monitoring, etc.

(3) The detailed method of updating is described in the ENC product specification in S-57. If, in the following clauses, there are conflicts between the requirements of S-52, Appendix 1 and the ENC product specification, the requirements of the latter are to be used.

3.4.1.1 Integration of updates

(1) Updates are to be clearly distinguishable on the display. Once accepted, integrated updates are to be indistinguishable from ENC data.

(2) Non-integrated updates (for example those entered manually) are to be distinguishable as described in S-52, Appendix 2/2.3.4.

(3) Official HO updates are to be distinguished from local ones.

3.4.1.2 Recall for display

(1) It is to be possible on demand to review a previously installed update.

3.4.1.3 Log file

(1) ECDIS is to keep a record of updates, including time of application and identification parameters described in S-52, Appendix 1/3.2(i), through a log file. The log file is to contain, for each update applied to or rejected by the SENC, the following information:

① date and time of application/rejection;

② complete and unique identification number of update as described in the S-57 product specification;

③ any anomalies encountered during application, an example of "anomalies" could be error messages or load warnings;

④ type of application: manual/automatic.

3.4.1.4 Update applied out of sequence

(1) The ECDIS is to warn the user when an update is out of sequence, terminate the update and restore the SENC as it was before application of the ENC update file.

3.4.2 Manual update

3.4.2.1 Keying and symbology

(1) The ECDIS is to enable manual entry of updates for non-integrated presentation on the display. A capacity is to exist to enable the mariner to:

① enter the update as described in S-52, Appendix 2;

② ensure all update text information relevant to the new condition and to the source of the update is entered by the mariner and recorded by the system, for display on demand.

(2) The system is to be capable of implementing manual updates to point objects and simple line and area objects such as traffic routing schemes and restricted areas, but excluding complicated lines and areas such as contours and coastlines.

3.4.2.2 Indications and alarms

(1) The ECDIS is to be capable of sensing indications and alarms related to non-integrated (manual) updates, just as it does for integrated ENC updates.

3.4.2.3 Presentation

(1) Manual updates are to be displayed as described in S-52, Appendix 2/2.3.4.

(2) It is to be possible to remove from the display any manual update. The removed update is to be retained in the ECDIS for future review until the commencement of the next voyage, but will not be otherwise displayed.

(3) Manual updates need to be retained only until a new edition of the cell is incorporated.

(4) For the purpose of retaining the removed updates in the ECDIS for future review, the commencement of the next voyage is defined as a period of three months.

3.4.3 Semi-automatic update

3.4.3.1 The ECDIS is to be capable of receiving updates in standard IHO S-57 format by CDROM and from any other interface or data storage media that are provided with the ECDIS for that purpose.

3.4.4 Reception of updates

3.4.4.1 The identification of the issuing authority of the update is to be checked for conformance with the corresponding identifier of the ENC.

3.4.4.2 If any errors are detected from the receiving device, the reception procedure is to be terminated and the ENC update flagged invalid in the record of updates. The user is to be informed of the corruption.

3.4.4.3 The ECDIS is to employ the error detection scheme defined by IHO for ENC data.

3.4.4.4 The ECDIS is to reject corrupted files and provide a warning of this action.

3.4.5 Sequence check

3.4.5.1 The following sequence number checks are to be performed at the time of application, for sequential and cumulative updates:

(1) file extension of the ENC update;

(2) number of the ENC update;

(3) sequence number of the individual records in the ENC update.

3.4.5.2 Refer to the IHO S-57 product specification for details on how these sequence numbers are encoded in the ENC update.

3.4.6 Consistency check

3.4.6.1 The mariner is to be warned of any previous ENC updates which have not been successfully applied.

3.4.7 Geographic applicability

3.4.7.1 Updates not relating to a cell within a set of ENCs in the ECDIS may be discarded.

3.4.8 Summary report

3.4.8.1 A summary report for each of the issuing authority's official update files is to be given after completion of receipt containing at least:

(1) identification of issuing authority;

(2) update numbers of the update files;

(3) cell identifiers of cells affected;

(4) edition number and date of cell involved;

(5) number of updates in the affected cells.

3.4.9 Review of ENC updates

3.4.9.1 It is to be possible for the mariner to review the updates applied through displaying the SENC contents with the updates highlighted.

3.4.10 Modification of updates

3.4.10.1 Rejection or amendment of an update by the mariner is to be achieved by the manual update method.

3.4.10.2 The questionable update is to be noted as an anomaly in the log file.

# Chapter 4 Display Requirements

## 4.1 Display of SENC information

4.1.1 SENC

4.1.1.1 ECDIS is to be capable of displaying all SENC information. An ECDIS is to be capable of accepting and converting an ENC and its updates into a SENC.

4.1.1.2 The ECDIS may also be capable of accepting a SENC resulting from conversion of ENC to SENC ashore, in accordance with IHO Technical Resolution A3.11①. This method of ENC supply is known as SENC delivery②. For ENC data delivered in SENC format, the chart update mechanism provided by the ECDIS is not to be inferior to the ENC update mechanism.

4.1.2 Warning indication

4.1.2.1 If SENC data from a private source is in use, warning indication is to be provided.

4.1.3 Categories of display

4.1.3.1 SENC information available for display during route planning and route monitoring is to be subdivided into the following three categories, Display base, Standard display and All Other Information.

4.1.3.2 Display base to be permanently shown on the ECDIS display, consisting of:

(1) coastline (high water);

(2) own ship's safety contour;

(3) isolated underwater dangers of depths less than the safety contour which lie within the safe waters defined by the safety contour;

(4) isolated dangers which lie within the safe waters defined by the safety contour, such as fixed structures, overhead wires, etc.;

(5) scale, range and north arrow;

(6) units of depth and height; and

(7) display mode.

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① IHO Miscellaneous Publication M-3.

② In addition to S-57 format, Governments, government-authorized hydrographic offices or other relevant government institutions may allow the distribution of HO data (ENC) for their waters in a SENC format, in accordance with IHO M-3 Technical Resolution A3.11. This requires distributors of HO data (ENC) in SENC format to obtain approval from the issuing authority and to operate under the regulations of that authority.

4.1.3.3 Standard display consisting of:

(1) display base;

(2) drying line;

(3) buoys, beacons, other aids to navigation and fixed structures;

(4) boundaries of fairways, channels, etc.;

(5) visual and radar conspicuous features;

(6) prohibited and restricted areas;

(7) chart scale boundaries;

(8) indication of cautionary notes;

(9) ships' routeing systems and ferry routes; and

(10) archipelagic sea lanes.

4.1.3.4 All other information, to be displayed individually on demand, for example:

(1) spot soundings;

(2) submarine cables and pipelines;

(3) details of all isolated dangers;

(4) details of aids to navigation;

(5) contents of cautionary notes;

(6) ENC edition date;

(7) most recent chart update number;

(8) magnetic variation;

(9) graticule;

(10) place names.

4.1.3.5 ECDIS is to present the standard display at any time by a single operator action.

4.1.3.6 When an ECDIS is switched on following a switch-off or power failure, it should return to the most recent manually selected settings for display.

4.1.3.7 It should be easy to add or remove information from the ECDIS display. It should not be possible to remove information contained in the display base.

4.1.3.8 The addition or removal of information is to be limited to categories of information, for example prohibited and restricted areas, spot soundings; not individual items, for example an individual area or an individual sounding.

4.1.4 Safety contour

4.1.4.1 It is to be possible for the mariner to select a safety contour from the depth contours provided by the SENC. ECDIS should emphasize the safety contour over other contours on the display, however:

(1) if the mariner does not specify a safety contour, this should default to 30 m. If the safety contour specified by the mariner or the default 30 m contour is not in the displayed SENC, the safety contour shown should default to the next deeper contour;

(2) if the safety contour in use becomes unavailable due to a change in source data, the safety contour should default to the next deeper contour; and

(3) in each of the above cases, an indication should be provided.

4.1.4.2 IHO' requirements for safety contour

(1) At all times, the safety contour is to be the one specified by the mariner or the next deeper contour if the specified one is not available. At a minimum, the mariner is to be informed by emphasizing the new safety contour.

4.1.5 Safety depth

4.1.5.1 It is to be possible for the mariner to select a safety depth. ECDIS is to emphasize soundings equal to or less than the safety depth whenever spot soundings are selected for display.

4.1.6 Information content

4.1.6.1 The ENC and all updates to it is to be displayed without any degradation of their information content. Degradation is to be understood as degradation in information quantity as well as quality with respect to the S-64 test data set.

4.1.7 Verification and updates

4.1.7.1 ECDIS is to provide a means to ensure that the ENC and all updates to it have been correctly loaded into the SENC.

4.1.7.2 The ENC data and updates to it is to be clearly distinguishable from other displayed information, including those listed in Appendix 3.

4.1.8 Information about chart objects

4.1.8.1 For any operator identified geographical position (for example by cursor picking), ECDIS is to display on demand the information about the chart objects associated with such a position.

4.1.9 Display scale

4.1.9.1 It is to be possible to change the display scale by appropriate steps, for example by means of either chart scale values or ranges in nautical miles.

4.1.10 Overscale

4.1.10.1 ECDIS should provide an indication if:

(1) the information is displayed at a larger scale than that contained in the ENC; or

(2) own ship's position is covered by an ENC at a larger scale than that provided by the display.

**4.2 Display of other navigational information**

4.2.1 Common reference system

4.2.1.1 ECDIS and added navigational information is to use a common reference system. If this is not the case, an indication is to be provided. Such advice is to be included in the manufacturer's installation handbook.

4.2.2 Radar and plotting information

4.2.2.1 Radar information and/or AIS information may be transferred from systems compliant with the relevant standards of IMO. Other navigational information may be added to the ECDIS display. However, it is not to degrade the displayed SENC information, and it is to be clearly distinguishable from the SENC information.

4.2.2.2 It is to be possible to remove the radar information, AIS information and other navigational information by a single operator action.

4.2.2.3 Transferred radar information may contain a radar image and/or tracked target information.

4.2.2.4 Where plotting information is added, it is to be indicated to the operator whether the vectors are relative or true, and if true whether they are sea or ground stabilized.

4.2.2.5 If the radar image is added to the ECDIS display, the chart and the radar image is to match in scale, projection and in orientation. The radar image and the position from the position sensor are both to be adjusted automatically for antenna offset from the conning position.

**4.3 Display mode and generation of the neighbouring area**

4.3.1 It is always to be possible to display the SENC in a “north-up” orientation. Other orientations are permitted. When such orientations are displayed, the orientation is to be altered in steps large enough to avoid unstable displays of the chart information. An unstable condition that changes orientation rapidly is distracting and can make text or symbols difficult to read.

4.3.2 ECDIS is to provide for true motion mode. Other modes are permitted.

4.3.3 When true motion mode is in use, reset and generation of the chart display of the neighbouring area is to take place automatically at own ship’s distance from the edge of the display as determined by the mariner.

4.3.4 It is to be possible to manually change the displayed chart area and the position of own ship relative to the edge of the display.

4.3.5 If the area covered by the ECDIS display includes waters for which no ENC at a scale appropriate for navigation is available, the areas representing those waters are to carry an indication (see Appendix 1) to the mariner to refer to the paper chart or to the RCDS mode of operation.

**4.4 Colours and symbols**

4.4.1 IHO recommended colours and symbols are to be used to represent SENC information①.

4.4.2 The colours and symbols other than those mentioned in 4.4.1 are to comply with the applicable requirements contained in the IMO standards for navigational symbols.

4.4.3 SENC information, when displayed at the scale specified in the ENC, is to use the specified size of symbols, figures and letters①. ECDIS is to allow the mariner to select whether own ship is displayed in true scale or as a symbol.

**4.5 Display requirements**

4.5.1 Route planning and monitoring

4.5.1.1 ECDIS is to be capable of displaying information for:

(1) route planning and supplementary navigation tasks;

(2) route monitoring.

4.5.2 Chart presentation size

4.5.2.1 The effective size of the chart presentation for route monitoring is to be at least 270 mm by 270 mm.

4.5.3 Colour and resolution

4.5.3.1 The display is to be capable of complying with the colour and resolution recommendations of IHO①.

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① See IHO special publication S-52, appendix 2.

4.5.4 Presentation

4.5.4.1 The method of presentation is to ensure that the displayed information is clearly visible to more than one observer in the conditions of light normally experienced on bridge of the ship by day and by night.

4.5.5 Removal of information categories

4.5.5.1 If information categories included in the standard display are removed to customize the display, this is to be permanently indicated. Identification of categories which are removed from the standard display is to be shown on demand.

**4.6 IHO' requirements for display of chart information**

4.6.1 Priority of chart display

4.6.1.1 Layers are required to establish the priority of data on the display. The general rule for the priority between different categories of information is given below①:

(1) ECDIS visual alarms/indications (for example caution, overscale);

(2) HO-data: points/lines and areas plus official updates;

(3) Notices to mariners, manual input and radio navigational warnings;

(4) HO-caution (ENC cautions);

(5) HO-colour-fill area data;

(6) HO's on-demand data;

(7) radar information;

(8) mariners data: points/lines and areas;

(9) manufacturer's data: points/lines and areas;

(10) mariners colour-fill area data.

4.6.2 Display of chart information

4.6.2.1 Scale and navigation purpose

(1) If data from different compilation scales appears on the display, the boundary between different scales is to be clearly indicated.

① This list is not intended to indicate a drawing sequence, but to specify that the information content of category n + 1 must not obscure the information content of category n or any higher category (i.e. n – 1, etc.).

(2) When the display cannot be completely covered with ENC data for the selected navigational purpose, the remaining part of the display is to be filled with data based on a more general navigational purpose (if available).

(3) A graphical index of the navigational purpose of available data is to be shown on demand.

(4) Data shown on the display are always to be of the same display scale. If a compilation scale boundary is shown on the display, the information shown in the overscale area is not to be relied upon at the scale of the display. The overscale area is to be identified as specified in S-52, Appendix 2[①].

(5) ECDIS is to give the navigator the ability to use intermediate display scales, or zoom in between scales. Means is to be provided to change the display scale by appropriate steps, for example by means of either chart scale values or ranges in nautical miles.

(6) A scale bar is to be provided as part of the display base for navigating on a large compilation scale (1:80 000 and larger).

(7) For chart displays at a compilation scale smaller than 1:80 000, a latitude bar is to be shown on the border of the standard display.

4.6.2.2 Text

(1) The text on the ECDIS is to be readable from 1 metre. Sans serif, non-italic fonts are to be employed. The computer "Ø" is not to be used.

(2) Similar fonts may be used as long as clarity is not reduced.

4.6.2.3 Units and legend

(1) Units to be used on ECDIS displays are defined in IEC 62288.

(2) A standard legend of general information relating to the area displayed, applicable to the ship's position, is to be shown on a graphic or text display. This legend is to contain as a minimum:

① units for depth;

② units for height;

③ scale of display;

④ data quality indicator;

⑤ sounding/vertical datum;

⑥ horizontal datum;

⑦ the value of the safety depth if used;

① This overscale identification only applies to automatic area scaling of parts of the display; it does not apply to overscaling of the entire display commanded by the mariner.

⑧ the value of the safety contour;

® magnetic variation;

⑩ date and number of last update affecting the chart cells currently in use;

⑪ edition number and date of issue of the ENC;

⑫ chart projection.

All of the listed general information must be available for simultaneous display. It is not necessary to accomplish this using a single “standard legend” window.

4.6.3 Display functions

4.6.3.1 Object information

(1) It is to be possible to call up all the information associated with an object by cursor enquiry on its symbol. This is to extend to areas (restricted area, depth area, etc.) and to “no symbol” areas (territorial seas, etc.) and meta areas (information about the area such as compilation scale, etc.). The search for area information is to extend only to the cell boundaries enclosing the cursor. Also refer to 4.1 of this Chapter.

(2) By identifying any object (point, line or area) with a cursor on the chart display, the object description and all available attributes are to be displayed in text in common language terms.

(3) Text is not to appear automatically whenever the object it is associated with appears on the display. It is always to be possible to remove text independently of the object.

4.6.3.2 Navigational information

(1) If the ECDIS offers a ship-centred display mode (relative motion mode), the manufacturer is to avoid overwriting between the ship symbol and a centred symbol for an area which wholly encloses the display (for example the traffic direction arrow (TSSLPT) in a very large traffic lane such as Dover Strait).

(2) This can be accomplished by moving the “centred” symbol. When the “centred” symbol is visible beneath the ship symbol, movement is not required.

4.6.3.3 Navigational calculations

(1) The system is to be capable of performing at least the following calculations:

① geographic co-ordinates to display co-ordinates and vice versa;

② transformation between local datum and WGS-84;

③ true distance and azimuth between two geographic positions;

④ geographic position from known position and distance/azimuth;

⑤ projection calculations such as true distance, rhumb line, convergence and great circle.

(2) The accuracy of these calculations is to be such that there is to be no visible distortion on the display between the following:

① rhumb line and chart data;

② great circle and chart data.

4.6.3.4 Date-dependant ENC objects

(1) Date-dependant objects, such as seasonal buoys, are only to be displayed over a certain period (IHO S-57 parameters PERSTA (periodic date start) to PEREND (periodic date end)). Other objects, such as a traffic separation scheme, may have a date on which they are introduced (DATSTA) or discontinued (DATEND). Any ENC object with one of the above attributes is not to be displayed outside its effective dates.

(2) To provide for effective route planning, for look-ahead during route monitoring, or for other purposes, the ECDIS is to provide means to allow the mariner to view chart data for any required date and time for the purpose of reviewing preplanned changes in chart data. The ECDIS manufacturer may provide this either:

① by allowing the mariner to select a date for displaying all chart objects active at that date and time, or

② by allowing the mariner to display all objects in the ENC, irrespective of the current date.

When this function is in use, a persistent indication is to be provided that the information displayed may be incorrect for the present real date and time.

4.6.4 Supplementary display functions

4.6.4.1 Additional mariner's information

(1) The mariner is to be provided with the capability of adding at least the following symbols, lines and areas to the SENC, and is to be able to revise or delete them:

① the caution (!) or information (i) symbol used to call up a note on the text display by cursor picking;

② simple lines and areas with or without colour fill, set up for cursor picking to give explanatory notes in the text display;

③ any of the symbols in the presentation library;

④ text notes.

In addition to the presentation library, other symbols may be used in accordance with the requirements of IEC 62288.

4.6.4.2 Additional non-HO information

(1) Additional information from non-HO sources may be displayed, provided this does not degrade the display of ENC data. This additional information is to be distinguished from the ENC data.

(2) No data

① If the area covered by the ECDIS display includes waters for which no ENC at a scale appropriate for navigation exists, the areas representing those waters are to carry an indication to the mariner to refer to the paper chart.

② An area with no chart data of any kind is to be marked with the "no data" symbology defined in the presentation library.

③ If an area with no ENC data is covered by non-ENC data, the area is to be marked by the "non-ENC area" symbology defined in the presentation library.

(3) Unknown object

Should an "unknown object" occur in the SENC which is not adequately defined or for which no symbol exists, its presence is to be indicated on the display by a magenta "?" with the IMO category "standard display".

(4) Text information

Text information about such objects or areas is to be displayed on demand in accordance with 4.6.3.1 of this Chapter.

4.6.4.3 Tidal adjustment

(1) Depth information is only to be displayed as it has been provided in the ENC and not adjusted by tidal height.

4.6.5 Use of the presentation library

4.6.5.1 Presentation library

(1) The library version number is included in the presentation library, and it is to be possible to display it on the ECDIS.

(2) The presentation library includes an ECDIS chart 1 showing both simplified and full chart symbols and their explanations. The ECDIS is to provide linking by cursor interrogation between the symbols and the explanations. This is valid for both the IHO presentation library and the one provided by a manufacturer.

4.6.5.2 Test diagrams

(1) The presentation library contains colour differentiation test diagrams to enable the mariner to detect the stage at which the display can no longer be used to discriminate important features by colour. These diagrams, one for each colour table, are coded in S-57 format. The ECDIS is to allow the selection and display of these test diagrams. The diagrams are to be used to check the discriminability of colours within all of the tables except day-bright.

4.6.6 Display characteristics

4.6.6.1 Display base

(1) Information is to be displayed in the ECDIS on one or more physical screens, which may be divided into more than one display. Information may be displayed automatically, on demand or as a result of hand-entry. In addition to the IMO performance standards, the following rules apply.

(2) The units for depth are always to be on the same screen as the chart display.

(3) The following information is to be visible on demand on the same screen as the chart display is visual or on an additional graphic or text display:

① positional data and time;

② legend;

③ object description and associated attributes (result of "cursor query");

④ textual information from SENC;

⑤ list of abbreviations (from INT-1);

® result from navigational computations;

⑦ record of ENC-updates;

⑧ list of categories which are removed from standard display;

® symbol library. (See S-52, Appendix 2.)

4.6.6.2 Navigators' notes

(1) Navigators' notes are to be visible as a result of a hand-entry on the same screen as the chart display or on an additional graphic or text display.

# Chapter 5 Performance Requirements

## 5.1 Calculations and accuracy

5.1.1 The accuracy of all calculations performed by ECDIS is to be independent of the characteristics of the output device and is to be consistent with the SENC accuracy. The output device includes ECDIS display, stored memory, and/or printout.

5.1.2 Bearings and distances drawn on the display, or those measured between features already drawn on the display, are to have accuracy no less than that afforded by the resolution of the display.

5.1.3 The system is to be capable of performing and presenting the results of at least the following calculations:

(1) true distance and azimuth between two geographical positions;

(2) geographic position from known position and distance/azimuth; and

(3) geodetic calculations such as spheroidal distance, rhumb line, and great circle.

## 5.2 Connections with other equipment (interfaces)

5.2.1 ECDIS is not to degrade the performance of any equipment providing navigation data inputs. Nor is the connection of optional equipment to degrade the performance of ECDIS below these Guidelines.

5.2.2 ECDIS is to be capable of being connected to equipment and systems providing information such as the ship's position fixing (e.g. GPS), direction (gyro compass) and speed (speed and distance measuring device). For ships not fitted with a gyro compass, ECDIS is to be connected to a marine transmitting heading device.

5.2.3 As a minimum, the ECDIS is to support the sentences given in Table 1.

**Mandatory IEC 61162-1 Sentences Table 1**

| Parameter | Sentence format | Comments |
|---|---|---|
| Time and date | $ -- ZDA | Input – 1 |
| Geographic position | $ -- GLL<br>$ -- GGA<br>$ -- GNS<br>$ -- RMC | Input – 1 |
| Datum | $ -- DTM | Input – 1 |
| Heading | $ -- HDT<br>$ -- THS | Input – 1 and – 2 (up to 50 Hz)<br>Input – 2 (up to 50 Hz) |
| Speed | $ -- VBW<br>$ -- VHW<br>$ -- VTG | Input – 1 from SDME<br>Input – 1<br>Input – 1 (from ground stabilized system) |

5.2.4 ECDIS may provide a means to supply SENC information to external equipment①.

### 5.3 Performance tests, malfunction alarms and indications

5.3.1 ECDIS is to be provided with means for either automatically or manually carrying out on-board tests of major functions. In case of a failure, the test is to display information to indicate which module is at fault.

5.3.2 On board tests of major functions include the integrity of sensor input. If there is any detectable reason why the information presented to the operator is invalid, adequate and clear warnings are to be given to the operator.

5.3.3 ECDIS is to provide suitable alarm or indication of system malfunction.

### 5.4 IHO Performance requirements

5.4.1 Redraw

5.4.1.1 Redraw during route monitoring to follow the ship's progress, including scale changes due to change in the scale of the chart information, is to take less than 5 seconds. Demands by the mariner that cannot be predicted by the ECDIS, such as draw at a different scale or in a different area may take more than 5 seconds. In the latter case:

(1) the mariner is to be informed;

(2) the display is to continue route monitoring until the new information is ready to draw within 5 seconds.

5.4.1.2 If there is a delay in preparing (re-generating) data for display (for example due to a request for scale change or look ahead to another area), the ECDIS is to inform the mariner. The previous display is to be maintained and updated, until the new display is ready for redraw.

5.4.2 Resolution

5.4.2.1 Minimum lines per mm ($L$) given by $L = 864/s$, where $s$ is the smaller dimension of the chart display area (for example for the minimum chart area, $s = 270$ mm and the resolution is $L = 3.20$ lines per mm, giving a "picture unit" size of 0.312 mm).

5.4.3 Symbols

5.4.3.1 The minimum sizes for all symbols are to be as shown in the presentation library.

5.4.3.2 In addition, the symbols are always to be drawn with at least the same number of pixels as are required to draw the symbol at the size defined in the presentation library for the minimum resolution and minimum chart display area (270 mm × 270 mm).

5.4.3.3 The ECDIS is to provide the mariner with the option of using either the traditional paper chart symbols or the new simplified symbols as best fits his purpose.

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① Test of this interface, if provided, is not required. The format of SENC data is by definition a manufacturer's internal ECDIS format and the data interface between an ECDIS and the external equipment for SENC data transfer is not defined in IEC 61162.

5.4.4 Number of colours

5.4.4.1 Colours: 64.

5.4.5 Brightness and contrast

5.4.5.1 The brightness and contrast controls are to have a provision to permit returning to the calibrated setting. The ECDIS manual is to carry a warning that use of the brightness control may inhibit visibility of information at night.

5.4.5.2 The colour tables are provided in the presentation library, all of which are to be available.

5.4.5.3 Colour tolerance values:

(1) the discrimination difference between any two colours displayed is to be not less than 10 ΔE* units for the bright-sun colour table, restricted to colour pairs of tabular ΔE* greater than 20;

(2) the difference between the colour displayed and the CIE colour defined in the specification is to be not greater than 16 ΔC* units. If a monitor is independently tested, then the difference is to be not greater than 8 ΔC* units;

(3) the luminance of the colour displayed is to be within 20 % of its specified value. Black is a special case and the luminance of it is to be not greater than 0.52 cd/m$^2$ for DAY-BRIGHT.

5.4.5.4 If an optical filter is used with colour table night-filtered, it is to be removable, and of the value 0.9 ND.

**5.5 IHO ergonomic requirements (IEC 61174/5.9)**

5.5.1 Mode and orientation

5.5.1.1 The north arrow is always to be shown at the top left corner of the chart display, just clear of the scale bar or the latitude scale.

5.5.2 Windows

5.5.2.1 Any windows containing text, diagrams, etc. superimposed on the route monitoring display is to be temporary①.

5.5.2.2 It is to be possible to re-locate such windows in a less important part of the display, such as on land, or behind the own ship symbol.

5.5.3 Mariner's information panel

5.5.3.1 A mariner's information panel on the same screen as the route monitoring display is to use only the "user interface" colours from the presentation library colour tables.

5.5.3.2 A mariner's information panel may use clearly visible colours deviating from the presentation library which do not detract from the chart display in any of the colour tables.

① Temporary for this application means that the window can be removed or moved from the chart display area.

# Chapter 6 Requirements for Backup arrangements

## 6.1 General requirements①

6.1.1 Adequate independent backup arrangements are to be provided to ensure safe navigation in case of ECDIS failure. Such arrangements include:

(1) facilities enabling a safe take-over of the ECDIS functions in order to ensure that an ECDIS failure does not result in a critical situation; It is a prerequisite that the route plan has been transferred to the backup device prior to the departure and after reassignment of the route plan in order to enable a safe takeover when ECDIS fails.

(2) a means to provide for safe navigation for the remaining part of the voyage in case of ECDIS failure. It is a prerequisite that a means to provide for safe navigation for the remaining part of the voyage is established prior to departure and is available during the voyage.

6.1.2 The purpose of an ECDIS backup system is to ensure that safe navigation is not compromised in the event of ECDIS failure. This is to include a timely transfer to the backup system during critical navigation situations. The backup system is to allow the ship to be navigated safely until the termination of the voyage.

## 6.2 Functional requirements

6.2.1 Required functions and their availability

6.2.1.1 Presentation of chart information

(1) The backup system is to display in graphical (chart) form the relevant information of the hydrographic and geographic environment which is necessary for safe navigation.

6.2.1.2 Route planning

(1) The backup system is to be capable of performing the route planning functions, including:

① taking over of the route plan originally performed on the ECDIS;

② adjusting a planned route manually or by transfer from a route planning device.

(2) If more than one route can be displayed, the selected route is to be clearly distinguishable from the other routes.

6.2.1.3 Route monitoring

(1) The backup system is to enable a takeover of the route monitoring originally performed by the ECDIS, and provide at least the following functions:

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① This Chapter does not address the use of official paper charts as a backup to ECDIS.

① plotting own ship's position automatically, or manually on a chart;

② taking courses, distances and bearings from the chart;

③ displaying the planned route;

④ displaying time labels along ship's track;

⑤ plotting an adequate number of points, bearing lines, range markers, etc., on the chart.

6.2.1.4 Display information

(1) The backup system is to be capable of displaying at least the information equivalent to the standard display as defined in the ECDIS performance standard.

(2) The backup system is at least to display the pre-planned route, own ship's position, coastlines, navigable waters, dangers to navigation and aids to navigation. This display is to include identification of dangers and aids to navigation.

(3) Any additional chart information as defined in 4.2 of Chapter 4, may be displayed and be subject to the same tests as the information in the standard display.

6.2.1.5 Provision of chart information

(1) The chart information to be used in the backup arrangement is to be the latest edition, as corrected by official updates, of that issued by or on the authority of a Government, an authorized hydrographic office or other relevant government institution, and conform to IHO standards.

(2) It is not to be possible to alter the contents of the electronic chart information.

(3) The chart or chart data edition and issuing date are to be indicated.

6.2.1.6 Updating

(1) The information displayed by the ECDIS backup arrangements is to be up-to-date for the entire voyage.

6.2.1.7 Scale

(1) The backup system is to provide an indication:

① if the information is displayed at a larger scale than that contained in the database; and

② if own ship's position is covered by a chart at a larger scale than that provided by the system.

6.2.1.8 Addition of radar and other navigational information

(1) If radar and other navigational information are added to a backup display, all corresponding requirements for radar information and other navigational information of these Guidelines are to be met.

(2) Radar information or other navigational information may be added to the backup system display. However, it is not to degrade the chart information, and is to be clearly distinguishable from the chart information. The backup system and added navigational information are to use a common reference system.

(3) Transferred radar information may contain a radar image and/or tracked target information.

(4) Where radar tracks are added, it is to be indicated to the operator whether the vectors are relative or true.

(5) If the radar image is added to the backup system display, the chart and the radar image are to match in scale, orientation and projection.

(6) The radar image and the position from the position sensor are both to be adjusted automatically for antenna offset from the conning position.

(7) It is to be possible to remove the radar, the tracked target information and AIS information by a single operator action.

6.2.1.9 The display mode and generation of the neighbouring area

(1) The display mode and generation of the neighbouring area are to be in accordance with 4.3 of Chapter 4.

(2) It is always to be possible to display the chart in a north-up orientation. Other orientations are permitted.

(3) The device is to provide for true motion mode. Other modes are permitted.

(4) When true motion mode is in use, reset and generation of the neighbouring area is to take place automatically at a distance from the border of the display, or from the centre of the screen, as determined by the mariner.

(5) It is to be possible manually to change the chart area and the position of own ship relative to the edge of the display.

6.2.1.10 Voyage recording

(1) The backup arrangements are to be able to keep a record of the ship’s actual track, including positions and corresponding times.

6.2.2 Reliability and accuracy

6.2.2.1 Reliability

(1) The backup arrangements are to provide reliable operation under prevailing environmental and normal operating conditions.

6.2.2.2 Accuracy

(1) Accuracy is to be in accordance with 5.1 of Chapter 5.

(2) The accuracy of all calculations performed by the backup system is to be independent of the characteristics of the output device and should be consistent with the chart database accuracy.

(3) Bearings and distances drawn on the display, or those measured between features already drawn on the display, are to have accuracy no less than that afforded by the resolution of the display.

6.2.3 Malfunctions, warnings, alarms and indications

6.2.3.1 The backup system is to provide a suitable alarm or indication of system malfunction.

## 6.3 Operational requirements

6.3.1 Ergonomics

6.3.1.1 The backup system is to be designed in accordance with the ergonomic principles of ECDIS.

6.3.1.2 Any windows containing text, diagrams, etc. superimposed on the route monitoring display are to be temporary. Temporary for this application means that the window can be moved or removed from the display.

6.3.1.3 It is to be possible to re-locate such windows in a less important part of the display, such as on land, or behind the own ship symbol.

6.3.1.4 A mariner's information panel on the same screen as the route monitoring display is to use only the "user interface" colours from the presentation library colour tables. (See S-52, Appendix 2/3.4.3.) Clearly visible colours which do not detract from the chart display in any of the colour tables may be accepted as equivalent to the "user interface" colours required.

6.3.2 Presentation of information

6.3.2.1 Colours and symbols

(1) Colours and symbols used in the backup arrangements are to be in accordance with the colour and symbols requirements of ECDIS and are to comply with IEC 62288.

(2) Chart information when displayed at the specified scale is to use the size specified in the relevant standards of symbols, figures and letters.

6.3.2.2 Effective size

(1) The effective size of the chart presentation is to be not less than 250 mm × 250 mm or 250 mm diameter.

## 6.4 Power supply

6.4.1 The backup power supply is to be separate from the ECDIS and conform to the requirements in 7.2 of Chapter 7.

6.4.2 It is to be possible to operate the backup system and all equipment necessary for its normal functioning when supplied by an emergency source of electrical power in accordance with the appropriate requirements of chapter II-1 of the 1974 SOLAS convention.

6.4.3 Changing from one source of power supply to another, or any interruption of the supply for a period of up to 45 s, is not to require the equipment to be re-initialized manually. The equipment is not required to remain operational during this interruption of the power supply.

**6.5 Connections with other equipment**

6.5.1 Backup

6.5.1.1 The backup system is:

(1) to be connected to systems providing continuous position-fixing capability; and

(2) not to degrade the performance of any equipment providing sensor input.

6.5.2 Radar

6.5.2.1 If radar with selected parts of the ENC chart information overlay is used as an element of the backup, the radar is to comply with IMO resolution MSC.192(79) as further specified by IEC 62388.

6.5.2.2 The minimum requirement for a backup system is a single interface to an EPFS. Other interfaces are allowed.

**6.6 Test requirements and results**

6.6.1 The test requirements for backup arrangements may be referred to paragraph 10.11 of Chapter 10.

# Chapter 7 Software Maintenance and Power Supply

## 7.1 Software maintenance

7.1.1 Adequate software maintenance arrangements are to be supported by the ECDIS manufacturer in accordance with IMO SN.1/Circ. 266. ECDIS equipment is to provide means to display on demand the current software version.

7.1.2 Means are to be provided to replace or install updates to software in systems aboard ship.

7.1.3 Manufacturers are to provide customers with timely access, for example by website, to a list showing the IHO standards currently in effect for ECDIS, ECDIS application software versions, compliance status and regulatory approvals for the listed configurations/versions.

## 7.2 Power Supply

7.2.1 It is to be possible to operate ECDIS and all equipment necessary for its normal functioning when supplied by an emergency source of electrical power in accordance with the appropriate requirements of chapter II-1 of the 1974 SOLAS convention, as amended.

7.2.1 Changing from one source of power supply to another, or any interruption of the supply for a period of up to 45 s, is not to require the equipment to be manually re-initialized. The equipment is not required to remain operational during this interruption of the power supply

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# Chapter 8 Type Approval and Inspections

## 8.1 General requirements

8.1.1 The equipment and arrangements referred to in paragraphs 1.2.1 and 1.2.2, Chapter 1 of these Guidelines are subject to type approval and subsequent delivery inspections in accordance with this Chapter.

8.1.2 Unless expressly provided in this Chapter, the type approval and inspections are to be in accordance with Chapter 3 “Inspections of Products” of PART ONE of ISC Rules for Classification of Sea-Going Ships and applicable requirements of IEC publications IEC61174, IEC60945, IEC61162, IEC62288, ISC GD01-2006 Guidelines for Type Approval Test of Electric and Electronic Products as well as the standards and technical documents listed in paragraph 1.3, Chapter 1 of these Guidelines.

## 8.2 Definitions and test methods

8.2.1 The terms, definitions and abbreviations given in paragraph 1.4, Chapter 1 of these Guidelines apply in this Chapter.

8.2.2 Performance check and performance test are clearly defined in IEC 60945. For the purposes of this Chapter, however, their definitions are identical, both referring to non-quantitative visual checks that the system is still operative.

8.2.3 Observation, check of documented evidence and measurement are used in type approval and inspections. For the definition and application of each of these three methods, see Appendix 8 “Guidance for Testing” of these Guidelines.

## 8.3 Submission of drawings and technical documents for approval

8.3.1 General principles

8.3.1.1 The range and details of submitted drawings and technical information are to be sufficient for check of compliance of the equipment with these Guidelines and relevant standards and a general check of the design of products in mechanical and electrical aspects.

8.3.1.2 The submitted documents are to be identified in accordance with the manufacturer’s quality management system and to provide easy access to relevant technical requirements.

8.3.2 The following drawings and technical information are to be submitted to ISC for examination:

(1) Technical instructions (specification) of products

The specification of products is to clearly define the requirements for the general performance and general design of products, including at least the following:

① required ambient conditions;

② required power supply conditions;

③ composition of products;

④ detailed description of functional and performance criteria;

⑤ backup arrangements as required by the SOLAS Convention. Where this is achieved by a network consisting of multiple pieces of equipment, a detailed description is to be given taking into account 8.3.2(2).

(2) Hardware and interfaces

At least the following are to be included:

① detailed description of primary hardware configuration;

② mechanical drawings (structural drawing, profile drawing), electrical drawings (schematic diagram, wiring diagram, functional block diagram) and explanatory documents necessary for description of functions, mechanical and electrical properties of the product and its components;

③ detailed description of interfaces between main elements of the product and between the product and other equipment (or systems), including mechanical and electrical properties, data protocol, data format or protocol conversion, interface configuration, etc.;

④ schematic diagram or functional block diagram of power supply device, power supply layout;

⑤ system wiring diagram showing a typical application of the system.

(3) Software

At least the following are to be included:

① main module description and version number of software;

② maintenance and updating instructions (the ECDIS manufacturer is to have sufficient and practicable updating arrangements as required by IMO SN.1/Circ.266-Rev.1, e.g. publishing at a website the software version number and any IHO standard which is met by each version).

(4) Installation manual, operation manual and maintenance manual for products

At least a translation into English is to be included. These manuals are to contain lists of all terms, abbreviations, symbols and icons shown on the system or equipment and relevant explanations. A detailed description is to be given for user interfaces and function menus to facilitate users and inspectors to get familiarized with the equipment and carry out related operations.

(5) Type test procedure (programme) and delivery test procedure (programme)

At least a description of the following is to be included: taking samples for type tests, principles for batches and sampling in delivery tests, requirements for test equipment, test items, test methods, analysis of and acceptance criteria for test results.

(6) Explanation of identification of products together with real pictures.

(7) Agreements or written documents on reliable access to official electronic charts published as authorized by the Government and subsequent access to information on their latest modified versions.

(8) Report on test for ambient conditions or performance test which the product has passed, appraisal report, if any.

(9) Manufacturer's quality control documents (e.g. ISO 9000).

(10) Other technical documents or quality control documents required to be submitted as deemed necessary by ISC, if any.

## 8.4 Type approval and subsequent delivery tests

8.4.1 Principled requirements

(1) The type approval certificate is to be issued, maintained, modified, renewed or canceled in accordance with the relevant requirements of Chapter 3, PART ONE of ISC Rules for Classification of Sea-Going Ships.

(2) The electronic chart system, as required by Reg. V/19.2.1.4 of the 1974 SOLAS Convention, is to be a dedicated standalone workstation. If the system, as a multifunction workstation forming part of an INS, is provided with an additional display unit, the applicable requirements of MSC.252(83) are to be complied with in addition to the requirements of these Guidelines.

(3) Where backup arrangements of the ECDIS are provided by means of electronic equipment, the approval and inspection of such equipment are to be in accordance with this Chapter and the performance test may be conducted only for the items specified in paragraph 10.11, Chapter 10 of these Guidelines.

(4) Where part of the test items are completed by the manufacturer at a test organization accepted by ISC and no change is made to the involved products after such tests, ISC may consider, at the request of the manufacturer, exemption from such items upon examination of relevant technical information and test reports.

8.4.2 Selection of typical samples and test arrangement

The model and specification of test samples are to be technically representative and to cover the range of products for which type approval is requested. Where a UPS is necessary for compliance of products with technical requirements of these Guidelines, the UPS is to be tested as part of the electronic chart system. Test samples are to be selected by ISC Surveyor at the manufacturer.

8.4.3 Test organization

An authoritative and impartial test organization accepted by ISC is to be selected for carrying out type approval tests. Such test organization is to be an internationally/nationally certified laboratory. Where test conditions are available at the manufacturer for some functional test items, such tests may be carries out at the manufacturer, subject to the agreement of ISC Surveyor upon his examination and under his on-site supervision.

8.4.4 Items and requirements for type approval tests

The ECDIS equipment is to be subjected to tests for ambient conditions and electrical safety (including protective enclosure, magnetic compass safe distance, electromagnetic compatibility, etc.), performance test and navigation-related information display test. The performance test and navigation-related information display test may be conducted in conjunction with each other.

(1) The tests for ambient conditions and electrical safety are to be in accordance with IEC 60945 and Table 8.4.4(1).

(2) The performance test is to be in accordance with Chapter 10 of these Guidelines.

(3) The navigation-related information display test is to be in accordance with IEC 62288 and Table 8.4.4(2).

**Test and Check Items for Ambient Conditions and Electrical Safety Table 8.4.4(1)**

| No. | Test item | Test method | Explanation |
|---|---|---|---|
| 1. | Ergonomics and HMI | IEC 60945, 6.1 | May be in conjunction with performance test |
| 2. | Hardware | IEC 60945, 6.2 | May be in conjunction with performance test |
| 3. | Software | IEC 60945, 6.3 | May be in conjunction with performance test |
| 4. | Inter-unit connection | IEC 60945, 6.3 | May be in conjunction with performance test |
| 5. | Extreme power supply short-term variation | IEC 60945, 7.1 | Normal test temperature |
| 6. | Excessive conditions for power supply | IEC 60945, 7.2 | |
| 7. | Dry heat, including extreme power supply conditions | IEC 60945, 8.2 & 7.1 | Carrying out performance test |
| 8. | Damp heat | IEC 60945, 8.3 | |
| 9. | Low temperature, including extreme power supply conditions | IEC 60945, 8.4 & 7.1 | Carrying out performance test |
| 10. | Vibration | IEC 60945, 8.7 | |
| 11. | Salt mist | IEC 60945, 8.12 | May be omitted where information provided by manufacturer |
| 12. | Conducted emissions | IEC 60945, 9.2 | |
| 13. | Radiated emissions | IEC 60945, 9.3 | |

| No. | Test item | Test method | Explanation |
|---|---|---|---|
| 14. | Immunity to conducted radio frequency disturbance | IEC 60945, 10.3 | |
| 15. | Immunity to radiated radio frequencies | IEC 60945, 10.4 | |
| 16. | Immunity to fast transients, *s* | IEC 60945, 10.5 | |
| 17. | Immunity to surges | IEC 60945, 10.6 | |
| 18. | Immunity to power supply short-term variation | IEC 60945, 10.7 | |
| 19. | Immunity to power supply failure | IEC 60945, 10.8 | |
| 20. | Immunity to electrostatic discharge | IEC 60945, 10.9 | |
| 21. | Acoustic noise and alarm signals | IEC 60945, 11.1 | |
| 22. | Compass safe distance | IEC 60945, 11.2 | |
| 23. | Protection against accidental access to dangerous voltages | IEC 60945, 12.1 | At least nIP20 for protective enclosure |
| 24. | Emission from visual display unit | IEC 60945, 12.3 | |
| 25. | High voltage | GD 01 – 2006, 2.14 | |

**Navigation-Related Information Display Test Specified in IEC 62288 Table 8.4.4(2)**

| No. | Test item | Test method | Explanation |
|---|---|---|---|
| | Arrangement of information | | |
| 1. | Consistency of layout | IEC 62288, 4.2.1 | |
| 2. | Consistent presentation of information | IEC 62288, 4.2.2 | |
| 3. | Separation of operational display area | IEC 62288, 4.2.3 | |
| | Readability | | |
| 4. | Readability under all ambient light conditions | IEC 62288, 4.3.1 | |
| 5. | Legibility of alphanumeric data and text | IEC 62288, 4.3.2 | |
| 6. | Presentation of text | IEC 62288, 4.3.3 | |
| 7. | Icons | IEC 62288, 4.3.4 | |
| | Colours and intensity | | |
| 8. | Discrimination of colours | IEC 62288, 4.4.1 | |
| | Symbols | | |
| 9. | Operational information | IEC 62288, 4.5.1 | |
| 10. | Electronic chart information | IEC 62288, 4.5.2 | |
| | Colour coding of information | | |
| 11. | Colour coding for discrimination | IEC 62288, 4.6.1 | |
| 12. | Colour coding of information | IEC 62288, 4.6.2 | |
| 13. | Colour coding in combination with other attributes | IEC 62288, 4.6.3 | |
| 14. | Flashing of information | IEC 62288, 4.6.4 | |
| | Integrity marking | | |

| No. | Test item | Test method | Explanation |
|---|---|---|---|
| 15. | Indication of source, validity and integrity status | IEC 62288, 4.7.1 | |
| 16. | Colour coding of validity and integrity | IEC 62288, 4.7.2 | |
| 17. | Indication of presentation failure | IEC 62288, 4.7.3 | |
| | Alarms and indications | | |
| 18. | Operational status | IEC 62288, 4.8.1 | |
| 19. | List of alarms | IEC 62288, 4.8.2 | |
| 20. | Alarm-related information from multiple sources | IEC 62288, 4.8.3 | |
| | Presentation mode | | |
| 21. | Indication of presentation mode in use | IEC 62288, 4.9.1 | |
| | Manuals | | |
| 22. | User manuals, instructions and reference guides | IEC 62288, 4.10.1 | May be in conjunction with document review and performance test |
| | Presentation of operational information | | |
| | Presentation of own ship information | | |
| 23. | Graphical representation of own ship | IEC 62288, 5.1.1 | |
| | Presentation of chart information | | |
| 24. | Presentation of chart information | IEC 62288, 5.2.1 | |
| 25. | Colours and symbols for charted information | IEC 62288, 5.2.2 | |
| | Presentation of radar information | | |
| 26 | Radar video images | IEC 62288, 5.3.1 | If the function is available |
| 27 | Target trails | IEC 62288, 5.3.2 | If the function is available |
| | Presentation of target information | | If the function is available |
| 28 | Providing target information | IEC 62288, 5.4.1 | If the function is available |
| 29 | Consistent user interface for target information | IEC 62288, 5.4.2 | If the function is available |
| 30 | Indication of exceeding target capacity | IEC 62288, 5.4.3 | If the function is available |
| 31 | Filtering sleeping AIS targets | IEC 62288, 5.4.4 | If the function is available |
| 32 | Activation of AIS targets | IEC 62288, 5.4.5 | If the function is available |
| 33 | Graphical presentation of targets | IEC 62288, 5.4.6 | If the function is available |
| 34 | Target selection | IEC 62288, 5.4.7 | If the function is available |
| 35 | Indication of target derivation | IEC 62288, 5.4.8 | If the function is available |
| 36 | Presentation of tracked radar target information | IEC 62288, 5.4.9 | If the function is available |
| 37 | Presentation of reported AIS target information | IEC 62288, 5.4.10 | If the function is available |
| 38 | Continual update of target information | IEC 62288, 5.4.11 | If the function is available |
| 39 | Own ship’s AIS information | IEC 62288, 5.4.12 | If the function is available |
| 40 | Obscuring the operational display area | IEC 62288, 5.4.13 | |
| | Operational alarms | | |
| 41 | Alarm status | IEC 62288, 5.5.1 | |
| 42 | CPA/TCPA alarms | IEC 62288, 5.5.2 | If the function is available |
| 43 | Acquisition/activation zones | IEC 62288, 5.5.3 | If the function is available |

| No. | Test item | Test method | Explanation |
|---|---|---|---|
| 44 | Lost target alarms | IEC 62288, 5.5.4 | If the function is available |
| | AIS and radar target association | | If the function is available |
| 45 | Target association | IEC 62288, 5.6.1 | If the function is available |
| 46 | AIS presentation status | IEC 62288, 5.6.2 | If the function is available |
| 47 | Trial manoeuvre | IEC 62288, 5.6.3 | If the function is available |
| | Measurement | | |
| 48 | Measurement from own ship | IEC 62288, 5.7.1 | |
| 49 | Bearing and range measurements | IEC 62288, 5.7.2 | |
| | Navigation Tools | | |
| 50 | Range rings | IEC 62288, 5.8.1 | If the function is available |
| 51 | Variable range marker (VRM) | IEC 62288, 5.8.2 | |
| 52 | Bearing scale | IEC 62288, 5.8.3 | If the function is available |
| 53 | Electronic bearing line (EBL) | IEC 62288, 5.8.4 | |
| 54 | Parallel index lines (PI) | IEC 62288, 5.8.5 | If the function is available |
| 55 | Offset measurement of range and bearing | IEC 62288, 5.8.6 | If the function is available |
| 56 | User cursor | IEC 62288, 5.8.7 | |
| | Radar and chart displays | | |
| 57 | Simultaneous display of radar and chart data | IEC 62288, 6.1.2 | If the function is available |
| 58 | Range scales | IEC 62288, 6.1.3 | If the function is available |
| 59 | Range ring scale | IEC 62288, 6.1.4 | If the function is available |
| 60 | Operational display area | IEC 62288, 6.1.5 | |
| 61 | Motion display modes | IEC 62288, 6.1.6 | |
| 62 | Orientation modes | IEC 62288, 6.1.7 | |
| 63 | Off-centring | IEC 62288, 6.1.8 | |
| 64 | Stabilisation modes | IEC 62288, 6.1.9 | |
| | Radar displays | | |
| 65 | Radar video image | IEC 62288, 6.2.1 | If the function is available |
| 66 | Brightness of radar information | IEC 62288, 6.2.2 | If the function is available |
| 67 | Display of chart information on radar | IEC 62288, 6.2.3 | If the function is available |
| 68 | Priority of radar information | IEC 62288, 6.2.4 | If the function is available |
| 69 | Display of map graphics | IEC 62288, 6.2.5 | If the function is available |
| | Chart displays | | |
| 70 | Display of chart information | IEC 62288, 6.3.1 | |
| 71 | IMO display categories | IEC 62288, 6.3.2 | |
| 72 | Adding or removing information from the display | IEC 62288, 6.3.3 | |
| 73 | Safety contour | IEC 62288, 6.3.4 | |
| 74 | Safety depth | IEC 62288, 6.3.5 | |
| 75 | Chart scale | IEC 62288, 6.3.6 | |
| 76 | Display of radar and target information | IEC 62288, 6.3.7 | If the function is available |

| No. | Test item | Test method | Explanation |
|---|---|---|---|
| 77 | Display of additional navigation-related information | IEC 62288, 6.3.8 | If the function is available |
| | Composite task-oriented presentations | | |
| 78 | User-configured presentations | IEC 62288, 6.4.1 | |
| 79 | Information associated with the task-at-hand | IEC 62288, 6.4.2 | |
| | Physical requirements | | |
| 80 | Display adjustment | IEC 62288, 7.2 | |
| 81 | Contrast and brightness | IEC 62288, 7.2.1 | |
| 82 | Magnetic interference | IEC 62288, 7.2.2 | |
| 83 | Temporal stability | IEC 62288, 7.2.3 | |
| 84 | Physical controls and status indicators | IEC 62288, 7.2.4 | |
| 85 | Screen size | IEC 62288, 7.3 | |
| 86 | Multicoloured display equipment | IEC 62288, 7.4 | |
| 87 | Screen resolution | IEC 62288, 7.5 | |
| 88 | Screen viewing angle | IEC 62288, 7.6 | |

8.4.5 Unit/batch inspections (delivery inspections after approval)

8.4.5.1 Where the ECDIS equipment is type approved, unit/batch inspections are required by ISC for issuing the Marine Products Certificate.

8.4.5.2 The manufacturer is to control the production process and the test process in accordance with the quality control documents submitted for approval and carry out delivery tests in accordance with the submitted test procedure.

8.4.5.3 ISC Surveyors are to carry out inspections by means of sampling, based on review of the manufacturer's quality records of products. Unit/batch inspections are to cover at least the following:

(1) Check of information on main elements of the equipment.

(2) Visual inspection.

(3) Confirmation of software version.

(4) Tests for confirmation of major functions of the equipment, including at least the function test for display adjustment specified in IEC 62288, 7.2, self-tests of the major functions specified in paragraph 10.8.17 of these Guidelines, the power supply test specified in paragraph 10.9.6 of these Guidelines, confirmation of functions of chart display and route planning (The use of the latest test set "ECDIS Data Presentation and Performance Check in Ships" provided by IHO is recommended).

(5) Additional test items may be required if deemed necessary by the Surveyor.

# Chapter 9 Inspections for Installation and during Service

## 9.1 General requirements

9.1.1 The installation of the ECDIS equipment onto ships is to be inspected according to the requirements of this Chapter.

9.1.2 Ships fitted with the ECDIS equipment are to be inspected for such equipment during their service according to the requirements of this Chapter.

## 9.2 Check of drawings and information

9.2.1 The following drawings are to be submitted together with other ship drawings:

(1) Arrangement of ECDIS equipment, including its installation position.

(2) ECDIS system diagram, including at least:

① functional block diagram showing connection between components of the system and between the system and external equipment;

② system wiring diagram;

③ power supply circuits of main and emergency power sources.

## 9.3 Inspections for installation

9.3.1 The certificate and inspection mark of the ECDIS equipment are to be examined, and compliance of the performance standard of the installed ECDIS equipment with the requirements of the latest relevant IMO resolution is to be checked.

9.3.2 Where the ECDIS equipment is in use, the following requirements are to be met:

(1) checking whether the chart information in use originates from the latest edition published by a government-authorized hydrographic office based on IHO's standards;

(2) ENC and RNC are databases resulting from computerized charts and relevant navigation information, and the contents of each ENC/RNC can be updated, but not altered; SENC and SRNC are ship databases resulting from ENC/RNC and other relevant information of a specific ship. The ENC/RNC used for SENC/SRNC must be updated and valid, meeting needs of the intended voyage;

(3) checking that the effective size of the chart presentation for route monitoring is at least 270 mm by 270 mm, an approval certificate is required for software/hardware, and confirming that ENC/RNC remains valid and updated;

(4) ECDIS is to be connected to systems providing continuous position-fixing capability (e.g. GPS/ GOLILEO receiver), direction (gyro compass course) and speed information, checking whether the connection is in order; the alarm function of ECDIS for loss of the input from the position-fixing system and its repeat of any alarm or indication passed to it from the position-fixing system are to be tested;

(5) the self-test procedure of the system is to be applied to test major functions of the system on board and examine the effectiveness of the system and its malfunction alarms;

(6) where ECDIS complies with the Convention's requirements for an emergency source of electrical power, the normal operation of ECDIS and its associated accessories as well as the equipment serving it is to be ensured; and the system is to be capable of being started automatically when changing from the main power supply to the emergency power supply and in case of any interruption of the supply for a period of up to 45 s;

(7) it is to be possible for the operator to remove by a single action using a key or other means the input information from the equipment capable of receiving the AIS information, radar information and other navigational information;

(8) confirming that the position indicated on the chart is consistent with the information given by the system's positioning system;

(9) when an ECDIS is switched on following a switch off or power failure, it is to return to the most recently manually selected settings for the display;

(10) verifying that the displayed information of the ship is correct: e.g. heading, speed, time, water depth, position;

(11) establishing, accessing and modifying a route plan, and confirming that it is in good order;

(12) comparing the measured bearing and range of a target on the chart with the radar information to confirm that the data are generally consistent;

(13) notifying the shipowner to indicate in the issued Form E that an electronic chart system is fitted and that the chart is required to be updated regularly.

9.3.3 ECDIS backup arrangements

9.3.3.1 Where ECDIS is used to fully or partially comply with the Convention's functional requirements for planning and displaying the route for the ship's intended voyage as well as for plotting and monitoring the ship's position throughout its voyage, the system is to be provided with backup arrangements.

9.3.3.2 The backup arrangements are to comply with the performance standards of A.817(19), as amended by Appendix 5, resolutions MSC.64(67) and MSC.86(70).

9.3.3.3 If a radar with selected parts of the ENC chart information overlay is used as an element of the backup, the radar is to comply with the requirements of resolution A.477(XII), as amended.

9.3.3.4 The backup arrangements of ECDISs installed after 1 January 2009 are to meet the requirements of Appendix 6 of resolution MSC.232(82). If a radar with selected parts of the ENC chart information overlay is used as an element of the backup, the radar is to comply with the requirements of resolution MSC.192(79), as amended.

9.3.3.5 Inspection requirements

(1) Where electronic equipment is in use, the inspection requirements are basically the same as those for the main system and in addition, separation of the power supply of backup arrangements from that of ECDIS is to be checked.

(2) Where any other backup system is used, such system (e.g. paper chart) is to allow the ship to be navigated safely until the termination of the voyage in case of failure of the main system.

### 9.4 Inspections during service

9.4.1 Where the ECDIS equipment is in use, the following requirements are to be met:

(1) checking whether the chart information in use originates from the latest edition published by a government-authorized hydrographic office based on IHO's standards and that such chart information is suitable and updated for the intended voyage;

(2) ECDIS is to be connected to systems providing continuous position-fixing capability (e.g. GPS receiver), direction (gyro compass course) and speed information, checking whether the connection is in order; the alarm function of ECDIS for loss of the input from the position-fixing system and its repeat of any alarm or indication passed to it from the position-fixing system are to be tested;

(3) the self-test procedure of the system is to be applied to test major functions of the system on board and examine the effectiveness of the system and its malfunction alarms;

(4) the normal operation of ECDIS and all equipment necessary for its normal functioning when supplied by an emergency source of electrical power required by the Convention is to be ensured; and the system is to be capable of being started automatically when changing from the main power supply to the emergency power supply and in case of any interruption of the supply for a period of up to 45 s.

9.4.2 ECDIS backup arrangements

9.4.2.1 Where electronic equipment is in use, the inspection requirements are basically the same as those for the main system and in addition, separation of the power supply of backup arrangements from that of ECDIS is to be checked;

9.4.2.2 Where any other backup system is used, such system (e.g. paper chart) is to allow the ship to be navigated safely until the termination of the voyage in case of failure of the main system.

# Chapter 10 Methods of Testing and Required Test Results

## 10.1 EUT installation, technical documentation and test requirements

10.1.1 The equipment under test (EUT) is to be installed in compliance with the manufacturer's installation manual.

10.1.2 Where equipment is divided (for example route planning on one display and route monitoring on the other), the entire configuration is to be tested together.

10.1.3 The manufacturer is to provide sufficient information and documentation for the equipment to be understood and operated. General guidance for testing is given in Appendix 8.

## 10.2 Interfaces

10.2.1 During testing, specified digital signals are to be input into the EUT to emulate the position, heading and speed over ground of the own ship. Signals may also be provided as necessary to represent radar returns appropriate to the equipment and the position of the ship. Tests are to be performed using a simulator or at sea.

(1) Signals carrying positional data are to conform to the IEC 61162 series and the appropriate EPFS standard.

(2) Signals carrying heading information are to conform to IMO resolutions A.424(XI) and A.821(19); any digital output is to conform to the IEC 61162 series.

(3) Signals carrying speed information are to conform to IMO resolution A.824(19); any digital output is to conform to the IEC 61162 series.

(4) Simulated ARPA signals may be provided by the supplier, and are to conform to IMO resolution A.823(19); any digital output is to conform to the IEC 61162 series.

(5) Simulated or real radar signals in accordance with IEC 62388 may be provided.

10.2.2 An IEC 61162 series interface simulator is to be connected. Messages are to be sent and received. For each sentence listed in 5.2.3 of Chapter 5, confirm that valid data is correctly received and applied. For each message, confirm that missing data, invalid data and data of low integrity is detected and indicated in conformance with the integrity marking requirements of IEC 62288.

## 10.3 General requirements and presentation requirements

10.3.1 General requirements

(1) All the general requirements of IEC 60945 appropriate to its category, i.e. "protected", are to be carried out. The manufacturer is to declare any preconditioning required before environmental checks. For the purposes of these Guidelines, the definitions for "performance check" and "performance test" are identical, both referring to non-quantitative visual checks that the system is still operative.

(2) The acoustic alarm level may be capable of being adjustable below the level defined in IEC 60945.

10.3.2 Presentation requirements

(1) All the presentation requirements of IEC 62288 shall be carried out as appropriate to the facilities provided with the EUT.

**10.4 Preparation**

10.4.1 Power-up

(1) The installed EUT is to be powered up in accordance with the manufacturer's recommended procedures. Any self-testing is to be completed using simulated inputs. Signal generators are to be activated in a coherent manner to represent a stationary ship at the position selected. All the necessary selections to configure the equipment for the test environment are to be undertaken in accordance with the manufacturer's recommendations and settings.

10.4.2 Initial ship parameters

(1) The following parameters are to be entered into the EUT for a simulated test:

| | |
|---|---|
| Ship's length | 300 m |
| Ship's beam | 30 m |
| Ship's draught | 7 m |
| Conning position: aft of ship's centre, on centre line | 100 m |
| Navigation receiver antenna:<br>Forward of conning position<br>Starboard of centre line | <br>5 m<br>10 m |
| Secondary navigation receiver antenna (if provided to meet the requirements of 2.2.4.1 (MSC.232/A11.4.7))<br>Forward of conning position<br>Starboard of centre line | <br>5 m<br>10 m |
| Radar antenna: Forward of conning position, on centre line | 7 m |

(2) The navigation receiver antenna offset is to be varied and it is to be confirmed that the position on the EUT changes accordingly.

10.4.3 Required test items

10.4.3.1 For the purposes of these tests, the following items are to be used:

(1) IHO ECDIS presentation library contained in IHO S-52, Appendix 2 including an ECDIS chart 1 and colour differentiation diagrams. If the manufacturer provides his own presentation library, chart 1 has to be adapted accordingly;

(2) IHO S-64 test data sets for ECDIS which includes ENC data, both encrypted and unencrypted, and its updates, together with the associated instruction manual. The contents of these test data sets are described in Appendix 5 of these Guidelines;

(3) SENC test data sets, if supported from each SENC distributor. The test data set contents are described in Appendix 5 of these Guidelines.

**10.5 Initial data tests**

10.5.1 Presentation library

Perform the following:

(1) check that the edition number of the presentation library can be displayed. Observe the chart display and check that the buoy symbols are as defined in the presentation library;

(2) check that ECDIS chart 1, contained in the presentation library, can be displayed. Select three symbols and check that these symbols can be interrogated by cursor and that the associated text explanation contained in the symbol library of the presentation library is displayed;

(3) load an ENC containing an object not valid for ENC purpose, i.e. an object, attribute and attribute value not recognized by the presentation library. Check that the symbol magenta "?" occurs at the indicated position on the test chart when the standard display is selected;

(4) check that the EUT provides the capability to select for display either the simplified chart symbols for buoys and beacons, special areas, etc., or the corresponding paper chart symbols.

10.5.2 ENC

10.5.2.1 Check that the edition number and date of the ENC included in the IHO test data set for ECDIS are displayed in the chart library.

10.5.2.2 Load an additional ENC cell and ensure that the chart coverage has changed and that the chart library is updated.

10.5.2.3 Remove an ENC cell and ensure that the chart coverage has changed and that the chart library is updated.

10.5.2.4 Load a data cell whose source identification indicates that the data is non-official (by the inclusion of a producer code, which indicates a source other than the official producers listed in Annex A to S-57 Appendix A). Check that when the area of this cell is displayed, the boundary of the area, or the edge of the display if the boundary is off-screen, is marked using the appropriate symbology as defined in the presentation library. The warning "No ENC available" is to appear.

10.5.2.5 Select a display area for part of which no ENC data is loaded and check that the "no data" area symbolization defined in the presentation library is displayed in the appropriate area.

10.5.3 Encrypted ENC

10.5.3.1 Confirm that systems can manage, authenticate and decrypt protected ENCs compliant with the IHO S-63 Data Protection Scheme. (Authentication is carried out by the ECDIS prior to decryption.) The checks are to be performed against the IHO S-63 Test Data Set. Additional guidance is provided in Appendix 7 of these Guidelines.

10.5.3.2 Verify that the system performs the following functions:

(1) ENC cell permit handling. Verify that the system can load and manage ENC cell permits in compliance with section S-63, 10.5;

(2) verify that the system can load a Root (IHO) Certificate as described in S-63, 10.6.2;

(3) verify that the system can authenticate an ENC Cell Digital Signature as described in S-63, 10.6.3;

(4) uncompress and decrypt ENC base and update files. Verify that, once the ECDIS has authenticated the source of the ENC cells, it can extract the necessary decryption keys and unlock the data in compliance with S-63, 10.7;

(5) ENC data management. Verify that the ECDIS can manage ENCs from multiple ENC providers, selected from a list provided by the manufacturer of the ECDIS, in compliance with S-63, 6;

(6) Data exchange media. Verify that S-63 encrypted ENCs can be accessed from CDROM and from any other interface or data storage media that is provided with the ECDIS for that purpose (refer to S-63, 7.5).

**10.6 Accuracy**

10.6.1 The test is to verify:

(1) the accuracy of EUT calculations consistent with SENC;

(2) the measurement accuracy is independent of the display resolution.

10.6.2 Perform the measurements provided for in the IHO test data set and confirm that they meet the required accuracy. Check that the system can perform the following calculations:

(1) transformation between a local datum and WGS-84, and between WGS-84 and a local datum;

(2) true distance and azimuth between two geographical positions;

(3) geographical position from known position and distance/azimuth;

(4) rhumb line and great circle.

10.6.3 Calculate and display both a rhumb line and a great circle line according to test scenario 1 of Appendix 6 of these Guidelines and verify that no visible distortion exists between these lines and the data.

10.6.4 This test s is to be carried out using the scale supported by the data, i.e. not overscaled.

**10.7 Visual requirements**

10.7.1 Symbols

10.7.1.1 In addition to the requirements of IEC 62288 for symbols, perform the following checks:

(1) check that the chart symbols conform to the current IHO presentation library and can be displayed correctly. Where an object does not have a defined symbology, check that the ECDIS displays this using the unknown or undefined symbol (refer to S52 Appendix 2 3.1.3);

(2) display simplified chart symbols. Check that the simplified symbols conform to the IHO presentation library;

(3) perform zoom-in and zoom-out operations in each mode and check that the symbols do not decrease in size below that shown in the IHO presentation library;

(4) check that it is possible to display own ship in true scale or as a symbol;

(5) display “Buoys and Beacons (Q)” part of the ECDIS Chart 1 (cell name AA5C1Q00). Check that the height of the CHKSYM01 symbol is not less than 5 mm;

(6) check that the number of pixels (lines) which comprise the vertical extent of the symbol CHKSYM01 is not less than 16;

(7) using a sample of text contained in the chart, for example manual updates, mariners’ notes, ENC text or pick reports, check that the height of uppercase characters is not less than 3.5 mm.

10.7.2 Units and legend

10.7.2.1 In addition to the requirements of IEC 62288 for navigation-related terminology and abbreviations, check that the following elements are available in the display of general information:

(1) units for depth;

(2) units for height;

(3) scale of display;

(4) data quality indicator;

(5) sounding/vertical datum;

(6) horizontal datum;

(7) the value of the safety depth;

(8) the value of the safety contour;

(9) magnetic variation;

(10) date and number of last update affecting the chart cells currently in use;

(11) edition number and date of issue of the ENC;

(12) chart projection.

10.7.3 Colour table

10.7.3.1 Colour calibration

Verify compliance in accordance with Appendix 9.

10.7.3.2 Other requirements

Perform the following:

(1) if an optical filter is provided for use with the equipment, check that it can be removed from the display. From the manufacturer's data verify that it has eight times attenuation (i.e. 0.9 neutral density);

(2) verify that the equipment manual includes a warning that use of a brightness or contrast control may inhibit visibility of information, particularly when using the night colour tables.

10.7.4 Resolution

Verify compliance in accordance with IEC 62288 for screen resolution.

10.7.5 Display characteristics

10.7.5.1 In addition to the requirements of IEC 62288 for chart displays, check that

(1) a mariner's information panel on the same screen as the route-monitoring display uses only the "user interface" colours defined in the presentation library, or

(2) clearly visible colours which do not detract from the chart display in any of the mandatory colour tables and can be accepted as equivalent to the "user interface" colours.

**10.8 Functional requirements**

The following tests are to be performed both in route planning and route-monitoring mode. The initial latitude/longitude position is to be that provided in the instruction manual for the IHO test data set. For all tests, confirm that there is no degradation in information content.

10.8.1 Standard display

10.8.1.1 Select standard display. Check that the EUT display is the same as the graphical representation of the standard display for the IHO test data set for ECDIS.

10.8.1.2 Ensure that the initial latitude/longitude position is entered and a chart is displayed. Refer to the operator's manual supplied with the equipment and change the settings of the operator menus or manual controls provided. Turn off EUT and then turn EUT back on. Confirm that the manually selected settings are the same as they were before the EUT was turned off.

10.8.2 Display base

10.8.2.1 Select standard display. Add selectable information. Remove all selectable information. Check that the EUT display is the same as the graphical representation of the display base for the IHO test data set for ECDIS. Verify that the standard display can be restored by a single operator action. Confirm that the display mode is indicated. Confirm by observation that means are provided to indicate which selectable information categories are enabled for display and which are not.

10.8.3 All other information

10.8.3.1 Select standard display. Add all other SENC information and check that the EUT display is the same as the graphical representation of the complete IHO test data set for ECDIS. Confirm that the display mode is indicated. Check that the presentation of new chart objects (ESSA, PSSA, ARCSLN, and ASLXIS) as specified in IHO S-57 are as specified.

10.8.4 Display priorities

10.8.4.1 Load ENC test data set A and check in detail that the drawing priority of the EUT display conforms with the drawing priority of the graphical presentation supplied with the IHO test data set.

10.8.5 Additional display functions

10.8.5.1 Check that the additional manufacturer- and mariner-entered information can be displayed on demand. Perform the following:

(1) verify that the navigator's notes can be displayed;

(2) select three different mariner-entered objects, check that these may be positioned at user-defined locations on the display. Similarly check that 10 lines, 25 text characters and two areas can be drawn at user-defined locations. Check that all information added by the mariner is distinguishable. Check that one of the areas can be filled, as described in S-52, Appendix 2/2.3.1b. Check that all of these objects can be added to the SENC. Recall them from the SENC and check that they may be deleted;

(3) if the manufacturer displays information, check that the presentation of the information conforms with the following:

① the caution (!) or information (i) symbol is used to call up a note on the alphanumeric display by cursor picking;

② simple lines, or areas without colour fill, are set up for cursor picking to give an explanatory note in the alphanumeric display. Colour fill is not to be used;

③ manufacturer information is distinguishable as described in S-52, Appendix 2/2.3.1c), and does not overwrite i.e. degrade HO chart information;

(4) it is not to be possible to adjust depth information by changes in tidal height;

(5) if non-ENC data is mixed with ENC, then it is not to be distinguishable as described in S-52, Appendix 2/2.3.1c. If the non-ENC data is clearly separated from the ENC data, it may be symbolized in the same way as ENC data, provided that a prominent warning of "non-ENC data" is displayed, and the area of non-ENC data is marked as defined in IHO S-52 Annex A Part I, 8.7.2.

10.8.6 Scale and navigation purpose

10.8.6.1 Perform the following:

(1) display information at a larger scale than that in the ENC (overscale) by zooming in, and ensure that an indication is provided;

(2) select the less detailed navigation purpose cell which includes own ship's position, covered by the more detailed navigational purpose cell in the ENC and ensure that an indication is provided;

(3) select an area where different compilation scales appear on the display. Verify that a boundary line between different scales is indicated. Check if areas which are overscaled are identified as specified in S-52, Appendix 2;

(4) verify that if the display cannot be completely covered with data for the detailed navigational purpose, the remaining part of the display will be covered by the data for the more general navigational purpose;

(5) a graphical index of the scale boundaries is to be shown on demand;

(6) verify the ability to use intermediate display scales changeable by appropriate steps, for example by increments of chart scale values and by increments of displayed range values in nautical miles;

(7) verify that the SCAMIN attribute removes clutter when changing to a smaller scale. Compare this with the graphical representation for SCAMIN attribute provided with the IHO test data set;

(8) verify that a scale bar is provided as part of the display base at a scale of 1:80 000 or larger;

(9) verify that a latitude bar is provided as part of the display base at a scale smaller than 1:80 000;

(10) set a display scale larger than 1:80 000 (for example 1:25 000) or the equivalent radar range scale and check that the 1 mile scale bar is displayed between 2 mm and 4 mm from the left side of the chart display area. Set a display scale smaller than 1:80 000 or the equivalent radar range scale and check that the latitude scale is displayed between 2 mm and 4 mm from the left side of the chart display area.

10.8.7 Mode and orientation

10.8.7.1 Perform the following:

(1) check that the north arrow symbol is always displayed at the top left corner of the chart area, not overlapping the scale or latitude bar. If the EUT offers the capability to show other than north-up presentation, check that the symbol realigns to north;

(2) ensure that true motion is provided. Reset the display and check that the generation of the neighbouring area takes place automatically at a distance selected by the mariner;

(3) check that it is possible to change manually the chart area and the position of own ship relative to the edge of the display;

(4) where a ship-centred display mode is provided, select a display scale so that the display shows only a portion of the chart which lies entirely within an area which is symbolized with a centred symbol (for example traffic lane). Check that overwriting between the ship symbol and the centred symbol does not occur or, the own ship symbol allows adequate visibility for the covered “centred” symbol;

(5) position own ship in an area for which no ENC is available. Confirm by observation that a “No ENC available” indication is provided that includes guidance to refer to a paper chart or RCDS mode of operation;

(6) for each bearing-stabilised orientation other than “north-up” that may be provided, confirm by analytical evaluation that for turning rates between 0 °/s and 20 °/s the displayed chart symbols and text do not re-orient more often than 2 times per second and remain legible.

10.8.8 Safety contour

10.8.8.1 In addition to the requirements of IEC 62288 for safety contour, perform the following:

(1) switch on. Do not select a safety contour. Check that the equipment defaults to a 30 m safety contour depth;

(2) select a depth contour value not contained in the SENC but which falls between two existing depth contours. Verify that the EUT selects the next deeper contour in the SENC and clearly indicates the selected contour;

(3) compare safety contour display with appropriate graphical representation provided with the IHO test data set. Verify that safety contour is emphasized. Ensure that isolated dangers within the ship’s safety contour are indicated.

10.8.9 Safety depth

10.8.9.1 In addition to the requirements of IEC 62288 for safety depth, for the display of spot soundings, set initial safety depth to 10 m. Compare safety depth display with appropriate graphical representation provided with the IHO test data set. Verify that spot soundings less than the safety depth are emphasized. Repeat test for 7 m and for 12 m. These depths are chosen because they are not depth contours.

10.8.10 Object information

10.8.10.1 Perform the following:

(1) select by cursor several locations with examples of the following area, line and point objects (see Table 10.8.10.1(1)). Check that the information contained in the ENC may be displayed on demand for objects within the general footprint of the cursor, including attributes of symbols as well as “no-symbol” information, such as territorial waters and compilation scale;

**Area, Line and Point Objects** **Table 10.8.10.1(1)**

| Area | Line | Point |
|---|---|---|
| Depth | Depth contour | Buoy |
| Restricted | Ferry route | Light |
| Sea | Recommended track | Wreck |

(2) check that text associated with chart objects is displayed only when selected and may be removed from the display. Confirm the displayed text uses common language terms, not hydrographic abbreviations;

(3) select an example of a note encoded using TXTDSC (text description). Check that the note is displayed within the light level of the current display and that it can be easily read, for example by displaying the note as it might appear on a paper chart;

(4) select an example of PICREP (picture representation). Check that it can be displayed in a manner that does not affect the user's night vision;

(5) select an example of TS_PAD (tidal stream panel information) and TS_PRH (tidal stream prediction by harmonic methods). Check that in both cases the data is displayed within the light level of the current display (Table L.1) and that the data can be easily read and is logically presented, for example by displaying the data as it might appear on a paper chart;

(6) select an example of an update or ENC object that comes into effect or becomes void at a future date using one of the attributes DATSTA/DATEND (date start/date end). Check that:

① the user is able to obtain information about the date of implementation and contents of the update;

② the update is displayed during the time of the validity;

③ the update is processed during route planning if it comes into effect during the dates specified for the voyage;

④ the update is processed for route monitoring during the time of validity;

(7) select an example ENC object that repeatedly comes into effect during a date-interval period specified using the attributes PERSTA/PEREND (date start/date end). Check that:

① the user is able to obtain information about the object and date of implementation;

② the object is normally displayed only during its time of the validity;

③ the object is processed during route planning if it comes into effect during the dates specified for the voyage;

④ the object is processed for route monitoring during the time of validity;

(8) enable display of an example date-dependant ENC object (DATSAT, PERSTA) outside its time of validity. Check that:

① the example ENC object is correctly displayed;

② a persistent indication is provided to inform the mariner that the information displayed may be incorrect for the present date and time;

(9) select an example of NEWOBJ. Check that:

① the user can query the CLSDEF and CLSNAM attribute;

② the object is correctly displayed according to the SYMINS attribute.

10.8.11 Navigation-related functions

10.8.11.1 In addition to the requirements of IEC 62288 for navigation tools, verify that at least one EBL and VRM are available.

10.8.12 Position integration

Perform the following:

(1) remove the simulated position input and connect a continuous positioning system to the EUT and verify that the correct position is displayed;

(2) with a second, independent positioning method ensure that the EUT displays any difference in reported positions;

(3) remove the positioning input to the EUT and ensure that an alarm is given;

(4) simulate a message from the positioning device that indicates an error condition, and observe that the alarm or indication is repeated by the EUT as an indication;

(5) select a different geodetic datum between the positioning system and the SENC, and ensure that an alarm is given;

(6) adjust the position manually. Observe that the amount of the correction is displayed on the screen and that the position changes accordingly. Recheck periodically to see that it remains unchanged;

(7) verify that the manufacturer's documentation includes guidance for implementing a common reference system (offsets);

(8) confirm by observation that the EUT indicates discrepancies between positions obtained by continuous positioning systems and positions obtained by manual observations;

(9) confirm by inspection that the EUT has the means to display the position from at least two positioning methods, to identify which method is being used and provide a means for the operator to select the method he wants to use.

10.8.13 Radar and plotting information

10.8.13.1 Where the capability for displaying radar information and/or AIS information is provided, in addition to the requirements of IEC 62288 for radar displays and presentation of target information, perform the following:

(1) observe the display without radar and AIS information, switch on the radar image overlay, the radar tracked target information and the AIS information, as available, and ensure that the SENC information is not degraded, and is clearly distinguished;

(2) observe the display without radar and AIS information, then switch on the radar image overlay, the radar tracked target information and the AIS information, as available, and ensure that these match in scale, orientation, projection and accuracy, within the ranges defined in IEC 62388. Check that a change of scale of the radar, if it is a separate unit, does not affect the radar image overlay of the EUT in scale, orientation, projection and accuracy;

(3) ensure that the radar image overlay, tracked target information, AIS information and other added navigational information may be removed by single operator action;

(4) set EUT to accept and display transferred radar tracked target and AIS information, as available. Set the simulator to the equivalent of stabilized, north-up mode and to 12-mile range. Check that the target and AIS information is being accepted and displayed correctly;

(5) vary the radar antenna offset and confirm that the position of radar image overlay and the radar tracked targets, as available, on the EUT changes accordingly.

10.8.13.2 For this test, a radar target in a fixed position is to be simulated.

10.8.14 Loading of corrupted data

10.8.14.1 Perform the following:

(1) load an example of corrupted ENC test data. Verify that EUT provides the appropriate warning;

(2) load the IHO ENC test data set. Enter an example of a corrupted update. Verify that the reception procedure is terminated and the update record is flagged as invalid;

(3) verify that the user is informed of the corruption.

10.8.15 Automatic updates

10.8.15.1 Receipt – installation and application

Perform the following①:

(1) verify that the system can receive updates via CDROM and from each type of removable storage media or interface that is provided with the ECDIS for the purpose of receiving or updating ENCs;

(2) apply the test update number 1 to the IHO ENC test data set;

(3) identify the issuing authority of the update. Check that this conforms with the corresponding identifier of the ENC;

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① The test data sets should be provided by the SENC producers for each SENC distributor approved for use with the EUT.

(4) attempt to load an improperly sequenced update; check that the update is rejected and that a warning is given to the user;

(5) attempt to load an update related to a newer edition of ENC; check that the update is rejected and the user is informed that a newer edition is available;

(6) attempt to load an update related to an older edition of ENC; check that the update is rejected and the user is informed that the update belongs to a previous edition;

(7) load a cell-cancellation update. Check that the cancelled cell is no longer available;

(8) verify in accordance with Appendix 7, that the ECDIS accepts encrypted ENC data;

(9) if the ECDIS supports SENC delivery (accepting a SENC resulting from conversion of ENC to SENC ashore, in accordance with IHO TR A3.11, IHO Miscellaneous Publication M-3), then the manufacturer is to supply a SENC version of the IHO ENC test data subset A and subset B for each SENC format for which SENC delivery is to be approved;

(10) for each SENC test data set supplied, verify compliance with (1) through (7) noting that the outcome of each resultant update stage should be identical to that which results from application of the updates supplied in the IHO ENC test data (subset B). Confirm by inspection of submitted documentation which hydrographic offices or RENCs have documented their approval of the submitted SENC version test data subsets;

(11) if the ECDIS supports SENC delivery, confirm by using the available updates in the ENC test data set that the ECDIS provides an update mechanism for delivered SENCs that is not inferior to the update mechanism of ENCs.

10.8.15.2 Display – show and verify

(1) Perform the following:

① ensure that the edition date/update number is displayed on request;

② ensure that the contents of the updates have been included in the SENC, by displaying the SENC contents and highlighting updates;

③ ensure that updates not relating to an ENC cell within the SENC are discarded;

④ ensure that official ENC updates can be distinguished from local updates;

⑤ verify that, once accepted, integrated updates are indistinguishable from ENC data.

(2) An update is to be applied to the SENC, displayed, and then manually annotated as rejected by the mariner, i.e. it is not to be possible for the mariner to reject an officially issued update by omitting its application entirely.

10.8.15.3 Records and logs

Tests are to be applied in all EUT operating modes, i.e. route planning and route monitoring as follows:

(1) list on the display, and observe the contents of the record of updates, including the time of application to the SENC;

(2) verify that the log file contains the following information:

① date and time of application/rejection;

② complete and unique identification of update described in the S-57 product specification;

③ any anomalies encountered during application;

④ type of application: manual/automatic;

(3) verify that the summary report for the update set provides the following information:

① identification of issuing authority;

② update numbers of the update files;

③ cell identifiers of cells affected;

④ edition number and date of ENC cells involved;

⑤ number of updates in the affected cells.

10.8.16 Manual updates

10.8.16.1 Using the test data subset C, as described in Appendix 5, check that the following manual update procedures may be carried out and that the update is distinguishable as described in S-52, Appendix 2/2.3.4:

(1) add a new point and restricted area features from the presentation library, locating them at selected positions;

(2) delete an existing feature;

(3) check to see that any update text information relevant to the new condition and to the source of the update entered by the mariner is recorded by the system. Verify that this update can be re-displayed on demand;

(4) verify that EUT is capable of sensing indications and alarms related to the SENC data from manual updates;

(5) verify that manual updates are distinguishable as described in S-52, Appendix 2/2.3.4;

(6) verify that any manual updates removed from the display during the last 3 month period are retained and can be reviewed.

10.8.17 Self-tests of major functions

10.8.17.1 Perform the following:

(1) perform tests of the major functions which are supported by the EUT. Verify that the EUT provides appropriate display information and indications;

(2) simulate the following sensor malfunctions (including for radar if provided for):

① interruption of sensor input (loss of signal);

② invalid sensor information (status);

③ physical breakdown of sensor connection;

(3) verify that the system provides suitable alarms or indication of system malfunction arising from failures in accordance with IEC 60945.

**10.9 Operational requirements**

10.9.1 Ergonomic principles

The EUT is to follow the ergonomic principles in MSC/Circ.982 taking into account the guidance given in IEC 62288.

10.9.2 Route planning

10.9.2.1 Perform the following:

(1) confirm that means are provided for the user to enter a minimum distance limit for indication of the proximity of a planned route to the boundary of a prohibited area, an area with special conditions, or point objects;

(2) for the routes to be planned as described below, the following general guidelines apply:

① initially plan the route without specifying a safety contour. Ensure that the default value is 30 m or the next deeper contour;

② at least one leg is to enter an area where the specified safety contour is not available. Ensure that the safety contour defaults to the next deeper contour and an indication is provided to the mariner;

③ at least one leg is to pass closer than the minimum distance limit to a safety contour. Ensure that an indication is provided;

④ at least one leg is to pass closer than the minimum distance limit to the boundary of a prohibited area. Ensure that an indication is provided;

⑤ at least one leg is to pass closer than the minimum distance limit to the boundary of a geographical area for which special conditions exist. Ensure that an indication is provided;

⑥ at least one leg is to pass closer than the minimum distance limit to a point object, such as a fixed or floating aid to navigation or isolated danger. Ensure that an indication is provided;

⑦ at least one leg is to cross the boundary of an area entered by the mariner which should generate an alarm or indication. Ensure that an indication is provided;

⑧ at least one leg of the route is to be planned through an area of the ENC test data at a different scale;

⑨ each leg is to be planned with an appropriate off-track limit (for example 100 m);

⑩ course changes are to be made, both to starboard and port, between different legs of the route and are to vary from 5° up to 175°;

⑪ the length of the legs is to vary from 0.5 nautical miles to at least 3 nautical miles with a total length of at least 25 nautical miles;

⑫ planned speed is to vary between 5 knots and 15 knots;

⑬ the planned route is to cross at least 3 cells of the ENC;

(3) observe that the displayed information for route planning, route monitoring and supplementary navigation tasks, such as pilotage or chart work is available;

(4) plan a route which uses at least 10 waypoints:

① test that the route can be planned using both straight and curved segments;

② save the planned route;

(5) retrieve the planned route and plan an alternative route as follows:

① add three waypoints using alphanumeric means and graphical means;

② delete three waypoints using alphanumeric means and graphical means;

③ change position of two waypoints using alphanumeric means and graphical means;

④ save the alternative route;

(6) plan complex tracks using scenarios 2 and 3 as noted in Appendix 6 and save the tracks. Check that track distances comply with those noted in Appendix 6 and that no distortions are visible.

10.9.3 Route monitoring

10.9.3.1 Perform the following:

(1) confirm by observation that means are provided to enter a look-ahead range in units of time or distance and to enter a distance limit for proximity to dangers. Confirm by analytical evaluation of a test scenario, that an indication of the hazard condition and location are given whenever continuing the present course and speed over the length of the look-ahead range will cause own ship to approach closer than the distance limit to an aid to navigation or to a danger (for example obstruction, wreck, rock) shallower than the mariner's safety contour;

(2) for route monitoring, the following general guidelines apply:

① initialize the simulator at the starting position for the planned route;

② select standard display and select the route;

③ the route is to be planned through an area covered by the IHO ENC test data set;

④ carry out route monitoring using the selected routes and starting at the first waypoint of the route;

⑤ at least one leg is to cross own ship's safety contour;

® at least one leg is to enter an area where the specified safety contour is not available;

⑦ at least one leg is to cross an overscale area. Verify that this is indicated;

⑧ at least one leg is to cross the boundary of an area entered by the mariner which should generate an alarm or indication. Ensure that an alarm or indication is provided;

(3) operate the own ship position function, and observe that the display shows own ship's position;

(4) shortly before the ship enters an area for which an alarm will be released (safety contour and prohibited areas), perform the following actions:

① display a sea area ahead of ship's position and outside present display (look ahead);

② verify that the appropriate alarms/indications are provided;

③ return to own ship's position by a single operator action and verify that this takes no more than 5 s;

(5) when the ship enters the area where the specified safety contour is not available, ensure that the safety contour shown defaults to the next deeper contour;

(6) verify that an alarm or indication, as selected by the mariner, is released each time the ship is going to cross the boundary of a prohibited area or safety contour, within the time specified by the mariner;

(7) select a scale smaller than the largest one available for the area. Simulate crossing over the safety contour. Check that an alarm is generated by EUT using data from the largest available scale;

(8) using the ENC test data set:

① simulate own ship's movement from an area of large-scale data into an adjoining area of small scale data. Ensure that each re-draw which occurs until the display is wholly within the small scale area is completed in less than 5 s (The situation where official chart data is not available is outside the scope of this test);

② select the display of an area not currently displayed, at least 10 nautical miles from own ship's position and which is covered by ENC data at a scale different from the one in use. Check that the old display is maintained from the start of the regeneration until the start of re-draw of the new display. An indication is to be given if the regeneration time is more than 5 s;

③ simulate deviation from intended track and verify that the off-track alarm is released;

④ verify that an alarm is released each time, within the time or distance specified, when a critical point has been reached by or is abeam of the ship;

⑤ display the alternative route and ensure that it is clearly distinguishable from the selected route. Change to the alternative route and verify that this becomes the selected route;

® modify the selected route by adding a new waypoint;

⑦ select an automatic time interval, within a range of 1 min to 120 min, simulate the ship's movement, and verify that the time labels are displayed. Ensure that time labels may also be entered manually;

(9) reload the complex route of scenario 2 and start monitoring the route with the first waypoint. Confirm that all waypoint changes, bearings and distances are calculated and displayed correctly during route monitoring;

(10) reload the complex route of scenario 3 and start monitoring the route with the first waypoint. Confirm that all waypoint changes, bearings and distances are calculated and displayed correctly during route monitoring.

10.9.4 Twelve-hour log

10.9.4.1 For recording purposes (see below) the data resolution is to be in accordance with 10.7.2. Perform the following:

(1) for voyage recording, a separate test route plan is to be made. The route plan is to be designed as a loop. It is to be possible for the simulator to carry out this test automatically;

(2) continue to run the test for 12 h. During this period, attempts should be made to manually edit the log. This is not to be possible. At the end of the 12 h period, the EUT log is then to be analyzed according to the procedures in the operating manual and the results are to comply with the test carried out;

(3) Ensure that the record for the previous 12 h, including all the items defined in 2.2.4.6 and 2.2.7.1 of Chapter 2, is stored and available on demand. Check that chart data according to 2.2.7.1 and 2.2.7.2 of Chapter 2 is stored at least initially and for each data change.

10.9.5 Voyage record

10.9.5.1 Perform the following:

(1) verify that the EUT records the track for the entire voyage, with time marks at intervals not exceeding 4 h. Verify that the logging capacity for the voyage has a minimum capacity of three months;

(2) ensure that the record, for the previous 12 h, and the voyage track, once recorded, can be preserved.

10.9.6 Power supply

10.9.6.1 Interrupt the power supply for 45 s, and ensure that the equipment does not need to be re-initialized manually.

10.9.6.2 Operator settings are to be checked that they have not changed.

10.9.7 LOP position fix

10.9.7.1 Perform the following:

(1) manually enter bearing data for one LOP and distance data for a second LOP. Confirm by observation that a means or method is provided to manually enter bearing and distance data for lines-of-position (LOP) and that this data is time-stamped when it is entered;

(2) confirm by observation that LOP data (range or bearing, time, source) can be presented both alphanumerically and graphically;

(3) confirm by analytical evaluation that an estimated position (EP) based on two LOPs selected by the operator is provided;

(4) enter data for a third LOP, 6 min later. Confirm by analytical evaluation that a means or method is provided to transfer LOPs observed at different times to the time of the most recent LOP, extrapolated forward in time using present heading and speed;

(5) confirm by analytical evaluation that a position fix based on three or more LOPs selected by the operator is provided;

(6) confirm by observation that, when a position fix is accepted by the operator, the plotted position is indicated graphically on the display. Confirm by observation that position plots indicate the time, source of data used and the type of plot, in the case of estimated position or dead-reckoned position plot (EP or DR) and comply with IEC 62288 for the presentation of colours and symbols;

(7) confirm by inspection of recorded data that the position fix data and the associated LOP data (range or bearing, time, source, and any time transfer applied) were automatically recorded and can be reproduced from the data log;

(8) verify that the graphic symbols for LOP bearing and LOP distance comply with IEC 62288;

(9) confirm by observation that the graphic symbols for position plots comply with IEC 62288;

(10) confirm by analytical evaluation that a means or method is provided to use the resulting position as a position update during dead reckoning operation;

(11) confirm by inspection that the operator's manual supplied with the equipment includes guidance on use of LOPs for calculation of position fixes.

**10.10 Software maintenance**

10.10.1 Verify that the current software version can be displayed.

10.10.2 Verify that replacement or installation of updates to software can be accomplished following information provided in the operator's manual and on the equipment.

10.10.3 Verify that a list can be accessed, following information provided in the operator's manual or on the ECDIS equipment, showing the ECDIS software application version and status of compliance with IHO standards in effect for ECDIS, and regulatory approvals.

**10.11 Methods of testing and required test results for backup arrangements**

10.11.1 EUT installation and technical documentation
See requirements in 10.1.

10.11.2 Interfaces
See requirements in 10.2.

10.11.3 General requirements and presentation requirements
See requirements in 10.3.

10.11.4 Preparation

10.11.4.1 Power-up
See requirements in 10.4.1.

10.11.4.2 Initial ship parameters

(1) The following parameters are to be entered into the EUT for a simulated test:

| | |
|---|---|
| Ship's length | 300 m |
| Ship's beam | 30 m |
| Ship's draught | 7 m |
| Conning position: aft of ship's centre, on centre line | 100 m |
| Navigation receiver antenna:<br>Forward of conning position<br>Starboard of centre line | <br>5 m<br>10 m |
| Radar antenna: Forward of conning position, on centre line | 7 m |

(2) The navigation receiver antenna offset is to be varied and it is to be confirmed that the position on the EUT changes accordingly.

10.11.5 Initial data tests

10.11.5.1 Chart

(1) Check that the edition number and date of the chart included in the test data set is displayed in the chart library;

(2) Check by operation that it is not possible to alter the content of the chart;

(3) Ensure that the edition date/update number is displayed on request.

10.11.6 Accuracy

10.11.6.1 The test is to verify:

(1) the accuracy of ECDIS calculations consistent with the chart;

(2) the measurement accuracy consistent with the display resolution.

10.11.6.2 Perform the measurements provided for in the IHO test data set and confirm that they meet the required accuracy. Check that the system can perform the following calculations:

(1) transformation between a local datum and WGS-84;

(2) true distance and azimuth between two geographical positions;

(3) geographic position from known position and distance/azimuth;

(4) rhumb line and great circle.

10.11.6.3 Calculate and display both a rhumb line and a great circle line according to test scenario 1 of Appendix 6 and verify that no visible distortion exists between these lines and the chart data.

10.11.6.4 This test is to be carried out using the scale supported by the data, i.e. not overscaled.

10.11.7 Visual requirements

10.11.7.1 Symbols

In addition to the requirements of IEC 62288 for symbols, check that the chart symbols conform to the current IHO presentation library.

10.11.7.2 Display characteristics

In addition to the requirements of IEC 62288, perform the following.

(1) Measure the displayed chart area while in route monitoring mode and check that it is at least 250 mm × 250 mm or 250 mm diameter.

(2) Check that in route monitoring mode any windows superimposed on the chart display area are removable or can be moved on display.

(3) Check that a mariner's information panel on the same screen as the route monitoring display uses the "user interface" colours from the presentation library colour tables or clearly visible colours which do not detract from the chart display in any of the colour tables and can be accepted as equivalent to the "user interface" colours.

10.11.8 Functional requirements

The following tests are to be performed both in route planning and route monitoring mode. The initial latitude/longitude position is to be that provided in the instruction manual for the IHO test data set. For all tests, confirm that there is no degradation in information content.

10.11.8.1 Chart display information

(1) Ensure that the initial latitude/longitude position is entered and a chart is displayed. Refer to the operator's manual supplied with the equipment and change the settings of the operator menus or manual controls provided. Turn off EUT and then turn EUT back on. Confirm that the manually selected settings are the same as they were before the EUT was turned off.

(2) Verify by visual inspection that the backup system can display all the information required in 6.2.1.4 of these Guidelines including identification of dangers and aids to navigation, and additional chart information if applicable.

10.11.8.2 Scale and navigation purpose

(1) Select a chart and display the information at a larger scale (overscale) by zooming in, and ensure that an indication is provided.

(2) Select a smaller scale chart that includes own ship's position, covered by a larger scale chart, and ensure that an indication is provided.

10.11.8.3 Mode and orientation

(1) If a presentation mode other than north up is available, check that the orientation of the screen is clearly indicated.

(2) Ensure that true motion is provided. Reset the display and check that the generation of the neighbouring area takes place automatically at a distance selected by the mariner.

(3) Check that it is possible to change manually the chart area and the position of own ship relative to the edge of the display.

10.11.8.4 Navigation-related functions

(1) Verify that at least one EBL and one VRM are available. Ensure that all the other symbols required for navigation purposes and specified in Appendix 3 are available.

10.11.8.5 Position integration

(1) Connect a simulated position input to the EUT and verify that the correct position is displayed.

(2) Adjust the position manually. Observe that the amount of the correction is displayed on the screen and that the position changes accordingly. Recheck periodically to see that it remains unchanged.

10.11.8.6 Radar, track plotting and AIS information
See requirements in 10.8.13.

10.11.8.7 Updates

Verify that updates on the ECDIS can be duplicated on the EUT and that the EUT can be manually updated.

10.11.8.8 Self-tests of major functions
See requirements in 10.8.17.

10.11.9 Operational requirements

10.11.9.1 Ergonomic principles

The EUT is to follow the ergonomic principles in MSC/Circ.982 taking into account the guidance given in IEC 62288.

10.11.9.2 Route planning

(1) Test that the route plan can be transferred from ECDIS to the EUT after completion of the route plan. Alter the route plan on ECDIS and transfer alterations/new route to the EUT and check that the previous route is corrected/overwritten.

(2) Test that route plans can be planned and can be adjusted manually.

(3) For the routes to be planned as described below, the following general guidelines apply:

① at least one leg of the route is to be planned through an area of the chart test data at a different scale. Set to test the 5 s maximum redraw;

② course changes are to be made, both to starboard and port, between different legs of the route and are to vary from 5° up to 175°;

③ the length of the legs is to vary from 0.5 nautical miles to at least 3 nautical miles with a total length of at least 25 nautical miles;

④ planned speed is to vary between 5 knots and 15 knots;

⑤ the planned route is to cross at least 3 different scales of chart data.

(4) Observe that the displayed information for route planning, route monitoring and supplementary navigation tasks, such as pilotage or chart work is available.

(5) Plan a route which uses at least 10 waypoints:

① add three waypoints;

② delete three waypoints;

③ change position of two waypoints;

④ change order of waypoints in the route;

⑤ save the alternate route.

10.11.9.3 Route monitoring

(1) Verify that the planned route is displayed with both straight and curved segments.

(2) Using the chart test data set, select an automatic time interval, within a range of 1 min to 120 min, simulate the ship's movement, and verify that the time labels are displayed. Ensure that time labels may also be entered manually.

10.11.9.4 Twelve-hour log

Ensure that the record for the previous 12 h and the voyage track, once recorded, can be preserved.

10.11.9.5 Voyage record

Verify that the EUT records the track for the entire voyage, with time marks at intervals not exceeding 4 h.

10.11.9.6 Power supply

(1) Check that the EUT can be powered from a separate supply other than the ECDIS. Switch off the power supply to the ECDIS. Verify that the EUT continues to function.

(2) Interrupt the power supply for 45 s, and ensure that the EUT does not need to be reinitialized manually.

(3) Operator settings are to be checked that they have not changed.

## Appendix 1 Alarms and Indicators

| Paragraph | Alarm information | Requirement |
|---|---|---|
| 2.2.3.3, Chapter 2 | Crossing safety contour | Alarm |
| 2.2.3.4, Chapter 2 | Area with special conditions | Alarm or indication |
| 2.2.3.5, Chapter 2 | Deviation from route | Alarm |
| 2.2.4.3, Chapter 2 | Positioning system failure | Alarm |
| 2.2.3.7, Chapter 2 | Approach to critical point | Alarm |
| 2.2.4.4, Chapter 2 | Different geodetic datum | Alarm |
| 5.3.3, Chapter 5 | Malfunction of ECDIS | Alarm or indication |
| 4.1.4.1, Chapter 4 | Default safety contour | Indication |
| 4.1.10.1(1), Chapter 4 | Information overscale | Indication |
| 4.1.10.1(2), Chapter 4 | Larger scale ENC available | Indication |
| 4.2.1.1, Chapter 4 | Different reference system | Indication |
| 4.3.5, Chapter 4 | No ENC available | Indication |
| 4.5.5.1, Chapter 4 | Customized display | Indication |
| 2.2.2.4, Chapter 2 | Route planning across safety contour | Indication |
| 2.2.2.5, Chapter 2 | Route planning across specified area | Indication |
| 2.2.3.6, Chapter 2 | Crossing a danger in route monitoring mode | Indication |
| 5.3.1, Chapter 5 | System test failure | Indication |

In these Guidelines the definitions of indicators and alarms provided in IMO resolution A.1021(26) apply.

Alarm: An alarm or alarm system which announces by audible means, or audible and visual means, a condition requiring attention.

Indicator: Visual indication giving information about the condition of a system or equipment.

# Appendix 2 ECDIS in the RCDS Mode of Operation

## 1 Introduction

1.1 The primary function of the ECDIS operating in the RCDS mode is to contribute to safe navigation.

1.2 When operating in the RCDS mode, an appropriate portfolio of up-to-date paper charts (APC) is to be carried on board and be readily available to the mariner.

1.3 In addition to the general requirements set out in IMO resolution A.694(17) (IEC 60945), ECDIS equipment operating in the RCDS mode is to meet the requirements of this Appendix and follow the relevant guidelines on ergonomic principles adopted by IMO MSC/Circ.982.

1.4 ECDIS operating in the RCDS mode is to be capable of displaying all chart information necessary for safe and efficient navigation originated by, and distributed on the authority of, government-authorized hydrographic offices.

1.5 ECDIS operating in the RCDS mode is to facilitate simple and reliable updating of the raster navigational chart.

1.6 Use of ECDIS operating in the RCDS mode is to reduce the navigational workload compared to using the paper chart. It is to enable the mariner to execute in a convenient and timely manner all route planning, route monitoring and positioning currently performed on paper charts. It is to be capable of continuously plotting the ship's position.

1.7 ECDIS operating in the RCDS mode is to have at least the same reliability and availability of presentation as the paper chart published by government authorized hydrographic offices.

1.8 ECDIS operating in the RCDS mode is to provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment. See Table 1 of this Appendix.

1.9 When the relevant chart information is not available in the appropriate form, some ECDIS equipment may operate in the RCDS mode as defined in this Appendix. RCDS mode of operation is to conform to performance standards not inferior to those set out in this Appendix.

1.10 The ECDIS display operating in the RCDS mode may also be used for the display of radar, radar tracked target information, AIS and other appropriate data layers to assist in route monitoring.

## 2 RCDS definitions

2.1 Information on RCDS definitions may be found in IHO S-32, Appendix 1.

## 3 Display of SRNC information

### 3.1 SRNC

3.1.1 ECDIS operating in the RCDS mode is to be capable of displaying all SRNC information.

3.1.2 SRNC information available for display during route planning and route monitoring is to be subdivided into two categories:

(1) the RCDS standard display consisting of RNC and its updates, including its scale, the scale at which it is displayed, its horizontal datum, and its units of depths and heights; and

(2) any other information such as mariner's notes.

**3.2 Categories of display**

3.2.1 ECDIS operating in the RCDS mode is to present the RCDS standard display at any time by a single operator action.

3.2.2 RCDS standard display is defined in 3.1 of this Appendix.

3.2.3 The chart should be displayed at the resolution contained in the RNC. Supplementary operator action may be necessary to access information contained in notes, diagrams, etc., that are not located on the portion of the chart currently being displayed.

3.2.4 It is to be easy to add to, or remove from the RCDS display, any information additional to the RNC data, such as mariner's notes. It is not to be possible to remove any information from the RNC.

3.2.5 The RNC data and updates to it are to be clearly distinguishable from other displayed information, including those listed in Appendix 3.

3.2.6 RNC colours are specified by the government-authorized hydrographic office providing the RNCs (S-61 3.4.2.17, 3.4.2.17.1 and 3.4.2.17.2) and are to be implemented in accordance with IEC 62288.

**3.3 Power failure**

3.3.1 When an ECDIS operating in the RCDS mode is switched on following a power failure, it is to return to the most recent manually selected settings for the display.

**3.4 Information content**
(See G.17.4.1, G.17.5.9.2.)

3.4.1 The RNC and all updates to it are to be displayed without any degradation of their information content. Degradation is to be understood as degradation in information quantity as well as quality.

**3.5 Verification and updates**

3.5.1 ECDIS operating in the RCDS mode is to provide a means to ensure that the RNC and all updates to it have been correctly loaded into the SRNC.

**3.6 Indication**

3.6.1 There is always to be an indication if the ECDIS equipment is operating in RCDS mode.

## 4 Provision and updating of chart information

### 4.1 Contents of the RNC

4.1.1 The RNC used in ECDIS operating in RCDS mode is to be the latest edition of that originated by, or distributed on the authority of, a government-authorized hydrographic office and conform to IHO Standards. RNCs not based on WGS-84 or PE-90 are to carry meta-data (i.e. additional data) to allow geo-referenced positional data to be displayed in the correct relationship to SRNC data.

4.1.2 The value of the shift between RNC geodetic datum and WGS-84 or PE-90 contained in the meta-data may be “shift not known”. This should be indicated on the display.

4.1.3 In order to identify the date and origin of the RNC in use, the ECDIS operating in RCDS mode is to include a graphical index of RNC data available, presented upon the mariner’s request and providing access to the edition and date of each.

4.1.4 A new edition of an RNC will supersede a previous RNC and its integrated updates issued by a government-authorized hydrographic office.

4.1.5 The contents of the SRNC are to be adequate and up-to-date for that part of the intended voyage not covered by ENC①.

4.1.6 It is not to be possible to alter the contents of the RNC.

### 4.2 Updates

4.2.1 Updates are to be stored separately from the RNC. Separate storage of updates may utilize the same data storage device.

4.2.2 ECDIS operating in the RCDS mode is to be capable of accepting official updates to the RNC data provided in conformity with IHO Standards. These updates are to be automatically applied to the SRNC. By whatever means updates are received, the implementation procedure is not to interfere with the display in use.

The contents of an update assume that all earlier updates have been applied to the SRNC.

4.2.3 ECDIS operating in the RCDS mode is also to be capable of accepting updates to the RNC data entered manually with simple means for verification prior to the final acceptance of the data. They are to be distinguishable on the display from RNC information and its official updates and not affect display legibility.

4.2.4 ECDIS operating in the RCDS mode is to keep and display on demand a record of updates including time of application to the SRNC. This record is to include updates for each RNC until it is superseded by a new edition.

---

① References to updates in G.4.2 refer either to individual updates or to collections of individual updates issued together at regular intervals, for example weekly.

4.2.5 ECDIS operating in the RCDS mode is to allow the mariner to display updates in order to review their contents and to ascertain that they have been included in the SRNC.

## 5 Scale

5.1 ECDIS operating in the RCDS mode is to provide an indication if:

(1) the information is displayed at a different scale than that contained in the RNC;

Overscale means displaying the RNC at a greater resolution (more pixels per millimetre) than that contained in the RNC. Underscale means displaying the RNC at a lesser resolution (fewer pixels per millimetre) than that contained in the RNC. or

(2) own ship's position is covered by an RNC at a larger scale than that provided by the display.

## 6 Display of other navigational information

### 6.1 Common reference system

6.1.1 When operating in the RCDS mode, ECDIS and added navigational information are to use a common reference system. If this is not the case, an indication is to be provided. Such advice is to be included in the manufacturer's installation handbook.

### 6.2 Radar and plotting information

6.2.1 Radar information and/or AIS information may be transferred from systems compliant with the relevant standards of IMO. Other navigational information may be added to the RCDS display. However, it is not to degrade the displayed SRNC information, and is to be clearly distinguishable from the SRNC information.

6.2.2 It is to be possible to remove the radar information, AIS information and other navigational information by a single operator action.

6.2.3 Transferred radar information may contain a radar image and/or tracked target information.

6.2.4 Where radar tracks are added, it is to be indicated to the operator whether the vectors are relative or true, and if true whether they are sea or ground stabilized.

6.2.5 If the radar image is added to the RCDS display, the chart and the radar image are to match in scale, projection and in orientation.

6.2.6 The radar image and the position from the position sensor are both to be adjusted automatically for antenna offset from the conning position.

## 7 Display mode and generation of the neighbouring area

7.1 It is always to be possible to display the SRNC in "chart up" orientation. Other orientations are permitted.

7.2 ECDIS operating in the RCDS mode is to provide for true motion mode. Other modes are permitted.

7.3 When true motion mode is in use, reset and generation of the chart display of the neighbouring area are to take place automatically at own ship's distance from the edge of the display as determined by the mariner.

7.4 It is to be possible to manually change the displayed chart area and the position of own ship relative to the edge of the display.

7.5 If the area covered by the RCDS display includes waters for which no RNC at a scale appropriate for navigation is available, the areas representing those waters should carry an indication (see Appendix 1) to the mariner to refer to the paper chart.

## 8 Colours and symbols

8.1 IHO recommended colours and symbols are to be used to represent SRNC information implemented in accordance with IEC 62288. (S-61 3.4.2.17, 3.4.2.17.1 and 3.4.2.17.2).

8.2 The colours and symbols other than those mentioned in 8.1 are to comply with the applicable requirements contained in the IMO standards for navigational symbols (IEC 62288).

8.3 ECDIS operating in the RCDS mode is to allow the mariner to select whether own ship is displayed in true scale or as a symbol.

## 9 Display requirements

### 9.1 Route planning and monitoring

9.1.1 ECDIS operating in the RCDS mode is to be capable of displaying information for:

(1) route planning and supplementary navigation tasks;

(2) route monitoring.

### 9.2 Display characteristics

9.2.1 The effective size of the chart presentation for route monitoring is to be at least 270 mm by 270 mm.

9.2.2 The method of presentation is to ensure that the displayed information is clearly visible to more than one observer in the conditions of light normally experienced on bridge of the ship by day and by night.

### 9.3 Chart notes

9.3.1 ECDIS operating in the RCDS mode is to be capable of displaying, simply and quickly, chart notes which are not located on the portion of the chart currently being displayed (S-61 3.4.2.18 and 3.4.2.19). "Simply and quickly" denotes not more than three operator actions.

## 10 Route planning, monitoring and voyage recording

### 10.1 General

It is to be possible to carry out route planning and route monitoring in a simple and reliable manner.

### 10.2 Route planning

10.2.1 It is to be possible to carry out route planning including both straight and curved segments.

10.2.2 It is to be possible to adjust a planned route alphanumerically and graphically including:

(1) adding waypoints to a route;

(2) deleting waypoints from a route;

(3) changing the position of a waypoint.

10.2.3 It is to be possible to plan one or more alternate routes in addition to the selected route. The selected route is to be clearly distinguishable from the other routes.

10.2.4 It is to be possible for the mariner to specify a cross track limit of deviation from the planned route at which an automatic off track alarm is to be activated.

### 10.3 Route monitoring

10.3.1 For route monitoring, the selected route and own ship's position are to appear whenever the display covers that area.

10.3.2 It is to be possible to display a sea area that does not have the ship on the display (for example, for looking ahead, route planning) during route monitoring. If this is done on the display used for route monitoring, the automatic route monitoring functions (for example in updating ship's position, and providing alarms and indications) are to be continuous. It is to be possible to return to the route monitoring display covering own ship's position immediately by single operator action.

10.3.3 An alarm is to be given when the specified cross track limit for deviation from the planned route is exceeded.

10.3.4 An alarm is to be given by ECDIS operating in the RCDS mode when the ship reaches a specified time or distance, set by the mariner, in advance of a critical point on the planned route.

10.3.5 ECDIS operating in the RCDS mode is to permit the mariner to define critical points and the time or distance at which an alarm is to be given. The words "to reach a critical point" are to be considered passing abeam of the critical point on the planned route.

10.3.6 It is to be possible to display alternative routes in addition to the selected route. The selected route is to be clearly distinguishable from the other routes. During the voyage, it is to be possible for the mariner to modify the selected sailing route or change to an alternative route.

10.3.7 It is to be possible to display:

(1) time-labels along a ship's track manually on demand and automatically at intervals selected between 1 and 120 minutes; and

(2) an adequate number of: points, free movable electronic bearing lines (EBL), variable and fixed range markers (VRM), and other symbols required for navigation purposes and specified in Appendix 3[①].

10.3.8 It is to be possible to activate an alarm when the ship crosses a mariner-entered point, line or is within the boundary of a mariner-entered feature within a specified time or distance.

### 10.4 Position integration

10.4.1 The ship's position is to be derived from a continuous positioning system of an accuracy consistent with the requirements of safe navigation. Whenever possible, a second independent positioning source preferably of a different type is to be provided. In such cases, ECDIS operating in the RCDS mode is to be capable of identifying discrepancies between the two sources.

10.4.2 The ECDIS operating in the RCDS mode is to have means to display the position from at least two positioning methods, to identify which method is being used, and provide a means for the operator to select the method to be used. Secondary positioning methods could include dead reckoning.

10.4.3 ECDIS operating in the RCDS mode is to provide an alarm when the input from the position, heading or speed sources is lost. ECDIS operating in the RCDS mode is also to repeat, but only as an indication, any alarm or indication passed to it from position, heading or speed sources.

10.4.4 The RCDS is only to accept data from an electronic position-fixing system referenced to the WGS-84 or PE-90 geodetic datum. RCDS is to give an alarm if the positional data is not referenced to one of these datums. If the displayed RNC cannot be referenced to the WGS-84 or PE-90 datum, then a continuous indication is to be provided.

10.4.5 It is to be possible to adjust the displayed geographic position of the ship manually. This manual adjustment is to be noted alphanumerically on the screen, maintained until altered by the mariner, and automatically recorded.

10.4.6 ECDIS operating in the RCDS mode is to indicate discrepancies between the positions obtained by continuous positioning systems and positions obtained by manual observations.

10.4.7 ECDIS operating in the RCDS mode is to allow the user to manually align the SRNC with positional data. This can be necessary, for example, to compensate for local charting errors.

### 10.5 Object information

10.5.1 It is to be possible for the mariner to enter points, lines and areas which activate an automatic alarm. The display of these features is not to degrade the SRNC information and is to be clearly distinguishable from the SRNC information.

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① An "adequate number" of EBL and VRM implies at least one of each.

10.5.2 This is the mechanism used by the mariner to enable the RCDS to emulate the alarms and warnings automatically generated by ENC data in the ECDIS.

10.5.3 It is to be possible to enter the geographic coordinates of any position① and then display that position on demand. It is also to be possible to select any point (feature, symbol or position) on the display and read its geographical coordinates on demand.

### 10.6 LOP position fix

10.6.1 ECDIS operating in the RCDS mode is to provide the capability to enter and plot manually obtained bearing and distance lines of position (LOP), and calculate the resulting position of own ship. It is to be possible to use the resulting position as an origin for dead reckoning.

10.6.2 Position plots are to indicate the time the plot was accepted and, in the case of estimated position or dead-reckoned position plot (EP or DR), the type of plot. Indication of the source of data used for the position may be selectable, on or off, by the operator.

10.6.3 Data for accepted position plots and the associated LOPs are to be recorded in the voyage recording.

### 10.7 Voyage recording

10.7.1 ECDIS operating in the RCDS mode is to store and be able to reproduce certain minimum elements required to reconstruct the navigation and verify the official database used during the previous 12 hours. The following data are to be recorded at one-minute intervals:

(1) to ensure a record of own ship's past track: time, position, heading and speed; and

(2) to ensure a record of official data used: RNC source, edition, date, and update history.

10.7.2 In addition, ECDIS operating in the RCDS mode is to record the complete track for the entire voyage, with time marks at intervals not exceeding 4 hours. For the purposes of logging, the entire voyage is defined as a maximum period of three months.

10.7.3 It is not to be possible to manipulate or change the recorded information.

10.7.4 ECDIS operating in the RCDS mode is to have a capability to preserve the record of the previous 12 hours and of the voyage track.

## 11 Calculations and accuracy

11.1 The accuracy of all calculations performed by ECDIS operating in the RCDS mode is to be independent of the characteristics of the output device and is to be consistent with the SRNC accuracy and scale. The output device includes RCDS display, stored memory, and/or printout.

11.2 Bearings and distances drawn on the display, or those measured between features already drawn on the display are to have an accuracy no less than that afforded by the resolution of the display.

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① In this context, the selection of "any point" means the selection of a mariner-entered point, line or area boundary.

11.3 The system is to be capable of performing and presenting the results of at least the following calculations:

(1) true distance and azimuth between two geographical positions;

(2) geographic position from known position and distance/azimuth; and

(3) geodetic calculations such as spheroidal distance, rhumb line, and great circle.

11.4 RCDS is to be capable of performing transformations between a local datum and WGS 84 datum whenever the correction data is provided in the chart database.

**12 Connections with other equipment (interfaces)**

12.1 ECDIS operating in the RCDS mode is not to degrade the performance of any equipment providing sensor inputs. Nor is the connection of optional equipment to degrade the performance of ECDIS operating in the RCDS mode below this standard.

12.2 ECDIS is to be connected to the ship's position fixing system, to the gyro compass and to the speed and distance measuring device. For ships not fitted with a gyro compass, ECDIS is to be connected to a marine transmitting heading device.

12.3 ECDIS may provide a means to supply SRNC information to external equipment.

**13 Performance tests, malfunction alarms and indications**

13.1 ECDIS operating in the RCDS mode is to be provided with means for either automatically or manually carrying out on-board tests of major functions. In case of a failure, the test is to display information to indicate which module is at fault.

13.2 On-board tests of major functions include the integrity of sensor input. If there is any detectable reason why the information presented to the operator is invalid, adequate and clear warnings are to be given to the operator.

13.3 ECDIS operating in the RCDS mode is to provide suitable alarm or indication of system malfunction.

**14 Backup arrangements for RCDS mode of operation**

14.1 Back-up arrangements for RCDS mode are the backup arrangements for ECDIS.

14.2 Adequate independent backup arrangements are to be provided to ensure safe navigation in case of an ECDIS failure:

(1) facilities enabling a safe takeover of the ECDIS functions are to be provided in order to ensure that an ECDIS failure does not result in a critical situation;

(2) a backup arrangement is to be provided facilitating means for safe navigation of the remaining part of the voyage in case of an ECDIS failure.

## 15 Power supply for RCDS mode of operation

15.1 The power supply for RCDS mode of operation is the power supply for ECDIS.

15.2 It is to be possible to operate ECDIS and all equipment necessary for its normal functioning when supplied by an emergency source of electrical power in accordance with the appropriate requirements of chapter II-1 of the 1974 SOLAS Convention as amended.

15.3 Changing from one source of power supply to another, or any interruption of the supply for a period of up to 45 s, is not to require the equipment to be manually re-initialized.

15.4 The equipment is not required to remain operational during this interruption of the power supply.

## 16 Requirements contained in IHO special publications

### 16.1 Structure of RNC data

16.1.1 This product specification does not define underlying raster data structures of a raster navigational chart. The national hydrographic office producing the raster navigational chart should select that data structure.

16.1.2 The arrangement of the image data and the meta-data into one or more digital files is to be determined by the national hydrographic offices originating the RNC.

16.1.3 The digital format of the image file is to be determined by the national hydrographic office producing the RNC.

16.1.4 The digital format of the meta-data is to be determined by the national hydrographic office originating the RNC.

16.1.5 For the purposes of these Guidelines, it is assumed that the range of different RNC formats or structures will be notified by the IHB. There are currently only two RNC formats or structures in use: HCRF (used by, for example UKHO ARCS and Australian HO Seafarer) and the USA BSB. The IHB has recommended that no other RNC formats be used.

### 16.2 RNC data resolution and accuracy

#### 16.2.1 **Resolution**

16.2.1.1 The resolution of the digital image (pixels-per-inch) and any method used to compress or process that image file is to be sufficient to display clearly all information that was contained on the original paper nautical chart. In particular, methods such as antialiasing are to be employed to achieve maximum contrast and fidelity of displayed chart information compared to the printed chart.

#### 16.2.2 **Accuracy**

16.2.2.1 The accuracy of the digital image file, as measured by the ability to determine the correct geographic coordinates of an individual pixel when the image file is used together with the RNC meta-data, is to allow a ship’s position to be displayed at least as accurately as when using the original paper chart.

### 16.3 RNC meta-data

16.3.1 Where an image file contains more than one discrete chart image, for example chart insets, in addition to the main panel of the chart the meta-data are to be included for each such discrete chart image.

### 16.4 RNC colours

16.4.1 Colours used for daytime viewing are to be those used on the paper versions of the same charts.

16.4.2 Colours for dusk and nighttime are to follow as closely as practicable the Colours and Symbols Standards specified in IHO Special Publication S-52, Appendix 2.

16.4.3 Colour palettes for daytime, dusk and nighttime are specified in the RNC meta-data by the issuing HO.

### 16.5 RNC notes, diagrams, etc

16.5.1 Sufficient information (should be included) which will allow each note, diagram, item of marginalia or other chart subarea of special interest to be found and displayed clearly, simply and quickly even though that subarea may not be located on the portion of the chart currently being displayed.

16.5.2 Sufficient information (should be included) to allow any source diagram, which provides information about data quality, to be displayed clearly, simply and quickly even though the source diagram may not be located on the portion of the chart currently being displayed.

16.5.3 It is sufficient to provide an index or listing of notes, etc. applicable to the RNC.

## 17 Methods of testing and required test results①

### 17.1 Preparation

#### 17.1.1 Required test items

For the purposes of these tests, the following items are to be used:

(1) test RNCs are specified by the HO providing the RNC service or on whose behalf the RNC service is provided;

(2) the test RNC must give examples of the full range of colours used on the source paper charts of the HO providing the RNC service or on whose behalf the RNC service is provided;

(3) RNCs are currently provided using either the HCRF format or the BSB format. Equipment testing can relate to the HCRF format, the BSB format or both formats. Type approval will only be valid for the format or formats tested.

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① The listed tests and required test results which are specific to the RCDS mode of operation. These are additional to the general ECDIS and ENC specific tests and test results contained in Chapter 6.

## 17.2 Initial data tests

17.2.1 **RNC**

17.2.1.1 Load a test RNC and ensure that:

(1) the RCDS mode indication is displayed;

(2) the edition number and date of the RNC is displayed in the chart library;

(3) verify that a graphical index of RNC data available can be presented upon request and provide access to the edition and date of the RNCs available;

(4) load an additional RNC and ensure that the chart coverage has changed and that the chart library is updated;

(5) remove an RNC and ensure that the chart coverage has changed and that the chart library is updated;

(6) switch to ECDIS mode and observe that the RCDS mode indication is no longer displayed.

17.2.1.2 A part of the intended voyage is covered by ENC when ENC of appropriate scale for safe route planning and route monitoring is available. Thus, for example, an area covered by ENCs of scale 1:200 000 or smaller would be considered “not covered by ENC” if a scale of 1:40 000 is required for safe navigation.

17.2.2 **Datum**

17.2.2.1 Enter the geographic coordinate of a position, and display that position. Select a point, which may be a charted symbol or a position and display its geographic coordinates. When the RNC is based on a local geodetic datum, the system must give an indication of whether that position is displayed with respect to the local geodetic datum or WGS-84 (PE-90) where the shift between the two datums is contained in the RNC.

17.2.2.2 Select a note or diagram contained in the RNC which does not appear on the portion of the RNC currently being displayed. Ensure that the note or diagram can be displayed simply and quickly. If this requirement is met by displaying the area of the chart which contains the note or diagram, ensure that it is possible to return to the original area simply and quickly.

17.2.2.3 Load an RNC for which the shift between geodetic datum and WGS-84 or PE-90 is specified in the RNC meta-data as “shift not known” and ensure that an indication is provided.

## 17.3 Accuracy

17.3.1 The test is to verify:

(1) the accuracy of EUT calculations consistent with SRNC;

(2) the measurement accuracy consistent with display resolution.

17.3.2 Perform the measurements provided for in the RNC test data set and confirm that they meet the required accuracy. Check that the system can perform the following calculations:

(1) transformation between a local datum and WGS-84;

(2) true distance and azimuth between two geographical positions;

(3) geographic position from known position and distance/azimuth;

(4) rhumb line and great circle.

17.3.3 Calculate and display both a rhumb line and a great circle line and verify that no visible distortion exists between these lines and the chart data according to test scenario 1 in Appendix 6 of these Guidelines.

17.3.4 This test is to be carried out using the scale supported by the data, i.e. not overscaled.

**17.4 Visual requirements**

17.4.1 **Visual display**

17.4.1.1 Check that the image is a faithful representation of the paper chart provided by the HO with the RNC test data set.

17.4.1.2 Check that the symbols for the navigational elements conform to IEC 62288.

17.4.1.3 Perform zoom-in and zoom-out operations in each mode and check that the symbols for the navigational elements do not decrease in size.

17.4.1.3 Check that it is possible to display own ship in true scale or as a symbol.

17.4.2 **Units and legends**

17.4.2.1 Check that the following elements can be determined easily and rapidly:

(1) RNC number;

(2) chart identifier (for example chart number) if different from RNC number;

(3) units for depth;

(4) units for height;

(5) RNC scale;

(6) scale of display;

(7) source data diagram (if available);

(8) sounding/vertical datum;

(9) horizontal datum;

(10) magnetic variation;

(11) date and number of last update affecting the RNC currently in use;

(12) edition number and date of issue of the RNC;

(13) chart projection;

(14) indication of north.

17.4.3 **Colour tables**

17.4.3.1 Verify that the colour palettes for daytime, dusk and nighttime viewing, and which are specified in the RNC meta-data, can be used.

17.4.3.2 Verify that the implementation complies with IEC 62288.

17.4.4 **Display characteristics**

17.4.4.1 Measure the displayed chart area while in route monitoring mode and check that it is at least 270 mm by 270 mm.

17.4.4.2 Ensure that when displayed at the resolution specified in the RNC meta-data, information is clearly visible to more than one observer, in the conditions of light normally experienced on the bridge of the ship by day and by night.

17.4.4.3 Verify that in route monitoring mode any windows superimposed on the chart display area are removable or can be moved.

**17.5 Functional requirements**

(1) The following tests are to be performed both in route planning and route monitoring mode. The initial latitude/longitude position is to be that provided in the instruction manual for the specific RNC test data set. For all tests, confirm that there is no degradation in information content.

(2) Follow the manufacturer's instruction to reinitialize the EUT in RCDS mode of operation. Ensure that the initial latitude/longitude position is entered and a chart is displayed. Refer to the operator's manual supplied with the equipment and change the settings of the operator menus or manual controls provided. Turn off EUT and then turn EUT back on. Confirm that the manually selected settings are the same as they were before the EUT was turned off.

17.5.1 **Additional display functions**

17.5.1.1 Verify that it is easy to add to, or remove from the EUT display, information additional to the RNC data such as mariner's notes. Verify that such information is clearly distinguishable from the RNC data.

17.5.1.2 Verify that it is possible for the mariner to add and save mariner-entered points, lines and areas. Verify that it is possible to amend and delete mariner-entered points, lines and areas. Check that examples of those items like 10 lines, 25 text characters and two areas can be drawn at user defined locations. Check that all information added by the mariner is distinguishable. Check that one of the areas can be filled, as described in S-52, Appendix 2/2.3.1b. Check that all of these objects (symbols) can be added to the system and set up for cursor picking to give an explanatory note in the text display. Recall them from the system and check that they may be deleted.

17.5.1.3 If the manufacturer displays information, check that the presentation of the information conforms with the following:

(1) the caution (!) or information (i) symbol is used to call up a note on the alphanumeric display by cursor picking;

(2) simple lines, or areas without colour fill, are set up for cursor picking to give an explanatory note in the alphanumeric display. Colour fill is not to be used.

17.5.1.4 Verify that the mariner-entered or manufacturer's information can be displayed on charts of other scales which cover the same geographical area.

17.5.1.5 Remove all additional information. Verify that the EUT display is the same as the graphical representation of the RNC test data set.

17.5.1.6 Verify that the RCDS mode standard display can be restored by a single operator action.

17.5.2 **Scale and navigation purpose**

17.5.2.1 Select an RNC and display it at a greater resolution than that contained in the RNC meta-data and ensure that an indication is provided.

17.5.2.2 Select an RNC and display it at a lesser resolution than that contained in the RNC meta-data and ensure that an indication is provided.

17.5.2.3 Load two RNCs of different scale which include own ship's position. Select the smaller scale RNC and ensure that an indication is given that a larger scale RNC is available for the displayed area.

17.5.3 **Mode and orientation**

17.5.3.1 Select an RNC which is not orientated "north-up". Verify that it is possible to determine quickly and easily the north direction. Verify that it is displayed "chart up".

17.5.3.2 Select an RNC. Ensure that true motion is provided. Reset the display and check that the generation of the neighbouring area takes place automatically at a distance selected by the mariner.

17.5.3.3 Select an RNC. Check that it is possible to change manually the chart area and the position of own ship relative to the edge of the display.

17.5.4 **Points, lines and areas**

17.5.4.1 Enter the geographic coordinates of a position, and display that position.

17.5.4.2 Enter examples of mariner-defined points, lines and areas which are intended to trigger alarms and ensure that the alarms are triggered when the ship reaches the appropriate position.

17.5.5 **Navigation related functions**

17.5.5.1 Verify that at least one EBL and VRM is available. Ensure that all the other symbols required for navigation purposes and specified in Appendix 3 are available.

17.5.6 **Position integration**

17.5.6.1 Load an RNC for which the shift between geodetic datum and WGS-84 or PE-90 is specified in the RNC meta-data. Connect a continuous position system to the EUT and verify that the system compensates automatically for this shift when plotting positions on the RNC. Ensure that the reference datum (geodetic datum or WGS-84 (PE-90)) being used by the system is clearly indicated.

17.5.6.2 With a second, independent positioning method ensure that the EUT displays any difference in reported positions.

17.5.6.3 Remove the positioning input to the EUT and ensure that an alarm is given.

17.5.6.4 Simulate a message from the positioning device which indicates an error condition, and observe that the alarm or indication is repeated by the EUT as an indication.

17.5.6.5 Select a different geodetic datum between the positioning system and the SRNC, and ensure that an alarm is given.

17.5.6.6 Adjust the position manually. Observe that the amount of the correction is displayed on the screen and that the position changes accordingly. Recheck periodically to see it remains unchanged.

17.5.6.7 Verify that the manufacturer’s documentation includes guidance for implementing a common reference system.

17.5.7 **Radar, radar tracks, and AIS information**

17.5.7.1 Where the capability for displaying radar information and/or AIS information is provided, in addition to the requirements of IEC 62288 for radar displays and presentation of target information, perform the following:

(1) observe the display without radar and AIS information, switch on the radar image overlay, the radar tracked target information and the AIS information, as available, and ensure that the SENC information is not degraded, and is clearly distinguished;

(2) observe the display without radar and AIS information, then switch on the radar image overlay, the radar tracked target information and the AIS information, as available, and ensure that these match in scale, orientation, projection and accuracy, within the ranges defined in IEC 62388. Check that a change of scale of the radar, if it is a separate unit, does not affect the radar image overlay of the EUT in scale, orientation, projection and accuracy;

(3) ensure that the radar image overlay, tracked target information, AIS information and other added navigational information may be removed by single operator action;

(4) set EUT to accept and display transferred radar tracked target and AIS information, as available. Set the simulator to the equivalent of stabilized, north-up mode and to 12-mile range. Check that the target and AIS information is being accepted and displayed correctly;

(5) vary the radar antenna offset and confirm that the position of radar image overlay and the radar tracked targets, as available, on the EUT changes accordingly.

17.5.7.2 For this test, a radar target in a fixed position is to be simulated.

17.5.8 **Loading of corrupted data**

The following checks are to be carried out:

(1) load an example of corrupted RNC test data. Verify that the EUT provides the appropriate warning;

(2) load the RNC test data set. Enter an example of corrupted update. Verify that EUT reception process is terminated and the update is flagged as invalid. Verify that the user is informed of the corruption.

17.5.9 **Automatic updates**

17.5.9.1 Receipt – installation and application

The following checks are to be carried out:

(1) verify that the system can receive updates via CDROM and from any other interface or data storage media that are provided with the ECDIS for that purpose;

(2) apply the test update number 1 to the relevant RNC;

(3) identify the issuing authority of the update. Check that this conforms with the corresponding identifier of the RNC;

(4) attempt to load an improperly sequenced update; check that the update is rejected and that a warning is given to the user;

(5) attempt to load an update related to a newer edition of the RNC; check that the update is rejected and the user is informed that a newer edition is available;

(6) attempt to load an update related to an older edition of the RNC; check that the update is rejected and the user is informed that the update belongs to a previous edition.

17.5.9.2 Display – show and verify

The following checks are to be carried out:

(1) ensure that the edition date/update number is displayed on request;

(2) ensure that the contents of the updates have been included in the SRNC, by displaying the SRNC contents and highlighting updates or by some other means allowing the mariner to verify that the updates have been included in the SRNC;

(3) ensure that official RNC updates can be distinguished from local updates;

(4) verify that, once accepted, integrated updates are indistinguishable from RNC data.

An update is to be applied to the SRNC, displayed, and then manually annotated as rejected by the mariner, i.e. it is not to be possible for the mariner to reject an officially issued update by omitting its application entirely.

17.5.9.3 Records

Tests are to be applied in all EUT operating modes, i.e. route planning and route monitoring.

Verify that the following summary report information is available for each RNC:

(1) RNC number and chart identifier if different from RNC;

(2) RNC edition date;

(3) list of corrections applied subsequent to the edition date;

(4) updates and update numbers;

(5) date and time of their application/rejection; and

(6) any anomalies encountered during application.

17.5.10 **Manual updates**

Using the RNC test data set, check that the following manual update procedures may be carried out and that the update is distinguishable from RNC data:

(1) add a new point and restricted area features, locating them at selected positions;

(2) annotate an existing feature as being deleted;

(3) check to see that any update text information relevant to the new condition and to the source of the update and entered by the mariner is recorded by the system. Verify that this update can be re-displayed on demand;

(4) verify that EUT is capable of sensing indications and alarms related to the SENC data from manual updates;

(5) verify that manual updates are distinguishable from RNC data;

(6) verify that any manual updates removed from the display are retained and can be displayed in a future review.

17.5.11 **Self-tests of major functions**

17.5.11.1 Perform tests of the major functions which are supported by the EUT. Verify that the EUT provides appropriate display information and indications.

17.5.11.2 Simulate the following sensor malfunctions (including for radar if provided for):

(1) interruption of sensor input (loss of signal);

(2) invalid sensor information (status);

(3) physical breakdown of sensor connection.

17.5.11.3 Verify that the system provides suitable alarms or indication of system malfunction arising from failures.

17.5.12 **LOP position fix**

(1) Manually enter bearing data for one LOP and distance data for a second LOP. Confirm by observation that a means or method is provided to manually enter bearing and distance data for lines-of-position (LOP) and that this data is time-stamped when it is entered.

(2) Confirm by observation that LOP data (range or bearing, time, source) can be presented both alphanumerically and graphically.

(3) Confirm by analytical evaluation that an estimated position (EP) based on two LOPs selected by the operator is provided.

(4) Enter data for a third LOP, 6 min later. Confirm by analytical evaluation that a means or method is provided to transfer LOPs observed at different times to the time of the most recent LOP, extrapolated forward in time using present heading and speed.

(5) Confirm by analytical evaluation that a position fix based on three or more LOPs selected by the operator is provided.

(6) Confirm by observation that, when a position fix is accepted by the operator, the plotted position is indicated graphically on the display. Confirm by observation that position plots indicate the time, source of data used and the type of plot, in the case of estimated position or dead-reckoned position plot (EP or DR) and comply with IEC 62288 for the presentation of colours and symbols.

(7) Confirm by inspection of recorded data that the position fix data and the associated LOP data (range or bearing, time, source, and any time transfer applied) were automatically recorded and can be reproduced from the data log.

(8) Verify that the graphic symbols for LOP bearing and LOP distance comply with IEC 62288.

(9) Verify that that the graphic symbols for position plots comply with IEC 62288.

(10) Confirm by analytical evaluation that a means or method is provided to use the resulting position as a position update during dead-reckoning operation.

(11) Confirm by inspection that the operator's manual supplied with the equipment includes guidance on use of LOPs for calculation of position fixes.

## 17.6 Operational requirements

17.6.1 **Ergonomic principles**

The EUT is to follow the ergonomic principles in MSC/Circ.982 taking into account the guidance given in IEC 62288.

17.6.2 **Route planning**

17.6.2.1 For the routes to be planned as described below, the following general guidelines apply:

(1) at least one leg is to come close enough to a mariner entered point that the automatic alarm would be initiated;

(2) at least one leg is to cross a mariner-entered linear feature;

(3) at least one leg is to cross the boundary of a mariner-entered area feature;

(4) at least one leg of the route is to be planned through an area of the RNC test data at a different scale. The adjoining RNC is to be loaded automatically when planning through the area;

(5) at least one leg of the route is to be planned through a chartlet area of the RNC test data set. The chartlet is to be loaded automatically when planning through the area;

(6) each leg chartlet is to be planned with an appropriate off-track limit (for example 100 m);

(7) course changes are to be made, both to starboard and port, between different legs of the route and are to vary from 5° up to 175°;

(8) the length of the legs is to vary from 0.5 nautical miles to at least 3 nautical miles with a total length of at least 25 nautical miles;

(9) planned speed is to vary between 5 knots and 15 knots;

(10) the planned route is to cross at least 3 RNCs. Where the appropriate RNC service or services supply RNCs based on different chart datums, the planned route is to include at least two different chart datums;

(11) the planned route is to enter an area where ENC data are available.

17.6.2.2 Observe that the displayed information for route planning, route monitoring and supplementary navigation tasks, such as pilotage or chart work is available.

17.6.2.3 Plan a route which uses at least 10 waypoints:

(1) test that the route can be planned using both straight and curved segments;

(2) save the planned route.

17.6.2.4 Retrieve the planned route and plan an alternative route as follows:

(1) add three waypoints;

(2) delete three waypoints;

(3) change position of two waypoints;

(4) change order of two waypoints;

(5) save the alternative route.

17.6.2.5 Plan complex tracks using scenarios 2 and 3 as noted in Appendix 6 and save the tracks. Check that track distances comply with those noted in Appendix 6 and that no distortions are visible.

17.6.2.6 Verify that there is an indication showing that the EUT is operating in the RCDS mode.

17.6.3 **Route monitoring**

17.6.3.1 For route monitoring, the following general guidelines apply:

(1) initialize simulator at the starting position for the planned route;

(2) select RNC and select the route;

(3) the route is to be planned through an area covered by the RNC test data set;

(4) carry out route monitoring using the selected routes and starting at the first waypoint of the route;

(5) at least one leg is to cross a mariner-entered linear feature;

(6) at least one leg is to cross a mariner-entered area feature;

(7) at least one leg is to come close enough to a mariner-entered point that the automatic alarm would be initiated;

(8) at least one leg is to enter an area where ENC data are available and an indication of "ENC data available" is to be triggered.

17.6.3.2 Operate the own ship position function, and observe that the display shows own ship's position.

17.6.3.3 Shortly before the ship enters an area for which an alarm based on a mariner-entered feature will be released, perform the following actions:

(1) display a sea area ahead of ship's position and outside present display (look ahead);

(2) verify that the appropriate alarms/indications are provided;

(3) return to own ship's position by a single operator action and verify that this takes no more than 5 s.

17.6.3.4 Verify that an alarm is released each time the ship is going to cross the boundary of a mariner-entered feature, within the time specified by the mariner.

17.6.3.5 Select an RNC of a smaller scale than that of 17.6.3.4 but covering the same area. Simulate crossing over the mariner-entered feature referred to in 17.6.3.4. Check that an alarm is generated by the EUT.

17.6.3.6 Using the RNC test data set:

(1) simulate own ship's movement from an area covered by one RNC into an adjoining area covered by another RNC. Ensure that each re-draw which occurs until the display is wholly within the different scale area is completed in less than 5 s;

(2) select the display of an area not currently displayed, at least 10 nautical miles from own ship position and which is covered by RNC data at a scale different from the one in use. Check that the old display is maintained from the start of the regeneration until the start of re-draw of the new display. An indication is to be given if the regeneration time is more than 5 s;

(3) simulate deviation from intended track and verify that the off-track alarm is released;

(4) verify that an alarm is released each time, within the time or distance specified, when a critical point has been reached by or is abeam of the ship;

(5) display the alternative route and ensure that it is clearly distinguishable from the selected route. Change to the alternative route and verify that this becomes the selected route;

(6) modify the selected route by adding a new waypoint;

(7) select an automatic time interval, within a range of 1 min to 120 min; simulate the ship's movement, and verify that the time labels are displayed. Ensure that time labels may also be entered manually;
(8) simulate own ship's movement from an area covered by an RNC into an area where ENC data are available. Ensure that the EUT indicates that the ENC data are available.

17.6.3.7 Verify that there is an indication showing that the EUT is operating in the RCDS mode.

17.6.3.8 Reload complex route of scenario 2 and start monitoring the route with the first waypoint. Confirm that all waypoint changes, bearings and distances are calculated and displayed correctly during route monitoring.

17.6.3.9 Reload complex route of scenario 3 and start monitoring the route with the first waypoint. Confirm that all waypoint changes, bearings and distances are calculated and displayed correctly during route monitoring.

17.6.4 **Twelve-hour log**

17.6.4.1 For voyage recording, a separate test route plan is to be made. The route plan is to be designed as a loop. It is to be possible for the simulator to carry out this test automatically.

17.6.4.2 Continue to run the test for 12 h. During this period, attempts should be made to manually edit the log. This is not to be possible. At the end of the twelve-hour period, the EUT log is then to be analyzed according to the procedures in the operating manual and the results are to comply with the test carried out.

17.6.4.3 Ensure that the record for the previous 12 h including all the items defined in 10.7 of this Appendix is stored and available on demand. Check that chart data according to 10.7 of this Appendix are stored initially and for each change.

17.6.5 **Voyage record**

17.6.5.1 Verify that the EUT records the track for the entire voyage, with time marks at intervals not exceeding 4 h, including the items listed in 10.7 of this Appendix.

17.6.5.2 Ensure that the record for the previous 12 h and the voyage track, once recorded, can be preserved, and that it is not possible to manipulate or change the recorded information.

## 18 RNC test data set

The latest versions of the RNC test data sets are available from the International Hydrographic Bureau at http://www.iho.shom.fr.

**Alarms and Indicators in the RCDS Mode of Operation Table 1**

| Paragraph | Information | Requirement |
|---|---|---|
| 10.3 | Deviation from route | Alarm |
| 10.4 | Position system failure | Alarm |
| 10.3 | Approach to critical point | Alarm |
| 10.4 | Different geodetic datum | Alarm or indication |
| 10.3 | Approach to mariner entered feature, for example area, line | Alarm |
| 13 | Malfunction of ECDIS operating in the RCDS mode | Alarm or indication |
| 3 | ECDIS operating in the RCDS mode | Indication |
| 5 | Larger scale information available, underscale or overscale | Indication |
| 5 | Larger scale RNC available for the area of the ship | Indication |

In these Guidelines the definitions of indicators and alarms provided in IMO resolution A.1021(26) apply.

Alarm: An alarm or alarm system which announces by audible means, or audible and visual means, a condition requiring attention.

Indicator: Visual indication giving information about the condition of a system or equipment.

## Appendix 3 Navigational Elements and Parameters

1 Own ship①

1.1 Past track with time marks for primary track

1.2 Past track with time marks for secondary track

2 Vector for course and speed made good

3 Variable range marker and/or electronic bearing line

4 Cursor

5 Event

5.1 Dead reckoning position and time (DR)

5.2 Estimated position and time (EP)

6 Fix and time

7 Position line and time

8 Transferred position line and time

8.1 Predicted tidal stream or current vector with effective time and strength

8.2 Measured tidal stream or current vector with effective time and strength

9 Danger highlight

10 Clearing line

11 Planned course and speed to make good

12 Waypoint

13 Distance to run

14 Planned position with date and time

15 Visual limits of lights arc to show rising/dipping range

16 Position and time of "wheel over"

① Elements 1.1 and 1.2 refer to the tracks from primary and secondary positioning methods.

## Appendix 4 Areas for which Special Conditions Exist

The following are the areas which ECDIS is to detect and provide an alarm or indication under 2.2.2.5 and 2.2.3.4, Chapter 2 of these Guidelines.

(1) Traffic separation zone

(2) Inshore traffic zone

(3) Restricted area

(4) Caution area

(5) Offshore production area

(6) Areas to be avoided

(7) User defined areas to be avoided

(8) Military practice area

(9) Seaplane landing area

(10) Submarine transit lane

(11) Anchorage area

(12) Marine farm/aquaculture

(13) PSSA (Particularly Sensitive Sea Area)

# Appendix 5 ENC Test Data Set

## 1 General requirements

1.1 This data set is necessary to accomplish all ECDIS testing requirements which are specified in these Guidelines. The data are to be encoded according to the IHO ENC product specification included in S-57. The data are to be provided, in an unencrypted form on CD-ROM.

1.2 The test data set is to include:

(1) data subset A for testing the ENC;

(2) data subset B for testing automatic updating; and

(3) data subset C for testing manual updating.

1.3 In addition to these data sets the following are to be provided:

(1) an instruction manual;

(2) a set of graphical representations; and

(3) a read-me file which is to include this specification together with an index to the data contents.

1.4 References to other IHO publications are to the latest editions of S-52 and its appendices 1 and 2.

1.5 The latest version of the ENC test data set is available from the International Hydrographic Bureau at http://www.iho.shom.fr.

## 2 Data subset A – ENC

### 2.1 Complex area

2.1.1 This data set is to cover a complex area representing a complicated navigational scenario.

2.1.2 The contents are to include:

(1) at least four, large-scale cells (>1:80 000) providing continuous coverage;

(2) an area containing no data;

(3) examples of features named in both English and another language;

(4) examples of features from each of the priority layers defined in 2.3.2a of S-52 and 2.3.2 of Appendix 2 of S-52;

(5) examples of features making use of SCAMIN;

(6) examples of features making use of INFORM, TXTDSC and PICREP;

(7) an example of an object, attribute and attribute value not valid for ENC purposes;

(8) at least two scale-area meta objects;

(9) an example of corrupted data;

(10) an example of a feature which is depicted as an area with an associated area-centred symbol;

(11) an example of objects;

(12) an example of "unofficial" data (i.e. data whose source identification indicates that the data is non-HO). This data should be in a datum other than WGS-84. Part of the "unofficial" data is to be superimposed on HO produced ENC data; and

(13) an example of NEWOBJ (a generic object to be used only to support new IMO requirements).

**2.2 Small-scale data**

The data set is to include equivalent data for the next smaller scale navigational purpose for the area specified in 2.1. The data set is to be at a scale of < 1:80 000 and is to include an area sufficient to cover a route of 25 nautical miles. It is also to include an area situated at least 10 nautical miles from the centre of the specified area.

**2.3 Data content**

The content of the data set is to support the use of display base, standard display and all other information as specified in 4.1 of Chapter 4.

**2.4 Alarms and indications**

The data set is to include:

(1) the 0 m, 10 m, 20 m, 30 m and 40 m depth contours in one cell and the 0 m, 10 m, 25 m, 30 m and 40 m depth contours in an adjacent cell;

(2) a range of spot soundings, including a 5 m and 15 m sounding; and

(3) examples of all features which trigger alarms or indications as listed in Appendix 1.

**2.5 Alarms and indications: large-scale data**

Where the large-scale data (2.1) and the smaller scale data (2.2) overlap, the large-scale data set is to be more geometrically complex than the smaller scale data for features which trigger alarms and indications.

**2.6 Mathematical calculations**

A separate text document is to be provided containing a selection of positions, distances, bearings, etc. relating to the data set and which supports examples of all the navigational calculations listed in 7.1 of S-52.

### 2.7 Graphical representations

Graphical representations of the data set are to be provided to the requisite accuracy and resolution for

(1) base display;

(2) standard display;

(3) all other information;

(4) small-scale representation of data for area 2.1 to demonstrate the use of the SCAMIN attribute; and

(5) small-scale data for area 2.2.

## 3 Data subset B – Automatic updating

### 3.1 Update data: contents

The data set is to include:

(1) multiple individual updates, certain of which are to affect topology;

(2) an update with an invalid producing agency identifier;

(3) an update referring to a superseded edition of a cell;

(4) an update which comes into effect at a future date;

(5) data which falls outside the area of data subset A;

(6) an example of corrupted data;

(7) a separate text document containing the required contents of the summary report and an application report described in 3.4.2(f) of Appendix 1 of S-52; and

(8) an example of a cell-cancellation update.

### 3.2 Update data: sequence

The data set is to include a sequence of update, for example 1, 2, 3, 4 and 5, where 3 and 4 are logically linked but two versions of 3 are provided, one which makes 4 invalid, the other being compatible with 4.

# 4 Data subset C – Manual updating

## 4.1 Update data: contents

A text document is to contain information for manual updating.

## 4.2 Update data: alarms and warnings

The text is to include reference to part of the contents of data subset C, including items which trigger alarms and warnings.

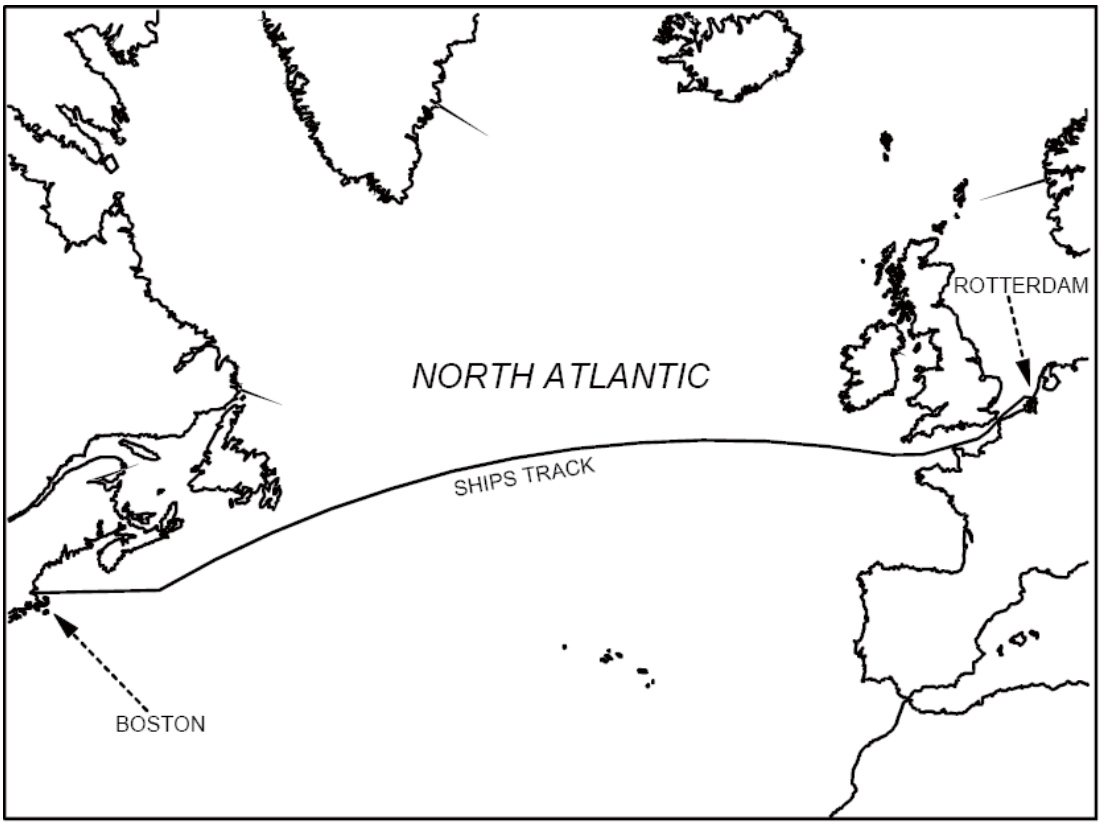
# Appendix 6 Scenario Definitions and Plots[①]

## 1 Scenario 1:

Rhumb Line/Great Circle Atlantic Track (Boston to Rotterdam) with ship class B (200 m/20 knots)

| **Waypoint No.** | **Latitude** | **Longitude** | **Track** (degrees) | **Distance** (NM) | **Radius** (NM) | **Rate of turn** (degrees/min) |
|---|---|---|---|---|---|---|
| 001 | 42°20.639' N | 071°00.786' W | 132 | 0.7 | | |
| 002 | 42°20.090' N | 070°59.864' W | 112 | 0.4 | 0.5 | 38 |
| 003 | 42°19.940' N | 070°59.465' W | 087 | 1.5 | 0.5 | 38 |
| 004 | 42°20.015' N | 070°57.525' W | 063 | 0.9 | 0.5 | 38 |
| 005 | 42°20.429' N | 070°56.397' W | 026 | 1.8 | 0.5 | 38 |
| 006 | 42°22.011' N | 070°55.325' W | 065 | 1 | 0.5 | 38 |
| 007 | 42°22.380' N | 070°54.210' W | 079 | 4.9 | 0.5 | 38 |
| 008 | 42°23.275' N | 070°47.663' W | 065 | 9.5 | 1.0 | 19 |
| 009 | 42°27.287' N | 070°35.953' W | 088 | 127 | 1.0 | 19 |
| 010 | 42°31.223' N | 067°44.616' W | 085 | 273 | 1.0 | 19 |
| 011 | 42°53.045' N | 061°34.463' W | 065 | 203 | 1.0 | 19 |
| 012 | 44°17.923' N | 057°20.346' W | 067 | 3.8 | 1.0 | 19 |
| 013 | 46°17.898' N | 050°37.294' W | 067 | 1767 | 1.0 | 19 |
| Great circle approximation | 48°46.606' N | 40°00' W | 075 | | | |
| | 50°04.574' N | 30°00' W | 082 | | | |
| | 50°28.684' N | 20°00' W | 090 | | | |
| | 50°00935' N | 10°00' W | 098 | | | |
| 014 | 49°38.074' N | 006°25.031' W | 084 | 148 | 1.0 | 19 |
| 015 | 49°52.252' N | 002°37.903' W | 074 | 144 | 1.0 | 19 |
| 016 | 50°30.788' N | 000°59.106' E | 049 | 18.3 | 1.0 | 19 |
| 017 | 50°42.637' N | 001°21.152' E | 016 | 13.1 | 1.0 | 19 |
| 018 | 50°55.140' N | 001°26.929' E | 038 | 19.8 | 1.0 | 19 |
| 019 | 51°10.551' N | 001°46.146' E | 041 | 15.7 | 1.0 | 19 |
| 020 | 51°22.252' N | 002°02.706' E | 041 | 46.4 | 1.0 | 19 |
| 021 | 51°57.145' N | 002°52.725' E | 084 | 13.5 | 1.0 | 19 |
| 022 | 51°58.304' N | 003°13.980' E | 082 | 24.6 | 1.0 | 19 |
| 023 | 51°01.567' N | 003°53.769' E | 112 | 7.5 | 1.0 | 19 |
| 024 | 51°58.858' N | 004°04.605' E | | | | |

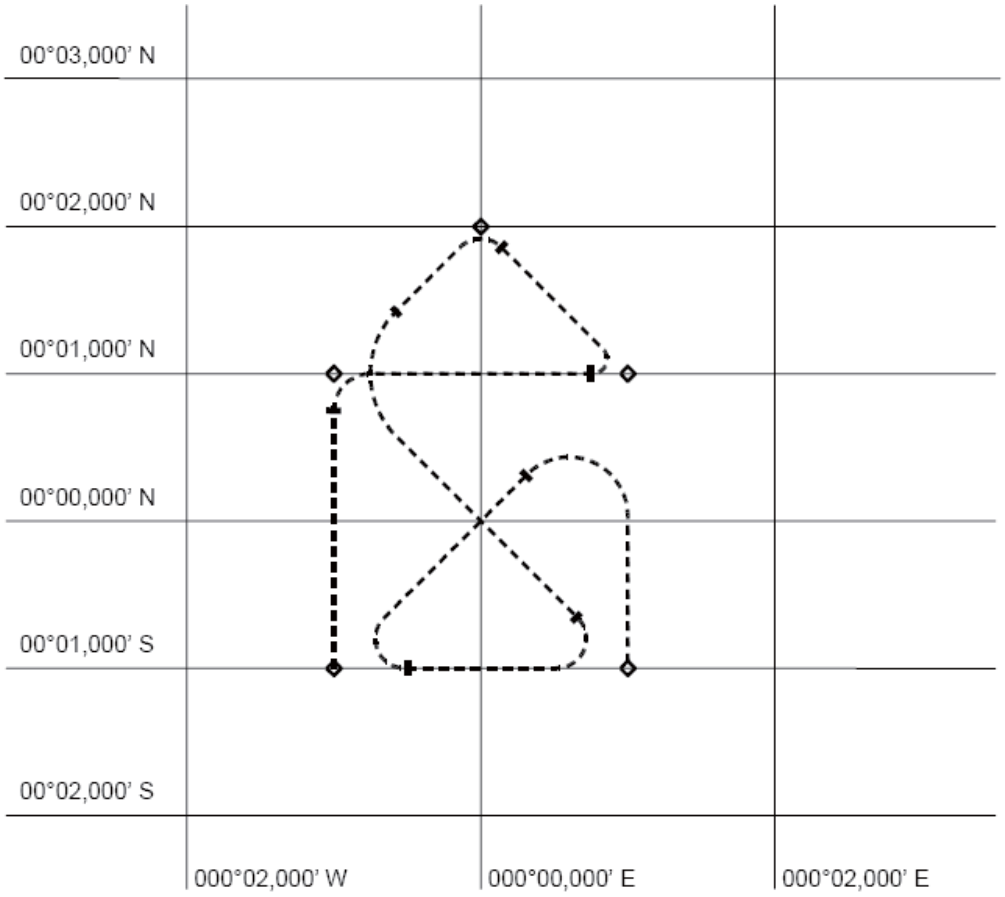
① These calculations assume an ellipsoid which agrees with WGS 84. Distances are measured along the track including the radius of the turn, from wheel-over point.




## 2 Scenario 2:

Complex track at 0/0 with ship class A (50 m/20 knots)

| **Waypoint No.** | **Latitude** | **Longitude** | **Track** (degrees) | **Distance** (NM) | **Radius** (NM) | **Rate of turn** (degrees/min) |
|---|---|---|---|---|---|---|
| 001 | 00°01.000' S | 000°01.000' W | 000.0 | 1.7 | | |
| 002 | 00°01.000' N | 000°01.000' W | 090.0 | 1.9 | 0.25 | 76 |
| 003 | 00°01.000' N | 000°01.000' E | 315.0 | 1.2 | 0.10 | 191 |
| 004 | 00°02.000' N | 000°00.000' E | 225.0 | 0.9 | 0.20 | 95 |
| 005 | 00°01.000' N | 000°01.000' W | 135.0 | 2.7 | 0.60 | 32 |
| 006 | 00°01.000' S | 000°01.000' E | 270.0 | 1.4 | 0.20 | 95 |
| 007 | 00°01.000' S | 000°01.000' W | 045.0 | 1.9 | 0.25 | 76 |
| 008 | 00°01.000' N | 000°01.000' E | 180.0 | 2.0 | 0.40 | 48 |
| 009 | 00°01.000' S | 000°01.000' E | | | | |

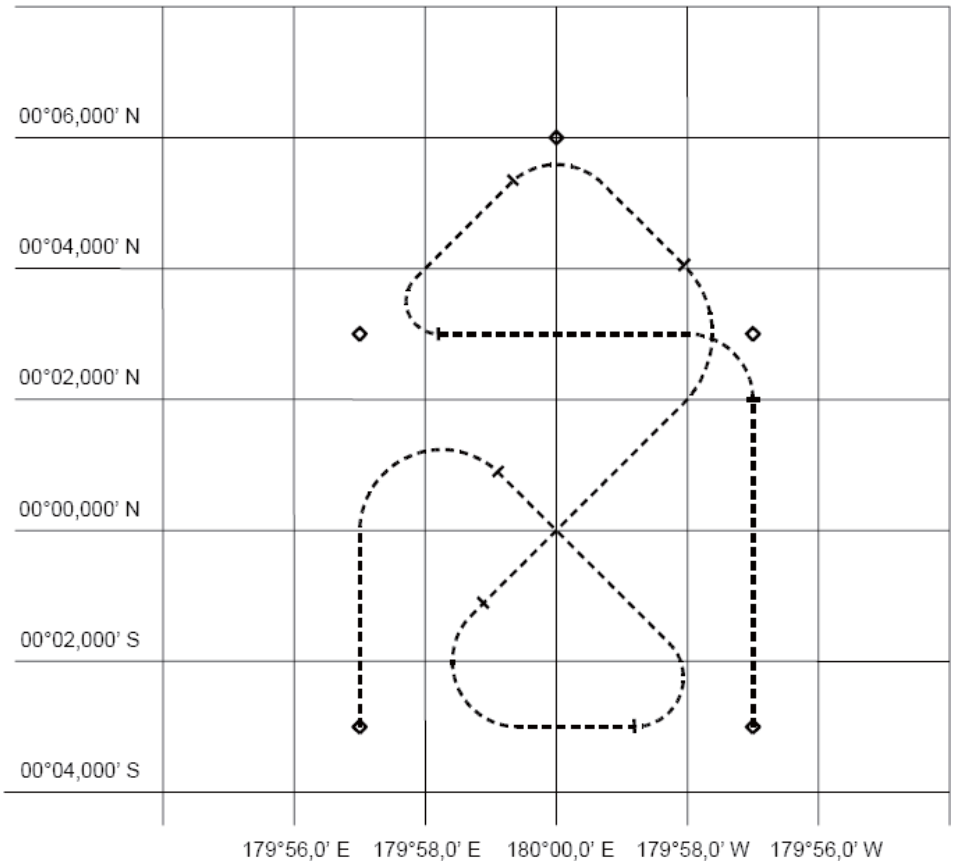



IEC 2185/01

## 3 Scenario 3:

Complex track at 0/180 with ship class C (300 m/10 knots)

| **Waypoint No.** | **Latitude** | **Longitude** | **Track** (degrees) | **Distance** (NM) | **Radius** (NM) | **Rate of turn** (degrees/min) |
|---|---|---|---|---|---|---|
| 001 | 00°03.000' S | 179°57.000' W | 000.0 | 5.0 | | |
| 002 | 00°03.000' N | 179°57.000' W | 027.0 | 5.4 | 1.00 | 10 |
| 003 | 00°03.000' N | 179°57.000' E | 045.0 | 3.2 | 0.50 | 19 |
| 004 | 00°06.000' N | 180°00.000' W | 135.0 | 3.3 | 1.00 | 10 |
| 005 | 00°03.000' N | 179°57.000' W | 225.0 | 6.9 | 1.50 | 6 |
| 006 | 00°03.000' S | 179°57.000' E | 090.0 | 4.1 | 1.0 | 10 |
| 007 | 00°03.000' S | 179°57.000' W | 315.0 | 5.4 | 0.75 | 13 |
| 008 | 00°03.000' N | 179°57.000' E | 180.0 | 5.9 | 1.25 | 8 |
| 009 | 00°03.000' S | 179°57.000' E | | | | |


00°06,000' N
00°04,000' N
00°02,000' N
00°00,000' N
00°02,000' S
00°04,000' S
179°56,0' E
179°58,0' E
180°00,0' E
179°58,0' W
179°56,0' W

# Appendix 7 Test Requirements for Encrypted ENC

## 1 IHO S-63 encrypted ENC data, test methods

1.1 This is a check to confirm the ECDIS is able to import ENC base and update data encrypted in accordance with the IHO S-63 Data Protection Scheme (Edition 1.1) into the ECDIS SENC. There is a further check that the ECDIS can manage the import of ENCs from multiple data providers, i.e. ENCs supplied from different suppliers using their own encryption keys and digital signatures.

1.2 There are several elements fundamental to the S-63 as follows:

(1) licensing, the ability of an ECDIS to install and manage ENC decryption keys, called ENC permits;

(2) authentication of the data provider via a root certificate installed onto the ECDIS;

(3) import and management of encrypted ENCs in a multiple data provider environment;

(4) the ECDIS error/warning messages defined within S-63.

The expected results to all the checks listed below are described in detail in the IHO S-63 Data Protection Scheme and outlined below.

## 2 ENC cell permit loading

2.1 The ENC cell permits are contained in a file named PERMIT.TXT. The purpose, content and format are described in detail in section 4 of S-63.

(1) Check how the system responds when a permit file is installed with no permits listed. Confirm the appropriate “Security Scheme Error (SSE)” 11 message is returned.

(2) Check how the system responds when a permit file with incorrectly formatted permits are installed. Confirm the appropriate warning SSE 12 is displayed and the process is terminated.

(3) Check how the system responds when a corrupted permit is loaded. Confirm that a CRC warning message (SSE 13 - CRC error) is returned and the process is terminated.

(4) Check how the system responds to a valid set of permits with less than 30 days until it expires. Confirm the appropriate SSE 20 warning message is returned and the process is allowed to continue.

(5) Check how the system responds to permits that have expired. Confirm that the appropriate SSE 15 message is displayed and the process terminates.

(6) Check that the ECDIS can install valid permit files from two independent sources. Confirm they are stored separately and that data from each source is available to the user without errors or warnings.

(7) Check that the system will install valid permits with an expiry date in excess of 30 days. Confirm these are installed correctly and an appropriate results dialog is displayed with the status of the installed permits.

(8) Check that the system can remove previously installed permits selectively, i.e. by provider. Confirm successful removal of a specified permit file.

**3 Authentication**

ENC authentication of an encrypted exchange set validates the source of an ENC data server providing ENCs and operating under a bona fide scheme administered by the IHO. The IHO provides a root certificate for installation on ECDIS independently of data and acting as a certification authority for all registered data providers.

**4 Installation of root (IHO) certificate**

(1) Check that the system can install and report the installed certificate. Confirm the user is informed that the certificate has been installed correctly.

(2) Check how the system responds if no certificate is found in the ECDIS. Confirm that the appropriate SSE 05 message is returned and the import process terminated.

(3) Check to see how the system responds when an installed certificate has expired. Confirm that the appropriate SSE 22 message is returned and the import process is terminated.

(4) Check how the system responds if the public key of the installed certificate is incorrectly formatted. Confirm that the appropriate SSE 02 message is returned and the process terminated.

(5) Check that the system is able to load a valid certificate with both positive and negative parameters. Confirm that the system can import both and authenticate against either parameter.

(6) Check that the system has the functionality that enables users to update the installed certificate. Confirm there is functionality within the GUI that allows the user to import a newly issued certificate.

**5 ENC cell digital signature authentication**

(1) Check that ENC data signatures are correctly authenticated, when loading ENC data and that it is reported correctly. Confirm the appropriate SSE 09 message is returned and the process terminates for that cell.

(2) Check that the ECDIS can correctly manage invalid signature file formats, when loading data and that is reported correctly. Confirm that the appropriate SSE 08 message is returned and the process terminates for that cell.

(3) Check that (1) and (2) above authenticate each cell individually. Check the system allows further authentication, at (1) and (2) above, of subsequent cells and does not permanently halt at a failure.

(4) Check that an invalid data provider’s IHO certificate is correctly reported. Confirm that the appropriate SSE 06 message is returned when authenticated against the corresponding signature in the ENC signature file.

(5) Check that a data set containing aggregated data, that is, data with signatures from multiple data providers, correctly installs. Confirm all cells and any updates import without error.

## 6 Uncompress and decrypt ENC base and update files

6.1 Once the ENC permits have been installed and the exchange set authenticated against the certificate installed in the ECDIS, the ENCs are available for decryption. The following checks are to be carried out to ensure that the ECDIS performs this process correctly.

(1) Check how the system responds when new ENCs are imported after valid, previously installed, ENC permits have expired. Confirm that the appropriate SSE 15 message is displayed and the process terminated.

(2) Repeat the test at (1) when the permits have less than 30 days until expiry. Confirm the appropriate SSE 20 message is displayed but the process is allowed to continue.

(3) Check how the system responds when the encrypted cell keys contained in the cell permit are not compatible with the keys used to encrypt the ENC. Confirm the appropriate SSE 21 message is displayed.

(4) Check that the system does not terminate under the conditions at (3) above and continues to check each ENC permit for a valid cell key. Confirm on a cell by cell basis to ensure that the process is not permanently halted for a single failure. Confirm the ECDIS reports the number of successful and unsuccessful imports.

(5) Check how the system responds when an encrypted exchange set is imported against a valid set of permits (cell keys). Confirm the ECDIS reports the number of successful imports.

(6) Check how the system responds to a corrupted ENC file following the successful decryption of the cell. Confirm that the appropriate SSE 16 is returned and the import is terminated.

## 7 ENC data management

7.1 The S-63 scheme is provided so that it is possible to operate it in a multiple data server environment. The test data simulates this by providing data sets issued by two data providers.

(1) Check that it is possible for the system to import data from one provider and then to load data from a second. Confirm that the data from multiple providers are managed correctly in line with section 6 of S-63. That is, data are managed individually based on the producer, for example the correct permits are accessed in order to decrypt the exchange set provided by the same provider.

(2) Check that pre-existing subscriptions are not overwritten by new data sets. Confirm that any data already stored on the system is unaffected by any new imports.

(3) Check that ENCs existing within both subscriptions do not cause corruption across service providers. Confirm that both providers' information is managed independently without conflict.

## 8 Exchange set media

8.1 The S-63 scheme is based on the concept of hard media exchange of ENC data. As the number of ENCs grows, DVD support within ECDIS hardware is expected. S-63 defines two methods of storing ENC data on DVD, either a single large exchange set or multiple exchange sets.

(1) Check that the system is capable of importing a single exchange set from CDROM and from any other interface or data storage media that is provided with the ECDIS for that purpose. Confirm import of ENC data from all media stipulated in the test.

(2) Check that the ECDIS can read data contained within multiple exchange sets on any of the media at (1) above. Confirm the ECDIS can read from multiple exchange sets on a single media.

(3) Check that the system has a browse facility so that users can navigate to the ENC_ROOT directory. Similar to (2) above, confirm the system has a browser function.

# Appendix 8 Guidance for Testing

## 1 Methods of test derived from ISO 9241-12

1.1 This Guidance is derived from ISO 9241-12, Ergonomic requirements for office work with visual display terminals (VDTs) – Part 12 – Presentation of information. It is intended to provide guidance to accredited testing laboratories for the development of test plans and test procedures that evaluate a minimum degree of compliance with the requirements specified. They do not identify specific processes, approaches or facilities.

## 2 Observation

2.1 Observation refers to simple examination of the presentation of information to confirm that a particular observable condition has been met. 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.

2.2 The phrase “confirm by observation” is used in the method of test. Conformance 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:

(1) existence of functions or features;

(2) use of symbols or a defined range of words;

(3) a system output in response to a defined input.

## 3 Inspection of documented evidence

3.1 Inspection of documented evidence refers to examination of relevant documents to confirm that a particular presentation or display requirement has been met. 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.

3.2 The phrase “confirm by inspection of documented evidence” is used in the method of test. Conformance is determined by comparing the documented property to the requirement. Typical confirmations by inspection of documented evidence include:

(1) conformance to a standard or other documented evidence;

(2) existence of optional features or functions;

(3) design and/or operation of algorithms.

## 4 Measurement

4.1 In this Guidance, measurement refers to measuring or calculating a value or variable for comparison to a specified value to determine that a particular requirement has been met. 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.

## 5 Analytical evaluation

5.1 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 presentation. Compliance is determined by comparing the observed property to the requirement.

# Appendix 9 Testing for Colours and Intensity

## 1 General

1.1 The IHO ECDIS Presentation Library (IHO S-52 Appendix 2 Annex A) contains colour differentiation test diagrams to enable a tester to determine whether it is possible to discriminate features by colour. (See IHO S-52 Appendix 2 paragraph 4.1.5.)

1.2 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 Publication 15.2 defines the following units for colour difference in terms of chrominance and luminance:

(1) ΔE* as a measure of the overall discrimination including both chrominance and luminance differences;

(2) ΔC* as a measure of the discrimination in chrominance alone.

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

(1) 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;

(2) ΔC* 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;

(3) luminance ratio (Lmeasured/Ldefined) 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.

1.4 ΔE* is to be a minimum of 10 except for colour pairs listed in IHO S-52 Appendix 2 Annex B paragraph 5.5, which, as defined, are very close in colour.

1.5 ΔC* is to 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). ΔC* is to 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).

1.6 The luminance of the colours displayed is to be within 20% of the value specified in IHO S-52 Appendix 2. The luminance value for the colour black using the “day” colour table is to be not greater than 0.52 cd/m². (See IHO S-52 Appendix 2 paragraph 5.2.3.1.)

1.7 The luminance ratio is to be within 20% of the value specified for each colour token within the colour table for each ambient light condition; day, dusk and night, except for the colour black, which is to be a maximum 0.52 cd/m² for the day colour table.

## 2 Test personnel

2.1 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 Table B-1/9. They should also have adapted to night viewing for 10 min before conducting tests using the night display.

## 3 Method of testing

3.1 The method of testing is as follows:

3.1.1 Confirm by analytical evaluation for each colour table that the difference between the calculated RGB values for any two colours in the table is at least 10 $\Delta E^*$ units, except for those pairs defined to have a tabular $\Delta E^*$ less than 20 (See IHO S-52 Appendix 2 paragraph 5.2.3.1 and IHO S-52 Appendix 2 Annex B paragraph 5.5).

3.1.2 Confirm by measurement and analytical evaluation as described below 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 (See IHO S-52 Appendix 2 Annex B paragraph 4).

3.1.3 Colour table calibration verification measurements are to be carried out in a darkroom. 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 the independent test of a monitor, the manufacturer is to provide a reference computer. For the independent test of a computer, the manufacturer is to provide a reference monitor. The test is to be performed as follows:

(1) 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$^2$);

(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 is to 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 $\Delta C^*$ ($\Delta C^* < 16$ for integrated units, $\Delta C^* < 8$ 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 test for CHWHT, CHMGF, CHYLW and BKAJ2 from the dusk colour table;

(5) repeat the test for CHWHT, CHMGF, CHYLW and BKAJ2 from the night colour table.

3.1.4 Colour table calibration verification observations are to be carried out as follows. The user's manual brightness control and contrast control, if provided, are to 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.

**Ambient Light Conditions** **Table 1**

| 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) |

3.1.5 For each colour table provided, under the appropriate ambient light condition, display the colour differentiation test diagram. (See IHO S-52 Appendix 2 Annex A Part III paragraph 4.1.) 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.

3.1.6 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 BKAJ02 (dark grey) is clearly distinguished against a black background (BKAJ01).

3.1.7 Confirm by observation that the procedure for on-board use of the colour differentiation test diagrams is defined in the equipment manual.

3.1.8 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.

3.1.9 Confirm by observation that each of the mandatory colour tables provided in the presentation library may be selected by the user.