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INTERNATIONAL STANDARD

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

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

PRICE CODE **XE**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION
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MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS –

Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results

FOREWORD

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International Standard IEC 61174 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

This third edition of IEC 61174 cancels and replaces the second edition published in 2001, of which it constitutes a technical revision.

The main changes with respect to the previous edition are listed below:

• this edition incorporates revised performance standards for ECDIS adopted by the IMO as resolution MSC.232(82) in December 2006;

• the test methods have been updated accordingly and new tests added for encrypted ENC data;

- the revised IMO performance standards refer to performance standards for displays adopted by the IMO as resolution MSC.191(79) and these have been incorporated by reference to IEC 62288;

- Annex E of the previous edition which defined navigation symbols has been deleted as this information is now in IEC 62288.

- five new annexes have been added.

IMO changed the order of the performance standards in MSC.232(82) compared with the previous standards in resolution A.817(19). Annex N gives a cross-referencing of clause numbering.

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

FDIS	Report on voting
80/535/FDIS	80/542/RVD

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

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

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

**MARITIME NAVIGATION AND RADIOCOMMUNICATION
EQUIPMENT AND SYSTEMS –**

**Electronic chart display and information system (ECDIS) –
Operational and performance requirements,
methods of testing and required test results**

1 Scope

This International Standard specifies the performance requirements, methods of testing and required test results of equipment conforming to performance standards not inferior to those adopted by the IMO in resolution MSC.232(82).

This standard is based upon the performance standards of IMO resolution MSC.232(82), and is also associated with IMO resolution A.694(17) and IEC 60945. Reference is made, where appropriate, to IMO resolution MSC.232(82), and all subclauses whose wording is identical to that in the resolution are printed in italics.

In association with the above IMO resolution MSC.232(82), are the International Hydrographic Organization (IHO) special publications S-32, S-52, S-57, S-61, S-63 and S-64. This standard has included extracts from the above publications where they are applicable to this equipment. Where reference is made, all subclauses whose wording is identical to that in the publications, are printed in italics.

(232/A2.1) These performance standards should apply to all ECDIS equipment carried on all ships as follows:

– *dedicated standalone workstation;*

– *a multifunction workstation as part of an INS.*

(232/A2.2) These performance standards apply to ECDIS mode of operation, ECDIS in RCDS mode of operation as specified in Annex G and ECDIS backup arrangements as specified in Annex F.

(232/A2.3) Requirements for structure and format of the chart data, encryption of chart data as well as the presentation of chart data are within the scope of relevant IHO standards, including those listed in the normative references.

The requirements of this standard are not intended to prevent the use of new techniques in equipment and systems, provided the facilities offered are not inferior to those stated.

2 Normative references

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

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

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

IEC 62288, *Maritime navigation and radiocommunication equipment and systems – Presentation of navigation-related information on shipborne navigational displays – General requirements – Methods of testing and required test results*

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

IMO *International Convention for the safety of life at sea (SOLAS)* 1974 (as amended)

IMO A.424(XI):1979, *Performance standards for gyro-compasses*

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

IMO A.821(19):1995, *Performance standards for gyro-compasses for high-speed craft*

IMO A.823(19):1995, *Performance standards for automatic radar plotting aids*

IMO A.824(19):1995, *Performance standards for devices to indicate speed and distance*

IMO A.830(19):1995, Code on Alarms and Indicators

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

IMO MSC.192(79), *Revised performance standards for radar equipment*

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

IMO MSC/Circ.982 (2000), *Guidelines on ergonomic criteria for bridge equipment and layout*

IMO SN/Circ.243 (2004), *Guidelines for the Presentation of Navigation-related Symbols, Terms and Abbreviations*

IMO SN.1/Circ.266 (2007), *Maintenance of electronic chart display and information system (ECDIS) software*

IHO M-3:2007, *Resolutions of the IHO, Chapter A, Section 3, Technical Resolution 3.11*

IHO S-32, appendix 1, *Hydrographic dictionary – Glossary of ECDIS related terms*

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

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

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

IHO S-57, appendix B.1: 2000, *ENC product specification*

IHO S-61:1999, *Product specification for raster navigational charts (RNC)*

IHO S-63:2008, *IHO data protection scheme*

IHO S-64, *Test data sets for ECDIS*

3   Terms, definitions and abbreviations

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

3.1   Definitions

3.1.1
appropriate portfolio of up to date paper charts
(APC)
(232/App.7 3.7) *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*

3.1.2
CIE colour calibration
procedure to confirm that the colour specified in S-52, appendix 2 is correctly reproduced on the ECDIS display

3.1.3
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

3.1.4
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

3.1.5
corrupted data
ENC data produced according to the S-57 ENC product specification, but altered or modified during production, transmission, or retrieval

3.1.6
dead-reckoned position
DR
position extrapolated from the last accepted position update, based on present course and speed, and updated on a time interval selected by the operator

3.1.7
degrade
reduce the quantity or quality of information content

3.1.8
display base
(232/A3.5) *the chart content as listed in* Annex A *and which cannot be removed from the display. It is not intended to be sufficient for safe navigation*

3.1.9
display redraw time
interval from when the display starts to change until the new display is complete

3.1.10
display regeneration time
interval from operator action until the consequent redraw is complete

3.1.11
display scale
ratio between a distance on the display and a distance on the ground, normalized and expressed as, for example 1:10 000

3.1.12
electronic chart display and information system
(ECDIS)
(232/A3.1) *a navigation information system which with adequate backup arrangements can be accepted as complying with the up-to-date chart required by regulation 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*

3.1.13
electronic navigation chart
(ENC)
(232/A3.2) *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 conform 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 (for example sailing directions) which may be considered necessary for safe navigation*

3.1.14
ENC cell
geographic division of ENC data for distributing purposes. For further information, refer to the ENC product specification in S-57

3.1.15
ENC data
data conforming to 3.1.13

3.1.16
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 Annex E

3.1.17
estimated position
(EP)
position of own ship determined by the common intersection of two LOPs

3.1.18
fix
position of own ship determined, without reference to any former position, by the common intersection of three or more LOPs

3.1.19
line of position
(LOP)
plotted line on which own ship is located determined by observation or measurement of the range or bearing to an aid to navigation or other charted element

3.1.20
non-ENC data
data not conforming to 3.1.13

3.1.21
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 is at various scales

3.1.22
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:

a) the ECDIS symbol library for chart features;

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

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

d) conditional symbology procedures for

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

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

e) description of symbology instructions;

f) supplementary features, for example ECDIS chart 1 colour differentiation test diagrams and colour calibration software

3.1.23
raster chart display system
(RCDS)
(232/App.7 3.1) *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*

3.1.24
raster navigational chart
(RNC)
(232/App.7 3.2) *a facsimile of a paper chart originated by, or distributed on the authority of, a government-authorized hydrographic office. RNC is used in these standards to mean either a single chart or a collection of charts*

3.1.25
RNC data
data conforming to 3.1.24

3.1.26
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

3.1.27
single operator action
single operation shall be achieved by activating a hardkey or softkey, including any necessary cursor movement

**3.1.28
standard display**
(232/A3.4) *the display mode intended to be used as a minimum during route planning and route monitoring. The chart content is listed in* Annex A

**3.1.29
system electronic navigational chart
(SENC)**
(232/A3.3) *a database in the manufacturer's internal ECDIS format, resulting from the lossless transformation of the entire ENC contents and updates. It is this database that is actually accessed by ECDIS for the display generation and other navigational functions, and is the equivalent of an up-to-date paper chart. The SENC may also contain information added by the mariner and information from other sources*

**3.1.30
system raster navigational chart database
(SRNC)**
(232/App.7 3.3) *a database resulting from the transformation of the RNC by the RCDS to include updates to the RNC by appropriate means*

3.2 Abbreviations

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

4 Minimum operational and performance requirements

4.1 General

(232/A1.1) *The primary function of the ECDIS is to contribute to safe navigation.*

(232/A1.2) *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 Annex F.)

(232/A2.4) *In addition to the general requirements set out in resolution A.694(17)* as further specified in IEC 60945 and *the presentation requirements set out in resolution MSC.191(79)* as further specified in IEC 62288, *ECDIS equipment* shall *meet the requirements of* MSC.232(82) *and follow the relevant guidelines on ergonomic principles adopted by the* IMO in MSC/Circ.982. (See 5.3, 6.3, 6.9.1.).

(232/A1.3) *ECDIS* shall *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*. (See 4.3, Clause 5.)

(232/A1.4) *ECDIS* shall *facilitate simple and reliable updating of the electronic navigational chart.* (See 4.4, 5.10)

(232/A1.5) *ECDIS* shall *reduce the navigational workload compared to using the paper chart. It* shall *enable the mariner to execute in a convenient and timely manner all route planning, route monitoring and positioning currently performed on paper charts. It* shall *be capable of continuously plotting the ship's position.* (See 4.10.)

(232/A1.7) *ECDIS* shall *have at least the same reliability and availability of presentation as the paper chart published by government authorized hydrographic offices*. (See 4.3, 4.8, 4.9, Clause 5.)

(232/A1.8) *ECDIS* shall *provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment.* (See Annex D.)

(232/A1.9) *When the relevant chart information is not available in the appropriate form,* (See 4.4) *some ECDIS equipment may operate in the Raster Chart Display System (RCDS) mode as defined in* Annex G*. The RCDS mode of operation* shall *conform to performance standards not inferior to those set out in* Annex G*.*

(232/A1.6) *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* in accordance with requirements of 232/A2.4, 232/A7.4, and 232/A9.2, as further specified herein. (See 4.6, 4.8, 4.12.)

4.2   ECDIS definitions

(232/A3.6) *Further information on ECDIS definitions may be found in* IHO S-32.

4.3   Display of SENC information

4.3.1   SENC

(232/A5.1a) *ECDIS* shall *be capable of displaying all SENC information. An ECDIS* shall *be capable of accepting and converting an ENC and its updates into a SENC.* (See 5.1 and Annex E.)

(232/A5.1b) *The ECDIS may also be capable of accepting a SENC resulting from conversion of ENC to SENC ashore, in accordance with IHO Technical Resolution A3.11 (IHO Miscellaneous Publication M-3). This method of ENC supply is known as SENC delivery.*

NOTE   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. (Refer to IHO M-3, TR A3.11.2 and A3.11.2.3.)

For ENC data delivered in SENC format, the chart update mechanism provided by the ECDIS shall not be inferior to the ENC update mechanism. (See 4.4.)

4.3.2   Warning indication

(See 6.5.2 a).)

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

4.3.3   Categories of display

(See 6.8.1 to 6.8.3.)

(232/A5.2) *SENC information available for display during route planning and route monitoring* shall *be subdivided into the following three categories, Display base, Standard display and All Other Information.* (See Annex A.)

(232/A5.3) *ECDIS* shall *present the Standard Display at any time by a single operator action.*

(232/A5.4) *When an ECDIS is switched on following a switch off or power failure, it* shall *return to the most recently manually selected settings for the display.*

(232/A5.5) *It* shall *be easy to add or remove information from the ECDIS display. It* shall *not be possible to remove information contained in the Display Base.*

The addition or removal of information shall 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. (See Clauses A.2 and A.3.)

4.3.4   Safety contour

(232/A5.8) *It* shall *be possible for the mariner to select a safety contour from the depth contours provided by the SENC. ECDIS* shall *emphasize the safety contour over other contours on the display, however:*

.1 *if the mariner does not specify a safety contour, this* shall *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* shall *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* shall *default to the next deeper contour; and*

.3 *in each of the above cases, an indication* shall *be provided.* (See 5.4.3.)

4.3.5   Safety depth

(See 6.8.9.)

(232/A5.9) *It* shall *be possible for the mariner to select a safety depth. ECDIS* shall *emphasize soundings equal to or less than the safety depth whenever spot soundings are selected for display.*

4.3.6   Information content

(See 6.8.)

(232/A5.10) *The ENC and all updates to it* shall *be displayed without any degradation of their information content.*

Degradation shall be understood as degradation in information quantity as well as quality with respect to the S-64 test data set.

4.3.7   Verification and updates

(See 6.8.5, 6.8.15.2.)

(232/A5.11) *ECDIS* shall *provide a means to ensure that the ENC and all updates to it have been correctly loaded into the SENC.*

(232/A5.12) *The ENC data and updates to it* shall *be clearly distinguishable from other displayed information, including those listed in* Annex B.

4.3.8   Information about chart objects

(232/A5.6) *For any operator identified geographical position (for example by cursor picking) ECDIS* shall *display on demand the information about the chart objects associated with such a position.* (See 5.4.1.)

4.3.9   Display scale

(232/A5.7) *It* shall *be possible to change the display scale by appropriate steps for example by means of either chart scale values or ranges in nautical miles.* (See 5.3.1.)

4.4   Provision and updating of chart information

4.4.1   Contents of the SENC

(See 6.5.2.)

(232/A4.1) *The chart information to be used in ECDIS* shall *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.*

In order to identify the date and origin of the ENC in use, the ECDIS shall 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. (See S-52 6.3(c).)

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

(232/A4.2) *The contents of the SENC* shall *be adequate and up-to-date to comply with regulation V/27 of the 1974 SOLAS Convention as amended.*

(232/A4.3) *It* shall *not be possible to alter the contents of the ENC or SENC information transformed from the ENC.*

4.4.2   Updates

(See 6.5.3, 6.8.15, 6.8.16.)

(232/A4.4) *Updates* shall *be stored separately from the ENC.*

Separate storage of updates may utilize the same data storage area.

(232/A4.5) *ECDIS* shall *be capable of accepting official updates to the ENC data provided in conformity with IHO standards. These updates* shall *be automatically applied to the SENC. By whatever means updates are received, the implementation procedure* shall *not interfere with the display in use.*

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

(232/A4.6) *ECDIS* shall *also 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* shall *be distinguishable on the display from ENC information and its official updates and not affect display legibility.*

(232/A4.7) *ECDIS* shall *keep and display on demand a record of updates including time of application to the SENC. This record* shall *include updates for each ENC until it is superseded by a new edition.*

(232/A4.8) *ECDIS* shall *allow the mariner to display updates in order to review their contents and to ascertain that they have been included in the SENC.*

(232/A4.9) *ECDIS* shall *be capable of accepting both non-encrypted ENCs and ENCs encrypted in accordance with the IHO Data Protection Scheme (IHO Special Publication S-63).*

4.5   Scale

(See 6.8.6.)

(232/A6.1) *ECDIS* shall *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.*

4.6   Display of other navigational information

4.6.1   Common reference system

(See 6.8.12 g).)

(232/A7.3) *ECDIS and added navigational information* shall *use a common reference system. If this is not the case, an indication* shall *be provided.*

Such advice shall be included in the manufacturer's installation handbook.

4.6.2   Radar and plotting information

(See 6.8.13.)

(232/A7.1) *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* shall *not degrade the displayed SENC information, and it* shall *be clearly distinguishable from the SENC information.*

(232/A7.2) *It* shall *be possible to remove the radar information, AIS information and other navigational information by a single operator action.*

(232/A7.4.1) *Transferred radar information may contain a radar image and/or tracked target information.*

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

(232/A7.4.2) *If the radar image is added to the ECDIS display, the chart and the radar image* shall *match in scale, projection and in orientation.*

(232/A7.4.3) *The radar image and the position from the position sensor* shall *both be adjusted automatically for antenna offset from the conning position.*

4.7   Display mode and generation of the neighbouring area

(See 6.8.7.)

(232/A8.1) *It* shall *always be possible to display the SENC in a 'north-up' orientation. Other orientations are permitted. When such orientations are displayed, the orientation* shall *be altered in steps large enough to avoid unstable displays of the chart information.* An unstable

condition that changes orientation rapidly is distracting and can make text or symbols difficult to read.

(232/A8.2) *ECDIS* shall *provide for true motion mode. Other modes are permitted.*

(232/A8.3) *When true motion mode is in use, reset and generation of the chart display of the neighbouring area* shall *take place automatically at own ship's distance from the edge of the display as determined by the mariner.*

(232/A8.4) *It* shall *be possible* to manually change *the displayed chart area and the position of own ship relative to the edge of the display.*

(232/A8.5) *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 shall carry an indication* (see Annex D) *to the mariner to refer to the paper chart or to the RCDS mode of operation* (see Annex G).

4.8 Colours and symbols

(See 6.7.1, 6.7.3.)

(232/A9.1) *IHO recommended colours and symbols* shall *be used to represent SENC information (See S-52, appendix 2).*

(232/A9.2) *The colours and symbols other than those mentioned in 232/A9.1* shall *comply with the applicable requirements contained in the IMO standards for navigational symbols.*

(232/A9.3) *SENC information, when displayed at the scale specified in the ENC,* shall *use the specified size of symbols, figures and letters (See S-52, appendix 2).*

(232/A9.4) *ECDIS* shall *allow the mariner to select whether own ship is displayed in true scale or as a symbol.*

4.9 Display requirements

4.9.1 Route planning and monitoring

(232/A10.1) *ECDIS* shall *be capable of displaying information for:*

.1 route planning and supplementary navigation tasks; (See 4.10.2.)

.2 route monitoring. (See 4.10.3.)

4.9.2 Chart presentation size

(See 6.3.2.)

(232/A10.2) *The effective size of the chart presentation for route monitoring* shall *be at least 270 mm by 270 mm.*

4.9.3 Colour and resolution

(See 6.7.3, 6.7.4.)

(232/A10.3) *The display* shall *be capable of complying with the colour and resolution recommendations of IHO (See S-52, appendix 2).*

4.9.4 Presentation

(See 6.7.5.)

(232/A10.4) *The method of presentation* shall *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.*

4.9.5   Removal of information categories

(See 6.8.2.)

(232/A10.5) *If information categories included in the Standard Display (see* Annex A and Annex M*) are removed to customize the display, this* shall *be permanently indicated. Identification of categories which are removed from the Standard Display* shall *be shown on demand.*

4.10   Route planning, monitoring and voyage recording

4.10.1   General

(See 6.9.2, 6.9.3.)

(232/A11.1) *It* shall *be possible to carry out route planning and route monitoring in a simple and reliable manner.*

(232/A11.2) *The largest scale data available in the* SENC *for the area given* shall *always 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* Annex D*.*

4.10.2   Route planning

(See 6.9.2.)

(232/A11.3.1) *It* shall *be possible to carry out route planning including both straight and curved segments.*

(232/A11.3.2) *It* shall *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.*

(232/A11.3.3) *It* shall *be possible to plan one or more alternative routes in addition to the selected route. The selected route* shall *be clearly distinguishable from the other routes.*

(232/A11.3.4) *An indication is required if the mariner plans a route across an own ship's safety contour.*

(232/A11.3.5) *An indication* shall *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* Annex C*). An indication* shall *also 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.

(232/A11.3.6) *It* shall *be possible for the mariner to specify a cross track limit of deviation from the planned route at which an automatic off-track alarm* shall *be activated.*

4.10.3   Route monitoring

(See 6.8.11, 6.9.3.)

(232/A11.4.1) *For route monitoring the selected route and own ship's position* shall *appear whenever the display covers that area.*

(232/A11.4.2) *It* shall *be possible to display a sea area that does not have the ship on the display (for example for look 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)* shall *be continuous. It* shall *be possible to return to the route monitoring display covering own ship's position immediately by single operator action.*

(232/A11.4.3) *ECDIS* shall *give an alarm if, within a specified* look-ahead *time set by the mariner, own ship will cross the safety contour.*

(232/A11.4.4) *ECDIS* shall *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 Annex C.)

(232/A11.4.5) *An alarm* shall *be given when the specified cross track limit for deviation from the planned route is exceeded.*

NOTE   Route monitoring will only provide an automatic alarm if the mariner has entered the appropriate data in 4.10.2.

(232/A11.4.6) *An indication* shall *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.*

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 shall 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 shall be the same applied to the proximity of all dangers and aids to navigation.

(232/A11.4.9) *An alarm* shall *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.*

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

(232/A11.4.11) *It* shall *be possible to display alternative routes in addition to the selected route*, where any have been planned. *The selected route* shall *be clearly distinguishable from the other routes. During the voyage, it* shall *be possible for the mariner to modify the selected sailing route or* to *change to an alternative route.*

(232/A11.4.12) *It* shall *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* Annex B.

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

4.10.4   Position integration

(See 6.8.12, 6.9.4.)

(232/A11.4.7) *The ship's position* shall *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* shall *be provided. In such cases ECDIS* shall *be capable of identifying discrepancies between the two sources.*

The ECDIS shall 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 4.10.6.

(232/A11.4.8) *ECDIS* shall *provide an alarm when the input from the position, heading or speed sources is lost. ECDIS* shall *also repeat, but only as an indication, any alarm or indication passed to it from position, heading or speed sources.*

(232/A11.4.10) *The positioning system and the SENC* shall *be on the same geodetic datum. ECDIS* shall *give an alarm if this is not the case.*

(232/A11.4.15.2) *ECDIS* shall *indicate discrepancies between the positions obtained by continuous positioning systems and positions obtained by manual observations.*

(232/A11.4.14) *It* shall *be possible to adjust the displayed geographic position of the ship manually. This manual adjustment* shall *be noted alpha-numerically on the screen, maintained until altered by the mariner, and automatically recorded.*

4.10.5   Object information

(See 6.8.10.)

(232/A11.4.13) *It* shall *be possible to enter the* geographic *coordinates of any position and then display that position on demand. It* shall *also be possible to select any point (*feature, *symbol or position) on the display and read its geographical co-ordinates on demand.*

4.10.6   LOP position fix

(See 6.9.7.)

(232/A11.4.15.1) *ECDIS* shall *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* shall *be possible to use the resulting position as an origin for dead-reckoning.*

Position plots shall 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.

Data for accepted position plots and the associated LOPs shall be recorded in the voyage recording (See 4.10.7.).

4.10.7   Voyage recording

(See 6.9.4, 6.9.5.)

(232/A11.5.1) *ECDIS* shall *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* shall *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.

(232/A11.5.2) *In addition, ECDIS shall* *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.

(232/A11.5.3) *It shall* *not be possible to manipulate or change the recorded information.*

(232/A11.5.4) *ECDIS shall* *have a capability to preserve the record of the previous 12 hours and of the voyage track.*

4.11 Calculations and accuracy

(See 6.6.)

(232/A12.1) *The accuracy of all calculations performed by ECDIS shall* *be independent of the characteristics of the output device and* shall *be consistent with the SENC accuracy.*

The output device includes ECDIS display, stored memory, and/or printout.

(232/A12.2) *Bearings and distances drawn on the display, or those measured between features already drawn on the display,* shall *have accuracy no less than that afforded by the resolution of the display.*

(232/A12.3) *The system* shall *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.* (see 5.4.4).

4.12 Connections with other equipment (interfaces)

(See 6.2, 6.6.)

(232/A15.1) *ECDIS shall* *not degrade the performance of any equipment providing sensor inputs. Nor shall the connection of optional equipment degrade the performance of ECDIS below this standard.*

(232/A15.2) *ECDIS* shall *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 shall be connected to a marine transmitting heading device.*

As a minimum, the ECDIS shall support the sentences from IEC 61162-1 given in Table 1.

Table 1 – Mandatory IEC 61162-1 sentences

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

(232/A15.3) *ECDIS may provide a means to supply SENC information to external equipment.*

NOTE 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.

4.13 Performance tests, malfunction alarms and indications

(See 6.8.17.)

(232/A13.1) *ECDIS* shall *be provided with means for either automatically or manually carrying out on-board tests of major functions. In case of a failure, the test* shall *display information to indicate which module is at fault.*

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 shall be given to the operator.

(232/A13.2) *ECDIS* shall *provide suitable alarm or indication of system malfunction*.

4.14 Back-up arrangements

(232/A14) *Adequate* independent *back-up arrangements* shall *be provided to ensure safe navigation in case of an ECDIS failure*: (See Annex F.)

.1 *Facilities enabling a safe take-over of the ECDIS functions* shall *be provided in order to ensure that an ECDIS failure does not result in a critical situation.*

.2 *A back-up arrangement* shall *be provided facilitating means for safe navigation of the remaining part of the voyage in case of an ECDIS failure.*

4.15 Power supply

(See 6.9.6.)

(232/A16.1) *It* shall *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* regulation II/1 *of the 1974 SOLAS convention, as amended.*

(232/A16.2) *Changing from one source of power supply to another, or any interruption of the supply for a period of up to 45 s,* shall *not require the equipment to be manually re-initialized.*

The equipment is not required to remain operational during this interruption of the power supply.

4.16 Software maintenance

(See 6.10.)

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

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

Manufacturers shall 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.

5 Requirements contained in IHO special publications

5.1 Content and structure of chart data

(See 6.6, 6.8.15.1.)

(S-52/3.1a)) *The chart data* shall *be delivered using the IHO transfer standard for digital hydrographic data* (S-57).

NOTE Chart data may also be delivered as a SENC.

(S-52/3.3(b)) *Any ECDIS shall 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 includes both that in the ENC and that delivered in digital format to update the ENC.*

(S-52/3.3(a)) *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 its system to meet the performance requirements stated in* S-52. *The resulting database is called the system ENC (SENC).*

The following restrictions also apply:

.1 (S-52/3.4(b)(1)) *The precision of HO supplied data* shall *be maintained, for example HO data provided in degrees and decimal degrees, when converted to manufacturer specific formats and structures and used in calculations,* shall *also be maintained to that accuracy.*

.2 (S-52/3.4(b)(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* shall *not differ from the ENC image by more than the display resolution.*

.3 (S-52/3.4(b)(3)) *HO data will be supplied in a cell structure.* (See S-52/3.6.) *If this cell structure is modified, it is the ECDIS manufacturer's responsibility to maintain cell dependent characteristics.*

5.2 Priority of chart display

(See 6.8.3, 6.8.4.)

(S-52/5.3(a)) *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 below:*

.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.

NOTE   *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.).* (S-52/5.3(b)(1)) (See S-52, appendix 2/2.3.2 a).)

5.3   Display of chart information

5.3.1   Scale and navigation purpose

(See 6.8.6.)

(S-52/6.3(a)) *If data from different* compilation *scales appears on the display, the boundary between different scales* shall *be clearly indicated.*

(S-52/6.3(b)) *When the display cannot be completely covered with ENC data for the selected navigational purpose, the remaining part of the display* shall *be filled with data based on a more general navigational purpose (if available)*

(S-52/6.3(c)) *A graphical index of the navigational purpose of available data* shall *be shown on demand.*

(S-52/3.5(d)) *Data shown on the display* shall *always be of the same* display *scale. If a* compilation *scale boundary is shown on the display, the information shown in the overscale area* shall *not be relied upon at the scale of the display. The overscale area* shall *be identified as specified in S-52, appendix 2. (Note that 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.)*

(S-52/6.3(e)) *The* manufacturer shall *give the navigator the ability to use intermediate* display *scales, or zoom in between scales.* Means shall *be provided to* change the display scale by appropriate steps for example by means of either chart scale values or ranges in nautical miles. (See 4.3 (232/A5.7).)

(S-52/6.3(g)) *A scale bar* shall *be provided as part of the display base for navigating on a large* compilation *scale (1:80 000 and larger).* (See S-52, appendix 2/ 3.2.3.9(a).)

(S-52/6.3(g)) *For chart displays at a* compilation *scale smaller than 1:80 000, a latitude bar* shall *be shown on the border of the standard display.* (See S-52, appendix 2 /3.2.3.9 (b).)

5.3.2   Text

(See 6.3)

(S-52, appendix 2/(3.1.5)) *The text on the ECDIS* shall *be readable from 1 metre. Sans serif, non-italic fonts* shall *be* employed*. The computer "Ø"* shall *not be used.* (See S-52, appendix 2/3.4.1.)

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

5.3.3   Units and legend

(See 6.7.2.)

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

(S-52/6.5) *A standard legend of general information relating to the area displayed, applicable to the ship's position,* shall *be shown on a graphic or text display. This legend* shall *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;*

.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.*

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.

5.4   Display functions

5.4.1   Object information

(See 6.8.10.)

(S-52, appendix 2/3.1.9) *It* shall *be possible to call up all the information associated with an object by cursor enquiry on its symbol. This* shall *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* shall *extend only to the cell boundaries enclosing the cursor.* Also refer to 4.3 (232/A5.6).

(S-52/3.1(d)) *By identifying any object (point, line or area) with a cursor on the chart display, the object description and all available attributes* shall *be displayed in text in common language terms.*

(S-52, appendix 2/2.3.3(c)) *Text* shall *not appear automatically whenever the object it is associated with appears on the display. It* shall *always be possible to remove text independently of the object.*

5.4.2   Navigational information

(See 6.8.7.)

(S-52, appendix 2/3.1.2.1.6(d)) *If the ECDIS offers a ship-centred display mode, the manufacturer* shall *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).*

This can be accomplished by moving the "centred" symbol. When the "centred" symbol is visible beneath the ship symbol, movement is not required.

5.4.3 Safety contour

5.4.3.1 Default safety contour

(See 6.8.8.)

(S-52/3.4(c) and S-52, appendix 2/3.2.2(1)) *If the mariner does not specify a safety contour, this* shall *default to 30 m. If the safety contour specified by the mariner is not in the SENC, the safety contour shown* shall *default to the next deeper contour.*

5.4.3.2 Information to the mariner

(See 6.9.2, 6.9.3.)

(S-52/3.4(c) and S-52, appendix 2/3.2.2(1)) *If the safety contour in use becomes unavailable due to a change in source data, the safety contour* shall *default to the next deeper contour. In each of the above cases, the mariner* shall *be informed.*

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

5.4.4 Navigational calculations

(See 6.6.)

(S-52/7.1(a)) *The system* shall *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;* (See S-52/6.1(c).)

.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.*

(S-52/7.1(b)) *The accuracy of these calculations* shall *be such that there* shall *be no visible distortion on the display between the following:*

.1 *rhumb line and chart data;*

.2 *great circle and chart data.*

5.4.5 Date-dependant ENC objects

(See 6.8.10.)

(S-52 appendix 2 Annex A Part I, 8.4.1) Date-dependant *objects, such as seasonal buoys, are only to be displayed over a certain period (*IHO S-57 parameters *PERSTA to PEREND). 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* shall *not be displayed outside its effective dates.*

(S-52 appendix 2 Annex A Part I, 8.4.1) *To provide for effective route planning, for look-ahead during route monitoring, or for other purposes, the ECDIS* shall *provide means to allow the mariner to view chart data for any required date and time for the purpose of reviewing pre-planned changes in chart data. The ECDIS manufacturer may provide this either*

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

b) *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 shall be provided that the information displayed may be incorrect for the present real date and time.

5.5   Supplementary display functions

5.5.1   Additional mariner's information

(See 6.8.5.)

(S-52, appendix 2/2.3.1(b)) *The mariner* shall *be provided with the capability of adding at least the following symbols, lines and areas to the SENC, and* shall *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; (See S-52, appendix 2/3.2.3(6).)

.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.

5.5.2   Additional non-HO information

5.5.2.1   Additional display functions

(See 6.8.5.)

(S-52/7.2(f)) *Additional information from non-HO sources, may be displayed provided this does not degrade the display of ENC data. This additional information* shall *be distinguished from the ENC data.* (See S-52, appendix 2.)

5.5.2.2   No data

(See 6.5.2.)

(S-52/3.4(a)) *If the area covered by the ECDIS display includes waters for which no HO ENC at a scale appropriate for navigation exists, the areas representing those waters* shall *carry an indication to the mariner to refer to the paper chart.* (See S-52, appendix 2.)

An area with no chart data of any kind shall be marked with the "no data" symbology defined in the presentation library. (See S-52, appendix 2/3.2.3(14).)

If an area with no ENC data is covered by non-ENC data, the area shall be marked by the "non-ENC area" symbology defined in the presentation library. (See S-52, appendix 2/3.2.3(13a) and (13b).)

5.5.2.3   Unknown object

(See 6.5.1.)

Should an "unknown object" occur in the SENC which is not adequately defined or for which no symbol exists, its presence shall *be indicated on the display by a magenta "?" with the IMO category "Standard Display".* (See S-52, appendix 2/3.1.3.)

5.5.2.4   Text information

Text information about such objects or areas shall be displayed on demand in accordance with 5.4.1.

5.5.3   Tidal adjustment

(See 6.8.5.)

(S-52/7.2(g)) *Depth information* shall *only be displayed as it has been provided in the ENC and not adjusted by tidal height.*

5.6 Use of the presentation library

5.6.1 Presentation library

(See 6.5.1.)

(S-52, appendix 2/1.2.3) *The* library *version number is included in the presentation library, and it* shall *be possible to display it on the ECDIS.*

(S-52, appendix 2/3.1.4) *The presentation library includes an ECDIS chart 1 showing both simplified and* full chart *symbols and their explanations. The* ECDIS shall *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.

5.6.2 Test diagrams

(See 6.7.3.)

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 shall allow the selection and display of these test diagrams. The diagrams shall be used to check the discriminability of colours within all of the tables except day-bright. (See S-52, appendix 2/5.2.5.)

5.7 Display characteristics

5.7.1 Display base

(See 6.8.2.)

(S-52/7.2) *Information shall 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.*

(S-52/7.2(a)) *The units for depth* shall *always be on the same screen as the chart display.*

(S-52/7.2(b)) *The following information* shall *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);*

.6 *result from navigational computations;*

.7 *record of ENC-updates;*

.8 *list of categories which are removed from standard display;*

.9 *symbol library.* (See S-52, appendix 2.)

5.7.2 Navigators notes

(See 6.8.5.)

(S-52/7.2(c)) *Navigators notes* shall *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.*

5.8 Performance requirements

5.8.1 Redraw

(See 6.9.3.)

The ECDIS shall:

(S-52/8(a)) *Redraw during route monitoring to follow the ship's progress, including scale changes due to change in the scale of the chart information,* shall *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:*

– *the mariner* shall *be informed;*

– *the display* shall *continue route monitoring until the new information is ready to draw within 5 seconds.*

(S-52 appendix 2/2.2.3) *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* shall *inform the mariner. The previous display* shall *be maintained and updated, until the new display is ready for* re-draw.

5.8.2 Resolution

(See 6.7.4.)

(S-52/8(c)) *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).*

5.8.3 Symbols

(See 6.7.1.)

(S-52, appendix 2/3.1.5) *The minimum sizes for all symbols* shall *be as shown in the presentation library.*

(S-52, appendix 2/3.1.5) *In addition, the symbols* shall *always 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).

(S-52, appendix 2/3.2.1(2)) *The ECDIS* shall *provide the mariner with the option of using either the traditional paper chart symbols or the new simplified symbols as best fits his purpose.*

5.8.4 Number of colours

(See 6.7.3.)

(S-52/8.(c)) *Colours: 64*

5.8.5 Brightness and contrast

(See 6.7.3.)

The brightness and contrast controls shall have a provision to permit returning to the calibrated setting. The ECDIS manual shall carry a warning that use of the brightness control may inhibit visibility of information at night. (See S-52, appendix 2/4.1.4.)

The colour tables are provided in the presentation library, all of which shall be available. (See S-52, appendix 2/4.1.5.)

Colour tolerance values:

.1 (S-52, appendix 2/5.2.3.1) (S-52, appendix 2/5.2.3.2) *the discrimination difference between any two colours displayed* shall *be not less than 10 ΔE* units for the bright-sun colour table, restricted to colour pairs of tabular ΔE* greater than 20*;

.2 (S-52, appendix 2/5.2.3.1) *the difference between the colour displayed and the CIE colour defined in the specification* shall *be not greater than* 16 *ΔC* units*. If a monitor is independently tested, then the difference shall be not greater than *8 ΔC* units;*

.3 (S-52, appendix 2/5.2.3.1) *the luminance of the colour* displayed shall *be within 20 % of its specified value*. Black is a special case and the luminance of it shall be not greater than 0,52 cd/m^2 for DAY_BRIGHT.

If an optical filter is used with colour table night-filtered, it shall be removable, and of the value 0,9 ND. (See S-52, appendix 2/4.1.2.) (See S-52, appendix 2/4.1.5.)

5.9 Ergonomic requirements

5.9.1 Mode and orientation

(See 6.8.7.)

(S-52, appendix 2/3.2.3(10)) *The north arrow* shall *always be shown at the top left corner of the chart display, just clear of the scale bar or the latitude scale.*

5.9.2 Windows

(See 6.3.2.)

(S-52, appendix 2/3.4.2) *Any windows containing text, diagrams, etc. superimposed on the route monitoring display* shall *be temporary.*

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

(S-52, appendix 2/3.4.2) *It* shall *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.

5.9.3 Mariner's information panel

(See 6.7.5.)

(S-52, appendix 2/3.4.3) *A mariner's information panel on the same screen as the route monitoring display* shall *use only the "user interface" colours from the presentation library colour tables.*

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. (See S-52, appendix 2/4.1.5.)

5.10 Update of chart information

5.10.1 General

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.

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

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 shall be used.

5.10.1.1   Integration of updates

(See 6.8.15.2.)

(S-52, appendix 1/3.4.1(c)) *Updates* shall *be clearly distinguishable on the display. Once accepted, integrated updates* shall *be indistinguishable from ENC data.*

Non-integrated updates (for example those entered manually) shall *be distinguishable as described in* S-52, appendix 2/2.3.4.

(S-52/4(a)) *Official HO updates* shall *be distinguished from local ones.*

5.10.1.2   Recall for display

(See 6.8.15.2, 6.8.16.)

(S-52, appendix 1/3.4.1(e)) *It* shall *be possible on demand to review* a *previously installed* update*.*

5.10.1.3   Log file

(See 6.8.15.3.)

(S-52, appendix 1/3.4.1(h)) *ECDIS* shall *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* shall *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;*

.4 *type of application: manual/automatic.*

An example of "anomalies" could be error messages or load warnings.

5.10.1.4   Update applied out of sequence

(See 6.8.15.1.)

(S-52, appendix 1/3.4.1(i)) *The ECDIS* shall *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.*

5.10.2   Manual update

5.10.2.1   Keying and symbology

(See 6.8.16.)

(S-52, appendix 1/3.4.3(a)) *The ECDIS* shall *enable manual entry of updates for non-integrated presentation on the display. A capacity* shall *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.

The system shall 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.

5.10.2.2　Indications and alarms

(See 6.8.16.)

(S-52, appendix 1/3.4.3(b)) *The ECDIS shall be capable of sensing indications and alarms related to non-integrated (manual) updates, just as it does for integrated ENC updates.*

5.10.2.3　Presentation

(See 6.8.16.)

(S-52, appendix 1/3.4.3) *Manual updates shall be displayed as described in S-52, appendix 2/2.3.4.*

(S-52, appendix 1/3.4.3(e))　*It shall be possible to remove from the display any manual update. The removed update shall be retained in the ECDIS for future review until the commencement of the next voyage, but will not be otherwise displayed.*

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

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.

5.10.3　Semi-automatic update

(See 6.8.15.1.)

(S-52, appendix 1/3.4.2(a(ii))) *The ECDIS shall 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.*

5.10.4　Reception of updates

(See 6.8.14, 6.8.15.1.)

(S-52, appendix 1/3.4.2(b(ii))) *The identification of the issuing authority of the update* shall *be checked for conformance with the corresponding identifier of the ENC.*

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

The ECDIS shall employ the error detection scheme defined by IHO for ENC data.

The ECDIS shall reject corrupted files and provide a warning of this action.

5.10.5　Sequence check

(See 6.8.15.3.)

(S-52, appendix 1/3.4.2(c)) *The following sequence number checks* shall *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.

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

5.10.6 Consistency check

(See 6.8.15.1.)

(S-52, appendix 1/3.4.2(d)) *The mariner* shall *be warned of any previous ENC updates which have not been successfully applied.*

5.10.7 Geographic applicability

(See 6.8.15.2.)

(S-52, appendix 1/3.4.2(e)) *Updates not relating to a cell within a set of ENCs in the ECDIS may be discarded.*

5.10.8 Summary report

(See 6.8.15.3.)

(S-52, appendix 1/3.4.2(f)) *A summary report for each of the issuing authority's official update files* shall *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.

5.10.9 Review of ENC updates

(See 6.8.15.2.)

(S-52, appendix 1/3.4.2(g)) *It* shall *be possible for the mariner to review the updates applied through displaying the SENC contents with the updates highlighted.*

5.10.10 Modification of updates

(See 6.8.15.2.)

(S-52, appendix 1/3.4.2(h)) *Rejection or amendment of an update by the mariner* shall *be achieved by the manual update method. The questionable update* shall *be noted as an anomaly in the log file.* (See S-52, appendix 1/3.4.1(h).)

6 Methods of testing and required test results

6.1 EUT installation, technical documentation, and test requirements

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

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

The manufacturer shall provide sufficient information and documentation for the equipment to be understood and operated.

General guidance for testing is given in Annex K.

6.2 Interfaces

(See 4.12, G.12.)

During testing, specified digital signals shall 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 shall be performed using a simulator or at sea.

a) Signals carrying positional data shall conform to the IEC 61162 series and the appropriate EPFS standard.

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

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

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

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

An IEC 61162 series interface simulator shall be connected. Messages shall be sent and received. For each sentence listed in Table 1, 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.

6.3 General requirements and presentation requirements

(See 5.3.2.)

6.3.1 General requirements

All the general requirements of IEC 60945 appropriate to its category, i.e. "protected", shall be carried out. The manufacturer shall declare any preconditioning required before environmental checks. For the purposes of this standard, the following definitions for "performance check" and "performance test", required by IEC 60945, shall apply.

Performance check   Reconfigure the EUT and check by non-quantitative visual checks that the system is still operative.

Performance test   During testing to IEC 60945 the "performance test" for the EUT shall be identical to the "performance check".

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

6.3.2 Presentation requirements

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

6.4   Preparation

6.4.1   Power-up

The installed EUT shall be powered up in accordance with the manufacturer's recommended procedures. Any self-testing shall be completed using simulated inputs. Signal generators shall 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 shall be undertaken in accordance with the manufacturer's recommendations and settings.

6.4.2   Initial ship parameters

The following parameters shall 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	100 m
On centre line	
Navigation receiver antenna	
Forward of conning position	5 m
Starboard of centre line	10 m
Secondary navigation receiver antenna (if provided to meet the requirements of 4.10.4 (232/A11.4.7))	
Forward of conning position	5 m
Starboard of centre line	10 m
Radar antenna:	
Forward of conning position	7 m
On centre line	

The navigation receiver antenna offset shall be varied and it shall be confirmed that the position on the EUT changes accordingly.

6.4.3   Required test items

(See 4.4.1, 5.1.)

For the purposes of these tests, the following items shall be used:

–   IHO ECDIS presentation library contained in 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;

–   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 Annex E;

–   SENC test data sets, if supported from each SENC distributor. The test data set contents are described in Annex E.

6.5   Initial data tests

6.5.1   Presentation library

(See 5.5.2.3, 5.6.1.)

Perform the following:

a) 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;

b) 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;

c) 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;

d) 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.

6.5.2   ENC

(See 4.3.2, 4.4.1, 5.5.2.2.)

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.

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

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

a) 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" shall appear.

b) 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.

6.5.3   Encrypted ENC

(See 4.4.2.)

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 shall be performed against the IHO S-63 Test Data Set. Additional guidance is provided in Annex J.

Verify that the system performs the following functions:

a) ENC Cell Permit Handling. Verify that the system can load and manage ENC cell permits in compliance with section S-63, 10.5;

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

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

d) 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;

e) 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;

f) 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. (Ref. S-63, 7.5).

6.6 Accuracy

(See 4.11, 4.12, 5.1, 5.4.4)

The test shall verify:

– the accuracy of EUT calculations consistent with SENC;

– the measurement accuracy is independent of the display resolution.

a) 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:

– transformation between a local datum and WGS-84, and between WGS-84 and a local datum;

– true distance and azimuth between two geographical positions;

– geographical position from known position and distance/azimuth;

– rhumb line and great circle.

b) Calculate and display both a rhumb line and a great circle line according to test scenario 1 of Annex I and verify that no visible distortion exists between these lines and the data.

This test shall be carried out using the scale supported by the data, i.e. not over-scaled.

6.7 Visual requirements

6.7.1 Symbols

(See 4.8, 5.3.3, 5.8.3, 5.9.)

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

a) 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 (ref. S52 Appendix 2 3.1.3);

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

c) 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;

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

e) 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;

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

g) 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 upper-case characters is not less than 3,5 mm.

6.7.2 Units and legend

(See 5.3.3.)

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:

a)   units for depth;

b)   units for height;

c)   scale of display;

d)   data quality indicator;

e)   sounding/vertical datum;

f)   horizontal datum;

g)   the value of the safety depth;

h)   the value of the safety contour;

i)   magnetic variation;

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

k)   edition number and date of issue of the ENC;

l)   chart projection.

6.7.3   Colour table

(See 4.8, 4.9.3, 5.6.2, 5.8.4, 5.8.5.)

6.7.3.1   Colour calibration

Verify compliance in accordance with Annex L.

6.7.3.2   Other requirements

Perform the following:

a) 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);

b) 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.

6.7.4   Resolution

(See 4.9.3, 5.8.2.)

Verify compliance in accordance with IEC 62288 for screen resolution.

6.7.5   Display characteristics

(See 4.9.4, 5.9.3.)

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

6.8   Functional requirements

(See 4.3.6.)

The following tests shall be performed both in route planning and route-monitoring mode. The initial latitude/longitude position shall 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.

6.8.1 Standard display

(See 4.3.3.)

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.

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.

6.8.2 Display base

(See 4.3.3, 4.9.5, 5.7.1.)

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.

6.8.3 All other information

(See 4.3.3, 5.2.)

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.

6.8.4 Display priorities

(See 5.2.)

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.

6.8.5 Additional display functions

(See 4.3.7, 5.5.1, 5.5.2.1, 5.5.3, 5.7.2.)

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

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

b) 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;

c) 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 shall not 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;

d) it shall not be possible to adjust depth information by changes in tidal height;

e) if non-ENC data is mixed with ENC, then it shall 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 S-52, appendix 2, 8.5.2 of Annex A. (See 6.5.2a).)

6.8.6 Scale and navigation purpose

(See 4.5, 5.3.1.)

Perform the following:

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

b) 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;

c) 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;

d) 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;

e) a graphical index of the scale boundaries shall be shown on demand;

f) 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;

g) 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;

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

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

j) 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.

6.8.7 Mode and orientation

(See 4.7, 5.4.2, 5.9.1.)

Perform the following:

a) 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;

b) 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;

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

d) 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 over-writing between the ship symbol and the centred symbol does not occur or, the own ship symbol allows adequate visibility for the covered "centred" symbol;

e) 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;

f) 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.

6.8.8   Safety contour

(See 5.4.3.1.)

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

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

b) 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;

c) 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.

6.8.9   Safety depth

(See 4.3.5.)

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.

6.8.10   Object information

(See 4.10.5, 5.4.1, 5.4.5.)

Perform the following:

a) select by cursor several locations with examples of the following area, line and point objects (see Table 2). 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;

Table 2 – Area, line and point objects

Area	Line	Point
Depth	Depth contour	Buoy
Restricted	Ferry route	Light

Area	Line	Point
Sea	Recommended track	Wreck

b) 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;

c) 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;

d) 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;

e) 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;

f) 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:
   – the user is able to obtain information about the date of implementation and contents of the update;
   – the update is displayed during the time of the validity;
   – the update is processed during route planning if it comes into effect during the dates specified for the voyage;
   – the update is processed for route monitoring during the time of validity;

g) 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:
   – the user is able to obtain information about the object and date of implementation;
   – the object is normally displayed only during its time of the validity;
   – the object is processed during route planning if it comes into effect during the dates specified for the voyage;
   – the object is processed for route monitoring during the time of validity;

h) enable display of an example date-dependant ENC object (DATSAT, PERSTA) outside its time of validity. Check that:
   – the example ENC object is correctly displayed;
   – a persistent indication is provided to inform the mariner that the information displayed may be incorrect for the present date and time;

i) select an example of NEWOBJ. Check that:
   – the user can query the CLSDEF and CLSNAM attribute;
   – the object is correctly displayed according to the SYMINS attribute.

6.8.11 Navigation related functions

(See 4.10.3.)

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

6.8.12 Position integration

(See 4.6.1, 4.10.4.)

Perform the following:

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

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

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

d) 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;

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

f) 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;

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

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

i) 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.

6.8.13 Radar and plotting information

(See 4.6.2.)

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:

a) 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;

b) 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;

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

d) 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;

e) 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.

For this test, a radar target in a fixed position shall be simulated.

6.8.14 Loading of corrupted data

(See 5.10.4.)

Perform the following:

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

b) 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;

c) verify that the user is informed of the corruption.

6.8.15 Automatic updates

6.8.15.1 Receipt – installation and application

(See 4.4.2, 5.1, 5.10.1.4, 5.10.3, 5.10.4, 5.10.6.)

Perform the following:

a) 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;

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

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

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

e) 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;

f) 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;

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

h) verify in accordance with Annex J, that the ECDIS accepts encrypted ENC data;

i) 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 shall 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;

j) for each SENC test data set supplied, verify compliance with 6.8.15.1 a) through (g) 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;

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

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

6.8.15.2 Display – show and verify

(See 4.3.7, 4.4.2, 5.10.1.1, 5.10.1.2, 5.10.7, 5.10.9, 5.10.10.)

Perform the following:

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

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

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

d) ensure that official ENC updates can be distinguished from local updates;

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

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

6.8.15.3   Records and logs

(See 4.4.2, 5.10.1.3, 5.10.5, 5.10.8.)

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

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

b) 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;

c) 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.

6.8.16   Manual updates

(See 4.4.2, 5.10.1.2, 5.10.2.1 to 5.10.2.3.)

Using the test data subset C, as described in Annex E, 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:

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

b) delete an existing feature;

c) 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;

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

e) verify that manual updates are distinguishable as described in S-52, appendix 2/2.3.4;

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

6.8.17   Self-tests of major functions

(See 4.13.)

Perform the following:

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

b) 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;

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

6.9 Operational requirements

6.9.1 Ergonomic principles

(See 4.1 (232/A2.4))

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

6.9.2 Route planning

(See 4.10.1, 4.10.2, 5.4.3.2.)

Perform the following:

a) 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 (Annex C), or point objects;

b) 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 shall 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 shall pass closer than the minimum distance limit to a safety contour. Ensure that an indication is provided;

4) at least one leg shall 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 shall 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 shall 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 shall 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 shall be planned through an area of the ENC test data at a different scale;

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

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

11) the length of the legs shall 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 shall vary between 5 knots and 15 knots;

13) the planned route shall cross at least 3 cells of the ENC;

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

d) 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;

e) 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;

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

6.9.3   Route monitoring

(See 4.10.1, 4.10.3, 5.4.3.2, 5.8.1.)

Perform the following:

a) 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;

b) 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 shall 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 shall cross own ship's safety contour;

   6) at least one leg shall enter an area where the specified safety contour is not available;

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

   8) at least one leg shall 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;

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

d) shortly before the vessel 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;

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

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

g) 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;

h) 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 ships 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 shall 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 vessel's movement, and verify that the time labels are displayed. Ensure that time labels may also be entered manually;

i) 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;

j) 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.

6.9.4   Twelve-hour log

(See 4.10.4, 4.10.7.)

For recording purposes (see below) the data resolution shall be in accordance with 6.7.2. Perform the following:

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

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

c) Ensure that the record for the previous 12 h, including all the items defined in 4.10.4 (232/A11.4.14) and 4.10.7 (232/A.11.5.1), is stored and available on demand. Check that chart data according to 4.10.7 (232/A11.5.1) and 4.10.7 (232/A11.5.2) is stored at least initially and for each data change.

6.9.5   Voyage record

(See 4.10.7.)

Perform the following:

a) 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;

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

6.9.6   Power supply

(See 4.15.)

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

Operator settings shall be checked that they have not changed.

6.9.7   LOP position fix

(See 4.10.6.)

Perform the following:

a) 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;

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

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

d) 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;

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

f) 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;

g) 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 (see 6.9.5);

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

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

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

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

6.10   Software maintenance

(See 4.16.)

Verify that the current software version can be displayed.

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

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.

Annex A
(normative)

SENC information to be displayed during route planning and route monitoring

(Appendix 2 of IMO resolution MSC.232(82))

1 *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 water 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.*

2 *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 *ship's routeing systems and ferry routes;*

   .10 *archipelagic sea lanes.*

3 *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.*

Annex B
(normative)

Navigational elements and parameters

(Appendix 3 of IMO resolution MSC.232(82))

1.   Own ship

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 'wheelover'

Elements 1.1 and 1.2 refer to the tracks from primary and secondary positioning methods.

Annex C
(normative)

Areas for which special conditions exist

(Appendix 4 of IMO resolution MSC.232(82))

The following are the areas which ECDIS shall detect and provide an alarm or indication under 4.10.2 (232/A11.3.5) and 4.10.3 (232/A11.4.4).

> *Traffic separation zone*
>
> *Inshore traffic zone*
>
> *Restricted area*
>
> *Caution area*
>
> *Offshore production area*
>
> *Areas to be avoided*
>
> *User defined areas to be avoided*
>
> *Military practice area*
>
> *Seaplane landing area*
>
> *Submarine transit lane*
>
> *Anchorage area*
>
> *Marine farm/aquaculture*
>
> *PSSA (Particularly Sensitive Sea Area)*

Annex D
(normative)

Alarms and indicators

(Appendix 5 of IMO resolution MSC.232(82))

Sub-clause	Requirement	Information
4.10.3 (232/A11.4.3)	Alarm	Crossing safety contour
4.10.3 (232/A11.4.4)	Alarm or indication	Area with special conditions
4.10.3 (232/A11.4.5)	Alarm	Deviation from route
4.10.4 (232/A11.4.8)	Alarm	Positioning system failure
4.10.3 (232/A11.4.9)	Alarm	Approach to critical point
4.10.4 (232/A11.4.10)	Alarm	Different geodetic datum
4.13 (232/A13.2)	Alarm or indication	Malfunction of ECDIS
4.3 (232/A5.8.3)	Indication	Default safety contour
4.5 (232/A6.1.1)	Indication	Information overscale
4.5 (232/A6.1.2)	Indication	Larger scale ENC available
4.6 (232/A7.3)	Indication	Different reference system
4.7 (232/A 8.5)	Indication	No ENC available
4.9 (232/A10.5)	Indication	Customized display
4.10.2 (232/A11.3.4)	Indication	Route planning across safety contour
4.10.2 (232/A11.3.5)	Indication	Route planning across specified area
4.10.3 (232/A11.4.6)	Indication	Crossing a danger in route monitoring mode
4.13 (232/A13.1)	Indication	System test failure

In this standard the definitions of indicators and alarms provided in IMO resolution A.830(19) 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.

Annex E
(normative)

ENC test data set

E.1   General requirements

This data set is necessary to accomplish all ECDIS testing requirements which are specified in this standard. The data shall be encoded according to the IHO ENC product specification included in S-57. The data shall be provided, in an unencrypted form on CD-ROM.

The test data set shall include:

– data subset A for testing the ENC;

– data subset B for testing automatic updating;

– data subset C for testing manual updating.

In addition to these data sets the following shall be provided:

– an instruction manual;

– a set of graphical representations;

– a read-me file which shall include this specification together with an index to the data contents.

References to other IHO publications are to the latest editions of S-52 and its appendices 1 and 2.

The latest version of the ENC test data set is available from the International Hydrographic Bureau at http://www.iho.shom.fr.

E.2   Data subset A – ENC

E.2.1   Complex area

This data set shall cover a complex area representing a complicated navigational scenario.

The contents shall include:

a) at least four, large-scale cells (>1:80 000) providing continuous coverage;

b) an area containing no data;

c) examples of features named in both English and another language;

d) examples of features from each of the priority layers defined in 5.3(a) of S-52 and 2.3.2 of appendix 2 of S-52;

e) examples of features making use of SCAMIN;

f) examples of features making use of INFORM, TXTDSC and PICREP;

g) an example of an object, attribute and attribute value not valid for ENC purposes;

h) at least two scale-area meta objects;

i) an example of corrupted data;

j) an example of a feature which is depicted as an area with an associated area-centred symbol;

k) an example of objects (see Table 2);

l) 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 shall be superimposed on HO produced ENC data;

m) an example of NEWOBJ (a generic object to be used only to support new IMO requirements).

E.2.2   Small-scale data

The data set shall include equivalent data for the next smaller scale navigational purpose for the area specified in E.2.1. The data shall be at a scale of <1:80 000 and shall include an area sufficient to cover a route of 25 nautical miles. It shall also include an area situated at least 10 nautical miles from the centre of the specified area.

E.2.3   Data content

The content of the data set shall support the use of display base, standard display and all other information as specified in Annex A.

E.2.4   Alarms and indications

The data set shall include:

a) 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;

b) a range of spot soundings, including a 5 m and 15 m sounding;

c) examples of all features which trigger alarms or indications as listed in Annex D.

E.2.5   Alarms and indications: large-scale data

Where the large-scale data (E.2.1) and the smaller scale data (E.2.2) overlap, the large-scale data set shall be more geometrically complex than the smaller scale data for features which trigger alarms and indications.

E.2.6   Mathematical calculations

A separate text document shall 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.

E.2.7   Graphical representations

Graphical representations of the data set shall be provided to the requisite accuracy and resolution for

a) base display;

b) standard display;

c) all other information;

d) small-scale representation of data for area E.2.1 to demonstrate the use of the SCAMIN attribute; and

e) small-scale data for area E.2.2.

E.3   Data subset B – Automatic updating

E.3.1   Update data: contents

The data set shall include:

a) multiple individual updates, certain of which shall affect topology;

b) an update with an invalid producing agency identifier;

c) an update referring to a superseded edition of a cell;

d) an update which comes into effect at a future date;

e) data which falls outside the area of data subset A;

f) an example of corrupted data;

g) 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;

h) an example of a cell-cancellation update.

E.3.2   Update data: sequence

The data set shall 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.

E.4   Data subset C – Manual updating

E.4.1   Update data: contents

A text document shall contain information for manual updating.

E.4.2   Update data: alarms and warnings

The text shall include reference to part of the contents of data subset C, including items which trigger alarms and warnings.

Annex F
(normative)

Back-up arrangements

(Appendix 6 of IMO resolution MSC.232(82))

NOTE   In Clauses F.1 to F.6, the text in italics is from Appendix 6 of IMO resolution MSC.232(82).

F.1   Introduction

As prescribed in 4.14, adequate independent back-up arrangements shall 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;

.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.

It is a prerequisite that the route plan has been transferred to the back-up device prior to the departure and after reassignment of the route plan in order to enable a safe take-over when ECDIS fails.

NOTE   This annex does not address the use of official paper charts as a back-up to ECDIS.

F.2   Purpose

The purpose of an ECDIS back-up system is to ensure that safe navigation is not compromised in the event of ECDIS failure. This shall *include a timely transfer to the back-up system during critical navigation situations. The back-up system* shall *allow the vessel to be navigated safely until the termination of the voyage.*

F.3   Functional requirements

F.3.1   Required functions and their availability

F.3.1.1   Presentation of chart information

(See F.7.8.1.)

(3.1.1)   The back-up system shall *display in* graphical *(chart) form the relevant information of the hydrographic and geographic environment which* is *necessary for safe navigation.*

F.3.1.2   Route planning

(See F.7.9.2.)

(3.1.2) The back-up system shall *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.

If more than one route can be displayed, the selected route shall be clearly distinguishable from the other routes.

F.3.1.3   Route monitoring

(3.1.3) *The back-up system* shall *enable a take-over of the route monitoring originally performed by the ECDIS, and provide at least the following functions:*

.1 plotting own ship's position automatically, or manually on a chart; (See F.7.8.5.)

.2 taking courses, distances and bearings from the chart;

.3 displaying the planned route; (See F.7.9.3.)

.4 displaying time labels along ship's track; (See F.7.9.3.)

.5 plotting an adequate number of points, bearing lines, range markers, etc., on the chart. (See F.7.8.4.)

F.3.1.4   Display information

(See F.7.8.1.)

(3.1.4)   The *back-up* system shall *be capable of displaying at least the information equivalent to the standard display as defined in* the ECDIS *performance standard.* (See Annex A.)

The back-up system shall at least display the pre-planned route, own ship's position, coast lines, navigable waters, dangers to navigation and aids to navigation. This display shall include identification of dangers and aids to navigation.

Any additional chart information as defined in Annex A, may be displayed and be subject to the same tests as the information in the standard display.

F.3.1.5   Provision of chart information

(See F.7.5.1.)

(3.1.5)

.1 The chart information to be used in the back-up arrangement shall *be the latest edition, as corrected by official updates, of that issued by or on the authority of a Government, authorized Hydrographic Office or other relevant government institution, and conform to IHO standards.*

.2 It shall *not be possible to alter the contents of the electronic chart information.*

.3 The chart or chart data edition and issuing date shall *be indicated.*

F.3.1.6   Updating

(See F.7.8.7.)

(3.1.6) *The information displayed by the ECDIS back-up arrangements* shall *be up-to-date for the entire voyage.*

F.3.1.7   Scale

(See F.7.8.2.)

(3.1.7)   The back-up system shall *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.

F.3.1.8   Addition of radar and other navigational information

(See F.7.8.6.)

(3.1.8) *If radar and other navigational information are added to a back-up display, all corresponding requirements for radar information and other navigational information of this standard* shall *be met.* (See 4.6.)

Radar information or other navigational information may be added to the back-up system display. However, it shall not degrade the chart information, and shall be clearly distinguishable from the chart information.

The back-up system and added navigational information shall use a common reference system.

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

Where radar tracks are added, it shall be indicated to the operator whether the vectors are relative or true.

If the radar image is added to the back-up system display, the chart and the radar image shall match in scale, orientation and projection.

The radar image and the position from the position sensor shall both be adjusted automatically for antenna offset from the conning position.

It shall be possible to remove the radar, the tracked target information and AIS information by a single operator action.

F.3.1.9   The display mode and generation of the neighbouring area

(See F.7.8.3.)

(3.1.9) The *display mode and generation of the neighbouring area* shall *be in accordance with* 4.7. (See 4.7.)

It shall always be possible to display the chart in a north-up orientation. Other orientations are permitted.

The device shall provide for true motion mode. Other modes are permitted.

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

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

F.3.1.10   Voyage recording

(See F.7.9.4 and F.7.9.5.)

(3.1.10) *The back-up arrangements* shall *be able to keep a record of the ship's actual track, including positions and corresponding times.*

F.3.2   Reliability and accuracy

F.3.2.1   Reliability

(See F.7.3.)

(3.2.1) *The back-up arrangements shall provide reliable operation under prevailing environmental and normal operating conditions.*

F.3.2.2   Accuracy

(See F.7.6.)

(3.2.2)   *Accuracy shall be in accordance with section 12 of* the ECDIS *performance standard* as further specified in 4.11.

The accuracy of all calculations performed by the back-up system shall be independent of the characteristics of the output device and should be consistent with the chart database accuracy.

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

F.3.3   Malfunctions, warnings, alarms and indications

(See F.7.8.8.)

(3.3)   The back-up system shall *provide a suitable alarm or indication of system malfunction.*

F.4   Operational requirements

F.4.1   Ergonomics

(See F.7.7.2 and F.7.9.1.)

(4.1)   The back-up system shall *be designed in accordance with the ergonomic principles of ECDIS*. (See 5.9.)

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

It shall 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.

A mariner's information panel on the same screen as the route monitoring display shall 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.

F.4.2   Presentation of information

F.4.2.1   Colours and symbols

(See F.7.7.1.)

(4.2.1)   *Colours and symbols used in the back-up arrangements shall be in accordance with the colour and symbols requirements of ECDIS* and shall comply with IEC 62288. (See 4.8.)

Chart information when displayed at the specified scale shall use the size specified in the relevant standards of symbols, figures and letters.

F.4.2.2   Effective size

(See F.7.7.2.)

(4.2.2)   *The effective size of the chart presentation* shall *be not less than 250 mm x 250 mm or 250 mm diameter.*

F.5   Power supply

(See F.7.9.6.)

(5)

.1   the back-up power supply shall *be separate from the ECDIS; and*

.2   conform to the requirements in the *ECDIS performance standard. (See 4.15.)*

It shall be possible to operate the back-up 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 regulation II/1 of the 1974 SOLAS convention.

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

F.6   Connections with other equipment

(See F.7.2.)

F.6.1   Back-up

(See F.7.8.5)

(6.1)   The back-up system shall:

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

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

F.6.2   Radar

(6.2)   *If radar with selected parts of the ENC chart information overlay is used as an element of the back-up, the radar* shall *comply with* IMO *resolution* MSC.192(79) as further specified by IEC 62388.

The minimum requirement for a back-up system is a single interface to an EPFS. Other interfaces are allowed.

F.7   Methods of testing and required test results

F.7.1   EUT installation and technical documentation

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

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

The manufacturer shall provide sufficient information and documentation for the equipment to be understood and operated.

F.7.2 Interfaces

(See F.6.)

See 6.2.

F.7.3 General requirements and presentation requirements

(See F.3.2.1.)

See 6.3.

F.7.4 Preparation

F.7.4.1 Power-up

The installed EUT shall be powered up in accordance with the manufacturer's recommended procedures. Any self-testing shall be completed using simulated inputs. Signal generators shall 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 shall be undertaken in accordance with the manufacturer's recommendations and settings.

F.7.4.2 Initial ship parameters

The following parameters shall 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 centre	100 m
On centre line	
Navigation receiver antenna	
Forward of conning position	5 m
Starboard of centre line	10 m
Radar antenna:	
Forward of conning position	7 m
On centre line	

The navigation receiver antenna offset shall be varied and it shall be confirmed that the position on the EUT changes accordingly.

F.7.5 Initial data tests

F.7.5.1 Chart

(See F.3.1.5)

a) Check that the edition number and date of the chart included in the test data set is displayed in the chart library.

b) Check by operation that it is not possible to alter the content of the chart.

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

F.7.6 Accuracy

(See F.3.2.2.)

The test shall verify:

    – the accuracy of ECDIS calculations consistent with the chart;

– the measurement accuracy consistent with the display resolution.

a) 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:

– transformation between a local datum and WGS-84;

– true distance and azimuth between two geographical positions;

– geographic position from known position and distance/azimuth;

– rhumb line and great circle.

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

This test shall be carried out using the scale supported by the data, i.e. not over-scaled.

F.7.7 Visual requirements

F.7.7.1 Symbols

(See F.4.2.1.)

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

F.7.7.2 Display characteristics

(See F.4.1, F.4.2.2.)

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

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.

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

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.

F.7.8 Functional requirements

The following tests shall be performed both in route planning and route monitoring mode. The initial latitude/longitude position shall 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.

F.7.8.1 Chart display information

(See F.3.1.1, F.3.1.4.)

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.

Verify by visual inspection that the back-up system can display all the information required in F.3.1.4 of this standard including identification of dangers and aids to navigation, and additional chart information if applicable.

F.7.8.2   Scale and navigation purpose

(See F.3.1.7.)

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

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

F.7.8.3   Mode and orientation

(See F.3.1.9.)

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

b) 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.

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

F.7.8.4   Navigation related functions

(See F.3.1.3.5.)

Verify that at least one EBL and one VRM are available. Ensure that all the other symbols required for navigation purposes and specified in Annex B are available.

F.7.8.5   Position integration

(See F.3.1.3.1, F.6.1.1.)

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

b) 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.

F.7.8.6   Radar, track plotting and AIS information

(See F.3.1.8.)

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:

a) 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;

b) 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;

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

d) 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;

e) 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.

For this test, a radar target in a fixed position shall be simulated.

F.7.8.7   Updates

(See F.3.1.6.)

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

F.7.8.8   Self-tests of major functions

(See F.3.3.)

a) Perform tests of the major functions, which are supported by the EUT. Verify that the EUT provides appropriate display information and indications.

b) 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.

c) Verify that the system provides suitable alarms and indication of system malfunction arising from failures in accordance with the relevant standard.

F.7.9   Operational requirements

F.7.9.1   Ergonomic principles

(See F.4.1.)

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

F.7.9.2   Route planning

(See F.3.1.2.)

a) 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.

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

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

   1) at least one leg of the route shall 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 shall be made, both to starboard and port, between different legs of the route and shall vary from 5° up to 175°;

   3) the length of the legs shall 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 shall vary between 5 knots and 15 knots;

   5) the planned route shall cross at least 3 different scales of chart data.

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

e) 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.

F.7.9.3　Route monitoring

(See F.3.1.3.3, F.3.1.3.4.)

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

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

F.7.9.4　Twelve-hour log

(See F.3.1.10.)

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

F.7.9.5　Voyage record

(See F.3.1.10.)

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

F.7.9.6　Power supply

(See F.5.)

a)　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.

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

c)　Operator settings shall be checked that they have not changed.

Annex G
(normative)

ECDIS in the RCDS mode of operation

(Appendix 7 of IMO resolution MSC.232(82))

NOTE   In Clauses G.1 to G.15, the text in italics is from Appendix 7 of IMO resolution MSC.232(82).

G.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) shall *be carried on board and be readily available to the mariner.*

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

(1.3)   ECDIS operating in the RCDS mode shall 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.

(1.4)   ECDIS operating in the RCDS mode shall facilitate simple and reliable updating of the raster *navigational chart.*

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

(1.7)   ECDIS operating in the RCDS mode shall 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 shall provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment. (See Annex H.)

(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 annex. *RCDS mode of operation* shall *conform to performance standards not inferior to those set out in* this annex.

(1.6)   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.

G.2   RCDS definitions

(3.6)   Further information on RCDS definitions may be found in S-32, appendix 1.

G.3   Display of SRNC information

G.3.1   SRNC

(See G.17.2.1, G.17.4.2.)

(5.1)   ECDIS operating in the *RCDS* mode shall *be capable of displaying all* SRNC *information.*

(5.2)   *SRNC information available for display during route planning and route monitoring* shall *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. (See G.3.2.)

G.3.2   Categories of display

(See G.17.5.1.)

(5.3)   ECDIS operating in the *RCDS* mode shall *present the* RCDS *standard display at any time by a single operator action.*

RCDS standard display is defined in G.3.1.

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. (See G.16.5.)

(5.5)   *It* shall *be easy to add to, or remove from the RCDS display, any information additional to the RNC data, such as mariner's notes. It* shall *not be possible to remove any information from the RNC.*

(5.12) *The* RNC *data and updates to it* shall *be clearly distinguishable from other displayed information, including those listed in* Annex B.

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 shall be implemented in accordance with IEC 62288.

G.3.3   Power failure

(5.4)   *When an ECDIS* operating in the RCDS mode *is switched on following a power failure, it* shall *return to the most recent manually selected settings for the display.* (See Clause G.15.)

G.3.4   Information content

(See G.17.4.1, G.17.5.9.2.)

(5.10) *The RNC and all updates to it* shall *be displayed without any degradation of their information content.*

Degradation shall be understood as degradation in information quantity as well as quality.

G.3.5   Verification and updates

(See G.17.5.8, G.17.5.9.1, G.17.5.9.2.)

(5.11) ECDIS operating in the *RCDS* mode shall *provide a means to ensure that the RNC and all updates to it have been correctly loaded into the SRNC.*

G.3.6   Indication

(See G.17.2.1)

(5.13) *There* shall *always be an indication if the ECDIS equipment is operating in RCDS mode.*

G.4   Provision and updating of chart information

G.4.1   Contents of the RNC

(See G.17.2.1, G.17.2.2.)

(4.1)   *The RNC used in* ECDIS operating in *RCDS* mode shall *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 on WGS-84 or PE-90 shall carry meta-data (i.e. additional data) to allow geo-referenced positional data to be displayed in the correct relationship to SRNC data.*

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.

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

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

(4.2)   *The contents of the SRNC* shall *be adequate and up-to-date for that part of the intended voyage not covered by ENC.*

NOTE   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.

(4.3)   *It* shall *not be possible to alter the contents of the* RNC.

G.4.2   Updates

(See G.17.5.9.2, G.17.5.9.3, G.17.5.10.)

(4.4)   *Updates* shall *be stored separately from the* RNC.

Separate storage of updates may utilize the same data storage device.

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

The contents of an update assume that all earlier updates have been applied to the SRNC. A new edition of an RNC shall supersede a previous RNC and its updates.

(4.6)   ECDIS operating in the *RCDS* mode shall *also 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 shall *be distinguishable on the display from RNC information and its official updates and not affect display legibility.*

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

(4.8) ECDIS operating in the *RCDS* mode shall *allow the mariner to display updates in order to review their contents and to ascertain that they have been included in the* SRNC.

G.5   Scale

(See G.17.5.2.)

(6) ECDIS operating in the *RCDS* mode shall *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.*

G.6   Display of other navigational information

G.6.1   Common reference system

(See G.17.5.6.)

(7.3)   When operating in the *RCDS* mode, ECDIS *and added navigational information* shall *use a common reference system. If this is not the case, an indication* shall *be provided.*

Such advice shall be included in the manufacturer's installation handbook.

G.6.2   Radar and plotting information

(See G.17.5.7.)

(7.1)   *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* shall *not degrade the displayed* SRNC *information, and* shall *be clearly distinguishable from the* SRNC *information.*

(7.2)   *It* shall *be possible to remove the radar information, AIS information and other navigational information by a single operator action.*

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

Where radar tracks are added, it shall be indicated to the operator whether the vectors are relative or true, and if true whether they are sea or ground stabilized.

(7.4.2) *If the radar image is added to the RCDS display, the chart and the radar image* shall *match in scale, projection and in orientation.*

(7.4.3) The radar image and the position from the position sensor shall both be adjusted automatically for antenna offset from the conning position.

G.7   Display mode and generation of the neighbouring area

(See G.17.5.3.)

(8.1)   It shall always be possible to display the SRNC in 'chart up' orientation. Other orientations are permitted.

(8.2)   ECDIS operating in the RCDS mode shall provide for true motion mode. Other modes are permitted.

(8.3)   When true motion mode is in use, reset and generation of the chart display of the neighbouring area shall take place automatically at own ship's distance from the edger of the display as determined by the mariner.

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

(8.5)   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 Annex D) to the mariner to refer to the paper chart.

G.8   Colours and symbols

(See G.17.4.1, G.17.4.3.)

(9.1)   IHO recommended colours and symbols shall 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)

(9.2)   The colours and symbols other than those mentioned in (9.1) shall comply with the applicable requirements contained in the IMO standards for navigational symbols (IEC 62288).

(9.4)   ECDIS operating in the RCDS mode shall allow the mariner to select whether own ship is displayed in true scale or as a symbol.

G.9   Display requirements

G.9.1   Route planning and monitoring

(10.1)   ECDIS operating in the RCDS mode shall be capable of displaying information for:

.1   route planning and supplementary navigation tasks; (See G.10.2.)

.2   route monitoring. (See G.10.3.)

G.9.2   Display characteristics

(See G.17.4.4.)

(10.2)   The effective size of the chart presentation for route monitoring shall be at least 270 mm by 270 mm.

(10.4)   The method of presentation shall 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.

G.9.3   Chart notes

(See G.17.2.2.)

(10.6)   ECDIS operating in the *RCDS* mode shall *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.

G.10 Route planning, monitoring and voyage recording

G.10.1   General

(11.1)   *It* shall *be possible to carry out route planning and route monitoring in a simple and reliable manner.* (See G.10.2 and G.10.3.)

G.10.2   Route planning

(See G.17.6.2.)

(11.3.1)   *It* shall *be possible to carry out route planning including both straight and curved segments.*

(11.3.2) *It* shall *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.

(11.3.3) *It* shall *be possible to plan one or more alternate routes in addition to the selected route. The selected route* shall *be clearly distinguishable from the other routes.*

(11.3.6) *It* shall *be possible for the mariner to specify a cross track limit of deviation from the planned route at which an automatic off track alarm* shall *be activated.*

G.10.3   Route monitoring

(See G.17.5.5, G.17.6.3.)

(11.4.1) *For route monitoring the selected route and own ship's position* shall *appear whenever the display covers that area.*

(11.4.2) *It* shall *be possible to display a sea area that does not have the ship on the display (for example. for look ahead, route planning), while 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)* shall *be continuous. It* shall *be possible to return to the route monitoring display covering own ship's position immediately by single operator action.*

NOTE Route monitoring will only provide automatic alarms and indications if the mariner has entered the appropriate data in G.10.2.

(11.4.5) *An alarm* shall *be given when the specified cross track limit for deviation from the planned route is exceeded.*

(11.4.9) *An alarm* shall *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.*

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

(11.4.11) *It shall* be possible to display alternative routes in addition to the selected route. The selected route *shall* be clearly distinguishable from the other routes. During the voyage, it shall *be possible for the mariner to modify the selected sailing route or change to an alternative route.*

(11.4.12) *It shall* 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* Annex B*.*

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

(11.4.17) *It shall* 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.*

G.10.4   Position integration

(See G.17.5.6, G.17.6.4.)

(11.4.7) *The ship's position shall* 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* shall *be provided. In such cases* ECDIS operating in the *RCDS* mode shall *be capable of identifying discrepancies between the two sources.*

The ECDIS operating in the RCDS mode shall 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.

(11.4.8) *ECDIS operating in the* RCDS mode shall *provide an alarm when the input from the position, heading or speed sources is lost. ECDIS* operating in the *RCDS* mode shall *also repeat, but only as an indication, any alarm or indication passed to it from position, heading or speed sources.*

(11.4.10) *The RCDS* shall *only accept data* from an electronic position-fixing system *referenced to the WGS-84 or PE-90 geodetic datum. RCDS* shall *give an alarm if the positional data is not referenced to one of these datum. If the displayed RNC cannot be referenced to the WGS-84 or PE-90 datum then a continuous indication* shall *be provided.*

In the first line, "data" refers to positional data, that is data from an electronic position-fixing system.

(11.4.14) *It shall* be possible to adjust the displayed geographic position of the ship manually. *This manual adjustment* shall *be noted alpha-numerically on the screen, maintained until altered by the mariner, and automatically recorded.*

(11.4.15.2)   *ECDIS operating in the RCDS mode* shall *indicate discrepancies between the positions obtained by continuous positioning systems and positions obtained by manual observations.*

(11.4.16) ECDIS operating in the *RCDS* mode shall *allow the user to manually align the SRNC with positional data. This can be necessary, for example, to compensate for local charting errors.*

G.10.5   Object information

(See G.17.5.1, G.17.5.4.)

(11.3.7)   *It* shall *be possible for the mariner to enter points, lines and areas which activate an automatic alarm. The display of these features* shall *not degrade the SRNC information and* shall *be clearly distinguishable from the SRNC information.*

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.

(11.4.13) *It* shall *be possible to enter the* geographic *coordinates of any position and then display that position on demand. It* shall *also be possible to select any point (feature, symbol or position) on the display and read its geographical co-ordinates on demand.*

In this context, the selection of "any point" means the selection of a mariner-entered point, line or area boundary.

G.10.6   LOP position fix

(See G.17.5.12.)

(11.4.15.1)   *ECDIS operating in the RCDS mode* shall *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* shall *be possible to use the resulting position as an origin for dead-reckoning.* Position plots shall 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.

Data for accepted position plots and the associated LOPs shall be recorded in the voyage recording. (See G.10.7.)

G.10.7   Voyage recording

(See G.17.6.4, G.17.6.5.)

(11.5.1) ECDIS operating in the *RCDS* mode shall *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* shall *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.*

(11.5.2) *In addition,* ECDIS operating in the *RCDS* mode shall *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.

(11.5.3) *It* shall *not be possible to manipulate or change the recorded information.*

(11.5.4) ECDIS operating in the *RCDS* mode shall *have a capability to preserve the record of the previous 12 hours and of the voyage track.*

G.11 Calculations and accuracy

(See G.17.3.)

(12.1) *The accuracy of all calculations performed by* ECDIS operating in the *RCDS* mode shall *be independent of the characteristics of the output device and* shall *be consistent with the SRNC accuracy* and scale.

The output device includes RCDS display, stored memory, and/or printout.

(12.2) *Bearings and distances drawn on the display, or those measured between features already drawn on the display* shall *have an accuracy no less than that afforded by the resolution of the display.*

(12.3) *The system* shall *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.*

(12.4) *RCDS* shall *be capable of performing transformations between a local datum and WGS 84 datum* whenever the correction data is provided in the chart database*.*

G.12 Connections with other equipment (interfaces)

(See 6.2.)

(15.1) ECDIS operating in the *RCDS* mode shall *not degrade the performance of any equipment providing sensor inputs. Nor* shall *the connection of optional equipment degrade the performance of* ECDIS operating in the *RCDS* mode *below this standard.*

(15.2) *ECDIS* shall *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* shall *be connected to a marine transmitting heading device*.

(15.3) *ECDIS may provide a means to supply SRNC information to external equipment.*

G.13 Performance tests, malfunction alarms and indications

(See G.17.5.11.)

(13.1) ECDIS operating in the *RCDS* mode shall *be provided with means for either automatically or manually carrying out on-board tests of major functions. In case of a failure, the test* shall *display information to indicate which module is at fault.*

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 shall be given to the operator.

(13.2) ECDIS operating in the *RCDS* mode shall *provide suitable alarm or indication of system malfunction*.

G.14 Back-up arrangements for RCDS mode of operation

Back-up arrangements for RCDS mode are the back-up arrangements for ECDIS. (See Annex F.)

(14)   *Adequate* independent *back-up arrangements* shall *be provided to ensure safe navigation in case of an* ECDIS *failure*:

.1 *Facilities enabling a safe take-over of the* ECDIS *functions* shall *be provided in order to ensure that an* ECDIS *failure does not result in a critical situation;*

.2 *a back-up arrangement* shall *be provided facilitating means for safe navigation of the remaining part of the voyage in case of an* ECDIS *failure.*

G.15 Power supply for RCDS mode of operation

The power supply for RCDS mode of operation is the power supply for ECDIS. (See 4.15.)

(16.1) *It* shall *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* regulation II/1 *of the 1974 SOLAS convention as amended.*

(16.2) *Changing from one source of power supply to another, or any interruption of the supply for a period of up to 45 s,* shall *not require the equipment to be manually re-initialized.*

The equipment is not required to remain operational during this interruption of the power supply.

G.16 Requirements contained in IHO special publications

G.16.1   Structure of RNC data

(S-61/1.2) *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.*

(S-61/3.2) *The arrangement of the image data and the meta-data into one or more digital files* shall *be determined by the national hydrographic offices originating the RNC.*

(S-61/3.3.1) *The digital format of the image file* shall *be determined by the national hydrographic office producing the RNC.*

(S-61/3.4.1) *The digital format of the meta-data* shall *be determined by the national hydrographic office originating the RNC.*

For the purposes of this standard, 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.

G.16.2   RNC data resolution and accuracy

G.16.2.1   Resolution

(See G.17.1.1.)

(S-61/3.3.2) *The resolution of the digital image (pixels-per-inch) and any method used to compress or process that image file* shall *be sufficient to display clearly all information that*

was contained on the original paper nautical chart. In particular, methods such as anti-aliasing shall *be employed to achieve maximum contrast and fidelity of displayed chart information compared to the printed chart.*

G.16.2.2   Accuracy

(See G.17.2.2, G.17.3.)

(S-61/3.3.3) *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,* shall *allow a ship's position to be displayed at least as accurately as when using the original paper chart.*

G.16.3   RNC meta-data

(S-61/3.4.2 and S61/3.5.1) *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* shall *be included for each such discrete chart image.*

G.16.4   RNC colours

(See G.17.4.3.)

(S-61/3.4.2.17.1) *Colours used for daytime viewing shall be those used on the paper versions of the same charts*.

(S-61/3.4.2.17.2) *Colours for dusk and night-time shall follow as closely as practicable the Colours and Symbols Standards specified in IHO Special Publication S-52, Appendix 2.*

Colour palettes for daytime, dusk and night-time are specified in the RNC meta-data by the issuing HO*.*

G.16.5   RNC notes, diagrams, etc

(See G.17.2.2.)

(S-61/3.4.2.18) *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.*

(S-61/3.4.2.19) *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.*

It is sufficient to provide an index or listing of notes, etc. applicable to the RNC.

G.17 Methods of testing and required test results

NOTE   This clause lists 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 Clause 6.

G.17.1   Preparation

G.17.1.1   Required test items

For the purposes of these tests, the following items shall be used:

- test RNCs are specified by the HO providing the RNC service or on whose behalf the RNC service is provided;
- 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;
- 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.

G.17.2   Initial data tests

G.17.2.1   RNC

(See G.3.1, G.3.6, G.4.1.)

Load a test RNC and ensure that:

a) the RCDS mode indication is displayed;

b) the edition number and date of the RNC is displayed in the chart library;

c) 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;

d) load an additional RNC and ensure that the chart coverage has changed and that the chart library is updated;

e) remove an RNC and ensure that the chart coverage has changed and that the chart library is updated;

f) switch to ECDIS mode and observe that the RCDS mode indication is no longer displayed.

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.

G.17.2.2   Datum

(See G.4.1, G.9.3, G.16.2.2, G.16.5.)

a) 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.

b) 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.

c) 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.

G.17.3   Accuracy

(See G.11, G.16.2.2.)

The test shall verify:

- the accuracy of EUT calculations consistent with SRNC;
- the measurement accuracy consistent with display resolution.

a) 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:

– transformation between a local datum and WGS-84;

– true distance and azimuth between two geographical positions;

– geographic position from known position and distance/azimuth;

– rhumb line and great circle.

b) 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. Use for this test scenario 1 is noted in Annex I.

This test shall be carried out using the scale supported by the data, i.e. not over-scaled.

G.17.4 Visual requirements

G.17.4.1 Visual display

(See G.3.4, G.16.2.1.)

a) Check that the image is a faithful representation of the paper chart provided by the HO with the RNC test data set.

b) Check that the symbols for the navigational elements conform to IEC 62288.

c) Perform zoom-in and zoom-out operations in each mode and check that the symbols for the navigational elements do not decrease in size.

d) Check that it is possible to display own ship in true scale or as a symbol.

G.17.4.2 Units and legends

(See G.3.1.)

Check that the following elements can be determined easily and rapidly:

a) RNC number;

b) chart identifier (for example chart number) if different from RNC number;

c) units for depth;

d) units for height;

e) RNC scale;

f) scale of display;

g) source data diagram (if available);

h) sounding/vertical datum;

i) horizontal datum;

j) magnetic variation;

k) date and number of last update affecting the RNC currently in use;

l) edition number and date of issue of the RNC;

m) chart projection;

n) indication of north.

G.17.4.3 Colour tables

(See G.8, G.16.4.)

Verify that the colour palettes for daytime, dusk and night-time viewing, and which are specified in the RNC meta-data, can be used.

Verify that the implementation complies with IEC 62288,

G.17.4.4   Display characteristics

(See G.9.2.)

Measure the displayed chart area while in route monitoring mode and check that it is at least 270 mm by 270 mm.

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.

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

G.17.5   Functional requirements

The following tests shall be performed both in route planning and route monitoring mode. The initial latitude/longitude position shall 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.

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.

G.17.5.1   Additional display functions

(See G.3.2, G.10.5.)

a) 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.

b) 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.

c) 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 shall not be used.

d) Verify that the mariner-entered or manufacturer's information can be displayed on charts of other scales which cover the same geographical area.

e) Remove all additional information. Verify that the EUT display is the same as the graphical representation of the RNC test data set.

f) Verify that the RCDS mode standard display can be restored by a single operator action.

G.17.5.2   Scale and navigation purpose

(See G.5.)

a) 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.

b) 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.

c) 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.

G.17.5.3   Mode and orientation

(See G.7.)

a) 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".

b) 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.

c) 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.

G.17.5.4   Points, lines and areas

(See G.10.5.)

Enter the geographic coordinates of a position, and display that position.

Enter examples of mariner-defined points, lines and areas which are intended to trigger alarms and ensure that the alarms are triggered when the vessel reaches the appropriate position.

G.17.5.5   Navigation related functions

(See G.10.3.)

Verify that at least one EBL and VRM is available. Ensure that all the other symbols required for navigation purposes and specified in Annex B are available.

G.17.5.6   Position integration

(See G.6.1, G.10.4.)

a) 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.

b) With a second, independent positioning method ensure that the EUT displays any difference in reported positions.

c) Remove the positioning input to the EUT and ensure that an alarm is given.

d) 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.

e) Select a different geodetic datum between the positioning system and the SRNC, and ensure that an alarm is given.

f) 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.

g) Verify that the manufacturer's documentation includes guidance for implementing a common reference system.

G.17.5.7   Radar, radar tracks, and AIS information

(See G.6.2.)

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:

a) 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;

b) 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;

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

d) 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;

e) 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.

For this test, a radar target in a fixed position shall be simulated.

G.17.5.8   Loading of corrupted data

(See G.3.5.)

a) Load an example of corrupted RNC test data. Verify that the EUT provides the appropriate warning.

b) 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.

G.17.5.9   Automatic updates

G.17.5.9.1   Receipt – installation and application

(See G.3.5, G.4.2.)

a) 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.

b) Apply the test update number 1 to the relevant RNC.

c) Identify the issuing authority of the update. Check that this conforms with the corresponding identifier of the RNC.

d) Attempt to load an improperly sequenced update; check that the update is rejected and that a warning is given to the user.

e) 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.

f) 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.

G.17.5.9.2   Display – show and verify

(See G.3.4, G.3.5, G.4.2.)

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

b) 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.

c) Ensure that official RNC updates can be distinguished from local updates.

d) Verify that, once accepted, integrated updates are indistinguishable from RNC data.

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

G.17.5.9.3   Records

(See G.4.2.)

Tests shall 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:

a) RNC number and chart identifier if different from RNC;

b) RNC edition date;

c) list of corrections applied subsequent to the edition date;

d) updates and update numbers;

e) date and time of their application/rejection; and

f) any anomalies encountered during application.

G.17.5.10   Manual updates

(See G.4.2.)

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.

a) Add a new point and restricted area features, locating them at selected positions.

b) Annotate an existing feature as being deleted.

c) 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.

d) Verify that manual updates are distinguishable from RNC data.

e) Verify that any manual updates removed from the display are retained and can be displayed in a future review.

G.17.5.11   Self-tests of major functions

(See G.13.)

a) Perform tests of the major functions which are supported by the EUT. Verify that the EUT provides appropriate display information and indications.

b) 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.

c) Verify that the system provides suitable alarms or indication of system malfunction arising from failures.

G.17.5.12   LOP position fix

(See G.10.6.)

a) 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.

b) Confirm by observation that LOP data (range or bearing, time, source) can be presented both alphanumerically and graphically.

c) Confirm by analytical evaluation that an estimated position (EP) based on two LOPs selected by the operator is provided.

d) 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.

e) Confirm by analytical evaluation that a position fix based on three or more LOPs selected by the operator is provided.

f) 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.

g) 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. Refer to 6.9.4.

h) Verify that the graphic symbols for LOP bearing and LOP distance comply with IEC 62288.

i) Verify that that the graphic symbols for position plots comply with IEC 62288.

j) Confirm by analytical evaluation that a means or method is provided to use the resulting position as a position update during dead-reckoning operation.

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

G.17.6   Operational requirement

G.17.6.1   Ergonomic principles

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

G.17.6.2   Route planning

(See G.10.2.)

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

   1) at least one leg shall come close enough to a mariner entered point that the automatic alarm would be initiated;

   2) at least one leg shall cross a mariner-entered linear feature;

   3) at least one leg shall cross the boundary of a mariner-entered area feature;

4) at least one leg of the route shall be planned through an area of the RNC test data at a different scale. The adjoining RNC shall be loaded automatically when planning through the area;

5) at least one leg of the route shall be planned through a chartlet area of the RNC test data set. The chartlet shall be loaded automatically when planning through the area;

6) each leg shall be planned with an appropriate off-track limit (for example 100 m);

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

8) the length of the legs shall 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 shall vary between 5 knots and 15 knots;

10) the planned route shall cross at least 3 RNCs. Where the appropriate RNC service or services supplies RNCs based on different chart datums, the planned route shall include at least two different chart datums; (See G.17.1.1.)

11) the planned route shall enter an area where ENC data are available.

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

c) 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.

d) 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.

e) Plan complex tracks using scenarios 2 and 3 as noted in Annex I and save the tracks. Check that track distances comply with those noted in Annex I and that no distortions are visible.

f) Verify that there is an indication showing that the EUT is operating in the RCDS mode.

G.17.6.3 Route monitoring

(See G.10.3.)

a) 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 shall 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 shall cross a mariner-entered linear feature;

6) at least one leg shall cross a mariner-entered area feature;

7) at least one leg shall come close enough to a mariner-entered point that the automatic alarm would be initiated;

8) at least one leg shall enter an area where ENC data are available and an indication of "ENC data available" shall be triggered.

b) Operate the own ship position function, and observe that the display shows own ship's position.

c) Shortly before the vessel 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.

d) Verify that an alarm is released each time the vessel is going to cross the boundary of a mariner-entered feature, within the time specified by the mariner.

e) Select an RNC of a smaller scale than that of d) but covering the same area. Simulate crossing over the mariner-entered feature referred to in d). Check that an alarm is generated by the EUT.

f) 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 shall 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 vessel'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.

g) Verify that there is an indication showing that the EUT is operating in the RCDS mode.

h) 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.

i) 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.

G.17.6.4 Twelve-hour log

(See G.10.4, G.10.7.)

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

b) Continue to run the test for 12 h. During this period, attempts should be made to manually edit the log. This shall not be possible. At the end of the twelve-hour period, the EUT log shall then be analyzed according to the procedures in the operating manual and the results shall comply with the test carried out.