



IEC 61174

Edition 4.0 2015-08

INTERNATIONAL STANDARD



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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 47.020.70

ISBN 978-2-8322-2822-7

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD	12
1 Scope	14
2 Normative references	14
3 Terms, definitions and abbreviations	16
3.1 Terms and definitions.....	16
3.2 Abbreviations.....	21
4 Minimum operational and performance requirements	22
4.1 General.....	22
4.2 ECDIS definitions.....	23
4.3 Display of SENC information.....	23
4.3.1 SENC	23
4.3.2 Indication about use of non-HO source	23
4.3.3 Categories of display	23
4.3.4 Safety contour	24
4.3.5 Safety depth	25
4.3.6 Information content	25
4.3.7 Verification and updates	25
4.3.8 Information about chart objects.....	25
4.3.9 Display scale	25
4.4 Provision and updating of chart information	25
4.4.1 Contents of the SENC.....	25
4.4.2 Updates	26
4.5 Scale	26
4.6 Display of other navigational information.....	26
4.6.1 General for all overlays.....	26
4.6.2 Radar information	27
4.6.3 AIS information	30
4.6.4 AIS target data.....	32
4.6.5 AIS voyage-related data	33
4.6.6 AIS CPA/TCPA alarms.....	33
4.6.7 AIS lost target warning.....	34
4.6.8 Anchor watch.....	34
4.7 Display mode and generation of the neighbouring area	35
4.8 Colours and symbols.....	35
4.9 Display requirements	36
4.9.1 Route planning and monitoring	36
4.9.2 Chart presentation size.....	36
4.9.3 Colour and resolution.....	36
4.9.4 Presentation	36
4.9.5 Removal of information categories.....	36
4.10 Route planning, monitoring and voyage recording.....	36
4.10.1 General.....	36
4.10.2 Route planning	37
4.10.3 Route monitoring	38
4.10.4 Position integration	40
4.10.5 Object information.....	41

4.10.6	LOP position fix	41
4.10.7	Voyage recording.....	41
4.11	Calculations and accuracy	42
4.12	Connections with other equipment (interfaces).....	42
4.12.1	Connection with navigation equipment.....	42
4.12.2	Connection with BAM.....	42
4.12.3	Connection with VDR.....	43
4.12.4	Connection with BNWAS.....	44
4.12.5	Connection for SENC information	44
4.12.6	Connection with NAVTEX or SafetyNET for MSI	44
4.12.7	Connection for transfer of route information	45
4.12.8	Connection with INS	46
4.13	Performance tests, malfunction alerts and indications	46
4.14	Back-up arrangements	46
4.15	Power supply	46
4.16	Software maintenance	46
4.17	Quality management requirements.....	47
4.18	Default control setting and saved user control settings.....	47
5	Requirements contained in IHO publications.....	49
5.1	Priority of chart display	49
5.2	Display of chart information	50
5.2.1	Scale and navigation purpose	50
5.2.2	Units and legend.....	50
5.2.3	Terminology.....	51
5.3	Display functions	51
5.3.1	Cursor pick	51
5.3.2	Navigational information	51
5.3.3	Date-dependant ENC objects.....	52
5.4	Supplementary display functions.....	52
5.4.1	Additional mariner's information.....	52
5.4.2	Additional non-HO information	52
5.4.3	Tidal adjustment	53
5.5	Use of the presentation library	53
5.5.1	Presentation library.....	53
5.5.2	Test diagrams.....	53
5.6	Display characteristics	53
5.7	Performance requirements.....	54
5.7.1	Redraw	54
5.7.2	Resolution	54
5.7.3	Symbols.....	54
5.7.4	Number of colours	55
5.7.5	Brightness and contrast	55
5.8	Ergonomic requirements	55
5.8.1	Mode and orientation	55
5.8.2	Windows	55
5.9	Update of chart information.....	56
5.9.1	General.....	56
5.9.2	Manual update	57
5.9.3	Semi-automatic update	58

5.9.4	Reception of updates	58
5.9.5	Sequence check	58
5.9.6	Consistency check	59
5.9.7	Geographic applicability	59
5.9.8	Summary report	59
5.9.9	Review of ENC updates	59
5.9.10	Modification of updates	59
5.10	Operational area	59
5.11	External removable media	60
6	Methods of testing and required test results	60
6.1	EUT installation, technical documentation, and test requirements	60
6.2	Interfaces	60
6.2.1	General	60
6.2.2	BAM interface	61
6.2.3	VDR interface	62
6.2.4	BNWAS interface	63
6.3	General requirements and presentation requirements	63
6.3.1	General requirements	63
6.3.2	Presentation requirements	63
6.4	Preparation	63
6.4.1	Power-up	63
6.4.2	Initial ship parameters	64
6.4.3	Required test items	64
6.5	Requirements related to ENC chart	64
6.5.1	General	64
6.5.2	Presentation library	65
6.5.3	ENC	65
6.5.4	Encrypted ENC	65
6.6	Accuracy	65
6.7	Visual requirements	65
6.7.1	Symbols	65
6.7.2	Terminology, units and legend	65
6.7.3	Colour table	65
6.7.4	Resolution	66
6.7.5	Display characteristics	66
6.8	Functional requirements	66
6.8.1	Methods of testing	66
6.8.2	Standard display	66
6.8.3	Display base	66
6.8.4	All other information	67
6.8.5	Viewing group layers and text group layers	67
6.8.6	Display priorities	67
6.8.7	Additional display functions	67
6.8.8	Scale and navigation purpose	67
6.8.9	Mode and orientation	68
6.8.10	Safety contour	68
6.8.11	Safety depth	68
6.8.12	Cursor pick	68
6.8.13	Navigation related functions	68

6.8.14	Position integration	69
6.8.15	Radar and other navigational information	69
6.8.16	Loading of corrupted data	72
6.8.17	Automatic updates	72
6.8.18	Manual updates	73
6.8.19	Self-tests of major functions.....	73
6.8.20	Operational area	73
6.8.21	External removable media.....	74
6.9	Operational requirements	74
6.9.1	Ergonomic principles.....	74
6.9.2	Route planning	74
6.9.3	Route monitoring	76
6.9.4	Twelve hour log	78
6.9.5	Voyage record	78
6.9.6	Power supply	78
6.9.7	LOP position fix	78
6.10	Software maintenance	79
6.11	Quality management	79
6.12	Default control setting and saved operator control settings	80
6.13	AIS information and AIS target data	80
6.13.1	General.....	80
6.13.2	AIS targets and data report capacity	80
6.13.3	AIS target filtering	80
6.13.4	Activation and deactivation of AIS targets	81
6.13.5	AIS functionality and presentation.....	81
6.13.6	AIS target data.....	82
6.13.7	AIS CPA/TCPA alarm.....	83
6.13.8	AIS lost target warning.....	83
6.14	AIS Voyage-related data	84
6.15	Anchor watch	84
6.16	NAVTEX and SafetyNET for MSI.....	85
6.17	Interface for transfer of route information	85
6.18	Interface with INS	86
Annex A (normative)	SENC information to be displayed during route planning and route monitoring	87
Annex B (normative)	Navigational elements and parameters.....	88
Annex C (normative)	Areas for which special conditions exist	89
Annex D (normative)	Alerts and indications.....	90
Annex E (normative)	Mandatory terminology and abbreviations	92
Annex F (normative)	Back-up arrangements	98
F.1	Overview.....	98
F.2	Purpose	98
F.3	Functional requirements.....	98
F.3.1	Required functions and their availability.....	98
F.3.2	Reliability and accuracy	102
F.3.3	Malfunctions, warnings, alerts and indications	102
F.4	Operational requirements	102
F.4.1	Ergonomics.....	102

F.4.2	Presentation of information	102
F.5	Power supply	103
F.6	Other requirement.....	103
F.6.1	Connection with other systems	103
F.6.2	Route transfer interface	104
F.6.3	Radar as back-up system.....	104
F.6.4	Operational area	104
F.6.5	Software maintenance	104
F.6.6	Quality management	104
F.6.7	Default Control Settings and Saved User Control Settings	104
F.6.8	External removable media.....	104
F.7	Methods of testing and required test results	105
F.7.1	EUT installation and technical documentation	105
F.7.2	Interfaces	105
F.7.3	General requirements and presentation requirements	105
F.7.4	Preparation.....	105
F.7.5	Initial data tests – Chart.....	106
F.7.6	Accuracy.....	106
F.7.7	Visual requirements	106
F.7.8	Functional requirements	106
F.7.9	Operational requirements.....	108
Annex G (normative)	ECDIS in the RCDS mode of operation	111
G.1	Overview.....	111
G.2	RCDS definitions	111
G.3	Display of SRNC information.....	112
G.3.1	SRNC	112
G.3.2	Categories of display	112
G.3.3	Power failure	112
G.3.4	Information content	112
G.3.5	Verification and updates	112
G.3.6	Indication.....	113
G.4	Provision and updating of chart information	113
G.4.1	Contents of the RNC	113
G.4.2	Updates	113
G.5	Scale	114
G.6	Display of other navigational information.....	114
G.6.1	General for all overlays.....	114
G.6.2	Radar information	114
G.6.3	AS information	115
G.6.4	AIS Target Data.....	115
G.6.5	AIS Voyage Related Data	115
G.6.6	AIS CPA/TCPA alarms.....	115
G.6.7	AIS lost target warning.....	115
G.6.8	Anchor watch.....	115
G.7	Display mode and generation of the neighbouring area	115
G.8	Colours and symbols.....	116
G.9	Display requirements	116
G.9.1	Route planning and monitoring	116
G.9.2	Display characteristics	116

G.9.3	Chart notes	117
G.10	Route planning, monitoring and voyage recording	117
G.10.1	General.....	117
G.10.2	Route planning	117
G.10.3	Route monitoring	117
G.10.4	Position integration	118
G.10.5	Object information.....	119
G.10.6	LOP position fix	119
G.10.7	Voyage recording.....	119
G.11	Calculations and accuracy	120
G.12	Connections with other equipment (interfaces).....	120
G.13	Performance tests, malfunction alerts and indications	121
G.14	Back-up arrangements for RCDS mode of operation	121
G.15	Power supply for RCDS mode of operation	121
G.16	Requirements contained in IHO publications	122
G.16.1	Structure of RNC data.....	122
G.16.2	RNC data resolution and accuracy	122
G.16.3	RNC meta-data	122
G.16.4	RNC colours	122
G.16.5	RNC notes, diagrams, etc	123
G.16.6	Operational area	123
G.16.7	External removable media.....	123
G.17	Methods of testing and required test results	123
G.17.1	Preparation – Required test items	123
G.17.2	Initial data tests	124
G.17.3	Accuracy.....	124
G.17.4	Visual requirements	125
G.17.5	Functional requirements	126
G.17.6	Operational requirement	131
G.18	RNC test data set	134
Annex H (normative)	Alerts and indications in the RCDS mode of operation	135
Annex I (normative)	Scenario definitions and plots.....	136
I.1	Overview.....	136
I.2	Scenario 1:	137
I.3	Scenario 2:	138
I.4	Scenario 3:	140
I.5	Scenario 4:	141
Annex J (informative)	Guidance on geodetic calculations.....	144
J.1	Overview.....	144
J.2	Distance deviations between Great Circle (orthodrome) and Rhumb Line (loxodrome)	144
J.3	Bearing deviations at start point between Great Circle (orthodrome) and Rhumb Line (loxodrome).....	145
Annex K (informative)	Guidance for testing	147
K.1	Methods of test derived from ISO 9241-12	147
K.2	Observation	147
K.3	Inspection of documented evidence	147
K.4	Measurement.....	147
K.5	Analytical evaluation	148

Annex L (informative) Examples of ENC Update Status Report	149
L.1 Overview.....	149
L.2 ENC Update Status Report – Summary.....	149
L.3 ENC Update Status Report – Full.....	150
L.4 ENC Management Report – Route Filtered	152
Annex M (normative) Elements of an electronic chart database	153
M.1 General.....	153
M.2 ECDIS implementation	153
M.3 Display base category.....	154
M.3.1 Coastline layer.....	154
M.3.2 Safety contour layer.....	155
M.3.3 Isolated underwater dangers layer	155
M.3.4 Isolated above-water dangers layer	155
M.4 Standard display category.....	156
M.4.1 Display base layer	156
M.4.2 Additional aids to navigation and fixed structures layer	156
M.4.3 Fairways layer	156
M.4.4 Conspicuous features layer.....	156
M.4.5 Prohibited and restricted areas layer.....	157
M.4.6 Ferry routes layer	157
M.4.7 Archipelagic sea lanes layer	157
M.4.8 Buoys and beacons layer	157
M.4.9 Traffic routeing layer.....	157
M.5 All other information category	158
M.5.1 Information about the chart display layer.....	158
M.5.2 Natural and man-made features, Port features layer	158
M.5.3 Depth, currents, etc. layer.....	159
M.5.4 Seabed, obstructions, pipelines layer.....	160
M.5.5 Traffic routes layer	160
M.5.6 Special areas layer	160
M.5.7 Service and small craft facilities layer	161
M.6 Text grouping.....	161
M.6.1 Important Text group layer	161
M.6.2 Other Text group layer	161
Annex N (informative) Use cases for safety contour and safety depth	163
Annex O (informative) Guidelines on use of electronic chart systems in polar waters	165
O.1 Projection and coordinate system	165
O.2 Consistency	166
Annex P (normative) Scenarios for polar areas above 85° North	167
Annex Q (normative) IEC 61162 interfaces	173
Q.1 General.....	173
Q.2 VDR interface	176
Q.3 AIS interface and interrogation.....	176
Q.4 Route transfer interface	177
Q.5 BAM interface	177
Annex R (informative) Conversion between IEC 61162-1 sentences and IEC 61162-3 parameter group numbers.....	181
Annex S (normative) Route plan exchange format – RTZ	183

S.1	General.....	183
S.2	RTP Data container	184
S.3	High-level description of the RTZ format	185
S.4	Adaptation to third-party extensions	185
S.4.1	Generic idea	185
S.4.2	Unique identification of a waypoint.....	185
S.4.3	Creation of new waypoints	186
S.4.4	Change of geographic data for a waypoint	186
S.4.5	Waypoint removal	186
S.5	Detailed RTZ format description.....	186
S.5.1	File components	186
S.5.2	Route node description	186
S.5.3	RouteInfo node description	187
S.5.4	Waypoints node description	188
S.5.5	DefaultWaypoint node description.....	188
S.5.6	Waypoint node description.....	189
S.5.7	Storing date and time for legs	190
S.5.8	Schedules node description	190
S.5.9	Schedule node description	190
S.5.10	Extensions node description	192
S.5.11	Extension node description	193
S.6	XML schema to be met by RTZ route files.....	193
S.7	Basic RTZ route example.....	205
S.8	Example of the RTZ route with embedded extensions	206
S.9	UML model of the Route exchange format.....	207
Annex T (normative)	Interface for reporting route transfer	209
T.1	Route encapsulation format for transmitting RTZ over IEC 61162-450	209
T.2	RRT – Report route transfer.....	210
Annex U (normative)	Sentences used by SafetyNET	211
U.1	General.....	211
U.2	SM1 – SafetyNET Message, All Ships/NavArea	211
U.3	SM2 – SafetyNET Message, Coastal Warning Area	213
U.4	SM3 – SafetyNET Message, Circular Area Address	215
U.5	SM4 – SafetyNET Message, Rectangular Area Address.....	217
U.6	SMB – IMO SafetyNET Message Body.....	220
U.7	An example of use	221
Annex V (normative)	Extension of TTD sentence, Protocol version 1	222
V.1	General.....	222
V.2	TTD – Tracked target data, Protocol version 1	222
Annex W (normative)	Symbols	223
Bibliography.....		224
Figure F.1	– Backup system logical interfaces	103
Figure I.1	– Definition of elements of route	136
Figure I.2	– Route for scenario 1.....	138
Figure I.3	– Route for scenario 2.....	139
Figure I.4	– Route for scenario 3.....	140

Figure I.5 – Route for scenario 4.....	143
Figure J.1 – Distance deviations between Great Circle and Rhumb Line	144
Figure J.2 – Bearing deviations at start point between Great Circle and Rhumb Line	146
Figure N.1 – Original situation	163
Figure N.2 – New situation.....	164
Figure P.1 – Examples of use of the tables	167
Figure Q.1 – ECDIS logical interfaces.....	173
Figure Q.2 – Alert reporting by ECDIS without escalation of a warning	177
Figure Q.3 – Alert reporting by ECDIS with escalation of a warning as alarm	178
Figure Q.4 – Alert reporting by ECDIS in case of remote acknowledge	178
Figure Q.5 – Alert reporting by ECDIS in case of remote silence.....	179
Figure Q.6 – Alert reporting by ECDIS in case of remote silence.....	180
Figure Q.7 – Alert reporting by ECDIS in case of remote silence.....	180
Figure S.1 – Description of route plan – Distance between WP 2 and WP 3	184
Figure S.2 – Description of route plan – Leg parameters belonging to WP 3	184
Figure S.3 – UML diagram	208
Figure T.1 – Examples of timing for route transfer.....	209
Table 1 – Tracked target display capacity	28
Table 2 – AIS display capacity	30
Table 3 – Control settings configured in response to ‘Default’ selection	47
Table D.1 – Alerts and indications resulting from IMO requirements.....	90
Table D.2 – Alerts and indications defined in this standard	91
Table E.1 – Chart display terminology.....	92
Table E.2 – Main function terminology	94
Table E.3 – Database terminology	95
Table E.4 – Route, route monitoring or route plan related terminology	96
Table H.1 – Alerts and indications in the RCDS mode of operation	135
Table J.1 – Rhumb Line distances	145
Table J.2 – Deviations from Great Circle distances	146
Table M.1 – Minimum ECDIS mariner viewing group layer selectors	153
Table M.2 – Minimum ECDIS mariner text group layer selectors	154
Table P.1 – Spatial control points from 85°N, 0°E as origin.....	168
Table P.2 – Spatial control points from 87°N, 0°E as origin	169
Table P.3 – Spatial control points from 89°N, 0°E as origin.....	170
Table P.4 – Spatial control points from 90°N, 0°E as origin, 180°E as origin of relative bearings.....	171
Table Q.1 – Mandatory sentences received by ECDIS	174
Table Q.2 – Optional sentences received by ECDIS.....	175
Table Q.3 – Mandatory sentences transmitted by the ECDIS	175
Table Q.4 – Optional sentences transmitted by the ECDIS.....	176
Table Q.5 – Mandatory information transmitted to the VDR.....	176
Table Q.6 – Information between the ECDIS and an ECDIS backup system.....	177

Table R.1 – Conversion from IEC 61162-1 to IEC 61162-3..... 181
Table R.2 – Conversion from IEC 61162-3 to IEC 61162-1..... 182
Table W.1 – Anchor watch symbol 223

INTERNATIONAL ELECTROTECHNICAL COMMISSION

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS –

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

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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

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

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

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

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

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

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

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

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

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

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

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

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

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS –

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

1 Scope

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

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

In association with the above IMO resolution MSC.232(82), are the International Hydrographic Organization (IHO) publications¹. IHO S-32, IHO S-52, IHO S-57, IHO S-61, IHO S-63 and IHO S-64. This standard has included extracts from the above publications where they are applicable to this equipment. Where reference is made, all subclauses whose wording is identical to that in the publications, are printed in italics.

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

- *dedicated standalone workstation.*
- *a multifunction workstation as part of an INS.*

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

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

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

2 Normative references

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

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

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

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

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

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

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

IEC 62288:2014, *Maritime navigation and radiocommunication equipment and systems – Presentation of navigation-related information on shipborne navigational displays – General requirements – Methods of testing and required test results*

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

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

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

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

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

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

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

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

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

IHO S-63, *IHO data protection scheme*

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

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

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

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

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

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

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

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