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Working Party on Inland Water Transport

Working Party on the Standardization of Technical and Safety Requirements in Inland Navigation

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Item 9 (b) of the provisional agenda

Promotion of River Information Services and other Information and Communication Technologies in inland navigation:

Recommendation on electronic chart display and information system for inland navigation (resolution No. 48, revision 3)

Consolidated version of amendments to the Recommendation on electronic chart display and information system for inland navigation (resolution No. 48, revision 3)

Annex to Resolution. No. 48

Recommendation on Electronic Chart Display and Information System for Inland Navigation (Inland ECDIS)

- A. Preface¹**
- B. Structure of the technical specifications for Inland ECDIS²**
- C. Comparison of the structures of the standard for (Maritime) ECDIS
and of the technical specifications for Inland ECDIS**

¹ *Note by the secretariat:* the Working Party may wish to update the preface to the Annex to resolution No. 48 based on recent developments.

² *Note by the secretariat:* the Working Party may wish to delete or update Parts B and C of the Annex to resolution No. 48, keeping in mind that a reference to these parts is included in paragraph 10 of the preface.

D Technical Specifications for Electronic Chart Display and Information System for Inland Navigation (Inland ECDIS) (Edition 2.4)

Section 1: Performance Standard for Inland ECDIS

1. General Provisions Introduction

(a) Electronic chart display and information system for inland navigation (Inland ECDIS) is composed of hardware, software for the operating system and application software; ~~Inland ECDIS contributes to safety and efficiency of inland shipping and thereby to the protection of the environment;~~

(b) ~~Inland ECDIS aims to contribute to safety and efficiency of inland shipping and thereby to the protection of the environment; Inland ECDIS reduces the navigational workload as compared to traditional navigation and information methods;~~

(c) Inland ECDIS can be designed for both information mode and navigation mode⁴ or for information mode only;

The minimum requirements for Inland ECDIS equipment designed for information mode only, specified in chapter 4.1 of section 1 and section 4 of this Annex, are mandatory on waterways where carriage requirements are enacted by the responsible legislative organs. In other regions they are recommended;

(d) ~~For the navigation mode of Inland ECDIS (Operating System Software, Application Software and Hardware) as specified in Sectionsection 4 of these technical specificationsthis annex must, Inland ECDIS (Operating System Software, Application Software and Hardware) must have a high level of reliability and availability; at least of the same level as other means of navigation;~~

(e) Inland ECDIS must use chart information as specified in ~~Sectionssections~~ 2 and 3 of ~~these technical specificationsthis annex;~~

~~——(f) Inland ECDIS must facilitate simple and reliable updating of the Inland Electronic Navigational Chart;~~

(f) National authorities and international bodies are recommended to consider transitional provisions when they are introducing carriage requirements for Inland ECDIS;

(g) ~~Inland ECDIS must provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment;~~

~~——(h) Inland ECDIS must meet the requirements of this performance standard.~~

(h) The terms "skipper" and "boatmaster" used in this annex must shall be deemed to be equivalent with the term "ship master" used in the Guidelines and recommendations for River Information Services (resolution No. 57) [and RIS Guidelines - Commission Regulation (EC) No. 414/2007];

(i) The producer or supplier of Inland ECDIS software must document in the user manual of the software which requirements for equipment (hardware) referred to

⁴ ~~On wide inland waterways, Basin Administration may waive the requirement concerning the differentiation between the "navigation mode" and "information mode" of usage of Inland ECDIS, just as it is the case in the IHO Standard S-52.~~

(i) The producer or supplier of Inland ECDIS software must document in the user manual of the software which requirements for equipment (hardware) referred to in IHO Special Publication S-52, "Specifications for Chart Content and Display Aspects of ECDIS", 6th Edition, March 2010, need to be fulfilled for Inland ECDIS in information mode on waterways where carriage requirements are enacted by the responsible legislative organs;

[(j) When the Inland ECDIS equipment provides essential services as defined in Directive (EU) 2016/1148 concerning measures for a high common level of security of network and information systems across the Union, the provisions of the said legislation apply];

(k) AIS is an automatic identification system for maritime vessels that complies with the technical and performance standards laid down in Chapter V of the International Convention for the Safety of Life at Sea, 1974 (SOLAS), as defined in the Guidelines and Recommendations for River Information Services (resolution No. 57). Inland AIS refers to the automatic identification system for inland waterway vessels as set out in the International Standard for Tracking and Tracing on Inland Waterways (VTT) (resolution No. 63). In this annex, whenever AIS is mentioned, it refers to both maritime AIS and Inland AIS, unless specified otherwise.

References

(a) IHO Special Publication No. S-57, "IHO Transfer Standard for Digital Hydrographic Data", Edition 3.1, ~~including~~ Supplement No. 2, June 2009 **with all Appendices and Annexes**;

(b) IHO Special Publication No. S-62, "ENC Producer Codes", Edition 2.5, December 2009;

(c) IHO Special Publication No. S-52, "Specifications for Chart Content and Display Aspects of ECDIS", 6th Edition-6, March 2010, **with all Appendices and Annexes**, including (hereafter S-52)

- S-52 Appendix 1 "Guidance on Updating the Electronic Navigational Chart", Edition 4.0, April 2012;
- Former S-52 Appendix 2 "Colours and Symbols Specifications", Edition 4.3 (January 2008)
- Former S-52 Appendix 3 "Glossary of ECDIS-related Terms Specifications" (now S-32, Appendix 1 (September 2007))
- Annex A to former S-52, Appendix 2, "Presentation Library", Edition 3.4 (2008);

(d) IMO Resolution MSC.232(82) "Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS)", December 2006, **Appendix 3 "Navigational elements and parameters"**

(e) International Standard IEC 61174, edition 3.0 "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", 2008;

(f) ~~EU Directive 2006/87/EC as amended by 2013/49/EU and Article 7.06 and Annex M-5, Sections I to III of the Rhine Vessel Inspection Regulation~~ **European Standard laying down technical requirements – Technical Requirements for inland waterway Inland Navigation vessels, Annex IX, Parts III to VI, " Edition 2017 (ES-TRIN**

2017): Requirements applicable to ~~signal lights~~, radar installations and rate-of-turn indicators”;

(g) IHO Special Publication S-32, Appendix 1 “Hydrographic Dictionary – Glossary of ECDIS-related Terms”;

(h) ~~ENIEC~~ 60945 (2002) and Corr.1 (~~2010~~2008): Marine navigational equipment; General requirements – Methods of testing and required test results;

~~(i) DC Recommendations on the main technical and operational parameters for the radar installations used for the navigation on the Danube, CD/SES 60/10, Budapest, 2003;~~

~~(j) UNECE Resolution No.~~ (i) Resolution No. 61, revised, “Recommendations on Harmonized Europe-Wide Technical Requirements for Inland Navigation Vessels”, Appendix 7, Part III “General technical specifications applicable to radar equipment” (ECE/TRANS/SC.3/172/Rev.1 and Amends. 1 and 2);

~~(k) UNECE~~ (lj) International standard IEC 61162, “Maritime navigation and radiocommunication equipment and systems – Digital interfaces”;

(k) IENC Domain in the S-100 Geospatial Information Registry;

(l) IEHG Product Specification for Inland ENC’s;

(m) IEHG Inland ENC Feature Catalogue;

(n) International Standard for Tracking and Tracing on Inland Waterways (VTT) (resolution No. 63);

(o) Annex II of Directive 2016/1629 of the European Parliament and of the Council of 14 September 2016 laying down technical requirements for inland waterway vessels;

(p) Resolution No. 57, revised, “Guidelines and Recommendations for River Information Services” (ECE/TRANS/SC.3/165/Rev.1).

Contents, Provision and Updating of Chart Information

Contents and Provision of Inland ~~ENCs~~ Electronic Navigational Charts (Inland ENC’s) and Bathymetric Inland ENC’s

(a) The chart information to be used in Inland ECDIS ~~must~~shall be the latest edition of information;

(b) Provisions ~~must~~shall be made to prevent the user from altering the contents of original Inland ENC and bathymetric Inland ENC editions;

(c) At least the following features ~~must~~shall be included in the Inland ENC:

- waterway axis with kilometres and hectometres or miles indication
- links to the external xml-files with operation times of restricting structures, in particular, locks and bridges
- location of ports and transshipment sites
- reference data for water level gauges relevant to navigation
- bank of waterway (at mean water level)
- ~~shoreline construction (e.g. bank of waterway (at mean water level))~~

- ~~shoreline construction (e.g. groyne, longitudinal control dam, training wall — any facility that is considered a hazard to navigation)~~
- contours of locks and dams
- boundaries of the fairway/navigation channel (if defined)
- isolated dangers in the fairway/navigation channel under water
- isolated dangers in the fairway/navigation channel above water level, such as bridges, overhead cables, etc.
- official aids-to-navigation (e.g. buoys, beacons, lights, notice marks)

~~• waterway axis with kilometres and hectometres or miles~~

~~• location of ports and transshipment sites~~

~~• reference data for water level gauges relevant to navigation~~

~~• links to the external xml files with operation times of restricting structures, in particular locks and bridges.~~

If the chart producer is using overlay files or bathymetric Inland ENC's the features ~~can~~ may be included in different cells, but the whole package ~~has to~~ must fulfil the minimum requirements **listed in the indents above**;

(d) ~~If~~ Where the chart is intended to be used for navigation mode, (**chapter 5.2 of this section**), the respective competent authority ~~decides~~ shall **decide** for each waterway or harbour ~~within its geographical area of responsibility~~ which of the ~~above named~~ features **referred to in point (c)** are to be verified. ~~The~~ After verification, the respective competent authority must declare which Inland ENC's and bathymetric Inland ENC's are approved for navigation mode within its geographical area of responsibility;² (**for details, see section 2A of this annex**);

(e) The System Electronic Navigational Chart (SENC) shall be stored in the Inland ECDIS.

3.2 Updates

(a) Inland ECDIS shall be capable of accepting updates to the Inland ENC data provided in conformity with the Product Specification for Inland ENC's and updates of the depth information provided in conformity with the Product Specification for bathymetric Inland ENC's. ~~These updates must be applied to the Inland SENC automatically. The implementation procedure of the update must not interfere with the display in use;~~

(b) Inland ECDIS must allow **for the** display of updates, so that the skipper may review their contents and ascertain that they have been included in the Inland SENC;

(c) Inland ECDIS must be capable of revoking automatically applied updates of the Inland ENC data;

(d) Original Inland ENC editions and later updates must never be merged;

(e) The Inland ENC and all updates to it must be displayed without any degradation of their information content;

(f) The Inland ENC data and updates to it must be clearly distinguishable from other information;

² For further details see Section 2a of these technical specifications.

(g) Inland ECDIS must ensure that the Inland ENC and all updates to it have been correctly loaded into the Inland SENC;

(h) Inland ECDIS must keep a record of updates, including the time of application to the Inland SENC;

(i) The contents of the Inland-SENC to be used must be adequate and up-to-date for the intended voyage.

4. Presentation of Information

4.1 Display Requirements ~~and Recommendations~~

(a) The display method must ensure that the displayed information is clearly visible to more than one observer in the typical conditions of light experienced in the wheelhouse of a vessel by day and night;

(b) ~~The~~**In navigation mode, the** display size of the chart presentation must be at least 270 mm by 270 mm for equipment designed and admitted for the navigation mode-;

(c) In information mode, ergonomic aspects must determine the size. The information displayed must be readily visible from the conning position:

The display diagonal shall be equal to or larger than 199 mm (7.85 inch). Under all conditions the boatmaster must be capable of perceiving the displayed information sufficiently in accordance with the Human Machine Interface guidelines.

If the software is sold without a display, the manufacturer's documentation shall include the information that it may only be used as Inland ECDIS in information mode if the display fulfils the requirements of this chapter 4.1.

(d) **The following criteria must be fulfilled in navigation mode as well as in information mode:**

- alphanumeric data and text ~~should~~**must** be presented using a clearly legible non-italic, sans-serif font
- the font size shall be appropriate for the viewing distance from user positions (i.e. with respect to reading distance and viewing angles) likely to be experienced in the wheelhouse of a vessel
- the character height and the size of AIS symbols in millimetres shall not be less than 3.5 times the nominal viewing distance in metres
- the minimum size of AIS symbols and the minimum character height of AIS information should be 3.5 mm
- the manufacturer's documentation shall identify the nominal viewing distance for the display equipment

(e) **The display requirements shall be complied with, whether in landscape or in portrait format.**

• (f) **In information mode for the size of the display it is recommended to use the size as specified for navigation mode ~~in this standard~~. In case the event that space for the installation of the display is an issue a problem, the display size might be reduced taking into account the nominal viewing distance for the display. ~~In any case, the display diagonal may not be smaller than 199 mm (7.85 inch). Under all conditions the shipmaster must be capable to perceive the displayed information sufficiently~~**

~~• if the software is sold without display the manufacturer's documentation shall include the information that it may only be used as Inland ECDIS in Information mode if the display fulfils the requirements of this chapter 4.1.~~

~~(c) The display requirements must be met whether in landscape or in portrait format.~~

4.2 Display Ranges (Scales)

(a) In information mode,² ~~it is recommended (refer to use the same ranges as specified in navigation mode. All~~ chapter 5.1 of this section), all scales and ranges are ~~allowed~~ permitted;

(b) In navigation mode,⁴ (refer to chapter 5.2 of this section), only the successive switchable ranges (scales) specified in ~~Section~~ section 4, ~~Chapter~~ chapter 4.7 of ~~these technical specifications~~ this annex are ~~allowed~~ permitted.

4.3 Image Positioning and Orientation

(a) In information mode all kinds of chart orientation are ~~allowed~~³ permitted; (see chapter 5.1 of this section);

(b) In navigation mode the chart ~~must~~ shall be automatically positioned and oriented in the relative motion, head-up orientation with the own vessel's position in the screen centre or off-centred,^{4,5} (see chapter 5.2 of this section).

4.4 Display of Inland SENC Information

(a) The display of Inland SENC information ~~must~~ shall be divided into the following three display categories:

~~• display Base~~

• ~~standard~~ Display Base

• ~~all~~ Standard Display (Standard Information Density)

• All Display.

The allocation of the feature classes to the display categories is given in detail in the "Look-up Tables" of the document referred to in Appendix 2, "Status of the Presentation Library for Inland ECDIS", of ~~these technical specifications~~ this annex.

(b) The Display Base category must contain at least the following features:

- bank of waterway (at mean water level)
- shoreline construction (e.g. groyne, longitudinal control dam, training wall — any facility that is considered a hazard to navigation)
- contours of locks and dams
- boundaries of the fairway/navigation channel (if defined)
- isolated dangers in the fairway/navigation channel under water

² See Chapter 5.1 of this Section.

⁴ See Chapter 5.2 of this Section.

⁵ On wide inland waterways, Basin Administration may allow the true motion and north up orientation of the picture.

- isolated dangers in the fairway/navigation channel above water level, such as bridges, overhead wires, etc.
 - official aids-to-navigation (e.g. buoys, lights and beacons).
- (c) The Standard Display category must contain at least the following features:
- the objects of Display Base category
 - prohibited and restricted areas
 - piers for commercial vessels (cargo and passenger)
 - kilometre and hectometre or mile marks on the banks.
- (d) The All Display category must display all features that are contained in the Inland SENC, individually on demand;
- (e) When ~~invoking~~**starting** the Inland ECDIS, it must come up with the Standard Information Density ~~at an appropriate range available as defined S-52 and the Glossary of Terms in the Inland SENC for the displayed area~~**section 5 of this annex**;
- (f) Inland ECDIS must be switchable to the Standard Information Density at any time by a single operator action;
- (g) Inland ECDIS must clearly indicate the information density ~~currently~~**in use** at all times;
- (h) Time variable depth information in the Inland ENC ~~must~~**shall** be displayed independently of the ~~above-named~~**three display categories, referred to in subparagraph (a).**

4.5 Display of Radar Information

- (a) In navigation mode, the radar image must have the highest display priority and ~~it is~~**must only allowed be permitted** to be presented in the relative motion, head-up mode. If the system is also type approved for maritime ECDIS, true motion and north-up mode may be implemented. ~~If such a system is used in true motion and/or north-up mode on European inland waterways, it is considered to be, but only for working in information mode;~~
- (b) The ~~under-laid~~**underlaid** Inland SENC must match in position, range and orientation. The radar image and the position from the position sensor must both be adjustable for the antenna offset to the conning position;
- (c) The overlaid radar image must conform to the minimum requirements as specified in ~~Section~~**section 4, Chapter**chapter 4.14 of ~~these technical specifications~~**this annex**;
- (d) The overlaid radar image may contain additional navigational information. Any additional navigational information and tracking and tracing symbols must however in no way degrade the display of the original radar content.

4.6 Display of Other Navigational Information

- (a) Inland ECDIS and additional navigational information (**Inland AIS**) must use a common **conventional geodetic coordinate** reference system;
- (b) It ~~must~~**shall** be possible to display the skipper's own vessel's position on the screen;
- (c) It ~~must~~**shall** be possible for the skipper to select safety **depth** limits;

- (d) Inland ECDIS ~~must~~**shall** indicate the falling short of the safety **depth** limits.

4.7 Colours and Symbols

(a) The display of colours and symbols to represent ~~Inland~~ SENC information ~~must comply, shall at least, be able to comply with the regulations of Section 3 of these technical specifications. Other this annex. Additionally, other user-selectable symbol sets are also allowed permitted;~~

(b) To present navigational elements and parameters as listed in ~~the~~ IMO Resolution MSC.232(82), Appendix 3, other colours and symbols than those mentioned in ~~4.7 subparagraph (a) must~~, chapter 4.7 of this section shall be used;

4.8 Data and Display Accuracy

(a) The accuracy of the calculated data that are presented must be independent of the display characteristics and must be consistent with the Inland SENC accuracy;

(b) The Inland ECDIS in navigation mode shall provide an indication whether the display uses a smaller display range than the accuracy of the Inland ENC data offers (over-scale indication);

(c) The accuracy of all calculations performed by Inland ECDIS must be independent of the characteristics of the output device and must be consistent with the Inland SENC accuracy;

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

5. Operation

5.1 Information Mode

(a) Information mode must be used for information only and not for navigation;

(b) In information mode all kinds of chart orientation, rotation, zooming and panning are allowed. However, it is recommended to use the same fixed ranges as in navigation mode and the chart orientation either:

- to north, or
- to the fairway axis at the actual position, or
- to the actual vessels- heading.

(c) It ~~should~~**shall** be possible to scroll the chart manually on the screen with the fairway axis in line with the vertical screen axis;

(d) Inland ECDIS may be connected to a positioning sensor to scroll the chart picture automatically and to display the section of the chart matching the actual surrounding, namely in the operator-selected range;

(e) Information regarding the position and orientation of other vessels, gathered by communication links like AIS, must be displayed only if they are up-to-date (nearly real-time) and accurate. ~~Th~~**if the heading of other vessels is not available, the position and the orientation of other vessels shall not be presented by:**

- a directed triangle, or
- a true outline (to scale)).

~~must not be presented if~~In this case, the heading usage of these other vessels is not available. A generic symbol is recommended.

The following time out values are recommended:⁴ (from IEC 62388):

<i>Category of vessel</i>	<i>Nominal reporting interval class A</i>	<i>Maximum time out value class A</i>	<i>Nominal reporting interval class B</i>	<i>Maximum time out value class B</i>
Vessel at anchor or moored and not moving faster than 3 knots (class B not moving faster than 2 knots)	3 min	18 min	3 min	18 min
Vessel at anchor or moored and moving at more than 3 knots	10 s	60 s	3 min	18 min
Vessel operating in SOLAS mode, moving at 0 to 14 knots	10 s	60 s	30 s	180 s
Vessel operating in SOLAS mode, moving at 0 to 14 knots and changing course	3 1/3 s	60 s	30 s	180 s
Vessel operating in SOLAS mode, moving at 14 to 23- knots	6 s	36 s	30 s	180 s
Vessel operating in SOLAS mode, moving at 14 to 23- knots and changing course	2 s	36 s	30 s	180 s
Vessel operating in SOLAS mode, moving faster than 23 knots	2 s	30 s	30 s	180 s
Vessel operating in SOLAS mode, moving faster than 23 knots and changing course	2 s	30 s	30 s	180 s
Vessel operating in inland waterway mode	2–10 s	60 s	—	—

The AIS targets ~~must~~should be marked as outdated if the position information of moving vessels is older than 30 seconds.

Information on the intention (blue sign) or the number of blue cones of other vessels, the status of signals, weather warnings (EMMA from Meteoalarm: www.meteoalarm.eu) and the water level received via Inland AIS may be displayed. The information on the intention (blue sign) must only be displayed on the right side of the symbol, if the heading of the vessel is available. If no heading information is available, the information must only be displayed in a direction independent form. ~~The following table is providing an example for the display.~~

⁴ — Values taken from IEC 62388.

The following table is providing an example for the display:

Visualization of Blue Sign status 0 to 2 and dangerous goods							
Blue Sign		Not connected or not available		Not set		Set	
Blue cones		no	1 to 3	no	1 to 3	no	1 to 3
Heading	No						
	Symbol						
	True shape						

(f) Information regarding AIS base stations, AIS Aids to Navigation (AtoN) and AIS Search and Rescue Transmitters (SART) may be displayed, if the symbols can be distinguished from other symbols (e.g. symbols 2.10 and 2.11 of IEC 62288 Edition 2, Table A.2);

(g) Information received by an AIS device and required by local police regulations shall be displayed;

(h) It shall be possible to display all information transmitted by an AIS on user request.

2 Navigation Mode

(a) In navigation mode, the Inland ECDIS display must be integrated with the own vessel's own-radar information. The radar information must be clearly distinguishable from the SENC information;

(b) The Integrated Display must be in accordance with the requirements for radar on inland waterways as specified in ~~Section~~section 4, ~~Chapter~~chapter 4.14 of ~~these technical specifications~~this annex;

(c) The chart and the radar image must match in size, position and orientation within the limits as specified in ~~Section~~section 4, ~~Chapter~~chapter 3.4 and 8.3.2 of ~~these technical specifications~~this annex;

(d) The Integrated Display must only be presented in the head-up orientation. Other orientations are permitted in systems with an additional maritime ECDIS type approval. If such a system is used in true motion and/or north-up mode on European inland waterways, it is considered to be working in information mode;⁷

(e) It must be possible for the operator to adjust the off-set values between the positions of the position sensor and the radar antenna of the vessel so that the SENC display matches the radar image;

(f) It must be possible to temporarily remove either the ECDIS or the radar information by a single operator action-temporarily;

⁷ On wide inland waterways, Basin Administration may allow the true motion and north-up orientation of the picture.

(g) The vessel's position must be derived from a continuous positioning system of which the accuracy is consistent with the requirements of safe navigation;

(h) Navigation mode must provide an indication when the input from the position-fixing system is lost-;

Navigation Mode must also repeat, but only as an indication, any alarm or indication passed to it from a position fixing system;

(i) The positioning system and the SENC must be based on the same geodetic datum;

(j) In navigation mode the data ~~according~~**referred to Chapterchapter 3.1 (c)**, first to seventh indent, of this ~~Sectionsection~~**, and the following elements** shall always be visible and shall not be obscured by other objects-:

- **Headline line** (as required by ETSI EN 302 194-1, see Annex 5, Sections I to III of ES-TRIN 2017)
- **Bearing line** (as required by ETSI EN 302 194-1, see Annex 5, Sections I to III of ES-TRIN 2017)
- **Range rings** (as required by ETSI EN 302 194-1, see Annex 5, Sections I to III of ES-TRIN 2017)
- **Navigation lines** (as required by ETSI EN 302 194-1, see Annex 5, Sections I to III of ES-TRIN 2017)
- **P-Lines**
- **Buoys**
- **Inland AIS symbols**
- **Inland AIS labels** (if displayed)
- **AtoN information.**

The transparency of the radar overlay shall, therefore, be user defined. **It shall be possible to switch Inland AIS labels off either manually or on base of a configured timeout value;**

(k) Information regarding the position and orientation of other vessels, gathered by other communication links than the ~~vessel's own radar~~, ~~are permitted to~~**may** be displayed only if they are up-to-date (nearly real-time) and meet the accuracy that is required for the support of tactical and operational navigation. Position information of the own vessel that is received from a repeater station must not be displayed;

(l) As tracking and tracing information (for example, AIS) of other vessels is useful for the planning of the passing, but of no use during passing itself, tracking and tracing (AIS) symbols must not disturb the radar image during passing and must be faded out therefore. Preferably the application must allow the skipper to define the area where the symbol is faded out;

(m) ~~The presentation off the heading of other vessels is available~~, the position and the orientation of other vessels **may be presented** by:

- a directed triangle, or
- a true outline (to scale)).

~~are permitted only if the heading of these other vessels is available.~~ In all other cases a generic symbol must be used (an octagon is recommended, a circle must not be used for applications which are certified according to maritime standards);

(n) Information that another vessel is carrying blue cones or lights may be displayed by a different colour of the vessel symbol. The number of the blue cones/lights must only be displayed in the pick report;

(o) Information on the intention of another vessel to pass on starboard (blue sign) may only be displayed on the right side of the directed triangle symbol or of the scaled shape if the heading of this vessel is available. If no heading information is available, the information must only be displayed in a direction independent form;

(p) Information regarding the position of AIS base stations, AIS ~~Aids-to Navigation (ATON)~~AtoN and AIS Search and Rescue Transmitters (SART) may be displayed, if the symbols can be distinguished from other symbols (e.g. symbols 2.10 and 2.11 of IEC 62288 ~~Ed.~~Edition 2, Table A.1).

5.3 Operation and Control Elements

(a) Inland ECDIS must be designed following ergonomic principles for user-friendly operation;

(b) The Inland ECDIS equipment must have a minimum of operation and control elements in accordance with Section 4 of these technical specifications;

(c) Operation and control elements, and indicators for connected sensors, may be integrated in Inland ECDIS;

(d) Standard settings and user-defined settings must be easily retrievable.

6. Connections with other Equipment

(a) Inland ECDIS must not affect the performance of any connected equipment adversely. Similarly the connection of optional equipment must not degrade the performance of Inland ECDIS;

(b) Inland ECDIS must be capable of generating information to other systems, e.g. for the purpose of electronic reporting;

(c) The relevant requirements of controls and indicators to connected equipment must be fulfilled.

7. Indications and Alarms

7.1 Built-in Test Equipment (BITE)

Inland ECDIS in navigation mode shall be provided with means for carrying out on board tests of major functions either automatically or manually. In case of a failure, the module at fault must be shown.

7.2 Malfunctions

(a) Inland ECDIS in navigation mode shall provide a suitable alarm or indication of system malfunctions;^{*} (refer to chapter 9 of section 4 of this annex);

^{*} See Section 4, Chapter 9 of these technical specifications.

(b) Inland ECDIS in information mode ~~shall~~**must** provide a suitable alarm or indication of missing input from – if connected – ~~GPS~~**GNSS receiver**, AIS and heading device.

8. Fallback Arrangements

8.1 Insufficient Accuracy of the SENC Positioning

In navigation mode, the SENC must be automatically switched off, if the SENC positioning does not match the radar picture within the limits of Section 4, Chapter 5.1 and 5.2 of these technical specifications.⁹

8.2 Defects

(a) If the Inland ECDIS system in navigation mode has an evident defect, it shall provide a suitable alarm;¹⁰

(b) Facilities enabling a safe take-over of the functions of the Inland ECDIS in navigation mode shall be provided in order to ensure that an Inland ECDIS failure does not result in a critical situation.

9. Power Supply in Navigation Mode

——~~The~~ Inland ECDIS must have its own separate, fused power supply.

Section 2: Data Standard for Inland ENC's

1. Introduction

(a) ~~This~~—**The Data Standard for Inland ENC's** describes the technical specifications to be used:

- for the exchange of digital hydrographic data between national inland waterway authorities, and
- ~~or~~**for** its distribution to manufacturers, skippers and other users.

(b) This Data Standard must be used for the production of Inland ENC's and bathymetric Inland ENC's. The transfer and distribution ~~must of Inland ENC's and bathymetric Inland ENC's shall~~ take place in such a way that ~~none of the information data integrity is lost~~**ensured**;

(c) This Data Standard is based on the “IHO Transfer Standard for Digital Hydrographic Data”, Special Publication No. 57, Edition 3.1, Supplement 2, with all Appendices and Annexes (see comparison table in the preface of these technical specifications), hereafter S-57;

(d) This Data Standard describes the necessary additions and clarifications to S-57 and the application of S-57 for the purpose of use in Inland ECDIS applications;

⁹ On wide inland waterways, Basin Administration may prescribe that Inland ECDIS must provide a suitable alarm and/or indication, if the SENC positioning does not match the radar picture within the limits of Section 4, Chapters 5.1 and 5.2.

¹⁰ See Section 4, Chapters 4.16 and 9 of these technical specifications.

(e) This Data Standard ~~comprises:~~

~~• this Section 2;~~

~~• must be compliant to Appendix 1.0, "Product Specification for Inland ENC's", Appendix 1.1, "Inland ENC Feature Catalogue", and Appendix 1.2, "Encoding Guide for Inland ENC's"; and~~

~~• Appendix 3.0, "Product Specification for Bathymetric Inland ENC's", and Appendix 3.1, "Feature Catalogue for Bathymetric Inland ENC's", bathymetric Inland ENC's" to this annex.~~

2. Theoretical Data Model

The description of the theoretical data model in S-57, Part 2 must apply to the theoretical data model of Inland ENC's and bathymetric Inland ENC's.

3. Data Structure

The description of the data structure in S-57, Part 3 must apply to the data structure of Inland ENC's and bathymetric Inland ENC's.

4. Product Specification for Inland ENC's and bathymetric Inland ENC's

(a) The Product ~~Specification~~**Specifications** for Inland ENC's¹¹ and for bathymetric Inland ENC's¹² are sets of specifications intended to enable chart producers to produce a consistent Inland ENC or bathymetric Inland ENC, and manufacturers to use that data efficiently in an Inland ECDIS that satisfies the Performance Standard for Inland ECDIS.⁴² **set out in section 1.**

(b) Data for **Inland** ENC's shall be made available to all manufacturers of applications.

An Inland ENC shall be produced in accordance with the rules ~~defined~~**laid down** in ~~these technical specifications~~**appendix 1 "Product Specification for Inland ENC's", edition 2.4** and shall be encoded using **the following documents referred to therein:**

- the Inland ENC Feature Catalogue;⁴⁴ **(appendix 1.1); and**
- the rules described in the Inland ENC Encoding Guide.⁴⁵ **(appendix 1.2).**

A bathymetric Inland ENC shall be produced in accordance with the rules ~~defined~~**laid down** in ~~these specifications~~**appendix 3 "Product Specification for bathymetric Inland ENC's", edition 2.4** and shall be encoded using:

- the bathymetric Inland ENC Feature Catalogue;⁴⁶ **(appendix 3.1), and**
- the rules described in the Inland ENC Encoding Guide.⁴⁷ **(appendix 1.2).**

¹¹ See Appendix 1.0.

¹² See Appendix 3.0.

⁴² See Section 1.

⁴⁴ See Appendix 1.1.

⁴⁵ See Appendix 1.2.

⁴⁶ See Appendix 3.1.

⁴⁷ See Appendix 1.2.

(c) ~~Official Inland ENC~~s and bathymetric Inland ENC**s approved for navigation mode shall be produced in accordance with the latest version of the “Data Standard” including the “Product Specification”. Official Inland ENC**s, which have been produced in accordance with earlier editions of the Inland ECDIS Standard and before the entry into force of these technical specifications remain valid until new editions of Official Inland ENC**s are published in accordance with these technical specifications**the Product Specification referred to in this section.

5. Definitions

Definitions of terms may be found in:

- ~~S 57, part 1, clause 5~~
- ~~“Glossary of ECDIS Related Terms”, S 52, Appendix 1~~
- ~~“Glossary of Terms”, Section 5 of these technical specifications.~~

Section 2a2A: Codes for Producers and Waterways⁴⁴ (in addition to IHO-S62 ENC Producer Codes)

(a) Codes for producers of Inland ENC**s** as well as the registration procedure are those mentioned in IHO S-62.

(b) Administrations or private companies which produce Inland ENC**s** and which are not ~~already~~ mentioned in IHO-S-62 and administrations or private companies which decide to produce Inland ENC**s** shall register a producer code at the S-100 registry of IHO at <http://registry.iho.int/navbar.html>;

(c) Since a producer code alone is not sufficient to ~~judge~~**establish** whether an Inland ENC is appropriate ~~for~~**to be used in navigation mode**, the ~~following declaration process is applicable~~:

1. ~~The competent authority for a waterway or a harbour must register itself on the authorities [referred to in Article 8 of Directive 2005/44/EC] shall maintain and provide via their official website of the organizations which have adopted these technical specifications. Details on the name an up-to-date list of the authority, its Inland ENC~~s approved for navigation mode within their geographical area of responsibility, ~~its official website and other communication possibilities must be given and must be accessible on this website.~~

2. ~~The competent authority for a waterway or a harbour must maintain a list of Inland ENC~~s which are appropriate for navigation mode within its geographical area of responsibility. The list ~~must~~**shall** include the file name of the ENC cell, the stretch of the inland waterway that is covered, the edition number, the issue date and a list of available ~~update~~**update** files to the currently valid edition, also with their issue dates. ~~By putting an~~ The list shall include all Inland ENC ~~on that list, the authority declares this for which the cell as verified concerning~~ complies with the requirements as regards the minimum content and ~~therefore appropriate~~**is approved** for navigation mode.

(d) ~~The lists~~**notification of the competent authorities for waterways or harbours with the above mentioned details**shall include information on the geographical area of

⁴⁴ The codes provided in this section are in addition to those listed in the IHO S-62 ENC Producer Codes.

responsibility and the official ~~websites of the organizations which have adopted these technical specifications are regarded as digital parts~~ website of the Inland ECDIS technical specifications and are named “Competentcompetent authorities and geographical responsibilities”;

(ed) The following codes for waterways are recommended for use in the file name of Inland ENC's:

<i>Waterway Code</i>	<i>Waterway Name</i>	<i>Remark</i>
ACK	Albertkanaal/Canal Albert	
AKL	Afleidingskanaal van de Leie	
BA	Balaton	
BCR	Branche de la Croyère	
BED	Benedendijle	
BEN	Beneden-Nete	
BEZ	Beneden-Zeeschelde	
BH	Kanaal Bocholt – Herentals	
BK	Boudewijn Kanaal	
BLO	Branche de La Louvière	
BME	Basse-Meuse	
BN	Kanaal Briegden – Neerharen	
BOS	Bovenschede	
BOZ	Boven-Zeeschede	
BRW	Beetzsee-Riewendsee-Wasserstraße	
BSK	Berlin-Spandauer Schifffahrtskanal	including Westhafenkanal and Charlottenburger Verbindungskanal
BZ	Beneden Zeeschede	
CCB	Canal Charleroi-Bruxelles/Kanaal Brussel-Charleroi	
CCG	Canal du Centre à Grand Gabarit	
CHV	Canal de Haccourt à Vise	
CLA	Canal de Lanaye	
CMO	Canal de Monsin	
CPC	Canal Pommeroeul-Condeé	
D	Danube	including Sulina branch
DA	Danube Chilia branch	
DAW	Dahme-Wasserstraße	
DB	Dunarea Barcea	
DCC	Danube Cernovoda canal	
DDT	Dijledoorocht	
DE	Dortmund-Ems Kanal	
DEN	Dender	
DHK	Datteln-Hamm Kanal	

<i>Waterway Code</i>	<i>Waterway Name</i>	<i>Remark</i>
DKW	Kanaal Dessel – Kwaadmechelen	
DR	Drava	
DTS	Kanaal Dessel – Turnhout – Schoten	
DUK	Raackevei-Duna	
DUM	Mosoni-Duna	
DUR	Gekanaliseerde Durme (Beneden-Durme)	
DUS	Szentendrei-Duna	
DV	Dunarea Veche	
EL	Elbe	
ELK	Elbe-Lübeck-Kanal	
EH	Elbe-Havel-Kanal	
EMS	Ems	
EPP	Embranchement Principal	
ES	Elbe-Seiten-Kanal	
EV	Estuaire Vaart	Estuary shipping between Zeebrugge and the Dutch border
GA	St. Gheorghe-Arm	
GMO	Grand Large de Mons	
GPE	Grand Large de Péronnes	
HES	Haut-Escaut	
HO	Havel-Oder-Wasserstraße	including Westeder
HVK	Havelkanal	
IJZ	Ijzer	
KB	Kanaal naar Beverlo	
KBK	Kanaal Bossuit – Kortrijk	
KGO	Kanaal Gent-Oostende	
KGt	Kanaal Gent-Terneuzen	
KK	Küstenkanal	
KLD	Kanaal Leuven – Dijle	
KND	Kanaal Nieuwpoort – Duinkerken	
KPN	Kanaal Plassendale – Nieuwpoort	
KRL	Kanaal Roeselare – Leie	
KTR	Kanaltrave	
KVE	Kanaal van Eeklo	
LA	Lahn	
LOK	Lokanaal	
LRS	Leie/Lys River	
MA	Main	
MD	Main-Donau-Kanal	

<i>Waterway Code</i>	<i>Waterway Name</i>	<i>Remark</i>
ME	Müritz-Elde-Wasserstraße	
MEU	Meuse/Maas	
ML	Mittelland-Kanal	
MMI	Meuse Mitoyenne Sud	
MO	Mosel	
MOE	Moervaart	
N	Dnipro	
NBP	Canal Nimy-Blaton-Peronnes	
ND	Desna	
NE	Neckar	
NOK	Nord-Ostsee-Kanal	
NPR	Prypiat	
NSU	Sula	
NTK	Netekanaal	
NVO	Vorskla	
OD	Oder	
OL	Olt	
PB	Pivdennyi-Buh	
PE	Peene	
PHV	Potsdamer Havel	
PK	Plassendale Kanaal	
RH	Rhine	
RHK	Rhein-Herne-Kanal	
RL	Nederrijn/Lek	
ROG	Ringvaart om Gent	
RU	Ruhr	
RUP	Rupel	
SA	Sava	
SAM	Sambre	
SE	Schelde	
SI	Sieł-ohzatorna	
SKH	Stichkanal Mittelland-Kanal – Hildesheim	
SKL	Stichkanal Mittelland-Kanal – Hannover- Linden	
SKO	Stichkanal Mittelland-Kanal – Osnabrück	
SKS	Stichkanal Mittelland-Kanal – Salzgitter	
SL	Saale	
SM	Smeermaas	

Waterway Code	Waterway Name	Remark
SO	Spree-Oder-Wasserstraße	
SPI	Spierkanaal	
SR	Saar	Currently SA is used; this will be changed to SR in the next edition
SRV	Schelde-Rijnverbinding	
TEK	Teltowkanal	
TI	Tisza	
TLE	Toeristische Leie (Leie)	
UH	Untere Havel-Wasserstraße	
UWE	Unterveser	from km UWeE 0.00
VKN	Verbindingskanaal Nieuwpoort	
WA	Waal	
WDK	Wesel-Datteln-Kanal	
WE	Mittelweser	until km 366.65/UWeE 0.00
WOD	Westoder	
ZBS	Zeekanaal Brussel-Schelde	
ZUL	Vertakking van Zulte	
ZWV	Zuid-Willemsvaart	

(f) ~~Additional waterway codes can be registered at <http://ienc.openecdis.org>.~~

Section 3: Presentation Standard for Inland ECDIS

1. Introduction

(a) This “Presentation Standard for Inland ECDIS” describes the technical specifications to be used for ~~presenting~~**the presentation of** Inland ECDIS data. The presentation must take place in such a way that none of the information is lost;

(b) This Presentation Standard is based on ~~the IHO document S-52 “Specification for Chart Content and Display Aspects of ECDIS”, Edition 6 of March 2010, with all Appendices and Annexes~~**S-52 (see “Comparison of the structures of the standard for (Maritime) ECDIS and of the technical specifications for Inland ECDIS” in the preface of these technical specifications);**

(c) This Presentation Standard describes the necessary additions and clarifications to S-52 and the application of S-52 for the purpose of use in Inland ECDIS applications;

(d) ~~This~~**The presentation of Inland ECDIS data shall meet the requirements of the Presentation Standard comprises:**

~~• this Section~~**described in section 3**

~~• Appendix and appendix 2, “Status of the Presentation Library for Inland ECDIS, with additions and clarifications”, to be applied to S-52, Annex A.~~**this annex;**

(e) Definitions of terms may be found in:

- ~~IHO S-57~~, Part 1, clause 5 of S-57
- ~~the “Glossary of ECDIS Related Terms” in IHO Special Publication S-32, Appendix 1~~
- the “Glossary for Inland ECDIS” in ~~Section~~section 5 of ~~these technical specifications~~this annex.

2. Presentation Library for Inland ECDIS

S-57 data sets **describe the data standard for Inland ENC**s, however, they do not contain any information about how the data ~~will~~is going to be presented. The chart presentation is generated online in the Inland ECDIS application. For that purpose, the Inland ECDIS application uses machine-readable symbolization instructions for each feature, which is drawn on the screen. For the presentation of ENCs, the ~~IHO S-52~~ standard is mandatory. The S-52 standard contains all rules which are necessary for the symbolization and presentation of ENCs on the screen.

Since the features, attributes and attribute values for ENCs were extended for Inland ENCs and bathymetric Inland ENCs, an extension of the S-52 standard is necessary in order to **be able to** also display the features specific to inland navigation. All extensions apply to Edition 3.4 of the IHO ECDIS Presentation Library (Annex A ~~of~~to former S-52).

2.1 Components of S-52 and Inland ECDIS Presentation Library

2.1.1 The major components of the S-52 ~~presentation library~~**Presentation Library** are:

- a library of symbols, line styles and fill styles
- a colour coding scheme which includes the IHO colour tables for day, dusk and night time
- a set of symbology command words from which machine readable instructions can be assembled. The result is a symbology instruction, which is processed to ~~symbolises~~symbolize ENC features in turn
- a set of conditional symbology procedures to decide the appropriate ~~symbolisations~~symbolization in cases determined by the mariner's selection (e.g. safety contour) or for complex symbols (e. g. top marks on buoys and beacons)
- a set of look-up tables that link feature descriptions from the SENC database to the appropriate symbology instructions depending on whether:
 - (a) - The link is straight forward, i.e. a direct relationship between a feature's description and its presentation such as a buoy or a land area. In this case, the look-up table provides the symbology instruction to show a symbol, an area fill, or a line style;
 - (b) - The link is conditional, i.e. depending on circumstances, for example a depth area, whose colour fill depends on the choice of the safety contour. In this case, the look-up table refers the decision to a conditional symbology procedure that selects the appropriate symbology instructions later.

2.1.2 Inland ECDIS must use all S-52 components plus extensions in:

- look up tables
- symbol library
- conditional symbology procedures.

~~Only the~~ The extensions are described in ~~Appendix~~ **appendix 2, “Status of the Presentation Library for Inland ECDIS”, to the present annex.**

2.2 Look-up Tables

2.2.1 For each geometry type (point, line, area) there is a separate look-up table. Each entry in a look-up table consists of the following fields:

- (a) 6-character code of the feature class (acronym);
- (b) Attribute combination;
- (c) Symbolization instructions;
- (d) Display priority, 0–9 (comparable with drawing layers);
- (e) Radar code;
- (f) Display category (Display base, standard, all other);
- (g) “Viewing group”, more refined grouping of features than the display categories.

Figure 1

Example Entry of a Look-up Table

«LNDMRK»,«CATLMK17»,«SY(TOWERS01)»,«7»,«O»,«OTHER»,«32250»

In this case the feature LNDMRK is shown by the symbol TOWERS01 with priority 7, if the attribute CATLMK equals 17. The feature lies over the radar.

The presentation of features in a specific area that are contained in different cells of the same usage follows the entries in the look-up tables.

2.2.2 The Presentation Library provides five look-up tables:

- paper chart point symbols
- simplified point symbols
- line symbols
- plain area boundary symbols
- symbolized area boundary symbols.

2.3 Conditional Symbology Procedures (CS)

~~Conditional Symbology Procedures (CS)~~ CS are generated for features of which the symbolization

- depends on application settings, e.g. safety contour
- depends on other features, e.g. top marks and their structure
- is too complex to be defined in a direct look-up table entry.

CS Procedures, which must be modified or implemented in an Inland ECDIS ~~additional~~ **additionally** to the CS Procedures of S-52, are described in ~~Appendix~~ **appendix 2.0, “Status of the Presentation Library for Inland ECDIS”, to this annex.**

2.4 Colours

Colours used in an ECDIS are defined in an absolute, ~~manner, independently from the monitor~~ **independent way (used (using CIE coordinates of the International Commission**

~~on Illumination (CIE)).~~ This ensures that ECDIS charts look similar on monitors of different suppliers. CIE values are converted into RGB values by means of a colour calibration software which must be used by the manufacturer.

Commercial displays usual in the trade are seen as matching these requirements.

~~Because of~~ Due to the ~~different~~ fact that various lighting conditions might occur on the bridge of a vessel, it is necessary to offer presentations with different brightness levels. For each level, a separate colour table exists.

The represented colour scheme must be chosen on the basis of ergonomic and physiological factors and the representation of indications in different colours ~~must~~ shall not result in mixed colours by ~~overlaying~~ superimposing.

2.5 ~~Representation~~ Presentation of Signs notice marks

~~Signs~~ Notice marks which are located ~~on~~ at the river banks ~~are represented in the chart displayed by generic symbols (notmrk01, notmrk02 and notmrk03).~~ This ~~must~~ does not apply to ~~signs~~ the notice marks on bridges.

Additional applications are required to be able to display the detailed symbol, which is similar to the real world indication, and the full set of object information of a user-selected ~~sign~~ notice mark.

~~Signs~~ Notice marks that are located ~~on the~~ at bridges, must be symbolized according to the orientation of the bridge.

~~Signs~~ Notice marks which specify distances or a velocity ~~will~~ must not be symbolized with the number itself, but only with that symbol which gives the general regulation or information.

Section 4: Operational and Performance Requirements, Methods of Testing and Required Test Results

1. Introduction

This section specifies the minimum requirements contained in Section 1 of these technical specifications and describes the test procedures and the required results concerning the hardware, the software, the functions, the operation, the display and the interfaces to other equipment on board of vessels.

2. Operating Modes and System Configuration

2.1 Operating Modes

(a) The Inland ECDIS technical specifications distinguish two operating modes: navigation mode and information mode;

(b) Inland ECDIS equipment designed for operating in navigation mode ~~must~~ shall fulfil the requirements of ~~these technical specifications~~ this annex and the standards ~~for~~ on navigational radar equipment and rate-of-turn indicators. For Inland ECDIS in navigation mode, a type approval is required by the competent authorities [referred to ~~be proven by conformity tests~~ in Annex II of Directive 2016/1629].

(c) For Inland ECDIS equipment designed for information mode only, the requirements of this section are to be understood as technical (operational and performance)

requirements. The producer has to ~~declare~~**document** the conformity with these technical requirements. A type approval is not required for Inland ECDIS in information mode. The documentation ~~of the conformity tests~~ shall be made available to ~~the~~ competent authorities and users on request.

2.2 System Configurations

2.2.1 **System configuration 1:** Inland ECDIS equipment, stand-alone-system without connection to radar

In this ~~system~~ configuration only operation in information mode is possible (~~Section 4b, Fig. section 4B, fig. 1~~).

2.2.2 **System configuration 2:** Inland ECDIS equipment, parallel installation and connection to radar

This ~~system~~ configuration allows operation in information mode as well as in navigation mode (~~Section 4b, Fig. section 4B, fig. 2~~).

2.2.3 **System configuration 3:** Inland ECDIS equipment, monitor shared with connected radar equipment

In this ~~case-system configuration~~, the monitor of the radar equipment is shared with the Inland ECDIS equipment. Prerequisite for this mode are matching graphic parameters for both video signals and a video switch, which allows a fast switchover of the video sources (see ~~Section 4b, Fig. section 4B, fig. 3~~).

This configuration allows operation in information mode as well as in navigation mode.

2.2.4 **System configuration 4:** Radar equipment with integrated Inland ECDIS functionality

This ~~system configuration~~ is a radar installation with integrated Inland ECDIS functionality that can be operated in information mode as well as in navigation mode (see ~~Section 4b, Fig. section 4B, fig. 4~~).

3. Performance Requirements

3.1 Hardware Performance

(a) Inland ECDIS equipment for operating in navigation mode must be designed and manufactured to withstand typical environmental conditions prevailing on board of a vessel without any degradation in quality and reliability. Furthermore, it must not disturb other communication and navigation equipment.

(b) In the configuration as described in Chapter 2.2.4 of this Section all components of Inland ECDIS equipment installed inside the wheelhouse must fulfil the requirements of the class (b) "protected from weather" equipment as specified in the standard IEC 60945 with the exception that the test temperature range is limited to 0° C to + 40° C (whereas the test temperature range in IEC 60945 is specified from - 15° C to + 55° C) unless specified differently in these technical specifications. For the configurations described in paragraphs 2.2.2 and 2.2.3 of this Section CE conformity is sufficient.

3.2 Software Performance

Software for the operation, visualization and functionality of Inland ECDIS equipment must be designed, developed, implemented, and tested in accordance with the software requirements described in Section 4a of these technical specifications.

3.3 Performance of Operation Controls

- (a) The operation of the system must be simple, appropriate and conform to common human interface standards. **The operational state of the system and the connected technical sub devices has to be clearly indicated;**
- (b) The number of operational controls must be as low as possible and restricted to the required number;
- (c) Wireless remote controls are not permitted;
- (d) The ON/OFF switch must perform and must be arranged in such a way that inadvertent operation is not possible;
- (e) The symbols of the operating controls must have a minimum character height of 4 mm and must be readable under all conditions that may exist in a wheelhouse;
- (f) The brilliance and the illumination of the operating controls must be adjustable to the required value.

3.4 Display Performance

~~For Inland ECDIS in information mode the requirements~~ The provisions of chapters 3.4.2 to 3.4.7 are recommendations only **recommended for Inland ECDIS in information mode.**

3.4.1 Display dimensions

- (a) In navigation mode the minimum chart and radar display area ~~have to~~ must be at least 270 mm x 270 mm;
- (b) In information mode the requirements of ~~Section 1~~ subparagraph (c) of chapter 4.1, section 1 ~~(b)~~ shall be **fulfilled** applicable.

3.4.2 Display orientation

- (a) A rectangular display may be mounted in landscape or in portrait orientation under the prerequisite that the ~~above-mentioned~~ minimum dimensions **set out in paragraph 3.4.1** are fulfilled;
- (b) Because of the limited space available in the typical wheelhouse of an inland vessel and the fact that a vessel usually follows the fairway- axis, the display must be installed preferably in the portrait orientation.

3.4.3 Display resolution

A display resolution of 5 m in the 1,200 m range is required. This leads to a maximum pixel dimension of 2.5 m x 2.5 m, i.e. about 1,000 pixels at the short edge of the display.

3.4.4 Display colours

The system must be able to display ergonomically proven colour combinations for day and night.

3.4.5 Display brilliance

The brilliance of the display must be adjustable to every operational required value. This is especially valid for the lowest value during operation ~~in darkness~~ **at night**.

3.4.6 *Picture renewal*

- (a) The picture renewal rate must not be shorter than that of the radar picture (≥ 24 pictures per minute);
- (b) Between two consecutive renewals no fluctuations of brilliance must occur;
- (c) On raster scan displays, the frame repetition rate must not be lower than 60 Hz.

3.4.7 *Display technology*

~~Preferably, display~~ Display systems ~~must be used~~ that are insensitive to the magnetic fields that may occur in the wheelhouse of an inland vessel **shall be used**.

4. Operational Functions

4.1 Operating Mode

- (a) If the equipment is able to work in both operation modes, it must provide for the possibility ~~to switch~~ **of switching** between navigation mode and information mode;
- (b) The operation mode in use must be displayed;
- (c) Suitable measures are required to prevent ~~the~~ inadvertent switching off of the navigation mode.

4.2 Equipment Pre-sets (Store/Recall) in Navigation Mode

- (a) After ~~invoking starting~~, the Inland ECDIS equipment ~~must emit~~ **shall come up with** a moderate brilliance pre-set which neither blinds in a dark environment nor makes the picture invisible in a bright environment;
- (b) Other parameters may come up with their values at the time before switching off or from stored settings.

4.3 Presentation of SENC Information in Navigation Mode

- (a) The radar picture must be clearly distinguishable from the chart independently of the chosen colour table;
- (b) Only a monochrome presentation of the actual radar picture is permitted;
- (c) The presentation of chart information must not mask or degrade important parts of the radar picture. This must be ensured by appropriate entries into the look-up tables (refer to ~~Section 3 of these technical specifications, Chapter~~ **section 3 of this annex, chapter 2.2, field "Radar code"**). The transparency of the radar overlay shall, therefore, be user defined;
- (d) ~~In navigation mode, chart~~ **Chart** and radar picture presentation must have the same scale;
- (e) The heading line must be always visible;
- (f) Additionally, the mariner's own vessel's contour and the safety contours may be inserted.

4.4 Chart Orientation, Positioning and Shifting

- (a) In navigation mode, only the chart orientation "relative motion, head up" and the "centred" or "off-centred" presentations, as required for the radar picture, are permitted;

(b) In information mode, at least the chart orientations “north” and “parallel to the waterway axis” as well as positioning are recommended. ~~With~~**By connection of a** positioning sensor, the displayed part of the chart can automatically follow the mariner’s own ~~vessel~~vessel’s position.

4.5 ~~Own Vessel’s~~ Position and Bearing of the own vessel

(a) In navigation mode, the own vessel’s position must always be visible in the display area, whether “centred” or “off-centred” as specified in ~~the radar requirements of appendix 7 to the annex to Resolution No. 61, revised, “Recommendations on Harmonized Europe Wide Technical Requirements for Inland Navigation Vessels”;~~Annex 5, Sections I to III of ES-TRIN 2017;

(b) In navigation mode, the heading line which runs from the display centre to the top and which must ~~be~~ always be visible, must represent the heading of the mariner’s own vessel.

4.6 Information Density

The information density must be at least adjustable to the three switch steps: “Base”, “Standard” and “All Information”. The latter displays all other features in addition to the “Standard” display, individually on demand. All corresponding visible features are defined in the “Performance Standard” and the “Presentation Standard” (including “Presentation Library for Inland ECDIS”) (Sections 1 and 3 of these technical specifications).

4.7 Ranges/range Rings

(a) In navigation mode the following fixed ranges and range rings are prescribed according to the radar regulations:

<i>Range</i>	<i>Range rings</i>
500 m	100 m
800 m	200 m
1 200 m	200 m
1 600 m	400 m
2 000 m	400 m
4 000 m	800 m

(b) Smaller and larger ranges with a minimum of four and a maximum of six range rings are permitted;

(c) Inland ECDIS equipment in navigation mode must have fixed range rings with the ~~above mentioned~~ intervals **set out in subparagraphs (a) and (b)** and at least one variable range marker (VRM);

(d) Switching on/off of fixed and variable range markers must be independent of each other and their display must be clearly distinguishable;

(e) The position of the VRM and the corresponding displayed distance ~~must~~**shall** use the same increments and resolution;

(f) The functions of the VRM and the electronic bearing line (EBL) may additionally be ~~realised~~**realized** by a cursor and by a corresponding numerical display, showing the range and bearing of the cursor position.

4.8 Picture Brilliance in Navigation Mode

(a) The brilliance of the display must be adjustable to the operationally necessary value. This applies in particular to operation in darkness;

(b) ~~The chart~~Chart and ~~the~~radar picture must have separate ~~brilliance~~brightness controls;

(c) Because of the strongly different environment brightness ~~by~~of bright day and dark night, another control for the basic ~~brilliance~~brightness of the display must be available additionally to the colour tables in the menu.

4.9 Picture Colours

At least the colour combinations included in the ~~IHO-S—52~~ Presentation Library, ~~6.0~~ (colour tables) for day, dusk and night shall be supported.

4.10 Pick report

(a) It shall be possible to get all underlying textual and/or graphical information concerning user selections of the features that are displayed in the chart;

(b) This additional textual and/or graphical information must not hamper the view of the waterway in the navigational chart.

4.11 Measurement Features

(a) Measurement features for distances and bearings are required;

(b) Resolution and accuracy must at least be the same as those of the display, but may not suggest better values than those of the chart data.

4.12 Input and Editing of Skippers' Own Chart Entries

(a) Inland ECDIS equipment must allow input, storing, ~~modification~~modifying and deletion of additional chart information by the skipper (skippers' own features) ~~;) in navigation mode as well as in information mode;~~

(b) These own chart entries must be distinguishable from the SENC data, and must not overlay or degrade the radar picture **in navigation mode**.

4.13 Loading and Updating of SENCs

(a) All manual activities concerning loading or updating of charts must be possible only outside ~~of the~~ navigation mode;

(b) Automatic updating must not ~~degraded~~downgrade the performance of the navigation display;

(c) A ~~roll-back~~rollback function must be implemented to allow restoring to the last working combination.

4.14 Radar Picture Presentation and Overlay

(a) The radar image representation is mandatory for operation in navigation mode;¹⁹

¹⁹ On wide inland waterways, Basin Administration may, where appropriate, consider this mandatory requirement as a recommendation.

(b) The dimensions, resolution and attributes of the radar presentation must fulfil the relevant radar requirements;

(c) The radar picture must not be degraded by other contents of the picture (see also ~~Chapter~~subparagraph (c) of chapter 4.3 (e) of this section);

(d) Provided the ~~performance~~functional requirements are fulfilled, overlaying of different information layers is permitted;

(e) The overlay of information regarding the position and orientation of other vessels is only allowed when:

- the information is up-to-date (nearly real-time) and
- the age of information does not exceed the maximum time out values provided in the first table in ~~5.1~~subparagraph (e) of ~~Section~~chapter 5.1 of section 1, ~~Performance Standard for Inland ECDIS. For moving vessels the~~. The symbols must be marked as outdated if the age of information exceeds 30 seconds. ~~for moving vessels. The vessel's own-position information must not of the own vessel shall only be displayed when the position is detected by an onboard subsystem and not if itthe position is received from a repeater station;~~

(f) The overlaid information derived from tracking and tracing devices regarding the position and orientation of other vessels must be faded out at a user-definable range;

(g) ~~The presentation of~~Only if the heading of other vessels is available, the position and the orientation of those other vessels may be presented by:

- a directed triangle, or
- a true outline (to scale)).

~~are permitted only if the heading of these other vessels is available.~~ In all other cases a generic symbol must be used (an octagon is recommended, a circle must be used for inland applications only);

(h) It must be possible to switch off the chart and any other information layer and to display only the radar picture by one easily accessible control element or menu area;

(i) If the quality and plausibility monitoring of the Inland ECDIS equipment detects that the chart cannot be oriented and/or positioned with the accuracy required by ~~these technical specifications~~this annex, an alarm must be presented on the display and the chart must be switched off automatically. ~~If there is no radar signal, the information mode shall be displayed. In both cases a warning or an alarm shall be given. The switching shall always be possible by manual action.~~

4.15 Inland ECDIS Functions with Immediate Access

(a) The following operational functions require direct access:

- RANGE
- BRILLIANCE
- COLOURS
- INFORMATION DENSITY.

(b) These functions must ~~have~~ either ~~have their~~ own control elements or ~~their~~ own menu areas, which are arranged in the highest menu level and are permanently visible.

4.16 Permanently Visible Function Parameters

The following function parameters must always be visible:

- actual RANGE
- sensor STATUS (in navigation mode: radar tuning, position quality, alarms; in information mode: if connected, **GPSGNSS receiver**, AIS and heading)
- selected WATER LEVEL (if available)
- selected SAFETY DEPTH (if available)
- selected INFORMATION DENSITY.

5. Service Functions

Service functions shall be protected by password or other suitable measures against unauthorized access. They shall not be selectable in navigation mode.

The requirements of **chapters** 5.1 to 5.3 are only applicable to navigation mode.

5.1 Static Correction of the Chart Position

(a) The position of the mariner's own vessel must be presented "centred" or "off-centred" on the display in accordance with the radar requirements. The chart position must match the radar image. Assuming an absolute position's input the permissible static difference between the actual radar position and the displayed radar centre must not exceed 1 m;

(b) It must be possible to correct an offset error (distance between the positions of the position sensor and the radar sensor).

5.2 Static Correction of the Chart Orientation

(a) The difference between the heading line orientation and the vessel's axis must not be greater than ± 1.0 degree;

(b) The chart and the radar image must have the same orientation. The static directional error between heading line and chart orientation must be less than ± 0.5 degree.

5.3 Configuration of Interfaces

(a) It must be possible to configure interfaces for connected sensors, actors and signals;²⁰

(b) Interfaces must comply with existing interface specifications ~~like the as defined in IEC 61162-1 standard~~ and the interface specifications for rate of turn indicators (20 mV/deg/min) **as defined in IMO Resolution MSC.232(82).**

6. Hardware test and Required Certificates

~~In navigation mode:~~

²⁰ ~~An actor transforms an electrical quantity into another physical quantity (e.g. optical). An actor is the opposite of a sensor.~~

(a) The test must consist of a comparison between the ~~equipment under test~~ **Equipment Under Test (EUT)** and the requirements of ~~these technical specifications~~ **this annex**;

(b) Proved equivalent tests, and proved and documented test results must be accepted without renewed tests;

(c) **The entire chapter 6 is valid for navigation mode, but the requirements that do not contain a specific reference to navigation mode are also valid for information mode.**

6.1 ~~Compatibility with the~~ **Resistance to Environmental Conditions in Navigation Mode**

(a) Inland ECDIS equipment, as described in ~~paragraph~~ **chapter 2.2.4 of this Section, must** ~~section, shall~~ fulfil the requirements of IEC 60945 ~~for concerning the resistance to environmental conditions (humidity, vibration and temperature; the latter reduced according to Chapterchapter 3.1 of this Sectionsection)~~ **and concerning electromagnetic compatibility**;

(b) The provider or ~~their~~ **his** representative must submit a relevant conformity declaration ~~by of~~ **an accredited laboratory.**

6.2 Equipment Documentation

The technical documentation must be checked to ~~be~~ **assure that it is** complete, appropriate, and understandable, and ~~to be~~ **that it is** sufficient for unproblematic installation, configuration and operation of the equipment.

6.3 Interfaces

(a) All interfaces must be ~~documented~~ **correctly and completely documented**;

(b) Electronic circuits must be ~~of~~ **designed** failsafe ~~design~~, mechanically ~~and as well as~~ **electronically**, and must not have degrading repercussions on connected equipment.

6.4 Characteristic of Operation Controls

All operation controls must be checked regarding the ergonomic and functional mode of operation and must fulfil the requirements of these technical specifications.

6.5 Characteristic of the Display in Navigation Mode

The display must fulfil all these technical specifications concerning dimension, displayable colours, resolution, and variation of brilliance.

7. Test of the Chart Presentation, Operation and Functionality

7.1 Preparation of the Equipment Under Test (EUT)

The EUT must be installed, assembled and connected according to the installation manual. After switching on, the test SENC must be loaded.

7.2 Test of the Operation Modes

All operating modes as described in the operating manual ~~will~~ **must** be successively ~~invoked~~ **started up** and tested. The requirements of chapter 4 of this section ~~must~~ **shall** be ~~met~~ **fulfilled**.

7.3 Test of the Displayed Features

~~All~~Whether all features included in the test SENC ~~will~~are visible and correctly displayed, shall be tested ~~for visibility and correct display~~. For this test, the information density must be switched to "all features". The system must be capable ~~of~~to at least ~~displaying~~display all features according to ~~"the Presentation Standard for Inland ECDIS"~~(~~Section~~ (section 3 of ~~these technical specifications~~), ~~this annex~~). Additionally, other user-selectable symbol sets are allowed.

If symbols that deviate from ~~Appendix~~appendix 2.0, ~~"Status of the Presentation Library for Inland ECDIS"~~, to this annex, are used for the presentation of any chart information, then they must:

- be legible
- be certain and unambiguous in their meaning
- be of sufficient size to support the nominal viewing distance.

Symbols added to the ECDIS Presentation Library must be clearly distinguishable from Presentation Library symbols.

7.4 Test of the Scale Dependent Information Density (SCAMIN)

(a) ~~The~~Whether the SCAMIN functionality (the minimum scale at which the feature may be used for ECDIS presentation) ~~must~~is installed correctly shall be tested ~~for correct installation~~;

(b) For this test, the range ~~must be used~~ at which the feature ~~is~~ must be visible according to its SCAMIN enumeration (refer to ~~Appendix 1.1, "chapter 8.4 of appendix 1, Product Specification for Inland ENCENCs", including appendices 1.1 "IENC Feature Catalogue", Catalogue"~~ and ~~S-52, Annex A, IHO ECDIS Presentation Library, Appendix 1.2, Part I, Users' Manual, Section 8.4)~~ must be used. "Inland Electronic Navigational Chart Encoding Guide").

7.5 Test of Brilliance Variation in Navigation Mode

The Inland ECDIS equipment must be operated in a dark room ~~with~~and the brilliance ~~at~~must be brought to its lowest level. The brilliance of the features must not exceed a value of 15 cd/m², and the background, a value of 0,5 cd/m².

7.6 Test of the Colours

All user selectable S-52 colour tables must be sequentially tested to conform to these technical specifications.

7.7 Test of the Measurement Functions

(a) All numeric display values of the electronic bearing line (EBL) and the variable range marker (VRM) must exactly match with the analogue positions of the EBL and the VRM (or correspond with the cursor coordinates);

(b) The resolution and increments of the numerical display must be identical to the analogue values of EBL and VRM.

7.8 Test of the Chart Update Function

Before and after each test step the version numbers of the loaded SENCs and updates must be recalled as described in the operation manual and showed on the display.

- Step 1: Loading of the test SENC
- Step 2: Update of the test SENC
- Step 3: Test of the roll-back function
- Step 4: Loading of a new SENC.

After an update it must be possible to recall and display all concerned features.

7.9 Test of Displayed Features in More than One Cell for the Same Area

(a) ~~All~~ It must be tested whether all features included in the test SENC and in the additional overlay test SENC ~~must be tested for visibility~~ are visible and correct ~~display~~ displayed. For this test, the information density ~~will~~ must be switched to “all ~~display~~ features”;

~~(b) The possibility~~ (b) It must be tested whether it is possible to select one or more specific cells for presentation if there are several cells from different producers for the same area with the same usage ~~must be tested~~;

(c) It ~~shall~~ must be tested whether the test bathymetric Inland ENC is displayed correctly together with the base SENC in accordance with chapter 6 of **appendix 2, “Status of the Presentation Library for Inland ENC ECDIS” to this annex.**

8. Test of Radar Picture Presentation and Operation in Navigation Mode

8.1 Preparations

(a) For the test purposes, the manufacturer or provider must provide a serial interface at the system to be approved (equipment under test – EUT) which delivers the same actual values (i.e. IEC 61162-1 strings) of position and heading that are used to position and orient the chart;

(b) During the test, a reference system must be used of which position and heading values are compared with those of the EUT;

(c) The EUT must be connected to any type approved radar equipment (provider's choice);

(d) The radar picture must be adjusted in range and bearing with reference to the heading line.

8.2 Test of the Radar Picture without ~~Underlaid~~ Under laid Chart

(a) If the Inland ECDIS equipment displays the radar picture but the radar operation control remains at the radar equipment (~~Section 4b, See figures 2 and 3 of section 4B~~), the radar picture of the ~~inland~~ Inland ECDIS equipment must be considered as the “daughter display” of an item of radar equipment. In that case, the radar picture must fulfil the display and picture-relevant requirements of the requirements for radar and rate-of-turn indicators **as defined in Sections I to III of ES-TRIN 2017**;

(b) If the EUT is a radar installation with integrated Inland ECDIS functionality (~~Section 4b, figure~~ See section 4B, fig. 4), all requirements of the standards for radar equipment and rate-of-turn indicators ~~must as defined in the document referred to in Sections I to III of ES-TRIN 2017~~ shall be fulfilled.

8.3 Test of the Radar Picture, Overlaid Information from Other Vessels and the Underlying Chart

The Inland ECDIS equipment must be installed in a reference environment. This can be real (on a vessel) or simulated. Position and orientation information of other vessels (according to the Inland AIS technical specifications) must be applied with several information ages.

8.3.1 Test of the radar overlay

(a) The radar image must not be degraded by the chart picture (~~Chapter 4.3 refer to subparagraph (c) of chapter 4.3 of this Section~~);

(b) The overlay of information regarding the position and orientation of other vessels must be displayed only when:

- the information is up-to-date (nearly real-time); and
- the age of information does not exceed the maximum time out values provided in the first table in ~~5.1~~subparagraph (e) of ~~Section~~chapter 5.1 of section 1, **Performance Standard for Inland ECDIS**, of this annex. The symbols must be marked as outdated if the age of the information exceeds 30 seconds for moving vessels. The position information of the own vessel must not be displayed if it is received from a repeater station;

(c) The overlay of information derived from tracking and tracing devices ~~on~~ regarding the position and orientation of other vessels must be faded out at a user-definable range. ~~The activation of this feature and the selected range of the restricted area must be indicated on the display;~~

(d) ~~The~~If the heading of other vessels is available, the position and the orientation of other vessels must be displayed by:

- a directed triangle; or
- a true outline (to scale).

~~must be displayed only when the heading of these other vessels is available.~~ For all other vessels a generic symbol must be used (a squarean octagon is recommended, a circle ~~may~~must be used for inland applications only);

(e) It must be possible to switch off the chart and any other information layer and to display only the radar picture by one easily accessible control element or menu area;

(f) The chart picture must be renewed not later than the radar picture.

8.3.2 Test of the chart positioning and orientation

(a) The static offset of the chart position must be less than ± 5 m in all ranges up to 2,000 m;

(b) The static azimuth orientation offset error between radar and chart image must be less than $\pm 0,5$ degree;

(c) The correction of these parameters referred to in subparagraphs (a) and (b) must be demonstrated in the service mode;

(d) The dynamic deviation of the chart orientation at rates of turn less than ± 60 deg./min must be less than ± 3 degrees;

(e) These tests must be performed visually or by evaluation of measured data.

8.3.3 *Test of scale conformity*

The chart's information must be compared with well-known reference points contained in the radar picture in order to test whether the chart scale sufficiently conforms to the radar scale.

9. Test of Alarms and Indications

(a) The alarms generated from Inland ECDIS equipment itself as well as the passed alarms delivered **to the ECDIS** by the connected sensors ~~to the ECDIS~~ must be tested;

(b) The test procedure in navigation mode ~~must~~**shall** comprise the following situations:

- any error in the Inland ECDIS equipment (built-in test equipment – ~~bite~~**BITE**)
- missing positioning signal
- missing radar signal
- missing rate of turn signal
- missing heading signal
- radar map matching not possible.
- **missing AIS signal;**

(c) The test procedure in information mode shall comprise the following situations:

- any error in the Inland ECDIS equipment (built-in test equipment – ~~bite~~**BITE**)
- missing positioning signal
- missing heading signal
- missing AIS signal.

The Inland ECDIS manufacturers have to confirm in their system documentation that the system includes those test procedures and signal indicators in information mode.

10. Test of Fall-back Arrangements in Navigation Mode

(a) This test must demonstrate the reaction of Inland ECDIS equipment to a failure of any internal or external component and the possible and required actions by the operator.

(b) In addition, the operating manual must be checked to determine whether the measures required by the operator are described adequately and appropriately.

Section ~~4a~~4A: Measures to ensure Software Quality

1. General Requirements

Software used in navigation mode is a safety-relevant part of a navigation system. Providers of navigation systems ~~must~~**shall** make sure that all software components used in navigation mode allow safe navigation in every situation.

~~The requirements of~~**Requirements of** in chapters 1.1 to 1.5 are only applicable to navigation mode, **while requirements in chapters 1.6 and 1.7 are applicable to both navigation mode and information mode.**

1.1 Software Design Requirements

Software components must be clearly designed by means of established software design methods. The design specification must indicate how safety requirements are addressed in the software design.

A software style guide must be provided that specifies code writing style, documentation style, modularization, conflict analyses and testing of software components. For every software component documents describing specification and design are required.

1.2 Implementation Requirements

Implementation of software modules must be done by qualified developers who fully understand the design and safety requirements.

If more than one developer is working on the navigation system software, a version control system must be used that guarantees conflict-free development.

The implementation must be according to the design specification and must reflect the software style guide. Moreover, well known implementation problems (depending on the language used) must be addressed in the implementation. This includes, but is not restricted to:

- null pointer handling
- uninitialized variables
- range checking
- array size verification
- memory allocation and de-allocation
- exception handling.

If parallel processing is used (e.g. multiple threads, tasks or processes) problems of conflict-free processing must be addressed in the implementation. This includes but is not restricted to:

- race conditions
- re-entrance problems
- priority inversion
- deadlocks.

1.3 Test Requirements

In accordance with the design specification, software modules have to be tested. The test results have to be compared with the design guidelines and documented in test reports.

Tests must incorporate module as well as system tests. Providers of a navigation system must use extensive simulator-based tests to ensure stability of their system. The simulator must allow the simulation of a complete navigation environment including all required external sensors.

1.4 Third Party Components Requirements

Third party components, **such as OEM** (Original Equipment Manufacturer ~~–(OEM)~~ products), include software not developed by the navigation system provider. This includes but is not restricted to:

- static or dynamic linked libraries
- computer aided design and engineering tools producing source or object code
- operating systems.

Third party software components must be chosen according to the general safety requirements. The navigation system provider must prove that third party components meet the high standards necessary for safe navigation either by providing acceptable quality certificates or by extensive and provable testing of the components.

1.5 Requirements for Additional Services in Navigation Mode

Navigation systems may support additional services in navigation mode if they are useful. These services must not interfere with **other requirement in navigation mode**.

The navigation system provider is responsible for additional test equipment, necessary to verify interface specification, protocol specification and compliance tests with the Inland ECDIS technical specifications.

1.6 Language

~~National~~**Additional national** versions of a type-approved Inland ECDIS must reapply for type approval ~~which will check~~**to be checked** for the translation of the user interface. **The type approval process is only foreseen for systems in navigation mode.**

The qualified institution which performs the type approval process of an Inland ECDIS system may request an expertise by a certified translator regarding the correct translation in a specific language from the system manufacturer.

1.7 Documentation Requirements for Users

The documentation (manuals) must contain comprehensive information on **the equipment, the installation, the operation and the service** of the navigation system. The presentation of user-relevant information must be ~~made~~ clear, understandable and without unnecessary technical terms. The user manual must **at least** be available in English, French, German and Dutch. The technical documentation may be made available in English only.

2. Methods of Testing and Required Test Results

2.1 Navigation Mode Operation Test

2.1.1 *Performance Requirements*

The navigation systems must make reliable estimations of position and heading. Moreover, the estimations of position and heading must be checked by the system for conformity with the required accuracy.

Position and heading information must be calculated and displayed for the same reference position. This should normally be the centre of the radar antenna. A new position estimate must, at least, be available with every revolution of the radar antenna.

2.1.1.1 Position

The navigation system must estimate and display the position of the vessel. The following minimal requirements must be fulfilled under normal operation conditions:

- (a) The average position estimation must not deviate more than 5 metres from the true position and must cover all systematic errors;
- (b) The standard deviation σ must be less than 5 metres and must be based on random errors only;
- (c) The system must be capable to detect deviations of more than 3σ within 30 seconds.

These results must be verified by a realistic test of at least 60 minutes.

2.1.1.2 Heading

The navigation system must estimate and display the heading of the vessel. The following minimal requirements must be fulfilled:

- (a) The average heading angle estimation must not deviate more than 1 degree from the radar heading direction and must cover all systematic errors. The offset between vessel heading direction and radar heading must be less than 1 degree;
- (b) The standard deviation σ must be less than 2 degrees and must be only based on random errors.

These results must be verified by a realistic test of at least 60 minutes.

2.1.2 *Sensor Failure*

The navigation systems must check proper operation of the position and heading estimation online. Problems must be detected within 30 seconds. In case of malfunction, the navigation system must inform the user about the problem and its ~~consequence~~consequences for navigation.

If a critical sensor alarm signalizes that position or the heading does not meet the required accuracy **criteria**, the navigation chart must be switched off.

2.1.3 *Performance Test Interface*

A navigation system provider must equip navigation systems during the compliance test with a standard IEC 61162-1 interface sending the position and heading information used by the navigation system. This information must be encoded by IEC 61162-1 sentences (see IEC 60945) known as GGA (Global Positioning System Fix Data) and HDT. (Heading

True). Additional sentences like RMC, (**Recommended Minimum Navigation Information**), ROT (**Rate Of Turn**) and VTG (**Track made good and Ground speed**) are accepted.

These strings must be sent preferably every 0,1 second, at least every second. Position and heading must be according to the definitions in ~~Chapter~~chapters 2.1.1.1 and ~~Chapter~~ 2.1.1.2 of this ~~Section~~section.

2.2 General Software Tests

2.2.1 *Equipment Documentation*

The following documents must be provided for admittance and must be shipped with every **Inland ECDIS used in navigation systemmode**:

- ~~user~~User's manual
- ~~installation~~Installation manual
- ~~service~~Service manual.

The following documents and files must be provided during the admittance procedure and are not required for end users:

- design specification
- software style guide
- certificates of third party software components or test and simulation protocols.

The documents and files provided must allow for a complete verification of compliance with ~~these technical specifications~~this annex.

A user's manual ~~shall~~must be shipped with every ~~information mode~~Inland ECDIS system.

2.2.2 *Endurance Test for navigation mode*

The navigation system must pass an endurance test of 48 hours of uninterrupted operation under normal operating conditions. The system must provide standard interfaces for performance and resource monitoring during operation. Monitoring the system must show no indication of system instability, memory leaking or any kind of performance loss over time. Navigation systems supporting additional services while running in navigation mode must provide the necessary test equipment including all documents mentioned in Chapter 1.7 of this Section.

3. Changes to Certified *Navigation* Systems

3.1 General Requirements

Navigation systems installed on board must be functionally equivalent to a system certified by authorities. For every system the navigation system provider must ship a statement of compliance with the Inland ECDIS technical specifications and its functional equivalence to the certified system.

The competent authority is entitled to check Inland ECDIS compliance of installed systems at any time.

3.2 Hardware and Software Changes

The navigation system provider may change software or hardware as long as Inland ECDIS compliance is maintained. Changes must be fully documented and submitted to the competent authority, together with an explanation of how the navigation system is affected by these changes. The competent authority may ~~request~~**require** a partial or complete renewal of certification if considered necessary. The aforementioned also applies to the use of an approved Inland ECDIS with another national version of the operating system.

The following changes do not affect certification of the system and require only a notice to the competent authority:

- minor changes on third party components (e.g. operation system or library updates)
- use of equivalent or better hardware components (e.g. faster microprocessor, newer chip revisions, equivalent graphic card, etc.)
- minor changes in source code or documentation.

Section ~~4b~~**4B**: System Configurations (Figures)²¹

Figure 1

Inland ECDIS equipment, self-sufficient system without connection to radar (**system configuration 1**)

Figure 2

Inland ECDIS equipment, **parallel installation** with connection to radar (**system configuration 2**)

Figure 3

Inland ECDIS equipment with connection to radar and shared monitor (**system configuration 3**)

Figure 4

Navigational radar equipment with integrated Inland ECDIS functionality (**system configuration 4**)

Section 5: Glossary of Terms

~~1. Sources used to define the terms and abbreviations provided in the text~~

- ~~1. IMO Resolution MSC.232(82)~~
- ~~2. IHO S-52 and IHO S-32, Appendix 1, "Glossary of ECDIS Related Terms"~~
- ~~3. IHO S-57 (especially Part 1 "General Introduction", clause 5 "Definitions")~~
- ~~4. Technical Specifications for Inland ECDIS, Edition 2.3~~
 - ~~4.1 Section 1: Performance Standard for Inland ECDIS~~
 - ~~4.2 Section 2: Data Standard for Inland ENC's~~
 - ~~4.3 Section 2a: Codes for Producers and Waterways~~
 - ~~4.4 Section 3: Presentation Standard for Inland ECDIS~~

²¹ ~~Note by the secretariat:~~ the figures are not modified and are not reproduced here.

- 4.5 — ~~Section 4: Operational and Performance Requirements, Methods of Testing and Required Test Results including its Sections 4a and 4b~~
5. — ~~Inland ENC Domain in the S-100 Registry~~
6. — ~~IEHG Product Specification for Inland ENC's~~
7. — ~~IEHG Inland ENC Feature Catalogue~~
8. — ~~IEC Guideline 61174, Edition 3.0~~
9. — ~~Annex IX, Parts III to VI, of the EU Directive 2006/87/EC as amended by 2013/49/EU: Requirements applicable to radar installations and rate of turn indicators~~
10. — ~~Commission Regulation (EC) No. 414/2007 concerning the technical guidelines for the planning, implementation and operational use of river information services (RIS)~~
11. — ~~DC Recommendations on the main technical and operational parameters for the radar installations used for the navigation on the Danube, CD/SES-60/10, Budapest, 2003~~
12. — ~~UNECE Resolution No. 61, revised, "Recommendations on Harmonized Europe-Wide Technical Requirements for Inland Navigation Vessels", Appendix 7, "Requirements concerning lights and the colour of signal lights on vessels, intensity and range of signal lights on vessels and general technical specifications applicable to radar equipment", ECE/TRANS/SC.3/172/Rev.1~~
13. — ~~UNECE Resolution No. 57, revised, "Guidelines and Recommendations for River Information Services", ECE/TRANS/SC.3/165/Rev.1~~

~~2. Definitions of Features and Attributes~~

~~Definitions of features and attributes can be derived from the Feature Catalogue for Inland ENC's (Appendix 1.1 to these technical specifications).~~

<i>Term or abbreviation</i>	<i>Definition</i>	<i>Source</i>
Acronym	6-character-code of the feature/of the attribute.	S-57
Actor	An actor transforms an electrical quantity into another physical quantity (e.g. optical). An actor is the opposite of a sensor.	
AIS	On-board equipment allowing automatic identification of ships for enhanced ship monitoring as well as voyage data recording and other functions. The automatic identification system should comply with the technical and performance standards laid down in Chapter V of the International Convention for the Safety of Life at Sea, 1974 (SOLAS).	S-52 and S-32 Resolution No. 57, revised
All information density	All information density (all display) means the maximum amount of SENC information. Here, in addition to the standard display (Standard Information Density), also all other objects are displayed, individually on demand.	4.1 Section 1 of this annex
Attribute	A defined characteristic of an entity (e.g. the category of a light, the sector limits, the light characteristics etc.). Definitions for diverse attributes may be derived from the Feature Catalogue for Inland ENC's referred to Appendix 1 "Product Specification for Inland ENC's" of this Annex.	S-57

<i>Term or abbreviation</i>	<i>Definition</i>	<i>Source</i>
Attribute copied	S-57/S-100 attributes (with their complete list of attribute values) which were extended according to the requirements of Inland ECDIS. All new attributes have the same name as their source, but written in small case letters.	
CCNR	Central Commission for Navigation of the Rhine; international commission based on the Mannheim Convention. Current Member States are Belgium, France, Germany, the Netherlands and Switzerland. The most important and permanent objectives of CCNR are: <ul style="list-style-type: none"> Prosperity of inland navigation on the Rhine and in Europe Maintenance of a high level of safety in inland navigation and its surroundings. 	
Cell (chart cell)	A cell is a geographical area containing Inland ENC or bathymetric Inland ENC data.	S-57
CIE colour calibration	Procedure to confirm that the colour specified in IHO-S-52 is correctly reproduced on the ECDIS display.	S-52 and S-32
Collection feature	Type of feature containing information about the relationships between other features.	
Compilation scale	The scale with which the chart information meets the IHO requirements for chart accuracy. It is established by the producing hydrographic office and encoded in the ENC.	
Datum	A set of parameters specifying the reference surface or the reference coordinate system used for geodetic control in the calculation of coordinates of points on the earth. Commonly datums are defined as horizontal and vertical datums separately. For the practical use of the datum it is necessary to have one or more well distinctive points with coordinates given in that datum. The horizontal datum is a set of parameters specifying the reference for horizontal geodetic control, commonly the dimensions and the location of a reference ellipsoid. (The horizontal datum must be compliant with WGS 84.) The vertical datum is a surface to which elevations and/or depths (soundings and tide heights) are referred. For elevations commonly a level (equipotential) surface, approximately the mean sea level is used, for depths in many cases low water.	S-52, and S-32 and IECG Product Specification for Inland ENCs
Datum, horizontal	A set of parameters specifying the reference for horizontal geodetic control, commonly the dimensions and the location of a reference ellipsoid. (The horizontal datum must be WGS 84).	
Datum, vertical	A surface to which elevations and/or depths (soundings and tide heights) are referred. For elevations commonly a level (equipotential) surface, approximately the mean sea level is used, for depths in many cases, low water.	
DC	Danube Commission; international river commission based on the Belgrade Convention of 1948, currently under revision. Current member States: Austria, Bulgaria, Croatia, Germany, Hungary,	

<i>Term or abbreviation</i>	<i>Definition</i>	<i>Source</i>
	Republic of Moldova, Romania, Serbia, Slovakia, Russian Federation and Ukraine. The most important objectives of DC are: Prosperity of the Danube navigation and its full integration into the European system of transport by inland waterway; and Maintenance of a high level of safety of navigation on the Danube.	
Differential GPS (DGPS)	A form of GPS in which the reliability and accuracy are enhanced by broadcasting a time-varying correction message from a GPS monitoring receiver (differential mode) at a known position on shore. The corrections are fed automatically into the GPS receiver on board and used to compute an improved position.	
Display base	Minimum information density; means the minimum amount of SENC information that is presented and which cannot be reduced by the operator, consisting of information that is required at all times in all geographic areas and under all circumstances.	IMO Resolution MSC.232(82)
Display scale	The ratio between a distance on the display and a distance on the ground, normalised and expressed as a ratio, e.g. 1:10 000.	S-52 and S-32
EBL	Electronic Bearing Line	4-5 Section 4 of this annex
ECDIS	Electronic Chart Display and Information System (ECDIS) means a navigation information system which with adequate back-up arrangements can be accepted as complying with the up-to-date chart required by regulations V/19 and V/27 of the 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.	IMO Resolution MSC.232(82)
Edge	A one-dimensional spatial object, located by two or more coordinate pairs (or two connected nodes) and optional interpolation parameters.	S-57
Electronic chart	Very broad term to describe the data, the software, and the electronic system, capable of displaying chart information. An electronic chart may or may not be equivalent to the paper chart required by the SOLAS Convention.	S-52 and S-32
ENC	Electronic Navigational Chart; the data base, standardised as to content, structure and format, issued for use with ECDIS on the authority of government authorised hydrographic offices. The ENC contains all the chart information necessary for safe navigation and may contain supplementary information in addition to that contained in the paper chart (e.g. sailing directions) which may be considered necessary for safe navigation.	IMO Resolution MSC.232(82)
ENC cell	The geographic division of ENC data for distributing purposes.	IEC Guideline 61174, edition 3.0
ETSI	European Telecommunications Standards Institute	

<i>Term or abbreviation</i>	<i>Definition</i>	<i>Source</i>
Enumeration	A specific quality or quantity assigned to an attribute (e.g. 'leading light', the limiting angles, the code specifying the light's colour – see attribute).	IEHG Inland ENC Feature Catalogue
Feature	An identifiable set of information. A feature may have attributes and may be related to other features. A digital representation of all or a part of an entity by its characteristics (attributes), its geometry, and (optionally) its relationships to other features (e.g., the digital description of a light sector specifying, amongst others, sector limits, the colour of the light, the visibility range, etc., and a link to a light tower, if any). Definitions for diverse features may be derived from the Feature Catalogue for Inland ENCs referred to in Appendix 1 to this Annex.	S-52 and S-32
Feature catalogue	The comprehensive list of currently identified features, attributes and enumerations which are allowed for the use in Inland ENCs.	IEHG Inland ENC Feature Catalogue
Feature copied	S-57 features (with their complete set of attributes) which were extended according to the requirements of Inland ECDIS. All new features have the same name as their source, but are written in small case letters.	
Feature Data Dictionary	A feature data dictionary specifies independent sets of features and attributes that may be used to describe geographic information in a particular context. A feature data dictionary may be used to develop a feature catalogue.	
File	An identified set of S-57 records collected together for a specific purpose. The file content and structure must be defined by a product specification.	S-52 and S-32
GNSS	Global Navigation Satellite System (GNSS) is a system that uses satellites to provide autonomous geospatial positioning.	
Geo-Feature	Type of feature containing the descriptive characteristics of a real world entity.	
Geometric Primitive	One of three basic geometric units of representation: point, line and area.	
Heading	The direction in which the longitudinal axis of a craft is pointed, usually expressed as an angular distance from north clockwise through 360 degrees (true, magnetic or compass).	S-52 and S-32
Head-up display	The information presented shown on the display (radar or ECDIS) is directed so that the vessel's heading is always pointing upward. This orientation corresponds to the visual view from the bridge in direction of the vessel's heading. This orientation may require frequent rotations of the display content. Changing the ship's vessel's course or yawing of the vessel may render this unstabilised orientation mode unreadable illegible .	S-52 and S-32
Human Machine Interface (HMI)	The user interface or human-machine interface is the part of the machine that handles the human-machine interaction. The engineering of the human-machine interfaces is enhanced by considering ergonomics (human factors). There are many ways to	

<i>Term or abbreviation</i>	<i>Definition</i>	<i>Source</i>
	develop human-machine interface (HMI) screens for machine and process automation applications. Guidelines, standards and handbooks covering the HMI design include those published by ISA, ASM, ISO, and NUREG.	
IEC	International Electrotechnical Commission: An international (non-governmental) organization which produces world standards for electrical and electronical engineering with the objective of facilitating international trade.	S-52 and S-32
IHO	International Hydrographic Organization: Coordinates the activities of national hydrographic offices; promotes standards and provides advice to developing countries in the fields of hydrographic surveying and production of nautical charts and publications.	S-52 and S-32
IHO registry	IHO Geospatial Information Infrastructure Registry. A registry is the information system on which a register is maintained. In the case of S-100 IHO hosts a registry that provides a facility to store various registers of hydrographic-related information.	IENC Domain in the S-100 Registry
(IHO) S 32 App.1	Hydrographic Dictionary – Glossary of ECDIS Related Terms.	
(IHO) S 52	Specifications for Chart Content and Display Aspects of ECDIS.	2
(IHO) S 52 App. 1	Guidance on Updating the Electronic Navigational Chart.	2
(IHO) S 57	IHO Transfer standard for Digital Hydrographic Data.	3
(IHO) S 57 App. A	IHO Object Catalogue.	3
(IHO) S 57 App. B	ENC Product Specifications.	3
(IHO) S 62	ENC Producer Codes.	
IMO	International Maritime Organization: Formerly called IMCO, IMO is a the specialized agency of the United Nations responsible for maritime safety, efficiency of navigation and prevention of marine pollution from ships.	S-52 and S-32
Information Mode	Means the use of the Inland ECDIS for information purposes only without overlaid radar image.	4.1 Section 1 of this annex
Inland AIS	AIS for the use in inland navigation and interoperable with (maritime) AIS – technically enabled by amendments and extensions to the (maritime) AIS. Automatic identification system for inland waterway vessels as set out in the International Standard for Tracking and Tracing on Inland Waterways (VTT) (resolution No. 63).	International Standard for Tracking and Tracing on Inland Waterways (VTT) (resolution No. 63)
Inland ECDIS	An Electronic Chart Display and Information System for inland navigation, displaying selected information from an Inland System Electronic Navigational Chart (Inland SENC) and optionally, information from other navigation sensors.	4.1 Section 1 of this annex

<i>Term or abbreviation</i>	<i>Definition</i>	<i>Source</i>
Inland ENC (IENC)	Inland Electronic Navigational Chart (IENC) means the database, standardised as to content, structure and format, for use with inland electronic chart display and information systems operated on-board of vessels transiting inland waterways. An IENC is issued by or on the authority of a competent government agency, and conforms to standards initially developed by the International Hydrographic Organization (IHO) and refined by the Inland ENC Harmonization Group. An Inland ENC IENC contains all the chart information necessary for safe navigation on inland waterways and may contain supplementary information in addition to that contained in the paper chart (e.g. sailing directions, machine-readable operating schedules, etc.) which may be considered necessary for safe navigation and voyage planning.	4-1 Section 1 of this annex
Inland ENC domain	Domain within the IHO Geospatial Information Infrastructure Registry dedicated for Inland ENC-related entries.	IENC Domain in the S-100 Registry
Inland SENC	Inland System Electronic Navigational Chart: a database resulting from the transformation of the Inland ENC by Inland ECDIS for appropriate use, updates to the Inland ENC by appropriate means and other data added by the mariner. It is this database that is actually accessed by the Inland ECDIS for the display generation and other navigational functions. The Inland SENC may also contain information from other sources.	4-1 Section 1 of this annex
INT-1	International chart 1 (INT-1) means a specification of symbols, abbreviations and terms to be used in the International Chart Series of IHO. It provides the chart user with a key to symbols, abbreviations and terms used on charts compiled in accordance with the "Chart Specifications of the IHO". INT-1 contains description entries for features and attributes. It can be seen as the reference to the legend of paper charts.	
Integrated display	Means a head-up, relative-motion picture consisting of the Inland SENC overlaid with the radar-image with matching scale, offset and orientation.	4-1 Section 1 of this annex
Look-up table	A table giving symbology instructions to link SENC objects to point, line or area symbolisation and providing display priority, radar priority, IMO category and optional viewing group.	S-52 and S-32
M-4	Chart specifications of the IHO (M-4) gives chart specifications for compiling nautical charts, together with agreed symbols and abbreviations adopted for general use by Member States. M-4 also provides regulations for INT Charts. M-4 contains description entries for features and attributes.	
Meta-object	A feature which contains information about other features.	
Navigation mode	Means the use of the Inland ECDIS for conning the vessel with overlaid radar image.	4-1 Section 1 of this annex
North-up display	Information shown on the display (radar or ECDIS) with the north direction upward.	S-52 and S-32

<i>Term or abbreviation</i>	<i>Definition</i>	<i>Source</i>
Other navigational information	Navigational Information not contained in the SENC, that may be displayed by an ECDIS, such as radar information.	S-52 and S-32
Own vessel	The term which identifies the vessel upon which an ECDIS is operating.	S-52 and S-32
Own vessel's safety contour	The contour related to the own vessel selected by the mariner from the contours provided for in the SENC, to be used by ECDIS to distinguish on the display between the safe and the unsafe water, and for generating anti-grounding alarms.	S-52 and S-32
Performance standard for ECDIS	Standard developed under the authority of IMO to describe the minimum performance requirements for navigational devices and other fittings required by the SOLAS Convention, included in MSC.232(82), as adopted by IMO on 5 December 2006.	S-52 and S-32
Pick report (feature report)	The result of querying a displayed point-symbol, line or area for further information from the data base which is not represented by the symbol.	S-52 and S-32
Presentation library for ECDIS	A set of mostly digital specifications, composed of symbol libraries, colour schemes, look-up tables and rules, linking every feature and attribute of the SENC to the appropriate presentation of the ECDIS display. Published by IHO as Annex A, Special Publication No 52 (S-52).	S-52 and S-32
Product specification	A defined subset of the entire specification combined with rules, tailored to the intended usage of the transfer data. (The ENC Product specification provides specifies the content, structure and other mandatory aspects of an ENC)	S-52 and S-32
(Radar) range	Distance from the radar antenna. For inland navigation the radar range has to be sequential switchable according to the CCNR Radar Regulations.	Annex IX, Parts III to VI, of the EU Directive 2006/87/EC as amended by 2013/49/EU. Requirements applicable to radar installations and rate-of-turn indicators Annex II of Directive 2016/1629 of the European Parliament and of the Council of 14 September 2016 laying down technical requirements for inland waterway vessels
Relative motion display	A relative motion display shows the chart information and radar targets moving relative to the vessel position fixed on the screen.	S-52 and S-32

<i>Term or abbreviation</i>	<i>Definition</i>	<i>Source</i>
Route planning	An ECDIS function in which the area is displayed which is needed to study the intended route, to select the intended track, and to mark the track, its way points and navigational notes.	IMO Resolution MSC.232(82)
SCAMIN	The minimum scale at which the feature may be used e.g. for ECDIS presentation.	S-57
SENC	System Electronic Navigational Chart: An internal data base in an Inland ECDIS which results out of the transformation of ENC's and their update files and other data added by the mariner boatmaster . It is this data base that is actually accessed by the ECDIS for the display generation and other navigational functions. The SENC may also contain information from other sources.	S-52 and S-32
Spatial object	An object which contains locational information about real world entities.	S-52 and S-32
Standard display	Standard Information Density means the default amount of SENC information that must be visible when the chart is first displayed on ECDIS.	
Standard Information Density	The default amount of SENC information that shall be visible when the chart is displayed when ECDIS is switched on. A screen with Standard Information Density (standard display) is the default state of the Inland ECDIS.	Section 1 of this annex
UNECE	United Nations Economic Commission for Europe organizes cooperation on economic and sectoral issues between its 56 member countries including all EU and non EU European States, Commonwealth of Independent States and North America. In the transport area, UNECE promotes the facilitation of international road, rail, inland waterway and combined transport, particularly through the improvement of transport infrastructure, simplification and harmonization of administrative border crossing procedures and through the harmonization of technical requirements.	
[Vessel] Tracking and Tracing	Tracking: the function of maintaining status information on the vessel, and if needed possibly combined with information on cargo and consignments; tracking tracing : and retrieving the retrieval of information concerning the whereabouts of the vessel, and if needed possibly combined with information on cargo, consignments and equipment tracing , as set out in the International Standard for Tracking and Tracing on Inland Waterways (VTT) (resolution No. 63).	International Standard for Tracking and Tracing on Inland Waterways (VTT) (resolution No. 63)
True motion display	A display in which the own vessel and each radar target moves with its own true motion, while the position of all charted information remains fixed.	S-52 and S-32
User-defined settings	Means the possibility to use and store a profile of display and operation controls- settings.	4.1 Section 1 of this annex
VRM	Variable Range Marker.	4.5 Section 4 of this annex

<i>Term or abbreviation</i>	<i>Definition</i>	<i>Source</i>
WGS 84	World Geodetic System: The geodetic basis for the 'Navigational Satellite Timing and Ranging – Global Positioning System', which enables the surveying of the earth and its entities and was developed by the United States Department of Defence. This global geodetic reference system is recommended by IHO for hydrographic and cartographic use.	IEHG Product Specification for Inland ENC _s