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BSI Standards Publication

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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National foreword

This British Standard is the UK implementation of EN 61174:2015. It is identical to IEC 61174:2015. It supersedes BS EN 61174:2008, which will be withdrawn on 23 September 2018.

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

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

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Matériels et systèmes de navigation et de radiocommunication maritimes - Systèmes de visualisation des cartes électroniques et d'information (ECDIS) - Exigences d'exploitation et de fonctionnement, méthodes d'essai et résultats d'essai exigés (IEC 61174:2015)

Navigations- und Funkkommunikationsgeräte und -systeme für die Seeschifffahrt - Elektronisches Kartendarstellungs- und Informationssystem (ECDIS) - Betriebs- und Leistungsanforderungen, Prüfverfahren und geforderte Prüfergebnisse (IEC 61174:2015)

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European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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European foreword

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The following dates are fixed:

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

IEC 61162 series	NOTE	Harmonized in EN 61162 series
IEC 61162-2:1998	NOTE	Harmonized as EN 61162-2:1998 (not modified).
IEC 61162-3	NOTE	Harmonized as EN 61162-3.
IEC 61162-460	NOTE	Harmonized as EN 61162-460.
IEC 61966-4:2000	NOTE	Harmonized as EN 61966-4:2000 (not modified).
IEC 62616:2010	NOTE	Harmonized as EN 62616:2010 (not modified).
ISO 9001	NOTE	Harmonized as EN ISO 9001.
ISO 9241-12	NOTE	Harmonized as EN ISO 9241-12.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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

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

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

Publication	Year	Title	EN/HD	Year
IEC 60945	-	Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results	EN 60945	-
IEC 61162-1	-	Maritime navigation and radiocommunication equipment and systems - Digital interfaces -- Part 1: Single talker and multiple listeners	EN 61162-1	-
IEC 61162-450	2011	Maritime navigation and radiocommunication equipment and systems - Digital interfaces -- Part 450: Multiple talkers and multiple listeners - Ethernet interconnection	EN 61162-450	2011
IEC 61924-2	2012	Maritime navigation and radiocommunication equipment and systems - Integrated navigation systems -- Part 2: Modular structure for INS - Operational and performance requirements, methods of testing and required test results	EN 61924-2	2013
IEC 61996-1	2013	Maritime navigation and radiocommunication equipment and systems - Shipborne voyage data recorder (VDR) -- Part 1: Performance requirements, methods of testing and required test results	EN 61996-1	2013

Publication	Year	Title	EN/HD	Year
IEC 62288	2014	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	EN 62288	2014
IEC 62388	2013	Maritime navigation and radiocommunication equipment and systems - Shipborne radar - Performance requirements, methods of testing and required test results	EN 62388	2013
ISO 8601	-	Data elements and interchange formats - Information interchange - Representation of dates and times	-	-
IHO M-3	2007	Resolutions of the IHO, Chapter A, Section 3, Technical Resolution 3.11	-	-
IHO S-52 Annex A	2014	IHO Presentation Library for ECDIS	-	-
IHO S-52 appendix 1	2012	Guidance on updating the electronic navigational chart	-	-
IHO S-52	2014	Specifications for Chart Content and Display Aspects of ECDIS	-	-
IHO S-57 appendix B.1	-	ENC product specification	-	-
IHO S-57	-	Transfer standard for digital hydrographic data	-	-
IHO S-61	1999	Product specification for raster navigational charts (RNC)	-	-
IHO S-63	-	IHO data protection scheme	-	-
IHO S-64	-	Test data sets for ECDIS	-	-
IMO A.694(17)	1991	General requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids	-	-
IMO MSC.191(79)	2004	Performance standards for the presentation of navigation-related information on shipborne navigational displays	-	-
IMO MSC.232(82)	2006	Adoption of the revised performance standards for electronic chart display and information systems (ECDIS)	-	-
IMO MSC.252(83)	-	Performance standards for integrated navigation systems (INS)	-	-
IMO MSC/Circular 982	2000	Guidelines on ergonomic criteria for bridge equipment and layout	-	-
IMO SN.1/Circular 266	2007	Maintenance of electronic chart display and information system (ECDIS) software	-	-
IMO SOLAS		Convention for safety of life at sea (SOLAS)	-	-

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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 fourth edition of IEC 61174 cancels and replaces the third edition published in 2008, of which it constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- updated references are provided to IHO publications and test methods are updated to IHO test data sets;
- requirements have been added for display of radar and AIS information;

- new interface requirements have been added for BNWAS, VDR, BAM, MSI, INS and route transfer;
- a requirement for an anchor watch has been added;
- additional test methods are specified for operation of ECDIS beyond the normal range between 85 degrees South latitude and 85 degrees North latitude.

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

FDIS	Report on voting
80/761/FDIS	80/767/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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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) publications[1]. IHO S-32, IHO S-52, IHO S-57, IHO S-61, IHO S-63 and IHO 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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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[1] IHO publications are available from http://www.iho.int, together with any supplementary information.

IEC 61162-1, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 1: Single talker and multiple listeners*

IEC 61162-450:2011 *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 450: Multiple talkers and multiple listeners – Ethernet interconnection*

IEC 61924-2:2012, *Maritime navigation and radiocommunication equipment and systems – Integrated navigation systems – Part 2: Modular structure for INS – Operational and performance requirements, methods of testing and required test results*

IEC 61996-1:2013, *Maritime navigation and radiocommunication equipment and systems – Shipborne voyage data recorder (VDR) – Part 1: Performance requirements, methods of testing and required test results*

IEC 62288:2014, *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 62388:2013, *Maritime navigation and radiocommunication equipment and systems – Shipborne radar – Performance requirements – Methods of testing and required test results*

ISO 8601, *Data elements and interchange formats – Information interchange – Representation of dates and times*

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

IHO S-52:2014, *Specifications for chart content and display aspects of ECDIS edition 6.1*

IHO S-52, appendix 1:2012, *Guidance on Updating the Electronic Navigational Chart edition 4.0*

IHO S-52, Annex A:2014, *Presentation library edition 4.0*

IHO S-57, *IHO transfer standard for digital hydrographic data*

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

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

IHO S-63, *IHO data protection scheme*

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

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

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

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

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

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

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

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

3 Terms, definitions and abbreviations

For the purposes of this document, the terms, definitions and abbreviations given in IEC 62288, as well as the following apply.

3.1 Terms and definitions

3.1.1
activated AIS target
(MSC.191/A) *target activated for the display of additional graphically presented information*

EXAMPLE Heading line, velocity vector, etc.

[SOURCE: IEC 62288:2014, 3.1]

3.1.2
appropriate portfolio of up to date paper charts
APC
a suite of paper charts of a scale to show sufficient detail of topography, depths, navigational hazards, aids to navigation, charted routes, and routeing measures to provide the mariner with information on the overall navigational environment

[SOURCE: IMO Resolution MSC.232(82):2006, clause 3]

3.1.3
CIE colour calibration
colour calibration at the monitor performed to transform the CIE-specified colours for ECDIS into the colour coordinate system of the screen

Note 1 to entry: This confirms that the colours specified in IHO S-52, Annex A are correctly reproduced on the ECDIS display.

[SOURCE: IHO S-32]

3.1.4
common reference system
means provided to assure that when navigational information from sensors and other information sources is displayed together with charted information, it is referenced to a consistent common reference point (CCRP)

3.1.5
compilation scale
the scale at which the data was compiled

Note 1 to entry: This is the scale established by the producing Hydrographic Office and encoded in the ENC database at which the chart information meets the IHO requirements for chart accuracy.

[SOURCE: IHO S-32]

3.1.6
corrupted data
ENC data produced according to the IHO S-57 ENC product specification, but altered or modified during production, transmission, or retrieval

3.1.7
dangerous target
(MSC.191/A) tracked radar or reported AIS *target with a predicted CPA and TCPA that violates values preset by the user. The respective target is marked by a "dangerous target" symbol*

[SOURCE: IEC 62288:2014, 3.11]

3.1.8
dead-reckoned position
DR
position extrapolated from the last accepted position update, based on present course and speed, and updated on a time interval selected by the operator

[SOURCE: IEC 62288:2014, 3.12]

3.1.9
degrade, verb
reduce the quantity or quality of information content

3.1.10
display base
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

[SOURCE: IMO Resolution MSC.232(82):2006, clause A3.5]

3.1.11
display redraw time
interval from when the display starts to change until the new display is complete

3.1.12
display regeneration time
interval from operator action until the consequent redraw is complete

3.1.13
display scale
ratio between a distance on the display and a distance on the ground

Note 1 to entry: This ratio is normalized and expressed as, for example 1:10 000.

3.1.14
electronic chart display and information system
ECDIS
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

[SOURCE: IMO Resolution MSC.232(82):2006, clause A3.1]

3.1.15
electronic navigational chart
ENC
the database, standardized as to content, structure and format, issued for use with ECDIS by or on the authority of a Government authorized Hydrographic Office or other relevant government institution, and conform to IHO standards

Note 1 to entry: *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.*

[SOURCE: IMO Resolution MSC.232(82):2006, clause A3.2]

3.1.16
ENC cell
the basic unit of ENC data covering a defined geographical area bounded by two meridians and two parallels

[SOURCE: IHO S-32]

3.1.17
ENC data
data conforming to 3.1.15

3.1.18
ENC test data set
standardized data set and testing instructions available as IHO S-64

3.1.19
estimated position
EP
position extrapolated from the last accepted position update, based on present course and speed (STW), including effects of wind, tide, current, and updated on a time interval selected by the operator

[SOURCE: IEC 62288:2014, 3.20]

3.1.20
fix
position of own ship determined, without reference to any former position, by the common intersection of two or more LOPs

[SOURCE: IEC 62288:2014, 3.21]

3.1.21
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

[SOURCE: IEC 62288:2014, 3.28]

3.1.22

lost target
(MSC.191/A) tracked radar or reported AIS *target* for which the system is no longer receiving *valid position* data

Note 1 to entry: The target is *represened* by a "lost target" symbol.

[SOURCE: IEC 62288:2014, 3.29]

3.1.23
non-ENC data
data not conforming to 3.1.5

3.1.24
non-HO source
database containing chart information for navigation similar to ENC but the source is not recognized as government authorized Hydrographic Office or other relevant government institution

Note 1 to entry: See IHO S-62 chapter I. IHO Member states and chapter II. Other States.

3.1.25
official
by, or on authority of a government, authorized Hydrographic Office or other relevant government institution

3.1.26
overscale
display of the chart information at a display scale larger than the compilation scale

Note 1 to entry: *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 navigational purposes.*

[SOURCE: IHO S-32]

3.1.27
permanent indication
indication that is displayed visually and continuously and cannot be removed from the display other than by eliminating the cause of the indication

3.1.28
readily available indication
indication that can be, at any moment, immediately displayed by a single operator action

3.1.29
presentation library
implementation of the display specifications in IHO S-52, Annex A, by de-coding and symbolizing the SENC

3.1.30
raster chart display system
RCDS
a navigation information system displaying RNCs with positional information from navigation sensors to assist the mariner in route planning and route monitoring and, if required, display additional navigation-related information

[SOURCE: IMO Resolution MSC.232(82):2006, Appendix 7 3.1]

3.1.31
raster navigational chart
RNC
a facsimile of a paper chart originated by, or distributed on the authority of, a government-authorized Hydrographic Office

Note 1 to entry: *RNC is used in these standards to mean either a single chart or a collection of charts.*

[SOURCE: IMO Resolution MSC.232(82):2006, Appendix 7 3.2]

3.1.32
RTS
Reported Target Simulator as defined in Annex F of IEC 62388:2013

3.1.33
route
series of waypoints connected by one or more legs including both straight and curved segments

3.1.34
RNC data
data conforming to 3.1.30

3.1.35
RNC test data set
standardized data set and testing instructions available as IHO S-64

3.1.36
single operator action
(MSC.252/A1) *procedure achieved by no more than one hard-key or soft-key action, excluding any necessary cursor movements, or voice actuation using programmed codes*

[SOURCE: IEC 62288:2014, 3.42]

3.1.37
safety contour
borderline between safe and unsafe water based on depth defined by the mariner

Note 1 to entry: The safety contour includes, for example, the ships draft plus under keel clearance.

3.1.38
safety depth
depth defined by the mariner, e.g. the ships draft plus under keel clearance, to be used by ECDIS to emphasise sounding on the display equal to or less than this value

[SOURCE: IHO S-32]

3.1.39
selected target
(MSC.191/A) *target selected manually or automatically for the display of detailed alphanumeric data, information and text in a separate user dialogue area. The target is represented by a "selected target" symbol*

[SOURCE: IEC 62288:2014, 3.40]

3.1.40
sleeping AIS target
(MSC.191/A) AIS *target indicating the presence of a vessel equipped with AIS in a certain location. The target is represented by a "sleeping target" symbol indicating the vessel's orientation. No additional information is presented until the AIS target is activated*

[SOURCE: IEC 62288:2014, 3.43]

3.1.41
standard display
the display mode intended to be used as a minimum during route planning and route monitoring

Note 1 to entry: The chart content is listed in Annex A.

[SOURCE: IMO Resolution MSC.232(82):2006, clause A3.4]

3.1.42
system electronic navigational chart
SENC
a database in the manufacturer's internal ECDIS format, resulting from the lossless transformation of the entire ENC contents and updates

Note 1 to entry: *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.*

Note 2 to entry: *The SENC may also contain information added by the mariner and information from other sources.*

[SOURCE: IMO Resolution MSC.232(82):2006, clause A3.3]

3.1.43
system raster navigational chart
SRNC
a database resulting from the transformation of the RNC by the RCDS to include updates to the RNC by appropriate means

[SOURCE: IMO Resolution MSC.232(82):2006, Appendix 7 3.3]

3.2 Abbreviations

AIS	Automatic Identification System
BAM	Bridge Alert Management
BNWAS	Bridge Navigational Watch Alarm System
CCRP	Consistent Common Reference Point
CIE	International Commission on Illumination
COG	Course Over Ground
DAC	Designated Area Code
EBL	Electronic Bearing Line
ECDIS	Electronic Chart Display
EP	Estimated Position
EPFS	Electronic Position-Fixing System
EUT	Equipment Under Test
FI	Function Indicator
GMDSS	Global Maritime Distress And Safety System
HO	Hydrographic Office
IHO	International Hydrographic Organization
IMO	International Maritime Organization
ISO	International Organization for Standardization
LAN	Local Area Network
MMSI	Maritime Mobile Service Identity

MSI	Maritime Safety Information
ROT	Rate Of Turn
SOG	Speed Over Ground
SOLAS	International Convention for the Safety of Life at Sea (SOLAS), 1974 as amended
TT	Target Tracking
USB	Universal Serial Bus
URI	Uniform Resource Identifier
VDL	AIS VHF Data Link
VDM	AIS VHF Data link Message
VDR	Voyage Data Recorder
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, 5.9)

(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 alerts 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.*

(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 1 IHO Technical Resolution A3.11 is now referred to as IHO Resolution 4/2002.

NOTE 2 In addition to IHO 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. 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.

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 Indication about use of non-HO source

(See 6.5.3)

If SENC data from a non-HO source is in use, a permanent indication of “non-ENC data” shall be provided.

4.3.3 Categories of display

(See 6.8.2 to 6.8.5)

(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 and Annex M)

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

Selection of Standard display shall not change any user setting other than selection of viewing groups for the display of charted objects. When Standard Display (Clause M.4) is selected, all viewing groups of that category shall be visible in the chart display and additional viewing groups of All Other Information (Clause M.5) shall not be visible in the chart 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.*

Each IMO SENC information category is divided into sub-classes called viewing group layers and viewing groups as specified in Annex M. The details of viewing group layers and subsets of viewing groups within each layer are available in Annex M.

ECDIS shall provide means to add or remove information from the display by selection of any of the viewing group layers except those of the Display Base (see IHO S-52 Annex A:2014, 14.3).

Any additional selection capability that may be provided shall be described in the user manual and shall be derived from the viewing group layers and viewing groups specified in Annex M.

The association of multiple viewing groups from different viewing group layers may be combined into an additional selection. However, the selection of viewing group layers and viewing groups of the Standard display category shall not be combined with those unique to the All Other category.

More detailed chart display control selectors than those based on viewing group layers may be provided but the addition or removal of information shall be limited to individual IHO viewing groups (for example “Soundings” from the viewing group layer “Depth, currents, etc.” could be provided as a selection) not selection of individual items, for example an individual area or an individual sounding.

(S-52, Annex A, Part 1/9.1) *The display of text* shall *be controlled independently of the display of the object it applies to. The mariner* shall *have full control over the display of text. All text is in the IMO Category "*All *other Information".*

NOTE 1 The text group layers specified in Annex M are intended as a framework on which the ECDIS manufacturers can base their own method of providing this capability. Each text group layer is divided into sub-classes called text groups. The details of text group layers and subsets of text groups within each layer are specified in Clause M.6.

(S-52, Annex A, Part 1/9.1) ECDIS shall *provide at least the capability to select "Important Text" and "Other Text", and* ECDIS *may provide further text groupings.*

Such further text group selectors shall be a subset of the parent text group layer (for example “Geographic names” from text group layer “Other text” could be provided with a dedicated display selector). ECDIS may provide also combined text display control selectors, but such selectors can only combine text groups from the same text group layer (i.e. it is not allowed to combine text groups from both “Important Text” and “Other Text” text group layers).

NOTE 2 As a guide for organizing the display of text, the last two digits of the SHOWTEXT instruction give a text classification that distinguishes between "Important" and "Other" text, and gives further suggested text groupings.

(S-52, Annex A/14.5) *National text* (text group 31, see Clause M.6.2) *is a supplementary option for ECDIS. If provided, the style* shall *be similar to that of the Presentation Library* (see IHO S-52, Annex A, Part 1/9.1).

(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* of SENC information.

4.3.4 Safety contour

(See 6.8.10, 6.9.2, 6.9.3)

(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:*

a) 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;*

b) 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*

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

NOTE More information about usage of safety contour and safety depth is available in informative Annex N.

4.3.5 Safety depth

(See 6.8.11)

(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

(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 IHO S-64 test data set.

4.3.7 Verification and updates

(See 6.8.7, 6.8.17.2)

(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 5.3.1)

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 5.2.1)

4.4 Provision and updating of chart information

4.4.1 Contents of the SENC

(See 6.5.3)

(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 4.3.7 and 5.2.1)

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 b*e 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 6.5.4, 6.8.17, 6.8.18)

(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.*

(S-52/10.7.2) *On mariner's demand automatic chart corrections of ENC information* shall *be highlighted* in accordance with IHO S-52/10.7.2.

(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).*

NOTE Non-encrypted ENCs can be available in plain IHO S-57 format or in accordance with the IHO S-63.

Means shall be provided for a full ENC Update Status Report in accordance with IHO S-63. Optionally means may be provided for Route Filtered ENC Update Status Report in accordance with IHO S-63. Optionally means may be provided for an ENC Management Report in accordance with the IHO S-63. (See Annex L)

4.5 Scale

(See 6.8.8)

(232/A6.1) *ECDIS* shall *provide a permanent indication if:*

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

b) 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 General for all overlays

(See 6.8.15, 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. (See also IEC 62288:2014, 6.3.3 and 6.3.8).

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

The ECDIS shall not track targets, calculate CPA/TCPA values, provide target related alerts or provide target association functionality unless it is fully compliant with relevant sections of IEC 62388.

(See 6.8.14 g)

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

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

(See 6.8.15.2

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

4.6.2 Radar information

4.6.2.1 General for radar information

(See 6.8.15.2, 6.8.15.3)

Target information may be provided by a radar target tracking system and/or by the AIS.

As far as practical, the radar video image and target information shall be presented in accordance with the radar Performance Standards (see IEC 62388:2013, Annex A) and with the presentation standards (see IEC 62288:2014, 5.4.1, 5.4.2 for radar image and 5.5.1 through 5.6.4 and 6.3.2 for target information).

As far as practical, the user interface and data format for operating and presenting tracked radar target information and reported AIS target information shall be consistent. (See IEC 62288:2014, 5.5.2.2).

4.6.2.2 Radar image information

(See 6.8.15.3)

(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* (i.e. CCRP).

The requirements of IEC 62288 for presentation of radar video images shall be met. (See IEC 62288:2014, 5.4.1)

4.6.2.3 Tracked target information

(See 6.8.15.4)

The requirements of this subclause apply if tracked target information is provided.

If tracked target information is available it shall be possible to display and provide full presentation functionality for a minimum number of tracked radar target reports according to Table 1.

Table 1 – Tracked target display capacity

Minimum tracked target capacity	40

NOTE 1 Unlike the radar ECDIS does not have multiple categories therefore minimum tracked target capacity is equivalent to CAT 1 as defined in IEC 62388.

Where tracked target vector 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.

The system shall process all tracked radar targets reported across the interfaces provided for that purpose. Data sources may report a greater number of tracked targets than capacity provided for ECDIS. To avoid exceeding the tracked target capacity of the ECDIS, means shall be provided to filter tracked target data received from external sources as specified in IEC 62288 for AIS targets.

There shall be an indication when the reported target processing or display capacity is about to be exceeded.

There shall be an indication when the reported target processing or display capacities have been exceeded.

The system shall present reported tracked targets information in accordance with IEC 62288:2014, 5.5.1.

Alert conditions included in the tracked target data, e.g. lost target warning and CPA/TCPA alarm shall not be repeated by ECDIS as an alert but may be graphically indicated using the appropriate symbols as defined in IEC 62288.

If the interface does not provide all details for CPA/TCPA or if some details are not available from the interface then the ECDIS may derive such details from the available details. If ECDIS derives CPA/TCPA from available values in the interface then the ECDIS shall meet the CPA/TCPA requirements of IEC 62388:2013, 11.3.14.7.

NOTE 2 Combination of TTD (protocol version 0), TLB and TTM sentences provides all details including CPA/TCPA available from radar for tracked targets, but TTM is not a requirement of IEC 62388 and may not be available from all radars. A combination of TTD (protocol versions 0 and 1) and TLB includes the CPA/TCPA values. TTD protocol version 1 is described in Annex V. Alternatively, the CPA/TCPA values may be derived using own ship speed and course from the OSD sentence.

An ECDIS that provides facilities for radar target detection and tracking that are independent of a shipborne radar system shall comply with the target tracking requirements of IEC 62388:2013, 11.3. For presentation of radar video images the requirements of IEC 62288 on radar presentation shall be met.

If facilities are provided for radar target detection and tracking that are independent of a shipborne radar system, then if the CPA and TCPA values of a tracked target are less than the set limits, a CPA/TCPA alarm shall be given and the target causing the alarm shall be clearly indicated.

Past positions for radar targets may be provided.

The last reported or predicted position of a lost target shall be clearly marked by a lost target symbol on the display as set forth in IEC 62288:2014, Annex A. If facilities are provided for radar target detection and tracking that are independent of a shipborne radar system, then the

lost target warning shall be given if the lost target warning function is enabled. The lost target symbol shall disappear if the signal (or message) for the target is received again or after the warning has been acknowledged. A means or method shall be provided for the user to enable or disable the lost target warning function. The default shall be disabled. There shall be a clear indication whether the lost target warning function for tracked targets is enabled or disabled. If a tracked radar target is excluded by a pre-determined range or pre-set parameter (if this feature is provided), then no warning shall be generated.

4.6.2.4 Target association

(See 6.8.15.5)

4.6.2.4.1 Target association – External

The requirements of this subclause apply if tracked target information is provided and if ECDIS uses target association information provided by radar using TTD and TLB sentences.

If both tracked target information and AIS target information are displayed at the same time on the ECDIS, then ECDIS shall display them as a single target according to Annex A of IEC 62288:2014. Where ECDIS also receives reported targets directly from AIS, ECDIS shall filter the display of the reported AIS targets using the MMSI to avoid duplicated targets.

If target information from AIS and radar tracking are both displayed at the same time and where the AIS and radar information is considered one target, then as a default condition, the activated AIS target symbol and the alphanumeric AIS target information shall be automatically selected and displayed as set forth IEC 62288:2014, Annex A. The user shall have the option to change the default condition to the display of tracked radar targets and shall be permitted to select either radar tracking or AIS alphanumeric information.

Where the AIS and radar information are considered as two distinct targets, one activated AIS target symbol and one tracked radar target symbol shall be displayed as set forth in IEC 62288:2014, Annex A. Where the AIS and radar information become sufficiently different so as to be considered as two distinct targets no alert shall be raised.

4.6.2.4.2 Target association – Internal

The requirements of this subclause apply if tracked target information is provided and if ECDIS provides an internal solution for target association.

If both tracked target information and AIS target information are displayed at the same time on the ECDIS and if ECDIS provides facilities for the automatic association of reported AIS targets with tracked radar targets that are independent of a shipborne radar target tracking system, then the facilities shall comply with IEC 62388:2013, 11.8.

If target information from AIS and radar tracking are both displayed at the same time and where the AIS and radar information are considered one target, then as a default condition, the activated AIS target symbol and the alphanumeric AIS target information shall be automatically selected and displayed as set forth in IEC 62288:2014, Annex A. The user shall have the option to change the default condition to the display of tracked radar targets and shall be permitted to select either radar tracking or AIS alphanumeric information.

Where the AIS and radar information are considered two distinct targets, one activated AIS target symbol and one tracked radar target symbol shall be displayed as set forth in IEC 62288:2014, Annex A. Where the AIS and radar information become sufficiently different so as to be considered as two distinct targets no alert shall be raised.

4.6.3 AIS information

4.6.3.1 General

(See 6.13)

The requirements for AIS information apply if an AIS interface is provided.

Reported targets provided by the AIS may be filtered according to user-defined parameters. Targets may be sleeping, or may be activated. Activated targets are treated in a similar way to radar tracked targets.

NOTE 1 Class A AIS is provided for SOLAS ships and provides full data. Class B AIS is for non-SOLAS craft providing a subset of that data.

NOTE 2 The AIS target state diagram is shown in Annex G of IEC 62388:2013.

4.6.3.2 AIS targets and data report capacity

(See 6.13.2)

It shall be possible to display and provide full presentation functionality for a minimum number of sleeping and activated AIS targets and AIS data reports according to Table 2.

A caution shall be generated when the capacity of processing/display of AIS targets and data reports is about to be exceeded.

A warning shall be generated when the AIS reported target processing/display capacity has been exceeded.

The AIS target display capacity defines the minimum number of AIS targets which can be displayed. The equipment shall provide the capability to display a minimum number of AIS targets and AIS data reports according to Table 2.

The AIS target processing capacity of the equipment shall provide the capability to process the number of VDM (VHF Data-link Messages) corresponding to 90 % of fully loaded VDL (VHF Data-link). In that condition, continuous and smooth update of displayed AIS targets and AIS data reports shall be maintained. The worst case conditions result from a very large number of anchored targets or a smaller number of fast moving targets and/or manoeuvring targets.

The user manual shall describe the display capacity and the processing capacity for the equipment and, in addition, shall describe the operation in the event that capacity is at, or close to, the maximum provided in each case.

NOTE 1 The AIS interface has a maximum data rate of 4 500 messages per minute.

Table 2 – AIS display capacity

Minimum part of the total capacity which may be activated AIS ship targets, Class A and Class B.	40
Minimum total capacity for all Class A (active and sleeping), Class B AIS (active and sleeping), AIS AtoN, AIS Base Station, AIS-SART and SAR Aircraft.	240

NOTE 2 Unlike the radar ECDIS does not have multiple categories therefore AIS display capacity is equivalent to CAT 1 as defined in IEC 62388.

NOTE 3 AIS-SART includes AIS search and rescue transmitters (SARTs) and other devices using AIS burst transmission technology, including AIS Man Overboard devices (AIS-MOB) and EPIRB-AIS devices.

4.6.3.3 AIS target filtering

(See 6.13.3)

To reduce display clutter, a means to filter the presentation of sleeping AIS targets shall be provided, together with an indication of the filter status (e.g. by target range, CPA/TCPA or AIS target Class A/B, etc.). It shall not be possible to remove individual AIS targets from the display. AIS target filtering provides means for an operator to control the number of displayed AIS targets and data reports within the limits of the display capacity.

If a filter is applied, then there shall be a permanent indication. The filter criteria in use shall be readily available.

Criteria for filtering to reduce display clutter shall only include sleeping Class A or sleeping Class B when combined with one or more other factors, for example including: CPA/TCPA Speed, Range, Course and Bearing.

For ECDIS the criteria for filtering shall include the possibility to filter all active and sleeping AIS targets.

NOTE The above would allow the ECDIS to display for example only AIS AtoN without any other AIS targets or information.

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

4.6.3.4 Activation and deactivation of AIS targets

(See 6.13.4)

A means to activate a sleeping AIS target and to deactivate an activated AIS target shall be provided. If zones for the automatic activation of AIS targets are provided, they shall be the same as for automatic radar target acquisition, if available. In addition, sleeping AIS targets may be automatically activated when meeting user defined parameters (e.g. target range, CPA/TCPA or AIS target Class A/B). Automatic activation is independent of AIS target filtering. If means are provided for automatic activation of AIS targets, then means for disabling that function shall be provided and the disable status shall be indicated. The manufacturer shall state what user defined parameters are available and shall show that they are described in the user manual.

Any user defined zones (for example, acquisition/activation zones) in use shall be presented in graphical form with their relevant symbols set forth in IEC 62288:2014, Annex A.

4.6.3.5 AIS functionality and presentation

(See 6.13.5)

The presentation of reported AIS targets and AIS data reports shall be in accordance with the requirements of IEC 62288.

AIS information shall be graphically presented as sleeping or activated targets.

AIS targets that are displayed shall be presented as sleeping targets by default.

The course and speed of a tracked radar target or reported AIS target shall be indicated by a predicted motion vector. The vector time (i.e. length) shall be adjustable and valid for presentation of any target regardless of its source.

A permanent indication of vector mode, time and stabilisation shall be provided. The AIS vector properties shall be generally consistent with those of tracked target vectors, if tracked target is provided.

The consistent common reference point shall be used for the alignment of tracked radar and AIS symbols with other information on the same display.

On large scale/low range displays, a means to present the true scale outline of an activated AIS target shall be provided in accordance with IEC 62288:2014, Annex A.

It shall be possible to display the past position of activated targets.

The reported AIS targets shall be time-referenced so that AIS symbology shall be progressively positioned according to its reported course and speed.

ECDIS shall be able to process and display the following VDL messages for AIS targets and AIS data reports:

a) Messages: 1, 2, 3 and 5 (Class A AIS and AIS-SART);

b) Messages: 18, 19 and 24 (Class B AIS);

c) Message 9 (AIS on Airborne SAR craft);

d) Message 21 (AIS AtoN);

e) Messages 12 and 14 (Safety related messages).

Optionally ECDIS may process and display additional VDL messages for AIS data reports (for example Messages 6 and 8, AIS application specific messages). The manufacturer shall declare in the user manual the supported AIS application specific messages including description of their functionality. The presentation shall be according to IEC 62288.

NOTE Messages 6 and 8 consist of a 16-bit application identifier (AI) and data content. The AI consist of a 10-bit designated area code (DAC) and a 6-bit function identifier (FI). DAC value 0 is for test purposes, DAC values 1 to 9 are for international use, DAC values 10 to 999 are for regional use and DAC values 1 000 to 1 023 are reserved for future use. The supported AIS application specific messages are identified as combination of DAC and FI. For example DAC set as 1 to 9 and FI set as 2, 3, 4, 5, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 30, 31 or 32 (see IMO SN.1/Circ.289).

4.6.4 AIS target data

(See 6.13.6)

Requirements for AIS target data apply, if an AIS interface is provided.

It shall be possible to select any AIS target for the alphanumeric display of its data. An AIS target selected for the display of its alphanumeric information shall be identified by the relevant symbol set forth in IEC 62288:2014, Annex A. If more than one target is selected for data display, the relevant symbols and the corresponding data shall be clearly identified. There shall be a clear indication to show that the target data is derived from AIS.

For each selected AIS target the following data shall be presented in alphanumeric form: source(s) of data, ship’s identification, navigational status, position and where available its quality, range, bearing, COG, SOG, CPA, and TCPA. Target heading and reported rate of turn shall also be made available. Additional target information shall be provided on request.

An indication shall be provided in the alphanumeric display when additional information is available.

For ECDIS the sea stabilization of speed vectors is an option. If provided and selected, the CTW and STW shall be presented in place of COG and SOG. If both optional AIS interface and tracked target interface is provided, the speed vectors shall share common operator

selection for vector time (length), relative/true and ground/sea stabilization. If provided, the vector time (length), relative/true selection and ground sea stabilization selection shall be indicated. The default selections shall be as indicated in Table 3.

For ECDIS the bow crossing is an option. If provided bow crossing range and bow crossing time (BCR/BCT) may be presented.

NOTE The AIS transponder provides for each AIS target the position and may provide COG, SOG and heading. Range, bearing, CTW, STW, CPA, TCPA, bow crossing range and bow crossing time (BCR/BCT) are calculation results against own ship data and they are not provided by the AIS transponder.

If ECDIS derives CPA/TCPA from available values in the interface then the ECDIS shall meet the CPA/TCPA requirements of IEC 62388:2013, 11.3.14.7.

Manufacturer's documentation shall include a description of which AIS data if received on the interface is used and which information and indications presented to the user are derived from the values available on the interface and the values available for own ship.

If the received AIS information is incomplete, the absent information shall be clearly indicated as "missing" within the target data field.

The data shall be displayed and continually updated, until another target is selected for data display or until the window is closed.

Means shall be provided to present own ship AIS data on request.

4.6.5 AIS voyage-related data

(See 6.14)

Requirements for AIS voyage related data apply, if an AIS interface is provided.

Means shall be provided for on demand display of the following own ship data. Means shall be provided for the user entry of the following data and output of this data via the interface to AIS. (See Table Q.4, VSD).

a) Cargo category

   The descriptions of ship and cargo are indicated by a number, which correspond to textual description. Refer to ITU-R M.1371-5 Annex 8, Message 5.

b) Navigation status

   The description of navigation status is indicated by a number, which corresponds to the textual description. Refer to ITU-R M.1371-5 Annex 8, Messages 1, 2, 3.

c) Ship's draft (maximum actual static)

   The ship's maximum draft is indicated by a number. Refer to ITU-R M.1371-5 Annex 8, Message 5.

d) Destination

   The description of destination is a maximum 20 character string. Refer to ITU-R M.1371-5 Annex 8, Message 5.

e) ETA date and time

   Month, day, hours, minutes, universal coordinated universal time (UTC). Refer to ITU-R M.1371-5 Annex 8, Message 5.

4.6.6 AIS CPA/TCPA alarms

(See 6.13.7)

If ECDIS provides facilities for radar target tracking that are independent of a shipborne radar system, means may be provided to create a common CPA/TCPA alarm function for AIS. If provided, the collision avoidance alarm criteria shall be the same for both AIS and tracked targets. It shall be possible to enable or disable a common CPA/TCPA alarm function for both AIS and tracked targets. An indication shall be given if the CPA/TCPA alarm function for AIS is disabled.

If the CPA/TCPA alarm function is activated, and if the calculated CPA and TCPA values of an activated AIS target are less than the set limits, a CPA/TCPA alarm shall be given and shall be identified as such and the target causing the alarm shall be clearly indicated.

If the ECDIS provides CPA/TCPA alarm function for tracked targets then the preset CPA/TCPA limits applied to targets from radar and AIS shall be identical. As a default state, the CPA/TCPA alarm functionality shall be applied to all activated AIS targets. On user request, the CPA/TCPA alarm functionality may also be applied to sleeping targets.

AIS ship outline dimension data is not required to be considered in CPA/TCPA for AIS targets. Such capabilities, if provided, should be described in the user manual.

4.6.7 AIS lost target warning

(See 6.13.8)

If ECDIS provides facilities for a CPA/TCPA alarm function for AIS targets, means may be provided to create a lost target warning function for AIS. The enabled state of the lost target warning function for AIS shall be available only when the CPA/TCPA alarm function is enabled.

It shall be possible to enable or disable the lost target warning function for activated AIS targets. A clear indication shall be given if the lost target warning function is disabled. A lost target warning function for sleeping targets may be provided.

If the following conditions are met for a lost AIS target:

- the AIS lost target warning function is enabled;
- the target is of interest, according to lost target filter criteria;
- a message is not received for a set time, depending on the nominal reporting rate of the AIS target (see IEC 62388:2013, Table 27);

then the following applies:

- the last known (or predicted) position shall be clearly indicated within the operational area as a lost target and warning shall be given;
- the indication of the lost target shall disappear if the signal is received again, or after the warning has been acknowledged;
- a means of recovering historical data from previous AIS reports shall be provided.

4.6.8 Anchor watch

(See 6.15)

NOTE This requirement derives from an IMO formal safety assessment of general cargo ship safety (see IMO MSC.88/19/2).

Means shall be provided for the operator to specify an anchor location as position offset from the common reference point to the anchor location.

Means shall be provided for the operator to specify the radius of the swing circle. When activated, the anchor watch function shall display the swing circle. The centre of the swing

circle shall be at the position derived from the anchor location and the own ship position at the time when the operator activated the function, i.e. when the anchor was dropped. An anchor symbol shall be displayed at the centre of this swing circle.

While the function is activated, the system shall monitor the outline of own ship. If any part of the outline moves outside the swing circle the system shall raise a warning. If this warning is not acknowledged within 2 min, and own ship remains outside the swing circle, the alert shall be escalated to an alarm (see 4.12.2.2).

If the anchor watch function is deactivated while this alert is present, the alert shall be cleared.

The swing circle and anchor symbol shall be as described in Annex W. The colour shall be red while any part of the outline of own ship remains outside of the circle.

4.7 Display mode and generation of the neighbouring area

(See 6.8.9)

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

NOTE 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, 6.8.6)

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

If SENC data from a non-HO source is in use, it may use other colours or symbols than specified by IHO S-52. In this case a permanent indication "non-ENC data" shall be provided.

NOTE "Non-ENC data" indicates that the equipment does not comply with carriage requirement of ECDIS.

If SENC data from HO source is in use and if the representation uses colours or symbols different from IHO S-52 then a permanent indication "non-ECDIS presentation, non SOLAS mode" shall be provided.

NOTE "Non-ECDIS presentation" indicates that the equipment does not comply with carriage requirement of ECDIS.

(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* (see IEC 62288).

(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,* Annex A*).*

(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 IHO S-52,* Annex A*).*

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 6.8.3)

(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.* (See 4.3.3)

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 alerts or indications of crossing the ship's safety contour,* of being too close to a point object, such as a fixed or floating aid to navigation or isolated danger

(navigational hazard) *and of entering a prohibited area, and for alerts and indications according to* Annex D*.*

4.10.2 Route planning

4.10.2.1 Route plan

(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.*

The indication shall be both graphical in the chart area using IEC 62288:2014, Table A.3, graphical symbol 3.5 b and textual in the user dialog area of the route plan.

The graphical highlight shall be the intersection between the planned route and the charted feature/object.

The charted feature/object which is the origin of the indication shall be displayed on demand together with the IEC 62288:2014, Table A.3, graphical symbol 3.5 b. This may require temporary override of the user selected viewing group layers (see Annex M) or temporary display of a charted feature/object from the largest scale available.

Optionally, the graphical indication in the chart area may be selectable between on and off state. When selected for off state, a permanent indication shall be provided that the "Indication of crossing safety contour is Off".

(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* (navigational hazard)*.*

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.

The indication shall be both graphical in the chart area using IEC 62288:2014, Table A.3, graphical symbol 3.5 c and textual in the user dialog area of the route plan.

The graphical highlight shall be the intersection between the planned route and the charted feature/object.

The charted feature/object which is the origin of the indication shall be displayed on demand together with the IEC 62288:2014, Table A.3, graphical symbol 3.5 c. This may require

temporary override of the user selected viewing group layers (see Annex M) or temporary display of a charted feature/object from the largest scale available.

Graphical indication in the chart area shall be selectable between on and off states separately for navigational hazards and for each prohibited area or each area with special conditions (see Annex C). If any of the selectable indications is in the off state, there shall be a relevant permanent indication: "Indication of navigational hazards is Off" or "Indication of some prohibited areas or areas with special conditions is Off". The full list of prohibited areas or areas with special conditions in the off state shall be available on demand.

(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.*

4.10.2.2 Annotated Route plan

(See 6.9.2)

NOTE An annotated route plan combines a route plan with additional mariner's information (see 6.4.1). It includes some of the information required by the guidelines for voyage planning (IMO A.893(21)).

Annotated route plan may be provided. If provided, the following rules apply:

1) additional mariner's information shall be organized in similar way to route plans, which means separately named entities such as files or databases;
2) annotation means that a route plan shall be linked to such separately named entities;
3) annotated route plan shall provide a textual document in electronic form. A paper version may be provided. The document shall list all items from both route plan and additional mariner's information in the same sequence as they will appear when the ship sails the planned route.

   EXAMPLE The sequence could be: waypoint 1 with ETD, caution (dangerous area), waypoint 2 with ETA, caution (danger), information (leave pilot), waypoint 3 with ETA, information (speed limit), etc.

4.10.2.3 Route plan exchange with other equipment

(See 6.9.2)

Optionally, means may be provided to export and import route plans and annotated route plans with other equipment. The media used may be a removable memory device (for example USB memory stick, SD card, etc.) or a fixed wired interface (for example IEC 61162-450, see 4.12.7 and Annex T). The format of the route plan exchange for export and import is described in Annex S.

4.10.3 Route monitoring

(See 6.8.13, 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 alerts 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.*

The system shall allow the user to select a route for monitoring only if the pre-planned route has been checked that the radius of planned turns allows each turn to complete before the next turn.

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

The visual indication of the alarm shall be graphical in the chart area using IEC 62288:2014, Table A.3, graphical symbol 3.5 b and textual in the user dialog area of the alert management.

The graphical highlight shall be the intersection between the own ship look-ahead area and the charted feature/object.

The charted feature/object which is the origin of the alarm shall be displayed on demand together with the IEC 62288:2014, Table A.3, graphical symbol 3.5 b. This may require temporary override of the user selected viewing group layers (see Annex M) or temporary display of a charted feature/object from the largest scale available.

Optionally, the graphical indication in the chart area may be selectable between on and off state. When selected for off state, a permanent indication shall be provided that the “Indication of crossing safety contour is Off”.

(232/A11.4.4) *ECDIS* shall *give a* warning *or* caution*, as selected by the mariner, if, within a specified* look-ahead *time* or distance *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)

The visual indication of the warning or caution shall be graphical in the chart area using IEC 62288:2014, Table A.3, graphical symbol 3.5 c and textual in the user dialog area of the alert management.

The graphical highlight shall be the intersection between the own ship look-ahead area and the charted feature/object.

The charted feature/object which is the origin of the warning or caution shall be displayed on demand together with the IEC 62288:2014, Table A.3, graphical symbol 3.5 c. This may require temporary override of the user selected viewing group layers (see Annex M) or temporary display of a charted feature/object from the largest scale available.

Graphical indication in the chart area shall be selectable between on and off states separately for each prohibited area or area with special condition (see Annex C). If any indication is in the off state, a permanent indication: "ProhAre" shall be provided. The full list of prohibited areas or areas with special conditions in the off state shall be available on demand.

(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) *A caution* 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* (navigational hazard).

The visual indication of the caution shall be graphical in the chart area using IEC 62288:2014, Table A.3, graphical symbol 3.5 c and textual in the user dialog area of the alert management.

The graphical highlight shall be the intersection between the own ship look-ahead area and the charted feature/object.

The charted feature/object which is the origin of the caution shall be displayed on demand together with the IEC 62288:2014, Table A.3, graphical symbol 3.5 c. This may require temporary override of the user selected viewing group layers (see Annex M) or temporary display of a charted feature/object from the largest scale available.

Optionally, the graphical indication in the chart area may be selectable between on and off states. When selected for off state, a permanent indication shall be provided that the "Indication of navigational hazards is Off".

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) *A warning* 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 a warning shall be given. The words "to reach a critical point" shall be considered as 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:*

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

b) 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 as specified in Annex B*.*

Measurements from own ship (for example, range rings, range and bearing, cursor, tracking data) shall be made with respect to the CCRP.

Note that an "adequate number" of EBL and VRM implies at least one of each.

4.10.4 Position integration

(See 6.8.14, 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 to the operator which method is being used, and provide a means for the operator to select the method to use. Manually obtained position fix and dead reckoning functions are required as one secondary independent positioning source, but these are not considered to be continuous even if it is based on continuous heading and speed sources. Refer to 4.10.6.

ECDIS shall permanently indicate using a yellow colour the source of the position whenever the source is from non continuous position system or method.

NOTE Yellow indicates here information with doubtful integrity in accordance with IEC 62288:2014, 4.8.2.1.

(232/A11.4.8) *ECDIS* shall *provide a warning when the input from the* continuous *position, heading or speed sources is lost. ECDIS* shall *also repeat, but only as an indication, any alert 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 a warning 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* (i.e. permanently indicated)*, maintained until altered by the mariner, and automatically recorded.*

4.10.5 Object information

(See 6.8.12)

(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, fix or dead-reckoned position plot (EP, fix 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 (from the position source in use), 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 the 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 (i.e. bearing) between two geographical positions;

2) geographic position from known position and distance/azimuth (i.e. bearing); and

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

Accuracy of geodetic calculations shall be for distance within 1 % or 30 m, whichever is the greater distance and shall be for bearings within 1° (see Annex J).

4.12 Connections with other equipment (interfaces)

4.12.1 Connection with navigation equipment

(See 6.2.1, 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.*

ECDIS shall also be capable to be connected to BAM equipment, BNWAS, ECDIS back-up system and VDR. Optionally ECDIS may be connected to other navigational and communication equipment, for example Radar, AIS, Autopilot, Track Control, Echo sounder, SafetyNET, and NAVTEX.

As a minimum, the ECDIS shall support the interfaces as given in Annex Q. The manufacturer shall specify which physical interfaces are supported. In addition, suitable alternative input or output interfaces may be used.

4.12.2 Connection with BAM

(See 6.2.2)

4.12.2.1 BAM compliant interface

NOTE The performance standards for Bridge Alert Management (BAM) tailor the IMO Code on Alerts and Indicators to harmonize the priority, classification, handling, distribution and presentation of alerts on bridge equipment.

ECDIS shall provide an alert management handling and interface compliant with the requirements of BAM Module A and C further specified for ECDIS in the Annex Q, the state

diagram of IEC 61924-2:2012, Annex J and the detailed sentence definitions of IEC 61924-2:2012, Annex K (see Annex D).

Alert management requires:

a) classification of all alerts available in the EUT;

b) presentation of the alerts;

c) reporting of alerts;

d) handling of unacknowledged warnings, see 4.12.2.2;

e) functionality of remote acknowledge and remote silencing, see 4.12.2.3.

4.12.2.2 Unacknowledged warnings

An unacknowledged warning shall be:

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

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

c) changed to alarm priority after a user selectable time not more than 5 min.

If a user selectable time setting is provided, the default time for the user selected period shall be 60 s.

4.12.2.3 Remote acknowledgments and silencing of alerts

Remote temporary silencing and remote acknowledgement shall be possible via alert related communication described in Annex Q and the detailed sentence definitions of IEC 61924-2:2012, Annex K.

Remote acknowledgement shall only be possible for category B alerts, see IEC 61924-2:2012, Annex C.

Remote silencing of the relevant audible alerts of the ECDIS shall be possible at any time.

4.12.3 Connection with VDR

(See 6.2.3)

4.12.3.1 VDR interface

An interface with VDR shall be provided based on IEC 61162-450 and IEC 61996-1:2013, Annex E and Annex G.

4.12.3.2 Transfer of screen image

A subjectively lossless graphic algorithm shall be used as defined in IEC 61996-1:2013, 5.8 (VDR).

Means shall be provided to configure at installation the header data for the following information in the “Status and information text field” as described in IEC 61996-1:2013, Annex E:

a) identity of the class of image including source type together with identifier, for example “Source:ECDIS.2”;

b) identity of the display location.

The Ethernet interface shall provide digital file transfers of one screen capture each 15 s. Means may be provided to configure the use of higher update rates.

Means shall be provided to change the synchronization of the image message transfer to the local clock within the 15 s update period. The default synchronization shall be ECDIS.1 local clock +8 i.e. send at:08,:23,:38,:53, ECDIS.2 local clock +12 i.e. send at:12,:27,:42,:57.

4.12.3.3 Transfer of ECDIS display source information

ECDIS display source information shall be transferred to VDR as defined in IEC 61996-1:2013, Annex G, Table G.1. Items defined in IEC 61996-1:2013, Annex G, Table G.2 may be included. The transfer shall happen at least every 10 min if the reported information is unchanged from previous transfer. The transfer shall happen within 2 s when any of the reported information has been changed.

The content of ECDIS display source information shall include charts used for display purposes and charts used for alert purposes (i.e. largest scales available).

4.12.4 Connection with BNWAS

(See 6.2.4)

To provide user activity information to BNWAS, an EVE sentence as specified in IEC 61162-1 shall be output in response to user-interaction with the ECDIS under conditions described in the user manual.

It is a requirement of BNWAS that it shall not be possible to initiate the reset function or cancel any audible alarm from any device, equipment or system not physically located in areas of the bridge providing proper look out. The ECDIS installation manual shall contain instructions about installation locations and/or configuration of the possibility of resetting the BNWAS timer from the ECDIS when the BNWAS interface can be connected or configured to reset the dormant period of the BNWAS.

4.12.5 Connection for SENC information

(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.

4.12.6 Connection with NAVTEX or SafetyNET for MSI

(See 6.16)

If provided, an interface with either NAVTEX (IEC 61097-6) or SafetyNET (IEC 61097-4) shall comply with the following requirements for processing and presentation of MSI messages received via NAVTEX or SafetyNET.

a) Provide an indication when a new MSI message is received until it has been displayed or 24 h have passed.

b) This indication may be suppressed if the MSI message does not meet criteria set by the mariner.

c) Means shall be provided for the operator to enter criteria for suppression of indication of new MSI messages based on time and distance from own ship, monitored route or planned route. Default setting is no suppression.

NOTE The criteria set for ECDIS indication of new MSI messages are independent of such settings on the MSI receiver which may optionally be controllable by NRM sentence for NAVTEX.

d) Details of the coverage areas and message categories which have been excluded by the operator from reception and/or display should be readily available.

e) For NAVTEX ECDIS shall provide means to view the receiver INS mask set inside the NAVTEX (see IEC 61097-6). Optionally ECDIS may provide means to set the NAVTEX receiver mask(s). The elements of the INS mask are: Frequency, transmitter coverage

area and message type (see NRM sentence). The elements of the INS mask shall be provided for display as characters ‘A’, ‘B’, etc.. ECDIS shall send a query sentence requesting an NRM sentence prior to display of the INS mask.

f) Capability for data storage of MSI messages for at least 255 most recent messages per each source of MSI shall be provided.

g) The user shall be able to tag individual messages for permanent retention. These messages may occupy up to 25 % of the available memory and shall not be overwritten by new messages. When no longer required, the user shall be able to remove these messages.

h) Means shall be provided to view the most recent message, past messages, and to view messages associated with selection of MSI symbols in the graphical display area.

i) Means for viewing MSI messages shall provide at least 16 lines of message text at a time with a minimum of 40 characters/line..

4.12.7 Connection for transfer of route information

(See 6.17)

If a fixed wire interface is provided (see 4.10.2.3) means shall be provided based on IEC 61162-450 to send and to receive information on a monitored route and alternate routes with other navigation equipment; for example, backup ECDIS, planning workstation, radar, etc. (see Annex T). The data shall comply with the appropriate parts of Annex S for this purpose, as a minimum.

Means shall include:

a) bidirectional transfer of route(s) for editing purposes. The reported type of transferred route is A in the RRT sentence;

b) transfer of route for monitoring purpose. The reported type of transferred route is M in the RRT sentence;

c) sending of RRT sentences using IEC 61162-450 to inform another party about the transfer of a route, and reception of RRT sentences using IEC 61162-450 for file transfer status and intended application status (see Annex T);

d) for sending:

- a method to initiate transfer of a route;
- indication of the status of the IEC 61162-450 file transfer and the status of the intended application based on the received RRT sentence;
- indication of no response if the RRT sentence is not received within the manufacturer’s specified timeout;

e) for receiving:

- a method to accept or reject a received route at application;
- reporting to the sender the status of the IEC 61162-450 file transfer and the status of the intended application based on the received RRT sentence. This reporting can be either by one or two RRT sentences. In a one sentence report a single RRT sentence reports both file transfer status and application level status. In a two sentence report the first RRT sentence reports only the file transfer status and the second RRT sentence reports the application level status;
- if the receiver is an ECDIS, a method to perform a safety check of the received route against chart database and a method to perform a geometry check at application level;
- a method to request a route from another ECDIS after power on (See Annex T, Q=Query for transmitting any monitored route or alternative route for editing);

f) a log of these interactions.

4.12.8 Connection with INS

(See 6.18)

The ECDIS shall indicate the received integrity and plausibility of the basic CCRS values using the information in the NSR sentence. Colour coding of the values as specified in IEC 62288 shall be used.

4.13 Performance tests, malfunction alerts and indications

(See 6.8.19)

(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.*

Major functions of ECDIS are: the ECDIS equipment itself, interface to electronic position fixing system, interface to the gyro compass, interface to the speed and distance measuring device, optional interface to the radar and optional interface to the AIS.

(232/A13.2) *ECDIS* shall *provide suitable* alert (i.e. warning) *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 F.3)

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.* (See 4.12.7)
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.* (See 4.12.7)

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, rev1. 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, at least by a website which is linked to the IHO 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. The procedures for providing timely access shall be part of the recognized quality system of the manufacturer.

4.17 Quality management requirements

(See 6.11)

The equipment and documentation shall be developed, produced and written in accordance with a recognised quality procedure, for example ISO 9001 or an equivalent recognised quality standard.

NOTE See also IEC 60945 Software.

4.18 Default control setting and saved user control settings

(See 6.12)

The configuration specified in Table 3 shall be selectable by a single operator action followed by an action to confirm the selection.

A facility shall be provided to store and recall user-specific settings that result after adjustments to suit the conditions at hand. At least two such configurations shall be available to be stored for recall. Selection for recalling a stored configuration shall be followed by an action to confirm the selection.

Table 3 – Control settings configured in response to 'Default' selection

(Appendix 6 of IMO resolution MSC.252(83))

Function	***Setting***
Display category	*ECDIS Standard display*
Chart related selector: Accuracy	Off
Chart related selector: Date dependent objects	current date
Chart related selector: Highlight date dependent	Off
Chart related selector: Full light lines	Off
Chart related selector: Highlight info	Off
Chart related selector: Highlight document	Off
Chart related selector: Unknown	On
Chart related selector: Scale min	Off
Chart related selector: Shallow pattern	Off
Chart related selector: Shallow water dangers	On
Chart related selector: Contour labels, if provided	Off
Chart related selector: Four shades, if provided	Off
Chart related selector: National language, if provided	Remain unchanged
Chart related selector: Paper chart / Simplified symbols	Paper chart
Chart related selector: Plain / Symbolized boundaries	Plain
Chart related selector: Text group layer	Important text
Selected sea area	*Around own ship with appropriate off-set*
Range	*3 NM*
Orientation	*True motion, north-up*

Function	***Setting***
True motion reset	10 % from display edge
Geodetic datum, if selectable	WGS84
Manual updates (see 5.9.2)	*If applied* i.e. displayed if available
Mariner's *notes* (see 5.4.1)	*If applied* i.e. displayed if available
Selected route	*Last selected route, including route parameters*
Past track	*On*
Past track length, if selectable (see Annex B, *1.1* and *1.2*)	12 h
Past track time-labels	On, 30 min
Look-ahead time	*6 min*
Any edit window (for example route plan)	Exit
Position data source	remain unchanged
Safety contour	remain unchanged
Safety depth	remain unchanged
Cross track limit	remain unchanged
Graphical indication of crossing safety contour during route planning, if selection provided	On
Graphical indication of prohibited areas, areas with special conditions and navigational hazards during route planning, if selection provided	On
Distance to prohibited areas, areas with special conditions and navigational hazards	remain unchanged
Graphical indication of crossing safety contour during route monitoring, if selection provided	On
Graphical indication of prohibited areas and areas with special conditions during route monitoring, if selection provided	On
Graphical indication of navigational hazards during route monitoring, if selection provided	On
Object highlight, selected object, track display from log	Cleared from display
Cursor pick	Closed
Any additional window (dual view, 3d, tides, etc.)	Closed
Any additional information layer, proprietary layer (weather, tides, AML, etc.)	Cleared from display
Chart update, Chart information exchange	Aborted
Colour differentiation test diagrams	Closed
Update review	Off
Chart 1	Closed
Units	m, NM, kn
Crossing a navigational hazard in route monitoring mode	Caution
Vector time (length)	6 min
Vector mode	True
Vector stabilization	Ground
Symbol for target association, if provided	AIS

Function	*Setting*
Collision warnings, if provided	ON (limits, CPA = 2 NM; TCPA = 12 min)
Radar and AIS target association, if provided	ON
AIS target filtering, if provided	target range = 6 NM target CPA = 4 NM target TCPA = 24 min target display = Off sleeping target display = Off AtoN display = On SART display = On repeated target display= Off
AIS true target outline	Off
Display of Radar image overlay, if provided	Off
Display of Radar tracked targets, if provided	Off
Display of AIS reported targets, if provided	Off
Target past positions, if provided	Off
Target trails, if provided	Off
Lost target warning, if provided	Off
Lost target warning range, if provided	12 NM
AIS interrogation, if provided	Off
Own ship true outline	Off
LOP source indication	Off
User selected time for warning escalation	60 s
Suppression of indication of user selected MSI messages based on first character of NAVTEX code field, if provided (see 4.12.6 b))	Remain unchanged
Supression of indication of user selected messages based on time and distance from own ship, monitored route or planned route (4.12.6 c))	No
Brightness and contrast controls, if software controlled	Calibrated setting

5 Requirements contained in IHO publications

5.1 Priority of chart display

(See 6.8.6)

(S-52/2.3.2a) *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 alerts/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) mariner's data: points/lines and areas (see 5.4.1);

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

10) mariner's colour-fill area data.

This list is not intended to indicate a drawing sequence, but to specify that the information content of category $n + 1$ shall not obscure the information content of category n or any higher category (i.e. n – 1, etc.). (S-52/2.3.2a).

5.2 Display of chart information

5.2.1 Scale and navigation purpose

(See 6.8.8)

(S-52/3.2.3(8a)) *If data from different* compilation *scales appears on the display, the boundary between different scales* shall *be clearly indicated.*

(S-52/3.1.7.2) *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-52/3.1.7(c)) *A graphical index of the navigational purpose of available data* shall *be shown on demand.*

(S-52/3.2.3(8b)) *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, Annex A. (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-52/3.2.3(9a)) *The IMO performance standards require an indication of scale and range as part of the display base. For display scale larger than 1:80 000: always display the 1 mile scale bar provided in the Presentation Library.*

(S-52/3.2.3(9b)) *For display scale at 1:80 000 or smaller: always display the 10 mile latitude scale provided in the Presentation Library.*

If the displayed area together with the used projection is such that scale is not uniform over the displayed area then the scale bar (more than 5 % difference in uniformity for all directions or displayed area is over latitude 70º) or latitude scale (more than 5 % difference in uniformity for latitude direction or displayed area is over latitude 70º) shall indicate the scale either at own ship location or at the centre of the displayed area. In such case a permanent indication "at own ship" or "at centre" shall be close to the scale bar or latitude scale.

5.2.2 Units and legend

(See 6.7.2)

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

(S-52/2.3.1g) *A standard legend of general information relating to the cursor pick location,* 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 shall be available for simultaneous display. It is not necessary to accomplish this using a single "standard legend" window.

5.2.3 Terminology

(See 6.7.2)

(S-52/Annex A, Part I/10.3.4.4) *User interface and manufacturer's documentation* shall *use terminology available in* Annex E, Table E.1 *for the mariner selections.*

(S-52/Annex A, Part I/14.3) *User interface and manufacturer's documentation* shall *use terminology available in* Annex E, Table E.1 *for the viewing group layers.*

(S-52/Annex A, Part I/14.5) *User interface and manufacturer's documentation* shall *use terminology available in* Annex E, Table E.1 *for the text group layers.*

User interface and manufacturer's documentation shall use the terminology available in Annex E, Table E.2, Table E.3 and Table E.4.

5.3 Display functions

5.3.1 Cursor pick

(See 6.8.12)

(S-52/3.1.9) *It* shall *be possible to call up all the information associated with an object by cursor pick 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* position *of the cursor.* Also refer to 4.3 (232/A5.6).

(S-52/3.1(e)) *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.*

An indication based on IEC 62288:2014, Table A.2, graphical symbol 2.12 shall be presented at the area of cursor pick as long as the information associated with the picked objects is presented. The symbol shall surround the area for picking objects.

5.3.2 Navigational information

(See 6.8.9)

(S-52/3.1.2.1.6(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.

5.3.3 Date-dependant ENC objects

(See 5.9.1)

(S-52/Annex A, Part I/10.4.1) *There are a number of objects within the Marine environment, which are seasonal, such as racing buoys. These objects are only to be displayed over a certain period. IHO S-57 uses attributes Period Start (PERSTA) and Period End (PEREND). Other objects, such as a traffic separation schemes, use the attributes Date Start (DATSTA) and Date End (DATEND) to indicate their introduction or removal. Any ENC object with one of the above attributes* shall *not be displayed outside its effective dates unless requested by the mariner.*

(S-52/ Annex A, Part I/10.4.1) *To provide the mariner effective route planning capabilities and for look-ahead during route monitoring ECDIS* shall *display date dependent chart data based on a mariner selected date or date range (start viewing date and end viewing date).*

(S-52/ Annex A, Part I/10.4.1) *During route planning and monitoring the Mariner* shall *be able to select a date or date range to display all date dependent chart objects. The display of date dependent information is indicated by the symbol SY(CHDAT01).*

(S-52/ Annex A, Part I/10.4.1) *When viewing date or date range do not include current date. The Mariner* shall *be informed by a permanent indication* ‘Display Not Real Time’ *on the chart display that the date has been adjusted.* The selected date or date range shall be readily available.

5.4 Supplementary display functions

5.4.1 Additional mariner’s information

(See 6.8.7)

(S-52/2.3.1(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;*
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.

5.4.2 Additional non-HO information

5.4.2.1 Additional display functions

(See 6.8.7)

(S-52/2.3.1a) *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 IHO S-52, Annex A. Part I)

Display of information from non-HO sources may use presentation based on IHO S-52 or proprietary presentation. Display of information from non-HO sources shall be indicated with permanent indication “non-ENC data” (see 4.3.2 and 4.8) and the area of the non-ENC data shall be marked as defined in IHO S-52, Annex A, Part I, 10.1.7.

5.4.2.2 No data

(See 6.5.3)

(S-52/2.3.1c.2) *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 IHO S-52/Annex A, Part I/10.1.5)

An area with no chart data of any kind shall be marked with the “no data” symbology defined in the presentation library. (See IHO S-52/Annex A, Part I/10.1.8.)

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 IHO S-52/Annex A, Part I/10.1.7)

5.4.2.3 Unknown object

(See 6.5.2)

(S-52/3.1.3) *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”.*

Text information about such objects or areas shall be displayed on demand in accordance with 5.3.1.

5.4.3 Tidal adjustment

(See 6.8.7)

(S-52/1.2(f)) *Depth information* shall *only be displayed as it has been provided in the ENC and not adjusted by tidal height.*

5.5 Use of the presentation library

5.5.1 Presentation library

(See 6.5.2)

(S-52/Annex A, Part I/19.1) *The edition number of the PresLib installed* shall *be available to the Mariner on request.*

(S-52/ 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.

5.5.2 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 IHO 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 colour tables. (See IHO S-52/5.2.5)

5.6 Display characteristics

(See 6.8.3)

(S-52/5.1) *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 mariner's selection.* In addition to the IMO performance standards the following rules apply.

(S-52/2.3.1(g)) *The units for depth* shall *always be on the same screen as the chart display.*

(S-52/2.3.1(e)) *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) *edition number of presentation library in use* (See IHO S-52, Annex A).

5.7 Performance requirements

5.7.1 Redraw

(See 6.9.3)

(S-52/5.1) *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 s. 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 s. 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 s.*

(S-52/2.2.3) *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.

5.7.2 Resolution

(See 6.7.4)

(S-52/5.1) *Minimum lines per mm (L) given by L = 864/s, where s is the smaller dimension of the chart display area (for example for the minimum chart area, s = 270 mm and the resolution is L = 3.20 lines per mm, giving a "picture unit" size of 0.312 mm).*

5.7.3 Symbols

(See 6.7.1)

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

(S-52/3.1.5) *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-52/3.2.1(2)) *The ECDIS* shall *provide the mariner with the option of using either the traditional paper chart symbols or the new simplified symbols, and either the symbolized or the plain area boundary line styles as best fits his purpose.*

5.7.4 Number of colours

(See 6.7.3)

(S-52/5.1) *Colours: 64*

5.7.5 Brightness and contrast

(See 6.7.3)

The brightness and contrast controls shall have a provision to permit returning to the calibrated setting. The user manual shall carry a warning that use of the brightness control may inhibit visibility of information at night. (See IHO S-52/4.2.4.2)

The colour tables are provided in the presentation library, all of which shall be available. (See IHO S-52/Annex A, Part I, Appendix A Colour Tables 4.1)

Colour tolerance values:

1) *(S-52/5.2.3.1) the discrimination difference between any two colours displayed (except those with a tabular ΔE^* less than 20)* shall *be not less than 10 ΔE^* units* for the DAY colour table;
2) *(S-52/5.2.3.1) the difference between the colour displayed and the CIE colour defined in the specification* shall *be not greater than 16 $\Delta(u^*,v^*)$ units. If a monitor is independently tested, then the difference* shall *be not greater than 8 $\Delta(u^*,v^*)$ units;*
3) *(S-52/5.2.3.1) 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/m2 for* DAY.

NOTE 1 (IHO S-52/5.2.3.1) define mathematical formulas as below

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

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

NOTE 2 The previous edition called $\Delta(u^*,v^*)$ as ΔC^*. In this edition $\Delta(u^*,v^*)$ is colour difference metric. CIE defines symbol ΔC^* as a metric of difference in colour saturation only.

5.8 Ergonomic requirements

5.8.1 Mode and orientation

(See 6.8.9)

(S-52/3.2.3(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.*

If the displayed area together with used projection is such that direction of the north is not uniform over the displayed area (more than 20º difference in uniformity or displayed area is over latitude 70º) then the North Arrow shall indicate the direction of North either at own ship location or at the centre of the displayed area. In such case a permanent indication “at own ship” or “at centre” shall be close to the North Arrow.

5.8.2 Windows

(See 6.7.5)

(S-52/3.4.2) *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-52/3.4.2) *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 Update of chart information

5.9.1 General

5.9.1.1 Update methods

Test requirements are addressed to individual update sets or cumulative updates (collection of sequential individual update sets). A third alternative update method is the reissue, i.e. a "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.

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

5.9.1.2 Integration of updates

(See 6.8.17.2, 6.8.18)

(S-52, appendix 1/3.4.1(c)) *Updates* shall *be clearly distinguishable on the display* (see 4.4.2). *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-52/2.3.4.*

5.9.1.3 Recall for display

(See 6.8.17.2, 6.8.17)

(S-52, appendix 1/3.4.1(e)) *It* shall *be possible on demand to review a previously installed* update (see 4.4.2).

Means shall be provided for a review of updates, installed within the last 3 months. The review shall not include updates installed before the current base cell was installed or a reissue of the current base cell was installed.

The review shall provide both graphical highlight (see IHO S-52/10.7.2) and textual report of the chart objects which have been updated including changes, insertions and deletions during the review period.

The mariner shall be able to select the review period by date.

NOTE Review by update numbers is difficult to handle for end users as the seamless chart database contains numerous individual chart cells which all have their unique update numbers. A date range is possible to understand and handle.

5.9.1.4 Log file

(See 6.8.17.3)

(S-52, appendix 1/3.4.1(h)) *ECDIS* shall *keep a record of updates, including time of application and identification parameters described in the Product Specification of S-57,*

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.

NOTE An example of “anomalies” could be error messages or load warnings.

5.9.1.5 Update applied out of sequence

(See 6.8.17.1)

(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.*

The permanent indication SSE 27 shall be displayed as defined in IHO S-63 covering this out of sequence case for the ENCs delivered in the IHO-63 format. For the plain IHO S-57 ENC charts and, if provided, for the SENC delivery, the ECDIS shall create the permanent indication “Chart information not up to date” by memorizing an attempt to load an update out of sequence. In such a case the memorized attempt to load out of sequence is reset by a successful application of a reissue, a new edition or complete sequence of updates or by removal of the cell.

NOTE SENC delivery is required not to be inferior to ENC delivery. The SENC delivery does not deliver out of sequence updates as they are already detected in the shore based SENC conversion. However, the SENC delivery conversion process detects the out of sequence case and informs the user of the SENC delivery using SSE 27 or “Chart information not up to date” that the chart is not up-to-date. The SENC delivery removes SSE 27 or “Chart information not up to date” after the chart supplier has fixed the situation. In other words, the SENC delivery has the capability to inform ECDIS user using SSE 27 or “Chart information not up to date” the situation that the current state of the delivered SENC in the ECDIS is not up-to-date compared to the update state of original source of the ENC.

5.9.2 Manual update

(See 6.8.18)

5.9.2.1 Keying and symbology

(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 IHO S-52;

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.

5.9.2.2 Indications and alerts

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

5.9.2.3 Presentation

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

5.9.3 Semi-automatic update

(See 6.8.17.1)

(S-52, appendix 1/3.4.2(a(ii))) *The ECDIS* shall *be capable of receiving updates in standard IHO S-57 format by one or more of the following means:*

- *CDROM;*
- *any other interface or data storage media that are provided with the ECDIS for that purpose;*
- *through a secure interface to telecommunication methods. Secure interface* shall *provide methods for authentication, data integrity and integrity of telecommunication channel.*

NOTE IHO S-63 includes authentication and data integrity.

Manufacturer provided documentation shall describe available methods.

5.9.4 Reception of updates

(See 6.8.16, 6.8.17.1)

(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 the check fails the reception procedure shall be terminated and the ENC update flagged invalid in the record of updates. The user shall be informed.

(S-52, appendix 1/3.4.1(b(iii))) *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, which includes CRC checksum (see IHO S-57) and signature (see IHO S-63).

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

NOTE Warning in this context means a notification on the screen that a message is added to the log warning that one or more ENC update has not been successfully applied.

5.9.5 Sequence check

(See 6.8.17.3)

(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) update number of the ENC update;

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

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

5.9.6 Consistency check

(See 6.8.17.1)

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

The warning shall be recorded into a log. After the warning the ECDIS shall continue to operate normally. The log shall be available on demand to the mariner.

NOTE Warning in this context means a notification on the screen that a message is added to the log warning that one or more ENC update has not been successfully applied.

5.9.7 Geographic applicability

(See 6.8.17.2)

(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.*

5.9.8 Summary report

(See 6.8.17.3)

(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.

5.9.9 Review of ENC updates

(See 6.8.17.2)

(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* (see 4.4.2).

5.9.10 Modification of updates

(See 6.8.17.2)

(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 IHO S-52, appendix 1/3.4.1(h).)

5.10 Operational area

(See 6.8.20)

Every ECDIS shall operate between 85°N and 85°S latitude. Optionally, an ECDIS may support operation above latitude 85°. The manufacturer shall declare the operational area of the ECDIS in the user manual. If the declared operational area extends beyond latitude 85° then a chart projection type suitable for navigation in higher latitudes shall be provided.

NOTE Mercator projection is considered not suitable for latitudes above 85°. Annex O contains informative details about operational areas in high latitudes.

It is not required that every ECDIS be able to handle ENCs beyond the 85° N latitude limit for the North pole and beyond the 85° S latitude limit for the South pole. If there is a maximum latitude limit for the EUT then:

a) if the area covered by the ECDIS display includes waters beyond the maximum latitude limit, the areas representing those waters shall carry an indication to the mariner to refer to the paper chart (see IHO S-52/Annex A, Part I/10.1.5). The area shall be marked by the "non-ENC area" symbology defined in the presentation library. (See IHO S-52/Annex A, Part I/10.1.7.) (See a similar but not identical case in 5.4.2.2);
b) an indication shall be provided when the planned route falls within a region beyond the maximum latitude;
c) an alert (caution) shall be provided when the monitored route falls within a region beyond the maximum latitude.

5.11 External removable media

(See 6.8.21)

Means shall be provided to protect the ECDIS from execution of any software on update storage devices or via interfaces to update storage sources, for example writeable CD-ROM, USB memory sticks, Network interfaces etc. All automatic execution from external removable media including auto-run shall be prohibited.

NOTE Guidance on protection from removable external data source is given in IEC 61162-460.

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

6.2.1 General

(See 4.12.1)

During testing, specified digital signals shall input into the EUT to emulate the position, heading and speed over ground of the own ship. Signals shall also be provided as necessary to represent any optional interface supported by the EUT, for example radar returns and AIS data, appropriate to the equipment and the position of the ship. Tests shall be performed using a simulator or at sea.

Annex Q specifies minimum mandatory logical interfaces and optional logical interfaces for which this standard has defined functionality. Logical interfaces shall use physical interface alternatives available as specified in Annex Q.

An interface simulator supporting all interfaces that the EUT supports according to the manufacturer's declaration shall be connected. Messages shall be sent and received. For each interface and sentence listed in Annex Q and supported by the EUT, confirm by analytical evaluation that valid data are correctly received, applied and sent. For these

messages, confirm by observation that missing data, invalid data and data of low integrity is detected and indicated in conformance with the integrity marking requirements of IEC 62288.

6.2.2 BAM interface

(See 4.12.2)

6.2.2.1 General

Confirm by inspection of the manufacturer's documentation that manufacturer defined alerts are in compliance with the criteria for classification and categories of alerts defined in IEC 61924-2 and the alerts for ECDIS listed in IEC 61924-2:2012, Annex C.

For test of alert communication and presentation, refer to the manufacturer's documentation to identify at least 2 of the available alarm conditions which may be chosen at random, 2 of the available warnings which may be chosen at random and 2 of the available cautions which may be chosen at random. Then perform the following test using a simulator for BAM:

a) verify the compliance of alert presentation in accordance with IEC 62288;

b) confirm by analytical evaluation that the alert communication complies with the sentences listed in Annex Q, the detailed sentence definitions of IEC 61924-2:2012, Annex K and the state diagram of IEC 61924-2:2012, Annex J;

c) confirm by analytical evaluation that, if means are provided for an interface to a centralised alert management system, a caution alert is provided when the periodic receptions of the HBT sentences is interrupted.

NOTE The HBT sentence has a field for periodic transmission time. After power up equipment does not know this value and therefore does not know a suitable timeout to activate the caution. IEC 61162-450 defines the period of HBT as "at least every 60 s". This value can be used as suitable default.

6.2.2.2 Remote acknowledgements and silencing of alerts

Perform the following test using a simulator for BAM:

a) Test of alert reporting and silencing:

   Create 2 alerts, at least one of Category B.

   Confirm by observation that ALF, ALC and HBT sentences are transmitted from the EUT to the BAM interface.

   Use a simulator to send the ACN sentence to the EUT to silence one of the alerts.

   Confirm by observation that ALF, ALC and HBT sentences report correctly the new state of the alerts.

   Use a simulator to send the ACN sentence to the EUT to acknowledge the Category B alert.

   Confirm by observation that ALF, ALC and HBT sentences report correctly the new state of the alerts.

b) Test of attempt to acknowledge Category A alert:

   Create an alert of Category A.

   Confirm by observation that ALF, ALC and HBT sentences are transmitted from the EUT to the BAM interface.

   Use a simulator to send the ACN sentence to the EUT to acknowledge the Category A alert.

   Confirm by observation that the EUT refuses to acknowledge and that the ARC sentence reports correctly this refusal.

   Use a simulator to send the ACN sentence to the EUT to silence the Category A alert.

   Confirm by observation that the EUT accepts the silence command and that the ARC sentence reports correctly the new state of the alerts.

6.2.2.3 Unacknowledged warnings

Confirm by inspection of the manufacturer's documentation that the default value for alert escalation is 60 s.

Confirm by observation that the user selectable time period for alert escalation is less than 5 min.

Confirm by inspection of the manufacturer's documentation that the manufacturer provides information about:

a) which warnings are repeated as warning;

b) which warnings are changed to alarms after the user selectable time period;

c) which warnings are changed to alarms after the manufacturer fixed time period.

Refer to the manufacturer's documentation to identify at least 2 cases which may be chosen at random, if available, in which a warning is repeated as warning. Confirm by observation that the time between repetitions is as selected by the user.

Refer to the manufacturer's documentation to identify at least 2 cases which may be chosen at random, if available, in which a warning is changed to alarm. Confirm by observation that the time before change of priority is as selected by the user.

6.2.3 VDR interface

(See 4.12.3)

6.2.3.1 Mandatory transmitted LAN information

A test receiver of LAN images (e.g. a VDR) shall be set up and connected to the ECDIS.

Confirm by observation of the transmissions of the EUT that:

a) sent images are sent at a minimum of every 15 s;

b) the images all contain a correctly formatted header;

c) the sender time indicated in the header in milliseconds matches the transferred image within 1 s, if the image contains time;

d) means are provided to configure at installation display location and class of image.

If the transfer is based on a lossless method (for example .bmp or .png), confirm by visual inspection that the transferred image is identical to the shown image except for brightness and colour calibration differences.

If the transfer is based on a lossy method (for example .jpg or jp2), confirm by observation that the image conforms to the minimum IEC 61996-1 requirements either by manufacturer's documentation or by measurement.

Confirm by observation that ECDIS display source information:

e) contains a correctly formatted header and the minimum information (chart, etc.) as defined in 4.12.3.3;

f) contains all information as required in 4.12.3.3;

g) the ECDIS display source information is sent within 2 s of a change between own ship position location and look-ahead location.

6.2.3.2 Image synchronization within the 15 s slot

Confirm by analytical evaluation that:

a) the image synchronization within the 15 s (or shorter slot) is configurable;

b) the image transmission moves in time after the new configuration;

c) the default setting is 8 s (ECDIS.1) and it is configurable as 12 s (ECDIS.2).

6.2.4 BNWAS interface

(See 4.12.4)

Confirm by observation that the ECDIS outputs an EVE sentence under the conditions described in the user manual.

Confirm by document inspection that the installation manual describes the installation location limitation and configuration of the ECDIS to reset the dormant period of the BNWAS.

6.3 General requirements and presentation requirements

(See Clause 4, Clause 5)

6.3.1 General requirements

All the general requirements of IEC 60945 appropriate to their 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

(See 4.9.2)

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. Test sources 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	
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 by observation that the position on the EUT changes accordingly.

6.4.3 Required test items

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

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

– IHO 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;

– SENC test data sets, if supported, from each SENC distributor. The SENC test data set shall contain test material for each test available in the IHO S-64.

6.5 Requirements related to ENC chart

6.5.1 General

The IHO S-64 test data sets for ECDIS contain a series of tests, associated test data and updates in encrypted and unencrypted forms. All required data sets and graphic plots are included in the IHO S-64 along with an instruction manual which details each test and specifies the required results.

All tests specified as mandatory within IHO S-64 shall be carried out to verify conformance with the requirements of this standard in accordance with IHO S-64. Other tests specified as optional within IHO S-64 shall be carried out if the EUT has the specified capability as described in IHO S-64.

IHO S-64 specifies which of the tests are not applicable for SENC delivery and which of the tests require alternatives specific for SENC delivery.

6.5.2 Presentation library

(See 5.4.2.3, 5.5.1)

Verified by conformance to 6.5.1.

6.5.3 ENC

(See 4.3.2, 4.4.1, 5.4.2.2)

Verified by conformance to 6.5.1.

6.5.4 Encrypted ENC

(See 4.4.2)

Verified by conformance to 6.5.1.

6.6 Accuracy

(See 4.11, 4.12)

Verified by conformance to 6.5.1.

6.7 Visual requirements

6.7.1 Symbols

(See 4.8, 5.7.3)

Chart symbols are verified by conformance to 6.5.1.

In addition to conformance to 6.5.1 display ECDIS Chart 1 (see IHO S-52 Presentation library) and confirm by measurement of symbols for 3 point, 3 line and 3 area objects chosen at random that the line widths used within the symbols are within ±1 pixel as defined in IHO S-52 Presentation Library for nominal viewing distance of 1 m. The requirement is proportional to manufacturer's declared viewing distance.

Verify conformance of other symbols including mariner symbols with the IEC 62288.

6.7.2 Terminology, units and legend

(See 5.2.2, 5.2.3)

Confirm by observation that the user interface and manufacturer's documentation uses terminology as given in Annex E.

Legend is verified by conformance to 6.5.1.

Verify conformance of units, terminology and abbreviations with IEC 62288.

6.7.3 Colour table

(See 4.8, 4.9.3, 5.5.2, 5.7.4, 5.7.5)

6.7.3.1 Colour calibration including colour differentiation test diagrams

Verify compliance in accordance with IEC 62288:2014, Annex G.1.

If a manufacturer provides own version of the test diagram instead of the IHO supplied diagrams in IHO S-57 ENC format, then the following additional tests apply:

a) confirm by measurement that the width of the diagonal lines in the test diagram is equal to drawing instructions available in the IHO supplied diagrams in the IHO S-57 ENC format;

b) confirm by analytical evaluation that the IHO specified colour tokens are used for line and background colours for all colour palettes.

6.7.3.2 Other requirements

Verify that the user 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, 5.7.2)

Verify compliance in accordance with IEC 62288 for screen resolution.

6.7.5 Display characteristics

(See 4.9.4, 5.8.2)

In addition to the requirements of IEC 62288 for chart displays, confirm by analytic evaluation 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)

6.8.1 Methods of testing

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 S-64 test data set. For all tests, confirm by observation that there is no degradation in information content.

6.8.2 Standard display

(See 4.3.3)

Verify conformance using IHO S-64.

Select standard display. Add selectable viewing group layers and text group layers (see Annex M). Remove all selectable viewing group layers and text group layers. Confirm by observation that the standard display can be restored by a single operator action. Confirm by observation that restoring of standard display did not change any user settings other than the selection of viewing groups for the display of charted data. Confirm by observation that the display mode is indicated.

6.8.3 Display base

(See 4.3.3, 4.9.5, 5.6)

Remove all selectable viewing group layers and text group layers and verify conformance of the Display base requirements using IHO S-64.

6.8.4 All other information

(See 4.3.3)

Select all selectable viewing group layers and text group layers and verify conformance of the All other information requirements using IHO S-64.

6.8.5 Viewing group layers and text group layers

(See 4.3.3)

Select Display base. Add one at a time all selectable viewing group layers and text group layers (see Annex M) and verify conformance of each at a time using IHO S-64. Confirm by observation that means are provided to indicate which selectable information categories are enabled for display and which are not.

If the EUT provides additional display selectors than the viewing group layers and text group layers listed in Annex M, confirm by analytical evaluation that such additional selectors:

a) do not combine viewing group layers or viewing groups of the Standard display category with those unique to the All Other category;
b) do not combine text group layers or text groups of the Important text category with those unique to the Other text category;
c) do not allow selection of individual items, for example an individual area, an individual sounding or an individual text.

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

6.8.6 Display priorities

(See 4.8, 5.1)

Verified by conformance to 6.5.1.

6.8.7 Additional display functions

(See 4.3.7, 5.4.1, 5.4.2.1, 5.4.3)

Verified by conformance to 6.5.1.

If provided, confirm by observation that use of other colours or symbols than specified by IHO S-52 for ENC data is indicated by permanent indication “non ECDIS presentation, non SOLAS mode”.

Confirm by observation that if the non-ENC data is clearly separated from the ENC data, it may be symbolized in the same way as ENC data, and that a permanent indication of “non-ENC data” is displayed, and the area of non-ENC data is marked as defined in IHO S-52, Annex A, Part I, 10.1.7.

6.8.8 Scale and navigation purpose

(See 4.5, 5.2.1)

Verified by conformance to 6.5.1.

If the EUT offers the capability to show such presentation for which the scale is not uniform over the displayed area, confirm by observation that there is permanent indication “at own ship” or “at centre” next to the scale bar or latitude scale.

6.8.9 Mode and orientation

(See 4.7, 5.3.2, 5.8.1)

Perform the following:

a) confirm by observation 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, confirm by observation that the symbol realigns to north. If the EUT offers the capability to show such presentation for which the direction of the north is not uniform over the displayed area, confirm by observation that there is a permanent indication “at own ship” or “at centre” next to the north arrow symbol;

b) ensure that true motion is provided. Confirm by observation that the display resets itself and check that the generation of the neighbouring area takes place automatically at a distance selected by the mariner;

c) confirm by observation 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). Confirm by observation 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.

6.8.10 Safety contour

(See 4.3.4)

Verified by conformance to 6.5.1.

6.8.11 Safety depth

(See 4.3.5)

Verified by conformance to 6.5.1.

6.8.12 Cursor pick

(See 4.10.5, 5.3.1)

Verified by conformance to 6.5.1.

In addition confirm by observation that symbol 2.12 of IEC 62288:2014 is presented at the area of cursor pick as long as the information associated with the picked objects is presented and that the symbol surrounds the area for picking objects.

6.8.13 Navigation related functions

(See 4.10.3)

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

Verify conformance of measurement from own ship for each provided tool in accordance with IEC 62288:2014, 5.8.1.2.

Verify conformance of measurement from other locations than own ship for each provided tool in accordance with IEC 62288:2014, 5.9.7.2.

6.8.14 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 confirm by observation that the correct position is displayed;

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

c) remove the positioning input to the EUT and confirm by observation that a warning is given;

d) simulate a message from the positioning device that indicates an error condition, and confirm by observation that the alert or indication is repeated by the EUT as an indication;

e) select a different geodetic datum between the positioning system and the SENC, and confirm by observation that a warning is given;

f) adjust the position manually. Confirm by observation that the amount of the correction is displayed on the screen and that the position changes accordingly. Confirm by observation periodically to see that it remains unchanged;

g) confirm by inspection of documented evidence 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 observation 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;

j) confirm by observation that the EUT indicates the source of position using yellow colour whenever the source is from a non-continuous position system or method.

6.8.15 Radar and other navigational information

6.8.15.1 Other navigational information

(See 4.6.1)

The test requirements of this clause only apply when means are provided for overlay of other navigational information.

Verify compliance in accordance with IEC 62288:2014, 6.3.3.2.

Confirm by observation that the other navigational information is clearly distinguishable from SENC information and that it does not degrade the displayed SENC information.

Confirm by analytic evaluation that the ECDIS and the other navigational information use a common reference system and if this is not the case then confirm by observation that there is a permanent indication.

Confirm by observation that the radar image overlay, tracked target information, AIS information and other added navigational information may be removed by single operator action.

6.8.15.2 General for radar

(See 4.6.2.1)

The test requirements of this clause only apply when means are provided for overlay of information on the chart area of the display, i.e. radar image, tracked target.

Confirm by analytic evaluation that the ECDIS and radar information use a common reference system and if this is not the case then confirm by observation that there is a permanent indication.

Where the capability for displaying radar video image or tracked target information is provided, perform the following tests with a simulated radar target in a fixed position:

a) observe the display without radar, switch on the radar image overlay and the radar tracked target information, as available, and confirm by observation that the SENC information is not degraded, and is clearly distinguished;

b) observe the display without radar, then switch on the radar image overlay and the radar tracked target information, as available, and confirm by analytical evaluation that these match in scale, orientation, projection and accuracy, within the tolerances defined in IEC 62388. Confirm by observation that a change of scale (displayed range) at the radar workstation, if it is a separate unit, does not affect the radar image overlay of the EUT in scale, orientation, projection and accuracy;

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

d) verify compliant presentation of the own ship symbol in accordance with IEC 62288, including indication of CCRP and radar antenna positions on the symbol;

e) confirm by observation that there are facilities in a non-operational menu to compensate for the offset between the antenna position and the CCRP;

f) vary the radar antenna offset and confirm by observation that the position of radar image overlay and the radar tracked targets, as available, on the EUT changes accordingly;

g) confirm by observation that where multiple radar antennas are installed, there is provision for applying different position offsets for each antenna;

h) confirm by observation that the offset is automatically applied for each selected antenna and that the offset values are maintained in non-volatile and transferable memory;

i) if a function for more than one CCRP is provided, confirm by observation that the antenna position offset is corrected according to the selected CCRP position;

j) confirm by observation that as far as practical, the user interface and data format for operating and presenting tracked radar target information and reported AIS target information, if available, is consistent with IEC 62288:2014, 5.5.2.2.

6.8.15.3 Radar information

(See 4.6.2.2)

If radar video image overlay is provided, verify compliance with the colour contrast and visibility in accordance with IEC 62288:2014, 5.4.1.2.

6.8.15.4 Target information

(See 4.6.2.3)

If tracked target information is provided perform the following:

a) confirm by observation that the EUT has at least the capacity to process and display 40 tracked targets;

b) verify conformance of a consistent user interface for tracked target and AIS information in accordance with IEC 62288:2014, 5.5.2;

c) verify conformance of indications provided for about to be exceeded and have been exceeded limits on tracked target capacity in accordance with IEC 62288:2014, 5.5.3;

d) verify conformance of the displayed symbols for target, associated vectors, selected target, dangerous target and lost target in accordance with IEC 62288:2014, 5.5.1, 5.5.7, 5.5.8 and 5.6.4.2;

If the ECDIS system provides facilities for radar target detection and tracking independent of a shipborne radar system:

e) verify conformance of the displayed radar image with requirements for target trails in accordance with IEC 62288:2014, 5.4.2;

f) verify conformance of the displayed radar image with requirements for gain and anti-clutter, target enhancement, radar signal correlation, signal processing and latency, second-time-around echoes, picture update, signal processing, any additional processing range compensation, minimum range, range and bearing discrimination, accuracy, in accordance with IEC 62388:2013, Clause 6 except for the following subclauses: 6.2, 6.3, 6.4.4, 6.5.5, 6.6.2, 6.10, 6.11);

g) verify conformance of the presentation, completeness of alphanumeric data provided, indication of radar/AIS source and update of tracked target and AIS information in accordance with IEC 62288:2014, 5.5.1 and 5.5.10;

h) verify conformance of the CPA/TCPA alarms and acquisition/activation zones in accordance with IEC 62288:2014, 5.6.2 and 5.6.3;

i) verify conformance of the lost target warnings in accordance with IEC 62288:2014, 5.6.4;

j) verify conformance of the target tracking functions and tracking performance in accordance with IEC 62388:2013, 11.3.

If the ECDIS system does not provide facilities for radar target detection and tracking independent of a shipborne radar system:

k) confirm by analytic evaluation that the EUT does not provide any of the following facilities independent of a shipborne radar system: track targets, calculate CPA/TCPA values, provide target related alerts, provide target association;

l) if the EUT derives CPA/TCPA from available values in radar interface, verify conformance of CPA/TCPA values in accordance with IEC 62388:2013, 11.3.14.7;

m) simulate as many radar tracked targets as the processing or displaying capacity of the EUT and confirm by observation that the EUT indicates that the capacity is about to be exceeded (see IEC 62288:2014, 5.5.3);

n) simulate more radar tracked targets than the processing or displaying capacity of the EUT and confirm by observation that the EUT indicates that the capacity has been exceeded (see IEC 62288:2014, 5.5.3);

o) simulate more radar tracked targets than the processing or displaying capacity of the EUT and use the means provided to filter tracked targets.

   1) Confirm by observation that the user can filter the presentation of targets.

   2) Confirm by observation that an indication remains when filter is active.

   3) Confirm by analytic evaluation that the filter criteria in use is readily available.

   4) Confirm by observation that the user cannot remove individual targets from the presentation.

6.8.15.5 Target association

(See 4.6.2.4)

This test applies to ECDIS that provides display of both AIS and tracked radar targets.

Verify conformance of target association between a radar and AIS sources and when repeaters provide multiple instances of AIS data for the same target in accordance with IEC 62288:2014, 5.7.1. Repeat this test for internal target association and for external association if both are provided by the ECDIS.

6.8.16 Loading of corrupted data

(See 5.9.4)

Verified by conformance to 6.5.1.

6.8.17 Automatic updates

6.8.17.1 Receipt – Installation and application

(See 4.4.2, 5.9.1.5, 5.9.3, 5.9.4, 5.9.6)

Verified by conformance to 6.5.1 using all methods provided by the EUT for this purpose.

For all telecommunication methods provided confirm by analytical evaluation that means are provided for authentication, data integrity and integrity of the telecommunication channel.

The plain IHO S-57 ENC chart delivery and, if provided, SENC delivery provides a permanent indication “Chart information not up to date” for an attempt to load an out of sequence update. Use the related test case in IHO S-64 and confirm by observation that the indication “Chart information not up to date” is permanently displayed in the chart display area when such a chart is in use (either displayed on chart area or used as largest scale available for chart related alerts and indications). Confirm by observation that the “Chart information not up to date” indication is removed after the successful application of:

- a reissued base cell and updates up to and including the out of sequence update number;
- a new edition; or
- complete sequence of updates up to and including the out of sequence update.

NOTE The indication “Chart information not up to date” is similar to the indication SSE27 defined in the IHO S-63, but the textual content focuses the essential information to the mariner.

6.8.17.2 Display – Show and verify

(See 4.3.7, 4.4.2, 5.9.1.2, 5.9.1.3, 5.9.7, 5.9.9, 5.9.10)

Verified by conformance to 6.5.1.

6.8.17.3 Records and logs

(See 4.4.2, 5.9.1.3, 5.9.5, 5.9.8)

Apply tests in all EUT operating modes, i.e. route planning and route monitoring as follows. Load an ENC base cell, load an update cell and load a corrupt update that will be rejected. Then perform the flowing actions:

a) confirm by observation that it is possible to list on the display the contents of the record of updates, including the time of application to the SENC;
b) confirm by observation 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 IHO S-57 product specification;
    3) any anomalies encountered during application;
    4) type of application: manual/automatic;

c) confirm by observation 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.

6.8.18 Manual updates

(See 4.4.2, 5.9.1.2, 5.9.2)

Verified by conformance to 6.5.1.

6.8.19 Self-tests of major functions

(See 4.13)

Perform the following:

a) perform tests of the major functions which are supported by the EUT. Confirm by observation that the EUT provides appropriate display information and indications;
b) simulate the following interface malfunctions (including for radar if provided for):
   1) interruption of input interface (loss of signal);
   2) invalid information from input interface (status);
   3) physical breakdown of interface connection;
   4) physical breakdown or shutdown of a test LAN information receiver (e.g. a VDR)
c) confirm by observation that the system provides suitable alerts or indication of system malfunction arising from failures in accordance with IEC 60945.

6.8.20 Operational area

(See 5.10)

ENC charts between latitude 85° N and 85° S is verified by conformance to 6.5.1.

Confirm by inspection of documented evidence that the manufacturer has declared in the user manual the operational area of the ECDIS.

If the manufacturer has declared any limit for the operational area of the ECDIS then:

a) confirm by observation that area covered by ECDIS display beyond the declared maximum latitude limit are displayed using “non-ENC area” symbology and carry an indication to the mariner to refer to paper chart (see IHO S-52/Annex A, Part I/10.1.5);
b) confirm by observation that an indication is provided when the planned route falls within a region beyond the maximum latitude;
c) confirm by observation that an alert (caution) is provided when the monitored route falls within a region beyond the maximum latitude.

If the declared operational area extends beyond latitude 85° then:

d) ENC charts beyond latitude 85° is verified by conformance to 6.5.1;
e) confirm by analytical evaluation that a chart projection type suitable for navigation in higher latitudes is provided. Confirm by inspection of documented evidence that the user manual states the projection types provided and describes the user interface involved in transitioning from one projection type to another. Then:

1) using the charts available in the IHO S-64 and confirm by observation that functions such as route planning, route monitoring, etc. are operative beyond latitude 85°;

2) plan a route using scenario 4 as noted in Annex I and save the route. Confirm by observation that distances of the route comply with those noted in Annex I and that no distortions are visible. Confirm by observation that the route passes though the intermediate points between waypoints 1 and 2;

3) reload the route of scenario 4 and start monitoring the route with the first waypoint. Confirm by observation that all waypoint changes, bearings and distances are calculated and displayed correctly during route monitoring;

4) confirm by observation that the alert requirements that apply to the safety contour and for areas for which special condition exist are also implemented for charted objects which include spatial points beyond the maximum latitude at which the ECDIS is fully functional;

5) repeat tests 1) to 4) above for each projection type provided by the ECDIS;

f) use charts available in the IHO S-64 and confirm by observation that accuracy of LOP, VRM, EBL, etc. measurements are within their tolerances.

1) Use tables available in Annex P. Select 3 test cases from each table for each navigation tool provided by the EUT and confirm by observation that the accuracy of range and bearing measurements relative to charted data of IHO S-64 scenario(s) using the tools provided by the ECDIS (VRM, EBL, ERBL, etc.) is within 1 % or 30 m whichever is greater for distances and within 1° for bearings.

2) Perform tests described in 6.9.7 in a region above 85° latitude;

g) when presentation of radar tracked target data or AIS information is provided, using the tables available in the Annex P, set the radar simulator for 3 test cases from each table, set charted symbols for the selected test cases and confirm by observation that positions and speed vectors when compared with the displayed chart, the overlaid data match in scale, orientation, projection and accuracy, within the tolerances defined in IEC 62388;

h) when the presentation of the radar overlay image is provided, using the tables available in the Annex P, set the radar simulator for 3 test cases from each table, set charted symbols for the selected test cases and confirm by observation that positions and speed vectors when compared with the displayed chart, the overlaid data match in scale, orientation, projection and accuracy, within the tolerances defined in IEC 62388.

6.8.21 External removable media

(See 5.11)

Use a USB-memory stick containing an auto-run executable module. Confirm by observation that the ECDIS refuses to execute the auto-run.

6.9 Operational requirements

6.9.1 Ergonomic principles

(See 4.1)

Confirm that the EUT follows the ergonomic principles in IMO MSC/Circ.982, taking into account the guidance given in IEC 62288.

6.9.2 Route planning

(See 4.3.4, 4.10.1, 4.10.2)

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

1) initially plan the route without specifying a safety contour. Confirm by observation 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. Confirm by observation 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. Confirm by observation 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. Confirm by observation 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. Confirm by observation 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. Confirm by observation 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 alert or indication. Confirm by observation 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 NM; to at least 3 NM with a total length of at least 25 NM;
12) the planned speed shall vary between 5 kn and 15 kn;
13) the planned route shall cross at least 3 cells of the ENC.

Perform the following:

a) confirm by observation 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) confirm by observation 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) confirm by observation 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 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;
e) plan complex tracks using scenarios 2 and 3 as noted in Annex I and save the tracks. Confirm by observation that track distances comply with those noted in Annex I and that no distortions are visible;
f) plan a route so that the following condition for detecting chart related alerts and indications will result:
    1) the planned route goes over an area which is covered both with large and small scale charts (for example 1:10 000 and 1:50 000). The alerts and indications related to the content of the small scale chart shall be different from the large scale chart. It shall miss some of the chart objects available in the large scale chart, and it shall have some of the chart objects in different places than in the large scale chart;

2) there shall be multiple examples for each category: route across an own ship's safety contour, route closer than a user-specified distance from the boundary of a prohibited area or a geographic area for which special conditions exist and route closer than a user-specified distance from a point object, such as a fixed or floating aid to navigation or isolated danger (navigational hazard);

3) there shall also be multiple examples for each category entered as manual updates (see 5.9.2.2);

4) set the scale so that only the small scale chart is displayed. Confirm by observation that the graphical areas of the indications are highlighted based on the large scale chart instead of the small scale chart (see IHO S-64). Confirm by observation that any charted feature/object behind each highlighted area is available on demand. Confirm by observation that the human machine interface of the route plan includes also textual indications;

g) if provided, plan an annotated route plan which uses at least 10 waypoints and 20 additional mariner's information (a mix of cautions, information, simple lines and areas with textual notes). Confirm by observation that a textual document is available which lists all items of the annotated route plan in the sequence as they appear when the ship sails the planned route;

h) if provided, export a route plan in the format as specified in Annex S. Confirm by inspection of the content that it conforms to Annex S;

i) if provided, use a test route plan in the format specified in Annex S. Import the route plan. Confirm by observation that the content of the route plan is as available in the test route plan.

6.9.3 Route monitoring

(See 4.3.4, 4.10.1, 4.10.3, 5.7.1)

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 the boundary of a prohibited area and an area for which a special condition exists. Ensure that a warning or caution as selected is provided;

8) at least one leg shall pass closer than selected distance from a navigational hazard. Ensure that a caution is provided;

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

10) at least one leg shall cross the boundary of an area entered by the mariner which should generate a warning or caution as selected. Ensure that a warning or caution is provided.

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 alert of the hazard condition and graphical 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) operate the own ship position function, and confirm by observation that the display shows own ship's position;

c) shortly before the vessel enters an area for which an alert will be released (safety contour, navigational hazard, area with special conditions and prohibited areas) perform the following actions:

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

   2) confirm by observation that the appropriate alerts are provided;

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

d) when the vessel enters the area where the specified safety contour is not available, confirm by observation that the safety contour shown defaults to the next deeper contour;

e) confirm by observation that an alert, as selected by the mariner, is released each time the vessel is going to cross the boundary of a prohibited area, boundary of area with special condition or safety contour or the vessel is going to pass closer than selected distance from a navigational hazard, within the time or distance specified by the mariner;

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

g) 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. Confirm by observation 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 NM from own ships position and which is covered by ENC data at a scale different from the one in use. Confirm by observation that the old display is maintained from the start of the regeneration until the start of re-draw of the new display. Confirm by observation that an indication is given if the regeneration time is more than 5 s;

   3) simulate deviation from intended track and confirm by observation that the off-track alarm is released;

   4) confirm by observation that a warning 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 confirm by observation that it is clearly distinguishable from the selected route. Change to the alternative route and confirm by observation 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. Confirm by observation that time labels may also be entered manually;

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

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

j) plan the monitored route so that following condition for detecting chart related alerts will result:

   1) the monitored route goes over an area which is covered both with large and small scale charts (for example 1:10 000 and 1:50 000). The alerts and indications related content of the small scale chart shall be different from the large scale chart – it shall miss some of the chart objects available in the large scale chart and it shall have some of the chart objects in different places than in the large scale chart;

   2) there shall be multiple examples for each category: own ship will cross the safety contour, own ship will cross the boundary of a prohibited area or of a geographic area for which special conditions exist, and 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 (navigational hazard);

3) there shall also be multiple examples for each category entered as manual updates (see 5.9.2.2);

4) set the scale so that only the small scale chart is displayed. Start monitoring the route and confirm by observation that the graphical areas of alerts are highlighted based on the large scale chart instead of the small scale chart. Confirm by observation that any charted feature/object behind each highlighted area is available on demand. Confirm by observation that the human machine interface of alert management includes textual alerts as required;

k) confirm by analytical evaluation that the system allows selection of a route for monitoring only when the route has been checked that radius of planned turns allows each turn to complete before the next turn.

6.9.4 Twelve hour log

(See 4.10.4, 4.10.7)

For recording purposes 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. Confirm by observation that this is not possible. At the end of the 12 h period, the EUT log shall then be analysed according to the procedures in the operating manual and the results shall be confirmed by observation to comply with the test carried out;

c) confirm by observation that the record for the previous 12 h, including all the items defined in 4.10.4 and 4.10.7, is stored and available on demand. Confirm by observation that chart data according to 4.10.4 and 4.10.7 is stored at least initially and for each data change.

6.9.5 Voyage record

(See 4.10.7)

Perform the following:

a) confirm by observation that the EUT records the track for the entire voyage, with time marks at intervals not exceeding 4 h. Confirm by analytical evaluation that the logging capacity for the voyage has a minimum capacity of three months;

b) confirm by observation that the record, for the previous 12 h, and the voyage track, once recorded, can be preserved, and that it is not possible to manipulate or change the recorded information.

6.9.6 Power supply

(See 4.15)

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

Confirm by observation that the operator settings 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 initial fix 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 course 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 user manual supplied with the equipment includes guidance on use of LOPs for calculation of position fixes.

6.10 Software maintenance

(See 4.16)

Confirm by observation that the current software version can be displayed.

Confirm by inspection of documented evidence that replacement or installation of updates to software can be accomplished following information provided in the installation manual.

Confirm by observation that the user manual contains information about accessing the IHO website for currently available versions of the IHO standard.

Confirm by observation that the manufacturer’s link on the IHO website leads to information that provides compliance status of regulatory approvals for manufacturer’s ECDIS software versions.

Confirm by inspection of documented evidence that the manufacturer’s recognized quality system includes procedures to link the list to the IHO website and procedures to maintain the list in a website.

6.11 Quality management

(See 4.17)

Confirm by inspection of documented evidence that the manufacturer has a recognized (e.g. ISO 9001 or an equivalent recognized quality standard) quality system.

Confirm by inspection of documented evidence that the manufacturer’s recognized quality system includes procedures to develop ECDIS (both hardware and software), to produce

ECDIS and to write and manage documents of ECDIS. If the manufacturer uses sub-contractors for development, production or documentation, confirm by inspection of documented evidence that the manufacturer's recognized quality system includes procedures to supervise and audit the quality of such sub-contractors.

6.12 Default control setting and saved operator control settings

(See 4.18)

Confirm by observation that a default setting selection, clearly labelled for example "Default Setting", is provided by a single operator action followed by an action to confirm the selection.

Confirm by observation that the result of the default settings selection matches Table 3.

Confirm by observation that means are provided to store and recall at least two different operator-specific control setting configurations.

Confirm by observation that a selection to recall one of these configurations is followed by a confirming action.

6.13 AIS information and AIS target data

6.13.1 General

(See 4.6.3)

Requirements of this clause apply, if optional AIS interface is provided. The tests require the use of a reported target simulator (RTS) as described in IEC 62238:2013, Annex F.

6.13.2 AIS targets and data report capacity

(See 4.6.3.2)

Perform the following:

a) confirm by document inspection that the manufacturer's stated AIS display processing capacity conforms to Table 2;

b) confirm by document inspection, that the user manual describes the operation of the equipment when the display capacity for activated targets has been exceeded and when the total display capacity has been exceeded;

c) confirm by observation, using the RTS and without any AIS target filtering applied, that an indication is given at 95 % of the manufacturer capacities;

d) confirm by observation, using the RTS and without any AIS target filtering applied, that the full display capacities are achieved;

e) confirm by observation, using the RTS to provide more than 100 % of the total display capacity and without any AIS target filtering applied, that a warning is provided;

f) confirm by observation with fully loaded VDL (VHF Data-link), using the RTS to generate a scenario of VDM sentences for 130 moving AIS targets updated every 2 s corresponding to approximately 90 % of a fully loaded VDL, that the displayed update shows smooth and continuous updates;

g) confirm by observation with a very large number of AIS targets, using the RTS to generate a scenario of VDM sentences for 6 000 AIS targets at anchor updated every 3 min with one or more moving AIS targets updated every 2 s, that the displayed update of a sample set of 10 displayed AIS targets of both types selected at random shows smooth and continuous updates.

6.13.3 AIS target filtering

(See 4.6.3.3)

Perform the following:

a) confirm by document inspection that the user manual describes the functionality of the available filters and filter criteria;

b) confirm by analytical evaluation and using the RTS that the filter provides and conforms to the requirements and to the functions described in the user manual;

c) confirm by observation that it is not possible for the operator to select a target manually to remove individual AIS targets from the display;

d) confirm by observation that an indication of the filter status is readily available when the filter is active;

e) confirm by observation that means are provided to access alphanumeric, or graphical, or both, display of the filter criteria in use;

f) confirm by observation and using the RTS that selectable criteria for filtering to reduce display clutter only includes sleeping Class A/B when combined with one or more other factors;

g) confirm by analytical evaluation and using the RTS to produce repeated AIS reports for own ship, AIS reports for a nearby AIS target moving at 24 kn and repeated AIS reports for this target with delayed and reduced update rate (for example: delayed by 30 s with a 10 s update rate), that the repeated data is not displayed and does not produce CPA/TCPA data or alarms.

6.13.4 Activation and deactivation of AIS targets

(See 4.6.3.4)

Perform the following:

a) confirm by observation that a function is provided to activate a sleeping target and to deactivate an activated target;

b) confirm by observation that where automatic activation zones are provided, they have the same properties as those provided for automatic radar target acquisition, if available;

c) confirm by observation that a function is provided to automatically activate sleeping AIS targets when those targets meet operator defined parameters for activation;

d) confirm by document inspection that the user defined parameters for automatic activation and the associated functionality, if provided, are described in the user manual;

e) confirm by observation that if means are provided for automatic activation, then means for disabling that function and indicating the disable status are provided;

f) confirm by observation that the zones are presented in accordance with IEC 62288:2014, Annex A.

6.13.5 AIS functionality and presentation

(See 4.6.3.5)

Perform the following:

a) verify in accordance with IEC 62288 that the symbology presented is compliant with requirements for presentation of AIS targets and AIS information;

b) confirm by observation and using the RTS that the AIS processing function provides a sleeping target status by default, and that a symbol compliant with IEC 62288 is provided;

c) confirm by observation that a permanent indication of vector mode (true/relative) and stabilisation reference (sea/ground) is provided, and as a minimum, the vector time is readily available in a top level menu;

d) confirm by observation and using the RTS, that course and speed of each AIS target are represented by a vector which represents predicted motion and that the vector velocity is modified correctly according to the sea/ground stabilisation selected;

e) confirm by observation, that a function is provided for the adjustment for the vector time (length) and that the vector time applies to any target, regardless of source;

f) confirm by observation that the vector presentation properties are according to IEC 62288;

g) confirm by observation, that a means to provide a true scale outline of an activated target is available and verify in accordance with IEC 62288 that the true scale outline is compliant;

h) confirm by observation, that the equipment provides functionality to support target past positions for activated AIS targets, and that the target past positions plot intervals provided they are compatible with the scale selected. Confirm by observation, that the target past position symbols conform to IEC 62288;

i) confirm by observation and using the RTS or live radar target signals that the equipment provides time-referencing of the reported AIS targets so that AIS symbology is progressively positioned according to its reported course and speed. If display of radar image is provided, the AIS position shall be observed to be co-located with the related radar video on each scan;

j) confirm by using an RTS or real AIS targets and data reports that the system is capable of receiving, processing and displaying the following AIS messages in accordance with IEC 62288:

   1) Messages 1, 2, 3 and 5;

   2) Messages 18, 19 and 24;

   3) Message 9;

   4) Message 21;

   5) Messages 12 and 14;

k) optionally, if provided, confirm by inspection of documented evidence that the manufacturer has described in the user manual the functionality of supported AIS application specific messages. Confirm by analytic evaluation using an RTS or real AIS data reports that the system is capable of receiving, processing and displaying the AIS Messages 6 and 8 for each pair of Designated Area Code (DAC) and Function Indicator (FI) types supported by the system. Verify conformance of the presentation of AIS messages with IEC 62288;

l) verify conformance of duplicated AIS messages in accordance with IEC 62288:2014, 5.5.4.2.

6.13.6 AIS target data

(See 4.6.4)

Perform the following:

a) confirm by observation that the equipment provides a function to select an AIS target and that, when selected, a target data field is provided for that target and that that target is identified by the relevant symbol in accordance with IEC 62288:2014, Annex A;

b) confirm by observation that the target parameters are presented in accordance with the above;

c) confirm by observation that the equipment provides the functionality to support AIS information and that the data provided conforms to the requirement. If the received AIS information is incomplete, confirm by observation that the absent information is clearly indicated as “missing” within the data field;

d) if provided, confirm by analytical evaluation that CPA/TCPA derived from calculations on AIS information are correct. Verify the calculations by simulating the reported message for 10 AIS targets. The data and graphical presentation resulting from the calculations shall be verified against the known simulation solution in accordance with IEC 62388:2013, 11.3.14.7;

e) if provided, confirm by observation that it is possible to select on or off state for CPA/TCPA based alarms. When selected in on state confirm by observation that the

ECDIS creates CPA and TCPA alarm when values of AIS targets are less than the set limits. Confirm by observation that it is possible to acknowledge this alarm;

f) confirm by analytical evaluation and by measurement that any other data than CPA/TCPA derived from calculations on AIS information are correct. Verify the calculations by simulating the reported message for 10 AIS targets based on IEC 62388:2013, 11.3.14.7. The data and graphical presentation resulting from the calculations shall be verified against the known simulation solution. The verification shall include target data, AIS target vectors and the conversion from ground stabilised to sea stabilised information;

g) confirm by observation and by analytical evaluation that the AIS graphical and target related information responds correctly when sea stabilisation is selected. A significant set (for example broad on the bow or beam) and drift (for example 5 kn) shall be applied;

h) confirm by observation and using the RTS, that it is possible to select AIS information by a simple user action;

i) confirm by observation that a selected target data is displayed and is continually updated, until another target is selected or until the window is closed;

j) confirm by observation that if the EUT provides a function to select multiple targets simultaneously, as a minimum a subset of paired target data is provided, for example CPA/TCPA, range and bearing, course and speed, bow crossing range and bow crossing time (BCR/BCT). If more than one target is selected for data display confirm by observation that the relevant symbols and the corresponding data are clearly identified;

k) confirm by observation that a functionality is available to present own ship data and that the data presentation is in accordance with IEC 62288.

6.13.7 AIS CPA/TCPA alarm

(See 4.6.6)

If CPA/TCPA alarm function for AIS is provided, perform the following:

a) confirm by observation that the ECDIS include facilities for radar target tracking that are independent of shipborne radar and that the ECDIS is capable of deriving CPA/TCPA values for AIS targets;

b) confirm by observation that it is possible to enable or disable a common CPA/TCPA alarm function for both AIS targets and tracked targets;

c) confirm by observation that an indication is available when the CPA/TCPA alarm function is disabled;

d) confirm by observation and using the target simulator that a selection of activated AIS targets which are set to approach own ship and are within the CPA and TCPA limits, shall cause a visual and audio alarm to be activated. The target causing the alarm shall be indicated;

e) confirm by inspection that, when the AIS automatic activation for targets meeting CPA/TCPA limits is disabled, the status is indicated;

f) confirm by observation that the same CPA and TCPA function limits are applied to both tracked targets and AIS targets;

g) confirm by observation that the CPA and TCPA function limits apply to all activated AIS targets and sleeping targets on user request;

h) confirm by observation that if AIS ship outline dimension data is considered in CPA/TCPA for AIS targets then this capability is described in the user manual.

6.13.8 AIS lost target warning

(See 4.6.7)

If a lost target warning function for AIS is provided, perform the following:

a) confirm by observation that the ECDIS includes facilities for a CPA/TCPA alarm function for AIS targets;

b) confirm by observation that it is possible to enable or disable the lost target warning function for activated AIS targets and that the enabled state is available only when the CPA/TCPA alarm function for AIS is enabled;

c) confirm by observation that an indication is available when the lost target warning function is disabled;

d) confirm by observation, the operation of the lost target warning functionality using the target simulator, and that the last reported (known or predicted) AIS target position is indicated with a lost target symbol according to IEC 62288.

6.14 AIS Voyage-related data

(See 4.6.5)

If an AIS interface is provided perform the following:

a) confirm by observation that means are provided for display and user entry of the following data as described in the user manual;

   1) Cargo category

      Confirm by observation that the cargo category is displayed and can be edited by the user for types of ship where the cargo category is defined (e.g. cargo ships or tankers).

      Confirm by observation that the cargo category is not displayed or indicated as undefined and that the cargo category cannot be edited by the user for ships where no cargo categories are defined (e.g. pilot vessels or tugs).

   2) Navigation status

      Confirm by observation, that the textual description of the navigational status is used.

   3) Ship's draft (maximum actual static);

   4) Destination;

   5) ETA date and time.

b) confirm by analytical evaluation that output of the VSD sentence conforms to the requirements of the interface provided by the EUT according to Annex Q.

6.15 Anchor watch

(See 4.6.8)

Perform the following:

a) confirm by observation that the operator can specify the anchor location as a position offset from the common reference point;

b) confirm by observation that the swing circle radius can be altered by the operator;

c) activate the anchor watch function and confirm by observation that a swing circle is displayed with the same colour and line width as the anchor symbol and is centred on the position derived from anchor location and own ship position at the time when the operator activated the function;

d) confirm by observation that an anchor symbol is displayed using distinguishable colour from similar shaped charted symbols at the centre of the swing circle;

e) confirm by observation that this swing circle is geostationary and does not move with own ship;

f) position part of the outline of own ship outside of the swing circle and confirm by observation that a category A warning is raised. Confirm by observation that the warning can be acknowledged and the warning stays available as an acknowledged warning. Position the outline of own ship inside the swing circle and confirm by observation that the warning is cleared. Confirm by observation that if the warning is not acknowledged within 2 min while the own ship remains outside the swing circle that the warning escalates as an alarm;

g) while the outline own ship is outside of the swing circle, confirm by observation that the circle and anchor symbol colour is red;

h) deactivate the anchor watch function and confirm by observation that the alert is cleared.

6.16 NAVTEX and SafetyNET for MSI

(See 4.12.6)

Perform the following:

a) simulate different content of MSI messages and confirm by observation that an indication is provided for each new MSI message which meets the operator selected suppression criteria until it has been viewed or 24 h have passed without viewing it. Perform this at least once for checking indication and suppression by content of a NRX sentence, by time and distance from own ship, by monitored route and by planned route;

b) confirm by observation that operator selectable suppression categories are readily available;

c) for the NAVTEX interface, confirm by observation that the operator can view the NAVTEX mask in plain language. If provided, confirm by observation that the operator can set the NAVTEX mask;

d) simulate over 255 MSI messages. Confirm by observation that at least the 255 most recent messages per each MSI source are available in data storage for viewing;

e) continue from the previous test and confirm by observation that the operator can tag 50 individual messages for permanent retention. Simulate more messages than the manufacturer declared maximum data storage capacity. Confirm by observation that the tagged messages are still available for viewing. Confirm by observation that the tagging of individual messages can be removed by removing 10 tagged messages;

f) confirm by observation that the most recent message is available for viewing. Confirm by observation that the operator can select an individual message for viewing from the data storage. Confirm by observation that the text of a graphically displayed message is available for viewing on demand;

g) confirm by observation that the viewer of MSI message display is capable of displaying at least 16 lines of message text with a minimum of 40 characters/line.

6.17 Interface for transfer of route information

(See 4.12.7)

Perform the following:

a) use an IEC 61162-450 simulator which is capable of displaying detailed content of sentences received from the EUT. Create a route plan in the EUT. Set the simulator to report file transfer as successful and application acceptance of the route using a single RRT sentence. Confirm by observation that the EUT can send the route plan (include both file and RRT sentence) to the simulator and that the EUT indicates correct status for file transfer and application;

b) use an IEC 61162-450 simulator which is capable of displaying detailed content of sentences received from the EUT. Create a route plan in the EUT. Set the simulator to report file transfer as successful and application acceptance of the route using two separate RRT sentences. Confirm by observation that the EUT can send the route plan (include both file and RRT sentence) to the simulator and that the EUT indicates first correct status for file transfer and later correct status for application;

c) create another route plan. Set the simulator to reject application acceptance of the route. Confirm by observation that the EUT can send the route plan to the simulator and that the EUT indicates successful status for file transfer and reject status for application;

d) create another route plan. Set the simulator to report a file transfer error for the route. Confirm by observation that the EUT can send the route plan to the simulator and that the EUT indicates error status for file transfer and not applicable for application;

e) create another route plan. Set the simulator not to report the RRT sentence. Confirm by observation that the EUT can send the route plan to the simulator and that the EUT indicates no response from the target of the sending of the route;

f) create another route plan. Set the simulator to report file transfer as successful and application acceptance of the route. Select the route plan for monitoring in the EUT. Confirm by observation that the EUT can send the route plan to the simulator and that the EUT indicates correct status for file transfer and application;

g) create a route plan in the simulator and send it to the EUT. Confirm by observation that the EUT accepts the route, that the EUT checks the route and that the simulator EUT indicates correct status for file transfer and application. Confirm by observation that the received route plan can be displayed in the EUT;

h) create a route plan including a syntax error in the simulator and send it to the EUT. Confirm by observation that the application of EUT rejects the route and that the simulator indicates successful status for file transfer and rejected status for application;

i) create a route plan in the simulator and send it to the EUT. Set the simulator to inform the EUT that this route plan is for monitoring. Set the EUT to monitor the received route. Confirm by observation that the application of the EUT checks and accepts the route and selects the received route for monitoring and that the simulator indicates correct status for file transfer and application;

j) create a route plan in the simulator and send it to the EUT. Set the simulator to inform the EUT that this route plan is for monitoring. If provided, set the EUT to reject monitoring of the received route and confirm by observation that the simulator indicates correct status for file transfer and application;

k) set EUT for power off. Create a route plan in the simulator and send it to the EUT. Set the simulator to inform the EUT that this route plan is for monitoring. Power on the EUT and confirm by observation that the EUT queries the monitored route from the simulator and after reception of the route from the simulator the application of the EUT checks and accepts the route and selects the received route for monitoring;

l) confirm by observation that the EUT has logged all interactions.

6.18 Interface with INS

(See 4.12.8)

Use a simulator to send GLL, NSR, THS, VBW and VDR sentences. One by one select each available state for the NSR sentence and confirm by observation that the corresponding value (e.g. position, heading, speed, etc.) changes state as appropriate at the EUT (see IEC 62288:2014, 4.8.2.1).

Annex A
(normative)

SENC information to be displayed during route planning and route monitoring

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

a) 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 above water 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.

b) 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 routing systems and ferry routes;
10) archipelagic sea lanes.

c) 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 a warning 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)

Alerts and indications

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

Table D.1 reproduces Appendix 5 of IMO resolution MSC.232(82) updated for the alert classification of Appendix 5 of IMO MSC.252(83). Table D.2 gives additional alerts and indications defined in this standard.

Table D.1 – Alerts and indications resulting from IMO requirements

Subclause	Requirement	Category	Information
4.10.3 (232/A11.4.3)	*Alarm*	*A*	*Crossing safety contour*
4.10.3 (232/A11.4.4)	*Warning or caution as selected by user*	*A*	*Area with special conditions*
4.10.3 (232/A11.4.5)	*Alarm*	*A*	*Deviation from route*
4.10.3 (232/A11.4.6)	*Caution (*)*	*A*	*Crossing a navigational hazard in route monitoring mode*
4.10.4 (232/A11.4.8)	*Warning*	*B*	*Positioning system failure*
4.10.3 (232/A11.4.9)	*Warning*	*A*	*Approach to critical point*
4.10.4 (232/A11.4.10)	*Warning*	*B*	*Different geodetic datum*
4.10.4 (232/A11.4.15.2)	*Indication*	*n/a*	*Discrepancies between positions*
4.10.4 (232/A11.4.14)	Permanent indication	n/a	Manual position adjustment
4.13 (232/A13.2)	*Warning*	*B*	*Malfunction of ECDIS*
4.3.4 (232/A5.8.3)	*Indication*	*n/a*	*Default safety contour*
4.5 (232/A6.1.1)	Permanent *Indication*	*n/a*	*Information overscale*
4.5 (232/A6.1.2)	Permanent *Indication*	*n/a*	*Larger scale ENC available*
4.6 (232/A7.3)	Permanent *Indication*	*n/a*	*Different reference system*
4.6.2.3 (191/6.4.2.1)	*Indication*	*n/a*	*Target processing/display capacity is about to be exceeded*
4.6.2.3 (191/6.4.2.2)	*Indication*	*n/a*	*Target processing/display capacity have been exceeded*
4.6.7 (191/6.4.7.4)	*Indication*	*n/a*	*Lost target warning enabled or disabled*
4.6.3.2 (192/5.26.2)	*Caution*	*A*	*AIS target processing/display capacity is about to be exceeded*
4.6.3.2 (191/6.4.2.2)	*Warning*	*A*	*AIS target processing/display capacity have been exceeded*
4.6.3.3(191/6.4.3.2)	*Permanent indication*	*n/a*	*AIS target filter status*
4.6.3.5 (191/5.27.3) and 4.6.4	*Permanent Indication*	*n/a*	Vector mode, time and stabilization
4.7 (232/A 8.5)	*Indication*	*n/a*	*No ENC available*
4.9.5 (232/A10.5)	*Permanent Indication*	*n/a*	*Standard display is customized*
4.10.2.1 (232/A11.3.4)	*Indication*	*n/a*	*Route planning across safety contour*
4.10.2.1 (232/A11.3.5)	*Indication*	*n/a*	*Route planning across specified area*
4.10.2.1 (232/A11.3.5)	*Indication*	*n/a*	Route planning across navigational hazard

Subclause	Requirement	Category	Information
4.13 (232/A13.1)	*Indication*	*n/a*	*System test failure*
(*) As a minimum requirement “caution” shall be available. The manufacturer may provide a user selection between “warning” and “caution”. The recommended default selection is “Caution” as specified by IMO.			

Table D.2 – Alerts and indications defined in this standard

Subclause	Requirement	Category	Information
4.3.2, 4.8, 5.4.2.1	Permanent Indication	n/a	Chart display includes non-ENC data
4.6.6	Warning	A	Outside anchor watch area
4.8	Permanent Indication	n/a	SENC data from non-HO source is in use and presentation is different from IHO S-52
4.10.2.1	Permanent Indication	n/a	Off state of route planning across safety contour, prohibited areas and hazards indication
4.10.3	Permanent Indication	n/a	Off state of safety contour, prohibited area and hazard indication in route monitoring
5.2.1	Permanent Indication	n/a	Chart scale is not uniform over the displayed area
5.3.3 (IHO S-52/10.4.1)	Permanent Indication	n/a	Viewing date or date range does not include current date
5.8.1	Permanent Indication	n/a	Chart orientation is not uniform over the displayed area
5.9.1.4 (IHO S-52 App. 1/3.4.1(i) and /IHO S-63)	Permanent Indication	n/a	Out of sequence update
4.6.2.3, 4.6.6	Alarm	A	CPA/TCPA
4.6.2.3, 4.6.7	Warning	B	Lost target

Annex E
(normative)

Mandatory terminology and abbreviations

Table E.1 to Table E.4 give mandatory terminology and abbreviations to be used for the ECDIS functions.

Table E.1 – Chart display terminology

Function	Term	Allowable synonyms and abbreviations	Comments
Show accuracy related symbols (IHO S-52/Annex A, Part I/10.3.4.4)	Accuracy		Setting
Selector for viewing group layer (Table M.1)	All isolated dangers		Setting
Selector for viewing group layer (Table M.1)	Archipelagic sea lanes		Setting
Selector for viewing group layer (Table M.1)	Boundaries and limits		Setting
Selector for viewing group layer (Table M.1)	Buoys, beacons, aids to navigation		Setting
Selector for viewing group layer (Table M.1)	Cautionary notes		Setting
5.2.1 Chart boundary shown	Chart boundary		Setting
Selector for viewing group layer (Table M.1)	Chart scale boundaries		Setting
Show contour labels (IHO S-52/Annex A, Part I/10.3.4.4)	Contour label		Setting
5.3.3 Date-dependant objects	Date dependent	Date dep., DatDep	
Deep contour (IHO S-52/Annex A, Part I/13.1.6)	Deep contour		Setting, initial installation default is ‘30 m’
Selector for viewing group layer (Table M.1)	Display base		Setting
Selector for viewing group layer (Table M.1)	Drying line		Setting
Use four shades (IHO S-52/Annex A, Part I/10.3.4.4)	Four shades		Setting
Selector for full light sector lines (IHO S-52/Annex A, Part I/10.3.4.4)	Full light lines		Setting
Show date dependent object (IHO S-52/Annex A, Part I/10.3.4.4)	Highlight date dependent		Setting
Show symbol for INFORM and NINFOM (IHO S-52/Annex A, Part I/10.3.4.4)	Highlight info		Setting
Show symbol for TXTDSC, NTXDS and PICREP (IHO S-52/Annex A, Part I/10.3.4.4)	Highlight document		Setting
Selector for viewing group layer (Table M.2)	Important text		Setting
Selector for viewing group layer (Table M.1)	Magnetic variation		Setting

Function	Term	Allowable synonyms and abbreviations	Comments
Selector for viewing group layer (Table M.1)	Miscellaneous		Setting
Show national language NOBJNM, text group 2 (IHO S-52/Annex A, Part I/10.3.4.4)	National language		Setting
Selector for viewing group layer (Table M.2)	Other text		Setting
Selection for point object style (IHO S-52/Annex A, Part I/10.3.4.4)	Paper chart / Simplified symbols		Setting
Selection for line style (IHO S-52/Annex A, Part I/10.3.4.4)	Plain / Symbolized boundaries		Setting
Selector for viewing group layer (Table M.1)	Prohibited and restricted areas		Setting
4.3.4 It shall be possible for the mariner to select a safety contour	Safety contour		‘10 m’
Depths in safety area shown, soundings in safe area shown	Safe depths shown		Setting
4.3.5 It shall be possible for the mariner to select a safety depth	Safety depth		Setting, ‘10 m’
Turn SCAMIN off, (IHO S-52/Annex A, Part I/10.3.4.4)	Scale min		Setting
Selector for viewing group layer (Table M.1)	Seabed		Setting
Shallow contour, (IHO S-52/Annex A, Part I/13.1.6)	Shallow contour		Setting, ‘2 m’
Show shallow pattern (IHO S-52/Annex A, Part I/13.1.6)	Shallow pattern		Setting
Show isolated dangers in shallow waters (IHO S-52/Annex A, Part I/10.3.4.4)	Shallow water dangers		Setting
Selector for viewing group layer (Table M.1)	Ships‟ routing systems and ferry routes		Setting
Selector for viewing group layer (Table M.1)	Spot soundings		Setting
Selector for viewing group layer (Table M.1)	Submarine cables and pipelines		Setting
Selector for viewing group layer (Table M.1)	Tidal		Setting
Use two shades (IHO S-52/Annex A, Part I/13.1.6)	Two shades		Setting
Selector for displaying unknown objects (IHO S-52/Annex A, Part I/10.3.4.4)	Unknown		Setting
Highlight objects which have undergone modification (IHO S-52/Annex A, Part I/10.3.4.4)	Update review		Setting

Table E.2 – Main function terminology

Function	Term	Allowable synonyms and abbreviations	Comments
4.6.3.1 Targets may be active	Active		
4.3.3 It shall be easy to add or remove information from the ECDIS display	Chart display	Display	
4.10.7 store and be able to reproduce certain minimum elements required to reconstruct the navigation and verify the official database used during the previous 12 h	Detail log		
4.10.4 indicate discrepancies	Discrepancy	Discr	
5.3.3 select a date for displaying all chart objects active at that date and time	Display date	Disp date	
4.6.3.1 AIS may be filtered	Filtered		
4.6.2 whether the vectors are relative or true, and if true whether they are sea or ground stabilized	Ground stabilized vector	GND STAB	
Show latitude/longitude grid	lat/long grid	grid	Setting
4.9.2 Manual update	Manual update		
4.10.1 a fixed or floating aid to navigation or isolated danger (navigational hazard)	Navigational hazard	NavHaz	
4.5 a) the information is displayed at a larger scale than that contained in the ENC	Overscale	Over scale, Over scl	Indication
4.5 b) own ship's position is covered by an ENC at a larger scale than that provided by the display	Larger scale available	Lg scl avail	
4.10.1 entering a prohibited area	Prohibited area	ProhAre	
4.6.2 Transferred radar information may contain a radar image	Radar overlay	RADAR overlay	
4.6.2 whether the vectors are relative or true, and if true whether they are sea or ground stabilized	Sea stabilized vector	Water stabilized vector	
4.13 means for either automatically or manually carrying out on-board tests of major functions	Self test		
No buzzer will sound on this ECDIS	Silent mode	Silent	
4.6.3.1 Targets may be sleeping	Sleeping	Slp	
4.10.2 a prohibited area or a geographic area for which special conditions exist (see Annex C)	Special condition area	SpeConAre	
4.6.2 Transferred radar information may contain tracked target information.	Tracked Target	TT	
5.4.1. Additional mariner's information	User chart		

Function	Term	Allowable synonyms and abbreviations	Comments
Underscale (Clause G.5)	Underscale	Under scale, Under scl	
velocity vector, speed vector, speed and course vector	Vector	VECT	
4.12.7 record the complete track for the entire voyage	Voyage log		
Extended route plan	Voyage plan		Only if all relevant IMO information can be entered, otherwise ‘route plan’ or ‘annotated route plan’ shall be used

Table E.3 – Database terminology

Function	Term	Allowable synonyms and abbreviations	Comments
4.3.1 ECDIS shall be capable of accepting and converting an ENC and its updates into a SENC	Import S57, Import S63, Convert S57, Convert S63		
4.3.7 means to ensure that the ENC and all updates to it have been correctly loaded into the SENC 4.4.2 the mariner to display updates in order to review their contents 5.9.1.2 on demand to review a previously installed update 5.9.9 Review of ENC updates	Update review		
5.9.8 Summary report	Update summary		
4.3.8 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 5.3.1 call up all the information associated with an object by cursor pick on its symbol	Cursor pick	Pick, Pick report	
4.4.1 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	Graphical index		
4.4.2 ECDIS shall also be capable of accepting updates to the ENC data entered manually	Manual update		
4.4.2 ECDIS shall keep and display on demand a record of updates including time of application to the SENC 5.9.13 keep a record of updates	Update log		
4.4.2 Means shall be provided for full ENC Update Status Report	ENC Update Status Report		

Function	Term	Allowable synonyms and abbreviations	Comments
4.4.2 Optionally means may be provided for ENC Management Report	ENC Management Report		
4.3.1 ECDIS may also be capable of accepting a SENC from conversion of ENC to SENC ashore.	Alternatives are SENC or Database	DB	Collection of charts and chart updates inside the ECDIS (SENC) or a single chart and its updates inside the ECDIS
4.3.1 ECDIS may also be capable of accepting a SENC from conversion of ENC to SENC ashore	Alternatives are Import SENC or Register database		Reading a set of charts (e.g. in SENC format) into a database (SENC) on an ECDIS
4.3.1 ECDIS may also be capable of accepting a SENC from conversion of ENC to SENC ashore	Alternatives are Delete SENC or Unregister database		Deleting the database from the ECDIS SENC
4.3.1 ECDIS may also be capable of accepting a SENC from conversion of ENC to SENC ashore	Add database		Add the database to the view (chart display)
4.3.1 ECDIS may also be capable of accepting a SENC from conversion of ENC to SENC ashore	Remove database		Remove the database from view (chart display)

Table E.4 – Route, route monitoring or route plan related terminology

Function	Term	Allowable synonyms and abbreviations	Comments
4.10.2.2 Annotated route plan combines a route plan with additional mariner's information	Annotated Route plan	Annot. route	
from own ship to next waypoint	Bearing to waypoint	BTW	
from own ship to wheel over point	Bearing to wheel over point	BWOL	
from waypoint to waypoint	Bearing waypoint to waypoint	BWW	
Cross-track deviation allowable on route leg, or actual cross-track deviation during voyage	Deviation	XTD	
XTD is larger than planned	Deviation exceeded	Dev Ex, exceed deviation	
XTD to port side	Deviation port	X PORT	
XTD to starboard side	Deviation starboard	X STBD	
from own ship to wheel over line	Distance to wheel over line	DWOL	
from own ship to next waypoint	Distance to waypoint	DWP	
from own ship to last waypoint of a route	Distance to arrival	DTA	
4.10.2.1 means may be provided to export route plans with other equipment	Export Route	Export	

Function	Term	Allowable synonyms and abbreviations	Comments
4.10.2.1 means may be provided to import route plans with other equipment	Import Route	Import	
4.10.3 within a specified look-ahead time or distance set by the mariner	Own ship look-ahead area Own ship look-ahead range Own ship look-ahead time Own ship look-ahead distance	Look-ahead	Defined as time or distance
The speed planned on the route	Planned speed		
Radius of route leg	Turning radius	radius, RAD	
Radius port of ship	Turning radius port	radius port, Rad PORT	
Radius starboard of ship	Turning radius starboard	radius starboard, Rad STBD	
No movement or direction is wrong for the next waypoint	Unreachable	Unreach	

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 Overview

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.7.8.2)

(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)

F.3.1.2.1 Route plan

(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.3.1.2.2 Annotated Route plan

Annotated route plan may be provided (see 4.10.2.2).

If an annotated route plan is provided, the back-up system shall be capable of taking over of the annotated route plan on the ECDIS.

F.3.1.2.3 Route plan exchange

The back-up system shall be capable of import and export of associated route plans from/to the ECDIS.

Optionally, means may be provided to export and import route plans with other equipment (see 4.10.2.3).

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* (see F.6.2), *and provide at least the following functions:*

1) *plotting own ship's position automatically, or manually on a chart;* (see F.7.8.6)
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.7.8.5)

F.3.1.4 Display information

(See F.7.8.2)

(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.

The back-up system shall provide user selection of viewing group layers and text group layers at least for viewing group and text groups which are part of the standard display. If any additional chart information is provided, then the back-up system shall provide relevant viewing group layer and text group layer selectors. (See Annex M, Table M.1 and Table M.2).

F.3.1.5 Provision of chart information

(See F.7.5)

(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.7.8.8)

(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.7.8.3)

(3.1.7) The back-up system shall *provide a* permanent *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

F.3.1.8.1 General for all overlays

(See 6.8.15, 6.13)

(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.

(See F.7.8.7)

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

F.3.1.8.2 Radar information

(See 6.8.15.2, 6.8.15.3)

Transferred radar information may contain a radar image (see 4.6.2.2) and/or tracked target information (see 4.6.2.3 and 4.6.2.4).

(See 6.8.15.3, 6.8.15.4)

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

(See 6.8.15.1)

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.

F.3.1.8.3 AIS information

(See 6.13.1 to 6.13.5)

See 4.6.3.

F.3.1.8.4 AIS target data

(See 6.13.6)

See 4.6.4.

F.3.1.8.5 AIS Voyage related data

(See 6.14)

See 4.6.5.

F.3.1.8.6 AIS CPA/TCPA alarms

(See 6.13.7)

See 4.6.6.

F.3.1.8.7 AIS lost target warning

(See 6.13.8)

See 4.6.7.

F.3.1.8.8 Anchor watch

(See 6.15)

See 4.6.8.

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

(See F.7.8.4)

(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, 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 shall 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, alerts and indications

(See F.7.8.9)

(3.3) The back-up system shall *provide a suitable* alert (i.e. warning) *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 5.8)

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.

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 × 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 Other requirement

F.6.1 Connection with other systems

(See F.7.2)

(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.

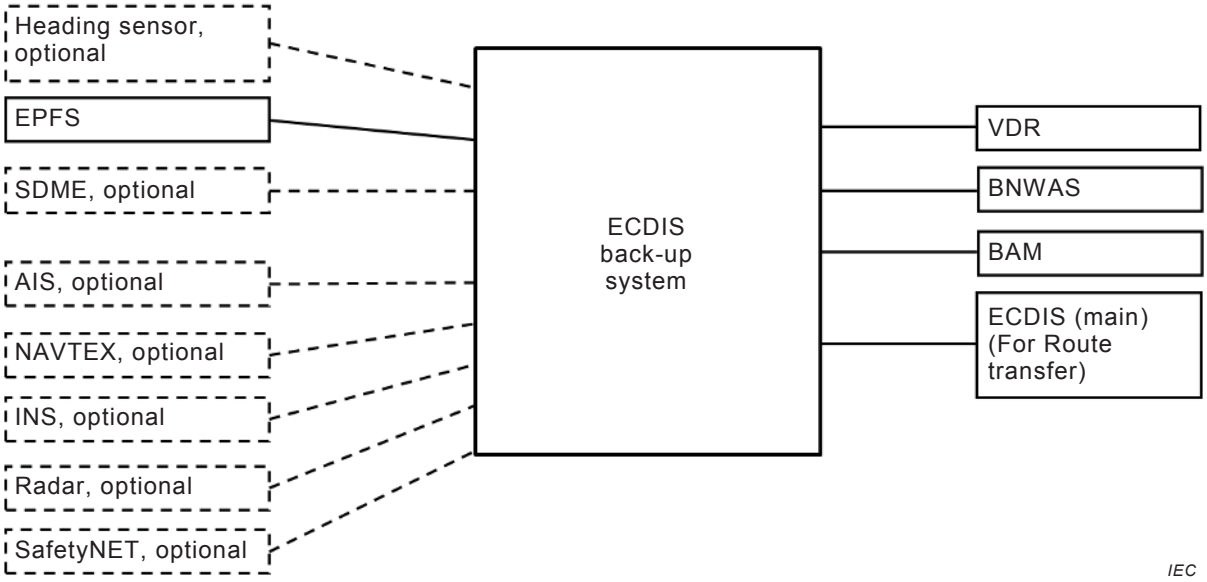


Figure F.1 – Backup system logical interfaces

The minimum interface requirements for a back-up system as shown in Figure F.1 are:

a) interface to an EPFS (see Annex Q);
b) interface with VDR (see Clause Q.1);
c) interface with BNWAS (see Annex Q);
d) interface with BAM equipment (see Annex Q) and;
e) interface for route transfer with main ECDIS (see Clause Q.3 and Annex T).

Other interfaces may be provided (see Annex Q).

F.6.2 Route transfer interface

(See F.7.9.7)

The interface for route transfer shall accept planned routes from the main ECDIS (reported type of transferred route is A in the RRT sentence) and shall accept the monitored route from the main ECDIS (reported type of transferred route is M in the RRT sentence). This interface shall have a method to accept or reject received routes and to report transport layer and application layer status to the sender. Accepted reception of a route for monitoring shall cause automatic route monitoring of the received route (see 4.12.7).

F.6.3 Radar as back-up system

(See F.7.9.8)

(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* the requirements specified by IEC 62388.

F.6.4 Operational area

(See F.7.9.9)

The back-up system shall operate between 85°N and 85°S latitude. Optionally, a back-up system may support operation above latitude 85°. The manufacturer shall declare the operational area of the back-up system in the user manual.

F.6.5 Software maintenance

(See F.7.9.10)

See 4.16.

F.6.6 Quality management

(See F.7.9.11)

See 4.17.

F.6.7 Default Control Settings and Saved User Control Settings

(See F.7.9.12)

See 4.18.

F.6.8 External removable media

(See F.7.9.13)

See 5.11.

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 Clause F.6)

See 6.3.

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. Test sources 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's 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 – Chart

(See F.3.1.5)

Confirm by observation that the edition number and date of the chart included in the test data set is displayed in the chart library.

Confirm by observation by operation that it is not possible to alter the content of the chart.

Confirm by observation that the edition date/update number is displayed on request.

F.7.6 Accuracy

(See F.3.2.2)

See 6.5.1

F.7.7 Visual requirements

(See F.4.2.1)

F.7.7.1 Symbols

See 6.7.1

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 confirm by observation that it is at least 250 mm × 250 mm or 250 mm diameter.

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

F.7.8 Functional requirements

F.7.8.1 Overview

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.7.8.2 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 user 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 by observation that the manually selected settings are the same as they were before the EUT was turned off.

Confirm by observation 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 (see 6.8.1), and additional chart information if applicable.

F.7.8.3 Scale and navigation purpose

(See F.3.1.7)

See 6.8.8.

F.7.8.4 Mode and orientation

(See F.3.1.9)

If a presentation mode other than north up is available, confirm by observation that the orientation of the screen is clearly indicated and that the symbol realigns to north. If the EUT offers the capability to show such presentation for which the direction of the north is not uniform over the displayed area, confirm by observation that there is permanent indication “at own ship” or “at centre” next to the north arrow symbol.

Ensure that true motion is provided. Confirm by observation that the display resets itself and check that the generation of the neighbouring area takes place automatically at a distance selected by the mariner.

Confirm by observation that it is possible to change manually the chart area and the position of own ship relative to the edge of the display.

F.7.8.5 Navigation related functions

(See F.3.1.3)

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

F.7.8.6 Position integration

(See F.3.1.3)

Connect a simulated position input to the EUT and confirm by observation that the correct position is displayed.

Adjust the position manually. Confirm by observation 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.7.8.7 Radar, track plotting and AIS information

(See F.3.1.8.2)

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 and in addition to 6.8.15.1 and 6.13, perform the following.

Confirm by observation that the radar image overlay, tracked target information, AIS information and other added navigational information may be removed by single operator action.

F.7.8.8 Updates

(See F.3.1.6)

Confirm by observation that updates on the ECDIS can be duplicated on the EUT and that the EUT can be manually updated.

F.7.8.9 Self-tests of major functions

(See F.3.3)

The methods of testing are as follows.

a) Perform tests of the major functions, which are supported by the EUT. Confirm by observation 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 information from input interface (status);
    3) physical breakdown of interface connection;
    4) physical breakdown or shutdown of a test LAN information receiver (e.g. a VDR).
c) Confirm by observation that the system provides suitable alerts and indication of system malfunction arising from failures in accordance with IEC 60945.

F.7.9 Operational requirements

F.7.9.1 Ergonomic principles

(See F.4.1)

Confirm that the EUT follows 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)

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 NM to at least 3 NM with a total length of at least 25 NM;
4) planned speed shall vary between 5 kn and 15 kn;
5) the planned route shall cross at least 3 different scales of chart data.

The methods of testing are as follows.

a) Confirm by observation that the route plan can be transferred from ECDIS to the EUT after completion of the route plan. Alter the route plan on the ECDIS and transfer alterations/new route to the EUT and confirm by observation that the previous route is corrected/overwritten.
b) Confirm by observation that routes can be planned and can be adjusted manually.
c) Confirm by observation 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 and confirm by observation that it is possible to
    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)

Confirm by observation that the planned route is displayed with both straight and curved segments.

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 confirm by observation that the time labels are displayed. Confirm by observation that time labels may also be entered manually.

F.7.9.4 Twelve hour log

(See F.3.1.10)

Confirm by observation 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)

Confirm by observation 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 Clause F.5)

Confirm by observation that the EUT can be powered from a separate supply other than the ECDIS power supply. Switch off the power supply to the ECDIS. Confirm by observation that the EUT continues to function.

Interrupt the power supply for 45 s, and confirm by observation that the EUT does not need to be re-initialized manually.

Confirm by observation that operator settings have not changed.

F.7.9.7 Route transfer interface with Main ECDIS

(See F.6.2)

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

a) Create a Route plan in the simulator and send it to the EUT. Confirm by observation that the EUT accept the route and that the simulator indicates accepted status for transport and application layers. Confirm by observation that the received Route plan can be viewed in the EUT.

b) Create a Route plan including a syntax error in the simulator and send it to the EUT. Confirm by observation that the EUT rejects the route and that the simulator indicates accepted status for the transport layer and non accepted for the application layer.

c) Create a Route plan in the simulator and send it to the EUT. Set the simulator to inform the EUT that this Route plan is for monitoring. Confirm by observation that the EUT accepts the route and selects the received Route for monitoring and that the simulator indicates accepted status for the transport and application layers.

d) Confirm by observation that the EUT has logged all interactions.

F.7.9.8 Radar as back-up system

(See F.6.4)

In addition to all what is specified in this standard for ECDIS back-up verify compliance in accordance with IEC 62388.

F.7.9.9 Operational area

(See F.6.3)

See 6.8.20.

F.7.9.10 Software maintenance

(See F.6.5)

See 6.10.

F.7.9.11 Quality management

(See F.6.6)

See 6.11.

F.7.9.12 Default control settings and saved user control settings

(See F.6.7)

See 6.12.

F.7.9.13 External removable media

(See F.6.8)

See 6.8.21.

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 Overview

(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 alerts 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 IHO S-32.*

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.17.5.2)

(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 (IHO 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.17.5.10.2)

(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.17.5.9, G.17.5.10.1, G.17.5.10.2)

(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 a permanent 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* (see IHO S-61). *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 the RNC geodetic datum and WGS-84 or PE-90 contained in the meta-data may be "shift not known". This shall be permanently 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.17.5.10.2, G.17.5.10.3, G.17.5.11)

(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.17.5.3)

(6) *ECDIS* operating in the *RCDS* mode shall *provide* a permanent *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 General for all overlays

(See G.17.5.7)

(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, a* permanent *indication* shall *be provided.*

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

(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 it* 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.*

G.6.2 Radar information

G.6.2.1 General

(See 6.8.15.1, 6.8.15.2 and G.17.5.8)

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

See 4.6.2.1.

G.6.2.2 Tracked target information

(See 6.8.15.3 and 6.8.15.4)

See 4.6.2.3.

G.6.2.3 Radar image information

(See 6.8.15.1)

(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* (i.e. CCRP).

The requirements of IEC 62288 for presentation of radar video images shall be met (See IEC 62288/5.4.1).

G.6.3 AS information

(See 6.8.13)

See 4.6.3.

G.6.4 AIS Target Data

(See 6.13.6)

See 4.6.4

G.6.5 AIS Voyage Related Data

(See 6.8.14)

See 4.6.5

G.6.6 AIS CPA/TCPA alarms

(See 6.13.7)

See 4.6.6

G.6.7 AIS lost target warning

(See 6.13.8)

See 4.6.7

G.6.8 Anchor watch

(See 6.15)

See 4.6.8

G.7 Display mode and generation of the neighbouring area

(See G.17.5.4)

(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 edge 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 H) *to the mariner to refer to the paper chart.*

G.8 Colours and symbols

(See G.17.4.3)

(9.1) *IHO recommended colours and symbols* shall *be used to represent SRNC information* implemented in accordance with IEC 62288. (IHO S-61 3.4.2.17, 3.4.2.17.1 and 3.4.2.17.2)

If SRNC data from a non-HO source is in use, it may use other colours or symbols than specified by IHO S-61. In such case a permanent indication "non-RNC data" shall be provided.

NOTE "Non-RNC data" indicates that the equipment does not comply with carriage requirement of ECDIS.

If SRNC data from HO source is in use and if the representation uses colours or symbols different from IHO S-61 then a permanent indication "non-ECDIS presentation, Refer to paper chart" shall be provided,

NOTE "Non-ECDIS presentation" indicates that the equipment may not comply with carriage requirement of ECDIS.

(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* (IHO 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

G.10.2.1 Route Plan

(See G.17.6.2)

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

(10.3.2) *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.

(10.3.3) *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.*

(10.3.6) *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.10.2.2 Annotated Route plan

(see 4.10.2.2)

G.10.2.3 Route Plan Exchange with other equipment

(see 4.10.2.3)

G.10.3 Route monitoring

(See G.17.5.6, 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 alerts 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 alerts and indications if the mariner has entered the appropriate data in G.10.2.

The system shall allow the user to select a route for monitoring only if the pre-planned route has been checked that radius of planned turn allows each turn to complete before the next turn.

(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) A warning 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 a warning 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,* warning or caution as selected by mariner *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.17.5.7)

(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. Visual position fix and dead reckoning functions are required as one secondary independent positioning source. Refer to 4.10.6.

(11.4.8) ECDIS operating in the *RCDS* mode shall *provide* a warning *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 alert 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* a warning or indication *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* (i.e. permanent) *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* (i.e. permanently indicated)*, 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.17.5.2, G.17.5.5)

(11.3.7) *It* shall *be possible for the mariner to enter points, lines and areas which activate an automatic alarm,* warning or caution*. 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, warnings and cautions 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.17.5.13)

(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, fix 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 (i.e. bearing) between two geographical positions;

2) geographic position from known position and distance/azimuth (i.e. bearing); 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.

Accuracy of geodetic calculations shall be for distance within 1 % or 30 m, whichever is greater distance and shall be for bearings within 1º (see Annex J).

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.*

ECDIS shall be capable to be connected to the BAM equipment, BNWAS, ECDIS back-up system and VDR. Optionally ECDIS may be connected to other navigational and communication equipment, for example Radar, AIS, Autopilot, Track Control, Echo sounder, SafetyNET, and NAVTEX (see 4.12).

As a minimum, the ECDIS shall support the interfaces as given in Annex Q. The manufacturer shall specify which physical interfaces are supported. In addition, suitable alternative input or output interfaces may be used.

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

G.13 Performance tests, malfunction alerts and indications

(See G.17.5.12)

(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.*

Major functions of ECDIS operating in the RCDS mode are: the ECDIS equipment itself, interface to electronic position fixing system, optional interface to the gyro compass, optional interface to the speed and distance measuring device, optional interface to the radar and optional interface to the AIS.

(13.2) ECDIS operating in the *RCDS* mode shall *provide suitable* alert (i.e. warning) *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 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)

(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, Annex A.*

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.16.6 Operational area

(See G.17.5.14)

Every ECDIS operating in the RCDS mode is required to operate between 85°N and 85°S latitude. Optionally, an ECDIS operating in the RCDS mode may support operation above latitude 85°. The manufacturer shall declare the operational area of the ECDIS operating in the RCDS mode in the user manual.

The North Pole and the South Pole are special cases where very little navigation exists. Therefore it is not required that every ECDIS operating in the RCDS mode be able to handle RNCs beyond the 85°N latitude limit for the North pole and beyond the 85°S latitude limit for the South pole.

G.16.7 External removable media

(See G.17.5.15)

Means shall be provided to protect the ECDIS operating in the *RCDS* mode from execution of any software on update storage devices or via interfaces to update storage sources, for example writeable CD-ROM, USB memory sticks, Network interfaces etc. All automatic execution from external removable media including auto-run shall be prohibited.

G.17 Methods of testing and required test results

G.17.1 Preparation – Required test items

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.

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

– test RNCs as specified by the HO providing the RNC service or on whose behalf the RNC service is provided;
– test RNCs giving 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 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 confirm by observation that:

a) the RCDS mode indication is displayed;

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

c) a graphical index of RNC data available can be presented upon request and provide access to the edition and date of the RNCs available.

Load an additional RNC and confirm by observation that the chart coverage has changed and that the chart library is updated.

Remove an RNC and confirm by observation that the chart coverage has changed and that the chart library is updated.

Switch to ECDIS mode and confirm by observation that the RCDS mode indication is no longer displayed.

Ensure that 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)

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, confirm by observation that the system indicates 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.

Select a note or diagram contained in the RNC which does not appear on the portion of the RNC currently being displayed. Confirm by observation 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, confirm by observation that it is possible to return to the original area simply and quickly.

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 confirm by observation that an indication is provided.

G.17.3 Accuracy

(See Clause G.11, G.16.2.2)

Confirm by observation that:

– the accuracy of EUT calculations is consistent with SRNC;

– the measurement accuracy is consistent with the display resolution.

Perform the measurements provided for in the RNC test data set and confirm by observation that they meet the required accuracy. Confirm by observation that the system can perform the following calculations:

– transformation between a local datum and WGS-84;
– true distance and azimuth (i.e. bearing) between two geographical positions;
– geographic position from known position and distance/azimuth (i.e. bearing);
– rhumb line and great circle.

Calculate and display both a rhumb line and a great circle line and confirm by observation 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)

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

Confirm by observation that the symbols for the navigational elements conform to IEC 62288.

Perform zoom-in and zoom-out operations in each mode and confirm by observation that the symbols for the navigational elements do not decrease in size.

Confirm by observation 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)

Confirm by observation that the following elements can be determined easily and rapidly:

– RNC number;
– chart identifier (for example chart number) if different from RNC number;
– units for depth;
– units for height;
– RNC scale;
– scale of display;
– source data diagram (if available);
– sounding/vertical datum;
– horizontal datum;
– magnetic variation;
– date and number of last update affecting the RNC currently in use;
– edition number and date of issue of the RNC;
– chart projection;
– indication of north.

G.17.4.3 Colour tables

(See Clause G.8, G.16.4)

Confirm by observation 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 confirm by observation that it is at least 270 mm by 270 mm.

Confirm by observation 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.

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

G.17.5 Functional requirements

G.17.5.1 Overview

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 by observation that there is no degradation in information content.

Follow the manufacturer's instruction to reinitialize the EUT in RCDS mode of operation. Confirm by observation that the initial latitude/longitude position is entered and a chart is displayed. Refer to the user 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 by observation that the manually selected settings are the same as they were before the EUT was turned off.

G.17.5.2 Additional display functions

(See G.3.2, G.10.5)

Confirm by observation that it is easy to add to, or remove from the EUT display, information additional to the RNC data such as mariner’s notes. Confirm by observation that such information is clearly distinguishable from the RNC data.

Confirm by observation that it is possible for the mariner to add and save mariner-entered points, lines and areas. Confirm by observation that it is possible to amend and delete mariner-entered points, lines and areas. Confirm by observation that examples of those items like 10 lines, 25 text characters and two areas can be drawn at user defined locations. Confirm by observation that all information added by the mariner is distinguishable. Confirm by observation that one of the areas can be filled, as described in IHO S-52/2.3.1b. Confirm by observation 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 confirm by observation that they may be deleted.

If the manufacturer displays information, confirm by observation that the presentation of the information conforms with the following:

a) the caution (!) or information (i) symbol is used to call up a note on the alphanumeric display by cursor picking;
b) simple lines, or areas without colour fill, are set up for cursor picking to give an explanatory note in the alphanumeric display. Colour fill is not used.

Confirm by observation that the mariner-entered or manufacturer’s information can be displayed on charts of other scales which cover the same geographical area.

Remove all additional information. Confirm by observation that the EUT display is the same as the graphical representation of the RNC test data set.

Confirm by observation that the RCDS mode standard display can be restored by a single operator action.

G.17.5.3 Scale and navigation purpose

(See Clause G.5)

Select an RNC and display it at a greater resolution than that contained in the RNC meta-data and confirm by observation that an indication is provided.

Select an RNC and display it at a lesser resolution than that contained in the RNC meta-data and confirm by observation that an indication is provided.

Load two RNCs of different scale which include own ship's position. Select the smaller scale RNC and confirm by observation that an indication is given that a larger scale RNC is available for the displayed area.

G.17.5.4 Mode and orientation

(See Clause G.7)

Select an RNC which is not orientated "north-up". Confirm by observation that it is possible to determine quickly and easily the north direction. Confirm by observation that it is displayed "chart up".

Select an RNC. Confirm by observation that true motion is provided. Reset the display and confirm by observation that the generation of the neighbouring area takes place automatically at a distance selected by the mariner.

Select an RNC. Confirm by observation that it is possible to change manually the chart area and the position of own ship relative to the edge of the display.

G.17.5.5 Points, lines and areas

(See G.10.5)

Enter the geographic coordinates of a position, and confirm by observation that EUT displays that position.

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

G.17.5.6 Navigation related functions

(See G.10.3)

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

G.17.5.7 Position integration

(See G.6.1, G.10.4)

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 confirm by

observation that the system compensates automatically for this shift when plotting positions on the RNC. Confirm by observation that the reference datum (geodetic datum or WGS-84 (PE-90)) being used by the system is clearly indicated.

With a second, independent positioning method confirm by observation that the EUT displays any difference in reported positions.

Remove the positioning input to the EUT and confirm by observation that a warning is given.

Simulate a message from the positioning device which indicates an error condition, and confirm by observation that the alert or indication is repeated by the EUT as an indication.

Select a different geodetic datum between the positioning system and the SRNC, and confirm by observation that a warning or indication is given.

Adjust the position manually. Confirm by observation that the amount of the correction is displayed on the screen and that the position changes accordingly. Recheck periodically to see it remains unchanged.

Confirm by observation that the manufacturer's documentation includes guidance for implementing a common reference system.

G.17.5.8 Radar, radar tracks, and AIS information

(See G.6.2.1)

Where the capability for displaying radar information and/or AIS information is provided, in addition to the requirements of IEC 62288 for radar displays and presentation of target information, and in addition 6.8.15.1 and 6.13, confirm by observation that the radar image overlay, tracked target information, AIS information and other added navigational information can be removed by single operator action.

G.17.5.9 Loading of corrupted data

(See G.3.5)

Load an example of corrupted RNC test data. Confirm by observation that the EUT provides the appropriate warning.

Load the RNC test data set. Enter an example of corrupted update. Confirm by observation that EUT reception process is terminated and the update is flagged as invalid. Confirm by observation that the user is informed of the corruption.

G.17.5.10 Automatic updates

G.17.5.10.1 Receipt – Installation and application

(See G.3.5)

Confirm by observation 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.

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

b) Identify the issuing authority of the update. Confirm by observation that this conforms with the corresponding identifier of the RNC.

c) Attempt to load an improperly sequenced update; confirm by observation that the update is rejected and that a warning is given to the user.

d) Attempt to load an update related to a newer edition of the RNC; confirm by observation that the update is rejected and the user is informed that a newer edition is available.

e) Attempt to load an update related to an older edition of the RNC; confirm by observation that the update is rejected and the user is informed that the update belongs to a previous edition.

G.17.5.10.2 Display – Show and verify

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

Confirm by observation that the edition date/update number is displayed on request.

Confirm by observation 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.

Confirm by observation that official RNC updates can be distinguished from local updates.

Confirm by observation that, once accepted, integrated updates are indistinguishable from RNC data.

Apply an update to the SRNC, display it, and then manually annotate it as rejected by the mariner, confirm by observation that it is not possible for the mariner to reject an officially issued update by omitting its application entirely.

G.17.5.10.3 Records

(See G.4.2)

Apply tests in all EUT operating modes, i.e. route planning and route monitoring.

Confirm by observation 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.17.5.11 Manual updates

(See G.4.2)

Using the RNC test data set, confirm by observation that the following manual update procedures can 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. Confirm by observation that this update can be re-displayed on demand.
d) Confirm by observation that manual updates are distinguishable from RNC data.
e) Confirm by observation that any manual updates removed from the display are retained and can be displayed in a future review.

G.17.5.12 Self-tests of major functions

(See Clause G.13)

Perform tests of the major functions which are supported by the EUT. Confirm by observation that the EUT provides appropriate display information and indications.

Simulate the following interface malfunctions (including for radar if provided for):

a) interruption of input interface (loss of signal);

b) invalid information from inout interface (status);

c) physical breakdown of sensor connection.

d) physical breakdown or shutdown of a test LAN information receiver (e.g. a VDR).

Confirm by observation that the system provides suitable alerts or indication of system malfunction arising from failures.

G.17.5.13 LOP position fix

(See G.10.6)

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.

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

b) Confirm by analytical evaluation that an initial fix based on two LOPs selected by the operator is provided.

c) 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.

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

e) 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.

f) 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 G.17.6.5.

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

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

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

j) Confirm by inspection that the user manual supplied with the equipment includes guidance on use of LOPs for calculation of position fixes.

G.17.5.14 Operational area

(See G.16.6)

RNC charts between latitude 85°N and 85°S is verified by conformance to 5.10.

Confirm by inspection of documented evidence that the manufacturer has declared in the user manual the operational area of the ECDIS operating in the RCDS mode.

If the declared operational area extends beyond latitude 85° then:

a) ENC charts beyond latitude 85° is verified by conformance to 6.5.1;

b) confirm by analytical evaluation that a chart projection type suitable for navigation in higher latitudes is provided. Confirm by inspection of documented evidence that the user manual states the projection types provided and describes the user interface involved in transitioning from one projection type to another;

   1) use charts available and confirm by observation that functions such as route planning, route monitoring, etc. are operative beyond latitude 85°;

   2) plan a route using scenario 4 as described in Annex I and save the route. Confirm by observation that distances of the route comply with those noted in Annex I and that no distortions are visible. Confirm by observation that the route pass though the intermediate points between waypoints 1 and 2;

   3) if there is a maximum latitude limit for the EUT, confirm by observation that an alert (caution) is provided when the monitored route falls within a region beyond the maximum latitude;

   4) reload the route of scenario 4 and start monitoring the route with the first waypoint. Confirm by observation that all waypoint changes, bearings and distances are calculated and displayed correctly during route monitoring;

   5) confirm by observation that the alert requirements that apply to safety contour and for areas for which special condition exist are also implemented for charted objects which include spatial points beyond the maximum latitude at which the ECDIS is fully functional;

   6) Repeat tests 1 to 4 above for each projection type provided by the ECDIS;

c) use charts and confirm by observation that accuracy of LOP, VRM, EBL, etc. measurements are within their tolerances;

   1) Use tables available in the Annex P. Select 3 test cases from each table for each navigation tool provided by the EUT and confirm by observation that the accuracy of range and bearing measurements relative to charted data of IHO S-64 scenario(s) using the tools provided by the ECDIS (VRM, EBL, ERBL, etc.) is within 1 % or 30 m whichever is greater for distances and within 1° for bearings.

   2) Perform tests described in 6.9.7 in a region above 85° latitude;

d) when presentation of radar tracked target data or AIS information is provided, use tables available in the Annex P, set radar simulator for 3 test cases from each table, set charted symbol for the selected test cases and confirm by observation that positions and speed vectors when compared with the displayed chart, match in scale, orientation, projection and accuracy, within the tolerances defined in IEC 62388;

e) when presentation of radar overlay image is provided, use tables available in the Annex P, set radar simulator for 3 test cases from each table, set charted symbol for the selected test cases and confirm by observation that positions and speed vectors, when compared with the displayed chart, match in scale, orientation, projection and accuracy, within the tolerances defined in IEC 62388.

G.17.5.15 External removable media

(See G.16.7)

Use a USB-memory stick containing an auto-run executable module. Confirm by observation that the ECDIS refuses to execute the auto-run.

G.17.6 Operational requirement

G.17.6.1 Ergonomic principles

Confirm that the EUT follows 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.)

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, warning or caution 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 NM to at least 3 NM with a total length of at least 25 NM;
9) planned speed shall vary between 5 kn and 15 kn;
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)
11) the planned route shall enter an area where ENC data are available.

Perform the following:

a) confirm by observation that the displayed information for route planning, route monitoring and supplementary navigation tasks, such as pilotage or chart work is available;
b) plan a route which uses at least 10 waypoints:
   1) confirm by observation that the route can be planned using both straight and curved segments;
   2) confirm by observation that the planned route can be saved.
c) retrieve the planned route and confirm by observation that one can 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;
d) plan complex tracks using scenarios 2 and 3 as decribed in Annex I and save the tracks. Confirm by observation that track distances comply with those noted in Annex I and that no distortions are visible;
e) confirm by observation 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)

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, warning or caution 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.

Perform the following:

a) operate the own ship position function, and confirm by observation that the display shows own ship's position;

b) shortly before the vessel enters an area for which an alarm, warning or caution 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) confirm by observation that the appropriate alerts/indications are provided;

   3) return to own ship's position by a single operator action and confirm by observation that this takes no more than 5 s.

c) confirm by observation that an alarm, warning or caution is released each time the vessel is going to cross the boundary of a mariner entered feature, within the time specified by the mariner;

d) select an RNC of a smaller scale than that of c) but covering the same area. Simulate crossing over the mariner entered feature referred to in c). Confirm by observation that an alarm, warning or caution is generated by the EUT;

e) 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. Confirm by observation 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 NM from own ship position and which is covered by RNC data at a scale different from the one in use. Confirm by observation that the old display is maintained from the start of the regeneration until the start of re-draw of the new display. Confirm by observation that an indication is given if the regeneration time is more than 5 s;

   3) simulate deviation from intended track and confirm by observation that the off-track alarm is released;

   4) confirm by observation that a warning 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 confirm by observation that it is clearly distinguishable from the selected route. Change to the alternative route and confirm by observation that this becomes the selected route;

   6) confirm by observation that one can 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 confirm by observation that the time labels are displayed. Confirm by observation 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. Confirm by observation that the EUT indicates that the ENC data are available.

f) confirm by observation that there is an indication showing that the EUT is operating in the RCDS mode;

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

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

i) confirm by analytic evaluation that the system allows selection of a route for monitoring only when the route has been checked that radius of planned turns allow each turn to complete before the next turn.

G.17.6.4 Twelve hour log

(See G.10.7)

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.

Continue to run the test for 12 h. During this period, attempts should be made to manually edit the log. Confirm by observation that this is not possible. At the end of the twelve-hour period, analyze the EUT log according to the procedures in the operating manual and confirm by observation that the results comply with the test carried out.

Confirm by observation that the record for the previous 12 h including all the items defined in G.10.7 is stored and available on demand. Confirm by observation that chart data according to G.10.7 is stored initially and for each change.

G.17.6.5 Voyage record

(See G.10.7)

Confirm by observation that the EUT records the track for the entire voyage, with time marks at intervals not exceeding 4 h, including the items listed in G.10.7.

Confirm by observation that the record for the previous 12 h and the voyage track, once recorded, can be preserved, and that it is not possible to manipulate or change the recorded information.

G.18 RNC test data set

The latest versions of the RNC test data sets are available from the International Hydrographic Organization at http://www.iho.int.

Annex H
(normative)

Alerts and indications in the RCDS mode of operation

Table H.1 describes the alerts and indications given in Table 1 of Appendix 7 of IMO resolution MSC.232(82) updated for the alert classification of Appendix 5 of IMO MSC.252(83).

Table H.1 – Alerts and indications in the RCDS mode of operation

Clause/Subclause	Requirement	Category	Information
G.10.3 (11.4.5)	*Alarm*	*A*	*Deviation from route*
G.10.4 (11.4.8)	*Warning*	*B*	*Position system failure*
G.10.3 (11.4.9)	*Warning*	*A*	*Approach to critical point*
G.10.4 (11.4.10)	*Warning or* permanent *indication*	*B*	*Different geodetic datum*
G.10.4 (11.4.14)	Permanent indication	n/a	Manual position adjustment
G.10.4 (11.4.15.2)	Indication	n/a	Discrepancies in position
G.10.3 (11.4.17)	*Alarm, warning or caution as selected by mariner*	*A*	*Approach to mariner entered feature, for example area, line*
G.13 (13.2)	*Warning*	*B*	*Malfunction of ECDIS operating in the RCDS mode*
G.3 (5.13)	Permanent *Indication*	*n/a*	*ECDIS operating in the RCDS mode*
G.4	Indication	n/a	Datum shift not known
G.5 (6.1)	Permanent *Indication*	*n/a*	*Larger scale information available, underscale or overscale*
G.5 (6.2)	Permanent *Indication*	*n/a*	*Larger scale RNC available for the area of the vessel*
G.6.1 (7.3)	Permanent *Indication*	*n/a*	*Different reference system between ECDIS and added navigational information*
G.7 (8.5)	*Indication*	*n/a*	*No RNC at a scale appropriate for navigation*
G.10.4 (11.4.10)	Permanent *Indication*	*n/a*	*Datum of position different from WGS-84 or PE-90*
G.13 (13.2)	*Warning*	*B*	*Malfunction of ECDIS*
G.13 (13.1)	*Indication*	*n/a*	*System test failure*

Annex I
(normative)

Scenario definitions and plots

I.1 Overview

This annex describes in Scenarios 1 to 4 the routes required for the tests of the EUT.

NOTE The data for the scenarios have been recalculated from the data given in IEC 61174:2001 (second edition)[2]. The calculations assumed a spheroid. These calculations assume an ellipsoid which agrees with WGS 84. Distances are approximately from wheel-over point to wheel-over point along the curved track (since accurate values are ship dependent).

All numeric values are from WOL to WOL, see Figure I.1 below.

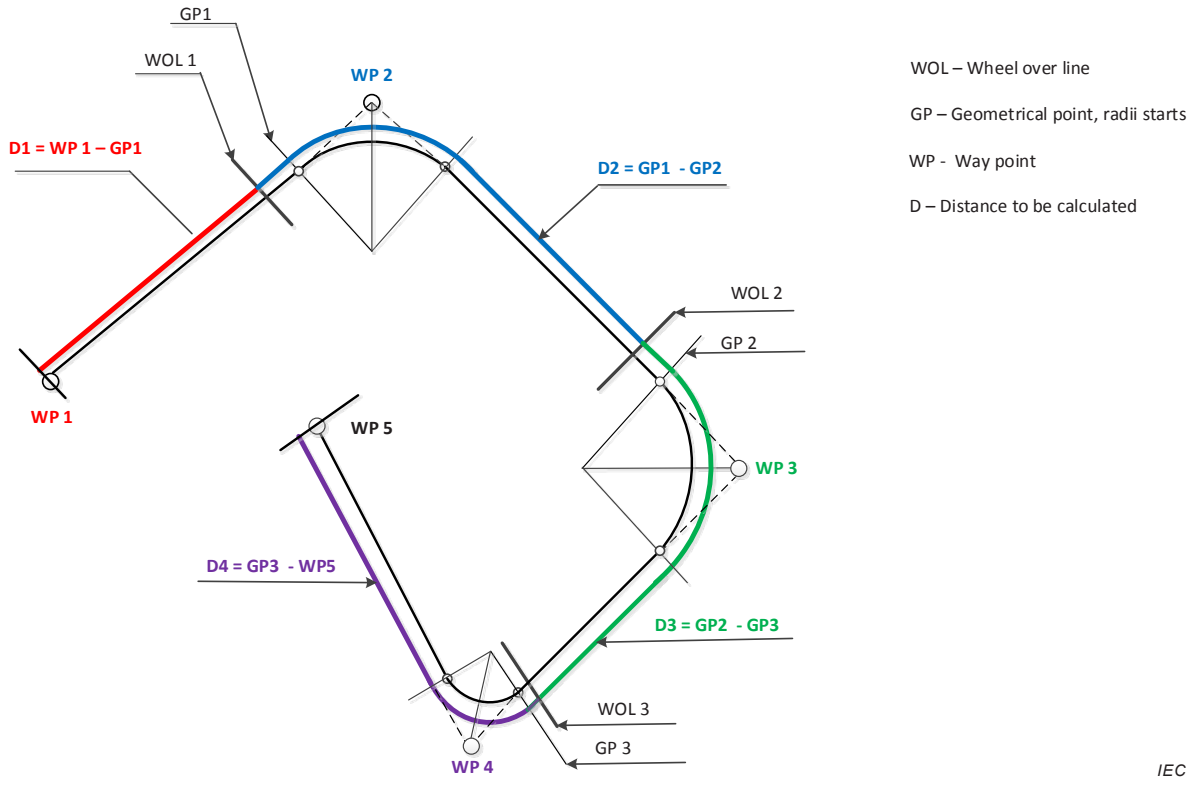


Figure I.1 – Definition of elements of route

2 IEC 61174:2001, *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*

I.2 Scenario 1:

Rhumb Line/Great Circle Atlantic Track (see Figure I.2 Boston to Rotterdam).

Waypoint No.	Latitude	Longitude	Track °	Distance NM	Radius NM
001	42°20,639' N	071°00,786' W	132,0	0,7	
002	42°20,090' N	070°59,964' W	112,1	0,4	1,0
003	42°19,940' N	070°59,465' W	087,0	1,4	1,0
004	42°20,015' N	070°57,525' W	063,7	0,9	1,0
005	42°20,429' N	070°56,397' W	026,7	1,8	1,0
006	42°22,011' N	070°55,325' W	065,9	1	1,0
007	42°22,380' N	070°54,210' W	079,6	4,9	1,0
008	42°23,275' N	070°47,663' W	065,2	9,5	1,0
009	42°27,287' N	070°35,953' W	088,2	126,4	1,0
010	42°31,223' N	067°44,616' W	085,4	272,9	1,0
011	42°53,045' N	061°34,463' W	065,3	202,7	1,0
012	44°17,923' N	057°20,346' W	067,1	307,8	1,0
013	46°17,898' N	050°37,294' W	067,1	1761	1,0
Great circle approximation	48°46,606' N 50°04,547' N 50°28,684' N 50°00,935' N	40°00' W 30°00' W 20°00' W 10°00' W	075,0 082,5 090,0 098,0		
014	49°38,074' N	006°25,031' W	084,5	147,4	1,0
015	49°52,252' N	002°37,903' W	074,5	144,2	1,0
016	50°30,788' N	000°59,106' E	049,8	18,3	1,0
017	50°42,637' N	001°21,152' E	016,3	13,0	1,0
018	50°55,140' N	001°26,929' E	038,2	19,6	1,0
019	51°10,551' N	001°46,164' E	041,6	15,6	1,0
020	51°22,252' N	002°02,706' E	041,7	46,7	1,0
021	51°57,145' N	002°52,725' E	085,0	13,2	1,0
022	51°58,304' N	003°13,980' E	082,4	24,7	1,0
023	52°01,567' N	003°53,769' E	112,1	7,2	1,0
024	51°58,858' N	004°04,605' E			
Distances available in the table are based on zero "advance and transfer" or "forwarding distance".					

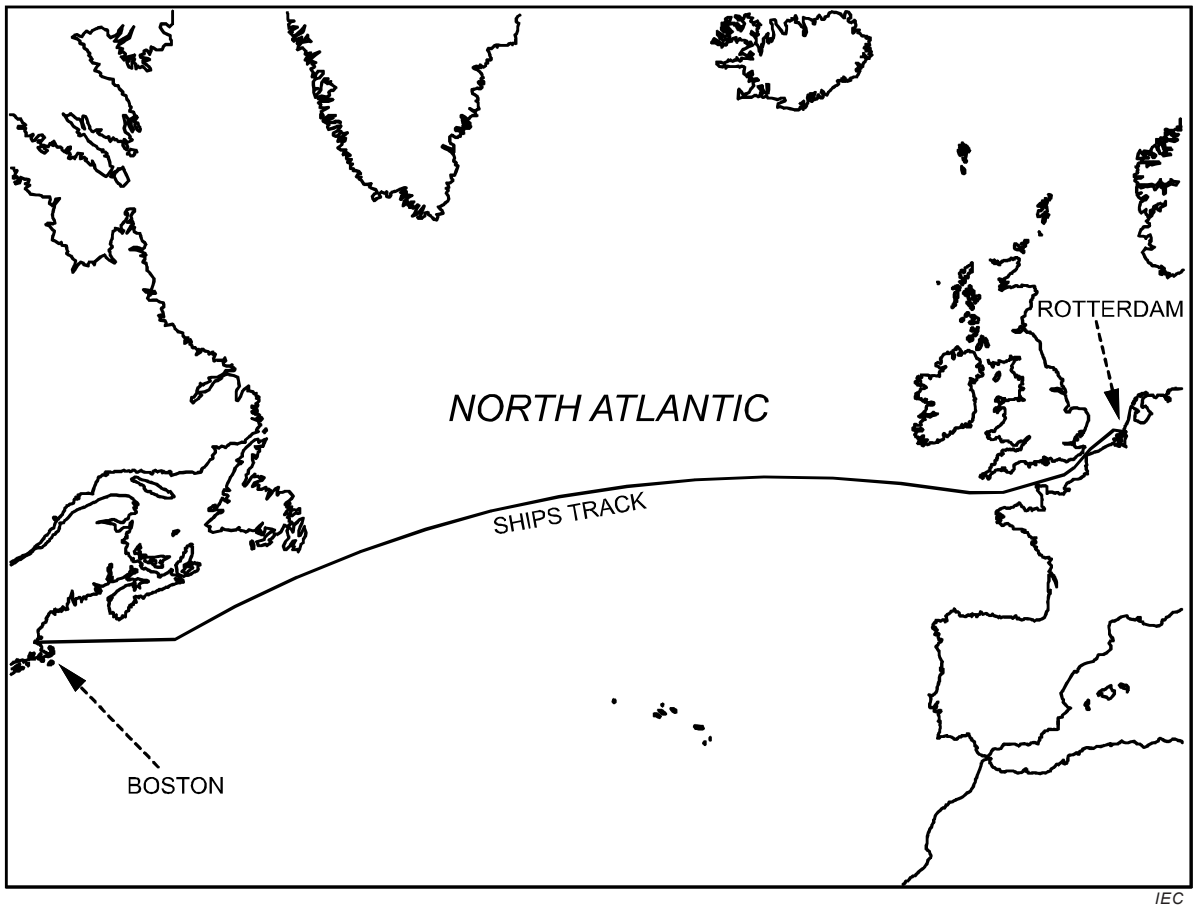


Figure I.2 – Route for scenario 1

I.3 Scenario 2:

Complex track at 0/0 (see Figure I.3).

Waypoint No.	Latitude	Longitude	Track °	Distance NM	Radius NM
001	00°01,000' S	000°01,000' W	000,0	1,4	
002	00°01,000' N	000°01,000' W	090,0	1,9	0,60
003	00°01,000' N	000°01,000' E	315,0	1,2	0,20
004	00°02,000' N	000°00,000' E	225,2	0,9	0,20
005	00°01,000' N	000°01,000' W	135,0	2,7	0,60
006	00°01,000' S	000°01,000' E	270,0	1,5	0,20
007	00°01,000' S	000°01,000' W	045,0	1,9	0,20
008	00°01,000' N	000°01,000' E	180,0	2,0	0,40
009	00°01,000' S	000°01,000' E			
Distances available in the table are based on zero "advance and transfer" or "forwarding distance".					

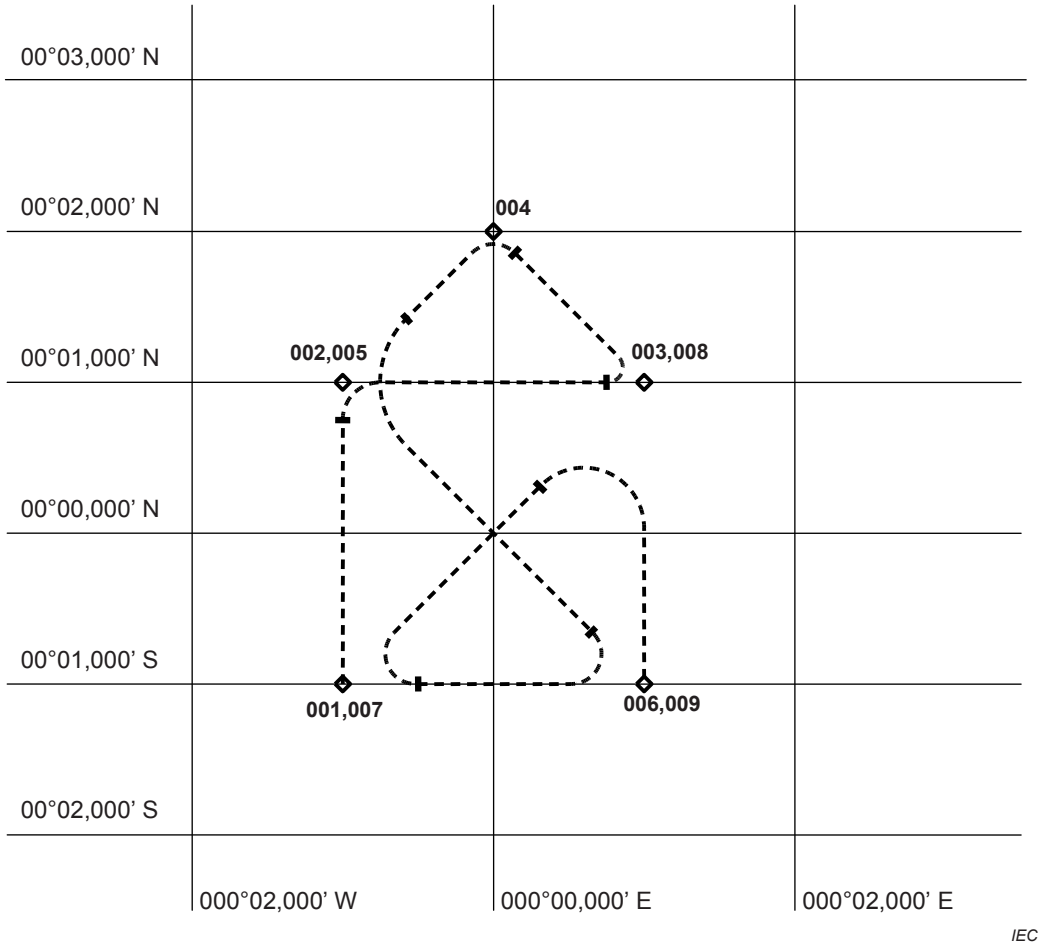


Figure I.3 – Route for scenario 2

I.4 Scenario 3:

Complex track at 0/180 (see Figure I.4).

Waypoint No.	Latitude	Longitude	Track °	Distance NM	Radius NM
001	00°03,000’ S	179°57,000’ W	000,0	5,0	
002	00°03,000’ N	179°57,000’ W	270,0	4,6	1,00
003	00°03,000’ N	179°57,000’ E	045,0	3,2	0,80
004	00°06,000’ N	180°00,000’ W	135,0	3,3	1,00
005	00°03,000’ N	179°57,000’ W	225,0	6,9	1,50
006	00°03,000’ S	179°57,000’ E	090,0	4,0	1,0
007	00°03,000’ S	179°57,000’ W	315,0	5,3	0,80
008	00°03,000’ N	179°57,000’ E	180,0	5,9	1,25
009	00°03,000’ S	179°57,000’ E			
Distances available in the table are based on zero “advance and transfer” or “forwarding distance”.					

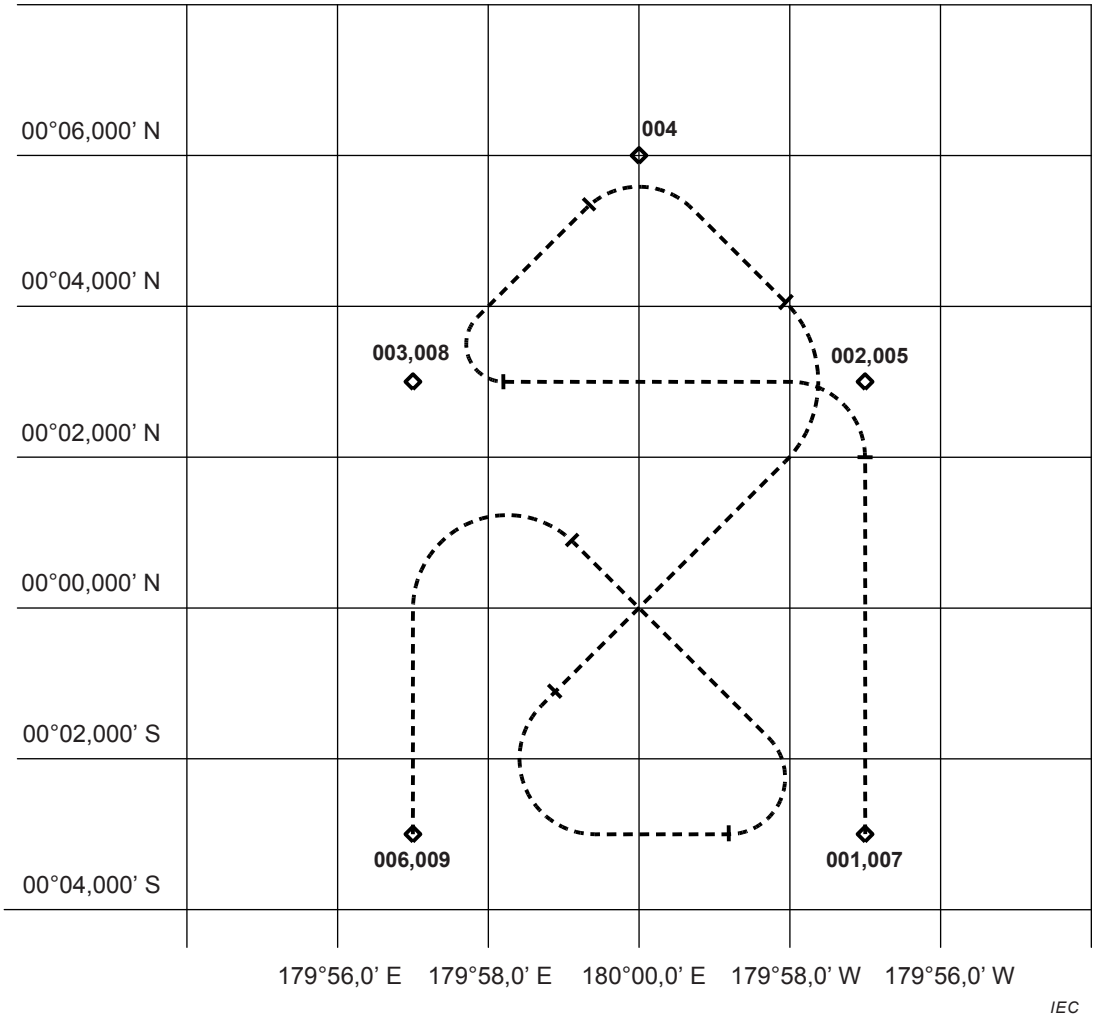


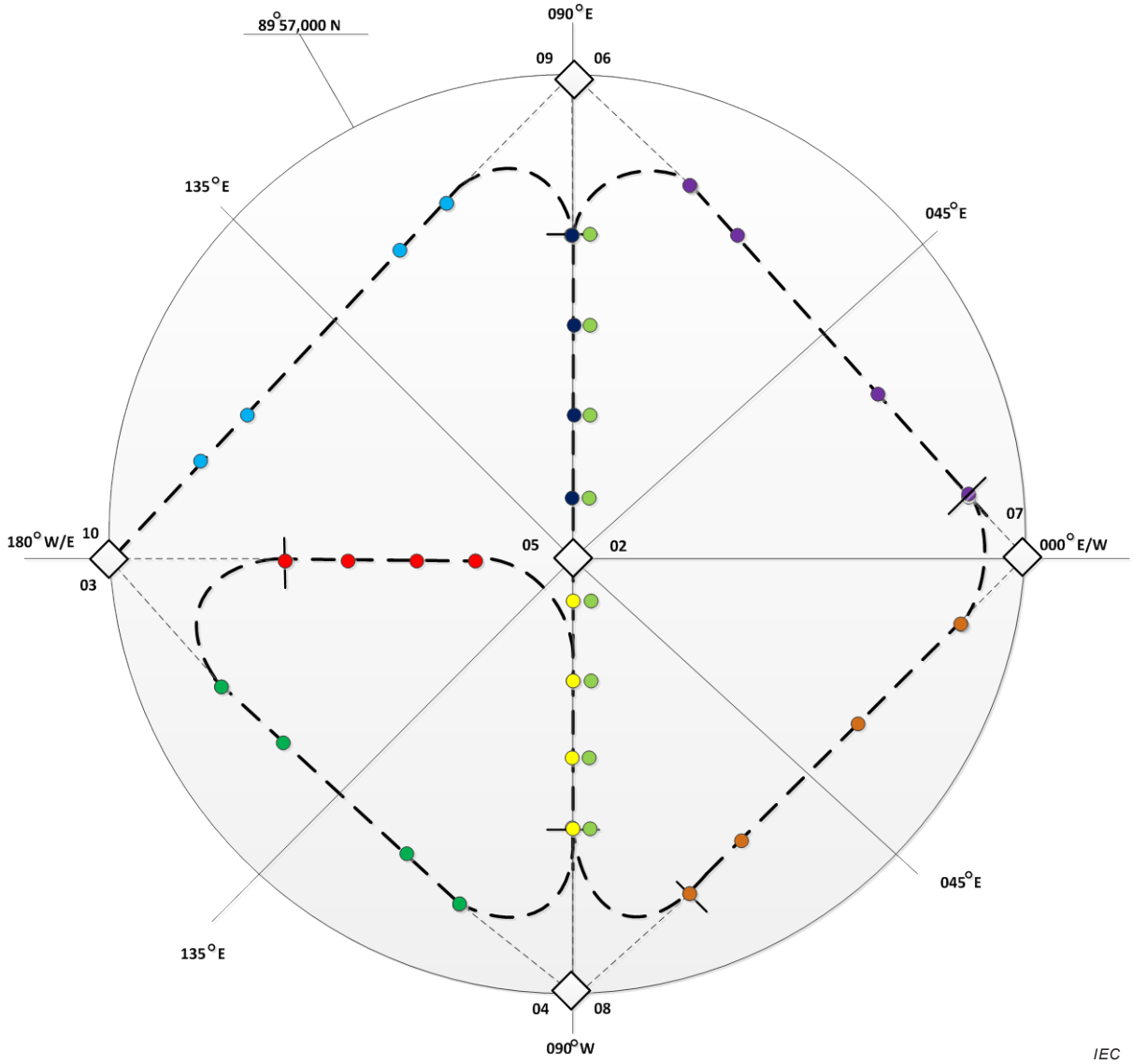
Figure I.4 – Route for scenario 3

I.5 Scenario 4:

Complex track at North Pole (see Figure I.5).

Waypoint No.	Latitude	Longitude	Track[a] °	Distance NM	Radius NM
001	84°00,000' N	090°00,000' W			
	85°00,000' N	090°00,000' W		60,30	
Orthodromic approximation	86°00,000' N 87°00,000' N 88°00,000' N	090°00,000' W 090°00,000' W 090°00,000' W		60,31 60,31 60,31 120,12	
				361,35	
002	90°00,000' N	000°00,000' W			0,50
Orthodromic approximation	89°59,500' N 89°59,000' N 89°58,600' N 89°58,250' N	180°00,000' W 180°00,000' W 180°00,000' W 180°00,000' W		0,79 0,50 0,40 0,40	
				2,09	
003	89°57,000' N	180°00,000' W			0,50
Orthodromic approximation	89°57,690' N 89°57,804' N 89°57,804' N 89°57,695' N	158°20,000' W 150°00,000' W 120°00,000' W 112°00,000' W		1,18 0,35 1,14 0,35	
				3,02	
004	89°57,000' N	090°00,000' W			0,50
Orthodromic approximation	89°58,250' N 89°58,750' N 89°59,250' N 89°59,750' N	090°00,000' W 090°00,000' W 090°00,000' W 090°00,000' W		1,23 0,50 0,50 0,75	
				2,98	
005	90°00,000' N	090°00,000' W			0,50
Orthodromic approximation	89°59,750' N 89°59,250' N 89°58,750' N 89°58,250' N	090°00,000' E 090°00,000' E 090°00,000' E 090°00,000' E		0,25 0,50 0,50 0,55	
				1,80	
006	89°57,000' N	090°00,000' E			0,50
				1,20	
Orthodromic approximation	89°57,695' N 89°57,804' N 89°57,804' N 89°57,344' N	068°00,000' E 060°00,000' E 030°00,000' E 008°00,000' E		0,33 1,14 1,07	
				3,74	
007	89°57,000' N	000°00,000' E			0,50
Orthodromic approximation	89°57,326' N 89°57,804' N 89°57,804' N 89°57,695' N	007°30,000' W 030°00,000' W 060°00,000' W 068°00,000' W		0,78 1,06 1,14 0,34 3,34	
008	89°57,000' N	090°00,000' W			0,50
				1,23	

Waypoint No.	Latitude	Longitude	Track[a] °	Distance NM	Radius NM
Orthodromic approximation	89°58,250’ N 89°58,750’ N 89°59,250’ N 89°59,750’ N 89°59,750’ N 89°59,250’ N 89°58,750’ N 89°58,250’ N	090°00,000’ W 090°00,000’ W 090°00,000’ W 090°00,000’ W 090°00,000’ E 090°00,000’ E 090°00,000’ E 090°00,000’ E		0,50 0,50 0,50 0,50 0,50 0,50 0,54 4,79	
009	89°57,000’ N	090°00,000’ E			0,50
Orthodromic approximation	89°57,695’ N 89°57,804’ N 89°57,804’ N 89°57,690’ N	112°00,000’ E 120°00,000’ E 150°00,000’ E 158°20,000’ E		1,20 0,33 1,14 0,35 1,21 4,24	
010	89°57,000’ N	180°00,000’ E			
Distances available in the table are based on zero “advance and transfer” or “forwarding distance”.					
[a] In the polar areas the track bearing changes constantly when you sail through the leg.					



WP number 01 is outside the area available in this figure.

Figure I.5 – Route for scenario 4

Annex J
(informative)

Guidance on geodetic calculations

J.1 Overview

This guidance is intended to help the understanding of geodetic calculations and to help checking conformance with the required accuracy.

Great Circle calculations (orthodrome) are carried out based on:

GeograficLib. http://geographiclib.sourceforge.net/

GeographicLib is a small set of C++ classes for performing conversions between geographic, UTM, UPS, MGRS, geocentric, and local Cartesian coordinates, for gravity (e.g., EGM2008), geoid height, and geomagnetic field (e.g., WMM2010) calculations, and for solving geodesic problems. It is a suitable replacement for the core functionality provided by geotrans. The library is licensed under the MIT/X11 License.

Rhumb Line (loxodrome) calculations are carried out in accordance with algorithms described in the article “THE LOXODROME ON AN ELLIPSOID” provided by R. E. Deakin, School of Mathematical & Geospatial Sciences, RMIT University, GPO Box 2476V, MELBOURNE VIC 3001, AUSTRALIA:

http://user.gs.rmit.edu.au/rod/files/publications/Loxodrome%20on%20Ellipsoid.pdf

J.2 Distance deviations between Great Circle (orthodrome) and Rhumb Line (loxodrome)

Great Circle distance is defined as a distance without any errors (see Figure J.1). Table J.1 shows the maximum deviation for all possible bearings. Deviation between Rhumb Line and Great Circle which exceeds 1 % is highlighted.

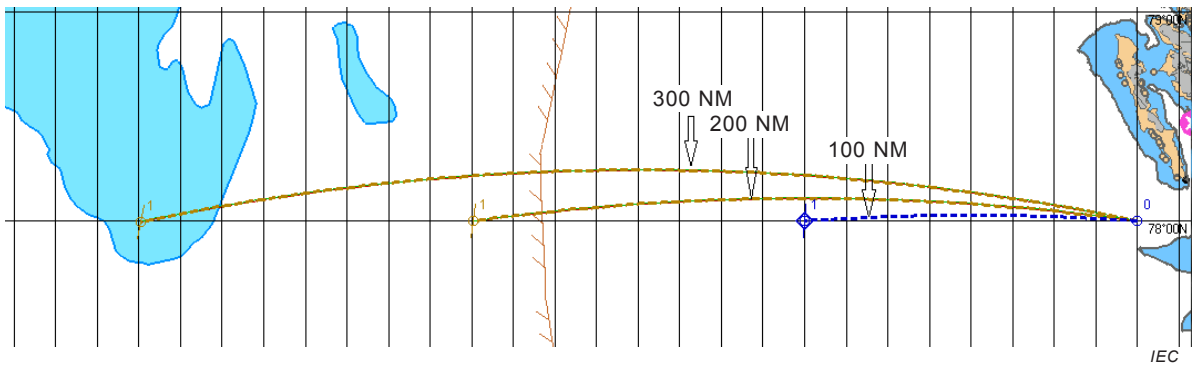


Figure J.1 – Distance deviations between Great Circle and Rhumb Line

Table J.1 – Rhumb Line distances

Lat	GREAT CIRCLE (Nautical Miles)								
	40	80	120	160	200	300	500	800	1000
3	40,00	80,00	120,00	160,00	200,00	300,00	500,00	800,02	1000,05
8	40,00	80,00	120,00	160,00	200,00	300,00	500,01	800,06	1000,13
13	40,00	80,00	120,00	160,00	200,00	300,01	500,03	800,12	1000,26
18	40,00	80,00	120,00	160,00	200,00	300,01	500,05	800,22	1000,46
23	40,00	80,00	120,00	160,00	200,01	300,02	500,08	800,36	1000,74
28	40,00	80,00	120,00	160,00	200,01	300,03	500,13	800,55	1001,12
33	40,00	80,00	120,00	160,01	200,01	300,04	500,19	800,81	1001,65
38	40,00	80,00	120,00	160,01	200,02	300,06	500,27	801,17	1002,37
43	40,00	80,00	120,01	160,01	200,02	300,08	500,39	801,66	1003,37
48	40,00	80,00	120,01	160,02	200,04	300,12	500,55	802,37	1004,80
53	40,00	80,00	120,01	160,02	200,05	300,17	500,79	803,40	1006,95
58	40,00	80,00	120,01	160,04	200,07	300,25	501,16	805,02	1010,37
63	40,00	80,01	120,02	160,06	200,11	300,37	501,76	807,76	1016,36
68	40,00	80,01	120,04	160,09	200,17	300,59	502,85	813,04	1028,83
70	40,00	80,01	120,05	160,00	200,21	300,73	503,55	816,69	1038,46
72	40,00	80,02	120,06	160,14	200,27	300,92	504,53	822,17	1055,52
74	40,00	80,02	120,07	160,18	200,35	301,19	505,96	831,29	n/a
76	40,00	80,03	120,10	160,23	200,46	301,60	508,18	850,30	n/a
78	40,00	80,04	120,14	160,32	200,64	302,34	512,01	n/a	n/a
80	40,01	80,06	120,20	160,47	200,94	303,35	519,91	n/a	n/a
82	40,01	80,09	120,31	160,76	201,51	305,63	n/a	n/a	n/a
84	40,02	80,16	120,57	161.40	202,87	312,03	n/a	n/a	n/a
86	40,05	80,38	121,36	163,54	208,04	n/a	n/a	n/a	n/a

J.3 Bearing deviations at start point between Great Circle (orthodrome) and Rhumb Line (loxodrome)

See Figure J.2. Table J.2 shows the maximum deviation for all possible bearings. Deviation between Rhumb Line and Great Circle which exceeds 1º is highlighted.

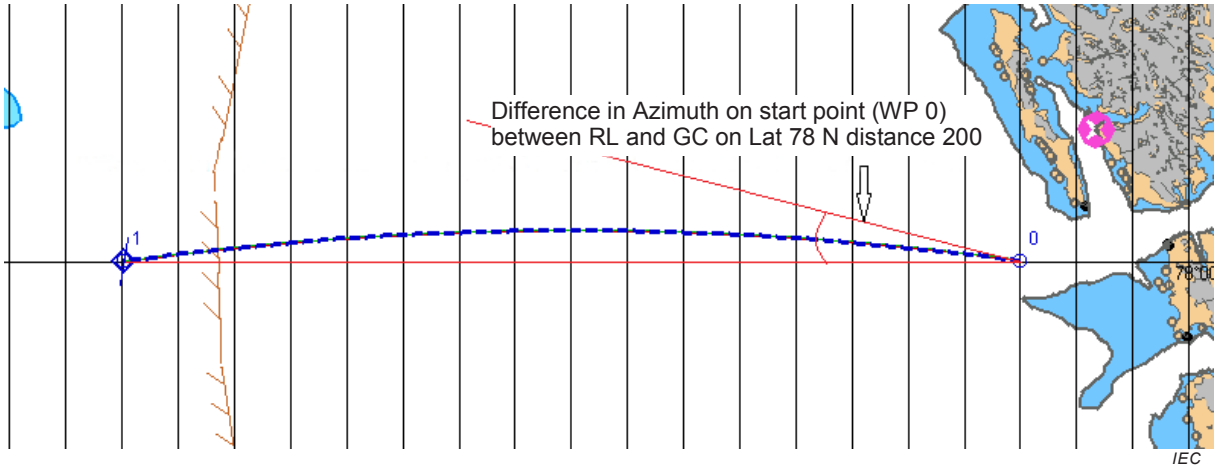


Figure J.2 – Bearing deviations at start point between Great Circle and Rhumb Line

Table J.2 – Deviations from Great Circle distances

Lat	GREAT CIRCLE (Nautical miles)								
	20	40	60	80	100	120	140	160	200
5°	0,015	0,029	0,044	0,058	0,073	0,088	0,103	0,118	0,149
10°	0,029	0,059	0,088	0,117	0,147	0,176	0,206	0,236	0,295
15°	0,045	0,089	0,134	0,178	0,223	0,268	0,312	0,357	0,447
20°	0,061	0,121	0,182	0,242	0,303	0,363	0,424	0,485	0,607
25°	0,078	0,155	0,233	0,310	0,388	0,465	0,543	0,621	0,777
30°	0,096	0,192	0,288	0,384	0,480	0,576	0,672	0,768	0,961
35°	0,116	0,233	0,349	0,466	0,582	0,698	0,815	0,932	1,165
40°	0,139	0,279	0,418	0,558	0,697	0,837	0,976	1,116	1,396
45°	0,166	0,332	0,498	0,664	0,831	0,997	1,163	1,330	1,663
50°	0,198	0,396	0,594	0,792	0,990	1,188	1,386	1,584	1,981
55°	0,237	0,474	0,711	0,948	1,186	1,423	1,661	1,898	2,374
60°	0,287	0,575	0,862	1,150	1,438	1,726	2,014	2,302	2,879
65°	0,356	0,712	1,068	1,424	1,780	2,136	2,493	2,850	3,566
70°	0,456	0,912	1,368	1,824	2,280	2,738	3,195	3,653	4,572
72°	0,510	1,021	1,532	2,043	2,555	3,067	3,580	4,094	5,124
74°	0,578	1,157	1,736	2,315	2,895	3,476	4,058	4,641	5,811
76°	0,665	1,331	1,997	2,663	3,331	3,999	4,670	5,342	6,692
78°	0,780	1,561	2,342	3,125	3,909	4,695	5,483	6,273	7,865
80°	0,941	1,882	2,824	3,769	4,715	5,666	6,620	7,578	9,513
82°	1,180	2,361	3,545	4,733	5,925	7,124	8,330	9,546	12,01
84°	1,578	3,159	4,746	6,341	7,949	9,572	11,21	12,88	16,30
86°	2,373	4,755	7,158	9,591	12,07	14,60	17,21	19,93	25,83
88°	4,761	9,602	14,62	19,954	25,854	33,03	n/a	n/a	n/a

Annex K
(informative)

Guidance for testing

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

This guidance is derived from ISO 9241-12. It is intended to provide guidance to accredited testing laboratories for the development of test plans and test procedures that evaluate a minimum degree of compliance with the requirements specified. They do not identify specific processes, approaches or facilities.

K.2 Observation

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

The phrase "confirm by observation" is used in the method of test. Conformance is determined by comparing the observed property to the requirement. Some observations may be made directly from the presentation. Other observations may require simulation of input from sensors or other sources. Typical confirmations by observation include:

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

K.3 Inspection of documented evidence

Inspection of documented evidence refers to examination of relevant documents to confirm that a particular presentation or display requirement has been met. Documented evidence may include manuals, system requirements, design justification, industry conventions, etc. Inspections may be made by a suitably qualified person who has the necessary education, skill and/or experience to apply the documentation to the system's presentation or display equipment. It is used when performance of a system's presentation or display equipment is not directly observable or measurable. It may also be used when observation would be excessively repetitious, time consuming, or expensive. The phrase "confirm by inspection of documented evidence" is used in the method of test. Conformance is determined by comparing the documented property to the requirement. Typical confirmations by inspection of documented evidence include:

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

K.4 Measurement

In this standard, measurement refers to measuring or calculating a value or variable for comparison to a specified value to determine that a particular requirement has been met. Measurements may require the use of test facilities and equipment. Measurements may be

made by any person with the necessary skill to measure and/or calculate the value and compare it against a requirement, standard or other documented evidence. Compliance is determined by comparing the measured or calculated value or variable to the requirement.

K.5 Analytical evaluation

The test method “analytical evaluation” refers to detailed examination of the presentation of information to confirm that a particular condition has been met. The phrase "confirm by analytical evaluation" is used. Analytical evaluations may be made by a relevant expert with the necessary education, skills and/or experience to make an informed and reliable judgement concerning the presentation of information, its appropriateness and usability. It is used for the evaluation of properties which can be judged only in the context of other information or knowledge which requires the tester presentation. Compliance is determined by comparing the observed property to the requirement.

Annex L
(informative)

Examples of ENC Update Status Report

L.1 Overview

This annex provides some examples of the ENC Update Status Reports. The normative reference is IHO S-63 and the normative tests are available in IHO S-64.

Examples are given of “ENC Update Status Report” intended as evidence for adequate and up to date charts for an intended voyage and “ENC Management Report” intended to help the mariner in the management of keeping the ENCs updated. The report could be from all ENCs or could be filtered for ENCs for the intended voyage (i.e. route plan).

L.2 ENC Update Status Report – Summary

ENC Update Status Report

Vessel Name:	HMS Goteborg
Identifier:	IMO 4653321
ENC Update Reference Date:	16 May 2013: WK24/2013
Date of Report:	1 Jun 2013
Content:	Filtered for Route Plan “Goteborg – Kiel”
Start WP:	Goteborg [57.7N,11.966667E]
End WP:	Kiel [54.333742N,10.159607E]

Chart Status Summary:

Chart Status:	**Count**
Total:	50
Up to Date	38/50
Not Up to Date	10/50
Withdrawn	2/50
Unknown	0/50

L.3 ENC Update Status Report – Full

ENC Update Status Report

Vessel Name: HMS Goteborg
Identifier: IMO 4653321
ENC Update Reference Date: 16 May 2013: WK24/2013
Date of Report: 1 Jun 2013
Content: Filtered for Route Plan “Goteborg – Kiel”
Start WP: Goteborg [57.7N,11.966667E]
End WP: Kiel [54.333742N,10.159607E]

Chart Status Summary:

Chart Status:	**Count**
Total:	50
Up to Date	38/50
Not Up to Date	10/50
Withdrawn	2/50
Unknown	0/50

Data server: GB				
Cell name	**Edition**	**Update**	**Issue date**	**Status**
DE316001	5	1	13 Mar 2013	Not Up to Date
DE416010	1	1	12 Apr 2012	Not Up to Date
DE416020	6	2	11 May 2012	Not Up to Date
DE416021	8	3	10 May 2012	Not Up to Date
DE416030	3	0	01 Jan 2013	Not Up to Date
DE516175	6	6	01 Jan 2013	Not Up to Date
DE516200	8	5	04 May 2013	Not Up to Date
DK2KATGS	4	4	22 Apr 2012	Not Up to Date
DK2LILBL	2	0	14 Nov 2012	Not Up to Date
DK2SKARK	6	7	25 Oct 2012	Not Up to Date
DK2STOBL	9	6	06 Aug 2011	Not Up to Date
DK4ABFNF	4	9	21 Jan 2011	Withdrawn
DK4FAVSF	2	1	19 Apr 2011	Withdrawn
DK4KATGN	1	2	28 Feb 2013	Up to Date
DK4KATGS	1	11	17 Jun 2012	Up to Date
DK4STOBN	1	2	14 Nov 2012	Up to Date
DK4STOBS	4	1	06 Jun 2013	Up to Date
DK5KALBG	5	8	03 Apr 2012	Up to Date
DK5KORSO	3	7	16 Aug 2012	Up to Date
SE2BHS0W	8	5	19 Nov 2012	Up to Date
SE2BI9SW	4	0	04 Jun 2012	Up to Date
SE3CI5D4	4	3	14 Nov 2012	Up to Date
SE3CI9T4	5	1	25 Oct 2012	Up to Date
SE3DI7L8	4	2	06 Aug 2011	Up to Date
SE3DI7LA	1	1	21 Jan 2011	Up to Date
SE3DI9T8	1	5	19 Apr 2011	Up to Date
SE4DI7L8	2	4	28 Feb 2013	Up to Date

Data server: GB				
Cell name	**Edition**	**Update**	**Issue date**	**Status**
SE4EI7LA	1	6	17 Jun 2012	Up to Date
SE4EI7LB	7	32	14 Nov 2012	Up to Date
SE4EI8PB	8	4	06 Jun 2013	Up to Date
SE4EI9T8	6	6	03 Apr 2012	Up to Date
SE4EI9T9	5	14	16 Aug 2012	Up to Date
SE4EIAX8	9	7	19 Nov 2012	Up to Date
SE4EIAX9	8	7	04 Jun 2012	Up to Date
SE4FI8PA	10	1	14 Nov 2012	Up to Date
SE4GI8PA	2	2	25 Oct 2012	Up to Date
SE4HI8PA	3	1	06 Aug 2011	Up to Date
SE4II8PA	1	11	21 Jan 2011	Up to Date
SE5DI7L8	13	2	14 Nov 2012	Up to Date
SE5EI7LA	3	9	25 Oct 2012	Up to Date
SE5EI9T8	14	8	06 Aug 2011	Up to Date
SE5EI9T9	2	7	21 Jan 2011	Up to Date
SE5EIAX8	6	5	19 Apr 2011	Up to Date
SE5EIAX9	8	3	28 Feb 2013	Up to Date
SE5FI7LB	8	4	17 Jun 2012	Up to Date
SE5FI8PA	1	1	14 Nov 2012	Up to Date
SE5GI7LB	7	2	06 Jun 2013	Up to Date

Data Supplier: PM				
Cell name	**Edition**	**Update**	**Issue date**	**Status**
SE5GI8PA	6	8	03 Apr 2012	Up to Date
SE5HI7LB	4	6	16 Aug 2012	Up to Date
SE5HI8PA	3	5	19 Nov 2012	Up to Date
SE5II7LB	5	4	04 Jun 2012	Up to Date
SE5II8PA	2	4	14 Nov 2012	Up to Date
SE6DI7LA	12	3	25 Oct 2012	Up to Date

L.4 ENC Management Report – Route Filtered

Route Filtered ENC Management Report

Vessel Name: HMS Goteborg
Identifier: IMO 4653321
Report Date: 16th May 2013
Content: Filtered for Route Plan "Goteborg – Kiel"
Start WP: Goteborg [57.7N,11.966667E]
End WP: Kiel [54.333742N,10.159607E]

Chart Status Summary:

Chart Status:	**Count**
Total:	50
Up to Date	38/50
Not Up to Date	10/50
Withdrawn	2/50
Unknown	0/50

Data supplier: GB						
Cell name	**Edition**	**Update**	**Issue date**	**Expiry date**	**Status**	**Action**
DE316001	5	1	13032013		Not Up to Date	To be installed
DE416010	1	1	12042012		Not Up to Date	To be installed
DE416020	6	2	11052012		Not Up to Date	To be installed
DE416021	8	3	10052012		Not Up to Date	To be installed
DE416030	3	0	01012013		Not Up to Date	To be installed
DE516175	6	6	01012013		Not Up to Date	To be ordered
DE516200	8	5	04052013		Not Up to Date	To be ordered
DK2KATGS	4	4	22042012		Not Up to Date	To be ordered
DK2LILBL	2	0	14112012		Not Up to Date	To be ordered
DK2SKARK	6	7	25102012		Not Up to Date	To be ordered
DK2STOBL	9	6	06082011		Not Up to Date	To be ordered
DK4ABFNF	4	9	21012011		Withdrawn	To be removed
DK4FAVSF	2	1	19042011		Withdrawn	To be removed
DK4KATGN	1	2	28022013		Up to Date	Renew
DK4KATGS	1	11	17062012		Up to Date	Renew
DK4STOBN	1	2	14112012		Up to Date	Renew
DK4STOBS	4	1	06062013		Up to Date	No action
DK5KALBG	5	8	03042012		Up to Date	No action
DK5KORSO	3	7	16082012		Up to Date	No action
SE2BHS0W	8	5	19112012		Up to Date	No action
SE2BI9SW	4	0	04062012		Up to Date	No action
SE3CI5D4	4	3	14112012		Up to Date	No action

Annex M
(normative)

Elements of an electronic chart database

M.1 General

This annex identifies the IHO viewing group layers and viewing groups.

ENC and other vector format electronic chart information is selectable for presentation by IMO display category (i.e. display base and standard display).

Changes in the presentation of electronic chart information are accomplished using “viewing group layers” or viewing groups of “elements” (i.e. objects, features, etc.) and text group layers or text groups selected from the electronic chart database subject to the over-riding requirements of the IMO display category (for example the display base).

Individual chart objects (or features) are not added or removed from the display.

The IHO viewing group layers and viewing groups listed in Clauses M.2 to M.5 are specified in IHO S-52/Annex A, Part I/14.2. The IHO provided viewing groups are numbered and arranged according to IMO display category, in the sequence of INT 1 for the paper chart.

The details of text group layers and subsets of text groups within each layer are available in M.6 (IHO S-52/Annex A, Part I/14.4).

M.2 ECDIS implementation

IHO S-52/Annex A, Part I/14.3 specifies ECDIS viewing group implementation based on IMO display categories. IHO S-52/Annex A, Part I/14.5 specifies ECDIS text group implementation based on IMO display categories.

As minimum ECDIS shall provide viewing group layers listed in Table M.1 for mariner selection. ECDIS may provide more mariner selectors within each viewing group layer.

Table M.1 – Minimum ECDIS mariner viewing group layer selectors

Number of viewing group layer	Mandatory name of the viewing group layer in the ECDIS	Viewing groups included
Display base		
1	Display base	10000 – 19999
Standard display		
2	Drying line	22010
3	Buoys, beacons, aids to navigation	21020, 22200 – 22240, 27000, 27010, 27011, 27020, 27025, 27030, 27040, 27050, 27060, 27070, 27080, 27200, 27210, 27230
4	Boundaries and limits	23030, 26050, 26220, 26240, 26250
5	Prohibited and restricted areas	26000, 26010, 26040
6	Chart scale boundaries	21030
7	Cautionary notes	26150
8	Ships‟ routeing systems and ferry routes	25010 – 25060

Number of viewing group layer	Mandatory name of the viewing group layer in the ECDIS	Viewing groups included
9	Archipelagic sea lanes	26260
10	Miscellaneous	Switches on and off all not covered objects by viewing group layers 20000 – 29999
Other		
11	Spot soundings	33010
12	Submarine cables and pipelines	34030, 34070
13	All isolated dangers	34050, 34051
14	Magnetic variation	31080
15	Depth contours	33020
16	Seabed	34010, 34020, 33040
17	Tidal	33050, 33060
18	Miscellaneous	Switches on and off all not covered objects by viewing group layers 30000 – 39999or not covered cases by independent mariner selections (see IHO S-52/Annex A, Part I/10.3.4.4)

As minimum ECDIS shall provide text group layers listed in Table M.2 for mariner selection. ECDIS may provide more mariner selectors within each text group layer.

Table M.2 – Minimum ECDIS mariner text group layer selectors

Number of text group layer	Mandatory name of the text group layer in the ECDIS	Text groups included
Important text		
1	Important text	11
Other text		
2	Other text	0 to 10, 20 to 49

M.3 Display base category

M.3.1 Coastline layer

- IHO viewing group 12000:
  - IHO viewing group 12010:
    i) land area (LNDARE)*;
- IHO viewing group 12400 – shoreline:
  - IHO viewing group 12410:
    i) coastline (COALNE),
    ii) crib (OBSTRN, CATOBS = 4)*,
    iii) dolphin (MORFAC, CATMOR = 1)*,
    iv) floating dock (FLODOC)*,
    v) floating oil barrier (OILBAR, CATOLB = 2),
    vi) flood barrage (DAMCON, CATDAM = 3)*,
    vii) gate (GATCON)*,
    viii) glacier (ICEARE, CATICE = 5)*,

ix) hulk (HULKES)*,
x) ice boom (OBSTRN, CATOBS = 8)*,
xi) log pond or booming ground (LOGPON)*,
xii) pile (PILPNT),
xiii) pontoon (PONTON)*,
xiv) shoreline construction (SLCONS)*,
xv) tie-up wall (MORFAC, CATMOR = 4)*,
xvi) wellhead (OBSTRN, CATOBS = 2)*,

– IHO viewing group 12420:
i) canal (CANALS)*,
ii) dock area (DOCARE)*,
iii) lock basin (LOKBSN)*.

NOTE The terms shoreline and coastline are generally used as synonyms.

M.3.2 Safety contour layer

- IHO viewing group 13000 – safety contour:
  – IHO viewing group 13010:
    i) depth contour (DEPCNT) output from conditional symbology procedure DEPCNT03,
  – IHO viewing group 13030:
    i) depth area (DEPARE)*,
    ii) dredged area (DRGARE)*.

M.3.3 Isolated underwater dangers layer

Isolated underwater dangers in water deeper than the safety contour:

- IHO viewing group 14010:
  – mooring cables (MORFAC, CATMOR = 6)*,
  – rocks, wrecks and obstructions from conditional symbology procedure OBSTRN05:
    i) obstructions (OBSTRN)*,
    ii) underwater/awash rock (UWTROC),
    iii) wrecks (WRECKS)*.

M.3.4 Isolated above-water dangers layer

Isolated above-water dangers in water deeper than the safety contour:

- IHO viewing group 12200 – dangers above water:
  – bridge (BRIDGE)*,
  – conveyor (CONVYR)*,
  – pylon (PYLONS)*,
  – offshore platform (OFSPLF)*,
  – overhead cable (CBLOHD),
  – overhead pipeline (PIPOHD);
- IHO viewing group 14050 – rocks, wrecks and obstructions which are “always dry” from conditional symbology procedure UDWHAZ04:
  – obstructions (OBSTRN)*,
  – underwater/awash rock (UWTROC),

– wrecks (WRECKS)*.

M.4 Standard display category

M.4.1 Display base layer

See Clause M.2.

M.4.2 Additional aids to navigation and fixed structures layer

- IHO viewing group 27000 – topmarks, lights, fog signals, radar:
  - IHO viewing group 27025:
    i) daymarks (DAYMAR),
  - IHO viewing group 27040:
    i) navigation system of marks (M_NSYS)*,
  - IHO viewing group 27050:
    i) topmarks (TOPMAR),
  - IHO viewing group 27070:
    i) lights (LIGHTS),
  - IHO viewing group 27080:
    i) fog signals (FOGSIG),
    ii) retro-reflector (RETRFL),
  - IHO viewing group 27200 – radar:
    i) racon (RTPBCN, CATRTP = 2 or 3),
  - IHO viewing group 27230:
    i) radar reflector (RADRFL);
- IHO viewing group 27000 – topmarks, lights, fog signals, radar:
- isolated above-water dangers in water shallower than the safety contour:
  - IHO viewing group 12200 – dangers above water:
    i) bridge (BRIDGE)*,
    ii) conveyor (CONVYR)*,
    iii) pylon (PYLONS)*,
    iv) offshore platform (OFSPLF)*,
    v) overhead cable (CBLOHD),
    vi) overhead pipeline (PIPOHD).

M.4.3 Fairways layer

- fairways (FAIRWY)* from IHO viewing group 26050

M.4.4 Conspicuous features layer

- IHO viewing group 22200 – conspicuous landmarks:
  - viewing group 22210 – radar conspicuous objects (i.e. with attribute CONRAD = 1):
    i) beacons (BCNCAR; BCNISD; BCNLAT; BCNSAW;BCNSPP),
    ii) buoys (BOYCAR; BOYINB; BOYISD; BOYLAT; BOYSAW; BOYSPP),
    iii) radar reflector (RADRFL),
  - IHO viewing group 22220 – visually conspicuous objects (i.e. with attribute CONVIS = 1):

i) building (BUISGL)*,
ii) landmark (LNDMRK)*,
iii) vegetation (VEGATN)*,

– IHO viewing group 22240 – built up areas:
i) built up areas (BUAARE)*.

M.4.5 Prohibited and restricted areas layer

- IHO viewing group 26010 – restricted areas:
  – restricted area (RESARE)*;
- prohibited and restricted areas objects (i.e. with attribute RESTRN >< 13 or 14):
  – offshore production area (OSPARE)* from IHO viewing group 26040,
  – military practice area (MIPARE)* from IHO viewing group 26040;
- information areas and protected areas with attribute RESTRN >< 13 or 14:
  – IHO viewing group 26230:
    i) cable area (CBLARE)*,
    ii) pipeline area (PIPARE)*,
  – IHO viewing group 26240:
    i) dumping ground (DMPGRD)*.

M.4.6 Ferry routes layer

- ferry routes (FERYRT)* from IHO viewing group 26040.

M.4.7 Archipelagic sea lanes layer

- archipelagic apron (SEAARE, CATSEA = 26) from IHO viewing group 26060.

M.4.8 Buoys and beacons layer

- IHO viewing group 27000 – buoys and beacons:
  – IHO viewing group 27010:
    i) buoys (BOYCAR; BOYINB; BOYISD; BOYLAT; BOYSAW; BOYSPP),
    ii) light float (LITFLT),
    iii) mooring buoy (MORFAC, CATMOR = 7)*,
  – IHO viewing group 27011:
    i) light vessel (LITFLT),
  – IHO viewing group 27020:
    i) beacon (BCNCAR; BCNISD; BCNLAT; BCNSAW;BCNSPP).

M.4.9 Traffic routeing layer

- IHO viewing group 25000 – traffic routing:
  – IHO viewing group 25010:
    i) deep water route centreline (DWRTCL),
    ii) deep water route part (DWRTPT)*,
    iii) inshore traffic zone (ISTZNE)*,
    iv) precautionary area (PRCARE)*,
    v) traffic separation line (TSELNE),
    vi) traffic separation scheme boundary (TSSBND),
    vii) traffic separation scheme lane part (TSSLPT)*,

viii) traffic separation zone (TSEZNE)*,
ix) two-way route part (TWRTPT)*,

– IHO viewing group 25020:
i) recommended traffic lane part (RCTLPT)*,
ii) recommended route centreline (RCRTCL),

– IHO viewing group 25060:
i) radio call-in point (RDOCAL).

* Denotes the possibility of area geometry. Area fill may not be appropriate for all presentations.

M.5 All other information category

M.5.1 Information about the chart display layer

- IHO viewing group 31000 – Information about the chart display:
  - IHO viewing group 31010:
    i) accuracy of data (MPCCY)
    ii) survey reliability (M_SREL)
    iii) survey source (M_SSOR)
    iv) quality of data (M_QUAL)
  - IHO viewing group 31011:
    i) symbol LOWACC01, identifying low accuracy data, applied to the spatial object of point and area wrecks, rocks and obstructions and to point land areas
  - IHO viewing group 31020
    i) nautical publication (M_NPUB)
  - IHO viewing group 31030
    i) information from attributes INFORM, TXTDSC, PICREP
  - IHO viewing group 31040
    i) data scale and coverage (M_CSCL, M_COVR)
  - IHO viewing group 31080
    i) magnetic variation (MAGVAR)
    ii) local magnetic anomaly (LOCMAG)

M.5.2 Natural and man-made features, Port features layer

- IHO viewing group 32000 – Natural Features:
  - IHO viewing group 32010:
    i) dunes hills (SLOGRD)
    ii) ridge, clifftop (SLOTOP)
    iii) contours and elevation (LNDELV)
  - IHO viewing group 31030:
    i) trees , vegetation, mangrove (VEGATN)
    ii) marsh (LNDRGN)
  - IHO viewing group 31050:
    i) river (RIVERS)
    ii) lake (LAKARE)
    iii) rapids (RAPIDS)
    iv) waterfall (WATFAL)

  - IHO viewing group 31070:
    i) tideway (TIDWAY)
    ii) saltpan (SLTPAN)
- IHO viewing group 32200 – Shore Structures
  - IHO viewing group 32220: any of the following not classified as CONVIS1 (conspicuous):
    i) landmark (LNDMRK)
    ii) building (BUISGL)
    iii) tank, silo, water tower (SILTNK)
    iv) cairn (CAIRNS)
    v) wall (FNCLNE)
    vi) fort (FORSTC)
  - IHO viewing group 32240:
    i) airport (AIRARE)
    ii) runway (RUNWAY)
  - IHO viewing group 32250:
    i) railway (RAILWY)
    ii) road (ROADWY)
    iii) tunnel (TUNNEL)
    iv) control point (CTRPNT)
  - IHO viewing group 32270:
    i) quarry, refinery, power station, tank farm, wind farm, factory, timber yard (PRDARE)
- IHO viewing group 32400 – Port Features
  - IHO viewing group 32410:
    i) harbour type (HRBFAC)
    ii) customs check point (CHKPNT)
  - IHO viewing group 32430:
    i) distance mark (DISMAR)
  - IHO viewing group 32440:
    i) berthing facility (BRTFAC)
    ii) berth number (BERTHS)
    iii) mooring facility (MORFAC)
    iv) gate (GATCON)
    v) dry dock (DRYDOC)
    vi) crane (CRANES)
  - IHO viewing group 32460:
    i) gridiron (GRIDRN),

M.5.3 Depth, currents, etc. layer

- IHO viewing group 33000 – Depths, Currents, Tide rips, etc:
  - IHO viewing group 33010:
    i) Soundings (SOUNDG)
  - IHO viewing group 33020:

i) depth contours (DEPCNT)

ii) line depth area (DEPARE)

– IHO viewing group 33021:

i) label for the safety contour

– IHO viewing group 33022:

i) label for contours other than the safety contour

– IHO viewing group 33040:

i) water turbulence (WATTUR)

– IHO viewing group 33050:

i) tidal information (T_HMON, T_NHM, T_TIMS)

– IHO viewing group 33060:

i) current and tidal stream information (CURENT, TS_FEB, TS_PAD, TS_PNH, TS_PRH, TS_TIS)

M.5.4 Seabed, obstructions, pipelines layer

- IHO viewing group 34000 – Seabed Information: rocks, wrecks and obstructions, pipes and cables:
  - IHO viewing group 34010:
    i) nature of seabed (SBDARE)
  - IHO viewing group 34020:
    i) spring (SPRING)
    ii) sea weed (WEDKLP)
  - IHO viewing group 34040:
    i) fish haven (FSHHAV)
    ii) fishing stakes, etc. (FSHFAC)
  - IHO viewing group 34050:
    i) rocks (UWTROC), wrecks (WRECKS), obstructions (OBSTRN), which are not a danger to own-ship's navigation (these are all Display Base if a danger to own-ship)
  - IHO viewing group 34051:
    i) non-dangerous rocks (UWTROC), wrecks (WRECKS) and obstructions (OBSTRN) which have a VALSOU attribute and are not a danger to own-ship’s navigation (these objects are all Display Base if a danger to own-ship)
  - IHO viewing group 34070:
    i) submarine cable (CBLSUB)
    ii) submarine pipeline (PIPSOL)

M.5.5 Traffic routes layer

- IHO viewing group 35000 – Routes:

M.5.6 Special areas layer

- IHO viewing group 36000 – Administrative Areas,:
  - IHO viewing group 36010:
    i) continental shelf (COSARE)
  - IHO viewing group 36020:
    i) harbour area (HRBARE) free port area (FRPARE), customs zone (CUSZNE)
  - IHO viewing group 36040:

i) fishery zone (FSHZNE)

– IHO viewing group 36050:

i) contiguous zone (CONZNE)

ii) exclusive economic zone (EXEZNE)

iii) national territorial area (NATARE)

iv) territorial sea (TESARE)

v) territorial sea baseline (STSLNE)

vi) administration area (ADMARE)

M.5.7 Service and small craft facilities layer

- IHO viewing group 38000 – Services:
  - IHO viewing group 38010:
    i) radar station (RADSTA)

    radio station (RDOSTA)
  - IHO viewing group 38030:
    i) coastguard station (CGUSTA), rescue station (RSCSTA)
- IHO viewing group 38200 – Small craft facilities:
  - IHO viewing group 38210:
    i) small craft facilities (SMCFAC)

M.6 Text grouping

M.6.1 Important Text group layer

- IHO text group 10 – Important text
  - IHO text group 11:
    i) vertical clearance of bridges, overhead cable, pipe or conveyor (BRIDGE, CBLOHD, PIPOHD, CONVYR, VERCSA, VERCLR, VERCCL, VERCOP)

    ii) bearing of navline, recommended route, deep water route centreline line, recommended track (NAVLNE, RCRTCL, DWRTCL, RECTRC, ORIENT)

    iii) name and communications channel of radio calling-in point (RDOCAL, OBJNAM, COMCHA)

M.6.2 Other Text group layer

- IHO text group 20 – Other text
  - IHO text group 21 – Names for position reporting:
    i) name or number (OBJNAM) of buoys (BOYxxx), beacons(BCNxxx), daymarks (DAYMAR), light vessel, light float (LITVES, LITFLT), offshore platform (OFSPLF)
  - IHO text group 23 – Light description string:
  - IHO text group 24:
    i) note on chart data (INFORM) or nautical publication (TXTDSC)
  - IHO text group 25 – Nature of seabed:
    i) nature of seabed (NATSUR of SBDARE)
  - IHO text group 26 – Geographic names:
    i) geographic names (OBJNAM of SEAARE, LNDRGN etc.)
  - IHO text group 27 – Value of: magnetic variation:

i) value of: magnetic variation (VALMAG of MAGVAR); swept depth (DRVAL1 of SWPARE)

– IHO text group 28 – Height of islet or land feature:
– IHO text group 29 – Berth number:
  i) berth number (OBJNAM of BERTHS, ACHBRT)
– IHO text group 31 – National language text:
  i) national language text (NOBJNM, NINFOM, NTXTDS)

Annex N
(informative)

Use cases for safety contour and safety depth

Safe navigation requires the possibility to separate navigable waters from non-navigable waters. ECDIS has a built-in feature called safety contour to perform this task but the usability of the safety contour depends on the availability of depth areas with sufficient depth layers. A typical ENC chart may have only 0, 5, 10, 20, 50, etc. metre depth areas, which is insufficient for separating navigable and non-navigable waters (see Figure N.1). The workaround is to use spot soundings to improve the interpretation between navigable and non-navigable waters. The use of spot soundings for this purpose requires that the value of safety depth, which controls the display style of the spot soundings, and the value of the safety contour, which controls the display style of depth areas, are separately settable. The following process describes a method of implementing the workaround.

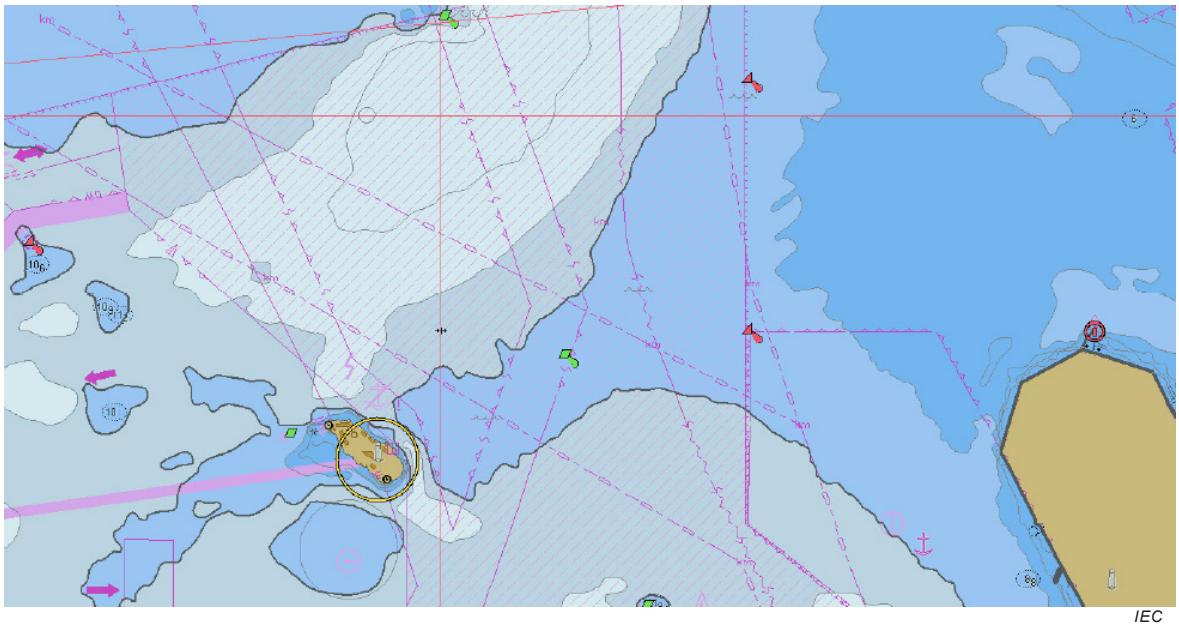


Figure N.1 – Original situation

Figure N.1 shows the original situation based on a safety contour with which there is no possibility to navigate. Available depth areas are 9,1 m and 18,2 m while the vessel should use 15 m.

When the safety contour is not useful:

- create a new “contour” using soundings;
- set the safety depth to the value of the desired contour (in this example 15 m);
- use a drawing tool to create “no-go” areas (user chart) over all dangerous soundings;
- make the area red and assign the property “danger”;
- change the safety depth, create green “Go-areas” and assign property “safe” – warning when leaving area;
- save the user chart with the name of the port and the depth, for example “San Francisco 15 m”.

Figure N.2 shows the new situation based on the mariner having used a selectable value of safety depth to develop custom “go” and “no go” areas.

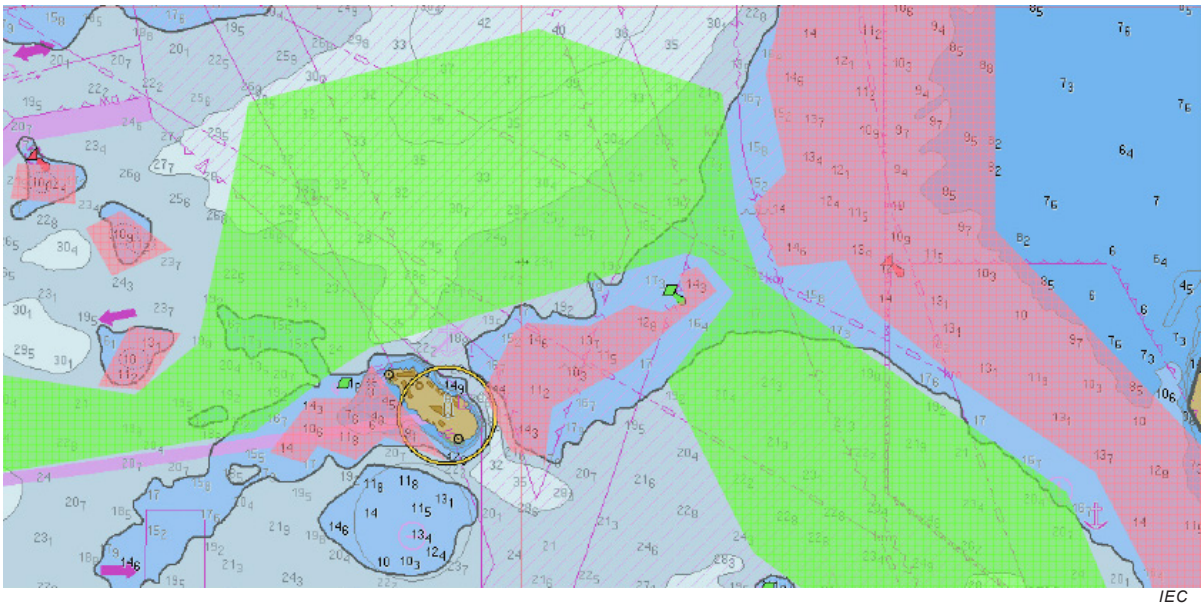


Figure N.2 – New situation

Annex O
(informative)

Guidelines on use of electronic chart systems in polar waters

O.1 Projection and coordinate system

Using north-referenced bearing coordinates, ship motion extrapolated into the future (i.e. a straight track along a great circle) does not follow a constant bearing. In this coordinate system, lines of constant bearing follow the path of rhumb-lines (loxodrome curves) that gradually spiral into the pole. These lines of constant bearing are transformed by Mercator projection into straight lines. However, the same transformation changes the path of straight tracks such as the line of sight from visual bearings, etc. (i.e. great circle) into curves with significantly increasing non-linearity approaching the poles. At low latitudes, over the distances of concern to a navigator, the non-linear divergence is of little consequence and is barely noticed. At high latitudes, however, the effect can be significant and reduces the utility of the Mercator projection for navigation. Some systems specialized for use in polar waters have implemented alternative projection methods and coordinate systems which have long been established to correct this situation while providing the useful characteristics of Mercator. However, the use of these alternatives has not been standardized.

A review of paper charts and a sample of ECDIS displays was conducted by the International Hydrographic Bureau. It observed that, at present, few ENCs are available for Polar waters in Navigation Purpose bands 3 to 6 (coastal, approach, harbour, and berthing). Although the criteria was not made clear, this IHB study concluded that a chart display and associated computations based on the Mercator projection are adequate up to 85° latitude. All navigable areas in the Antarctic have a latitude less than 85°. Much of the expected traffic in Polar regions operate at latitudes less than 85°N. In current ECDIS practice, there appears to be some consensus that Mercator should not be used beyond approximately 85° for display at the scales commonly used for navigation, i.e. scales 1:1 500 000 or larger.

A practical criteria for minimally acceptable navigation accuracy and uniformity across a displayed chart area might be based on maintaining accuracy requirements as specified for radar, i.e. *Range – within 30 m or 1 % of the range scale in use, whichever is greater; Bearing – within 1°*. These criteria can be used to define limits on the largest scale Mercator projection that may be used at various polar latitudes (refer to the tables provided in Annex J).

For ECDIS, the user manual provided by the manufacturer should state the maximum latitude north or south at which in the ECDIS is capable of meeting the performance required:

a) calculations and measurements "*consistent with the SENC accuracy"*, and

b) track data, AIS information and radar overlay image, when compared with the displayed chart, that "*match in scale, orientation, projection* and accuracy, within the ranges defined in IEC 62388." The stated maximum latitude should be at least 85°.

Any limits imposed on the selection of display scales available at higher latitudes should also be described.

Chart projection types in addition to Mercator may be provided. If the stated maximum latitude of the ECDIS is greater than 85°, then at least one chart projection type suitable for navigation in higher latitudes should be provided in addition to the Mercator projection. The user manual should state the projection types provided and describe the user interface involved in transitioning from one projection type to another.

O.2 Consistency

Overlay of information on an ECDIS chart display of information from other sources (e.g. satellite imagery) and the generation of measurements taken using ECDIS navigation tools should be consistent with respect to the type of chart projection and the coordinate system used.

Annex P
(normative)

Scenarios for polar areas above 85° North

This annex provides in Table P.1, Table P.2, Table P.3 and Table P.4 pre-calculated control points for polar areas above 85°. The control points are calculated using orthodromes based on the tabled range bearings. The result is the same as a radar sees the surrounding world.

The tables can be used in various ways: own ship could be at the origin of a table or the origin of a navigation tool (EBL, VRM, etc.) could be the origin of a table.

A radar simulator, which is operating relative to radar antenna, can be set to have radar echoes at the tabled ranges and bearings. This will enable checking both radar echo overlay and tracked radar targets.

Figure P.1 shows examples of use of the tables. The small dots indicate tabled positions.

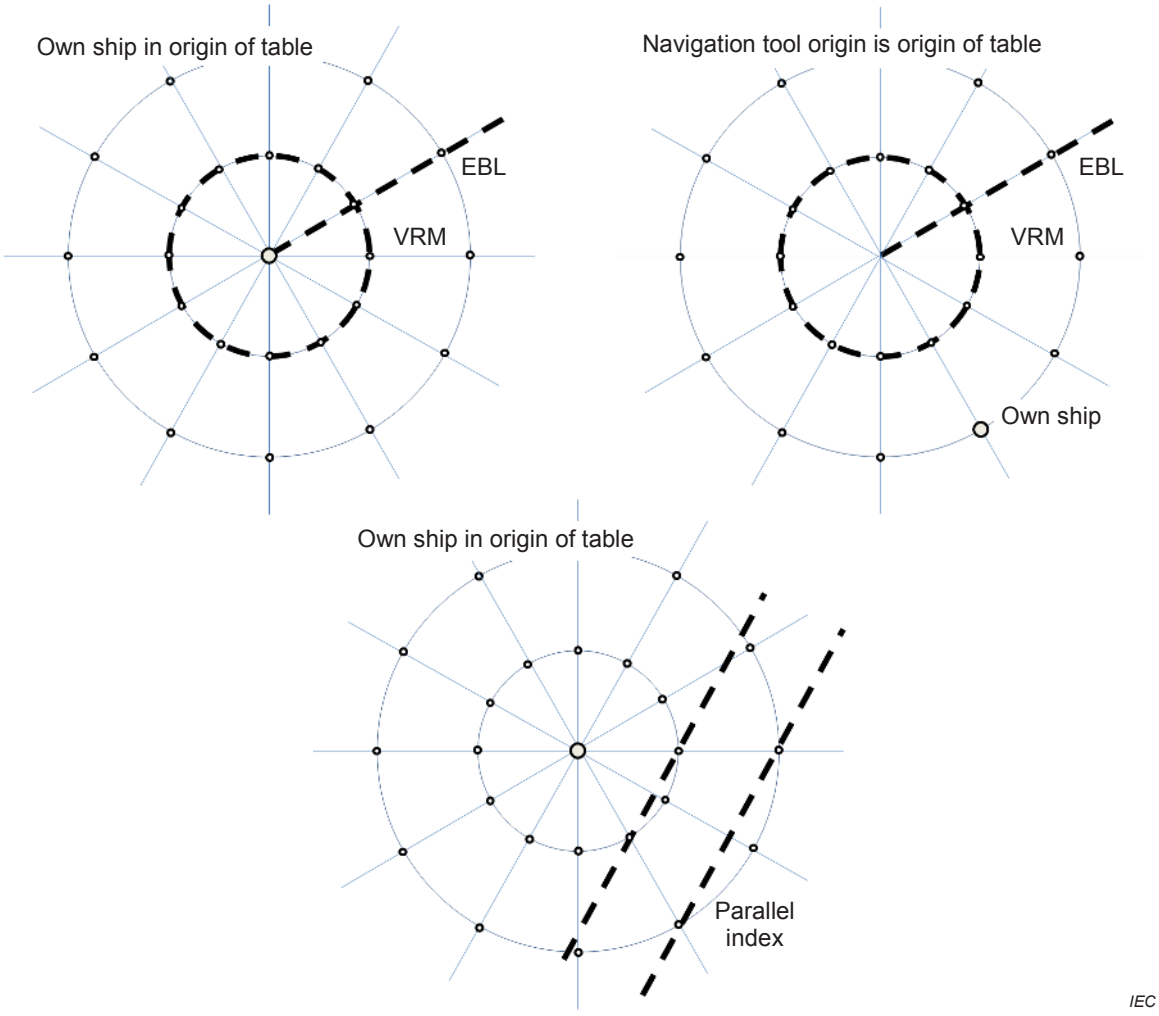


Figure P.1 – Examples of use of the tables

Table P.1 – Spatial control points from 85°N, 0°E as origin

Range	Bearing	Lat	Lon
3	0	85°02,985'N	000°00,000'E
3	30	85°02,581'N	000°17,271'E
3	60	85°01,481'N	000°29,804'E
3	90	84°59,985'N	000°34,244'E
3	120	84°58,497'N	000°29,510'E
3	150	84°57,411'N	000°16,977'E
3	180	84°57,015'N	000°00,000'E
3	210	84°57,411'N	000°16,977'W
3	240	84°58,497'N	000°29,510'W
3	270	84°59,985'N	000°34,244'W
3	300	85°01,481'N	000°29,804'W
3	330	85°02,581'N	000°17,271'W
6	0	85°05,970'N	000°00,000'E
6	30	85°05,155'N	000°34,843'E
6	60	85°02,940'N	000°59,903'E
6	90	84°59,941'N	001°08,481'E
6	120	84°56,971'N	000°58,726'E
6	150	84°54,816'N	000°33,665'E
6	180	84°54,030'N	000°00,000'E
6	210	84°54,816'N	000°33,665'W
6	240	84°56,971'N	000°58,726'W
6	270	84°59,941'N	001°08,481'W
6	300	85°02,940'N	000°59,903'W
6	330	85°05,155'N	000°34,843'W
12	0	85°11,939'N	000°00,000'E
12	30	85°10,278'N	001°10,919'E
12	60	85°05,788'N	002°00,981'E
12	90	84°59,763'N	002°16,909'E
12	120	84°53,856'N	001°56,276'E
12	150	84°49,603'N	001°06,206'E
12	180	84°48,061'N	000°00,000'E
12	210	84°49,603'N	001°06,206'W
12	240	84°53,856'N	001°56,276'W
12	270	84°59,763'N	002°16,909'W
12	300	85°05,788'N	002°00,981'W
12	330	85°10,278'N	001°10,919'W
24	0	85°23,878'N	000°00,000'E
24	30	85°20,425'N	002°27,006'E
24	60	85°11,200'N	004°06,644'E
24	90	84°59,054'N	004°33,388'E
24	120	84°47,378'N	003°47,868'E
24	150	84°39,099'N	002°08,111'E
24	180	84°36,121'N	000°00,000'E

Range	Bearing	Lat	Lon
24	210	84°39,099'N	002°08,111'W
24	240	84°47,378'N	003°47,868'W
24	270	84°59,054'N	004°33,388'W
24	300	85°11,200'N	004°06,644'W
24	330	85°20,425'N	002°27,006'W

Table P.2 – Spatial control points from 87°N, 0°E as origin

Range	Bearing	Lat	Lon
3	0	87°02,985'N	000°00,000'E
3	30	87°02,579'N	000°28,928'E
3	60	87°01,474'N	000°49,797'E
3	90	86°59,975'N	000°57,023'E
3	120	86°58,489'N	000°48,979'E
3	150	86°57,409'N	000°28,110'E
3	180	86°57,015'N	000°00,000'E
3	210	86°57,409'N	000°28,110'W
3	240	86°58,489'N	000°48,979'W
3	270	86°59,975'N	000°57,023'W
3	300	87°01,474'N	000°49,797'W
3	330	87°02,579'N	000°28,928'W
6	0	87°05,969'N	000°00,000'E
6	30	87°05,144'N	000°58,707'E
6	60	87°02,909'N	001°40,411'E
6	90	86°59,901'N	001°54,014'E
6	120	86°56,942'N	001°37,140'E
6	150	86°54,806'N	000°55,433'E
6	180	86°54,031'N	000°00,000'E
6	210	86°54,806'N	000°55,433'W
6	240	86°56,942'N	001°37,140'W
6	270	86°59,901'N	001°54,014'W
6	300	87°02,909'N	001°40,411'W
6	330	87°05,144'N	000°58,707'W
12	0	87°11,939'N	000°00,000'E
12	30	87°10,234'N	002°00,950'E
12	60	87°05,663'N	003°24,081'E
12	90	86°59,605'N	003°47,779'E
12	120	86°53,744'N	003°11,019'E
12	150	86°49,567'N	001°47,831'E
12	180	86°48,061'N	000°00,000'E
12	210	86°49,567'N	001°47,831'W
12	240	86°53,744'N	003°11,019'W
12	270	86°59,605'N	003°47,779'W
12	300	87°05,663'N	003°24,081'W

Range	Bearing	Lat	Lon
12	330	87°10,234'N	002°00,950'W
24	0	87°23,877'N	000°00,000'E
24	30	87°20,232'N	004°17,211'E
24	60	87°10,672'N	007°01,030'E
24	90	86°58,425'N	007°33,580'E
24	120	86°46,952'N	006°09,128'E
24	150	86°38,967'N	003°24,388'E
24	180	86°36,123'N	000°00,000'E
24	210	86°38,967'N	003°24,388'W
24	240	86°46,952'N	006°09,128'W
24	270	86°58,425'N	007°33,580'W
24	300	87°10,672'N	007°01,030'W
24	330	87°20,232'N	004°17,211'W

Table P.3 – Spatial control points from 89°N, 0°E as origin

Range	Bearing	Lat	Lon
3	0	89°02,985'N	000°00,000'E
3	30	89°02,565'N	001°29,335'E
3	60	89°01,435'N	002°31,780'E
3	90	88°59,926'N	002°50,872'E
3	120	88°58,453'N	002°24,423'E
3	150	88°57,397'N	001°21,960'E
3	180	88°57,015'N	000°00,000'E
3	210	88°57,397'N	001°21,960'W
3	240	88°58,453'N	002°24,423'W
3	270	88°59,926'N	002°50,872'W
3	300	89°01,435'N	002°31,780'W
3	330	89°02,565'N	001°29,335'W
6	0	89°05,969'N	000°00,000'E
6	30	89°05,088'N	003°06,950'E
6	60	89°02,751'N	005°10,857'E
6	90	88°59,704'N	005°40,904'E
6	120	88°56,804'N	004°41,538'E
6	150	88°54,762'N	002°37,339'E
6	180	88°54,031'N	000°00,000'E
6	210	88°54,762'N	002°37,339'W
6	240	88°56,804'N	004°41,538'W
6	270	88°59,704'N	005°40,904'W
6	300	89°02,751'N	005°10,857'W
6	330	89°05,088'N	003°06,950'W
12	0	89°11,938'N	000°00,000'E
12	30	89°09,982'N	006°51,252'E
12	60	89°04,989'N	010°49,991'E

Range	Bearing	Lat	Lon
12	90	88°58,824'N	011°15,235'E
12	120	88°53,226'N	008°54,461'E
12	150	88°49,408'N	004°51,060'E
12	180	88°48,062'N	000°00,000'E
12	210	88°49,408'N	004°51,060'W
12	240	88°53,226'N	008°54,461'W
12	270	88°58,824'N	011°15,235'W
12	300	89°04,989'N	010°49,991'W
12	330	89°09,982'N	006°51,252'W
24	0	89°23,877'N	000°00,000'E
24	30	89°18,906'N	016°53,329'E
24	60	89°07,679'N	023°16,802'E
24	90	88°55,424'N	021°42,069'E
24	120	88°45,149'N	016°02,274'E
24	150	88°38,444'N	008°25,082'E
24	180	88°36,123'N	000°00,000'E
24	210	88°38,444'N	008°25,082'W
24	240	88°45,149'N	016°02,274'W
24	270	88°55,424'N	021°42,069'W
24	300	89°07,679'N	023°16,802'W
24	330	89°18,906'N	016°53,329'W

Table P.4 – Spatial control points from 90°N, 0°E as origin, 180°E as origin of relative bearings

Range	Bearing	Lat	Lon
3	0	89°57,015'N	180°00,000'E
3	30	89°57,015'N	150°00,000'E
3	60	89°57,015'N	120°00,000'E
3	90	89°57,015'N	090°00,000'E
3	120	89°57,015'N	060°00,000'E
3	150	89°57,015'N	030°00,000'E
3	180	89°57,015'N	000°00,000'E
3	210	89°57,015'N	030°00,000'W
3	240	89°57,015'N	060°00,000'W
3	270	89°57,015'N	090°00,000'W
3	300	89°57,015'N	120°00,000'W
3	330	89°57,015'N	150°00,000'W
6	0	89°54,031'N	180°00,000'E
6	30	89°54,031'N	150°00,000'E
6	60	89°54,031'N	120°00,000'E
6	90	89°54,031'N	090°00,000'E
6	120	89°54,031'N	060°00,000'E
6	150	89°54,031'N	030°00,000'E

Range	Bearing	Lat	Lon
6	180	89°54,031'N	000°00,000'E
6	210	89°54,031'N	030°00,000'W
6	240	89°54,031'N	060°00,000'W
6	270	89°54,031'N	090°00,000'W
6	300	89°54,031'N	120°00,000'W
6	330	89°54,031'N	150°00,000'W
12	0	89°48,062'N	180°00,000'E
12	30	89°48,062'N	150°00,000'E
12	60	89°48,062'N	120°00,000'E
12	90	89°48,062'N	090°00,000'E
12	120	89°48,062'N	060°00,000'E
12	150	89°48,062'N	030°00,000'E
12	180	89°48,062'N	000°00,000'E
12	210	89°48,062'N	030°00,000'W
12	240	89°48,062'N	060°00,000'W
12	270	89°48,062'N	090°00,000'W
12	300	89°48,062'N	120°00,000'W
12	330	89°48,062'N	150°00,000'W
24	0	89°36,123'N	180°00,000'E
24	30	89°36,123'N	150°00,000'E
24	60	89°36,123'N	120°00,000'E
24	90	89°36,123'N	090°00,000'E
24	120	89°36,123'N	060°00,000'E
24	150	89°36,123'N	030°00,000'E
24	180	89°36,123'N	000°00,000'E
24	210	89°36,123'N	030°00,000'W
24	240	89°36,123'N	060°00,000'W
24	270	89°36,123'N	090°00,000'W
24	300	89°36,123'N	120°00,000'W
24	330	89°36,123'N	150°00,000'W

Annex Q
(normative)

IEC 61162 interfaces

Q.1 General

The ECDIS shall be capable of at least transmitting and receiving data with the non optional logical interfaces in Figure Q.1 using the sentences listed in the Table Q.1, Table Q.2, Table Q.3, Table Q.4 and the protocols listed in Table Q.5. Optional logical interfaces, if provided, shall be capable of at least transmitting and receiving data using the sentences listed in the Table Q.2 and Table Q.4.

Figure Q.1 shows the logical interfaces. If more than one logical interface is implemented on a single physical interface then all aspects of each logical interface, including alert communication, heartbeat, etc., shall be distinguishable from those of other logical interfaces implemented on the same physical interface.

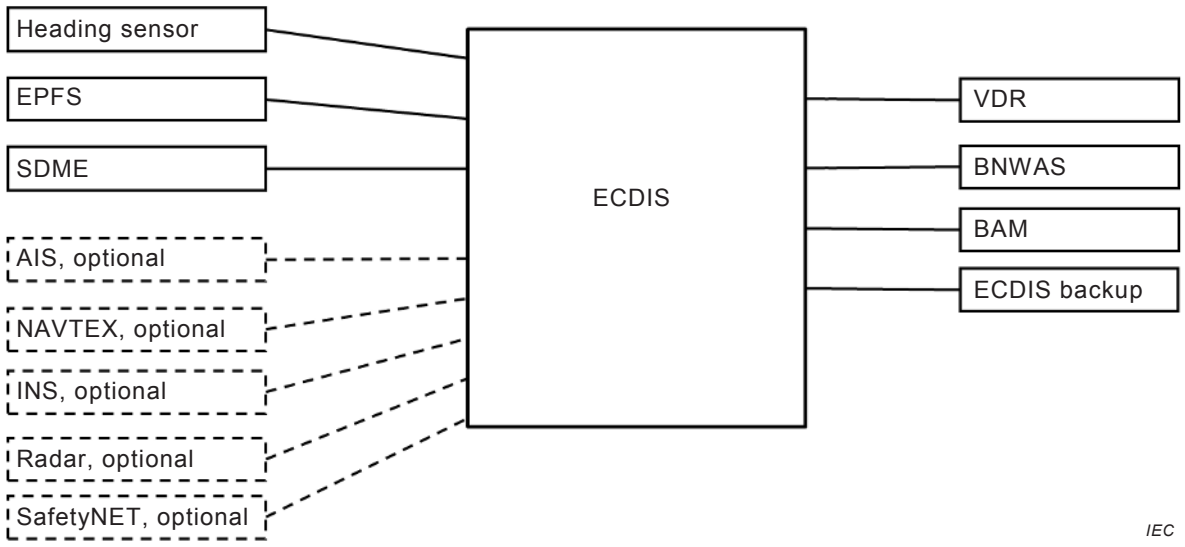


Figure Q.1 – ECDIS logical interfaces

Table Q.1, Table Q.2, Table Q.3 and Table Q.4 specify sentences which can be used with interface alternatives IEC 61162-1, IEC 61162-2 and IEC 61162-450. If, additionally, interface IEC 61162-3 is used equivalent PGNs are listed in Annex R.

Table Q.1 – Mandatory sentences received by ECDIS

Mnemonic	Interface (see Figure Q.1)	Name	Comment
ACN[a]	BAM	Alert command	Alert command e.g. acknowledge
DTM[b]	EPFS	Datum reference	
GLL[b] GGA[b] GNS[b] RMC[b] (*)	EPFS	Geographic position – latitude/longitude	
HBT[b]	BAM, INS	Heartbeat	Support reliable alert related communication Repeated once per 1 min
NSR[a]	INS	Navigational status report	Integrity and plausibility of the CCRS data from INS
THS[b] HDT[b] (*)	Heading sensor, INS	Heading source	
RRT[c]	ECDIS backup	Report route transfer	
VBW[b] VHW[b] (*)	SDME, INS	Speed log	
VTG[b]	EPFS, INS	Speed and course from EPFS	
NOTE Sentences included for backward compatibility are marked with an asterisk (*).			
[a] See IEC 61924-2. [b] See IEC 61162-1. [c] See Annex T.			

Table Q.2 – Optional sentences received by ECDIS

Mnemonic	Interface (see Figure Q.1)	Name	Comment
NRX[a] NRM[a]	NAVTEX	Received NAVTEX messages	Source of MSI data Criteria for suppression of MSI messages
SM1[b] SM2[b] SM3[b] SM4[b] SMB[b]	SafetyNET	Received SafetyNET messages	Source of MSI data
OSD[a]	Radar	Own ship data	
RSD[a]	Radar	Radar system data	
TLB[a] TTD[a c] TTM[a] (*)	Radar	Tracked target data	
VDM[a] VDO[a]	AIS	AIS target and own ship information	
Sentences included for backward compatibility are marked with an asterisk (*).			
[a] See IEC 61162-1. [b] See Annex U. [c] See also Annex V.			

Table Q.3 – Mandatory sentences transmitted by the ECDIS

Mnemonic	Interface (see Figure Q.1)	Name	Comment
ALC[a]	VDR, BAM, INS	Cyclic alert list	List of current alert
ALF[a]	VDR, BAM, INS	Alert sentence	Details of a new alert
ARC[a]	BAM, INS	Alert command refused	Alert command not accepted
EVE[b]	BNWAS	Operator activity	Reset dormant period of the BNWAS
HBT[b]	BAM, INS	Heartbeat	Support reliable alert related communication
RRT[c]	ECDIS backup	Report route transfer	
[a] See IEC 61924-2. [b] See IEC 61162-1. [c] See Annex T.			

Table Q.4 – Optional sentences transmitted by the ECDIS

Mnemonic	Interface (see Figure Q.1)	Name	Comment
NRM[a] $--CRQ,NRM[a]	NAVTEX	Setup for NAVTEX	Control criteria for suppression Query for current setup
VSD[a]	AIS	Cargo category Navigation status Ships' draft (max actual static) Destination ETA date & time Regional application flags	
[a] See IEC 61162-1.			

Q.2 VDR interface

Table Q.5 describes the information transmitted by the ECDIS to the VDR.

Table Q.5 – Mandatory information transmitted to the VDR

Parameter	Specification	Comment
Display	Interface: IEC 61162-450 (UDP) Header and format: IEC 61996-1:2013, Annex E	
Display source information	Interface: IEC 61162-450 (UDP) Header and format: IEC 61996-1:2013, Annex G	

Q.3 AIS interface and interrogation

An AIS interface is optional and the functionality of interrogation is optional within this optional interface.

NOTE The AIS VDL is limited in its number of RATDMA transmissions. Interrogations (Message 15) and responses (e.g., Messages 5 and 24) are both RATDMA type transmissions. Repeated interrogations will limit the AIS transponder's ability to make other high priority message exchanges by RATDMA (e.g. Meassge 14 –safety related). RATDMA messages, especially multi-slot messages (e.g., Message 5 Ship Static and Voyage Related) are especially unfriendly to a heavily-loaded AIS VDL. Message 5 is the first message to fail in a loaded AIS VDL and the more you interrogate for it (i.e., with Message 15), the more prone you are to not being able to receive it.

AIS interrogation, if provided, shall not cause too heavy a load to the AIS VDL. Rules for optional AIS interrogation are:

a) ECDIS may support the $--AIR sentence for interrogation specified in IEC 61162-1 as a means to initiate requests for specific ITU-R M.1371 messages from distant mobile stations, for example when Message 5 (Ship Static and Voyage Related) has not been

received. The AIS interrogation (AIR sentence) is not intended to be used by a large amount of users as over-use will downgrade the AIS performance as a whole. Transmission from a single vessel may cause all other vessels to generate heavy parallel interrogation traffic;

b) when the interrogation capability is provided, it shall be possible to select it to Off and it shall have the following limitations. The requests for Messages 5 and 24 shall be intentionally limited to vessels within 7 NM of own ship for which a Message 5 (Class A) or Message 24 Part B (Class B) has not been received within the last hour. When these conditions are met, the rate of interrogations transmitted to an individual vessel shall not exceed one per hour.

Q.4 Route transfer interface

If a fixed wire interface is provided (see 4.10.2.3) Table Q.6 gives the information to be transmitted and received between the ECDIS and an ECDIS backup system.

Table Q.6 – Information between the ECDIS and an ECDIS backup system

Parameter	Specification	Comment
Route	Interface: IEC 61162-450 (UDP)	To transfer route exchange files as specified in Annex S
RRT, Report Route Transfer	Interface: IEC 61162-450 (UDP)	RRT sentence is used to inform other party about the transferred file, see Annex T.

Q.5 BAM interface

Timing diagrams for alert sentences ALF, ALC, ARC and ACN are given in Figure Q.2, Figure Q.3, Figure Q.4, Figure Q.5, Figure Q.6 and Figure Q.7.

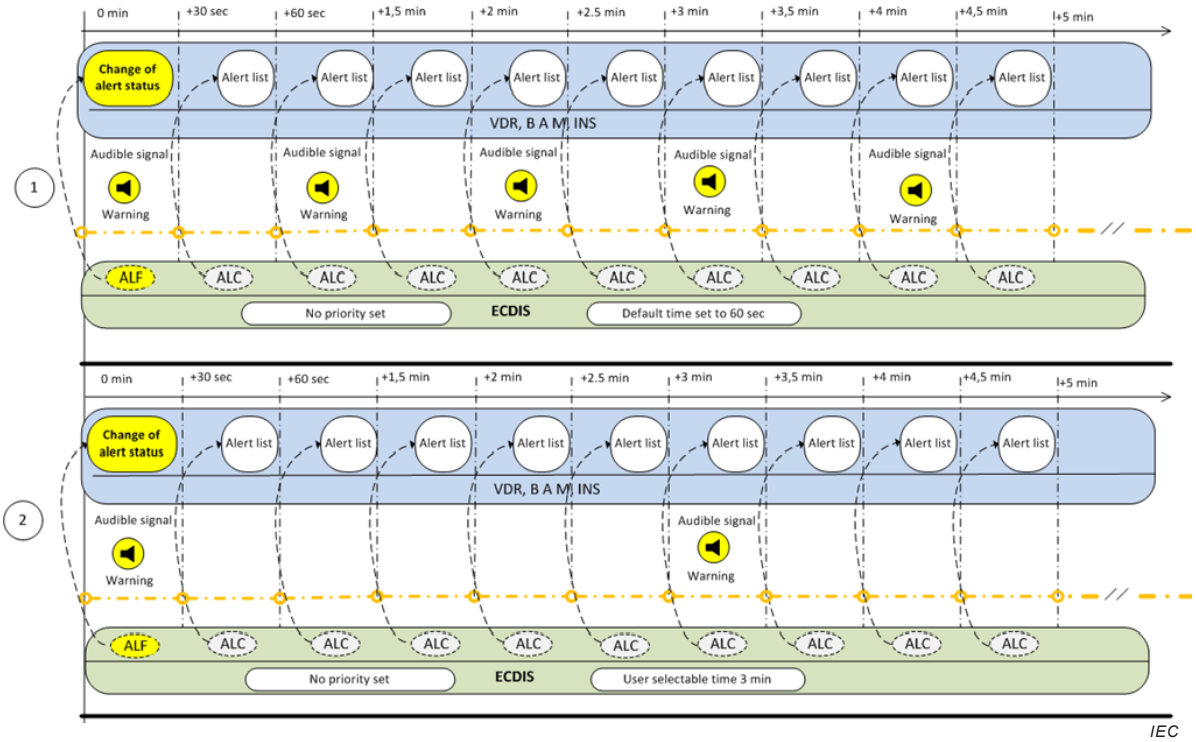


Figure Q.2 – Alert reporting by ECDIS without escalation of a warning

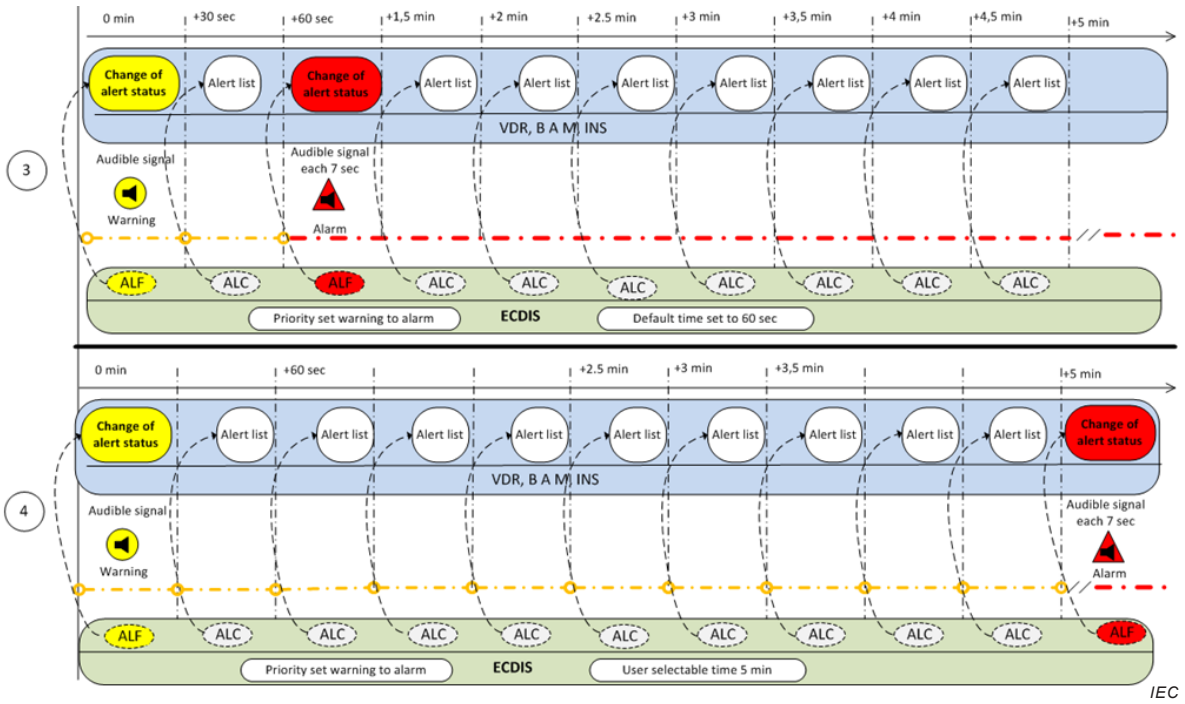


Figure Q.3 – Alert reporting by ECDIS with escalation of a warning as alarm

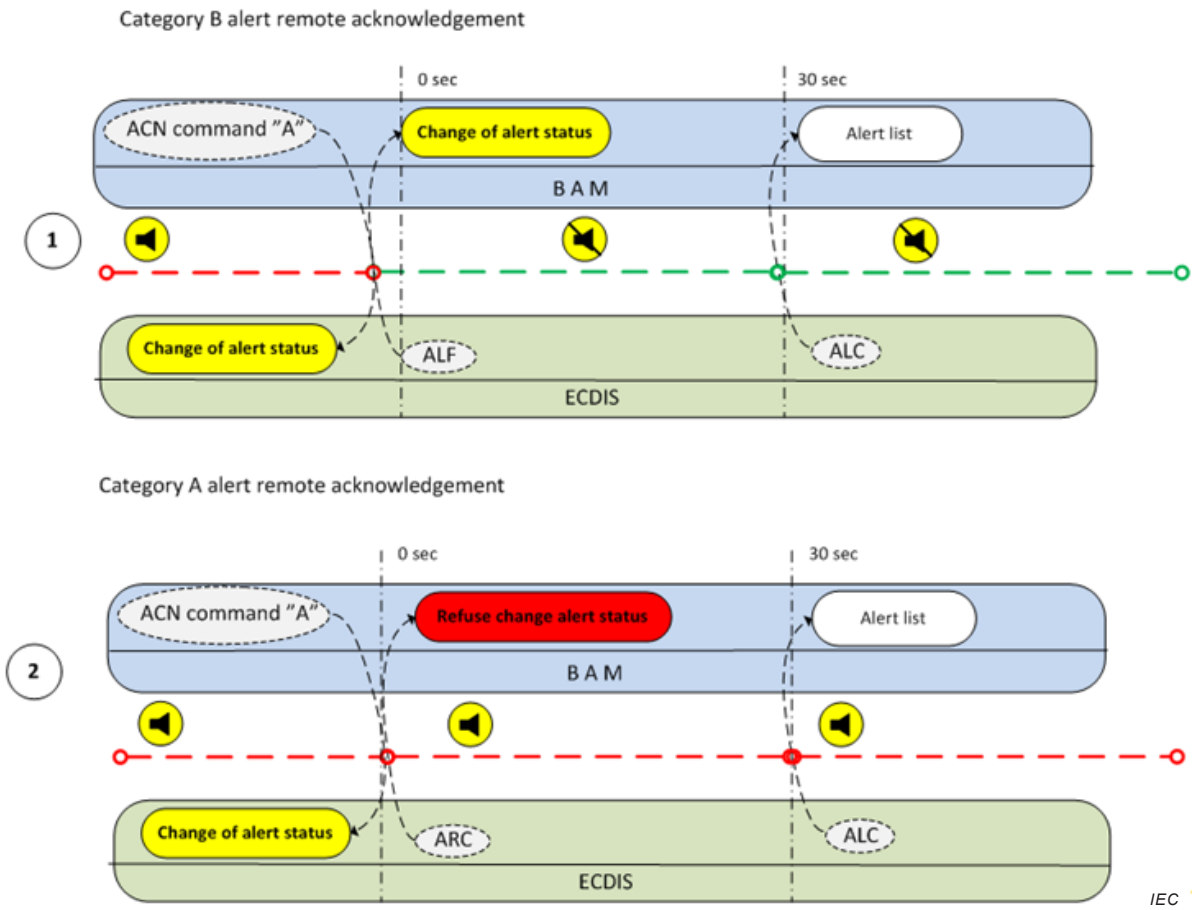


Figure Q.4 – Alert reporting by ECDIS in case of remote acknowledge

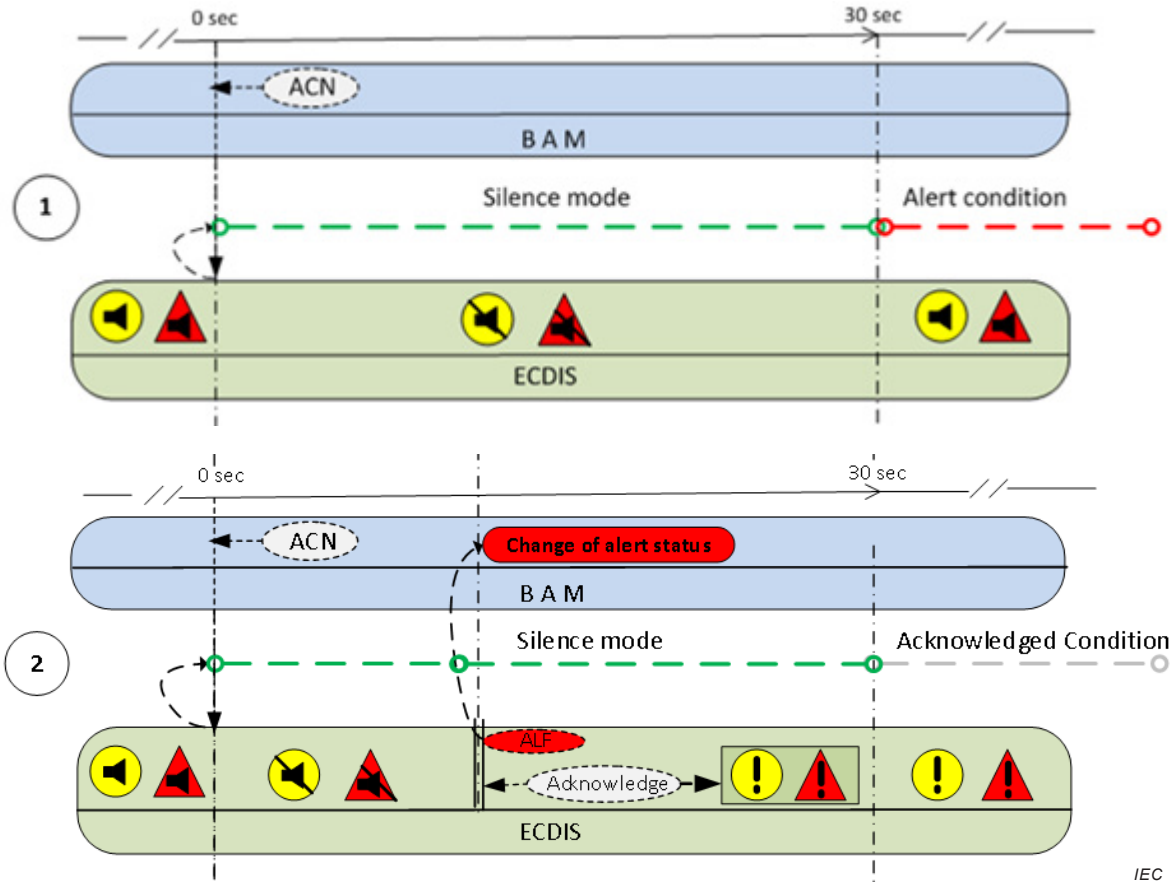


Figure Q.5 – Alert reporting by ECDIS in case of remote silence

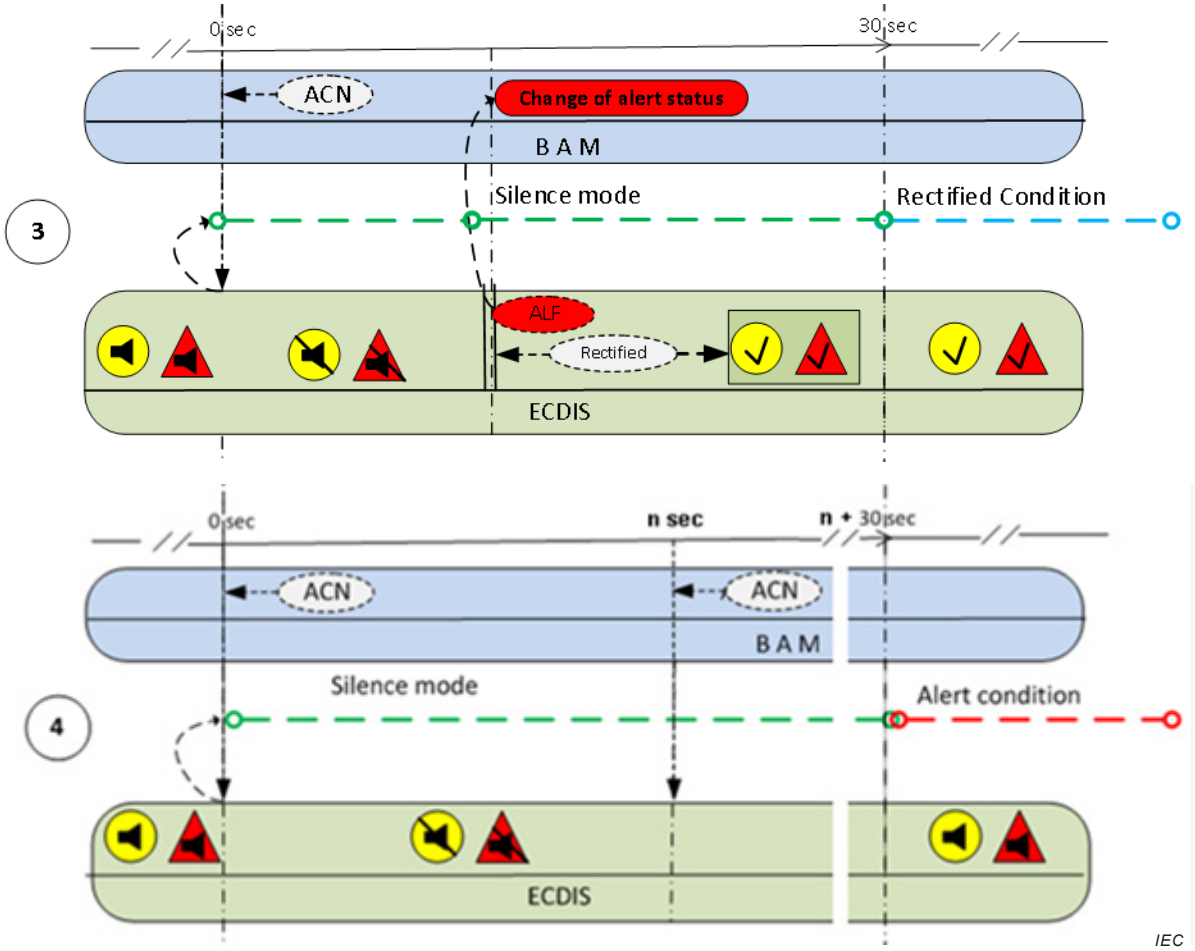


Figure Q.6 – Alert reporting by ECDIS in case of remote silence

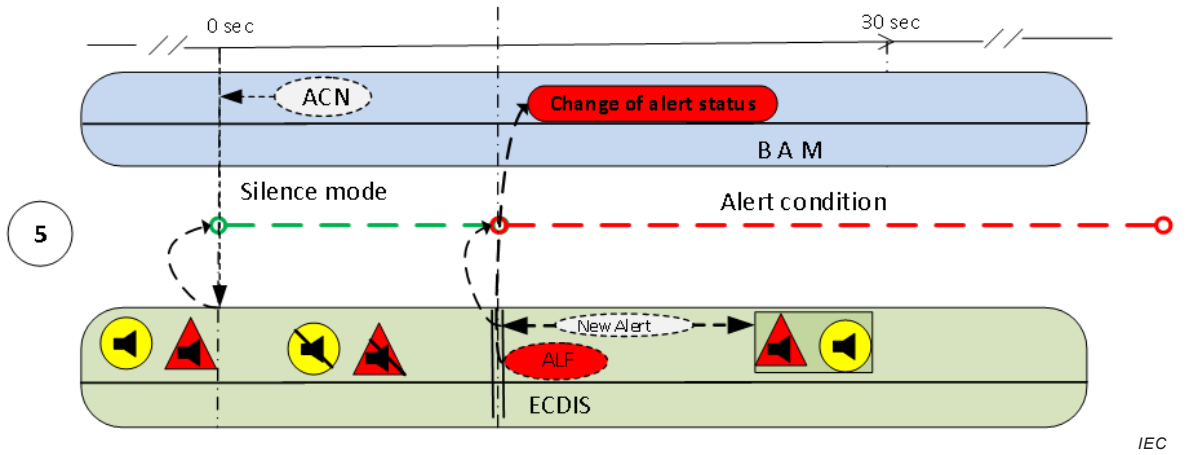


Figure Q.7 – Alert reporting by ECDIS in case of remote silence

Annex R
(informative)

Conversion between IEC 61162-1 sentences and IEC 61162-3 parameter group numbers

Table R.1 and Table R.2 give minimum equivalents for transferring data over IEC 61162-1 interfaces and IEC 61162-3 interfaces.

Table R.1 – Conversion from IEC 61162-1 to IEC 61162-3

IEC 61162-1 sentence		IEC 61162-3 PGN	
DTM	Datum reference	129044	Datum
		129045	User datum setting
GGA	Global positioning system (GPS) fix data	129025	Position, rapid update
		129029	GNSS position update
GLL	Geographic position – Latitude/longitude	129025	Position, rapid update
		129029	GNSS position update
GNS	GNSS fix data	129025	Position, rapid update
		129029	GNSS position update
HDT	Heading true	127250	Vessel heading
RMC	Recommended minimum specific GNSS data	129025	Position, rapid update
		129026	COG and SOG, rapid update
		129029	GNSS position update
THS	True heading and status	127250	Vessel heading
VBW	Dual ground/water speed	128259	Speed, water referenced
		130577	Direction data
VHW	Water speed and heading	127250	Vessel heading
		128259	Speed, water referenced
		130577	Direction data
VTG	Course over ground and ground speed	129026	COG and SOG, rapid update
ZDA	Time and date	126992	System time
		129033	Time and date

Table R.2 – Conversion from IEC 61162-3 to IEC 61162-1

IEC 61162-3 PGN		IEC 61162-1 sentence	
126992	System time	ZDA	Time and date
127250	Vessel heading	HDG	Heading, deviation and variation
		HDT	Heading true
		OSD	Own ship data
		THS	True heading and status
		VHW	Water speed and heading
128259	Speed, water referenced	VBW	Dual ground/water speed
		VHW	Water speed and heading
129025	Position, rapid update	GGA	Global positioning system (GPS) fix data
		GLL	Geographic position – Latitude/longitude
		GNS	GNSS fix data
		RMC	Recommended minimum specific GNSS data
129026	COG & SOG, rapid update	RMC	Recommended minimum specific GNSS data
		VTG	Course over ground and ground speed
129029	GNSS position update	GGA	Global positioning system (GPS) fix data
		GLL	Geographic position – Latitude/longitude
		GNS	GNSS fix data
		GSA	GNSS DOP and active satellites
		RMC	Recommended minimum specific GNSS data
129033	Time and Date	ZDA	Time and date
129044	Datum	DTM	Datum reference
129045	User datum setting	DTM	Datum reference
130577	Direction data	OSD	Own ship data
		VBW	Dual ground/water speed
		VHW	Water speed and heading

Annex S
(normative)

Route plan exchange format – RTZ

S.1 General

This route plan exchange format is intended be used for many purposes. For example it can be used onboard for route plan exchange between main and backup ECDIS, ECDIS and radar, ECDIS and optimization systems, etc. Another example use is between ship and shore where it can be used to inform the shore about the plan of the vessel, the shore can recommend a route, the shore can optimize a route, etc.

This route plan exchange format is based on standardizing a single route plan. The application level of the sender and receiver is assumed to be able to handle multiple route plans for use cases which require availability of multiple routes, for example alternative route plans for the same voyage or route plans for different purposes.

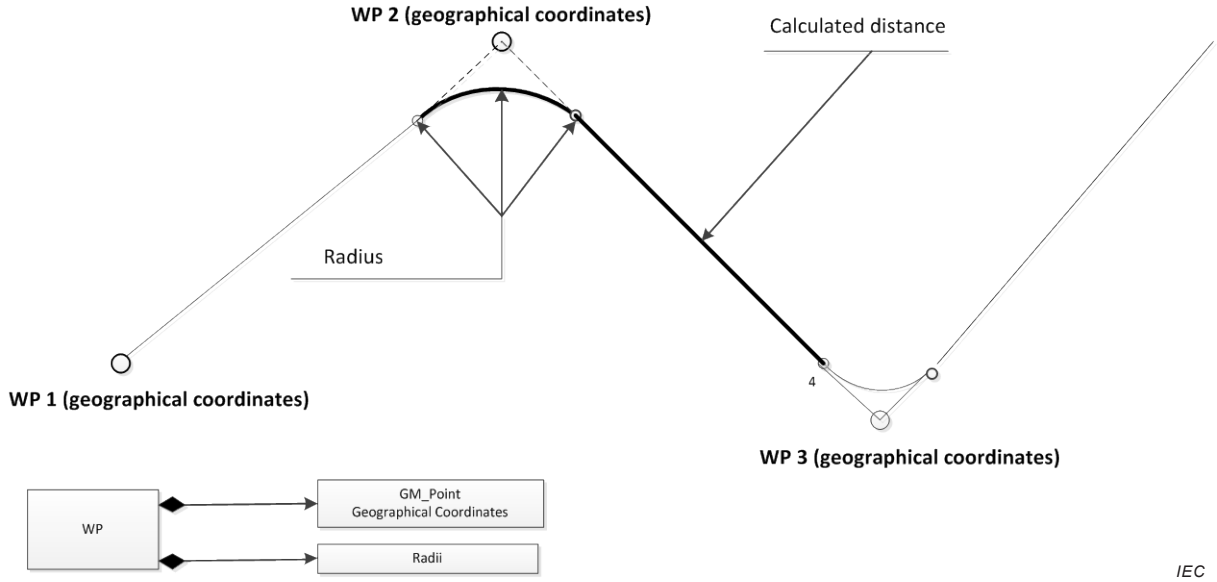
A route plan consists of waypoints. Each waypoint contains information related to the leg from the previous waypoint. Descriptions of route plans are shown in Figure S.1 and Figure S.2. The route exchange format is a file containing an XML coded version of the route plan.The XML route exchange file uses the extension **.rtz**. A description of the RTZ format is given in Clause S.5. Examples of RTZ format routes are given in Clauses S.7 and S.8.

Clause S.6 gives an XML schema to be met by RTZ route files so that their structure and content can be verified.

NOTE 1 This route exchange format has some limitations for applicability due to the simple geometric mode used. Application for latitudes above 70º may cause significantly different paths over the earth surface between two systems. Application to long legs such as an ocean crossing is subject to differences in the exact path over the earth surface.

NOTE 2 It is recommended that the receiver of the route exchange always performs a check against the chart database and a geometry check before use for navigation purposes.

NOTE 3 Information in addition to the route exchange format will be necessary between third parties to assure the level of accuracy and repeatability required for Track Control System purposes.



The distance between waypoints is from WOL to WOL with zero “advance and transfer” or “forwarding distance”.

Figure S.1 – Description of route plan – Distance between WP 2 and WP 3

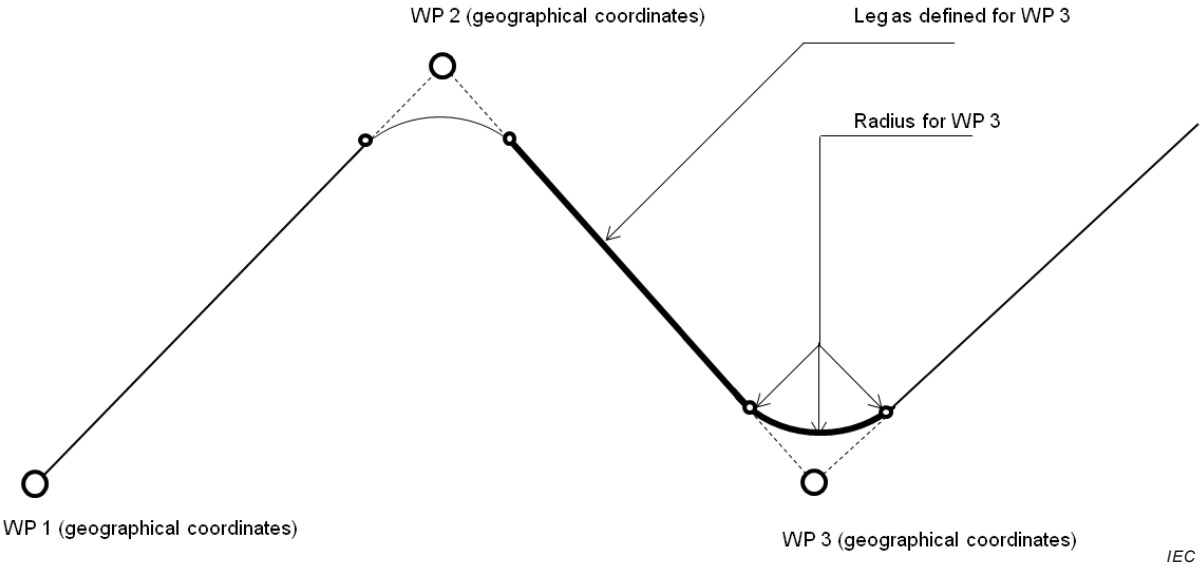


Figure S.2 – Description of route plan – Leg parameters belonging to WP 3

S.2 RTP Data container

Data containers are standard ZIP archive files used to compress the size of the route exchange files.

The container file **.rtzp** stores a XML file **.rtz**, which conforms to the XML schema described in Clause S.6.

Use of the data container is optional with removable media. In this case the route exchange may be used with or without the data container. When used without the data container the filename of the route exchange is **.rtz** instead of **.rtzp**.

NOTE The filename is the attribute routeName described in S.5.3.

In addition to the .rtz file a number of free-format files may be placed in the data container. The semantic data link between the XML nodes and files may be documented using a HTTP like scheme "rtz://<URI>", where "<URI>" identifies a file name inside the data container.

For example:

```
  <extensions>
    <extension manufacturer="Acme" version="2.1"
      name="AuxRouteInfo-9674F26E-EAFB-4319-AE24-08D5BA69D895">
      <property name="source"

value="http://services.acme.com/auto route/?id=3e891884e620970e5303fd2399427986"/>
      <property name="attachment" value="rtz://assignement-13.04.2013.docx"/>
      <property name="attachment" value="rtz://MFD_original.rt3"/>
    </extension>
  </extensions>
  <extensions>
```

S.3 High-level description of the RTZ format

The logical design of a route consists of three independent units:

- a block with general information about the route;
- a block with route geography (geometry) information which consists of blocks describing individual legs. Legs are listed in the order they appear on the route;
- a block that contains a set of route schedules.

Each block can be extended by manufacturers to fit their needs.

S.4 Adaptation to third-party extensions

S.4.1 Generic idea

Extended information in most cases refers to the geography (geometry) of a route.

There is a need to ensure that:

- there is a possibility to keep extensions from different manufacturers in a single file;
- modifying the geography (geometry) of a route shall not result in the data bindings in extensions becoming invalid;
- when changing, adding or removing legs, data consistency should not break down due to unknown extensions in codes for a particular manufacturer.

S.4.2 Unique identification of a waypoint

Each waypoint in a route has a unique composite ID.

It is assumed that all RTZ extensions use this identifier to link their data to the geography.

The identifier consists of two parts:

- **id**, which allows the finding of a waypoint in the list;
- **revision**, which allows the determination of modifications of a waypoint since the entry of the data into a file extension.

id is an integer,

revision is a monotonically increasing integer.

S.4.3 Creation of new waypoints

After creation of the waypoint the **revision** attribute gets the value of 0.

S.4.4 Change of geographic data for a waypoint

When the data of a waypoint changes, the software should increase the revision number **revision**, so that third-party software that works with the extension, is able to find out that the data to which it is associated is no longer valid.

S.4.5 Waypoint removal

When deleting a waypoint from a route, all the waypoint data including schedule data is deleted and the waypoint numbers within the route are updated.

Responsibility for the extension's data modification is assigned to the manufacturer’s code only.

The data that software is not able to recognize (e.g. extensions and options) are written back into the modified file without modification.

It is assumed that the receiver which understands extensions is able to filter out data when reading the route and be able to eliminate the data of extensions related to removed or to non-existent waypoints.

S.5 Detailed RTZ format description

S.5.1 File components

The RTZ file consists of:

- the mandatory XML processing instruction, which allows the specification of the encoding of string data;
- a root <route> node, which includes the URIs of the standard namespace http://www.w3.org/2001/XMLSchema-instance as well as the RTZ namespace[3] http://www.cirm.org/RTZ/1/0;
- the version attribute in the format **"Major.Minor"** (currently "1.0").

The preferred file encoding is UTF-8.

S.5.2 Route node description

This is the only "root" element of the RTZ file.

It has one mandatory attribute "version" that contains the version of the RTZ format used during file creation.

Version is specified as a combination of two figures separated with a dot. The first figure corresponds to the major version. It shall be changed in the case of significant modifications to the document structure. Formats with different major versions are incompatible.

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3 Comité International Radio-Maritime (CIRM) is the international association for marine electronics companies.

The second figure corresponds to the minor version and indicates format changes that do not affect compatibility.

The **Route** node consists of a sequence of the following child nodes:

- **RouteInfo** node that contains basic information on the route;
- **Waypoints** node that describes the geographical components of the route;
- **Schedules** node that describes calculated schedule and timing defined by a user;
- **Extensions** node that allows for extending the format to fit the particular needs of a manufacturer.

S.5.3 RouteInfo node description

The **RouteInfo** node provides a place to store information related to the whole route.

Information is stored in the following attributes:

Attribute	Description	Format	Status	Comment
routeName	name of the route	String	Mandatory	
routeAuthor	Author of route	String	Option	
routeStatus	Status of route	String	Option	
validityPeriodStart	Start of validity period	ISO 8601	Option	
validityPeriodStop	Stop of validity period	ISO 8601	Option	
vesselName	Ship's name	String	Option	
vesselMMSI	Ship's MMSI	XXXXXXXXX	Option	
vesselIMO	Ship's IMO number	XXXXXXX	Option	
vesselVoyage	Number of the voyage	String	Option	
vesselDisplacement	Ship's displacement	Integer	Option	Unit: tons
vesselCargo	Ship's cargo	Integer	Option	Unit: tons
vesselGM	Metacentric height	XX.XX	Option	Metacentric height of the ship for intended voyage. Unit: metres
optimizationMethod	Route is optimized to meet KPI	String	Option	Could be fixed speed, Lowest Fuel Consumption, Fixed ETA
vesselMaxRoll	Ship's max roll angle allowed	XX	Option	Unit: degrees
vesselMaxWave	Ship significant wave height limit	XX.X	Option	Unit: metres
vesselMax_Wind	Ship's max wind speed limit	XX.X	Option	Unit: metres
vesselSpeedMax	Ship's max speed	XX.X	Option	Unit: knots, Speed through water
vesselServiceMin	Ship's preferred service speed window_min	XX.X	Option	Unit: knots, Speed through water
vesselServiceMax	Ship's preferred service speed window_max	XX.X	Option	Unit: knots, Speed through water
routeChangesHistory	Cause of route change, Originator and Reason	String	Option	

For example:

```
<RouteInfo routeName="AROUNDtheSKAGEN" />
           vesselName=”ACME”
           validityPeriodStart=”2014-01-03T03:15:00Z”
           validityPeriodStop=”2014-01-06T10:15:00Z”
           vesselMMSI=”xxxxxxxxx”
           vesselVoyage =”xxxx”/>
```

Additionally, the node may contain a child **extensions**.

S.5.4 Waypoints node description

The **Waypoints** node contains data related to the geometry of the route.

As minimum, it shall contain a sequence of **Waypoint** nodes that describe every leg of the route.

The order of the **Waypoint** nodes follows the order of the legs.

Before the sequence of **Waypoint** nodes it is possible to insert a **DefaultWaypoint** node, which defines default values of attributes for newly created legs except for the geometry data.

For example:

```
<Waypoint id="24" revision="3" radius="0.6">
    <Position lat="53.0513" lon="8.87509"/>
    <Leg starboardXTD="0.2" portsizeXTD="0.1" geometryType="1"/>
</Waypoint>
```

Additionally, the node may contain a child **extensions** node.

S.5.5 DefaultWaypoint node description

The **DefaultWaypoint** node allows the definition of default values of attributes for newly created waypoints.

For example:

```
<Waypoints>
    <DefaultWaypoint radius="1.4">
         <Leg starboardXTD="0.5" portsizeXTD="0.5" geometryType="0"/>
    </DefaultWaypoint>
```

If the DefaultWaypoint node is provided before the sequence of waypoints, then it shall contain values for attributes for newly created waypoints.

For example:

`<Waypoints>`
`  <DefaultWaypoint radius="1.4">`
`  <Leg starboardXTD="0.3" portsideXTD="0.3"`
`  geometryType="0"/>`
`  </DefaultWaypoint>`
	Defaults settings for all waypoints

`  <Waypoint id="33" rev="1"/>`
`  <Position lat="53.0492" lon="8.87731"/>`
`  </Waypoint>`
	For this waypoint default settings applied

`<Waypoint id="17" rev="3" radius="0.3">`
`<Position lat="53.0513" lon="8.87509"/>`
`<Leg starboardXTD="0.4" portsideXTD="0.5"`
`geometryType="1"/>`
`</Waypoint>`
	For this waypoint user settings applied:
	Port XTD = 0,5 NM
	Starboard XTD = 0,4 NM
	Turn radius = 0,3 NM
	Geometry type is orthodrome

S.5.6 Waypoint node description

The **Waypoint** node contains the geographical description of a leg between waypoints.

Information is stored in the following attributes:

Attribute	Description	Format	Status	Comment
id	Unique identifier	Integer	Mandatory	It does not have to be equal to the index of the waypoint
revision	Waypoint revision	Integer	Option	Index of revision
name	Waypoint	String	Option	
radius	Turn radius	Real	Option	Unit: NM
position	Geographic point	GM_Point	Mandatory	Unit: degrees
leg	Leg attributes		Mandatory	Optional for the first waypoint

Position node contains the latitude and longitude of the waypoint.

Attribute	Description	Format	Status	Comment
lat	Latitude	Real	Mandatory	Unit: degrees with decimal
lon	Longitude	Real	Mandatory	Unit: degrees with decimal

Leg node contains attributes of the leg associated with the waypoint (see Figure S.2).

Attribute	Description	Format	Status	Comment
starboardXTD	Starboard XTD	Real	Option	Unit: NM with decimal
portsideXTD	Portside XTD	Real	Option	Unit: NM with decimal
safetyContour	Planned Safety contour	Real	Option	Unit: metres
safetyDepth	Planned Safety depth	Real	Option	Unit: metres
geometryType	Geometry type of leg	Enumeration	Option	loxodrome (= rhumb line) or orthodrome (= great circle)
planSpeedMin	Lowest cruising speed	Real	Option	Unit: knots, Speed over ground
planSpeedMax	Highest allowed speed	Real	Option	Unit: knots, Speed over ground
draughtForward	Static Draught Forward	Real	Option	Unit: metres

Attribute	Description	Format	Status	Comment
draughtAft	Static Draught Aft	Real	Option	Unit: metres
staticUKC	Minimum UKC on the leg	Real	Option	Unit: metres
dynamicUKC	Minimum Dynamic UKC on the leg	Real	Option	Unit: metres
masthead	Height of masthead	Real	Option	Unit: metres Calculated from keel
legReport	Reporting information	String	Option	Part of annotated route plan
legInfo	Nice to know	String	Option	e.g. telephone / web / service point Could be relevant in approach to harbour or VTS
legNote1	Notes regarding the ETD/ETA	String	Option	
legNote2	Local remarks	String	Option	

If an optional attribute is absent the appropriate parameter will be taken from the element **defaults** node. If this parameter is absent in the **defaults** node, then its value is set to "zero" or "empty", depending on the type of the parameter. For the case when geometryType is absent, this attribute should be considered as “Loxodrome”.

Additionally, the node may contain a child **extensions** node.

S.5.7 Storing date and time for legs

Date and time parameters that are associated with the corresponding legs are stored as strings of calender date and UTC in extended format according to ISO 8601.

For example:

```
<Schedule id="2" name="Schedule2">
  <Manual>
    <ScheduleElement id="100" etd="2002-11-17T15:25:00Z"/>
    <ScheduleElement id="105" eta="2002-11-17T15:25:00Z"/>
  </Manual>
</Schedule>
```

S.5.8 Schedules node description

The **Schedules** node contains data on the schedules associated with the route.

Children **schedule** nodes describe the specific schedule.

Additionally, the node may contain a child **extensions** node.

S.5.9 Schedule node description

S.5.9.1 Components

Schedule node consists of a sequence of the following child nodes:

- **Manual** node that describes user's preferences for the schedule;

- **Calculated** node that describes schedule calculation results according to user's preferences.

Additionally, the node may contain a child **extensions** node.

S.5.9.2 Manual node description

Manual node contains a sequence of **ScheduleElement** nodes that describe time preferences and calculation restrictions for each leg of the route. A waypoint should not have more than one associated ScheduleElement within a Manual node.

Additionally, the node may contain a child **extensions** node.

S.5.9.3 Calculated node description

Calculated node contains a sequence of **ScheduleElement** nodes that store calculations results according to user's preferences. A waypoint should not have more than one associated ScheduleElement within a Calculated node.

Additionally, the node may contain a child **extensions** node.

S.5.9.4 ScheduleElement (manual/calculated) node description

ScheduleElement node stores a number of time oriented values related to the route leg (N-1, N), where N is a zero-based index of the leg in the list.

Information is stored in the following attributes:

Attribute	Description	Format	Status	Comment
waypointID	Identifier of waypoint	Integer	Mandatory	
etd	Departure time	ISO 8601	Option	
etdWindowBefore	Describes the uncertainty of the predicted etd after optimization	± HH.MM	Option	- HHMM to etd
etdWindowAfter	Describes the uncertainty of the predicted etd after optimization	± HH.MM	Option	+ HHMM after etd
eta	Arrival time	ISO 8601	Option	
etaWindowBefore	Describes the uncertainty of the predicted eta after optimization	± HH.MM	Option	- HHMM to eta
etaWindowAfter	Describes the uncertainty of the predicted eta after optimization	± HH.MM	Option	+ HHMM after eta
stay	Stay time on WP	dd.hh.mm	Option	Length of stop on WP
speed	Ground speed	Real	Option	Unit: knots
speedWindow	Describes the uncertainty of the predicted speed after optimization	± x.xx	Option	Unit: knots - x.xx knots to + x.xx knots
windSpeed	True wind speed	Real	Option	Unit: knots
windDirection	True wind direction	Real	Option	Unit: degrees

Attribute	Description	Format	Status	Comment
currentSpeed	Current speed	Real	Option	Unit: knots
currentDirection	Current direction	Real	Option	Unit: degrees
windLoss	Speed loss caused by wind	Real	Option	Unit: knots Calculated during optimization
waveLoss	Speed loss caused by wave	Real	Option	Unit: knots Calculated during optimization
totalLoss	Total speed loss	Real	Option	Unit: knots Calculated during optimization
rpm	Advised Engine RPM	Integer	Option	Unit: RPM Calculated during optimization
pitch	Advised propeller pitch	Integer	Option	Unit: % Calculated during optimization
fuel	Predicted fuel consumption on leg	Real	Option	Unit: kg Calculated during optimization
relFuelSave	Relative fuel saving after optimization	Real	Option	Unit: kg Calculated during optimization
absFuelSave	Absolute fuel saving after optimization	Real	Option	Unit: kg Calculated during optimization
Note		String	Option	

For example:

```
<Schedule id="2" name="Schedule2">
  <Manual>
    <SheduleElement id="100" etd="2002-11-17T15:25:00Z" />
    <SheduleElement id="105" eta="2002-12-17T15:25:00Z" />
  </Manual>
  <Calculated>
    <SheduleElement id="100" etd="2002-11-17T15:25:00Z” speed="11.00000000"/>
    <SheduleElement id="105" eta="2002-12-17T15:25:00Z" speed="12.23242000"/>
  </Calculated>
  <Extensions>
  </Extensions>
</Schedule>
```

Additionally, the node may contain a child **extensions** node.

S.5.10 Extensions node description

The **Extensions** node contains a set of child **extension** nodes, each of which specify additional information that may be associated with:

- whole route;

- whole geographical data;
- certain waypoint;
- whole schedules block;
- certain schedule;
- certain schedule element.

S.5.11 Extension node description

extension node contains a set of mandatory attributes that identify the extension and a number of child nodes that may contain arbitrary information. Format of these nodes is beyond the scope of this standard.

If provided, the manufacturer shall include the specification of his extension nodes in the user manual.

The following attributes are used:

Attribute	Description	Format	Status	Comment
manufacturer	Unique vendor identifier	String	Mandatory	
name	Extension name	String	Mandatory	
version	Extension version	String	Option	

An example that illustrates one of the Acme extensions for GMDSS areas is:

```
<Extensions>
  <Extension manufacturer="acme" name="GMDSS-96CF94DF-6ADB-4B08-B43F-355F939AF5F8"
             version="1.3">
    <Point id="77" class="A1" range="20.0"/>
    <Point id="79" class="A1" range="22.0"/>
    <Point id="80" class="A2" range="121.2"/>
  </Extension>
</Extensions>
```

S.6 XML schema to be met by RTZ route files

```
<?xml version="1.0" encoding="utf-8"?>
<!--


  Route Exchange Format (RTZ)

  XML schema

  Revision 1.0

  Source: IEC 61174 Ed 4.0:2015
-->

<xsd:schema
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns="http://www.cirm.org/RTZ/1/0"
  targetNamespace="http://www.cirm.org/RTZ/1/0"
  elementFormDefault="qualified">

  <xsd:annotation>
    <xsd:documentation>
      RTZ schema version 1.0 – For more information on RTZ and this schema,
      visit http://www.cirm.org/RTZ.

      RTZ uses the following conventions: all coordinates are relative to the WGS8
      datum.
```

```
    All measurements are in nautical miles unless otherwise specified.
  </xsd:documentation>
</xsd:annotation>

<!--              -->
<!-- Root element -->
<!--              -->
<xsd:element name="route" type="Route">
  <xsd:annotation>
    <xsd:documentation>
      Route is the root element in the XML RTZ file.
    </xsd:documentation>
  </xsd:annotation>
</xsd:element>

<!--                              -->
<!-- Root element type definition -->
<!--                              -->
<xsd:complexType name="Route">
  <xsd:annotation>
    <xsd:documentation>
      RTZ files contain a number of waypoints, followed with auxiliary schedules.
      You can add your own elements to the extension section of the RTZ document.
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element name="routeInfo" type="RouteInfo" minOccurs="1" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>
          Generic route information.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="waypoints" type="Waypoints" minOccurs="1" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>
          A list of waypoints.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="schedules" type="Schedules" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>
          Optional list of schedules.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>
          You can add extend RTZ by adding your own elements from another schema
          here.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
  <xsd:attribute name="version" type="xsd:string" use="required" fixed="1.0">
    <xsd:annotation>
      <xsd:documentation>
        Format version (currently "1.0").
      </xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:complexType>

<!--                                      -->
<!-- "RouteInfo" element type definition  -->
<!--                                      -->
<xsd:complexType name="RouteInfo">
  <xsd:sequence>
```

```
      <xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>
            You can add extend RTZ by adding your own elements from another schema
            here.
          </xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
    <xsd:attribute name="routeName" type="xsd:string" use="required">
      <xsd:annotation>
        <xsd:documentation>The name of the route.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="routeAuthor" type="xsd:string">
      <xsd:annotation>
        <xsd:documentation>The author of route.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="routeStatus" type="xsd:string">
      <xsd:annotation>
        <xsd:documentation>Status of route.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="validityPeriodStart" type="xsd:dateTime">
      <xsd:annotation>
        <xsd:documentation>
          Start of validity period in ISO 8601 format.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="validityPeriodStop" type="xsd:dateTime">
      <xsd:annotation>
        <xsd:documentation>
          Stop of validity period in ISO 8601 format.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="vesselName" type="xsd:string">
      <xsd:annotation>
        <xsd:documentation>The name of ship.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="vesselMMSI" type="xsd:nonNegativeInteger">
      <xsd:annotation>
        <xsd:documentation>MMSI of ship.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="vesselIMO" type="xsd:nonNegativeInteger">
      <xsd:annotation>
        <xsd:documentation>IMO number of ship.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="vesselVoyage" type="xsd:string">
      <xsd:annotation>
        <xsd:documentation>Number of the voyage.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="vesselDisplacement" type="xsd:nonNegativeInteger">
      <xsd:annotation>
        <xsd:documentation>Displacement of ship in tons.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="vesselCargo" type="xsd:nonNegativeInteger">
      <xsd:annotation>
        <xsd:documentation>Cargo of ship in tons.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
```

```
  <xsd:attribute name="vesselGM" type="LengthType">
    <xsd:annotation>
      <xsd:documentation>Metacentric height in metres.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="optimizationMethod" type="xsd:string">
    <xsd:annotation>
      <xsd:documentation>Route is optimized to meet KPI.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="vesselMaxRoll" type="xsd:nonNegativeInteger">
    <xsd:annotation>
      <xsd:documentation>
        Max roll angle of ship allowed in degrees.
      </xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="vesselMaxWave" type="LengthType">
    <xsd:annotation>
      <xsd:documentation>
        Ship significant wave height limit in metres.
      </xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="vesselMaxWind" type="xsd:decimal">
    <xsd:annotation>
      <xsd:documentation>
        Max wind speed limit of ship in metres per second.
      </xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="vesselSpeedMax" type="SpeedType">
    <xsd:annotation>
      <xsd:documentation>Max speed of ship in knots.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="vesselServiceMin" type="SpeedType">
    <xsd:annotation>
      <xsd:documentation>
        Preferred service speed window minimum in knots.
      </xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="vesselServiceMax" type="SpeedType">
    <xsd:annotation>
      <xsd:documentation>
        Preferred service speed window maximum in knots.
      </xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="routeChangesHistory" type="SpeedType">
    <xsd:annotation>
      <xsd:documentation>
        Cause of route change, originator and reason.
      </xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:complexType>

<!--                                      -->
<!-- "LengthType" element type definition -->
<!--                                      -->
<xsd:simpleType name="LengthType">
  <xsd:annotation>
    <xsd:documentation>Length type.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:decimal">
    <xsd:minInclusive value="0.0"/>
  </xsd:restriction>
```

```
  </xsd:simpleType>

  <!--                                       -->
  <!-- "SpeedType" element type definition -->
  <!--                                       -->
  <xsd:simpleType name="SpeedType">
    <xsd:annotation>
      <xsd:documentation>Speed type.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:decimal">
      <xsd:minInclusive value="0.0"/>
    </xsd:restriction>
  </xsd:simpleType>

  <!--                                    -->
  <!-- Extension point type definition -->
  <!--                                    -->
  <xsd:complexType name="Extensions">
    <xsd:annotation>
      <xsd:documentation>
        You can add extend GPX by adding your own elements from another schema here.
      </xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:any namespace="##any" processContents="skip"
               minOccurs="0" maxOccurs="unbounded">
        <xsd:annotation>
          <xsd:documentation>
            You can add extend GPX by adding your own elements from another schema
            here.
          </xsd:documentation>
        </xsd:annotation>
      </xsd:any>
    </xsd:sequence>
  </xsd:complexType>

  <!--                                        -->
  <!-- "Waypoints" element type definition  -->
  <!--                                        -->
  <xsd:complexType name="Waypoints">
    <xsd:sequence>
      <xsd:element name="defaultWaypoint" type="DefaultWaypoint" minOccurs="0"
        maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Waypoint defaults.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="waypoint" type="Waypoint" minOccurs="2" maxOccurs="unbounded">
        <xsd:annotation>
          <xsd:documentation>Waypoint details.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="extensions"  type="Extensions" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>
            You can add extend RTZ by adding your own elements from another schema
            here.
          </xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>

  <!--                                           -->
  <!-- "DefaultWaypoint" element type definition -->
  <!--                                           -->
  <xsd:complexType name="DefaultWaypoint">
    <xsd:sequence>
      <xsd:element name="leg" type="Leg" minOccurs="0" maxOccurs="1">
```

```
      <xsd:annotation>
        <xsd:documentation>Leg attributes.</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>
          You can add extend RTZ by adding your own elements from another schema
          here.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
  <xsd:attribute name="radius" type="RadiusType">
    <xsd:annotation>
      <xsd:documentation>Turn radius in NM.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:complexType>

<!--                                       -->
<!-- "RadiusType" element type definition -->
<!--                                       -->
<xsd:simpleType name="RadiusType">
  <xsd:annotation>
    <xsd:documentation>Radius type.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:decimal">
    <xsd:minInclusive value="0.0"/>
    <xsd:maxExclusive value="10.0"/>
  </xsd:restriction>
</xsd:simpleType>

<!--                                    -->
<!-- "Waypoint" element type definition -->
<!--                                    -->
<xsd:complexType name="Waypoint">
  <xsd:sequence>
    <xsd:element name="position" type="GM_Point" minOccurs="1" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>Geographic point.</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="leg" type="Leg" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>Leg attributes.</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="extensions"  type="Extensions" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>
          You can add extend RTZ by adding your own elements from another schema
          here.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
  <xsd:attribute name="id" type="xsd:nonNegativeInteger" use="required">
    <xsd:annotation>
      <xsd:documentation>
        Unique waypoint identifier.
      </xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="revision" type="xsd:nonNegativeInteger">
    <xsd:annotation>
      <xsd:documentation>
        Waypoint revision. Increased on every change.
      </xsd:documentation>
```

```
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="name" type="xsd:string">
      <xsd:annotation>
        <xsd:documentation>
          Waypoint name.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="radius" type="RadiusType">
      <xsd:annotation>
        <xsd:documentation>
          Turn radius in NM.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
  </xsd:complexType>

  <!--                                -->
  <!-- "Leg" element type definition -->
  <!--                                -->
  <xsd:complexType name="Leg">
    <xsd:attribute name="starboardXTD" type="XtdType">
      <xsd:annotation>
        <xsd:documentation>Starboard XTE in NM.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="portsideXTD" type="XtdType">
      <xsd:annotation>
        <xsd:documentation>Portside XTE in NM.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="safetyContour" type="LengthType">
      <xsd:annotation>
        <xsd:documentation>Safety contour in metres.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="safetyDepth" type="LengthType">
      <xsd:annotation>
        <xsd:documentation>Safety depth in metres.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="geometryType" type="GeometryType">
      <xsd:annotation>
        <xsd:documentation>Geometry type of leg.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="speedMin" type="SpeedType">
      <xsd:annotation>
        <xsd:documentation>Lowest cruising speed in knots.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="speedMax" type="SpeedType">
      <xsd:annotation>
        <xsd:documentation>Highest allowed speed in knots.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="draughtForward" type="LengthType">
      <xsd:annotation>
        <xsd:documentation>Static draught forward in metres.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="draughtAft" type="LengthType">
      <xsd:annotation>
        <xsd:documentation>Static draught aft in metres.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="staticUKC" type="LengthType">
```

```
    <xsd:annotation>
      <xsd:documentation>Minimum UKC on the leg.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="dynamicUKC" type="LengthType">
    <xsd:annotation>
      <xsd:documentation>Minimum dynamic UKC on the leg.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="masthead" type="LengthType">
    <xsd:annotation>
      <xsd:documentation>Height of masthead.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="legReport" type="xsd:string">
    <xsd:annotation>
      <xsd:documentation>Reporting information.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="legInfo" type="xsd:string">
    <xsd:annotation>
      <xsd:documentation>Nice to know.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="legNote1" type="xsd:string">
    <xsd:annotation>
      <xsd:documentation>Notes regarding the ETD/ETA.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="legNote2" type="xsd:string">
    <xsd:annotation>
      <xsd:documentation>Local remarks.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:complexType>

<!--                       -->
<!-- XTD type definition -->
<!--                       -->
<xsd:simpleType name="XtdType">
  <xsd:annotation>
    <xsd:documentation>
      XTD of the point. Nautical miles.
    </xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:decimal">
    <xsd:minInclusive value="0.0"/>
    <xsd:maxExclusive value="10.0"/>
  </xsd:restriction>
</xsd:simpleType>

<!--                                                -->
<!-- "geometry/geopoint" element type definition -->
<!--                                                -->
<xsd:complexType name="GM_Point">
  <xsd:attribute name="lat" type="LatitudeType" use="required">
    <xsd:annotation>
      <xsd:documentation>Latitude in degrees.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="lon" type="LongitudeType" use="required">
    <xsd:annotation>
      <xsd:documentation>Longitude in degrees.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:complexType>

<!--                                    -->
```

```
<!-- RL/GC indicator type definition -->
<!--                                 -->
<xsd:simpleType name="GeometryType">
  <xsd:annotation>
    <xsd:documentation>RL/GC indicator.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="Loxodrome"/>
    <xsd:enumeration value="Orthodrome"/>
  </xsd:restriction>
</xsd:simpleType>

<!--                                      -->
<!-- Geographical latitude type definition -->
<!--                                      -->
<xsd:simpleType name="LatitudeType">
  <xsd:annotation>
    <xsd:documentation>
      The latitude of the point. Decimal degrees, WGS84 datum.
    </xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:decimal">
    <xsd:minInclusive value="-90.0"/>
    <xsd:maxInclusive value="90.0"/>
  </xsd:restriction>
</xsd:simpleType>

<!--                                       -->
<!-- Geographical longitude type definition -->
<!--                                       -->
<xsd:simpleType name="LongitudeType">
  <xsd:annotation>
    <xsd:documentation>
      The longitude of the point. Decimal degrees, WGS84 datum.
    </xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:decimal">
    <xsd:minInclusive value="-180.0"/>
    <xsd:maxExclusive value="180.0"/>
  </xsd:restriction>
</xsd:simpleType>

<!--                                    -->
<!-- "Schedules" element type definition -->
<!--                                    -->
<xsd:complexType name="Schedules">
  <xsd:sequence>
    <xsd:element name="schedule" type="Schedule" minOccurs="0" maxOccurs="unbounded">
      <xsd:annotation>
        <xsd:documentation>Schedule definition.</xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="extensions"  type="Extensions" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>
          You can add extend RTZ by adding your own elements from another schema
          here.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
</xsd:complexType>

<!--                                              -->
<!-- "schedules/schedule" element type definition -->
<!--                                              -->
<xsd:complexType name="Schedule">
  <xsd:annotation>
    <xsd:documentation>
```

```
      Schedule definition.
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element name="manual" type="Manual" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>
          Manual schedule values definition.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="calculated" type="Calculated" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>
          Calculated schedules.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="extensions"  type="Extensions" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>
          You can add extend RTZ by adding your own elements from another schema
          here.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
  <xsd:attribute name="id" type="xsd:nonNegativeInteger" use="required">
    <xsd:annotation>
      <xsd:documentation>
        Schedule name.
      </xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="name" type="xsd:string">
    <xsd:annotation>
      <xsd:documentation>
        Schedule name.
      </xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
</xsd:complexType>

<!--                                  -->
<!-- "Manual" element type definition -->
<!--                                  -->
<xsd:complexType name="Manual">
  <xsd:annotation>
    <xsd:documentation>User defined schedule parameters.</xsd:documentation>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element name="sheduleElement" type="ScheduleElement"
      minOccurs="1" maxOccurs="unbounded">
      <xsd:annotation>
        <xsd:documentation>
          Manual schedule leg definition.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>
          You can add extend RTZ by adding your own elements
          from another schema here.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
</xsd:complexType>
```

```
<!--                                        -->
<!-- "Calculated" element type definition -->
<!--                                        -->
<xsd:complexType name="Calculated">
  <xsd:annotation>
    <xsd:documentation>
      Calculated schedule parameters.
    </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence>
    <xsd:element name="sheduleElement" type="ScheduleElement"
      minOccurs="0" maxOccurs="unbounded">
      <xsd:annotation>
        <xsd:documentation>
          Calculated schedule waypoint parameters.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
    <xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>
          You can add extend RTZ by adding your own elements
          from another schema here.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
</xsd:complexType>

<!--                                           -->
<!-- "ScheduleElement" element type definition -->
<!--                                           -->
<xsd:complexType name="ScheduleElement">
  <xsd:sequence>
    <xsd:element name="extensions" type="Extensions" minOccurs="0" maxOccurs="1">
      <xsd:annotation>
        <xsd:documentation>
          You can add extend RTZ by adding your own elements from another schema
          here.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:element>
  </xsd:sequence>
  <xsd:attribute name="waypointId" type="xsd:nonNegativeInteger" use="required">
    <xsd:annotation>
      <xsd:documentation>Unique waypoint identifier.</xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="etd" type="xsd:dateTime">
    <xsd:annotation>
      <xsd:documentation>
        UTC estimated departure time in ISO 8601 format.
      </xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="etdWindowBefore" type="xsd:time">
    <xsd:annotation>
      <xsd:documentation>
        Describes the uncertainty of the predicted ETD after optimization.
      </xsd:documentation>
    </xsd:annotation>
  </xsd:attribute>
  <xsd:attribute name="etdWindowAfter" type="xsd:time">
    <xsd:annotation>
      <xsd:documentation>
        Describes the uncertainty of the predicted ETD after optimization.
      </xsd:documentation>
    </xsd:annotation>
```

```
    </xsd:attribute>
    <xsd:attribute name="eta" type="xsd:dateTime">
      <xsd:annotation>
        <xsd:documentation>
          UTC estimated arrival time in ISO 8601 format.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="etaWindowBefore" type="xsd:time">
      <xsd:annotation>
        <xsd:documentation>
          Describes the uncertainty of the predicted ETA after optimization.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="etaWindowAfter" type="xsd:time">
      <xsd:annotation>
        <xsd:documentation>
          Describes the uncertainty of the predicted ETA after optimization.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="stay" type="xsd:time">
      <xsd:annotation>
        <xsd:documentation>Stay time on WP.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="speed" type="SpeedType">
      <xsd:annotation>
        <xsd:documentation>True speed in knots.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="speedWindow" type="xsd:decimal">
      <xsd:annotation>
        <xsd:documentation>
          Describes the uncertainty of the predicted speed after optimization in knots.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="windSpeed" type="SpeedType">
      <xsd:annotation>
        <xsd:documentation>True wind speed in metres per second.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="windDirection" type="CourseType">
      <xsd:annotation>
        <xsd:documentation>True wind direction in degrees.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="currentSpeed" type="SpeedType">
      <xsd:annotation>
        <xsd:documentation>Current speed in knots.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="currentDirection" type="CourseType">
      <xsd:annotation>
        <xsd:documentation>Current direction in degrees.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="windLoss" type="SpeedType">
      <xsd:annotation>
        <xsd:documentation>Speed loss caused by wind in knots.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="waveLoss" type="SpeedType">
      <xsd:annotation>
        <xsd:documentation>Speed loss caused by wave.</xsd:documentation>
      </xsd:annotation>
```

```
    </xsd:attribute>
    <xsd:attribute name="totalLoss" type="SpeedType">
      <xsd:annotation>
        <xsd:documentation>Total speed loss.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="rpm" type="xsd:nonNegativeInteger">
      <xsd:annotation>
        <xsd:documentation>Advised Engine RPM.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="pitch" type="xsd:integer">
      <xsd:annotation>
        <xsd:documentation>Advised Engine Pitch.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="fuel" type="xsd:decimal">
      <xsd:annotation>
        <xsd:documentation>Predicted fuel consumption on leg.</xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="relFuelSave" type="xsd:decimal">
      <xsd:annotation>
        <xsd:documentation>
          Relative fuel saving after optimization in percent.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="absFuelSace" type="xsd:decimal">
      <xsd:annotation>
        <xsd:documentation>
          Absolute fuel saving after optimization.
        </xsd:documentation>
      </xsd:annotation>
    </xsd:attribute>
    <xsd:attribute name="Note" type="xsd:string">
    </xsd:attribute>
  </xsd:complexType>

  <!--                          -->
  <!-- Course type definition -->
  <!--                          -->
  <xsd:simpleType name="CourseType">
    <xsd:annotation>
      <xsd:documentation>Course type in degrees.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:decimal">
      <xsd:minInclusive value="0.0"/>
      <xsd:maxExclusive value="360.0"/>
    </xsd:restriction>
  </xsd:simpleType>

</xsd:schema>
```

S.7 Basic RTZ route example

```
<?xml version="1.0" encoding="UTF-8"?>
<route xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
         xmlns="http://www.cirm.org/RTZ/1/0" version="1.0"
         xsi:schemaLocation="http://www.cirm.org/RTZ/1/0 rtz.xsd">
    <routeInfo routeName="AROUNDtheSKAGEN"/>
    <waypoints>
        <defaultWaypoint radius="0.1">
            <leg portsideXTD="0.1" starboardXTD="0.1"/>
        </defaultWaypoint>
        <waypoint id="15" revision="1">
           <position lat="53.0492" lon="8.87731"/>
        </waypoint>
```

```
        <waypoint id="52" revision="3">
            <position lat="53.0513" lon="8.87509"/>
            <leg portsideXTD="0.3" starboardXTD="0.3"
                safetyContour="11.20000000" safetyDepth="22.20000000"
                geometryType="Orthodrome"/>
        </waypoint>
        <waypoint id="1" revision ="1" name="To the pier">
            <position lat="53.5123" lon="8.11998"/>
            <leg portsideXTD="0.1" starboardXTD="0.1"/>
        </waypoint>
        <waypoint id="5" revision ="3" name="To the pier">
            <position lat="53.0492" lon="8.87731"/>
            <leg portsideXTD ="0.1" starboardXTD ="0.1"
                safetyContour ="11.20000000" safetyDepth ="22.20000000"
                geometryType="Orthodrome"/>
        </waypoint>
    </waypoints>
    <schedules>
        <schedule id="1" name="Schedule1">
            <manual>
                <sheduleElement waypointId="15" etd="2002-11-17T15:25:00Z" />
                <sheduleElement waypointId="15" eta="2002-11-17T15:25:00Z" />
            </manual>
            <calculated/>
        </schedule>
        <schedule id="2" name="Schedule2">
            <manual>
                <sheduleElement waypointId="15" etd="2002-11-17T15:25:00Z" />
                <sheduleElement waypointId="15" eta="2002-12-17T15:25:00Z" />
            </manual>
            <calculated>
                <sheduleElement waypointId="15" etd="2002-11-17T15:25:00Z"
                    speed="11.34520000"/>
                <sheduleElement waypointId="15" eta="2002-12-17T15:25:00Z"
                    speed="12.66635112"/>
            </calculated>
        </schedule>
    </schedules>
    <extensions/>
</route>
```

S.8 Example of the RTZ route with embedded extensions

```
<?xml version="1.0" encoding="UTF-8"?>
<route xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
         xmlns="http://www.cirm.org/RTZ/1/0" version="1.0"
         xsi:schemaLocation="http://www.cirm.org/RTZ/1/0 rtz.xsd">
    <routeInfo routeName="AROUNDtheSKAGEN"/>
    <waypoints>
        <defaultWaypoint radius="0.1">
            <leg portsideXTD ="0.1" starboardXTD ="0.1"/>
        </defaultWaypoint>
        <waypoint id="15" revision="1">
           <position lat="53.0492" lon="8.87731"/>
            <leg portsideXTD="0.1" starboardXTD="0.1"
                safetyContour="11.20000000"
                safetyDepth="22.20000000" geometryType="Loxodrome"/>
        </waypoint>
        <waypoint id="52" revision="3">
            <position lat="53.0513" lon="8.87509"/>
            <leg portsideXTD="0.3" starboardXTD="0.3"
                safetyContour="11.20000000"
              safetyDepth="22.20000000" geometryType="Orthodrome"/>
        </waypoint>
        <waypoint id="1" revision="1" name="To the pier">
            <position lat="53.5123" lon="8.11998"/>
            <leg portsideXTD ="0.1" starboardXTD ="0.1"/>
        </waypoint>
```

```
    </waypoints>
    <schedules>
        <schedule id="1" name="Schedule1">
            <manual>
                <sheduleElement waypointId="15" etd="2002-11-17T15:25:00Z"/>
                <sheduleElement waypointId="1" eta="2002-11-17T15:25:00Z"/>
            </manual>
            <calculated/>
        </schedule>
        <schedule id="2" name="Schedule2">
            <manual>
                <sheduleElement waypointId="15" etd="2002-11-17T15:25:00Z"/>
                <sheduleElement waypointId="15" eta="2002-12-17T15:25:00Z"/>
            </manual>
            <calculated>
                <sheduleElement waypointId="15" etd="2002-11-17T15:25:00Z"
                    speed="11.34520000"/>
                <sheduleElement waypointId="15" eta="2002-12-17T15:25:00Z"
                    speed="12.66635112">
                    <extensions>
                        <extension manufacturer="Acme" version="2.1"
                            name="Int-681EA94E-C27A-4CCA-A405-98BDA20AA7C6">
                            <struct name="xxx">
                                <Param name="x" value="y" />
                            </struct>
                        </extension>
                    </extensions>
                </sheduleElement>
            </calculated>
            <extensions/>
        </schedule>
    </schedules>
    <extensions>
        <extension manufacturer="Acme" version="1.0"
            name="Internal-C93B70B2-D733-4388-937C-639472E2C6CF">
        <saypoint id="15" rev="1" link="rtz://symbols.png"/>
        </extension>
    </extensions>
</route>
```

S.9 UML model of the Route exchange format

Figure S.3 gives the Unified Modelling Language diagram for the route exchange format.

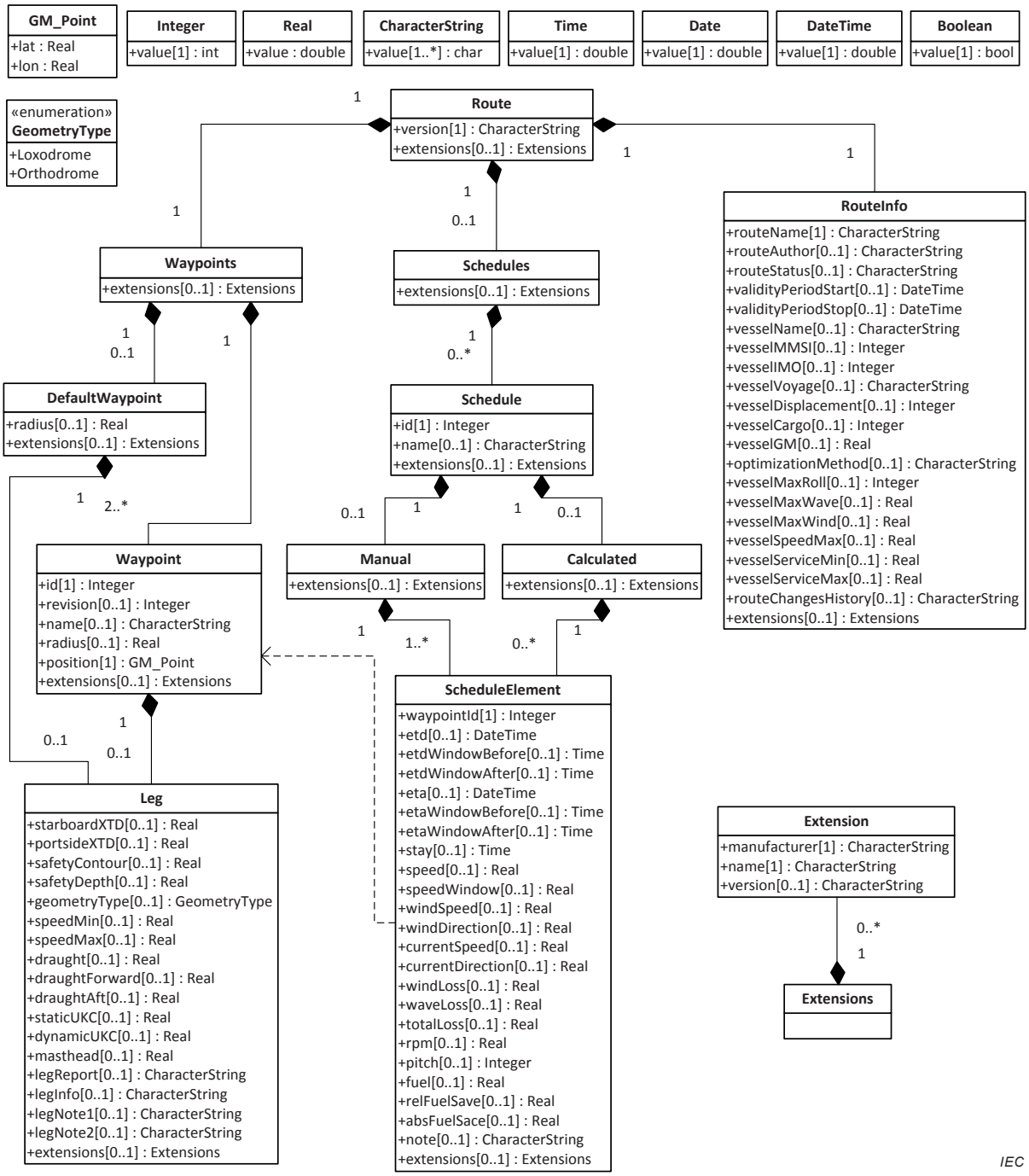


Figure S.3 – UML diagram

Annex T
(normative)

Interface for reporting route transfer

T.1 Route encapsulation format for transmitting RTZ over IEC 61162-450

The route shall be sent as a data block (‘binary image’, “RaUdP”) according to IEC 61162-450, where the DataType is set to ‘application/xml’ for RTZ or ‘application/zip’ for RTZP. The status indication field shall be “RTZ/1.0” or “RTZP/1.0” as applicable terminated by <CR><LF>. The “1.0” is the version field of the header or status field, where a receiver shall accept any “1.y” subversions, but issue a caution for “x.y” when $x > 1$. Additional lines in the status indication field can be used to optionally indicate for example error conditions or other status information. For RTZ and RTZP refer to Annex S.

The sender shall use the multicast address default 239.192.0.25 port 60025 or as configured at installation. A receiver shall per default receive on the same multicast address or as configured at installation.

A manufacturer may provide re-transmittable data blocks “RrUdP” as an option. The sender shall use the multicast address default 239.192.0.30 port 60030 or as configured at installation. A receiver shall per default receive on the same multicast address or as configured at installation.

Examples of timing are shown in Figure T.1.

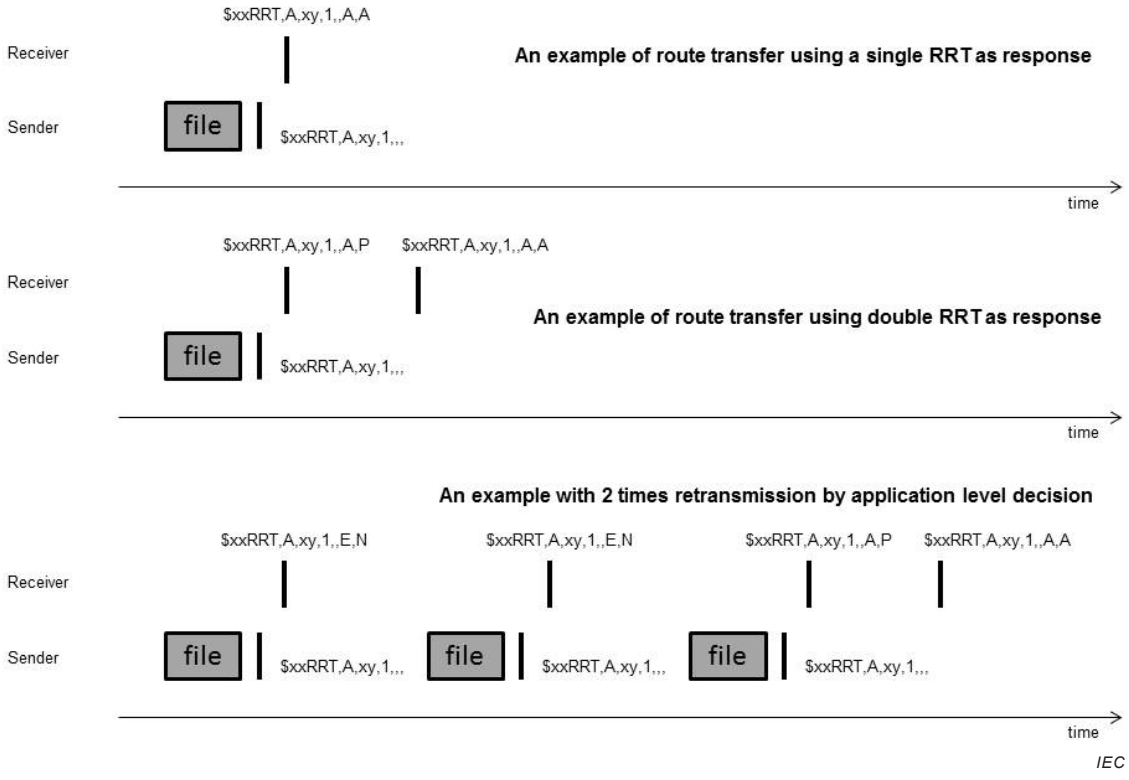


Figure T.1 – Examples of timing for route transfer

T.2 RRT – Report route transfer

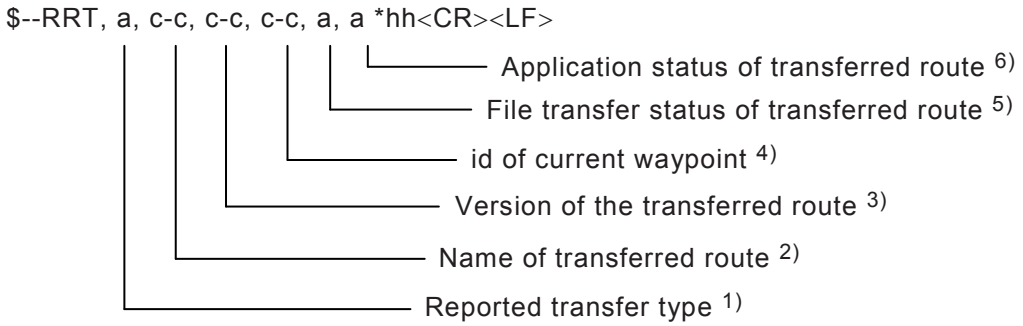
NOTE Refer to IEC 61162-1 for a possible later version of this sentence.

This sentence is used as to notify a device about a route transmission and to report the status of a received route transmission.

When the sentence is used to inform or notify a device that a monitored route has been sent to that device, data fields 5 and 6 shall be null. When the sentence is used to inform or notify a device that an alternate route has been sent to that device, data fields 4, 5, and 6 shall be null. When the sentence is used to report the status of receiving and processing a monitored route by the receiving device all data fields are required. When the sentence is used to report the status of receiving and processing an alternate route by the receiving device all data fields except data field 4 are required. In this case data field 4 shall be null.

The sentence may also be used to request route information for the case of an ECDIS that was not powered when a route was sent over the network and thus will not have the latest information.

After power on, an ECDIS shall send one or more sentences with a ‘Q’ to ask for a retransmission. A receiver on receiving a sentence with a ‘Q’ shall resend any monitored and alternate route. If no route is being monitored, the receiver shall respond with an empty ‘M’ sentence ($--RRT,M,,,,,*hh<CR><LF>). If no alternate route is active, then an empty ‘A’ sentence shall be sent.



Comments:

1) Reported type of transferred route. This field should not be null.

   M = Monitored route

   A = Alternate route for editing

   Q = Query for transmitting any monitored or alternative route for editing

2) Name of transferred route. Max. 30 characters. This field should not be null except for a query or to indicate that no route is monitored in response to a query.

3) Version of transferred route. Max. 20 characters. This field should not be null except for a query or to indicate that no route is monitored in response to a query.

4) id of current waypoint for monitored route. Max. 10 characters. This field is null for alternate routes for editing.

5) File transfer status of transferred route. This field shall be null when informing the transfer of a route. The following values are used for reporting the reception status:

   A = successful reception of the route file transfer;

   E = error in reception of the route file transfer.

6) Status of the intended application of the transferred route. This field shall be null when informing the transfer of a route. The following values are used for reporting the reception status:

   A = content of the received route accepted and valid;

   V = content of received route rejected;

   P = pending, application level has not yet evaluated the received route;

   N = not applicable. This is used when reporting the reception status and when the file transfer status of the transferred route indicated an error in the reception of the route file transfer.

Annex U
(normative)

Sentences used by SafetyNET

U.1 General

Refer to IEC 61162-1 for a possible later version of this sentence.

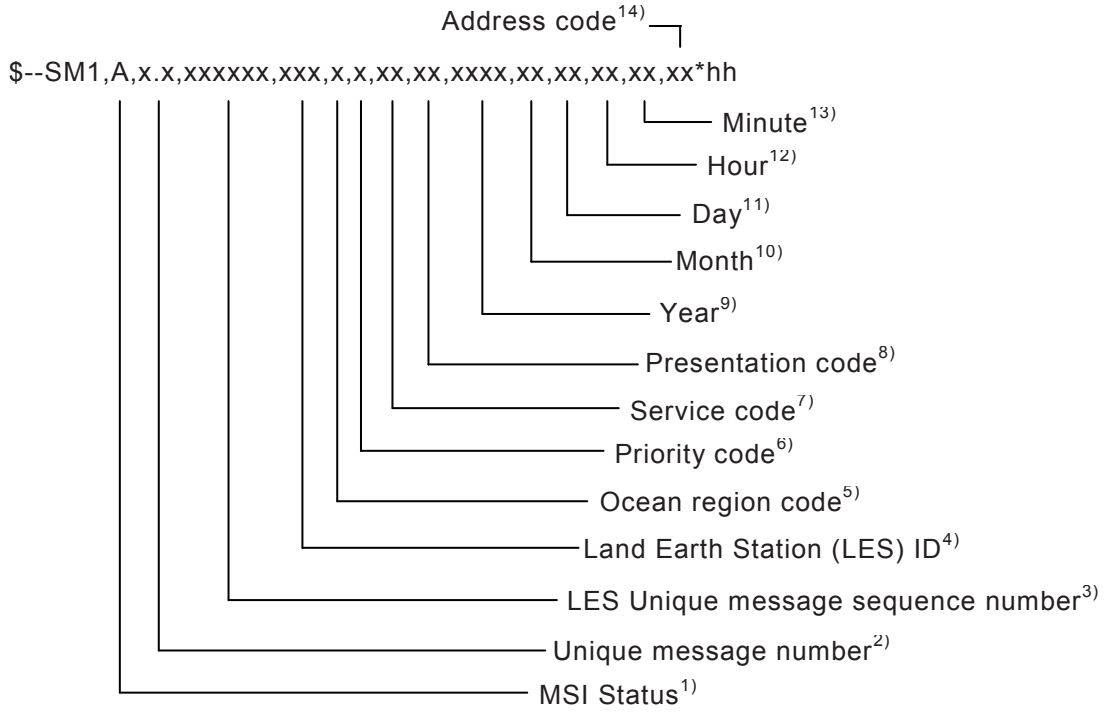
The SM1, SM2, SM3, SM4 and SMB sentences support Enhanced Group Call (EGC) Inmarsat-C and mini-C terminals as part of the international SafetyNET Service, an integral component of the Global Maritime Distress and Safety System (GMDSS).

The combination of the SM1, or SM2, or SM3, or SM4 and SMB sentences are used to report Maritime Safety Information (MSI) consisting of navigational and meteorological warnings, meteorological forecasts, Search and Rescue (SAR) information and other urgent safety-related messages to other shipboard equipment.

U.2 SM1 – SafetyNET Message, All Ships/NavArea

The SM1 sentence is used to report MSI messages addressed to all ships as a general call or to provide an area designation as described in comment 14 below, based upon the MSI Service Code value of zero (00) or thirty one (31).

This SM1 sentence contains qualifying information related to the MSI message body in the corresponding SMB sentence(s). This includes the identification of the source of the MSI message, purpose and scope of the MSI message, and date/time of receipt. One or more SMB sentences shall always follow this sentence. This sentence and related SMB sentences are linked by the Unique Message number generated by the receiving EGC Terminal data field included in both sentences.



Comments:

1) The MSI Status field confirms if the entire Marine Safety Information Message has been or has not been correctly and completely received by the EGC Terminal.

   A = MSI Message complete: all data fields in this sentence and associated SMB sentences are complete and valid.

   V = MSI Message not complete: some data fields in this sentence may be null or set to an unknown state, or some characters within the MSI message body within the associated SMB sentences may be represented by the underscore "_" character.

2) This data field contains the Unique Message Number generated by the receiving EGC Terminal, sometimes referred to as a Mobile Earth Station (MES) or Ship Earth Station (SES). This is a variable length integer value with no decimal place or decimal digits. The maximum size of this field is 6 digits. This same data field is contained in the SMB sentence. This field shall not be null.

3) The Unique Message Sequence Number is assigned by the Land Earth Station (LES) originating this MSI message. This field is always 6 fixed digits, requiring zero fill if the value from received from the LES contains less than 6 digits. For example, if the LES broadcast a 5 digit number "10345", it would be represented in this data field as "010345", both having the same numeric value. If any portion of the Unique Message Sequence Number is received in error (i.e. due to satellite radio link interference) or unknown by the EGC Terminal, then this field shall be null.

4) This field contains the 3-digit numeric ID of the LES that originated this MSI message. This field is always 3 fixed digits, requiring zero fill if the value from received from the LES contains less than 3 digits. If any portion of the LES ID is received in error (i.e. due to satellite radio link interference) or unknown by the EGC Terminal, then this field shall be null.

5) Ocean Region code. This field shall not be null.

   0 = Atlantic Ocean Region – West

   1 = Atlantic Ocean Region – East

   2 = Pacific Ocean Region

   3 = Indian Ocean Region

   4 – 7 = Reserved

   8 = Unknown

   9 = All ocean regions

6) Priority code of the MSI message. This field shall not be null.

   1 = Safety

   2 = Urgency

   3 = Distress

4 -8 = Reserved

9 = Unknown

7) The fixed two-digit Service code identifies the type of this MSI message and corresponds to one specific address area (see comment 14). This field is set to null for all other Service Code values.

Service Code	Type of service
00	All ships (general call)
31	NAVAREA/METAREA warning, MET Forecast, or Piracy warning to NAVAREA/METAREA

8) The Presentation code is a fixed two-digit numeric value that defines the language to be used for presentation of this MSI message. Current definitions are provided below.

Presentation Code Value	Language
00	International Alphabet Number 5.

9) Year of message reception UTC (4 fixed digits).

10) Month of message reception UTC (2 fixed digits, 01 to 12).

11) Day of message reception UTC (2 fixed digits, 01 to 31).

12) Hour of message reception UTC (2 fixed digits, 00 to 23).

13) Minute of message reception UTC (2 fixed digits, 00 to 59).

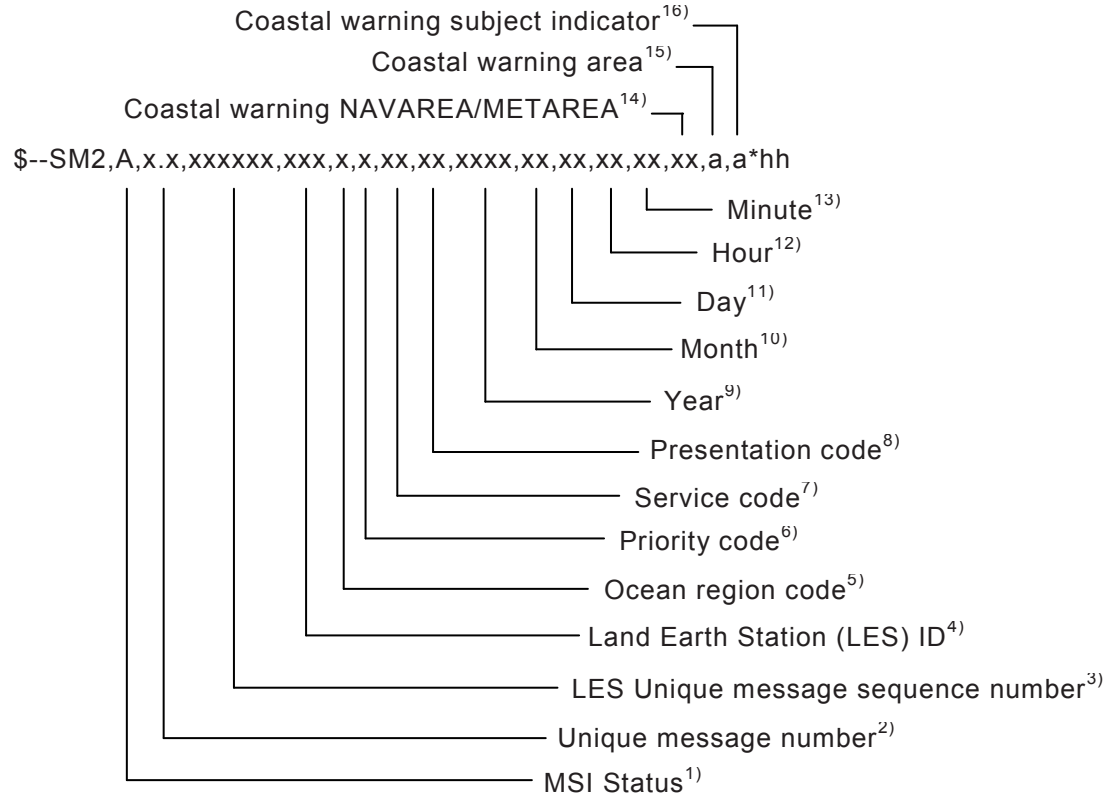
14) This field contains a fixed two-digit Address code/NAVAREA/METAREA and is dependent upon the Service code value provided in data field 7 as follows:

Service Code Value (data field 7)	Address Code value and meaning (data field 14)
00	00 – All Ships
31	01 to 21 – NAVAREA/METAREA number. 22 to 99 – Reserved for future address code assignments.
All other values or null	This data field is set to null.

U.3 SM2 – SafetyNET Message, Coastal Warning Area

The SM2 sentence is used to report MSI messages containing navigational, meteorological, or piracy coastal warnings as described in comments 14, 15, and 16 below, based upon the MSI Service Code value of thirteen (13).

This SM2 sentence contains qualifying information related to the MSI message body in the corresponding SMB sentence(s). This includes the identification of the source of the MSI message, purpose and scope of the MSI message, and date/time of receipt. One or more SMB sentences shall always follow this sentence. This sentence and related SMB sentences are linked by the Unique Message number generated by the receiving EGC Terminal data field included in both sentences.



Comments:

1) The MSI Status field confirms if the entire Marine Safety Information Message has been or has not been correctly and completely received by the EGC Terminal.

   A = MSI Message complete: all data fields in this sentence and associated SMB sentences are complete and valid.

   V = MSI Message not complete: some data fields in this sentence may be null or set to an unknown state, or some characters within the MSI message body within the associated SMB sentences may be represented by the underscore "_" character.

2) This data field contains the Unique Message Number generated by the receiving EGC Terminal, sometimes referred to as a Mobile Earth Station (MES) or Ship Earth Station (SES). This is a variable length integer value with no decimal place or decimal digits. The maximum size of this field is 6 digits. This same data field is contained in the SMB sentence. This field shall not be null.

3) The Unique Message Sequence Number is assigned by the Land Earth Station (LES) originating this MSI message. This field is always 6 fixed digits, requiring zero fill if the value from received from the LES contains less than 6 digits. For example, if the LES broadcast a 5 digit number "10345", it would be represented in this data field as "010345", both having the same numeric value. If any portion of the Unique Message Sequence Number is received in error (i.e. due to satellite radio link interference) or unknown by the EGC Terminal, then this field shall be null.

4) This field contains the 3-digit numeric ID of the LES that originated this MSI message. This field is always 3 fixed digits, requiring zero fill if the value from received from the LES contains less than 3 digits. If any portion of the LES ID is received in error (i.e. due to satellite radio link interference) or unknown by the EGC Terminal, then this field shall be null.

5) Ocean Region code. This field shall not be null.

   0 = Atlantic Ocean Region – West

   1 = Atlantic Ocean Region – East

   2 = Pacific Ocean Region

   3 = Indian Ocean Region

   4 – 7 = Reserved

   8 = Unknown

   9 = All ocean regions

6) Priority code of the MSI message. This field shall not be null.

   1 = Safety

   2 = Urgency

3 = Distress

4 -8 = Reserved

9 = Unknown

7) The fixed two-digit Service code identifies the type of this MSI message and corresponds to the coastal warning area (see comments 14, 15, and 16). This field is set to null for all other Service Code values.

Service Code	Type of service
13	Navigational, Meteorological, or Piracy Coastal warning

8) The Presentation code is a fixed two-digit numeric value that defines the language to be used for presentation of this MSI message. Current definitions are provided below.

Presentation Code Value	Language
00	International Alphabet Number 5.

9) Year of message reception UTC (4 fixed digits).

10) Month of message reception UTC (2 fixed digits, 01 to 12).

11) Day of message reception UTC (2 fixed digits, 01 to 31).

12) Hour of message reception UTC (2 fixed digits, 00 to 23).

13) Minute of message reception UTC (2 fixed digits, 00 to 59).

14) The Coastal warning address consists of three fields, where this field identifies the NAVAREA/METAREA with a range from 01 to 21. This field is a two-digit numeric field containing the first two digits (X1X2) from the transmitted message's "4 alphanumeric coastal warning area address X1X2B1B2" that identify the NAVAREA/METAREA. (See IMO, International SafetyNET Manual). This field shall null if there is an error in the received NAVAREA due to satellite radio link interference or if the Service Code field is not 13.

15) The Coastal warning area is a single alpha character field and has a range from A to Z. This is the second field (third character) from the transmitted message's "4 alphanumeric coastal warning area address X1X2B1B2". This field shall null if there is an error in the received Coastal warning area due to satellite radio link interference or if the Service Code field is not 13. The coastal warning area associated with this character field is defined in the "MASTER PLAN OF SHORE-BASED FACILITIES FOR THE GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS MASTER PLAN)", (IMO GMDSS.1/Circ.14).

16) The Coastal warning subject indicator is a single alpha character field and has a range from A to Z. This is the third field (fourth character) from the transmitted message's "4 alphanumeric coastal warning area address X1X2B1B2". This field shall null if there is an error in the received subject indicator due to satellite radio link interference or if the Service Code field is not 13.

A = Navigational warnings

B = Meteorological warnings

C = Ice reports

D = Search and rescue information, and acts of piracy warnings

E = Meteorological forecasts

F = Pilot service messages

G = AIS

H = LORAN messages

I = not used

J = SATNAV messages

K = Other electronic navaid messages

L = Other Navigational warnings – additional to subject indicator code (c_2) of A

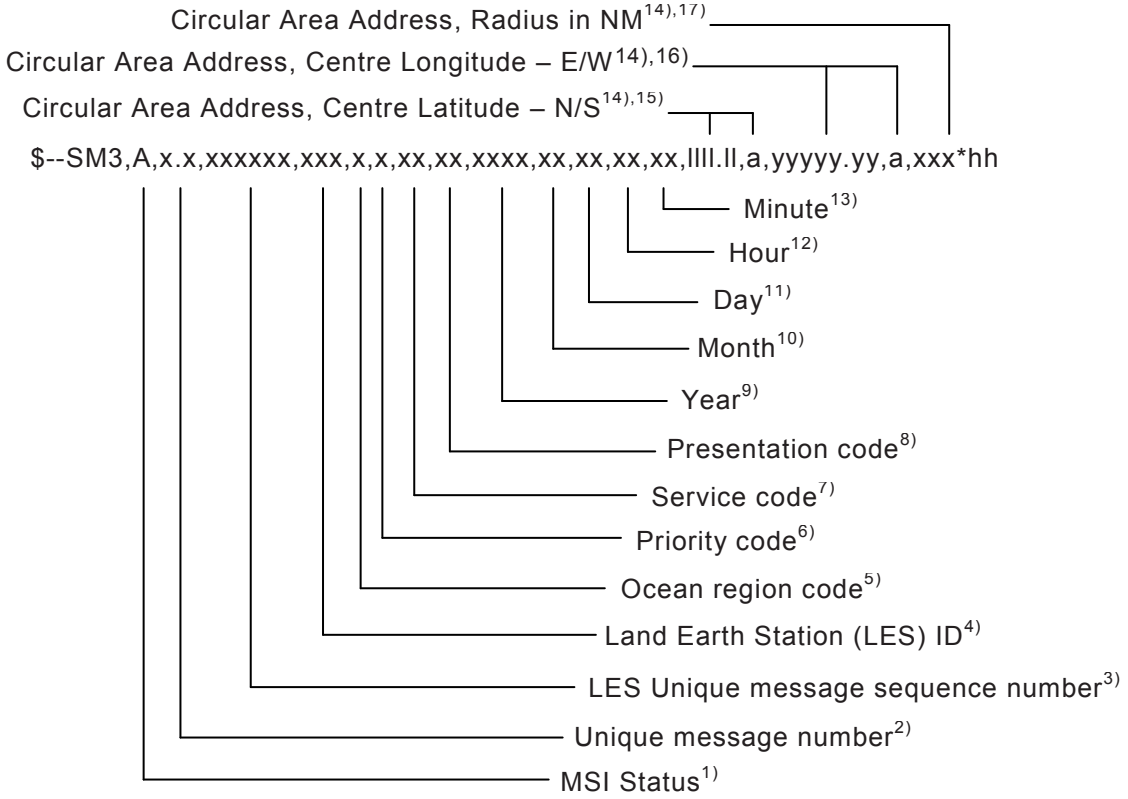
V, W, X, Y = Special services allocation by the International SafetyNET Panel

Z = No messages on hand

U.4 SM3 – SafetyNET Message, Circular Area Address

The SM3 sentence is used to report MSI messages containing a shore-to-ship distress alert, or navigational, meteorological, or piracy warning, or SAR coordination to a circular area as described in comments 14, 15, 16, and 17 below, based upon the MSI Service Code values of either fourteen (14), twenty-four (24) or forty-four (44).

This SM3 sentence contains qualifying information related to the MSI message body in the corresponding SMB sentence(s). This includes the identification of the source of the MSI message, purpose and scope of the MSI message, and date/time of receipt. One or more SMB sentences shall always follow this sentence. This sentence and related SMB sentences are linked by the Unique Message number generated by the receiving EGC Terminal data field included in both sentences.



Comments:

1) The MSI Status field confirms if the entire Marine Safety Information Message has been or has not been correctly and completely received by the EGC Terminal.

   A = MSI Message complete: all data fields in this sentence and associated SMB sentences are complete and valid.

   V = MSI Message not complete: some data fields in this sentence may be null or set to an unknown state, or some characters within the MSI message body within the associated SMB sentences may be represented by the underscore "_" character.

2) This data field contains the Unique Message Number generated by the receiving EGC Terminal, sometimes referred to as a Mobile Earth Station (MES) or Ship Earth Station (SES). This is a variable length integer value with no decimal place or decimal digits. The maximum size of this field is 6 digits. This same data field is contained in the SMB sentence. This field shall not be null.

3) The Unique Message Sequence Number is assigned by the Land Earth Station (LES) originating this MSI message. This field is always 6 fixed digits, requiring zero fill if the value from received from the LES contains less than 6 digits. For example, if the LES broadcast a 5 digit number "10345", it would be represented in this data field as "010345", both having the same numeric value. If any portion of the Unique Message Sequence Number is received in error (i.e. due to satellite radio link interference) or unknown by the EGC Terminal, then this field shall be null.

4) This field contains the 3-digit numeric ID of the LES that originated this MSI message. This field is always 3 fixed digits, requiring zero fill if the value from received from the LES contains less than 3 digits. If any portion of the LES ID is received in error (i.e. due to satellite radio link interference) or unknown by the EGC Terminal, then this field shall be null.

5) Ocean Region code. This field shall not be null.

   0 = Atlantic Ocean Region – West

   1 = Atlantic Ocean Region – East

   2 = Pacific Ocean Region

   3 = Indian Ocean Region

4 – 7 = Reserved

8 = Unknown

9 = All ocean regions

6) Priority code of the MSI message. This field shall not be null.

1 = Safety

2 = Urgency

3 = Distress

4 -8 = Reserved

9 = Unknown

7) The fixed two-digit Service code identifies the type of this MSI message and corresponds to a circular area address (see comments 14), 15), 16), and 17)). This field is set to null for all other Service Code values.

Service Code	Type of service
14	Shore-to-Ship Distress Alert to a circular area
24	Navigational, Meteorological, or Piracy warning to a circular area
44	SAR Coordination to a circular area

8) The Presentation code is a fixed two-digit numeric value that defines the language to be used for presentation of this MSI message. Current definitions are provided below.

Presentation Code Value	Language
00	International Alphabet Number 5

9) Year of message reception UTC (4 fixed digits).

10) Month of message reception UTC (2 fixed digits, 01 to 12).

11) Day of message reception UTC (2 fixed digits, 01 to 31).

12) Hour of message reception UTC (2 fixed digits, 00 to 23).

13) Minute of message reception UTC (2 fixed digits, 00 to 59).

14) The Circular Area Address within an Inmarsat-C transmitted MSI message is a fixed ten-digit field consisting of eight-numeric digits and two-alpha digits. Example: A circle centered at latitude of 56°N and longitude of 34°W with a radius of 35 nautical miles is represented as “56N034W035” from the form “D1D2LaD3D4D5LoR1R2R3” (See IMO International SafetyNET Manual). Comments 15 – 17 describe how this information is apportioned to standard IEC 61162 data fields.

15) The Centre Latitude and latitude direction (N/S) is from the first three characters of the transmitted Circular Area Address, “D1D2LaD3D4D5LoR1R2R3”. This is a fixed length field containing two digits of latitude in units of degrees, with the two digit minutes portion set to zeros and no decimal place or decimal minutes. A value of 56º N would be represented as “5600,N” in the sentence. Leading zeros are required when the latitude value is between 0 and 9 degrees. This field shall null if there is an error in the received Centre Latitude due to satellite radio link interference or if the Service Code field is not 14, 24, or 44.

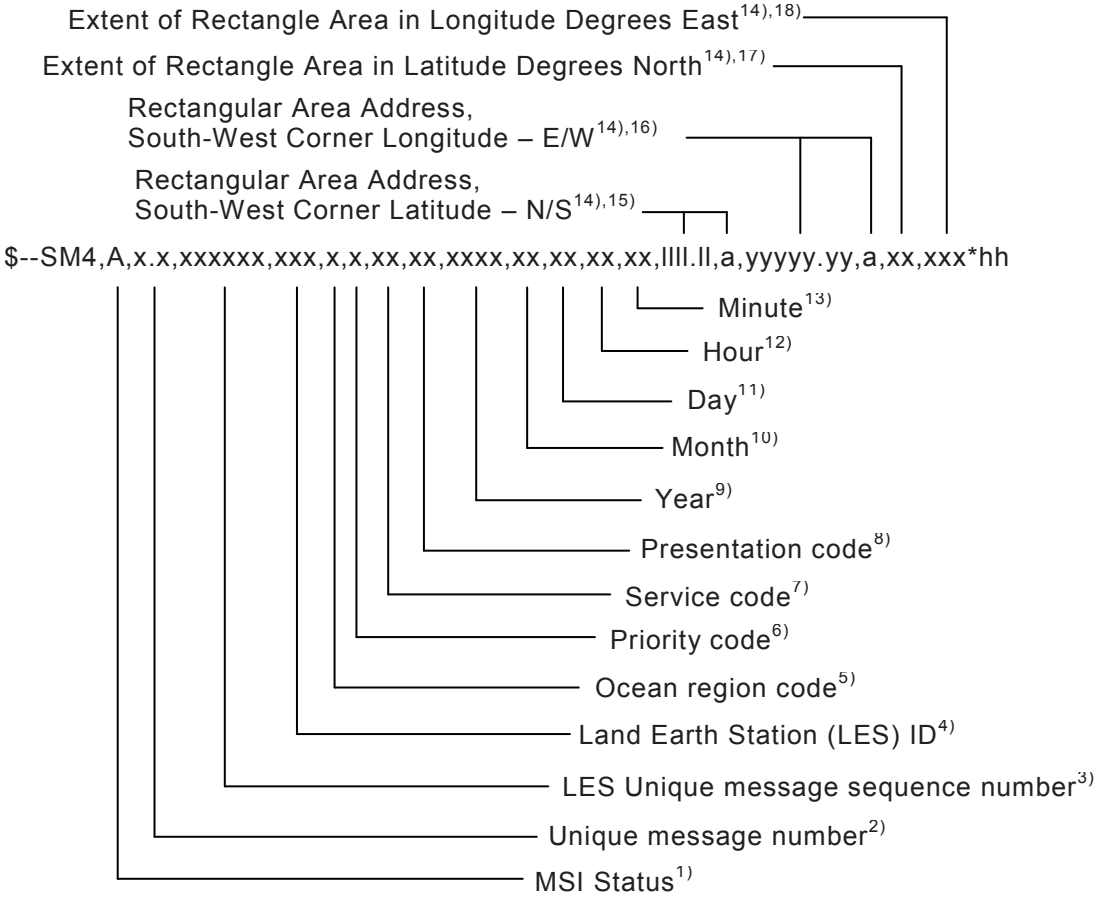
16) The Centre Longitude and longitude direction (W/E) is from the fourth through seventh characters of the transmitted Circular Area Address, “D1D2LaD3D4D5LoR1R2R3”. This is a fixed length field containing three digits of longitude in units of degrees, with the two digit minutes portion set to zeros and no decimal place or decimal minutes. A value of 34º W would be represented as “03400,W” in the sentence. Leading zero(s) are required when the longitude value is between 0 and 99 degrees. This field shall null if there is an error in the received Centre Longitude due to satellite radio link interference or if the Service Code field is not 14, 24, or 44.

17) The Radius is from the last three characters of the transmitted Circular Area Address, “D1D2LaD3D4D5LoR1R2R3”. This is a three digit fixed length numeric field containing the radius in units of nautical miles A value of 035 would be represented as “035” in the sentence. Leading zero(s) are required when the radius value is between 0 and 99 degrees. The maximum value for this field is 999 miles. This field shall null if there is an error in the received Radius due to satellite radio link interference or if the Service Code field is not 14, 24, or 44.

U.5 SM4 – SafetyNET Message, Rectangular Area Address

The SM4 sentence is used to report MSI messages containing navigational, meteorological, or piracy warning, or SAR coordination to a rectangular area as described in comments 14), 15), 16), 17), and 18) below, based upon the MSI Service Code values of either four (4), or thirty-four (34).

This SM4 sentence contains qualifying information related to the MSI message body in the corresponding SMB sentence(s). This includes the identification of the source of the MSI message, purpose and scope of the MSI message, and date/time of receipt. One or more SMB sentences shall always follow this sentence. This sentence and related SMB sentences are linked by the Unique Message number generated by the receiving EGC Terminal data field included in both sentences.



Comments:

1) The MSI Status field confirms if the entire Marine Safety Information Message has been or has not been correctly and completely received by the EGC Terminal.

   A = MSI Message complete: all data fields in this sentence and associated SMB sentences are complete and valid.

   V = MSI Message not complete: some data fields in this sentence may be null or set to an unknown state, or some characters within the MSI message body within the associated SMB sentences may be represented by the underscore "_" character.

2) This data field contains the Unique Message Number generated by the receiving EGC Terminal, sometimes referred to as a Mobile Earth Station (MES) or Ship Earth Station (SES). This is a variable length integer value with no decimal place or decimal digits. The maximum size of this field is 6 digits. This same data field is contained in the SMB sentence. This field shall not be null.

3) The Unique Message Sequence Number is assigned by the Land Earth Station (LES) originating this MSI message. This field is always 6 fixed digits, requiring zero fill if the value from received from the LES contains less than 6 digits. For example, if the LES broadcast a 5 digit number "10345", it would be represented in this data field as "010345", both having the same numeric value. If any portion of the Unique Message Sequence Number is received in error (i.e. due to satellite radio link interference) or unknown by the EGC Terminal, then this field shall be null.

4) This field contains the 3-digit numeric ID of the LES that originated this MSI message. This field is always 3 fixed digits, requiring zero fill if the value from received from the LES contains less than 3 digits. If any portion of the LES ID is received in error (i.e. due to satellite radio link interference) or unknown by the EGC Terminal, then this field shall be null.

5) Ocean Region code. This field shall not be null.

   0 = Atlantic Ocean Region – West

   1 = Atlantic Ocean Region – East

2 = Pacific Ocean Region

3 = Indian Ocean Region

4 – 7 = Reserved

8 = Unknown

9 = All ocean regions

6) Priority code of the MSI message. This field shall not be null.

1 = Safety

2 = Urgency

3 = Distress

4 -8 = Reserved

9 = Unknown

7) The fixed two-digit Service code identifies the type of this MSI message and corresponds to a rectangular area address (see comments 14, 15, 16, 17, and 18). This field is set to null for all other Service Code values.

Service Code	Type of service
04	Navigational, Meteorological, or Piracy warning to a rectangular area
34	SAR Coordination to a rectangular area

8) The Presentation code is a fixed two-digit numeric value that defines the language to be used for presentation of this MSI message. Current definitions are provided below.

Presentation Code Value	Language
00	International Alphabet Number 5.

9) Year of message reception UTC (4 fixed digits).

10) Month of message reception UTC (2 fixed digits, 01 to 12).

11) Day of message reception UTC (2 fixed digits, 01 to 31).

12) Hour of message reception UTC (2 fixed digits, 00 to 23).

13) Minute of message reception UTC (2 fixed digits, 00 to 59).

14) The Rectangular Area Address within an Inmarsat-C transmitted MSI message is a fixed twelve-digit field consisting of ten-numeric digits and two-alpha digits. Example: a rectangle whose south-west corner is 60º N and 010º W, extending 30º north and 25º east, is coded as: 60N010W30025 from the form “D1D2LaD3D4D5LoD6D7D8D9D10” (See IMO, International SafetyNET Manual). Comments 15 – 18 describe how this information is apportioned to standard IEC 61162 data fields.

15) The South-West Corner Latitude and latitude direction (N/S) is from the first three characters of the transmitted Rectangular Area Address, “D1D2LaD3D4D5LoD6D7D8D9D10”. This is a fixed length field containing two digits of latitude in units of degrees, with the two digit minutes portion set to zeros and no decimal place or decimal minutes. A value of 60º N would be represented as “6000,N” in the sentence. Leading zero(s) are required when the latitude value is between 0 and 9 degrees. This field shall null if there is an error in the received South-West Corner Latitude due to satellite radio link interference or if the Service Code field is not 04 or 34.

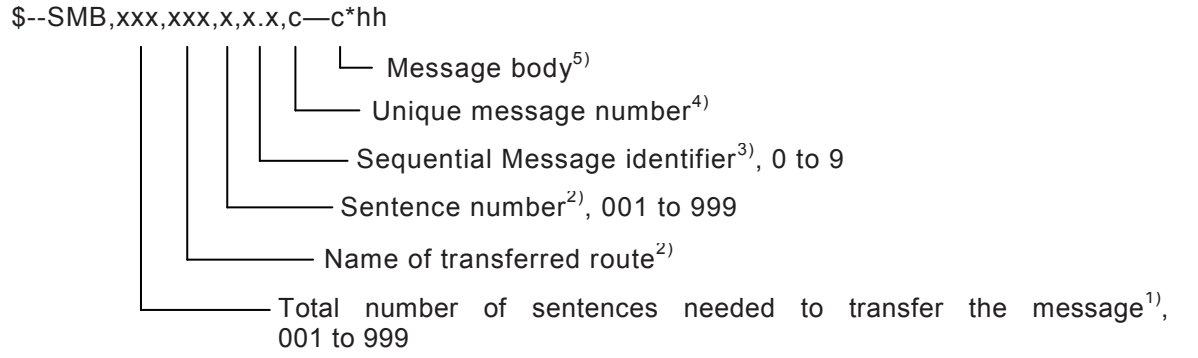
16) The South-West Corner Longitude and longitude direction (W/E) is from the fourth through seventh characters of the transmitted Rectangular Area Address, “D1D2LaD3D4D5LoD6D7D8D9D10”. This is a fixed length field containing three digits of latitude in units of degrees, with the two digit minutes portion set to zeros and no decimal place or decimal minutes. A value of 10º W would be represented as “01000,W” in the sentence. Leading zero(s) are required when the longitude value is between 0 and 99 degrees. This field shall null if there is an error in the received South-West Corner Longitude due to satellite radio link interference or if the Service Code field is not 04 or 34.

17) The Extent of Rectangle Area in Latitude Degrees is from the eighth and ninth characters of the transmitted Rectangular Area Address, “D1D2LaD3D4D5LoD6D7D8D9D10”. This is a fixed length field containing two digits of latitude in units of degrees North. A value of 30º would be represented as “30” in the sentence. Leading zero(s) are required when the latitude value is between 0 and 9 degrees. This field shall null if there is an error in the received Extent of Rectangle Area in Latitude Degrees due to satellite radio link interference or if the Service Code field is not 04 or 34.

18) The Extent of Rectangle Area in Longitude Degrees is from the last three characters of the transmitted Rectangular Area Address, “D1D2LaD3D4D5LoD6D7D8D9D10”. This is a fixed length field containing three digits of longitude in units of degrees East. A value of 25º would be represented as “025” in the sentence. Leading zero(s) are required when the longitude value is between 0 and 99 degrees. This field shall null if there is an error in the received Extent of Rectangle Area in Longitude Degrees due to satellite radio link interference or if the Service Code field is not 04 or 34.

U.6 SMB – IMO SafetyNET Message Body

The SMB sentence(s) contains the MSI message body related to the qualifying information in the preceding SM1, or SM2, or SM3, or SM4 sentence. This includes the identification of the source of the MSI message, purpose and scope of the MSI message, and date/time of receipt. One or more SMB sentences shall always follow a SM1, or SM2, or SM3, or SM4 sentence. The SM1, or SM2, or SM3, or SM4 sentence and related SMB sentence(s) are linked by the Unique Message number generated by the receiving EGC Terminal data field included in both sentences.



Comments:

1) The total number of sentences field contains the number of sentences used for a MSI message, minimum value “001”. This field cannot be null.

2) The sentence number field identifies which sentence number this specific SMB sentence is within the group of sentences that make up the MSI message, minimum value “001”. This field may be null only when the “total number of sentences” field is “001” and no additional sentences are need to convey this MSI message.

3) The sequential message identifier field is critical to identifying groups of 2 or more sentences that make up this multi-sentence message. This field is incremented each time a new multi-sentence message is generated with the same sentence formatter. This field’s value is reset to zero when it is incremented beyond the maximum value of nine. (range 0..9). This field may be null only when the “total number of sentences” field is “001” and no additional sentences are need to convey this MSI message.

4) This data field contains the Unique Message Number generated by the receiving EGC Terminal, sometimes referred to as a Mobile Earth Station (MES) or Ship Earth Station (SES). This is a variable length integer value with no decimal place or decimal digits. This field cannot be null.

5) The Message body contains ASCII characters, and code delimiters if needed, up to the maximum permitted sentence length. Field four, the “Unique Message Number”, is variable length field usually containing six digits. When field four contains six digits, the message body may contain up to 53 characters including any code delimiters. Characters of the MSI message text shall be represented as underscore “_” if they are unknown or received in error by the EGC terminal (i.e. due to satellite radio link interference). The table below provides the allowable number of characters in this field based upon the number of digits in the Unique Message Number.

Unique Message Number Field Size (digits)	Message Body Field Size (characters)
1	58
2	57
3	56
4	55
5	54
6	53
7, 8, 9	52, 51, 50

U.7 An example of use

The example shows a typical MSI message received by an EGC Terminal at 1430 on April 5th, 2012, and distributed by the SMB sentence.

<start of example>

LES 798 – MSG 5213 – **Distress Alert** to Area: 34N 76W 300
FROM: Maritime Rescue Coordination Centre xxx
TO: ALL SHIPS IN xxxxxxx
SAR SITREP NO: 02
FISHING BOAT 'xxx' WITH THREE PERSONS ON BOARD DEPARTED FROM xxx ISLAND ON xxx AT NOONTIME AND SINCE THEN NO INFORMATION ABOUT HER. PARTICULARS ...
SHIPS SAILING IN VICINITY ARE KINDLY REQUESTED TO KEEP A SHARP LOOK OUT
INFORMING MRCC
REGARDS
DUTY OFFICER

<end of example>

Inspecting the corresponding SM3 and SMB sentences would typically show:

```
$CSSM3,123456,005213,798,0,3,14,00,2012,04,05,14,30,3400,N,076,W,300*hh
$CSSMB,008,001,0,123456,FROM:Maritime Rescue Coordination Centre xxx^0D^0ATO:*hh
$CSSMB,008,002,0,123456, ALL SHIPS IN xxxxxxx^0D^0ASAR SITREP NO: 02^0D^0AFIS*hh
$CSSMB,008,003,0,123456,HING BOAT 'xxx' WITH THREE PERSONS ON BOARD DEPARRTED*hh
$CSSMB,008,004,0,123456, FROM xxx ISLAND ON^0D^0Axxx AT NOONTIME AND SINCE TH*hh
$CSSMB,008,005,0,123456,EN NO INFORMATION ABOUT HER. PARTICULARS ...^0D^0ASHI*hh
$CSSMB,008,006,0,123456,PS SAILING IN VICINITY ARE KINDLY REQUESTED TO KEEP A*hh
$CSSMB,008,007,0,123456, SHARP LOOK OUT^0D^0AINFORMING MRCC^0D^0AREGARDS^0D*hh
$CSSMB,008,008,0,123456,^0A     DUTY OFFICER*hh
```

Annex V
(normative)

Extension of TTD sentence, Protocol version 1

V.1 General

Refer to IEC 61162-1 for a possible later version of this sentence.

IEC 61162-1 includes the TTD sentence and defines protocol version 0. Protocol versions 1, 2 and 3 are left for future modifications. This annex defines protocol version 1 for the TTD sentence which includes information for CPA and TCPA.

V.2 TTD – Tracked target data, Protocol version 1

Parameter	Number of bits	Range and resolution	Description
Protocol version	2	0 to 3	The protocol version shall always be set to one (1) for the structure defined below. Value zero (0) is defined in IEC 61162-1. Other values (2 and 3) are reserved for future modification of this structure.
Target number	10	0 to 1 023	The target number associated with the label with corresponding number. Target number zero is reserved for no tracking target.
CPA	14	to 163,83 NM Step 0,01 NM	CPA of target 163,84 min = invalid or N/A data
TCPA	14	From + 81,91 min to -81,91 min Step 0,01 min	Time to CPA of target, "-" increasing + 81,92 NM = invalid or N/A data
Parameter = Reserved	2		Reserved for future use Always set to zero
TOTAL	42		42/6 = 7 characters
N/A Not available			

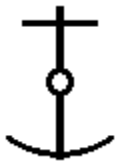
Annex W
(normative)

Symbols

Refer to IEC 62288 for a possible later version of these symbols.

IEC 62288 defines the symbols used in ECDIS. Table W.1 defines a symbol not yet available in IEC 62288.

Table W.1 – Anchor watch symbol

Description	Symbol(s)
Anchor watch Centre of the swing circle shall be presented as an anchor symbol. The height of the symbol shall be not more than 8 mm. The centre of the symbols shall have an open circle of not more than 2 mm. The symbol shall be drawn using a thick solid line style. The colour shall be distinguishable from similar charted symbols. The swing circle symbol shall use the same colour.	

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