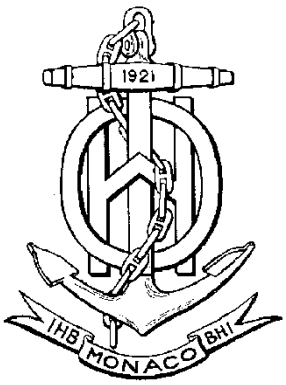
INTERNATIONAL HYDROGRAPHIC ORGANIZATION



IHO ECDIS PRESENTATION LIBRARY

Edition 4.0.0, September 2014

Publication S-52
ANNEX A

Published by the
International Hydrographic Organization
MONACO

FOREWORD

Edition 4.0.0 of the Presentation Library brings into effect all the deferred amendments issued since Edition 3.4 and also includes other substantial changes to bring it up to date with the IMO ECDIS Performance Standard requirements, and to provide clearer examples and guidance. This publication provides a clear, concise and comprehensive guide to implementing IHO S-52 symbology in ECDIS.

In keeping with previous versions of the presentation library the contents of the symbols, lookups and other ancillary files are published as a set of files which carry a subscription charge for each new edition to help to cover maintenance costs. These files are the authoritative statement of the presentation library contents.

The tables below detail the changes made to create S-52 Presentation Library Edition 4.0.0.

New Mandatory ECDIS Requirements

S-52 Ed. 4.0.0 Clause	Description	Justification
10.3.4.4	Ability to turn Isolated Dangers in Shallow Water on/off.	**Existing feature in e3.4 changed from optional to mandatory** This allows the Mariner the flexibility to navigate in shoal areas with or without the isolated danger symbol.
10.4.2	Ability to turn SCAMIN on/off.	SCAMIN is not universally applied by HO's in the same way. Mariners need to be able to view all data and need a function to turn the SCAMIN attribute off.
10.5.7	Mandatory implementation of ability to display shallow water pattern.	**Existing feature in e3.4 changed from optional to mandatory** Safety critical feature as it becomes increasingly difficult to detect the changes in the depth shades in ECDIS night colour table.
10.5.9	Detection and Notification of Navigational Hazard. Lists the S-57 features and attributes that will raise an indication.	**IMO PS Requirement** Enables clear and transparent identification of objects that will raise an indication within the ECDIS.
10.5.9	New Mariner Object 'indhlt'	**IMO PS Requirement** Designed for conditions that require a highlight in the ECDIS chart area, to conform to IMO requirements. IMO has dictated that the colour red is only allowed for alarms in ECDIS and that the colour yellow must be used for warning and cautions. Design of a graphical highlight symbol in colour yellow. The current S-52 traditional graphical highlight symbol dnghlt is red.

S-52 Ed. 4.0.0 Clause	Description	Justification
10.5.10	Detection of Areas, for which Special Conditions Exist. Lists the S-57 features and attributes that will raise an indication or alert as defined by the Mariner.	**IMO PS Requirement** Enables clear and transparent identification of objects that will raise an indication or alert within ECDIS as defined by the Mariner.
10.5.12	Detecting the Safety Contour. Lists the S-57 feature and attribute combinations required to detect the safety contour. Rocks, Wrecks and Obstructions have been removed in e4.0.0 from detection of the safety contour process and moved to Detection and Notification of Navigational Hazards. This change is in line with the IMO PS requirement.	**IMO PS Requirement** IMO PS states that rocks, wrecks and obstruction will only be an indication. Removing them from detecting the safety contour will reduce the number of audible alerts in ECDIS.
10.6.1.1	New viewing group created to allow separate display on/off for INFORM01 symbol: “Highlight info” for INFORM and NINFRM. “Highlight document” for TXTDSC, NTXDSC and PICREP.	**IMO PS Requirement** Mariner feedback during IMO Oct 2012 ECDIS meeting expressed irritation at not being able to control the display of features in ECDIS as there were not enough selectors. This was sighted as a major reason for cluttered ECDIS display.
10.7.2	Use of new symbols for identifying automatic ENC updates.	**IMO PS Requirement** Previously no standardized symbols available.
14.3	Adoption of the IMO PS naming convention for ECDIS viewing groups available in ECDIS.	**IMO PS Requirement** Mariner feedback during IMO Oct 2012 ECDIS meeting expressed irritation at not being able to control the display of features in ECDIS as there were not enough selectors. This was sighted as a major reason for cluttered ECDIS display.

Changes and Clarifications

S-52 Ed. 4.0.0 Clause	Description	Justification
	Inserted Standards Terms and Definitions.	
	Inserted new text boxes are used to highlight important text and notes in the new edition of the standard.	**Clarification** Highlights critical points in ECDIS presentation for developers.
Annex A	FLODOC, PONTON, HULKES display priority changed from 5 to 1.	**Error in LUT entries** These objects are part of group 1, skin of the earth objects, they all have a solid area fill and should be lowest in the drawing priority. Before the change for example cranes in a flodoc area were masked by the high priority drawing of solid brown colour.

S-52 Ed. 4.0.0 Clause	Description	Justification
Annex A App A	The Mariner colours introduced by MD8 have been included in S-52 e4.0.0. NINFO has been removed from the list of colour tokens that can be substituted.	**MD8**
	Description of the Symbology Instructions**,** removed Backus-Naur diagrams and replaced with POSIX style manual pages.	
10.1.3	ECDIS must only display one ENC chart in an area where ENC cells of the same scale and usage overlap.	**Clarification** Unfortunately despite best efforts ENC from different HOs sometimes do overlap. Previously there was no guidance on how overlaps should be handled in ECDIS. Mixing of overlapping charts created cluttered and unusable displays.
10.4	A means to insert a date or date range to display date dependant features. New symbol to indicate where in the chart display the objects with temporal attributes are located.	e3.4 provided two options to perform this function, select date or show all. E4.0.0 has removed the show all option as it was confusing for the Mariner. E4.0.0 has also introduced a new symbol that will indicate the presence of temporal attributes on features.
10.3.3.8	Use of default symbol NEWOBJ01 if SYMINS instruction cannot be understood.	**Clarification** Fail safe procedure.
10.6.2	The ECDIS legend will be made available at the position selected by the Mariner.	**Change** Ensuring the chart legend is available from the location chosen by the Mariner will remove any confusion about what data should be displayed when the own ships position is not on the ECDIS chart screen.
10.8.5	Guidance on the use of hover over function for a limited number of S-57 features.	**Change** Speeds up chart enquiry by the user. Recommendation from IEC 61174 drafting committee.
	CSP name change LIGHTS05 - LIGHTS06.	**MD8** New colour added, blue and to allow the display of 360 degree major light sectors with a nominal range of 10nM or greater.
	CSP name change LITDSN01 - LITDSN02.	**MD8** New colour added, blue.
	CSP name change SYMINS01 - SYMINS02.	**Clarification** Default symbolization instruction added.
	CSP name change SNDFRM03- SNDFRM04	**MD7** Introduction of new attribute found by Diver
	CSP name change SOUNDG02 – SOUNDG03.	**MD7** No change to CSP, numbering changed as CSP calls sub-procedure SNDFRM.

S-52 Ed. 4.0.0 Clause	Description	Justification
	CSP name change WRECKS04 – WRECKS05.	**MD7** No change to CSP, numbering changed as CSP calls sub-procedure SNDFRM.
	CSP name change OBSTRN06 – OBSTRN07.	**MD7** No change to CSP, numbering changed as CSP calls sub-procedure SNDFRM.
	CSP name change RESARE03 – RESARE04.	**MD8** To harmonize portrayal of entry prohibited restricted areas with INT 1.
	CSP name change DEPARE02 – DEPARE03.	**MD5** This change should have been already between Ed 3.3 and Ed 3.4.
	CSP name change SLCONS03 – SLCONS04.	**Clarification** The expert review team found an error in handling of “low accuracy symbols”.
8.5.1	When areas are split by the ECDIS screen the system must display centred symbols in each part.	**Clarification**
10.9	Display of TS_PAD template in ECDIS pick report.	**Clarification** Previously no guidance on how the data from the S-57 feature TS_PAD should be presented in the pick report.
S-52 ENC Symbol Catalogue	All conspicuous symbols must be drawn with a 0.6 line width. All non-conspicuous symbols have 0.3 line width.	**Clarification** Logical consistency, the more prominent a feature the more distinguishable it should be in the ECDIS chart display.
Annex A App B, C, D, E, F	ALL LUT entries with CONRAD 1 or 3 changed to suppressed.	**Clarification**
Annex A App B, C, D, E, F	Found typo style errors have been fixed for CURENT, FERYRT, LNDMRK, RCRTCL, VEGATN.	**Clarification** As part of the expert review process the existing printed version of the LUT has been fixed for typo style errors.
Annex A App B, C, D, E, F	Selected meta object without visible presentation has been modified to have viewing group, category, priority, etc., but still no visible symbol. This allows them to be selected for display in a pick report: M_ACCY, M_HOPA, M_SDAT, M_SREL, M_VDAT.	**Clarification** A technical method to access meta objects by pick report has been clarified.
Annex A App B, C, D, E, F	Selected meta object without visible presentation has been modified to have visible presentation: M_NPUB.	**Clarification** Technical possibility for ECDIS and practical graphical indication for mariner to access Nautical publication using Pick report.

Deletions

S-52 Ed. 3.4 Clause	Description	Justification
4.1	User Interface Colours	MSC.191(79) and IEC 62288 set rules for user interfaces within ECDIS.
6	The Raster-Symbol Description Format	Presentation Library 3.4 does not contain any raster symbol definitions and has never provided details.
10.5.7	Raster Image Pattern Definition	Presentation Library 3.4 does not contain any raster image pattern definitions.
10.6.7	Raster Image Symbol Module Example	Presentation Library 3.4 does not contain any raster symbols.
	All Mariners Objects, symbols and LUT entries	IMO and IEC 62288 is the authority for Mariner objects.

CHANGE CONTROL HISTORY SINCE 1996

Amendment Abbreviations: MD Maintenance Document
IA Immediate Amendment
DA Deferred Amendment

Specifications for Chart Content and Display Aspects of ECDIS (S-52)

Previous Edition	Amendments Applied	Resulting Edition
Edition 5.0 (Dec 1996)	Mar 1999	"5th Edition, amended Mar 1999"
"5th Edition, amended Mar 1999"	Dec 2001	"5th Edition, amended Mar 1999 & Dec 2001"
"5th Edition, amended Mar 1999 & Dec 2001"	MD7 + Merging with former S-52 App. 2 (C&S specs)	Edition 6.0 (Mar 2010)
Edition 6.0 (Mar 2010)	Deleted Annex B and corrections made to Annex C (not from an amendment)	Edition 6.1 (Sep 2014)

Guidance on Updating the Electronic Navigational Chart (S-52, Appendix 1)

Current Edition	Amendments Applied
Edition 3.0 (Dec 1996)	No revisions since 1996

Colours & Symbols Specifications (Former S-52, Appendix 2)

Previous Edition	Amendments Applied	Resulting Edition
Edition 3.0 (Jul 1996)	July 1997	Edition 4.0 (Jul 1997)
Edition 4.0 (Jul 1997)	MD1 IA i01	Edition 4.1 (Jan 1999)
Edition 4.1 (Jan 1999)	MD2 DA d02 MD4 DA d6	Edition 4.2 (Mar 2004)
Edition 4.2 (Mar 2004)	MD5 DA d7	Edition 4.3 (Jan 2008)

Glossary of ECDIS-Related Terms Specifications (Former S-52, Appendix 3)

Previous Edition	Amendments Applied	Resulting Edition
Edition 3.0 (Dec 1997)	Transferred to S-32	S-32, Appendix 1 (Sep 2007)

Presentation Library (Annex A to former S-52, Appendix 2)

Previous Edition	Amendments Applied	Resulting Edition	Digital PresLib	Addendum to Part I
Edition 3.0 (July 1997)	MD1 IA i01	Edition 3.1 (Jan 1999)	PRSLIB03.dai (Jul 1997) PSLB03_1.dai (Dec 1998)	
Edition 3.1 (Jan 1999)	MD 3 IA i04	Edition 3.2 (May 2000)	PSTY03_0.dai (Jun 1999) PSLB03_2.dai (May 2000)	2003
Edition 3.2 (May 2000)	MD2 DA d02 MD3 DA d05 MD4 DA d6	Edition 3.3 (2004)	PSTY3_2b.dai (Oct 2001) PSLB03_3.dai (Mar 2004)	2007
Edition 3.3 (2004)	MD5 IA i5 MD5 DA d7 MD6 IA i6	Edition 3.4 (2008)	PSLB03_4.dai (Jan 2008)	2008
Edition 3.4 (2008)	MD7 DA d8 MD8 DA d9 and other edits	Edition 4.0.0 (Sep 2014)	PSLB04_0.dai (Sep 2014)	2014

The grace periods from the issuing date of a new edition after which changes are required to be included in an ECDIS nominally are:

- for new development one year
- for new selling (already type-approved before date of issue) one year

GENERAL LAYOUT OF THE PRESENTATION LIBRARY

PART I:

USERS' MANUAL

Sections 1-10 Description of symbolisation methods
Sections 11 -12 Description of the Digital Presentation Library

TABLES AND SYMBOLISATION PROCEDURES

Section 13 Conditional Symbology Procedures(UML)
Section 14 Tables
Section 15 Symbol library for use on ECDIS

ECDIS CHART 1, SYMBOL PLOTS &COLOUR TEST DIAGRAM

Section 16 ECDIS Chart 1, Symbol plots& colour test diagram
Section 17 Contents of the Digital Presentation Library
Section 18 Use of Digital Chart 1 & Colour Test Diagram

Appendix A Colour Tables: Day, Dusk, Night
Appendix B Look-up Table for areas with plain boundaries
Appendix C Look-up Table for areas with symbolized boundaries
Appendix D Look-up Table for lines
Appendix E Look-up Table for paper chart points
Appendix F Look-up Table for simplified points

Addendum S-52 ENC Symbol Catalogue: Paper Based Symbol Specifications

PART II:

MARINERS' NAVIGATIONAL OBJECTS

section 1 Mariners' Object Classes
section 2 Navigational Attributes
section 3 References

DIGITAL FILES ON CD-ROM:

- .DAI file version of the Presentation Library
- pseudo-S-57 file version of ECDIS Chart 1
- colour test diagram (pseudo S-57 code with look-up table)

PART I

USERS' MANUAL

TABLES AND SYMBOLISATION PROCEDURES

SYMBOL LIBRARY AND SYMBOL PLOTS

REFERENCES AND NOTES

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1. Scope

This document is intended to explain the mechanisms of the IHO ECDIS Presentation Library to the ECDIS manufacturer, and to help them implement the library correctly. Therefore, it provides the software developer with the information needed to translate abstract descriptions of S-57 [5] objects into effective ECDIS display according to S-52 [3]. The symbols used in the Presentation Library are described by a vector drawing language. There are many components to the ECDIS display and this document presents them in a structured fashion describing how the ENC data is to be rendered on screen and what facilities shall be provided to the Mariner by the display. This document also explains how the various parts of the ECDIS Presentation Library are related to each other, how these parts must be used to achieve an ECDIS presentation and how the symbol library can be transferred in a machine readable form.

This manual assumes, that the reader has carefully studied in advance the various standards for ECDIS, i.e., IHO S-52/S-57 [4,5,6] and IMO Performance Standards for ECDIS [2].

Sections 4, 5 and 6 of this documentation start with an overview of the Presentation Library. They were written for the reader who is interested in the basic concept. Details that address especially the designer of an ECDIS system are explained from section 7 onwards.

Note: The Presentation Library does not cover all aspects of the ECDIS display. The IMO Performance Standards as well as the C&S Specifications and IEC publications 61174 [6] and 62288 must also be used in conjunction with this document. The IHO Test Data Sets (S-64) [9] must be used when testing ECDIS software.

1.1 Use of Language

Throughout this document the word must is used to describe mandatory ECDIS requirements, the word may is used to describe optional requirements.

2. Terms and Definitions

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

2.1 Alarm
(MSC.302/A) a high-priority alert. Condition requiring immediate attention and action by the bridge team, to maintain the safe navigation of the ship.

2.2 Alert
(MSC.302/A) announcement of abnormal situations and conditions requiring attention. Alerts are divided in four priorities: emergency alarms, alarms, warnings and cautions. An alert provides information about a defined state change in connection with information about how to announce this event in a defined way to the system and the operator

2.3 Caution
(MSC.302/A) lowest priority of an alert. Awareness of a condition which does not warrant an alarm or warning condition, but still requires attention out of the ordinary consideration of the situation or of given information.

2.4 CIE Colours
One of the first mathematically defined colour spaces the CIE XYZ colour space was created by the International Commission on Illumination 1931.

2.5 Colour Token
A five-letter code identifying a colour and its use in ECDIS. The day, dusk and night colours which are identified by the token are given in the colour tables (in CIE coordinates). Note that several colour tokens may share the same colour.

2.6 Complex Line Styles
Lines that are themselves symbols or that have symbols interlaced. Examples of a line as a symbol are the submerged pipeline LC(PIPSOL05) and the T T T lines indicating the inside of an area LC(ENTRES51). A simple or complex line may have a symbol interlaced, such as an anchor for anchorage area LC(ACHARE51).

2.7 Conditional Symbology Procedure
A decision-making procedure used to link an object-class and its attributes to a symbol. Used in cases where the symbol depends on system configuration, Mariner options and the objects spatial relationship to other features (e.g. whether a wreck is symbolized as an "isolated danger" depends on its relationship to the safety contour chosen by the Mariner) or where symbolization is complex (e.g. light sector).

2.8 Display Category
IMO Performance Standards for ECDIS [2] establish three display categories for the presentation of SENC objects. These are Display Base, objects that are always on the display; Standard Display, the ECDIS' default display, which may be modified by the mariner; and Other Information, which consists of objetcs in the SENC that are not in the Standard Display that may be displayed on demand.

2.9 Display Priority
A hierarchy to stipulate the order in which objects are displayed. Display priorities range from 0 to 9, where 9 is the highest priority. Higher priority objects are displayed on top of lower priority objects.

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

2.11 ECDIS Chart 1
An ECDIS version of chart 1, including all symbols, line styles and colour coding used for chart presentation. Intended for the Mariner to both familiarize himself with ECDIS and to look-up specific symbols. The manufacturer must program the look-up of symbols drawn from the Presentation Library, including certain diagrams which are copied from INT 1 [1].

2.12 Geometric Primitive
A plain point, a plain line, a plain area as defined in geometry (i.e. without any meaning attached).

2.13 Indication
Visual indication giving information about the condition of a system or equipment.[2]

2.14 Look-up Table
A table that links SENC objects to area, point symbol and line representation on ECDIS, and provides display priorities, radar flag, IMO category and viewing groups

2.15 No symbol Object
In some cases, the database contains information that is not intended for display. (An example might be a general area such as 'Great Australian Bight' which would be available for an answer to cursor interrogation of the sea area.)

2.16 Opaque fill
The background is completely filled with the colour fill. (e.g. depth area). The point and line SENC features may be overwritten. The raw RADAR image is a special case of opaque fill which overwrites all other features expect those with "priority over radar" (OVERRADAR).

2.17 Pattern fill
A method of identifying areas by large, faintly coloured symbols well spaced out across the area. A pattern spacing algorithm ensures that the pattern symbols are visible without being so dense as to cause clutter. Used to ensure pattern symbols are always visible at any display scale.

2.18 Pivot Point
The pivot point is the point around which the symbol gets scaled and rotated. When the symbol is placed in the world space, the symbol's pivot point is positioned exactly on the object's position and all elements of the symbol are geometrically related to that position.

2.19 Radar Priority
IMO PS [2] requires that radar can be switched off with a "single action control" in order to see SENC and Mariners info clearly. However certain other info, such as planned route, safety contour, coastline must always be written over the radar.

2.20 Radar Transparency
A method of varying the transparency of radar in a continuous progression from no radar to a totally opaque radar overlay, by merging the radar colour with the colour of the object it overlays at each pixel

2.21 SCAMIN
The smallest scale at which an object is displayed (e.g. a minor light, SCAMIN of 1:50,000, would not be displayed at a scale of 1:75,000).

2.22 Simple Line Styles
Solid lines, dots and dashes.

2.23 Symbol Size
The size is specified in normalized units of 0.01 mm. The minimum dimension is always more than 4 mm. This size applies to display on a standard minimum screen specified in S-52 [3].

2.24 Symbology Instruction
A machine readable symbolization order used in look-up tables to link object-classes to symbols, in straight forward cases (i.e. where a conditional symbology instruction is not required)

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

2.26 Text Label
A textual description of an object. Can be formatted to include standard text as well as feature attribute values. For example, light descriptions, place names etc.

2.27 TFT
Thin film transistor (used in LCD display technology).

2.28 Transfer, Exchange
These words are used as verbs or nouns to mean "provide" or "carry information".

2.29 Transparent Fill
A method of identifying areas by covering a given percentage of each 4 pixel square with the fill colour, leaving the remainder "transparent". Used to ensure the information underneath shows through.

2.30 Unknown Object Vector Format Symbol
If an object-class is not listed in the look-up table, the ECDIS must inform the Mariner that an unknown object exists in the display area, and symbolize all such objects with a question mark.

2.31 Vector Format Symbol
A symbol described in vector coordinates.

2.32 Warning
(MSC.302/A) alert for condition requiring immediate attention, but no immediate action by the bridge team. Warnings are presented for precautionary reasons to make the bridge team aware of changed conditions which are not immediately hazardous, but may become so if no action is taken.

3 References

[1] International Hydrographic Organization. - International Chart Series INT 1: Symbols, Abbreviations, Terms used on Charts. Bundesamt für Seeschiffahrt und Hydrographie, Hamburg, Germany. (Current Edition).

[2] International Maritime Organization: Performance Standards for Electronic Chart Display and Information Systems; (Current Edition).

[3] International Hydrographic Organization: Specifications for Chart Content and Display Aspects of ECDIS / International Hydrographic Bureau, Monaco. (Publication S-52, Current Edition)

[4] International Hydrographic Organization: Hydrographic Dictionary, Glossary of ECDIS-related Terms / International Hydrographic Bureau, Monaco. (Publication S-32, Appendix 1, Current Edition)

[5] International Hydrographic Organization: IHO Transfer Standard for Digital Hydrographic Data / International Hydrographic Bureau, Monaco. (Publication S-57, Current Edition)

[6] International Electrotechnical Commission Publication 61174: Electronic Chart Display and Information System (ECDIS) - Operational and performance requirements, methods of testing and required test results; Geneva, Switzerland (Current Edition).

[7] International Electrotechnical Commission Publication 62288: Presentation of navigation related information - General requirements, methods of test and required test results; Geneva, Switzerland (Current Edition).

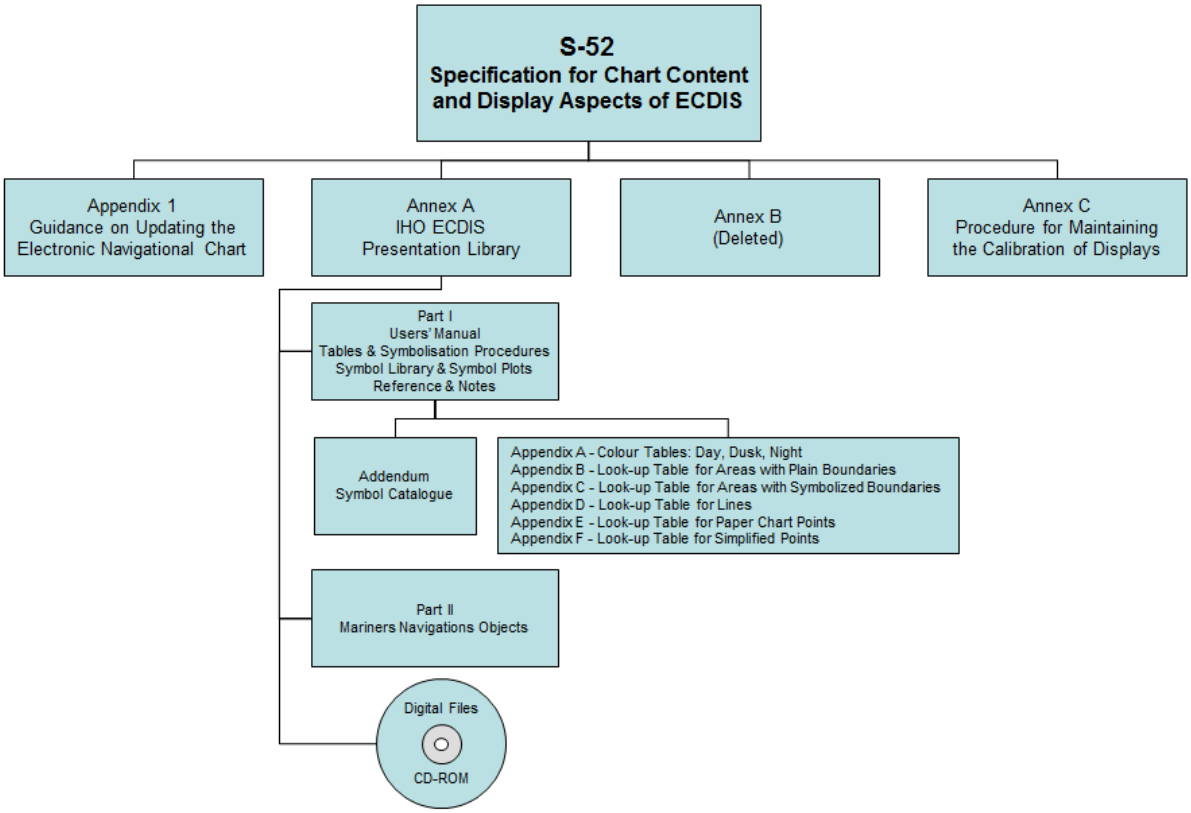
[8] International Hydrographic Organization: C&S Maintenance Document for Colours and symbols specifications for ECDIS and its Annex A: IHO ECDIS PRESENTATION LIBRARY (Current Edition)

[9] International Hydrographic Organization: ECDIS Test Data Set, International Hydrographic Bureau, Monaco. (Publication S-64, Current Edition)

[10] International Hydrographic Organization: Maintenance Section under (www.iho.int > Publications > Download List)

4 Structure of the Presentation Library

The IHO Presentation Library is annex A to IHO S-52 "Specifications for Chart Content and Display Aspects of ECDIS".



The Digital Files CD-ROM contains the followinig:

- Presentation Library Part I Symbol Catalog Adendum
- Colour and Look-up Table Appendicies A-F in Microsoft Word format
- Colour and Look-up Tables in machine readable DAI file format
- ECDIS Chart 1 ENC format files
- Colour Test Diagram

4.1 S-57 and the Presentation Model for ECDIS

The Presentation Model for ECDIS refers to the official IHO Transfer Standard for Digital Hydrographic Data (S-57) [5]. The IHO Transfer Standard states in Part 2, section 3;

"The model described in this part of the Standard does not contain any rules for the presentation or display of information. It provides only the means for the factual description of the real world. The presentation of this information may vary to suit a particular use (e.g. it may be presented either graphically, using symbols, or in a textual form). Therefore, the presentation of information is considered to be independent of its storage. Different applications must provide their own specific "presentation models". A presentation model defines, via a set of presentation rules, the way in which real world information must be displayed for a specified application. The concept of keeping information storage independent of presentation provides for greater versatility and flexibility. It allows the same data to be used for many purposes without requiring any change to its structure or content. If the presentation style or medium changes, only the presentation model has to be changed."

In contrast to a presentation model suitable for paper chart application, a presentation model to be used by ECDIS systems must take into account the requirements of the IMO/IHO "Performance Standard for ECDIS" [2] and the IHO "Specifications for Chart Content and Display Aspects of ECDIS", IHO Publication S-52 [3]. In particular, this means, that the presentation of charts on an ECDIS screen changes depending on parameters and selections defined by the Mariner, such as safety contour, time of the day, traditional or simplified symbology, etc. Thus the presentation model must cover not only colour and symbol definitions but also instructions how to handle a dynamically changing presentation as well.

4.2 Structure of the Presentation Model for ECDIS

The **Presentation Model for ECDIS** is built from two major parts:

- A library of colours, line styles, fill styles, point symbols and a set of symbology instructions and look-up tables for the translation of object descriptions into symbology instructions. This part is called "**Presentation Library for ECDIS**
- A description of the required programmable structure, which serves as a model for the graphic display within an ECDIS system and which explains how to use the elements of the Presentation Library and how to ensure the correct display of data structured according to S-57.

4.3 Supply and amendment of the Presentation Library

From edition 3.3 onwards the word-processed version of the Presentation Library is the "official" version. A digital version in .dai format is provided on the same CD-ROM as a manufacturer's option for edition 4.0.0. It consists of look-up tables; symbols; and colour tables and is supplied in ASCII format in the .dai file.

The name of the file on this CD which contains the official, word processed Presentation Library is "PSLBmm_n.pdf" where mm_n is the edition number.

IMPORTANT: The edition number of the PresLib installed must be available to the Mariner on request.

The general layout of the Presentation Library is shown in section 4 of this publication. The various components of the Presentation Library are supplied and amended as follows:

The Presentation Library as a word processed file is issued on a CD-ROM, which carries a subscription charge for each new edition to help to cover maintenance costs. The word-processed Presentation Library includes:

1. the look-up tables, colour tables and symbol library.

2. the narrative and diagram conditional symbology procedures in UML form, together with symbolizing instructions (in section 13) for special IMO and IHO requirements which are needed to complete the symbolizing of an ENC,

3. further information needed for implementing the above in ECDIS is given in all sections

On each occasion of an immediate amendment of the Presentation Library:

1. a description of the items in the amendment will be freely available from the IHO web site under the Maintenance Section (www.iho.int > Publications > Download List) [10].

2. the amended word-processed Presentation Library will be posted on the IHO web site (www.iho.int > Catalogue) together with the ECDIS Test Data Set (S-64) [10]. A subscription may be required.

Note: Only immediate amendments and not those of deferred amendments, will be included in the amended Presentation Library of .2 above.

The following digital files are also provided on the CD-ROM containing the word-processed Presentation Library:

1. The .dai file of the Presentation Library, consisting of look-up tables, symbols and colour tables.

Note: The .dai version is provided as a manufacturer's option for edition 4.0.0, but may not be available for succeeding editions.

The "Test Edition Version" of the .dai file provided with old editions of the presentation library is no longer required in IEC 61174 and has been removed permanently from the digital Presentation Library. However symbol SY(CHKSYM01) has been retained for use in checking symbol size.

2. ECDIS Chart 1 & Colour Differentiation Test Diagram, consisting of:

- S-57 files containing a collection of all symbols coded as NEWOBJ using the SYMINS attribute and similarly arranged as INT1 [1] for paper charts
- S-57 files containing combinations of foreground and background colours as line and area geometries.

3. UML models of the CSPs in Enterprise Architect format

5 Basic Concept of ECDIS Display

All elements of the Presentation Library are required to be implemented by a manufacturer unless otherwise stated. OEMs developing ECDIS display must follow this documentation to perform the link between the S-57 feature object characteristic and the actual presentation on the ECDIS screen.

Fig 1 is an example of how the various elements of the Presentation Library can be linked together in order to display an S-57 object from the SENC. Only the individual elements (symbol library, look-up tables, etc.) are provided in the Presentation Library. The ECDIS manufacturer writes software linking the elements.

Section 10 gives further details of key functions that must be taken into consideration by the ECDIS developer.

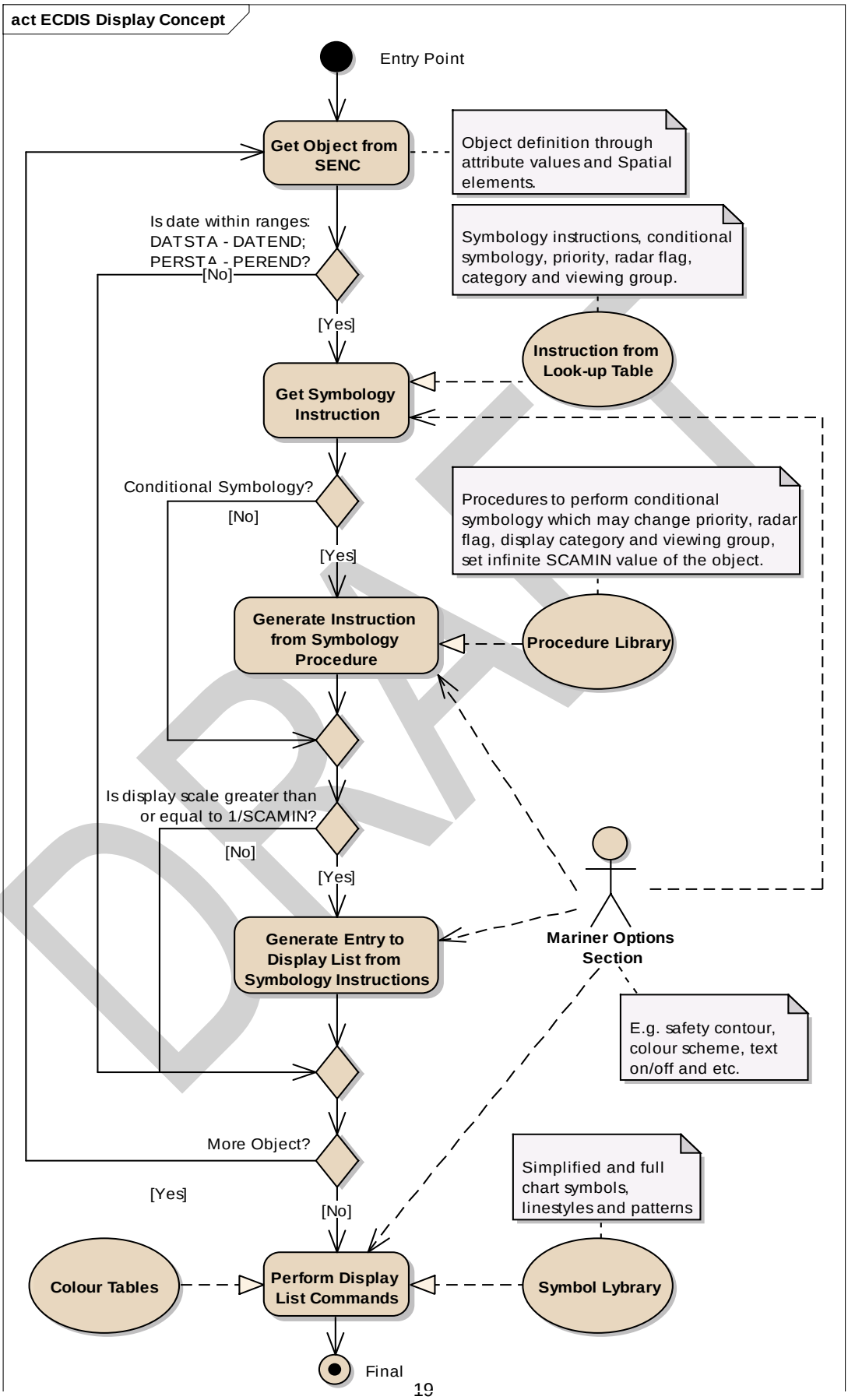

act ECDIS Display Concept
Entry Point
Get Object from SENC
Object definition through attribute values and Spatial elements.
Is date within ranges: DATSTA - DATEND; PERSTA - PEREND?
[No]
[Yes]
Symbology instructions, conditional symbology, priority, radar flag, category and viewing group.
Instruction from Look-up Table
Get Symbology Instruction
Conditional Symbology?
[No]
[Yes]
Procedures to perform conditional symbology which may change priority, radar flag, display category and viewing group, set infinite SCAMIN value of the object.
Generate Instruction from Symbology Procedure
Procedure Library
Is display scale greater than or equal to 1/SCAMIN?
[No]
[Yes]
Generate Entry to Display List from Symbology Instructions
Mariner Options Section
E.g. safety contour, colour scheme, text on/off and etc.
More Object?
[Yes]
[No]
Simplified and full chart symbols, linestyles and patterns
Colour Tables
Perform Display List Commands
Symbol Lybrary
Final

Fig 1. ECDIS display concept

Entry Point	Clipped portion of ENC to be displayed on the ECDIS screen. Perform for each SENC object.
Get Object from SENC	Object definition through attribute values and Spatial elements.
Is date within ranges: DATSTA - DATEND; PERSTA - PEREND?	Is the current date of presentation within the range of existence of the object? I.e. if there are values of the attributes' pairs DATSAT - DATEND or PERSTA - PEREND then the current date is more than Start date and less than End date of the existence period of the object.
Get Symbology Instruction	Get symbology instructions, conditional instructions, priority value, radar flag, display category and viewing group from the appropriate line of the Look-up table file.
Instruction from Look-up Table	Take the Look-up Table file according to geometry type of the object and mariner parameters ('simplify point', 'pattern area boundaries')
Conditional Symbology?	Does a Conditional Symbology Procedure exist?
Generate Instruction from Symbology Procedure	Execute the conditional symbology procedure to get Symbology Instructions with parameters of presentations.
Procedure Library	Procedures to perform conditional symbology which may change priority, radar flag, display category and viewing group, set infinite SCAMIN value of the object.
Is display scale greater than or equal to 1/SCAMIN?	Is the current display scale greater than or equal to 1/SCAMIN value from the object?
Generate Entry to Display List from Symbology Instructions	Add graphical primitives to the display list taking into account Presentation parameters (priority, radar flag, display category and viewing group)
More Object?	Are there more objects in the SENC? If it is, go to the next object.
Perform Display List Commands	
Mariner Options Section	E.g. safety contour, colour scheme, text on/off and etc.
Symbol Library	Simplified and full chart symbols, linestyles and patterns
Colour Tables	Colour tokens with XYL values for different palettes (Day, Dusk and Night palettes)
Final	Final presentation of the SENC

The basic concept of ECDIS display is as follows:

1. The ECDIS determines which feature objects contained within the SENC are required for display.
2. The ECDIS maintains a set of Mariner defined parameters (such as safety contour, safety depth, display category).
3. Each feature object, whether point, line or area geometric primitive are transformed into symbolisation instructions using lookup tables and conditional symbology procedures described in this document.
4. The symbolisation instructions are drawn to the screen using lookup tables to define colour values for the selected pallet and taking into account data-defined parameters which may affect display, such as DATSTA-DATEND and SCAMIN.

If, for example, the Mariner subsequently selects another safety contour, the list of symbolisation instructions are renewed and the depth areas distinguishing shades are changed by a symbology procedure which is called to generate symbology instructions for the object class DEPARE (depth area). There are many display options, some of which are mandatory and which are described in this document. The ECDIS manufacturer is also able to provide Mariner features within their ECDIS which build on the mechanisms described in this document.

Note that the ECDIS must not initiate any change of state automatically or by linkage, e.g., it must not automatically select “lights” because the Mariner selects the night colour table. All changes to the composition of the display must be initiated by the Mariner.

6 The Elements of the Presentation Library - An Overview

The Presentation Library consists of seven elements:

1. A colour coding scheme defining the IHO colour tables for day and night time

2. A library of symbols, line styles and fill styles

3. A set of symbology command words from which symbolisation instructions can be assembled. These are used to symbolize S-57 [6] objects.

4. A set of conditional symbology procedures to decide the appropriate symbolization in cases determined by the Mariner’s selection (e.g., safety contour) or in complex symbols (e.g., light sectors).

5. A set of look-up tables that link S-57 feature object descriptions and geometric primitives to the appropriate symbology command words using one of two separate mechanisms:

    a) A simple lookup where the link is straight forward, i.e., a direct relationship between an object's description and its presentation such as a buoy or 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) A more complex lookup where the link between the feature and its symbology is dependent on a parameter or other context, 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 which then selects the appropriate symbology instructions.

6. A .tif file (or other medium) set of diagrams that can be displayed or printed on demand and explain the symbology to the Mariner (Mariners' ECDIS Chart 1)

7. A catalogue of navigational object classes that comprise objects that the Mariner may add to the chart. (These are specified in Part II of the Presentation Library [4])

The following section gives a short description of each of the elements of the Presentation Library.

6.1 The Colour Coding Scheme

The Presentation Library uses a colour scheme, which classifies colours by their usage (see section 7). Each colour usage is represented by a five letter colour token. Each colour token corresponds to a colour definition given in CIE coordinates in one of a set of colour tables for different bridge lighting conditions. Each colour table is referred to as a "pallet" such as "Day", "Dusk" and "Night".

Symbols, fill styles and line styles refer to the colour tables by using the standardized colour tokens as part of the symbol definition. See section 7 and 15 on how to use colour tokens, section 11.4 on how colour tables are transferred in the digital version. Appendix A of this document provides the XYL values for each colour token in Day, Dusk and Night palette.

6.2 The Library of Symbols, Fill Styles and Line Styles

Symbols, area fill patterns and line styles are described in detail in the Symbol Library (section 16 and the Addendum). They are also supplied in a machine readable format on the digital file.

6.2.1 Symbols

The Presentation Library provides two sets of symbols, referred to as "simplified" and "traditional". The symbols for point objects are generally based on the traditional paper chart symbols and, in addition a set of more compact, but more visible, 'simplified' buoy and beacon symbols are provided for use under difficult viewing conditions.

6.2.2 Area Fills

The Presentation Library offers various ways to fill areas. They can be filled with an opaque colour; with a colour shown with some transparency; or with a pattern of symbols (fill pattern)or with a centred symbol. Fill patterns and centred symbols are introduced as a solution for the symbolization of areas in special situations. When using the traditional (paper chart) way, e.g.,

to symbolize the traffic direction by using an arrow, it might happen that the arrow-symbol moves off the screen because the size and position of the viewing window on the ECDIS chart cannot be predetermined. A fill pattern showing arrows does not have a certain position on the chart like the paper chart arrow-symbol. It shows up as long as any part of the traffic separation lane can be seen on the screen. A centred symbol moves to the centre of the part of the area that remains in the display window.

The Presentation Library provides two options for area boundaries, referred to as “plain” and “symbolised”. There are look-up tables for plain area boundaries (intended for use at small scale to reduce clutter) and symbolized area boundaries (intended for use at larger scales to assist area identification. Note that centred symbols must still be used with symbolized boundaries to symbolize the case when the entire display window lies within an area. See section 9 for symbology instructions and 11.5 for details of the digital format.

6.2.3 Line Styles

The Presentation Library uses two types of line styles: simple line styles and complex line styles. Simple line styles are solid, dashed or dotted lines with varying colour and thickness. Complex line styles are composed of repeating line patterns. See section 9for symbology instructions and 11.7 for details of the digital format.

6.3 Symbology Instructions

The ECDIS chart display is generated from symbology instructions. The symbology instructions are in turn assembled from a set of symbology commands which have been designed for the Presentation Library. Symbology commands are intended to be machine readable instructions which can be easily decoded in a straightforward manner to low level graphic actions that are performed by the ECDIS to generate the ECDIS display.

Currently there are five types of symbology instructions:

1. instructions for line objects
2. instructions for area objects
3. instructions for point objects
4. instructions for text labels
5. call to conditional symbology procedures

Symbology instructions are explained in section 15.

6.4 Conditional Symbology Procedures

To handle complex presentation situations conditional symbology is required. Conditional symbology is different from standard symbology in that a procedure is processed rather than a straightforward symbology lookup instruction. Thus decisions are made by the ECDIS at run time which affect symbolization and other display factors such as priority, radar flag, category, viewing groups. The Conditional Symbology Procedures are defined in section 13.

6.5 The Look-Up Tables and other symbolizing instructions

Instructions on how to symbolize an instance of an object class can be found in look-up tables that come with the Presentation Library on the distribution CD-ROM.

There are five look-up tables:

1. paper chart point symbols
2. simplified point symbols
3. line symbols
4. plain area boundary symbols
5. symbolized area boundary symbols

IMPORTANT: The manufacturer must allow the Mariner to select freely between the two point symbol tables and the two area symbol tables. There must be no linkages, for example linking simplified point symbols to plain area boundaries, etc.

Each line of a look-up table, called a look-up table entry, contains the S-57 feature class., a string of attribute-value combinations and symbology instructions or a call to a conditional symbology procedure which in turn creates symbology instructions.

To find the correct symbolization for an instance of an object class the look-up table is entered with the object class code and its presentation-relevant attribute values. The resulting symbology instructions can then be used by the ECDIS to render the symbol on screen.

Every entry to the look-up tables matches either all objects of an object class or a subset. Therefore, the look-up tables are also used to assign the objects to the IMO/IHO display category, display priority, radar flag and optional viewing group. The viewing groups may be used by the Mariner to either reduce or add information shown on the screen.

Look-up table entries are supplied in Annex A and in a machine readable format in the .DAI file.

Some display features cannot be handled by look-up tables, generally because they are not defined S-57 objects and fall between the look-up tables and the conditional symbology procedures. Some examples are the scalebar, the ECDIS chart legend, manual correction identifiers, cursor pick etc. These are described in section10.

6.6 Mariners' ECDIS Chart 1 and Colour Differentiation Test diagrams

To familiarise the Mariner with ECDIS symbology, a printable set of symbol diagrams, following the sequence of the paper chart INT 1 [1], is provided in section 16, along with a numbered list of symbol meanings to explain the use of each symbol.

The digital equivalent, a set of symbol diagrams in the form of S-57 compliant charts, is included on the CD-ROM for edition 4.0.0. These provide symbol meaning, through cursor picking referring to the symbol descriptions given in the symbol library.

A Colour Differentiation Test diagram is included to enable the Mariner to verify the ability of his ECDIS display screen to distinguish between differently colour-coded areas, lines and point symbols. See 16.3 for the diagram and 18.3 for its use.

6.7 Mariners' Navigational Object Classes

IMO Resolution MSC.191(79) 2004 is the performance standard for the display of navigation-related information on all shipborne navigational systems and equipment. IMO SN/Circ 243 describes symbols used for the display of navigation-related information on all shipborne navigational systems and equipment. IEC 62288 defines the general requirements and the testing methods for navigational related information on shipbourne navigational displays in support of MSC.191(79).

The symbols for which IMO is the authority represent non-chart objects which are not defined in S-57. The IHO has defined three Mariner objects for use in ECDIS the objects are defined in S-52- Part II and the symbols are contained in the ENC symbol catalogue.

The symbology instruction for Mariner objects detailed in S-52 Part II can be found in the look-up tables like the symbology instruction suitable for any S-57 object class.

Please see Part II for further details and definitions of the Mariners' navigational object classes.

6.8 Test Edition of the Presentation Library

The Test Edition is no longer required in IEC 61174 [7] and has been removed permanently from the S-52 Presentation Library. However symbol SY(CHKSYM01) has been retained for use in checking correct symbol size.

7 Description of the Colour Coding System

The colours of the Presentation Library for ECDIS are named with a five character code that reflects their usage, e.g., CHMGD for "chart magenta, dominant". These names are called "colour tokens". The colour tokens are referred to by symbology instructions, symbol definitions and line/fill styles. The colour tokens are defined by CIE-coordinates. The IEC standards that describe methods of converting CIE colour coordinates into RGB values are listed in S-52, section 4.2.3.

The colour tokens are organized in a colour scheme that groups the tokens in colour sections. Each colour section contains a set of colour tokens that serves a special purpose, e.g., to provide colours for the chart content.

7.1 The Sections of the Colour Scheme

The Colour Scheme is split into several sections based on intended usage. The colour values themselves are listed in the colour tables (Appendix A). This section describes each of the tokens within each section.

7.1.1 General Colours

The colours of this section are used in combination with every section of the whole colour scheme:

Token	Colour	Usage
TRNSP	transparent	invisible pixels
NODTA	grey	areas without chart data
CURSR	orange	cursor colour,VRM,EBL

TRNSP- This means a 100% "transparent" colour. This is not a "real" colour since it is invisible. Every pixel on the screen, which has the colour value 0 shows up as 100% transparent. In case the pixel was already painted with another (visible, e.g., black) colour this colour is not overwritten by the transparent colour. In case the pixel was cleared before or not yet painted the "background" colour shows up (see **NODTA**).

NODTA- This abbreviation stands for "No Data". This colour shows up on every pixel on the screen, which is neither covered by chart features nor covered by other elements of the ECDIS display (e.g., radar overlay, user interface). Thus, it can also be called the "empty background colour" (see **TRNSP**).

CURSR- In most graphic systems the cursor is treated as an item that can be handled completely independent from the graphic of the chart area. Therefore the cursor is given its own colour and it is kept separately from the other sections of the colour scheme. The cursor colour is also used by variable range marker (VRM), electronic bearing line (EBL), parallel indexing lines and other tools to perform absolute and relative measurements in the chart.

7.1.2 Chart Colours

The colours in this section are specifically designed for chart display.

Token	Colour, day/night	Usage
CHBLK	black/grey	general
CHGRD	grey dominant	general
CHGRF	grey, faint	general
CHRED	red	general
CHGRN	green	general
CHYLW	yellow	general
CHMGD	magenta, dominant	general
CHMGF	magenta, faint	general
CHBRN	brown	general
CHWHT	white	general
OUTLW	black	symbol outline on sea area background
OUTLL	pale/dark brown	symbol outline on land area background
LITRD	red	red lights
LITGN	green	green lights
LITYW	yellow	white/yellow/orange/amber lights
ISDNG	magenta	isolated danger
DNGHL	red	danger highlight
TRFCD	magenta, dominant	traffic control features
TRFCF	magenta, faint	traffic control features
LANDA	brown	Land areas
LANDF	brown	Landforms, land features
CSTLN	black/grey	Coastline, shoreline constructions
SNDG1	grey	deep soundings > safety depth
SNDG2	black/white	shallow soundings <= safety depth
DEPSC	grey	safety contour
DEPCN	grey	depth contours
DEPDW	white/black	deeper than selected deep contour
DEPMD	pale/dark blue	safety contour to selected deep contour
DEPMS	light/medium blue	shallow contour to selected safety contour
DEPVS	medium/light blue	zero meter contour to shallow contour
DEPIT	yellow-green	high water line to zero meter contour

CHBLK, CHGRD, CHGRF, CHRED, CHGRN, CHYLW, CHMGD, CHMGF, CHBRN, CHWHT- This selection of colours is used in general to design symbols and chart line features as well as fill styles. They are not used in cases where other colours are available for a special usage.

OUTLW, OUTLL - These colours are used to outline symbols depending on which background they are normally shown (water/land).

LITRD, LITGN, LITYW- Light symbols have their own colours to give the opportunity to influence their colour luminance individually. Yellow (**LITYW**) is used for white, yellow, orange and amber lights because it might be difficult to distinguish these colours from each other on a badly calibrated monitor. It also follows the tradition to show up white lights with a yellow flare or coloured arc.

ISDNG- Since the isolated danger symbol forms one of the most important items on the ECDIS screen, it is given a separate colour.

DNGHL- This colour is used for symbology that highlights Mariner selected dangers. The Mariner decides during route planning which features are highlighted by this colour.

TRFCD, TRFCF- Traffic separation schemes are complex chart features. The navigator is confronted with important elements of the schemes and with less important elements as well.

TRFCD is used to distinguish important traffic routeing features.

LANDA - This colour is used for land areas in general.

LANDF - Landforms and land features are given a contrasting brown.

CSTLN - The coastline is a very important feature of the chart. If a radar image is combined with the chart picture it is required that coastline elements clearly show up on top of the green radar picture (see also **RADHI/RADLO**). To have full control over this combination under all conditions (day/night) a separate colour is reserved for coastline features.

SNDG1- This colour is used for soundings that are deeper than the selected safety depth ("safe" soundings).

SNDG2- This colour is used for soundings that are shallower than or equal to the selected safety depth ("unsafe" soundings).

DEPSC - This colour is reserved for the selected safety contour.

DEPCN- All depth contours other than the safety contour must use this colour.

DEPDW, DEPMD, DEPMS, DEPVS, DEPIT- These are depth shades. The depth zones are:

DEPDW: areas deeper than the Mariner-selected deep contour;

DEPMD: areas between deep contour and the Mariner-selected safety contour;

DEPMS: areas between safety contour and the Mariner-selected shallow water contour;

DEPVS: areas between shallow water contour and the low water line (zero meter contour);

DEPIT: areas between zero meter contour and coastline (intertidal).

For route monitoring it may be desirable to distinguish only two water shades, plus **DEPIT**: deeper than own-ship's safety contour and shallower than safety contour. In that case **DEPDW** and **DEPVS** must be used. At night it may be difficult to distinguish between **DEPMD** and **DEPDW**.

7.1.3 Radar Image Overlay Colours

Token	Colour	Usage

RADHI	green	high intensity echo or single int. echo
RADLO	green	low intensity echo & target trail
ARPAT	green, dashed	ARPA, target symbols & infos

The radar image overlay can be generated by using either one intensity colour or a range of intensities. The colour for high echo intensity (**RADHI**) must be used where only one intensity is used. If you prefer to show more than one echo intensity or fading target trails, the corresponding colour intensities must be interpolated between the colour for high echo intensity (**RADHI**) and the colour for low echo intensity (**RADLO**). A separate colour token is used for ARPA targets and information tagged on them (**ARPAT**).

Optionally, the manufacturer may vary the radar green overlay by making it transparent. As described in section 8.4.2, there are two ways of doing this:

1) Use "pixel swap" transparency, as described in detail in section 8.4.2.

2) by mixing the fill and underlying colour at each pixel to give a continuous transparency change from 0% to 100%. This must be done in such a way that no appearance of colour or shape change occurs in any SENC feature on the display, at any intermediate transparency value. The underlying SENC information must remain distinguishable, except when the overlay colour approaches 100%, in which case S-52, section 2.3.2 (b) applies and an indication is required.

7.1.4 Mariners' & Navigation Information Colours

Token	Colour	Usage
SCLBR	orange	scalebar
CHCOR	orange	chart corrections
NINFO	orange	Navigators Notes
ADINF	yellow	Mariners' transparent area fill and manufacturers' points and lines

SCLBR Used to generate the scalebar.

CHCOR Hand-entered chart corrections are marked by the colour.

NINFO Mariners' notes of any form (Symbols, Text) are generated using the colour.

7.1.5 Other Colours

Token	Colour	Usage
RESBL	blue	AIS features and symbols
RESGR	grey	reserved for line features & screened areas
BKAJ1	black	black level test symbol background
BKAJ2	grey	black level test symbol foreground

7.1.6 Colour Section V / Ship Symbol & Planned Route

Token	Colour,day/night	Usage
SHIPS	black/white	own ship, Co&SpMG vector
PSTRK	black/white	Past Track
SYTRK	grey	Secondary Track
PLRTE	red	planned route & notations
APLRT	orange	alternate planned route

Own ship symbol, course over ground and the speed over ground vector are shown in the colour **SHIPS**.

The past track of the main position sensor and a secondary position sensor are shown in **PSTRK** and **SYTRK**.

The planned route uses the colour **PLRTE** as well as the symbol set for the planned route elements (waypoints, etc.). Any alternate route is shown in **APLRT.**

7.1.7 User Interface Colours

For ECDIS user interface colours please refer to MSC.191(79) and IEC 62288.

8. The Vector Symbol Description Language

This section describes the format that is used by the Presentation Library to define point symbols, complex line-styles and fill patterns.

The vector format uses an imaginary "pen" to draw on a “canvas” (an area of the screen). Positions on the canvas are referred to by two-dimensional Cartesian coordinates (x,y). The coordinates are always within the range of 0 to 32767 units. Each unit represents 0.01 mm on screen. The origin of the coordinates (position 0,0) is on the upper left corner of the two-dimensional canvas. Thus x-coordinates extend to the right and y-coordinates extend downwards.

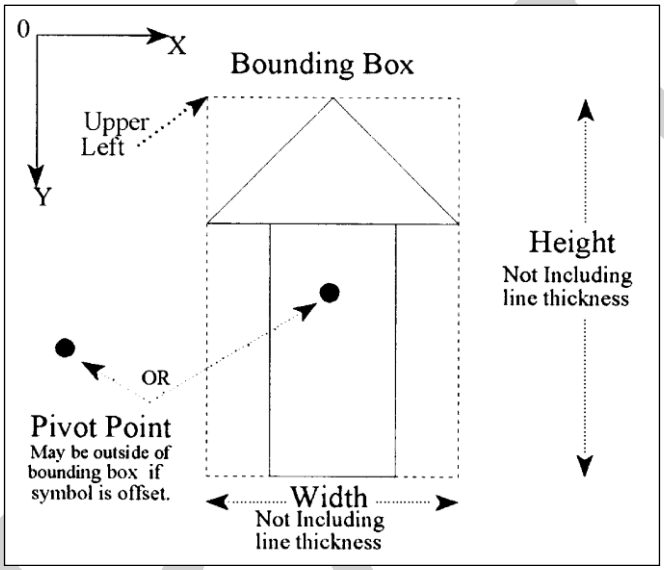


Fig 2. Pivot point, bounding box and symbol coordinates.

The definitions of point symbols, complex line styles and fill patterns are composed of multiple instructions. Vector symbol definitions described by the vector format are defined within the 'PVCT/SVCT/LVCT'-fields (see section 11). The vector format uses the following additional instructions:

; The semicolon separates the instructions from each other. Every instruction must be terminated by a semicolon.

, The comma separates the parameters of an instruction from each other. If an instruction does not have any parameters no comma is allowed following the instruction.

Vector Instruction	Parameter	Description
SP	**Colour**	The SP instruction selects a pen with a certain colour. The parameter is a single letter which identifies a colour token. The colour tokens used are defined in the "Colour Reference"-fields (see section 10.5.4) which map the single

		letter definition to one of the standard colour tokens. An SP instruction remains in effect until a new pen is selected. Thus, all following instructions are performed using the selected pen colour.
ST	**Transparency**	The ST instruction defines the transparency of the colour that is currently selected. The transparency is given in steps of 25% (0-3, see section 7.4.2). The transparency only affects the polygon fill instruction (see FP) while other instructions (AA, CI, EP, PD) produce opaque drawings.
SW	**Width**	The SW instruction parameter defines the physical pen-tip width in units of 0.3 millimetres. If a single point is defined, (a pen down with no movement followed by a pen up) then a dot would be drawn using the current line width as a diameter or a square using the current width. (standard pixel diameter).
PU	**x-coordinate, y-coordinate**	The PU instruction raises the pen and then moves it to the absolute x,y-coordinates. Thus, no line is drawn by the PU instruction.
PD	**x-coordinate, y-coordinate [,x,y, ... x,y]**	The PD instruction lowers the pen at the current position and then moves it to the absolute x,y-coordinates. Thus a line in the current colour (see SP) and width (see SW) is drawn by the PD instruction.
CI	**Radius**	The CI instruction draws a circle of a specified radius. The radius determines the size of the circle. The current pen position is the centre of the circle. The CI instruction includes an implicit pen down feature. When a CI instruction is used the pen lifts, moves from the centre of the circle to the starting point on the circumference, lowers the pen, draws the circle, then returns with the pen up to the centre of the circle. The circle is drawn using the current pen colour (see SP) and pen width (see PW).
PM	**n**	The PM instruction places the command interpreter in polygon definition mode. In this mode you can construct polygons using other instructions (PU, PD and CI). These instructions are stored in the polygon buffer; they are not executed until the polygon is completely defined. In order to draw the polygon it must be filled with the FP instruction and/or outlined with the EP instruction. To define a polygon move the pen to the desired starting position (see PU or PD). Then execute PM 0 to enter the polygon mode and specify the appropriate instructions to define the shape of the polygon. If you want to define a sub polygon, end the shape with a PM 1 instruction and define the next shape; execute PM 2 to exit the polygon mode. The current pen position before PM 0 is the first point (vertex) of the polygon. The vertices can be defined with the pen up or down (see PU, PD). However, if you intend to outline the polygon with the EP instruction, note that EP will only draw those points that are defined with the pen down. The FP instruction, on the other hand, fills the polygon, regardless of the pen up / down

		status.
EP		The EP instruction outlines any polygon that has been previously stored in the polygon buffer (see PM). Only vertices that were defined with the pen down are edged. They are edged using the current pen colour (see SP) and pen width (see PW). Upon completion of the EP instruction, the original pen position and status are restored.
FP		The FP instruction fills a polygon that has been previously placed in the polygon buffer (see PM). The polygon is filled using the current pen colour (see SP) and transparency (see ST). Upon completion of the FP instruction, the original pen position and status (pen up/down) are restored.
SC	**symbol name, orientation**	*The SC instruction calls another symbol definition. Orientation specifies whether the called symbol is drawn upright (orientation = 0) or rotated to the direction of the last pen moving instruction (orientation = 1), or rotated at 90 degrees to the tangent of the symbolized edge at the position of the symbol (orientation = 2). The pivot point of the symbol will be placed on the current pen position. Upon completion of the SC instruction, the original pen position and status (pen up/down) are restored.*

Note: The Vector drawing language defines how symbols must look on the ECDIS screen when drawn. The ECDIS manufacturer does not have to replicate the drawing mechanism itself within their ECDIS. The choice of SENC storage and symbol drawing procedures are up to the manufacturer. The only requirement is that the colours and symbols are replicated from the specifications contained within this document to the satisfaction of the manufacturers type approval body.

8.1 Size and Orientation of a Vector-Symbol

For each vector symbol the height and width are define in units of 0.01 mm. Symbols in the Presentation Library are already sized to give good readability and appropriate prominence. Only the ship symbol is allowed to be scaled to the actual dimension of the ship.

Every symbol has its own pivot point. The pivot point is the point around which the symbol is rotated. When a point symbol is placed on the display, the symbol's pivot point is positioned exactly on the object's position and all the instructions in the symbol's definition are relative to that position. For further information about position of the pivot point and the symbol definitions, see section 11.6.

8.2 Description of Complex Line Style rendering.

A complex linestyle is formed from a repeating symbol. The symbol definition for a line style is very similar to the symbol definition for a point symbol and uses Cartesian coordinates as defined in the previous section. The linestyle symbol has its own pivot point around which it is

rotated. The orientation is given by the direction between the two vertices of the **segment of the** line being drawn.

To symbolize some lines a composite type of complex linestyle is used, in which the unit is composed of a series of horizontal lines and symbols, strung together along the line object to form the linestyle unit

In order to draw a complex linestyle, first locate the start and end points along the edge to be symbolized. Then draw the complex linestyle along the edge between the start and end positions repeating as necessary. If a symbol needs to be embedded in the line, then the rotation angle relative to the line segment must be determined. The diagram below shows how the composite symbol is created from the linestyle and its embedded symbols.

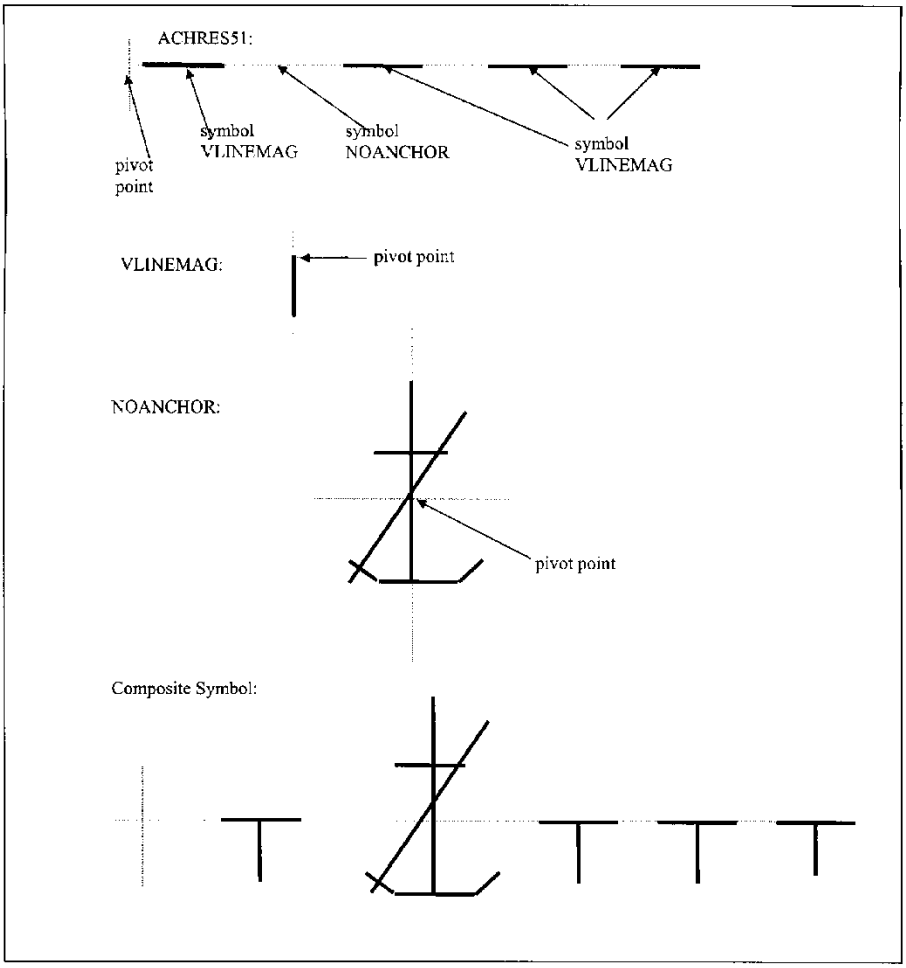


Fig 3. Complex Line Styles.

8.3 Vector Format Examples

8.3.1 Sample Definition in Vector Format

S-57 Feature Object	S-52 Symbol	Vector Drawing Instruction (see 11.6.3)	ECDIS Display
Mooring/ Warping Facility	MORFAC03	SYCL = 00747 SYRW = 00746 SYHL = 00253 SYVL = 00253 SBXC = 00603 SBXR = 00617 SCRF ALANDABCHBLK SVCT SPA;SW2;ST0; PU603,617;PM0;PD856,617; PD856,870;PD605,870;PD603,617; PM2;FP; SVCT SPB;SW2;PU603,617; PD856,617;PD856,870; PD605,870;PD603,617; SPA;SW2;ST0;PU603,617;PM0;PD856,617;PD856,870;PD605,870;PD603,617;PM2;FP;	

8.3.2 Sample Symbol Library Format for Composite Complex Linestyle Symbols

The following sample Symbol Library sequence illustrates the step from the “Single Unit" type of complex linestyle to the "Composite" type. The complex linestyle achres51.lin LC(ACHRES51) has been modified as follows (refer to definitions of file formats):

Complex Linestyle achres51.lin:

```
LNST    10LS03354NIL
LIND    38ACHRES5100108008100272900503004460057 2
LXPO    64boundary of an area where anchoring is prohibited or
restricted^_
LCRF    6ACHMGD
LVCT    29SPA;SW1;PU446,810;PD747,810;
LVCT    24PU595,810;SCVLINEMAG,2;
LVCT    25PU1208,810;SCNOANCHOR,2;
LVCT    31SPA;SW1;PU1655,810;PD1957,810;
LVCT    25PU1808,810;SCVLINEMAG,2;
LVCT    31SPA;SW1;PU2248,810;PD2552,810;
LVCT    25PU2404,810;SCVLINEMAG,2;
LVCT    31SPA;SW1;PU2874,810;PD3175,810;
LVCT    25PU3024,810;SCVLINEMAG,2;
```

NOTE: The VLINEMAG and NOANCHOR symbols will be embedded in the linestyle at the position given by the last position of the pen before the inclusion the embedded symbol. The only vectors in this linestyle are the four horizontal dashes that are to be drawn.

Symbol noanchor.sym:

```
SYMB    7SY00000
SYMD    39NOANCHORV012070084800431005030098700572
SXPO    36Anchor symbol with a line through it
SCRF    6ACHMGD
SVCT    32SPA;SW1;PU1208,572;PD1208,1074;
SVCT    31SPA;SW1;PU1052,721;PD1356,721;
SVCT    55SPA;SW1;PU1005,971;PD1111,1075;PD1309,1075;PD1407,974;
SVCT    31SPA;SW1;PU1418,640;PD987,1071;
```

Symbol vlinemag.sym:

```
SYMB    7SY00000
SYMD    39VLINEMAGV005950081000010000100059500810
SXPO    28Vertical Chart-Magenta Line
SCRF    6ACHMGD
SVCT    29SPA;SW1;PU595,810;PD595,970;
```

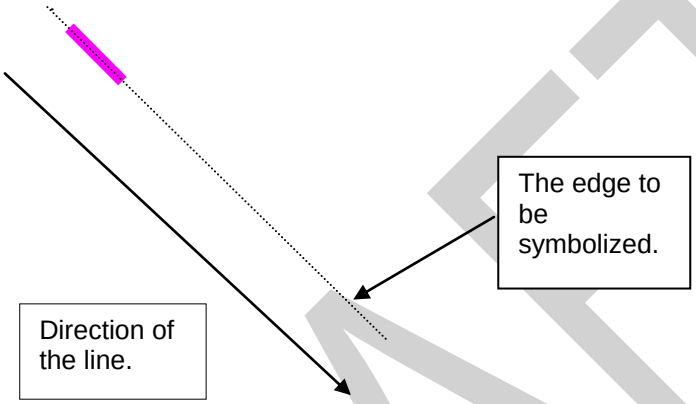
8.3.3 Sample Implementation of the Composite Complex Linestyle Symbols

The following is a simplified example for determining rotation of the symbol that is part of the complex linestyle. This example uses the ACHRES51 complex linestyle described in the documentation.

Each symbolization instruction will be drawn in sequence. The diagrams are as follows:

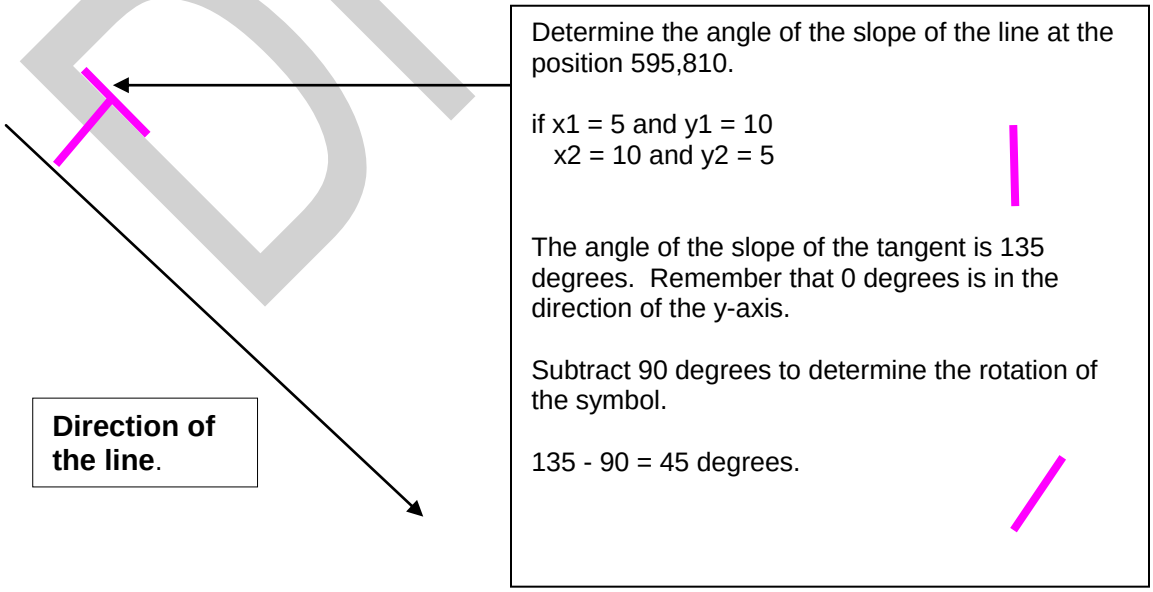
STEP 1: Draw the first straight line segment along the edge of the object.

LVCT 28SPA;SW1;PU446,810;PD747,810;



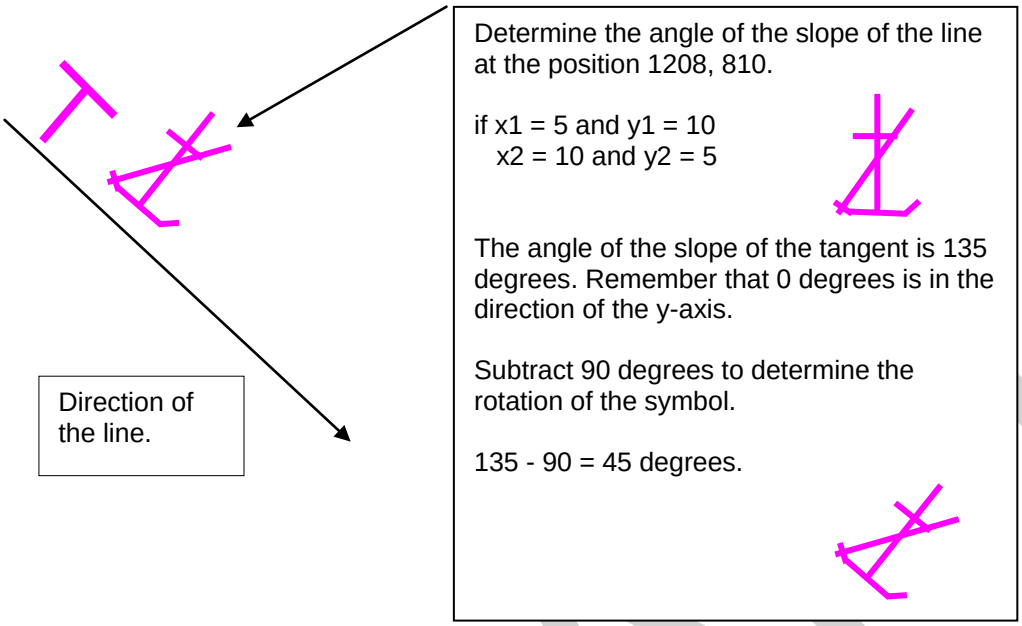
STEP 2: Draw the first LINEMAG symbol at position 595, 810.

LVCT 23PU595,810;SCVLINEMAG,2;



STEP 3: Draw the first NOANCHORsymbol at position 1208, 810.

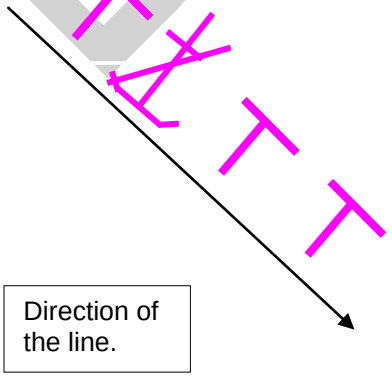
LVCT 24PU1208,810;SCNOANCHOR,2;



STEP 4: Repeat with the other straight line segments and the VLINEMAG symbols.

LVCT 30SPA;SW1;PU1655,810;PD1957,810;
LVCT 24PU1808,810;SCVLINEMAG,2;
LVCT 30SPA;SW1;PU2248,810;PD2552,810;
LVCT 24PU2404,810;SCVLINEMAG,2;
LVCT 30SPA;SW1;PU2874,810;PD3175,810;
LVCT 24PU3024,810;SCVLINEMAG,2;

The resulting line is ...



8.4 Symbology Instruction for Area Objects

The SHOWAREA instruction was designed to symbolize area objects. It performs a variety of fill operations. The prime requirement is that the area symbolization must always be clearly visible in the part of the area that lies within the viewing window of the ECDIS. If the area covers a large part of the viewing window, more than one symbol may be required. On the other hand, a secondary requirement is not to show more symbols than necessary, as this will cause distracting clutter. One solution is to centre a symbol in the part of the area exposed by the viewing window.

8.4.1 Fill Operations

An area can be identified in several ways:

- with an opaque colour fill (e.g. depth areas);
- with a transparent colour fill (e.g. traffic separation zone);
- with a pattern of symbols (e.g. traffic arrows) or texture (e.g. pack ice)
- with a symbol or text located on a position inside the area (e.g. traffic arrow)

A transparent colour fill may overlap an opaque fill and a patterned fill may overlap any other fill, including another patterned fill. For overlapping fills the respective area has to be filled more than once in a sequence of several area-fill operations.

8.4.2 Transparent Fill

The presentation library supports two methods of transparent fill.

1.) with only a percentage of the pixels having the fill colour (stippled fill, pseudo transparency);

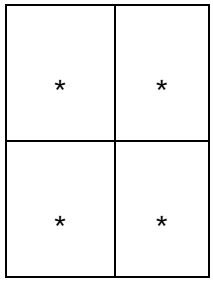
2.) by mixing the fill and underlying colour at each pixel, according to the fill percentage.

When method 1 and a 4 pixel group is used to achieve transparency then only the percentages 25%, 50% and 75% can be used for the transparency. For compatibility with both transparency methods only percentage values 25%, 50% and 75% are used within the presentation library.

The following explains the pseudo-transparency that can be achieved by method 1.
If an area of 4 by 4 pixels has to be filled with a transparent colour only 3, 2 or 1 pixel(s) of this area are tinted with the opaque fill colour while the remaining pixel(s) are tinted using the colour 'TRNSP' (= 100% transparent, see 4.2.1), which means the colour fill is not performed for these pixels. Thus the colour of the underlying pixels still can be seen through. On a high resolution screen the result will be very close to a real transparent fill.

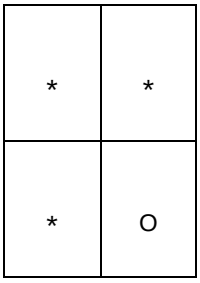
* = pixel tinted in fill colour

O = pixel tinted in TRNSP (transparent)



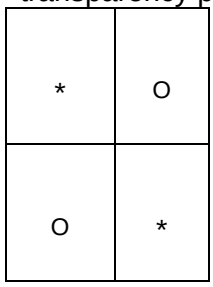
opaque fill with
0% transparency

transparency parameter = 0



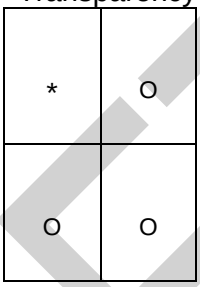
25% transparency

Transparency parameter = 1



50% transparency

transparency parameter = 2



75% transparency

Transparency parameter = 3

Because it is very likely that most of the ECDIS systems do a transparent fill with this technique only the 25%, 50% and 75% percentages for the transparency are used within the presentation library.

8.5 Area Symbolization by a centred Symbol

Centred symbols are used to reduce clutter in areas of heavy traffic. Since such areas may be large we use large symbols and since many restrictions may apply to a given area (e.g. traffic lane; precautionary area; no anchoring or fishing) the symbols have built-in offsets to prevent overwriting.

8.5.1 Positioning centred symbols and text

A pivot point for centred symbols and text will be at the centre of the area, or close enough to the centre that it is evident which area the symbol applies to. The offsets for symbols and text are given with respect to the pivot point.

Multiple centred symbols are often used. For example, a traffic lane with restrictions on entry and on fishing will have a centred traffic arrow and an offset “entry restricted” symbol with a subscript “!” to indicate that other restrictions apply.

If the centre of the symbol bounding box falls outside of the area then it must not be drawn.

There are situations where the chart display will split objects into multiple parts appearing in the ECDIS display as separate objects. In this situation the system must calculate the c of g of each part of the object and display centred symbols in each part.

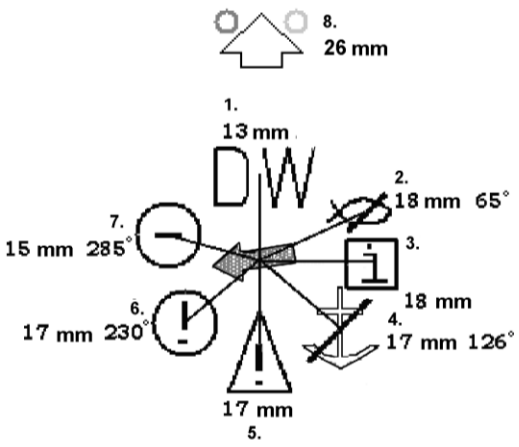


Fig 4. Centred Symbols

8.5.1.1 Centred symbol

A centred symbol must remain within the area even when the border of the display progressively truncates the area. This can be achieved by repeatedly re-calculating the centre of gravity (c of g) of the area, make sure the symbol remains within the area, this is particularly important if the area is concave (e.g. L shaped, or a disc). One method of doing this if the c of g falls outside the area is to subdivide the area by the x,y coordinates of the calculated c of g then recalculate the component areas recursively until a point within the object is found.

8.5.2 Centred symbols on a ship-centred display

Some ECDIS draw a true-motion display which is updated frequently enough to keep own-ship close to the centre. If, when using this display mode, the situation arises that the display window lies completely within an area which is symbolised by centred symbols, these symbols will draw close to or under the own-ship symbol (having lower display priority) and will cause clutter and confusion.

IMPORTANT: Manufacturers who use a ship-centred display must keep any centred area symbols a minimum of 20 mm from the own-ship symbol to avoid a potentially dangerous and confusing display.

8.5.3 Calculating the representative point of an area

The default method for identifying the representative point of an area must be the centre of gravity algorithm.
A method for finding the centre of gravity of an area must be adopted by the ECDIS manufacturer.

This must ensure that the correct symbol is viewable on screen even when the area is only partially on screen. It must also be robust enough to uniquely identify areas which are concave, and where the centre is outside the area (for example, in an L-shaped area the centre is not within the area but the symbol must be drawn inside).

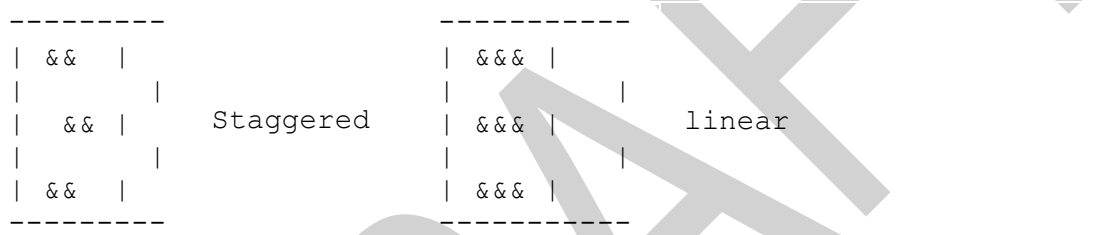
If the c of g algorithm fails to identify the position within the area the manufacturer must choose another more suitable calculation.

8.5.4 Patterns Fill & Textures for areas

Fill patterns use widely spaced symbols, for example for a prohibited area. Textures consist of continuous shapes, such as the dots of a dredged area or the diamond pattern that highlights water of depth less than the safety contour at night.

The form of a pattern symbol or texture unit may be described by a pixel array or vector description.

Fill patterns may be either staggered or linear:



The Presentation Library only uses fixed pattern fill spacing, the pattern must not move as the Mariner pans the chart display.

The position where an area fill with a pattern symbol is started must be based on a geographical position and not on an edge of the screen. If the fill pattern was based on an edge of the screen the pattern symbols would not stay on the same position of the chart while the picture was moving underneath in centred mode. Also do not base a fill pattern on the edge of the area to be filled. This will result in a strange looking pattern fill when two adjacent areas are filled by the same pattern.

Note: The symbols of a pattern fill must be closer together for a small or thin area, to ensure enough symbols are seen, and farther apart for a large area, to avoid clutter.

The pattern type and the symbol spacing gives full control over a set of variations (|#| represents the pattern symbol):

	#	#	#
#	#	#
#|#|#| Linear type with constant space = 0	|#|#|#
#	#
#	#	#	staggered type with constant space = 0
|#| |#| |#| |#| |#| |#| |#| |#| |#| Linear type with constant space > 0	|#| |#| |#| |#| |#| |#| |#| |#| staggered type with constant space > 0

Linear type with variable spacing

|#| |#| |#| |#| |#| |#| |#| |#| |#| minimum distance (small area / scale	|#| |#| |#| |#| |#| |#| |#| |#| |#| maximum distance (large area / scale

Staggered type with variable spacing

|#| |#| |#| |#| |#| |#| |#| |#| minimum distance (small area / scale	|#| |#| |#| |#| |#| |#| |#| |#| maximum distance (large area / scale

The vertical and horizontal distance between pattern symbols is given in the pattern definition (see Appendix C). This distance is the space between symbol covers. The symbol cover is calculated by taking the symbol's bounding box and expanding it to include the pivot point. This mechanism allows the pivot point to be used for fine adjustments to symbol spacing.

Note: An area pattern which is described in the written «Description of Symbols» of the symbol library as a «pattern of symbols» (e.g., FSHHAV02) may be substituted by a single centred symbol. However, this must never be done with an area texture (pattern of symbols, e.g., NODATA03, RCKLDG01, TSSJCT02, etc.)

8.6 Area Boundaries

8.6.1 Plain and Symbolized Boundaries

The Presentation Library provides look-up tables for plain area boundaries (intended for use at small scale to reduce clutter) and symbolized area boundaries (intended for use at very large scale to show immediately on which side of the boundary the area lies and to identify the area).

Note: Centred area symbols must also be used with symbolized boundaries to symbolize the case when the entire display window lies within an area.

The Mariner must be given the option to select use of either plain or symbolized boundaries. See also section 8.2 about the limitations of symbolized linestyles on curved boundaries.

8.6.2 Masked Lines

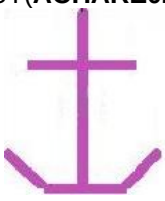
Masked lines (MASK subfield of FSPT field set to {1}) and cell boundary lines (edges encoded with [USAG] = {3}) must not be drawn."

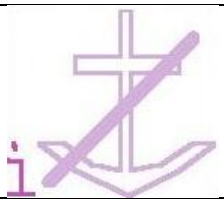
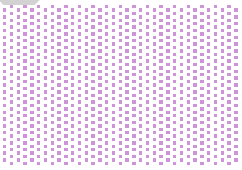
8.6.3 Area Borders

When areas are filled with a colour or a pattern the borders must be included in the fill as well. This generates an image without gaps between neighbouring areas. It is also important for a perfect fit of adjacent cells. If the borders of the area are to be distinguished from the area's fill, the borders have to be re-drawn on top of the fill. This is forced when a SHOWLINE instruction (see section 9.3) is called within a SHOWAREA instruction. The SHOWLINE instruction then performs the presentation of the border.

8.7 Colours and Descriptions for Symbols

The colours and descriptions for all symbols in the symbol library are listed in the hard copy addendum containing the "ECDIS Chart 1", which is bound with the Colour & Symbol Specifications. The general naming convention for symbols is described in the following table:

Objects	Drawing Instructio	Description	Example
Symbols	SY(AAAAAAnn)	where A = abbreviated name, n = serial number Anchorage area as a point at smal scale, or anchor points of mooring trot at large scale	SY(**ACHARE02**) 
	SY(AAAAAA5n)	centred symbol for area Area where anchoring is prohibited or restricted	SY(**ACHRES51**) 
	SY(AAAAAA6n)	centred symbol for area with added caution restriction Area where anchoring is prohibited or restricted, with other cautions	SY(**ACHRES61**) 
	SY(AAAAAA7n)	centred symbol for area with added information restriction	SY(**ACHRES71**)

		Area where anchoring is prohibited or restricted, with other information	
Lines	LS(type, thickness, colour)	simple line of type solid, dashed or dotted NAVNLE	LS(DASH,1,CHGRD)
	LC(AAAAAAnn)	is a complex line Ferry Route	LC(**FERYRT01**) 
	LC(AAAAAA5n)	is a complex linestyle for an area boundary Boundary of a deep water route	LC(**DWRUTE51**) 
Area	AC(CCCCC)	is an area colour fill, where C is the colour token Built-Up Area	AC(**CHBRN**) 
	AC(CCCCC,n)	is a transparent area colour fill, where n = transparency Traffic Separation Zone TRFCF = magenta, faint 75% transparency	AC(**TRFCF,3**) 
	AP(AAAAAAnn)	is an area pattern fill Airport pattern fill	AP(**AIRARE02**) 

NOTE: All names (A,n) for symbols, complex lines and area patterns (but not colour fills) have 8 characters.

9 Description of the Symbology Commands

Symbology commands are used in the look-up table entries to perform the symbolization of objects. Currently there is a choice of five commands used in the lookup tables:

- SHOWTEXT (TE and TX) to display text labels
- SHOWPOINT (SY) to symbolize points and place symbols inside areas
- SHOWLINE (LC and LS) to symbolize lines and borders of areas
- SHOWAREA (AP and AC) to symbolize areas
- CALLSYMPROC (CS) to call conditional symbology procedures

The entries in the lookup tables map S-57 object/attribute combinations to sequences of command words which describe in precise detail the symbology required to be displayed. This section describes the meaning, syntax and operation of the command words used in the lookup tables.

Entries in the lookup tables may be composed of more than one command word, for example the lookup for ACHARE is:

"SY(ACHARE51);LS(DASH,2,CHMGF);CS(RESTRN01)"

This displays the ACHARE51 symbol in the centre of the area as well as a dashed linestyle in CHMGF colour and then executes the RESTRN01 conditional symbology procedure in case other symbols are required.

Each command is capable of accepting one or more parameters. These parameters affect the way the chosen symbol, line style or pattern fill is displayed. Some parameters can be linked to the value of an S-57 attribute of the feature object which is the subject of the lookup table entry. For example, "SY(TSSLPT51,ORIENT)" translates as the symbol TSSLPT51 oriented in the direction given by the value of attribute ORIENT.

For variable parameters default values can be provided as a fail-safe in case the attribute cannot be found in the feature object description. This can be done by assigning a default value to the parameter e.g. ORIENT='90.0'. The assignment is done within the parameter list of the command word.

IMPORTANT: The symbology command must be terminated, if a parameter is mandatory (has to be passed) and no value is assigned to it either because a constant is missed from the parameter list or an attribute value cannot be found (attribute is missed from the object definition and no default value was assigned).

This does not mean that the whole symbology instruction is terminated since it may be composed of more than one command word e.g. the first command word in a symbology instruction shows a light flare and the second shows a buoy symbol. If the first command fails the second is still performed and the buoy is shown in the chart.

The full command syntax and parameters are listed in the following sections

9.1 SHOWTEXT

Name:

TX (Display of textual labels) or
TE (Display of numeric or other formatted text strings)

Syntax:

TX (STRING, HJUST, VJUST , SPACE , 'CHARS' , XOFFS , YOFFS , COLOUR , DISPLAY);
TE ('FORMAT' , 'ATTRIB1,ATTRIB2,…', HJUST, VJUST, SPACE, CHARS, XOFFS, YOFFS,COLOUR, DISPLAY);

Description:

Show a text string at a particular position on screen. In order to show text on the display two commands are used.:

1. For purely alphanumeric text, the "TX" Command is used.
2. For numeric text, a prefix is normally used to distinguish between numbers and soundings. For this purpose the "TE" command is used to format the text string shown on the display.

The description of how the FORMAT/ATTRIB lookups and prefixes work is documented in section 16.3. The following text must be followed when rendering text on the chart display.

1. Text is normally coloured black, to give best readability under all light conditions.
2. Text must only be displayed when the object it applies to is displayed.
3. Text must always have display priority 8, to ensure it is readable, independent of the object it applies to.
4. The manufacturer must provide the capability to select "Important Text" and "Other Text", and he may also provide further text groupings if he so wishes.

The display of text must be controlled independently of the display of the object it applies to and the Mariner must have full control over the display of text. All text is in the IMO Category "Other Information". As a guide to organizing the display of text, the last two digits of the SHOWTEXT instruction give a text classification that distinguishes between "Important" and "Other" text, and gives further suggested text groupings. The abbreviations used on the ECDIS display are listed in Section 14.6. All the abbreviations in section 14.6 must be readily accessible to the Mariner.

Parameters:

STRING: Represents the alphanumeric string to be displayed on the display. The STRING parameter passes a text string in single quotes that shall be written on the ECDIS screen. For example: TX('DR',2,3,2,'15110',-1,1,CHBLK,50);
Note: the six character acronym of a valid S-57 attribute (e.g. LITVES, OBJNAM) can also be passed as a parameter to STRING parameter. If the attribute is either of an enumeration type or list type (e.g. COLOUR), then the enumeration value must be converted into the respective text string from the attribute definition in the object catalogue. If the attribute is of a numerical type, it may just be written as a string. If the attribute is an L-type attribute (e.g. SBDARE, NATSUR) the text equivalent of the listed attribute values must be written sequentially separated by a space with no punctuation marks. If the attribute or character string named in a text command is not included in the SENC object, the text command must be

disregarded. If the symbology instruction for an object includes more than one text command, only the text command whose attribute value or character string is missing must be disregarded; the other text command must be implemented.

HJUST: Horizontal justification parameter: These can have three distinct values:

1. CENTRE – The pivot point is located at the centre of the overall length of text string
2. RIGHT - The pivot point is located at the right side of the last character of text string)
3. LEFT (default) - This is the default value. The pivot point is located at the left side of the first character of text string

VJUST: Vertical justification parameter. These can have three distinct values:

1. BOTTOM (default) - This is the default value. The pivot point is located at the bottom line of the text string
2. CENTRE - The pivot point is located at the centre line of the text string
3. TOP The pivot point is located at the top line of the text string

SPACE: Character spacing parameter. These can have three distinct values:

1. Fit (not used) - The text string must be expanded or condensed to fit between the first and last position in a spatial object
2. Standard (default) - The standard spacing in accordance with the typeface given in CHARS must be used
3. Standard (with word wrap) - the standard spacing in accordance with the typeface given in CHARS must be used; text longer than 8 characters must be broken into separate lines by whole words.

CHARS: Font specification parameter. This defines the font to be used for the text display. There are four numeric components to this parameter and they are concatenated together and enclosed in single quotes in order to be passed as a single value, e.g. '15110'. The format is therefore 'abcdd' where :

a = 1, a plain serif font.

b = 4, 5 or 6 for light, medium or bold text. The default is medium.

c = 1, meaning upright, non-italic text.

d = Body size given in pica points (1 point = 0.351 mm) that specify the height of an uppercase character. The smallest size to be used is pica 10, and this is also the default size. Larger sizes may be used.

XOFFS X offset parameter: defines the X-offset of the pivot point given in units of BODY SIZE (see CHARS parameter) relative to the position of the spatial object (0 is default if XOFFS is not given or undefined); positive x-offset extends to the right (the "units of BODYSIZE" means that if for example, the body size is 10 pica points each unit of offset is 10 (0.351) = 3.51 mm).

YOFFS Y offset parameter: defines the y-offset of the pivot point given in units of BODY SIZE (see CHARS parameter) relative to the position of the spatial object (0 is default if YOFFS is not given or undefined); positive y-offset extends downwards.

COLOUR Text colour parameter: colour token as described in section 7 and 15.

DISPLAY Text display parameter: defines which text grouping the string belongs to.

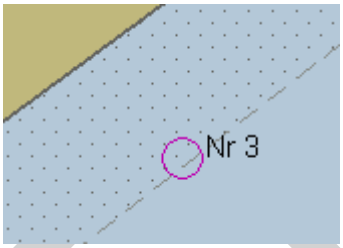
9.1.1 SHOWTEXT Examples

"BUAARE","","AC(CHBRN**);TX(OBJNAM,1,2,3,'15110',0,0,CHBLK,26)**;LS(SOLD,1,LANDF)","3","S","STANDARD","22240"

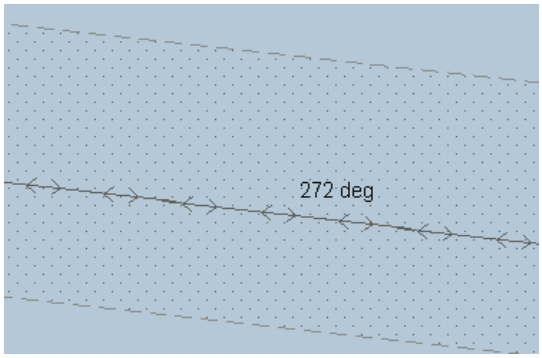
Name	Lookup table value	Description	ECDIS Display
ECDIS Textual Output	OBJNAM	Charmouth	
Horizontal Justification	1	Centre	
Vertical Justification	2	Centre	
Text Spacing	3	Standard with word wrap	
Font Style	1	Sans serif	
Text Weight	5	Medium	
Text Width	1	Upright	
Body Size	10	3.51mm	
X-offset	0	No text offset	
Y-offset	0	No text offset	
Text Colour	CHBLK	Black	
Text Group	26		

Formatted Text Example

"BERTHS","","SY(BRTHNO01);**TE('Nr %s','OBJNAM',3,1,2,'15110',1,0,CHBLK,29)**",
"3","S","OTHER","32440"

Name	Lookup table value	Description	ECDIS Display
ECDIS Textual Output	Nr (string from attribute OBJNAM)		
Horizontal Justification	3	Left	
Vertical Justification	1	Bottom	
Spacing	2	Standard	
Font Style	1	Plain serif	
Text Weight	5	medium	
Width	1	upright, non-italic text	
Body Size	10	3.51mm	
X-offset	1	3.51mm	
Y-offset	0	No offset	
Colour	CHBLK	Black	
Text Group	29		

"RECTRC","CATTRK1TRAFIC4","LC(RECTRC10);**TE('%03.0lf deg','ORIENT',1,1,2,'15110',0,-1,CHBLK,11)**","6","O","STANDARD","25020"

Name	Lookup table value	Description	ECDIS Display
ECDIS Textual Output		Floating point number from attribute ORIENT followed by deg	
Horizontal Justification	3	Left	
Vertical Justification	1	Bottom	
Spacing	2	Standard	
Font Style	1	Plain serif	
Text Weight	5	medium	
Width	1	upright, non-italic text	
Body Size	10	3.51mm	

X-offset	1	3.51mm	
Y-offset	0	No offset	
Colour	CHBLK	Black	
Text Group	29		

9.2 SHOWPOINT

Name:

SY – Showpoint, Show symbol command.

Syntax:

SY(SYMBOL [, ROT]);

Description:

The SY command displays a symbol at a given point on the display. The command takes a standard symbol name as its first mandatory argument. A second parameter can impose a rotation on the symbol about the pivot point. In the case of an area object the "SY" command is used to display a centred area symbol.

Parameters:

SYMBOL: The name of the symbol to be displayed, e.g. ISODGR01. This will be the name as defined in the vector description language SYNM field.

ROT: An optional rotation parameter. The following notes apply to this parameter.

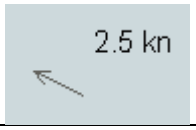
1. Symbols with no rotation must always be drawn upright with respect to the screen.
2. Symbols with a rotation instruction must be rotated with respect to the top of the screen (-y axis in figure 2 of section 8.1).
3. Symbols rotated by means of the six-character code of an S-57 attribute such as ORIENT must be rotated with respect to true north.
4. The symbol must always be rotated about its pivot point. Rotation angle is in degrees clockwise from 0 to 360. The default value is 0 degrees."

9.2.1 SHOWPOINT Example

SY(BOYCAR01);SY(LIGHTDEF,135) :

S-52 Symbol	Description	ECDIS Example
BOYCAR01	Simplified symbol - North Cardinal Mark	
LIGHTDEF, 135	LIGHTDEF is a symbol selected by a conditional symbology procedure (LIGHTS06). The command string "SY(LIGHTDEF,135)" selects a default light flare rotated by 135 degrees	

SY(EBBSTR01,ORIENT)

S-52 Symbol	Description	ECDIS Example
EBBSTR01	Tidal stream - flood/ebb object, ebb stream symbol rotated by value from the ORIENT attribute. In the example ORIENT = 297.3	

9.3 SHOWLINE

Name:

LS – Showline (complex linestyle) or
LC – Showline (simple linestyle).

Syntax:

LS(PSTYLE, WIDTH, COLOUR);
LC(LINNAM);

Description:

The SHOWLINE instruction is designed to symbolize line objects. It is also used within the SHOWAREA instruction to symbolize area boundaries. The command is used to show simple or complex line-styles (described below) and subsequent commands may add a symbol or text as well.

Parameters:

PSTYLE: Predefined line style parameter: One of three values:

```
'SOLD' (_________)
'DASH' (-----)
'DOTT' (.........)
```

dash: 3.6 mm; space: 1.8 mm
dot: 0.6 mm; space: 1.2 mm

WIDTH Line width parameter. Units are 0.32 mm (approximately pixel diameter)

COLOUR Line colour parameter. A valid colour token as described in section 7

LINNAM: Name of complex linestyle. This parameter will symbolise the line using the complex linestyle named by the LINNAM parameter.

9.3.1 SHOWLINE Example

LS(DASH,2,CHMGD). Displays a dashed line in "chart magenta, dominant", 0.6 mm (2 x 0.3 mm) width.

LC(ACHARE51). Displays the complex line-style called ACHARE51 defined for borders of anchorage areas. (see below).

9.4 SHOWAREA

Name:

AP – Showarea (area fill) or
AC – Showarea (pattern fill).

Syntax:

AP(PATTERN)
AC(COLOUR [,TRANSP])

Description:

The two showarea commands are used for symbolising area objects (often in conjunction with linestlyes for border rendering). There are two types of colour fill:

1. area fill with a basic colour using one of the standard colour tokens.
2. pattern fill using a pattern to fill areas.

Parameters:

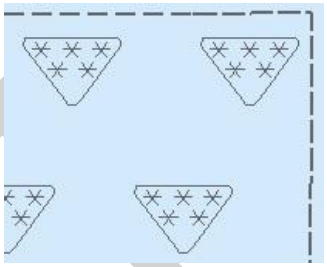
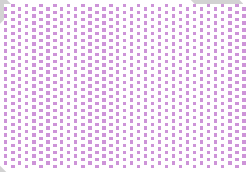
COLOUR: colour fill parameter. A valid colour token as described in section 7

PATTERN: the name of the pattern

TRANSP: Transparency, an optional parameter for colour fills used to make a fill partially transparent. If the transparency parameter is not set then the default value is 0%, i.e. an opaque colour fill. There are three permissible values:

1. 25% where 1 out of every 4 pixels use TRNSP
2. 50% where 2 out of every 4 pixels use TRNSP
3. 75% where 3 out of every 4 pixels use TRNSP

9.4.1 SHOWAREA Examples

S-52 Instruction	Description	Example
AC(CHBRN)	area filled with opaque colour 'chart brown'	
AP(DQUALA21);LS(DASH,2,CHGRD)	area filled with pattern for ‘category of zone of confidence; bordered by a dashed line in 'chart grey , dominant', 0.6 mm width	
AC(TRFCF,3);	Area filled by magenta, faint colour with 75% transparency for traffic separation zone	

9.5 CALLSYMPROC

Name:

CS – CALLSYMPROC: Call conditional symbology procedure.

Syntax:

CS(PROCNAME);

Description:

The CALLSYMPROC command “CS” calls a named conditional symbology procedure. It is used either on its own in order to symbolise a particular class of object/attribute combinations or in conjunction with other commands in order to add symbols to the display dependent on ECDIS Mariner settings, e.g.

The lookup for ACHARE is “SY(ACHARE51);LS(DASH,2,CHMGF);CS(RESTRN01)”

Note that the calling of the conditional symbology may affect values in the rest of the lookup table entry, for instance the viewing group or display priority may be affected by the operation of the conditional symbology procedure invoked by the SY command.

Parameters:

PROCNAME: The name of the conditional symbology procedure to invoke, e.g. RESTRN01 in the above example. Conditional symbology procedures are normally named by the object class that is interpreted by the procedure. The name is normally an 8 letter code that is composed of the class code (6 letters) and a serial number (2 letters).

10. ECDIS Requirements

This section provides ECDIS developers with other details of ECDIS display that must be taken into account while designing ECDIS.

10.1 Data Consistency

ENC presentation depends very much on the consistency of the underlying S-57 data. Thus ECDIS manufacturers should be aware of the consistency of the data that will be processed by their ECDIS.

10.1.1 Unknown Objects

Feature objects must be of an officially adopted object class. If feature objects are of proprietary non-ENC classes (i.e. not included in S-57 Product Specification for ENC) they must be treated as members of unknown object classes. There will be no appropriate entry in the look-up tables but all objects must be presented on the ECDIS screen. The occurrence of such an object must be logged during transformation from ENC to SENC as an anomaly and the unknown objects must be displayed using the question mark symbol QUESMRK1 as per section 10.3.3.4.

10.1.2 Unknown or Missing Mandatory Attributes

All mandatory attributes required by S-57 Appendix B1, ENC Specification, including the changes in Supplement 3, should be populated, except for cases where S-57 Appendix B1 Annex A, Use of the Object Catalogue, deliberately codes by omission (e.g., clauses 5.8.2 and 10.2.1.1). In reality, sometimes the attribute values may not be available and a producer may encode the attribute value as “unknown.” S-57 defines how null/unknown and missing attributes are encoded within ENCs. It should be noted that a missing attribute is not “unknown”. The Presentation Library provides default symbolization for many cases of attribute value omitted (e.g., in the first line for every object class in the look-up table).

10.1.3 Data Overlaps

The S-57 Product specification for ENC prohibits data overlaps in ENC cells of the same usage band.

“Cells with the same navigational purpose may overlap. However, data within the cells must not overlap. Therefore, in the area of overlap only one cell may contain data, all other cells must have a meta object M_COVR with CATCOV = 2 covering the overlap area. This rule applies even if several producers are involved”.

Despite the best efforts of the IHO, there are still some areas of the world where ENC overlaps exist.

Where an overlap of two or more cells exists the ECDIS must only display one cell for the overlap area and provide a permanent and persisting indication “overlap”.

10.1.4 Gaps

S-57 Use of the object catalogue edition 3.0.0 states;

“There must be no gaps in data between adjoining cells of the same Navigational Purpose”.

Despite the best efforts of the IHO, there are still some areas of the world where gaps in ENC coverage exist.

Where gaps in ENC data of the same navigational usage exist smaller scale data from the SENC may be used to fill the gap. If there is no smaller scale data available the gap must be filled with the no data area fill pattern.

10.1.5 No Data Coverage

IMO Performance standards states;

6.1 ECDIS should provide an indication if:

1. the information is displayed at a larger scale than that contained in the ENC; or
2. own ship’s position is covered by an ENC at a larger scale than that provided by the display.

IHO Specifications for ECDIS chart content and display S-52:

An indication "refer to the official chart" is required if the display includes waters for which no ENC at appropriate scale exists.

If a scale boundary is shown on the display, the information in an overscale area should be identified, and should not be relied on.

A graphical index of the navigational purpose of available data should be shown on demand.

10.1.6 ENC Coverage

S 57 app. B1 - "ENC Product Specification", section 2.2, describes the cell system and the use of object class M_COVR to indicate data coverage. Note that a value of M_COVR, CATCVR=2 does not necessarily indicate "no data", since data could be contained in an overlapping cell.

10.1.7 Limit of ENC Coverage: Non-HO Data on the Display

Since the HO will not issue a data coverage diagram, the ECDIS must compile a graphical index of the HO ENC data available, classified by navigational purpose, and make it available to the mariner.

The end of HO data need not be identified on the display. The appearance of the “No data” colour (NODTA) and fill pattern AP(NODATA03) will indicate the end of data.

If non-HO data is shown on the ECDIS display, its boundary must be identified by the linestyle LC(NONHODAT). The display priority is 3; over radar; display base; viewing group 11060. Note that the LC(NONHODAT) is a “one-sided” line and the boundary of the non-HO data must be drawn according to S-57 rules to ensure that the diagonal stroke of the line is on the non-HO data side of the line.

10.1.8 No Data Areas

To make sure that the mariner is aware of areas where no data exist, the entire screen must always be filled with grey NODTA colour fill together with the fill pattern AP(NODATA03) at the start, before any other information is drawn. The display priority is 0 (allowing non-ENC data to be overdrawn); radar flag suppressed by radar; the category is DISPLAYBASE and the viewing group is 11050.

An indication that the mariner must refer to the official chart must be given whenever line LC(NONHODAT) appears on the display, or whenever the display is comprised of other than ENC data.

10.1.9 Scale Boundaries

"Navigational purpose" is used in S 57 to express the concept of scale (ENC Product Specification 2.1).

10.1.9.1 Chart Scale Boundaries

The "chart scale boundaries", where the navigational purpose of the data changes, must be symbolised on the ECDIS display by a simple linestyle LS(SOLD,1,CHGRD). Alternatively linestyle LC(SCLBDYnn) may be used, with the double line (indicating better resolution) on the side of the larger scale data. The display priority is 3; over-radar; standard display; viewing group 21030.

Only the significant changes from one navigational purpose to another must appear as chart scale boundaries; boundaries marking minor changes in compilation scale that lie within the range of a navigational purpose must not be drawn.

10.1.9.2 Graphical Index of Navigational Purpose

The chart catalogue for official charts may be used as a model for the graphical index of navigational purpose, except that minor changes in compilation scale that lie within the range of a navigational purpose must not be drawn on this index. Only the significant changes from one navigational purpose to another must appear.

10.1.10 Overscale

Scale is expressed as a fraction, representing: [length of an object on the chart] / [actual length of that object on the ground]. Thus 1/10,000 is twice as large a scale as 1/20,000, because the length of a given object on the chart is twice as long at 1/10,000 scale as at 1/20,000.

The "Compilation Scale" is the reference for overscale calculation. This is coded in the CSCL subfield of the DSPM field. The object M_CSCL, CSCALE is only used if the compilation scale is different for some part of the data set, and when encoded must also be taken into account. (S 57 App. B1, Ann. A - "Use of the Object Catalogue").

10.1.10.1 Overscale Indication

The overscale indication is intended to remind the mariner that the size of chart errors is magnified when he increases the display scale. A 1 mm error at compilation scale of 1/20,000 becomes a 1.3 mm error at a display scale of 1/15,000 and a 2 mm error at 1/10,000.

The overscale factor must be calculated as [denominator of the compilation scale] / [denominator of the display scale], expressed as, for example "X1.3", or "X2" (using the figures in the example above.)
This must be indicated on the same screen as the chart display, and treated as display base. Use colour SCLBR.

This overscale indication is required by IMO PS [3] whenever the display scale exceeds the compilation scale.

Note: If the display is compiled from more than one ENC of the same compilation scale, and if the mariner deliberately chooses to zoom in so that the display scale exceeds the compilation scale, then only the "overscale indication" must be shown. The "overscale pattern" AP(OVERSC01) must not be shown.

10.1.10.2 Overscale Area at a Chart Scale Boundary

Section 10.1.10.1 above dealt with overscale deliberately selected by the mariner. A different overscale situation arises when the ship approaches a scale boundary from a larger to a smaller scale ENC, typically when leaving harbour, as illustrated in the data coverage diagram below. In combining data from the large scale and the small scale ENCs to generate a display at the larger scale, the ECDIS will have "grossly enlarged" the small scale data to the left of the scale boundary on this figure.

In addition to drawing the scale boundaries, the "grossly overscale" part of the display must be identified with pattern AP(OVERSC01), as illustrated. Its display priority is 3; over-radar; standard display; viewing group 21030.

In this context, "grossly enlarged" and "grossly overscale" must be taken to mean that the display scale is enlarged/overscale by X2 or more with respect to the compilation scale. For example, at the left edge of Fig 5 the display scale of 1/12,500 is X4 the compilation scale of 1/50,000, and so the overscale pattern is required.

Note that in this situation the pattern AP(OVERSC01) must only be shown on the area compiled from the smaller scale ENC. If the area from the larger scale ENC is also overscale, this must

be indicated by the "overscale indication". The pattern AP(OVERSC01) must not be shown on the part of the display taken from the larger scale ENC. For example if the display scale of the situation in the data coverage diagram was 1/3,500 the area of compilation scale 1/12,500 would have an overscale indication of X 3.6 but would have no pattern AP(OVERSC01).

10.1.10.3 Larger Scale Data Available

Visualise the opposite situation from that in the data coverage diagram below. This time, the ship is approaching harbour from the left edge of the figure, displaying an ENC at a compilation scale of 1/50,000. As the display window begins to cover an ENC at a compilation scale of 1/12,500, the ECDIS must indicate that larger scale data will shortly become available, as required by IMO PS [3].

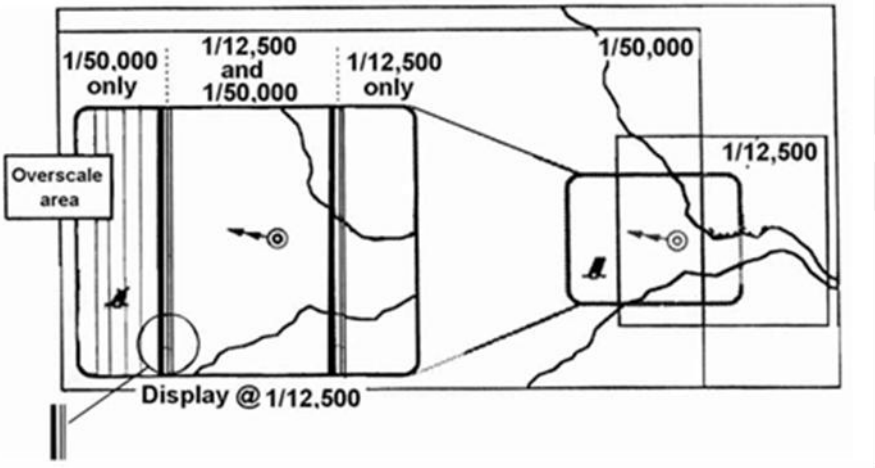


Fig 5. Data Coverage Diagram

(The right hand side of the diagram shows the ENC layout with the screen window overlaid, and the left hand side is enlarged to show the ECDIS display on that screen.)

10.2 Queries

To successfully use the Presentation Library, ECDIS must be capable of performing spatial queries on ENC data during import and symbolisation. Spatial query is understood as possibility to inspect graphical position and numerical value of spatial coordinates associated with a charted object. Spatial query could be available as a part of cursor pick (see 10.8) or as an independent function. Due to the complex nature of these queries it is recommended that the inspector of this requirement tests extensively that all required geometric primitives are accounted for in these tests and that the conditional symbology procedures are thoroughly understood during manufacture. Refer to section 13 for further details of which queries are required.

Note: IHO S-64, Edition 3.0.0 contains examples of cases which ECDIS must be able to handle, such as the safety countour tests in sections 3.3.4 a, b, c & d.

10.3 How to use the Look-Up Tables

Prior to drawing any chart objects on screen, the first action the ECDIS must perform as a fail-safe measure, is to cover the screen with grey NODTA colour fill together with fill pattern NODATA03. Display priority is 0, supressed by radar, category “displaybase”, viewing group is 11050. This section describes how S-57 features objects are converted to symbols, line and fill styles using the lookup tables. A number of ECDIS display requirements derived from the IMO

Performance Standards and the IHO specifications are not handled by look-up tables. These are described in section 10.5.

10.3.1 Layout of the Look-Up tables

The S-52 look-up tables are made up of five separate lists. The look-up tables specify how object classes are presented graphically on the chart display. Each look-up table entry contains six mandatory fields plus one optional field separated by commas "," and using the double quote " as a text delimiter for each value. The following lookup tables are defined:

1. Symbolised boundaries for area features.
2. Plain boundaries for area features
3. Line features
4. Simplified point features
5. Traditional point features.

10.3.2 Lookup Table Entry Example

"BOYCAR","BOYSHP2","SY(BOYCAN01);TE('by %s','OBJNAM',2,1,2,'15110',-1,-1,CHBLK,21)","8","O","STANDARD","27010"

Field	Description	Look-Up Table Entry Example
1	feature object acronym	BOYCAR
2	feature attribute	BOYSHP2
3	symbolization instruction	SY(BOYCAN01);TE('by%s','OBJNAM',2,1,2,'15110',-1,-1,CHBLK,21)
4	display priority	8
5	OVERRADAR flag	O
6	display category	STANDARD
7	optional viewing group	27010

The fields are defined as follows:

1. Feature object acronym – This is the S-57 acronym for a particular feature class, e.g. BOYCAR, LNDARE etc. A default value of "######" is also defined.
2. Feature attribute combination – This field is used to define a set of feature attributes which may be matched. It consists of a concatenated list of valid S-57 attribute acronyms together with optional values. A line in the lookup tables matches a given feature object if, and only if, fields 1 and 2 match according to the rules defined in this section.
3. Symbolisation instructions. The instructions to be used to symbolise the feature objects. This may be composed of any of the symbolization commands defined in section XX of this document.
4. Display priority
5. OVERRADAR flag

6. Display category – can be “DISPLAYBASE”, “STANDARD”, “OTHER”, “MARINERS”.

7. Viewing group.

10.3.3 Matching Entries in the Lookup Tables

It is important to note that look-up table lines with the same feature object class in field 1 must be grouped together and the order defined in the Presentation Library must be preserved, to provide correct symbolization. The order of the attributes within a given line has no significance, but the order of the attribute values within a given attribute field (2) is significant. When a matching line is found for a feature object the lookup table line used for its symbology instructions must then also be used for display priority, over radar flag, IMO category and optional viewing group unless modified by a conditional symbology procedure..

10.3.3.1 Look-Up Table Entry Matching

To find the symbology instruction for a specific object, enter the look-up table with the object's class code and gather all lines that contain the class code in field 1. If only a single line is found, field 2 of that line must be empty and the object is always shown with the same symbology regardless of its description.

If there is more than one line in the look-up table, search for the first line each of whose attribute values in field 2 can also be found in the attribute values of the object. If more than one attribute value is given in the look-up table, the match to the object must be exact, in order as well as content.

For example, a look-up table attribute value 4,3,4 is not matched by object attribute values 3,4,3 or 4,3. However, the existence of further attribute values does not invalidate the match: in the above example object attribute values 4,3,4,7 would match the look-up table, (because value 7 is not used in symbolizing). Use the symbology instruction given by that line in field 3 to symbolize the object's geometry. As a further example, an object "BCNLAT","COLOUR3,1", for which there is no exact match in the simplified point look-up table, must be symbolized using the line for "BCNLAT","COLOUR3".

Look- Up Table	Data Match	Result
attribute value 4,3,4	attribute values 3,4,3	No Match
	attribute values 4,3	No Match
	attribute values 4,3,4,7	Match (value 7 is not used in symbolization)

IMPORTANT: If no look-up table line can be identified where all attribute values in field 2 match the object's attributes, select the symbology instruction from the first line that contains the object class code in field 1. Field 2 of this line must be empty and field 3 must contain a fail-safe generic symbolization instruction.

10.3.3.2 Look-Up Table Attribute Matching

The rule in the paragraph above applies in the usual case when the look-up table contains specific values of the attribute in field 2. In this case fields 1 and 2 are of the general form: "OBJCLS", "ATTRBAiATTRBBj", where ATTRBA (attribute A) and ATTRBB (attribute B) are drawn from the SENC. Only values “i”" and “j” of ATTRBA and ATTRBB respectively will match.

Other forms of feature object/attribute matching may be used in certain cases:

(i) No value is given for the attribute value in field 2; the value is missing.
This look-up table line is of the form "OBJCLS", "ATTRBA".
It is used when the same symbolization is to be employed for all values of attribute A.
Any value of the attribute except «unknown» will give a match.

(ii) The placeholder “?” is given for the attribute value.
This look-up table line is of the form "OBJCLS", "ATTRBA?".
Only the attribute value=unknown (i.e., omitted in the data) will give a match in this case. S-57 defines how “unknown” is encoded as a value for various attribute types.

Example: "DEPARE","DRVAL1?DRVAL2?","AC(NODTA);AP(PRTSUR01)" etc., is the symbolization for an incompletely surveyed area.

(iii) There is one instance where S-57 uses the “omission” of a mandatory attribute (i.e., the mandatory attribute is not present and the attribute code is omitted) to code a specific object: “TSSLPT”,””, where ORIENT is omitted, codes a traffic junction.

In every other case, the first look-up table line for each object class omits all attributes and is used to give the default symbolization for that feature object..

10.3.3.3 Look-Up Table Conditional Symbology

For some object classes the relation between attribute values and symbology instruction is too complex or the presentation depends on Mariners' selection. Therefore a conditional symbology procedure is defined in the "symbolization instruction" field which in turn produces the symbology instructions for presentation and may modify the priority, the radar flag, the IMO category and/or viewing group.

10.3.3.4 Symbolizing a non-ENC object class

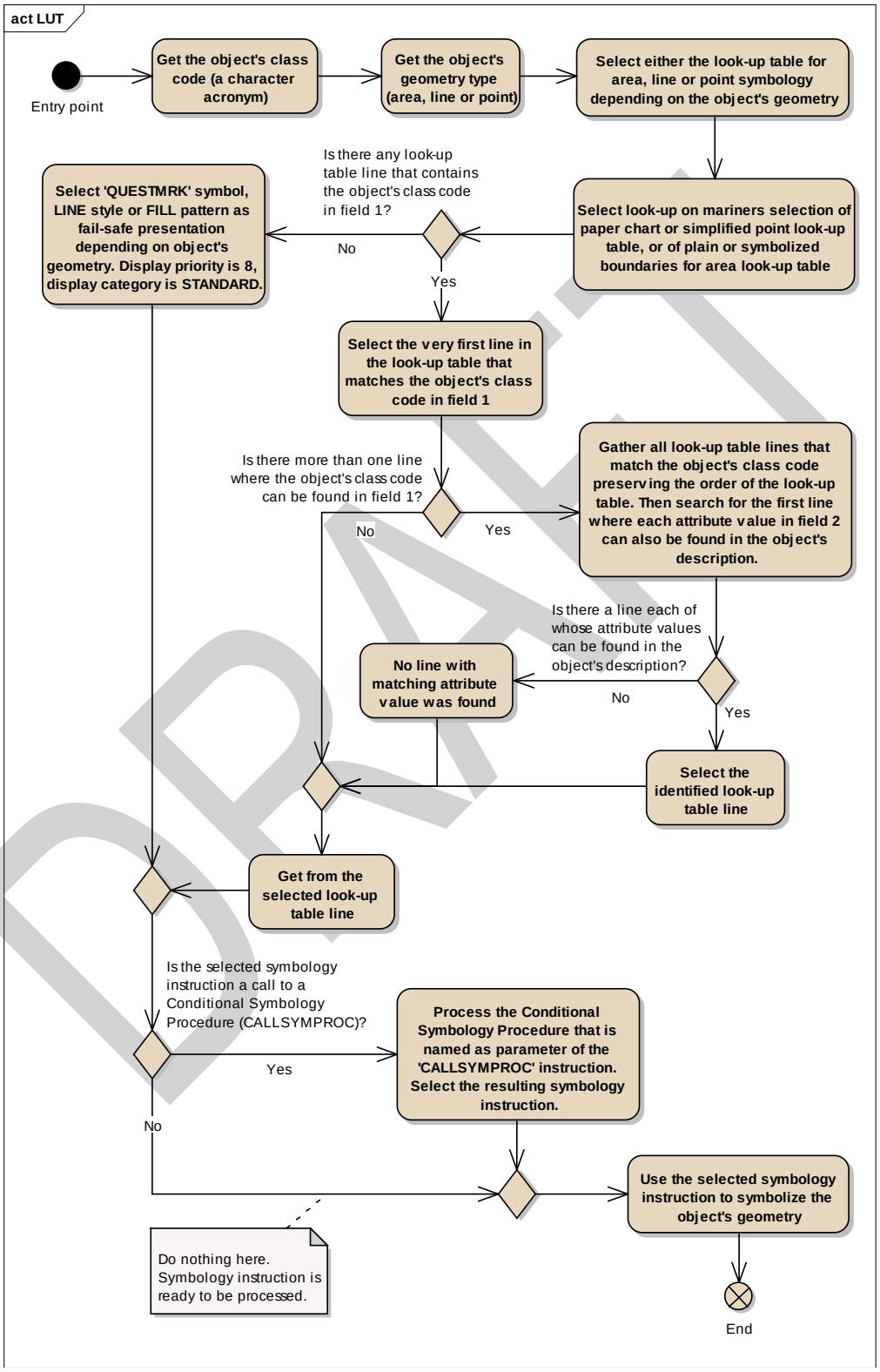
When there is no look-up table entry matching the object, the look-up table is incomplete or the object is of an unknown object class, the ECDIS presentation must use the symbol ('QUESMRK1'). All known S-57 attributes permitted for ENCs that have been populated, must be available for cursor enquiry. Values of unknown attributes must also be available via the cursor enquiry.

Symbol	QUESMRK1

Display Priority	**5**
Over Radar	**O**
Display Category	**Standard**
Viewing Group	**21010**

10.3.3.5 UML Diagram, How to use the Lookup Tables

The following flow chart diagram explains in detail how to use the look-up tables.



10.3.3.6 Not set attributes

The symbology instruction may refer to attributes that are not listed in field 2, for example TX(OBJNAM). If these attributes are not set in the feature object, this particular command word must be ignored and the rest of the symbology instruction must be completed.

10.3.3.7 'No Symbol' - Objects

In some cases the "symbolization instruction"-fields in a look-up table line are empty. Such an explicitly "empty" instruction means that no actual presentation for the respective object is required by the presentation library. Such objects are not symbolized and they are not shown on the screen. For example, there is no symbolisation of a point BRIDGE feature The empty entry into the look-up table is simply for completeness.

10.3.3.8 Presentation of New Object NEWOBJ

The ‘New Object’ feature class has been added to S-57 through Supplement 3. For details on its use and encoding please see the S-57 Use of the Object Catalogue. NEWOBJ will cater for future requirements specified by the IMO that affect safety of navigation which cannot adequately be encoded by any existing S-57 object class. It will not be used unless approved by the Transfer Standard Maintenance and Application Development Working Group (TSMAD) and the Digital Imaging and Portrayal Working Group (DIPWG).

For the presentation of objects of class NEWOBJ there are two defined presentations to be used depending on whether the SYMINS attribute is defined.

To distinguish a new object symbol from the standard “Non ENC object” symbol (magenta question mark), an exclamation mark shaped in a magenta filled circle has been developed. The new symbol is named ‘NEWOBJ01’. If the SYMINS attribute is defined then it is used to symbolise the feature object using the CS(SYMINS01) conditional symbology procedure.

IMPORTANT: Where the ECDIS fails to identify the symbol contained in the SYMINS attribute the SY(NEWOBJ01) must be used as a default

10.3.4 Display Priority, Radar Priority, Display Category, Viewing group

10.3.4.1 Display Priority

Each symbolization instruction from a look-up table line has a display priority given in field 4. The display priority can be of a value between '0' and '9', where '9' identifies the highest priority. The display priority applies irrespective of whether an object is a point, line or area. If the display priority is equal among objects, line objects have to be drawn on top of area objects whereas point objects have to be drawn on top of both. If the display priority is still equal among objects of the same type of geometry (area, line or point) the given sequence in the data structure of the SENC, or some other neutral criterion, must be used for an arbitrary decision as to which object is drawn on top. Text must be drawn last (except for own ship etc.), in priority 8.

The display priority must be used to ensure that objects that overlap each other are drawn in the right sequence. Thus, an object with a higher priority must be drawn after (on top of) an object

with a lower display priority. However, if two line objects, or two area boundaries, or a line and an area boundary, are located at the same position and share the same extent (their coordinates are identical), then the line symbolization with the higher display priority must suppress the line symbolization of the other object (line or area). Therefore only the line symbolization of the object (line or area) of the higher display priority is drawn. Where two objects share the same spatial edge and both have the same display priorities each line must be symbolized.

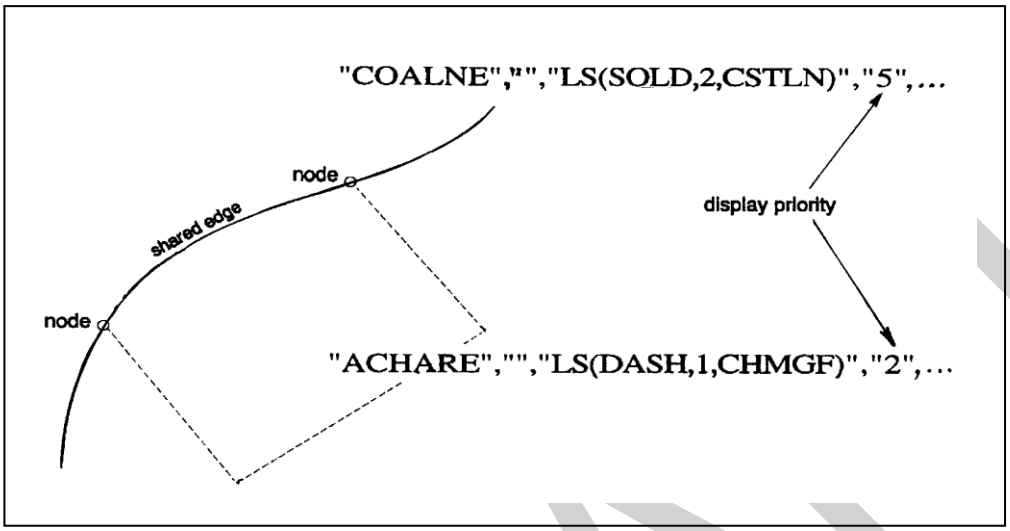


Fig 6. Symbolization of shared edges

The coastline object is symbolized with a solid line while the anchorage area is bordered with a dashed line. Both objects share an edge that is part of the coastline. The symbolization of the coastline object suppresses the border of the anchorage area since the display priority of the coastline symbolization is higher. Note that priorities have to be evaluated again, if the presentation scale changes (see section 8.4).

This suppression only applies to line objects and area boundaries. The rule for centred symbols, area patterns and point symbols is that all symbols must be drawn with the highest priority object being drawn last independent of the geometric primitive (point, line or area).

There is one exception to this rule for suppressing overlapping lines. The manual chart correction lines LC(CHCRIDnn) and LC(CHCRDELn) must coexist with the underlying line. Both LC(CHCRIDnn) or LC(CHCRDELn) and the underlying line must be drawn.

Overdrawing may be essential, for example in the case of a buoy, and its name and light flare. These are given offsets in the symbol library to avoid the symbols being drawn over each other.

The following table gives an indication of how priorities are allocated. Within each group priorities are adjusted to meet specific cases:

Data Groupings	Display Priorities
no data filled area pattern	priority 0
S-57 group 1 filled areas	priority 1
superimposed areas	priority 2, 3
restricted area	priority 5
traffic areas	priority 6
land features	priority 4, 5
water features	priority 3, 4, 5, 6
coastline features	priority 5, 6, 7
routeing lines	priority 5, 6, 7
symbols for lines and areas	priority 4, 5, 6
hazards (bridge, safety contour)	priority 8
Mariners VRM & EBL	priority 9
own ship	priority 9

NOTE: To ensure seamless presentation of a single intended usage (navigational purpose) all objects of same display priority from all cells in same intended usage must be drawn together.

10.3.4.2 RADAR Flag

Field 5 of the look-up table lines contain the OVERRADAR flag. It classifies whether objects are shown on top of the raw radar picture. Two different values can occur in this field:

Value	Description
O	puts the object's presentation over radar
S	the presentation is suppressed by radar

Radar Table

OVERRADAR is similar to a display layer that assigns objects to the information shown on top of the raw radar picture. As a fail-safe, objects are automatically assigned 'O' OVERRADAR if field 5 of a look-up table line is empty.

When the RADAR overlay is present on the ECDIS chart display the OVERRADAR flag takes precedence over the objects display priority.

10.3.4.3 Display Categories

Every entry to the look-up table matches either all objects of an object class or a subset of objects. Therefore the look-up table can be used to assign the objects to the IMO Display Categories (see IMO Performance Standards for ECDIS [2]).

The IMO "display categories" are as follows:

Display Base is that part of the Standard Display which must be permanently retained on the display (see IMO Performance Standards [2]).

Standard Display information is that part of the SENC which must be presented when the ECDIS display is first switched on, and at any time by a single operator action (see IMO Performance Standards [2]).

All Other Information includes all SENC information that is not in the Standard Display, to be displayed on demand by the Mariner.

10.3.4.4 Independent Mariner Selections

There are a number of settings in ECDIS that can be operated by the Mariner that will alter the charted display. Each of these objects has a display category assigned but must only be shown in that display category if the Mariner has decided to select this option. Listed alphabetically below are the Mariner selectors that must be available in ECDIS, the name of the selector in the ECDIS GUI and a functional description. There are a number of other optional extra Mariner selectors that can be included in ECDIS at the bottom of the table.

Clause	ECDIS Implementation	Name of Selector in ECDIS	Function Description
14.2	Mandatory	Accuracy	Independent pattern selection of CATZOC, viewing group 31010. Symbol LOWACC01, viewing group 31011
10.4.1	Mandatory	Date dependent	Date Dependent Objects – to turn on and off the display of temporal objects by viewing a date range.
13.2.7	Mandatory	Full light lines	Full Light Sector Lines
10.4.1.1	Mandatory	Highlight date dependent	Indication of date dependent objects – to turn on and off the display of symbol CHDATD01
10.6.1.1	Mandatory	Highlight info Highlight document	Additional Information - viewing group 31030 (INFORM, NINFOM) Additional Documents – viewing group 31031

			(TXTDSC, NTXDS, PICREP)
10.3.3.4	Mandatory	Unknown	Unknown Objects - to turn on the display of objects which are not specified in S-52 standard – viewing group 21010
10.7.1.5	Mandatory	Update review	Review of Updates – This function turns on colour highlighting for the objects which have undergone modification in the process of the latest accepted correction;
10.4.2	Mandatory	Scale min	Turn SCAMIN Off
10.5.7	Mandatory	Shallow pattern	Shallow Water Pattern
13.2.24	Mandatory	Shallow water dangers	Isolated Dangers in Shallow Water – to turn on the display of isolated danger objects which are located in the unsafe waters - viewing group 24050
14.2	Optional	Contour label	Contour Labels – to turn on the display of contour labels (incl. label of safety contour) – viewing group 33021, 33022
	Optional	Four shades	Four Colour Depth Shades
10.6.1.2	Optional	National language	National Language NOBJNM, text group 31
12	Mandatory	Paper chart / simplified symbols	Point symbol style
12	Mandatory	Plain / Symbolized boundaries	Line symbol style

10.3.4.5 Mariners' objects

All Mariners' navigational objects, which are listed in the look-up table under "Non-standard classes", are assigned in the look-up tables to a "Mariners"category.

The display of Mariners' objects is independent of the ECDIS display category (Display Base, Standard and All Other).

10.3.4.6 Viewing groups

The Mariner must have effective control over which features appear on the display (subject to the over-riding requirements of IMO category), as required by the IMO ECDIS Performance Standard, section 3.5.

The viewing groups in table 14.2 are a framework on which the ECDIS manufacturer can base his own method of providing this capability. The minimum mandatory ECDIS implementation is described in 14.3 and 14.5.

Viewing groups are 'on' or 'off' switches for use by the Mariner to control the information appearing on the display. An item in the viewing group table may be a chart object; a Mariners' or other time-variable object; a special symbol such as the "depth less than safety contour" pattern; or a non-ENC feature such as the shallow water pattern. In edition 3.3 further 'symbol viewing groups' have been added, to allow auxiliary symbols such as contour labels, the 'low accuracy' symbol, etc., to be switched on or off without affecting the primary symbolisation of the object.

Items in the viewing group tables in section 14.2 are arranged in numbered groups (e.g. group 26230 consisting of the items pipeline area and cable area) which in turn are arranged in layers (e.g. layer 26000 consisting of cautionary areas). The groups are arranged by IMO Category, in the sequence of INT 1 [1].

IMPORTANT: Viewing groups from different IMO categories must not be combined under a single display selector.

Although the viewing groups reflect the IMO category, the authority for category is the classification in field 6of the look-up table.

The Presentation Library provides a similar classification for text - see sections 9.1 and 14.4.

10.3.4.7 Display Priority & Display Category in Conditional Symbology Procedures

A conditional symbology procedure is called from the look-up tables (see 14). Thus the symbolization that is generated by the procedure has the display priority, OVERRADAR classification and display category which is given in field 4, 5 & 6 of the look-up table entry from which the procedure was called.

A conditional symbology procedure can assign the symbolization to another display category, put it on top of radar or give it a different display priority if necessary. Thus it 'overwrites' the default assignments given in the look-up table e.g. if a depth contour is identical with the safety contour the depth contour is assigned to the DISPLAYBASE category (see symbology procedure diagram 'DEPCNT03', section 14).

In the symbology procedure diagram the new assignment is given explicitly if the conditional symbology procedure overwrites the default look-up table assignments. The default assignments from the look-up tables are valid if there is no explicit assignment for display category, display priority or OVERRADAR.

10.3.5 Check Symbol SY(CHKSYM 01)

The symbol SY(CHKSYM01) has been retained for use in checking symbol size.

10.4 Display of objects - Date Dependent and Display Scale

10.4.1 Date dependent ENC Objects

There are a number of objects within the Marine environment, which are seasonal, such as racing buoys. These objects are only to be displayed over a certain period, S-57 uses the attributes Period Start (PERSTA) and Period End (PEREND) to encode these dates. Other objects, such as traffic separation schemes, use the attributes Date Start (DATSTA) and Date End (DATEND) to indicate their introduction or removal. In order for the Mariner to receive important changes to traffic separation schemes before the event Hydrographic Offices are required to provide updates or new editions containing the alterations at least one month before they come into force. Any S-57 object with one of the above attributes must not be displayed outside its effective dates unless requested by the Mariner.

To provide the Mariner with effective route planning capabilities and for the look-ahead function during route monitoring ECDIS must display date dependent chart data based on a Marinerselecteddate or date range (start viewing date and end viewing date).

During route planning and monitoring the Mariner must be able to select a date or date range to display all date dependentchart objects. The display of date dependent information is indicated by the symbol SY(CHDATD01) section 10.4.1.1

Example: A new traffic separation scheme is coming into effect on 01.01.2013, it has been encoded by the ENC producer using the attribute date start (DATSTA). The current date is 12.12.2012 and the Mariner is planning a route that will cross this area over the effective start period.

The ECDIS must be capable of providing the Mariner the ability to set the date he will be in the area (02.01.2013) and the system must show the new traffic scheme.

IMPORTANT: When viewing date or date range do not include current date. The Mariner must be informed by a permanent indication on the chart display that the date has been adjusted. Please use one of the following options below.

Display Not Real Time – Display is based on date dd mmm yyyy

Or

Display Not Real Time – Display is based on viewing date range from dd mmm yyyy to dd mmm yyyy

(Note: dd mmm yyyy = Day, Month, Year, example; 28 Jan 2014)

10.4.1.1 Indication of date dependent objects

All objects for which any of the values for the attributes DATSTA,DATEND, PERSTA PEREND are within the Mariner selected date range must be indicated using SY(CHDATD01).

10.4.2 Scale-Dependent Objects

To reduce screen clutter most objects within ENC will carry the attribute SCAMIN to specify the smallest display scale at which they must be drawn. At display scales smaller than SCAMIN the object must not be drawn. For example, an object with a SCAMIN value of 50,000, indicating a scale of 1/50,000, must not be drawn on an ECDIS display of 1/60,000.

IMPORTANT: ECDIS must provide the Mariner a selector to turn off the SCAMIN attribute to display all objects in the chart display.

10.5 IMO Presentation Instructions not Handled by Look-up Tables

In some cases the Presentation Library does not provide a symbology instruction in the look-up tables or flow chart of a conditional symbology procedure that specifies how to present a specific feature on the ECDIS screen. The reason is, that such a feature cannot be clearly identified as an S-57 object class or it appears to be illogical to include it to the Mariners' navigational object classes (see Part II for further details and definitions of the Mariners' navigational object classes).

Therefore, the following presentation instructions are in free text in order to assist the manufacturer to set up a satisfactory and comprehensive ECDIS display.

10.5.1 Scalebar and Latitude Scale

For display scales larger than 1/80,000 (e.g. a scale of 1/50,000) draw symbol 'SCALEB10' on the left side of the chart display, bottom justified and 3mm in from the border of the display. Make sure the symbol is properly sized by your software to represent 1 nautical mile (1852 m) at the scale of the display. For display scales of 1/80,000 or smaller (e.g. 1/250,000) use symbol 'SCALEB11', similarly located, and scaled to represent 10 miles at the scale of the display.

Symbol	**SCALEB10 SCALEB11**
Display Priority	**9**
Over Radar	**O**
Display Category	**Base**
Viewing Group	**11030**

10.5.4 North Arrow

Use symbol 'NORTHAR1' to indicate true north. Place it in the top left corner of the chart display, inside the scalebar. Rotate the symbol to true north if the display is other than north up, and make sure it is clear of the scalebar even if the latter extends the full height of the display

Symbol	NORTHAR1
Display Priority	**9**
Over Radar	**O**
Display Category	**Base**
Viewing Group	**11040**

10.5.5 Graticule

If the ECDIS shows a graticule (IMO PS [2]) the lines must be one unit wide, CHBLK.

10.5.6 Display Mode

The ECDIS manufacturer must provide the indication of display mode required in the display base by IMO PS [2].

10.5.7 Shallow Water Pattern

When the entire water area on the ECDIS display is of less depth than the safety contour, it is not possible for the Mariner to easily detect this problem. The issue is exacerbated when the ECDIS is set to night mode due to the small differences between the depth area shades in the ECDIS chart display. Therefore S-52 provides a faint lattice pattern DIAMOND1 to distinguish shallow water (see conditional symbology procedure SEABEDnn).

IMPORTANT: The Mariner must be provided with a selection to turn the shallow water pattern on or off from within the ECDIS.

Symbol	DIAMOND1
Display Priority	**3**
Over Radar	**S**
Display Category	**Standard**
Viewing Group	**23010**

10.5.8 Black Level Adjustment Symbol

Unless the brightness and contrast controls of the monitor, are properly adjusted there is a danger that information may be lost from the chart display, particularly at night. Symbol BLKADJ01 is provided for checking correct adjustment and for re-adjusting as necessary. It must be available for call-up by the Mariner as required. Instructions for its use are given in section 18.3 and S-52, section 4.2.4.5. Display priority is 9; over radar; IMO category is standard display; viewing group does not apply as the black level adjustment symbol is a case of special call-up.

10.5.9 Detection and Notification of Navigational Hazards

The IMO Performance Standard for ECDIS MSC.232(82), clause 11.3.5 Route planning states;

"An indication should also be given if the Mariner plans a route closer than a user-specified distance from a point object, such as a fixed or floating aid to navigation or isolated danger".

Clause11.4.6 Route monitoring states;

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

The following table lists the S-57 objects and their attributes that satisfy the conditions above and must precipitate an indication within the ECDIS. The point, line or areas must be graphically indicated using the instructions contained in the lookup tables named "indhlt". "indhlt" is not an ENC charted object class, but an object that must be created by the ECDIS. See Fig 7 for example.

NOTE: This is a minimum requirement and does not preclude providing additional functionality allowing Mariner selection to individually alarm on each object class.

S-57 Objects	Condition (if any)	Geometric primitive
BCNCAR		POINT
BCNISD		POINT
BCNLAT		POINT
BCNSAW		POINT
BCNSPP		POINT
BOYCAR		POINT

BOYINB		POINT
BOYISD		POINT
BOYLAT		POINT
BOYSAW		POINT
BOYSPP		POINT
BRIDGE		POINT, LINE, AREA
CBLOHD		LINE
DAYMAR		POINT
PIPOHD		LINE
CONVYR		LINE, AREA
MORFAC		POINT, LINE, AREA
NEWOBJ	CLSNAM = Virtual AtoN, *	POINT
FSHFAC		POINT, LINE, AREA
ICEARE		AREA
LITFLT		POINT
LITVES		POINT
LNDARE		POINT, LINE
LOGPON		POINT, AREA
OFSPLF		POINT, AREA
OILBAR		LINE
PILPNT		POINT
PYLONS		POINT, AREA
OBSTRN	**DEPTH_VALUE < safety contour value	POINT, LINE, AREA
UWTROC	DEPTH_VALUE < safety contour value	POINT
WRECKS	DEPTH_VALUE < safety contour value	POINT, AREA
SOUNDG	EXPSOU=2 and VE3D subfield<safety contour value	POINT

*Denotes that all New Objects with the object class name pre-fix 'Virtual AtoN' must be indicated.

** DEPTH_VALUE is not an S-57 attribute, it is derived from CSP OBSTRNnn and WRECKSnn. The safety contour value is set by the user.

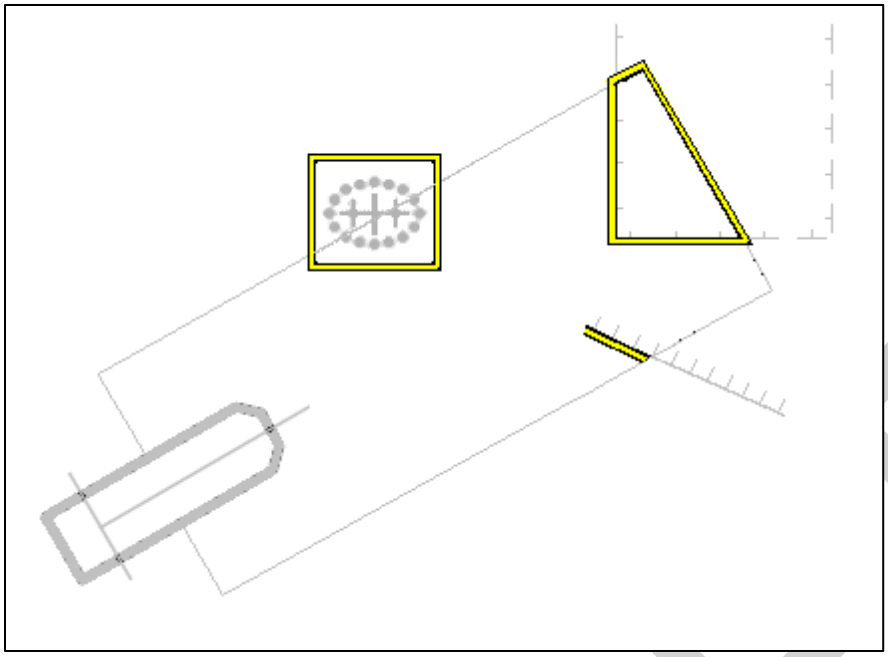


Fig 7. Example of indication highlighting ECDIS described in 10.5.9 and 10.5.10

10.5.10 Detection of Areas, for which Special Conditions Exist.

The IMO Performance Standard for ECDIS MSC.232(82), clause 11.3.5 Route Planning states;

“An indication should be given if the Mariner plans a route closer than a user-specified distance from the boundary of a prohibited area or a geographic area for which special conditions exist.”

Clause 11.4.4 Route Monitoring states;

"ECDIS should give an alarm or indication, as selected by the Mariner, if, within a specified time set by the Mariner, own ship will cross the boundary of a prohibited area or area for which special conditions exist".

The IMO Performance Standard, Appendix 4, specifies the following areas which ECDIS must detect and provide an alert or indication.

- Traffic separation zone
- Inshore traffic zone
- Restricted area
- Caution area
- Offshore production area
- Areas to be avoided
- Military practice area
- Seaplane landing area
- Submarine transit lane
- Anchorage area

- Marine farm/aquaculture
- PSSA (Particularly Sensitive Sea Area)

The following table provides an authoritative mapping between the areas identified within the IMO Performance standard for ECDIS and S-57 feature objects, their attributes and geometric primitives. The point, line or area features must be graphically indicated using the presentation named as “indhlt” in the look-up tables.

IMO Special condition	S-57 Object	Attribute	Geometry
Traffic separation zone	TSEZNE		AREA
Inshore traffic zone	ISTZNE		AREA
Restricted area	RESARE	RESTRN !=14 and CATREA != 28	AREA
Caution area	CTNARE		AREA, POINT
Offshore production area	OSPARE		AREA
Areas to be avoided	RESARE	RESTRN = 14	AREA
Military practice area	MIPARE		AREA, POINT
Seaplane landing area	SPLARE		AREA, POINT
Submarine transit lane	SUBTLN		AREA
Anchorage area	ACHARE		AREA, POINT
Marine farm/aquaculture	MARCUL		AREA, LINE, POINT
PSSA (Particularly Sensitive Sea Area)	RESARE	CATREA = 28	AREA

10.5.11 Visualization of the Safety Contour

The safety contour is defined as an edge between safe and unsafe skin of the earth objects. This edge must be visualized using the presentation below.

"SAFCON","","LS(SOLD,3,DEPSC)","8","O","DISPLAYBASE","13000"

10.5.12 Detection of Safety Contour

The IMO Performance Standard for ECDIS MSC.232(82), clause 11.3.4 Route Planning states;

“An indication is required if the Mariner plans a route across an own ship's safety contour”

Clause 11.4.3 Route Monitoring states;

"ECDIS should give an alarm if the ship, within a specified time set by the Mariner, is going to cross the safety contour".

The following table specifies the S-57 objects, conditions and geometry that constitute the safety contour and must therefore be used when raising the safety contour alarm.

The point, line or area must be graphically indicated using the presentation named as “dnghlt” in the look-up tables.

S-57 Object	Condition	Geometry
DEPARE	*DEPARE03 “UNSAFE=TRUE”	AREA
DRGARE	*DEPARE03 “UNSAFE=TRUE”	AREA
FLODOC	-	LINE, AREA
HULKES	-	POINT, AREA
LNDARE	-	POINT, LINE, AREA
PONTON	-	LINE, AREA
UNSARE	-	AREA
SLCONS	-	POINT, LINE, AREA

* DEPARE03 is not an S-57 attribute, it is a CSP.

Note: Rocks, Wrecks and Obstructions are in Navigational Hazard Detection.

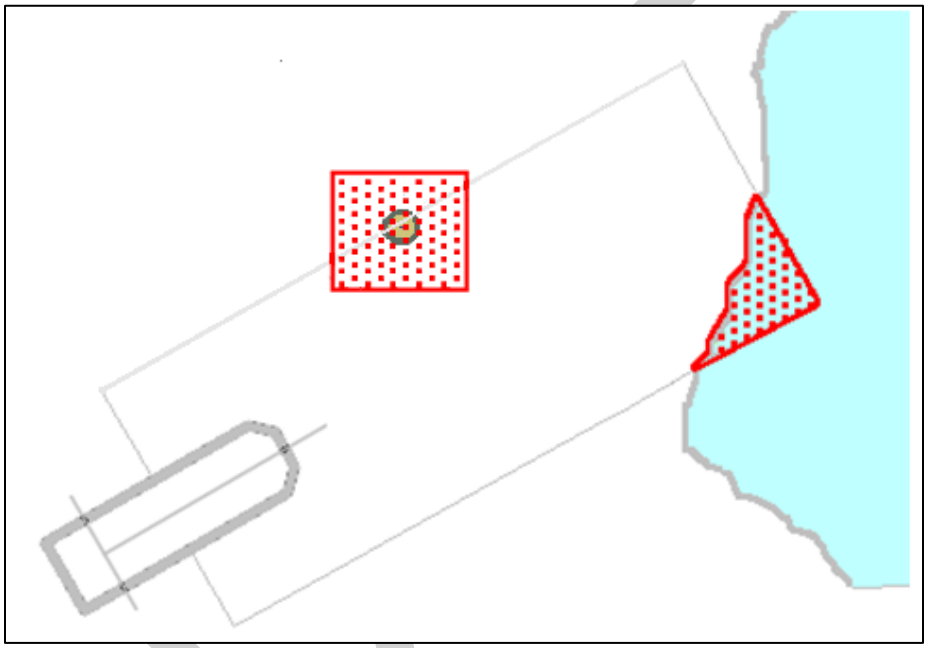


Fig 8. Example Danger Highlight in ECDIS

10.6 HO-Specified Display Features

10.6.1 Additional Chart Information

10.6.1.1 Standard Attributes INFORM, NINFOM, TXTDSC, NTXTDS and PICREP

Additional chart content is encoded using a number of standard attributes. The INFORM attribute is the most common and is used to carry extra information about feature objects. There are a total of five similar universal attributes:

S-57 Acronym	Description	Attribute Type
INFORM	Information	String
NINFOM	Information in a national language	String
TXTDSC	Textual Description	String encodes the file name of an external text file
NTXTDS	Textual Description in a national language	String encodes the file name of an external text file
PICREP	Pictorial Representation	String encodes the file name of an external picture file

NOTE: ECDIS must provide independent user selection to turn on and off the symbol INFORM01 for two cases;

1.INFORM, NINFOM

2.TXTDSC, NTXTDS and PICREP

This rule applies to all SENC objects whether symbolized by look-up tables or conditional symbology procedures.

The pivot point of SY(INFORM01) must be placed at the position of a point object, at the midpoint of a line object, or at the centre of an area object. SY(INFORM01) is intended as a temporary overlay. The display priority is 8, overradar, category other, viewing group 31030.

Symbol (SY)	INFORM01
Display Priority	**8**
Over Radar	**O**
Display Category	**Other**
Viewing group	**31030**

IMPORTANT: The ECDIS manufacturers must provide appropriate solutions that enable PICREP and other ancillary files to be displayed without affecting the night vision of the user.

10.6.1.2 Display of National Language Attributes and Content

Information contained in National language attributes and associated ancillary files (such as NOBJNM and information in NTXTDS files) can be encoded in a number of formats and many IHO member states encode such fields in their data. National language information is not covered by the ECDIS Performance Standard but it is however strongly recommended that OEMs support all text formats contained in the national language attributes and files, see S-57 Appendix B1 «ENC Specification», section 3.11, lexical level 2 for details.

10.6.2 ECDIS Legend

The ECDIS chart legend containing the following elements must be available for display at the position selected by the Mariner. The following table indicates which ENC data elements must be used.

ECDIS Legend	**Values**
Units for depth	DUNI subfield of the DSPM field.
Units for height	HUNI subfield of the DSPM field.
Note: Units for depth and height: although the ENC Product Specification of S-57 does not allow any other than metric depths and heights, these two elements must be stated for clarity for the Mariner	
Scale of display	Selected by Mariner. (The default display scale is defined by the CSCL).
Data quality indicator	a. CATZOC attribute of the M_QUAL object for bathymetric data. b. POSACC attribute of the M_ACCY object (if available) for non-bathymetric data.
Note: Due to the way quality is encoded in the ENC, both values (a and b) must be used.	
Sounding/vertical datum	SDAT and VDAT subfields of the DSPM field or the VERDAT attribute of the M_SDAT object and M_VDAT object when available. (VERDAT attributes of individual objects must not be used for the legend.)
Horizontal datum	HDAT subfield of the DSPM field.
Value of safety depth	Selected by Mariner. Default is 30 metres.
Value of safety contour	Selected by Mariner. Default is 30 metres.
Note: If the Mariner has selected a contour that is not available in the ENC and the ECDIS displays a default contour, both the contour selected and the contour displayed must be quoted.	
Magnetic variation	VALMAG, RYRMGV and VALACM of the MAGVAR object. Item must be displayed as; VALMAG RYRMGV (VALACM) e.g., 4°15W 1990 (8'E)
Date and number of latest update affecting chart cells currently in use.	ISDT and UPDN subfields of the DSID field of the last update cell update file (ER data set) applied.
Edition number and date of the ENC.	EDTN and UADT subfields of the DSID field of the last EN data issue of current ENC issue of the ENC set.

Chart projection	Projection used for the ECDIS display (e.g., oblique azimuthal). This must be appropriate to the scale and latitude of the data in use.

The list above is the minimum that must be available, but the complete list need not always be shown. Individual items may be picked by the Mariner for display for a period; examples are magnetic variation, data quality for depths (M_QUAL, CATZOC) etc.

10.6.3 Light Description Text Strings

Previous versions of the presentation library provided C-code that enabled the building of light description text strings to be displayed on the ECDIS. The C-code has now been removed from the presentation library and a textual description of how light descriptions must be constructed is provided. Control over how the light description is used in the display is still within the conditional symbology LIGHTS06. This section defines the syntax, layout and map of the S-57 attributes to the ECDIS text string.

To produce textual light descriptions in ECDIS, the ECDIS system must use an abbreviated form of the S-57 attributes of the Lights feature in a particular order. The number next to the attribute denotes the draw order in which the ECDIS must output the light description text string. Overall structure:

1 Category of Light (CATLIT)

2 Light Characteristic (LITCHR)

3 Signal Group (SIGGRP)

4 Colour (COLOUR)

5 Signal Period (SIGPER)

6 Height (HEIGHT)

7 Value of Nominal Range (VALNMR)

8 Status (STATUS)

The following tables define a map between the ENC attribute values and the required ECDIS textual output.

S-57 Attribute CATLIT - Category of Light

ENC Input		ECDIS Output
S-57 Attribute Code ID	S-57 Category of Light Attribute Value	Abbreviation
1	directional function	Dir
5	aero light	Aero

7	fog detector light	Fog Det Lt

S-57 Attribute - Status

ENC Input		ECDIS Output
S-57 Attribute Code ID	S-57 Status Attribute Value	Abbreviation
2	occasional	occas
7	Temporary	temp
8	Private	priv
11	extinguished	exting
17	un-watched	U

S-57 Attribute - Light Characteristic

ENC Input		ECDIS Output
S-57 Attribute Code ID	S-57 Light Characteristic Attribute Value	Abbreviation
1	Fixed	F
2	Flashing	Fl
3	long-flashing	LFl
4	quick-flashing	Q
5	very quick-flashing	VQ
6	ultra quick-flashing	UQ
7	Isophased	Iso
8	Occulting	Oc
9	interrupted quick-flashing	IQ
10	interrupted very quick-flashing	IVQ
11	interrupted ultra quick-flashing	IUQ
12	Morse	Mo
13	fixed/flashing	FFl
14	flash/long-flash	Fl+LFl
15	occulting/flashing	OcFl
16	fixed/long-flash	FLFl
17	occulting alternating	AlOc
18	long-flash alternating	AlLFl
19	flash alternating	AlFl
20	group alternating	Al
25	quick-flash plus long-flash	Q+LFl
26	very quick-flash plus long-flash	VQ+LFl
27	ultra quick-flash plus long-flash	UQ+LFl
28	Alternating	Al
29	fixed and alternating flashing	AlF Fl
Wrong	alternating occulting/flashing	AlOc Fl

Units of measure suffixes

S-57 Attribute	Description	Units of Measure
Signal Period	Seconds	s
Height	Metres	m
Value of Nominal Range	Miles	M

When the signal group value is set to or include "()" and/or "(1)" there is no requirement for this to be populated in the light description text. Only when the signal group value differs from the above mentioned values must the value be output on the ECDIS screen, this follows the paper chart convention Mariners are used to seeing.

The default presentation for each numeric value: signal period, height and value of nominal range is no decimals. If the value of the attribute has non-zero decimal part then the value is displayed to one decimal place.

Example: Given a light with the following attributes;

Feature	LIGHTS
Light Characteristic	Flashing
Signal Group	(1)
Colour	White
Signal Period	30 seconds
Height	7 metres
Value of Nominal Range	10 miles

The ECDIS must display the lights textual description as follows: **FL W 30s7m10M**

10.7 Displaying Manual and Automatic Updates and Added Chart Information

10.7.1 Manual Updates

Manual updates of ENC information must be displayed using the same symbology as ENC information and must be distinguished from ENC information as follows:

10.7.1.1 Added Feature

Point object: superimpose SY(CHCRIDnn)*
Line object: overwrite with line LC(CHCRIDnn)*
Area object: overwrite area boundary with line LC(CHCRIDnn) and superimpose SY(CHCRIDnn) on any centred symbol.

10.7.1.2 Deleted Feature

The object must remain on the display and must be marked as follows:

Point object: Superimpose SY(CHCRDELn)*
Line object: Overwrite with line LC(CHCRDELn)* (do not remove the original line)
Area object: Overwrite area boundary with line LC(CHCRDELn) and superimpose SY(CHCRDELn) on any centred symbol.

*SY(CHCRIDnn) means the current version of symbol CHCRID, i.e., CHCRID01 in 1997. CHCRID and CHCRDEL symbols have the category and viewing group of the object they are attached to, display priority «8», radar priority «O».

NOTE: The line symbols LC(CHCRIDnn) and LC(CHCRDELn) must not suppress the underlying line (see section 10.3.4.1).

10.7.1.3 Moved Feature

As for deleted feature, followed by added feature.

10.7.1.4 Modified Feature

a) If the only modification is an addition(e.g., an existing buoy has a retro-reflector added with no other change): superimpose SY(CHCRIDnn) or LC(CHCRIDnn)

b) If the only modification is a deletion of a part (e.g., an area has a «fishing prohibited» restriction removed), then this creates both a change and a deletion and both must be symbolized:

Point: superimpose SY(CHCRIDnn) and SY(CHCRDELn)
Line: overwrite with LC(CHCRIDnn) and LC(CHCRDELn)
Area: overwrite the boundary with LC(CHCRIDnn) and LC(CHCRDELn) and also superimpose SY(CHCRIDnn) and SY(CHCRDELn) on any centred symbol.

c) If the modification is an addition and a deletion then it is handled as in 10.7.1.4 b above.

A deleted feature must appear on the display only when its IMO category and viewing group are displayed.

S-52 Appendix 1 requires that a manually updated feature must be capable of the same performance in feature selection, response to cursor-picking, etc., as an ENC feature. In addition, it must provide updating information (identification and source of update, when and by whom entered, etc.) on cursor picking.

10.7.2 Identifying Automatic Chart Corrections On Mariners Demand

The ECDIS manufacturer must provide a means of identifying chart corrections to the SENC on demand by the Mariner.

The ECDIS manufacturer must provide a means of identifying chart corrections to the SENC on demand by the Mariner.

On mariners demand automatic chart corrections of ENC information must be highlighted as follows:

10.7.2.1 Added Feature

When the ENC ISO 8211 record update instruction (RUIN) is set to 1 = Insert

Point object: superimpose SY(CHRVID01)
Line object: overwrite with line LC(CHRVID01)
Area object: overwrite area boundary with line LC(CHRVID01) and superimpose SY(CHRVID01) on any centred symbol.

10.7.2.2 Deleted Feature

When the ENC ISO 8211 record update instruction (RUIN) is set to 2 = Delete

Point object: Superimpose SY(CHRVDEL1)
Line object: Overwrite with line LC(CHRVDEL1) (do not remove the original line)
Area object: Overwrite area boundary with line LC(CHRVDEL1) and superimpose SY(CHRVDEL1) on any centred symbol.

10.7.2.3 Moved Feature

As for deleted feature, followed by added feature.

10.7.2.4 Modified Feature

When the ENC ISO 8211 record update instruction (RUIN) is set to 3 = Modify

Point: superimpose SY(CHRVID01) and SY(CHRVDEL1)
Line: overwrite with LC(CHRVID01) and LC(CHRVDEL1)
Area: overwrite the boundary with LC(CHRVID01) and LC(CHRVDEL1) and also superimpose SY(CHRVID01) and SY(CHRVDEL1) on any centred symbol.

10.7.3 Non-HO (Non-ENC) Chart Information

Limited non-HO data added to existing HO ENC data to augment the chart information must be distinguished from the HO-ENC information as follows:

Point object: superimpose SY(CHCRIDnn)
Line object: overwrite with line LC(CHCRIDnn)
Area object: overwrite area boundary with line LC(CHCRIDnn) and superimpose SY(CHCRIDnn) on any centred symbol.

Non-HO data must be distinguished from manually updated chart information, which uses the same identifiers, by cursor picking.

See IHO S-52, section 2.3.1c, for information on how to symbolize other cases of non-HO data appearing on the ECDIS display.

Non-HO chart information may be updated by any systematic procedure. A record of updates must be maintained.

The Mariner must be able to remove all non-HO chart information if the need should arise.

10.8 Cursor Pick and Interface Panel Display

There are a number of rules that must be applied to all ECDIS cursor pick reports.

No	Cursor Pick Rules
1	Full S-57 Object and Attribute names must be displayed
2	Enumerate value names must be displayed
3	There must not be any padding of attribute values, e.g. a height of 10 metres must not be padded to 10.000000 metres as this could potentially confuse or mislead the Mariner.
4	Units of measure must be included after all attribute values which are weights or measures.
5	S-57 category “C” feature attributes must not be displayed unless requested by the user. Attributes in this subset provide administrative information about an object and the data describing it. In most cases it is of no practical use to the Mariner. This information is only relevant to S-57 data transferred between Hydrographic Offices. An exception to show the value of SORDAT if it is for the following objects: - WRECKS, OBSTRN, UWTROC, and SOUNDG with value QUASOU= 9 and geometry attribute QUAPOS=8 - DRGARE with QUASOU=11 - SWPARE - Any object class with attribute CONDTN=1or 3 or 5
6	Dates must be given in the form “Day Month Year” DD-MMM-YYYY. JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV,DEC
7	The pick report must only return information about the visible objects on the ECDIS display. If the viewing group is turned on all objects even no symbol objects without visible presentation within that viewing group are available via the cursor pick report

8	Cursor enquiry must extend to the spatial object, which carries accuracy attributes QUAPOS and POSACC. It must include collection objects which carry additional information for example the OBJNAM of traffic separation systems, navigation lines (NAVLNE, RECTRC, DWRTCL, etc.).

10.8.1 Pick Report Descriptions

A plain language explanation of each symbol is included in the Symbol Library and in the Presentation Library, section 17. This gives the Mariner quick and understandable information which is not always obvious from the object class and attribute information. The manufacturer must always provide explanations to the Mariner in response to a cursor pick on the symbol.

Attribute values provided in addition to the above explanation must be connected to their meaning, and the definitions must also be available.

10.8.2 Sorting

Effective cursor-pick sorting will be covered in the following deferred amendment. Only a limited number of initial considerations are given below,

10.8.3 User Defined Curser Pick Parameters

The Mariner must be able to configure the content displayed in the pick report.

10.8.4 Sorting by Significance

A general cursor enquiry must be sorted by the drawing priority of the object as defined in the look-up table for symbolizing. When the drawing priority of objects is equal the geometric primitive will be used to order the information, points followed by lines and finally areas.

10.8.5 Hover-over Function

OEMs may wish to include hover-over functions for Mariners to access important charted feature details without having to select a pick report. If this function is implemented within an ECDIS the Mariner must be able to configure the system function on and off.

The hover-over function must only be used on the following feature objects and for the symbols SY(INFORM01) and SY(CHDATD01):

Feature	**S-57 Acronym**
Lights	LIGHTS
Beacon, cardinal	BCNCAR
Beacon, isolated danger	BCNISD
Beacon, lateral	BCNLAT

Beacon, safe water	BCNSAW
Beacon, special purpose/general	BCNSPP
Buoy, cardinal	BOYCAR
Buoy, installation	BOYINB
Buoy, isolated danger	BOYISD
Buoy, lateral	BOYLAT
Buoy, safe water	BOYSAW
Buoy, special purpose/general	BOYSPP
Landmarks	LNDMRK

10.8.6 Unknown Attributes

When the ECDIS encounters an unknown attribute not present in the S-57 Attribute catalogue its value must be available via the ECDIS cursor pick. The existence of unknown attributes must not change the function of the look-up table matching see 10.3.3.2.

10.9 Tidal Stream Panels : S-57 feature TS_PAD

Tidal Stream Panel

When a tidal stream feature object (TS_PAD) is encoded within ENC, the data from the attribute tidal stream - panel values (TS_TSP) must be formatted for display in the ECDIS cursor pick report. The following section describes the template that must be used for displaying the values.

The S-57 attribute catalogue defines the TS_TSP attribute as a coded string. The strings constituent parts are broken down as follows;

1. **Tidal station identifier**
2. **Tidal station name**
3. **Reference Water level (High or Low Water)**
4. **Direction of Stream 13 values given in degrees**
5. **Rate of Stream 13 values given in knots**

Example from S-57 Attribute catalogue Edition 3.1
63230,Darwin,HW,124,2.2,128,2.1,125,2.9,116,2.8,110,2.0,095,0.6,020,0.2,320,1.9,315,2.1,300,2.8,268,2.6,200,2.4,165,2.5

The following tabular template must be used by ECDIS when displaying the TS_PAD object in the pick report, the fonts, colours and dimensions are all to be defined by the OEM;

Tidal Station:			
Tidal Station Identifier:			
	Hours	Direction of stream (degrees)	Rates at spring tide (knots)
Before	-6		
	-5		
	-4		
	-3		
	-2		
	-1		
	0		
After	+1		
	+2		
	+3		
	+4		
	+5		
	+6		

Populated TS_PAD cursor pick template using the values from the attribute TS_TSP;

Tidal Station: Darwin			
Tidal Station Identifier: 63230			
	Hours	Direction of stream (degrees)	Rates at spring tides (knots)
Before	-6	124	2.2
	-5	128	2.1
	-4	125	2.9
	-3	116	2.8
	-2	110	2.0
	-1	095	0.6
HW	0	020	0.2
After	+1	320	1.9
	+2	315	2.1
	+3	300	2.8
	+4	268	2.6
	+5	200	2.4
	+6	165	2.5

NOTE : The water level must not be hard coded into the TS_PAD template, this is incorrect as the water level in the TS_PAD values can also refer to 6 hours before/after low water.

11 Digital Presentation Library Format Description

This section contains a specification of the format which allows for initial transfer and automatic updating of line styles, fill patterns, point symbols, look-up table entries and colour definitions in the digital version of the Presentation Library. The transfer format is '.dai' format.

The initial transfer file contains a library identification, three colour tables, five look-up tables and all line, pattern, and point symbols; written in that order. The '.dai' file is written as modules, where the library identification is a single module, each of the colour tables is a single module, each line in the look-up table is a module unto itself and each symbol (line, pattern or point symbol) is a module unto itself. Modules are terminated with '****'.

Revision data sets will always include a library identification module. The remaining modules will only be included in the revision set as required, with the exception of the look-up table entries which will be written as a complete replacement set.

For each module and field it is specified whether it can repeat in the file or module. Comments that explain and give domains or constraints are included in "/* ... */".

11.1 Format of the Library Identification Module

The library identification module contains general information about the status of the transferred library data. It defines the version of the library as well as its purpose.

11.1.1 Library Identification Module

```
||                                  ||
||    Module does not repeat.       ||
||                                  ||
```

11.1.2 Library Identification (LBID)

```
||    Field does not repeat.        ||
||    Subfields do not repeat.      ||


L B I D  Module Identifier
-------
    /* Forms unique module identification
         within the exchange set. */

MODN     A(2)       /*    Module Name -
                    two alphabetic characters 'LI'
                         indicating module type.          */

RCID     I(5)       /*    Record Identifier -
         00000 < x < 32768; with MODN shall
               form unique identification within
```

```
                                    the exchange set.                   */
```

```
EXPP     A(3)       /*    Exchange Purpose -
         NEW   Denotes that the exchange
               set is a NEW library.
               REV   Denotes that the exchange
                     set is a REVision to an
                               existing library.          */

PTYP     A(1/15)    /*    Product Type – e.g.,'IHO'       */

ESID     A(1/15)    /*    Exchange Set Identification Number
- continuous serial number.                               */

EDTN     A(1/15)    /*    Edition Number –
continuous serial number.*/

CODT     A(8)       /*    Compilation Date of Exchange Set -
YYYYMMDD                   */

COTI     A(6)       /*    Compilation Time of Exchange Set -
HHMMSS                     */

VRDT     A(8)       /*    Library-Profile Versions Date –
                           YYYYMMDD                        */

PROF     A(2)       /*    Library Application Profile –
         PN  Presentation New Information
                           PR  Pres. Revision Information  */

OCDT     A(8)       /*    Date of Version of the applied
                           Object Catalogue - YYYYMMDD     */

COMT     A(1/15)    /*    Comment                         */
```

11.2 Format of the Look-Up Table Entry Module

Look-up table entries are transferred in this module. They have to be inserted in the respective look-up table by the recipient. The module allows for the transfer of a complete new edition of a look-up table as well as for the updating of a single entry within a look-up table. To send a new edition this module is repeated for each entry to a look-up table. To update a look-up table a new transmission of a previously transmitted entry (identified by the object class / attribute combination) replaces or deletes the old entry depending on the content of the 'STAT' field ('NIL' for a new edition, 'ADD' for insertion, 'MOD' for replacement, 'DEL' for deletion). Note that where more than one look-up table entry for a specific object class is transferred, look-up table entries must be grouped and all look-up table entries where the "Attribute Combination"-field is populated must be inserted to the look-up table right after the look-up table entry where the "Attribute Combination"-field is empty and which therefore contains the fail-safe presentation (see section 10.3, for further details).

11.2.1 Look-Up Table Entry Module

```
||                                   ||
||      Module does repeat.          ||
||                                   ||
```

11.2.2 Look-Up Table Entry Identifier-Field (LUPT)

```
||    Field does not repeat.          ||
||    Subfields do not repeat.        ||

L U P T  Look-Up Table Entry Identifier
-------
                    /*    Identifies a look-up table Entry
                          module.                          */

MODN     A(2)       /*    Module Identifier (Module Name):
         presently a constant string = 'LU';
         labels a module of 'look-up table'-
                    type.                                  */

RCID     I(5)       /*    Record Identifier:
         continuous numbering where
         x is 00000 < x < 32768;
         uniquely identifies an instruction-
                          modulewithin the data-transfer
                          -set.                            */

STAT     A(3)       /*    status of the module contents:
         'NIL' no change, used for new
                          editions and editions            */

OBCL     A(6)       /*    Name of the addressed object
                          Class                            */

FTYP     A(1)       /*    Addressed Object Type -
              'A' Area
              'L' Line
                             'P' Point                    */

DPRI     I(5)       /*    Display Priority                 */
RPRI     A(1)       /*    Radar Priority -
              'O' presentation on top radar
              'S' presentation suppressed
                             by radar                     */

TNAM     A(1/15)    /*    Name of the addressed Look-up
                          Table Set -

                          'PLAIN_BOUNDARIES' or 'SYMBOLIZED_
                          BOUNDARIES' (areas)
                          'SIMPLIFIED' or 'PAPER_CHART' (points)
                          and 'LINES' (lines)              */
```

11.2.3 Attribute Combination- Field (ATTC)

```
||      Field does repeat.          ||
||     Subfields do repeat.         ||


*A T T C  Attribute Combination
-------
```

```
                /*          Describes individual characteristics
                            of an object which lead to the
                            presentation described in the
                                 INST-field.
                            The attributes of the object catalogue
                            shall be used.                          */

        *ATTL   A(6)        /*    6 Character Attribute Code.       */

        ATTV    A(1/15)     /*    Attribute Value; Shall be a valid
                value for the domain specified
                            by the attribute label in ATTL.         */
```

11.2.4 Instruction-Field (INST)

```
        ||    Field does not repeat          ||
        ||    Subfield does not repeat.      ||


        *I N S T  Symbology Instruction
        -------
                /*    Describes the instruction entry to
                            The look-up table;                      */

        SINS    A(1/15)     /*    Symbology Instruction String      */
```

11.2.5 Display Category-Field (DISC)

```
        ||    Field does not repeat          ||
        ||    Subfield does not repeat.      ||

        *D I S C  Display Category
        -------
                /*    Defines membership within a display
                            category                                */

        DSCN    A(1/15)     /*    Name of the display category      */
```

11.2.6 Look-Up Comment-Field (LUCM)

```
        ||    Field does not repeat          ||
        ||    Subfield does not repeat.      ||

        *L U C M  Look-Up Comment
      -------
                /*          Describes look-up table entry           */
      LUED      A(1/15)     /*    free text to describe look-up
                            entry                                   */
```

11.3 Format of the Symbology Procedure Module

This section has been deleted because the module has not been developed.

11.4 Format of the Colour Table Module

The colour-definition (colour token, colour coordinate, usage) for colours is transferred by this module. The module allows for the transfer of a complete new edition of a colour table as well as for the updating of a single entry within a colour table. To send a new edition this module contains all entries of a colour table. To update a colour table a new transmission of a previously transmitted entry (identified by the colour token) replaces or deletes the old entry depending on the content of the 'STAT' field ('NIL' for a new edition, 'ADD' for insertion, 'MOD' for replacement, 'DEL' for deletion).

11.4.1 Colour Table Module

```
||                                    ||
||     Module does repeat.            ||
||                                    ||
```

11.4.2 Colour Table Identifier-Field (COLS)

```
||    Field does not repeat.          ||
||    Subfields do not repeat.        ||


C O L S  Colour Table Identifier
-------
         /*         Identifies a colour-table.              */

MODN     A(2)       /*    Module Name:
                    constant string ='CS';
         marks a module of the
                    'Colour Scheme'-type                    */

RCID     I(5)       /*    Record Identifier :
         continuous numbering where
         x is 00000 < x < 32768;
         uniquely identifies a
         Colour-Table-Module within
                    the transfer-data-set.                  */

STAT     A(3)       /*    status of the module contents:
         'NIL' no change, used for new editions
                          and editions                      */

CTUS     A(1/15)    /*    Name of the addressed Colour Table;
         valid keywords are: 'DAY_BRIGHT';
         'DAY_WHITEBACK'; 'DAY_BLACKBACK';
         'DUSK'; 'NIGHT'.                        */
```

11.4.2 Colour Definition CIE-Field (CCIE

```
||      Field does repeat.            ||
||    Subfields do not repeat.        ||

*C C I E  Colour Definition CIE
```

```
-------
         /*         Describes CIE-System's colour-
                         definition                          */

CTOK     A(5)       /*    COLOUR (Colour-Token)             */

CHRX     R(1/15)    /*    x-Coordinate (CIE-System)         */

CHRY     R(1/15)    /*    y-Coordinate (CIE-System          */

CLUM     R(1/15)    /*    Luminance  (CIE-System)           */

CUSE     A(1/15)    /*    Use of colour (free text)         */
```

11.5 Format of the Pattern Module

Definitions for fill patterns are transferred by this module which may contain a raster image (bit-map) or a vector definition. The maximum size of the raster image is 122 x 122 pixels. The maximum size of the vector space is 32767 by 32767 units. See section 8.4.5 for usage of patterns.

The module allows for the transfer of a complete new edition of fill patterns as well as for the updating of a single fill pattern. To update a fill pattern a new transmission of a previously transmitted fill pattern (identified by the pattern name) replaces or deletes the old version of a fill pattern depending on the content of the 'STAT' field ('NIL' for a new edition, 'ADD' for insertion, 'MOD' for replacement, 'DEL' for deletion).

11.5.1 Pattern Module

```
||                                   ||
||      Module does repeat.          ||
||                                   ||
```

11.5.2 Pattern Identifier-Field (PATT)

```
||    Field does not repeat.         ||
||    Subfields do not repeat.       ||


P A T T  Pattern Identifier
-------
         /*    Identifies a pattern-module.          */

MODN     A(2)       /*    Module Identifier (Module Name):
         presently a constant string = 'PT';
         labels a module of the
                    'pattern'-type.                        */

RCID     I(5)       /*    Record Identifier:
         continuous numbering where
         x is 00000 < x < 32768;
                         uniquely identifies a pattern-module
                         within the data-transfer-set.
                         */
```

```
STAT     A(3)       /*    status of the module contents:
                           'NIL' no change, used for new editions
                           and edition                  */
```

11.5.3 Pattern Definition-Field (PATD)

```
||    Field does not repeat.        ||
||    Subfields do not repeat.      ||

P A T D  Pattern Definition
-------
               /*    defines several pattern-
                           parameters.                  */

PANM     A(8)       /*    name of the fill pattern;    */


PADF     A(1)       /*    type of pattern definition:
         V  Vector definition
                    R  Raster definition                */

PATP     A(3)       /*    type of the fill pattern:
         STG  staggered pattern
                    LIN  linear  pattern                */

PASP     A(3)       /*    pattern-symbol spacing:
         CON  constant space
                    SCL  scale dependent spacing        */

PAMI     I(5)       /*    minimum distance (units of 0.01 mm)
         between pattern symbols covers
         (bounding box + pivot point);
                    where 0 <= PAMI <= 32767            */

PAMA     I(5)       /*    maximum distance (units of 0.01 mm)
                           between        pattern        symbols
                           covers(bounding box + pivot point);
         where 0 <= PAMA <= 32767; PAMA is
                    meaningless if PASP = 'CON'         */

PACL     I(5)       /*    pivot-point's column number;
         PACL is counted from the top,
                           left corner of the vector/raster space
                           to  the  right;-9999(left)<=  PACL  <=
                           32767(right)                 */

PARW     I(5)       /*    pivot-point's row number;
         PARW is counted from the top,
                           left corner of the vector/raster
                           space to the bottom;
                    -9999(top)<=PARW <=32767(bottom)*/

PAHL     I(5)       /*    width of bounding box;
         where 1<= PAHL <=122 for raster and
                    where 1<= PAHL <=32767 for vector
                    Note:doesnotincludevectorline
```

```
                              Width                                 */

        PAVL     I(5)         /*   height of bounding box;
                 where 1<= PAVL <=122 for raster and
                              where 1<= PAGL <=32767 for vector
                              Note: does not include vector line
                              width                                 */
      PBXC       I(5)         /*   bounding box upper left column number;
                 where 0<= PBXC <=122 for raster and
                              where 0<= PBXC <=32767 for vector     */

        PBXR     I(5)         /*   bounding box upper left row number;
                 where 0<= PBXR <=122 for raster and
                              where 0<= PBXR <=32767 for vector     */
```

11.5.4 'Pattern Exposition'-Field (PXPO)

```
       ||      Field does repeat.          ||
       ||    Subfield does not repeat.     ||

       P X P O  Pattern Exposition Field
       -------
                    /*   describes meaning & use of symbology
                         elements                                   */

       EXPT     A(1/15)     /*   free text for symbology
                            explanation                             */
```

11.5.5 'Pattern Colour Reference'- Field (PCRF)

```
        ||     Field does not repeat.       ||
        ||     Subfields do repeat.         ||

       P C R F  Pattern Colour Reference
       -------
                /*   Contains the colour reference for the
                         bitmap or vector field.                    */

       *CIDX    A(1)        /*   Letter (ASCII >= 64) used as colour
                index within PBTM.BITR field or
                            within the PBTM.VECT field.             */

       CTOK     A(5)        /*   colour token which is identified
                            by the letter in CIDX.                  */
```

11.5.6 'Pattern Bitmap'- Field (PBTM)

```
        ||     Field does repeat.                ||
        ||   Number of repetitions shall be      ||
        ||  identical to content of PAVL-field   ||
        ||    Subfield does not repeat.          ||

       *P B T M  Pattern Bitmap
       -------
                /*   Contains one row of a raster image;
                                 Each pixel is represented by a letter
                                 (ASCII>=64); The letter represents
```

```
                              a colour token defined within the
                              PCRF.CTOKsubfield. The letter
                              '@'represents a 100% transparent
                              pixel(TRNSP). Note: PBTM andPVCT
                              are mutual exclusive.            */

        BITR     A(1/15)    /*   Raster Bit-map Row -
                 maximal length 122 characters;
                 The length shall be identical to
                           content of PAHL-field.              */
```

11.5.7 'Pattern Vector'- Field (PVCT)

```
        ||       Field does repeat.        ||
        ||     Subfield does not repeat    ||

        *P V C T  Pattern Vector
        -------
                 /*   Contains a vector image definition;
                 Colours are identified by a letter
                 (ASCII>=64); The letter represents
                              a colour token defined within
                              the PCRF.CTOKsubfield. The letter
                              '@'identifies a fully transparent
                              colour. Note: PVCT and PBTM are
                              mutual exclusive.                */

        VECD     A(1/15)    /*   String of vector commands;    */
```

.

11.5.8 Example for a Vector Image Pattern Definition

The example illustrates a vector definition for a fill pattern (pattern name 'SAMPLE01') which is sent as a replacement of a previous one. The pattern shows a rectangle drawn in chart grey, dominant (CHGRD, identified by the letter A) with a pen width of 0.6 mm (2 x 0.3mm). It is a linear pattern (LIN). The symbol spacing is constant (CON). The distance between the symbols is 5 mm (500 x 0.01 mm). The pivot point of the pattern symbol is situated in row 500, column 500 of the coordinate space. The pattern has a size of 10mm by 10mm (1000 x 0.01mm). The upper left corner of the bounding box is located at position 1,1.

```
PATT  10PT00001MOD
PATD  55SAMPLE01VLINCON005000000000500005000100001000000010000 1
PXPO  32This is a sample vector pattern
PCRF  6ACHGRD
PVCT  15SPA;SW2;PU1,1;
PVCT  31PD1000,1,1000,1000,1,1000,1,1;
```

See section 8 for further explanation of the vector symbol description language.

11.6 Format of the Symbol Module

Definitions for symbols are transferred by this module which contains either a raster image (bit-map) or a vector definition of the symbol. The maximum size of the raster image is 64 x 64 pixels. The maximum extent of the vector space is 32767 by 32767 units.

The module allows for the transfer of a complete new edition of point symbols as well as for the updating of a single symbol. To update a symbol a new transmission of a previously transmitted symbol (identified by the symbol name) replaces or deletes the old version of a symbol depending on the content of the 'STAT' field ('NIL' for a new edition, 'ADD' for insertion, 'MOD' for replacement, 'DEL' for deletion).

11.6.1 Symbol Module

```
||                                        ||
||     Module does repeat.                ||
||                                        ||
```

11.6.2 Symbol Identifier-Field (SYMB)

```
||    Field does not repeat.              ||
||    Subfields do not repeat.            ||


S Y M B  Symbol Identifier
-------
         /*         identifies a symbol-module.            */

MODN     A(2)       /*   Module Identifier (Module Name):
         presently a constant string ='SY';
         labels a module of the
                    'Symbol'-type.                         */

RCID     I(5)       /*   Record Identifier:
         continuous numbering where
         x is 00000 < x < 32768;
         uniquely identifies a symbol-
         module within the
                    data-transfer-set.                     */

STAT     A(3)       /*   status of the module contents:
         'NIL' no change, used for new
                          editions and editions.          */
```

11.6.3 Symbol Definition-Field (SYMD)

```
||    Field does not repeat.              ||
||    Subfields do not repeat.            ||

S Y M D  Symbol Definition
-------
         /*         Defines several symbol-parameters.*/

SYNM     A(8)       /*   name of the symbol;              */
```

```
SYDF     A(1)       /*   type of symbol definition:
         V  Vector definition
                    R  Raster definition                    */

SYCL     I(5)       /*   pivot-point's column-number;
         SYCL is counted from the top,
         left corner of the vector/raster
         space to the right;
                    -9999(left)<= SYCL <=32767(right)*/

SYRW     I(5)       /*   pivot-point's row-number;
         PROW is counted from the top, left
         corner of the vector/raster space
         to the bottom ;
                    -9999(top)<= SYRW <= 32767(bottom)     */

SYHL     I(5)       /*   width of bounding box;
         where 1<= PAHL <=128 for raster and
                    where 1<= PAHL <=32767 for vector
                    Note: does not include vector line
                         width                              */

SYVL     I(5)       /*   height of bounding box;
         where 1<= PAVL <=128 for raster and
                    where 1<= PAGL <=32767 for vector
                    Note: does not include vector line
                         width                              */

SBXC     I(5)       /*   bounding box upper left column number;
         where 1<= SBXC <=128 for raster and
                    where 1<= SBXC <=32767 for vector      */

SBXR     I(5)       /*   bounding box upper left row number;
         where 1<= SBXR <=128 for raster and
                    where 1<= SBXR <=32767 for vector      */
```

11.6.4 Symbol Exposition- Field (SXPO)

The exposition field for the symbol module is identical to the exposition field for the pattern module (see section 11.5.4).

11.6.5 Symbol Colour Reference- Field (SCRF)

The colour reference field for the symbol module is identical to the colour reference field for the pattern module (see section 11.5.5).

11.6.6 Symbol Bitmap- Field (SBTM)

The bitmap field for the symbol module is identical to the bitmap field for the pattern module (see section 11.5.6).

11.6.7 Symbol Vector- Field (SVCT)

The vector field for the symbol module is identical to the vector field for the pattern module (see section 11.5.7).

11.6.8 Example for a Vector Image Symbol Module

The example shows the vector definition for the symbol 'SAMPLE33'. The pivot point of the symbol is situated in row 400, column 400 of the coordinate space. The symbol has a size of 8mm by 8mm (800 x 0.01 mm). The upper left corner of the bounding box is located at position 1,1.

```
SYMB  10SY00001NIL
SYMD  39SAMPLE33V00400004000080000800000100001
SCRF  6ACHBLK
SVCT  15SPA;SW2;PU1,1;↓
SVCT  28PD1000,1,800,800,1,800,1,1;↓
```

See section 8 for further explanation of the vector symbol description language.

11.7 Format of the Complex Linestyle Module

Definitions for complex linestyles are transferred by this module which contains a vector definition.

The module allows for the transfer of a complete new edition of linestyles as well as for the updating of a single linestyle. To update a linestyle a new transmission of a previously transmitted linestyle (identified by the linestyle name) replaces or deletes the old version of a linestyle depending on the content of the 'STAT' field ('NIL' for a new edition, 'ADD' for insertion, 'MOD' for replacement, 'DEL' for deletion).

11.7.1 Linestyle Module

```
||                                   ||
||     Module does repeat.           ||
||                                   ||
```

11.7.2 Linestyle Identifier- Field (LNST

```
||    Field does not repeat.         ||
||    Subfields do not repeat.       ||


L N S T  Linestyle Identifier
-------
                     /*    identifies a linestyle-module.    */

MODN     A(2)        /*    Module Identifier (Module Name):
         presently a constant string ='LS';
                     labels a module of 'Linestyle'
                          -type.                              */

RCID     I(5)        /*    Record Identifier:
                     continuous numbering where
                     x is 00000 < x < 32768;
```

```
                        uniquely identifies a linestyle-module
                             within the data-transfer-set.     */

STAT     A(3)       /*   status of the module contents:
         'NIL' no change, used for new
                             editions and editions             */
```

11.7.3 Linestyle Definition- Field (LIND)

```
||    Field does not repeat.         ||
||    Subfields do not repeat.       ||

L I N D  Linestyle Definition
-------
         /*         Defines several linestyle-
                             parameters.                       */

LINM     A(8)       /*   name of the linestyle;              */

LICL     I(5)       /*   pivot-point's column-number;
         LICL is counted from the top,
         left corner of the vector space
         to the right;
                        -9999(left)<= LICL <= 32767(right)     */

LIRW     I(5)       /*   pivot-point's row-number;
         LIRW is counted from the top
         left corner of the vector space
         to the bottom;
                        -9999(top)<= LIRW <= 32767(bottom)*/

LIHL     I(5)       /*   width of bounding box;
                        where 1<= LIHL <=32767;
                        Note: does not include vector line
                             width                             */

LIVL     I(5)       /*   height of bounding box;
                        where 1<= LIVL <=32767;
                        Note: does not include vector line
                             width                             */

LBXC     I(5)       /*   bounding box upper left column number;
                        where 0<= LBXC <=32767;                */

LBXR     I(5)       /*   bounding box upper left row number;
         where 0<= LBXR <=32767;                               */
```

11.7.4 Linestyle Exposition- Field (LXPO)

The exposition field for the linestyle module is identical to the exposition field for the pattern module (see section 11.5.4).

11.7.5 Linestyle Colour Reference- Field (LCRF)

The colour reference field for the linestyle module is identical to the colour reference field for the pattern module (see section 11.5.5).

11.7.6 Linestyle Vector- Field (LVCT)

The vector field for the linestyle module is identical to the vector field for the pattern module (see section 11.5.7).

11.7.7 Example for a Linestyle Module

The example shows the vector definition for the linestyle 'CBLLNE01'. The centre line of the linestyle is situated in column 750, row 750 of the coordinate space. The linestyle shows a curved line, width 0.3mm (1 x 0.3 mm).

```
LNST  10LS00000NIL
LIND  38CBLLNE01007500075000200001000075000700
LCRF  6ICHMGD
LVCT  57SPI;PU850,750;SW1;AA900,750,180;PU850,750;AA800,750,180;
```

See section 8 for further explanation of the vector symbol description language.

12 Look-Up Table Listings

The Presentation Library provides five look-up tables:

Lookup Table Name	S-52, Annex A, Appendix
Area symbols with plain boundaries	Appendix B
Area symbols with symbolized boundaries	Appendix C
Line symbols	Appendix D
Paper chart point symbols	Appendix E
Simplified point symbols	Appendix F

Some of the look-up table entries describe the presentation of Mariners' navigational objects. Please see Part II of the PresLib for further details and definitions of Mariners' navigational object classes.

The ECDIS must provide the mariner with the ability to select between "paper chart" and "simplified" point symbols and also between "plain boundaries" and "symbolized boundaries" area symbols.

13 Conditional Symbology Procedure (CSP) Diagrams

13.1 Introduction

The CSP diagrams in edition 3.4 of the Presentation Library were provided in Nassi-Shneiderman format. This style of presenting complex data flows has been cited as a potential cause of ECDIS related display issues, therefore the decision has been taken to transform the diagrams into Unified Modelling Language (UML) behavioural activity diagrams.

13.1.1 General

The following pages present UML activity diagrams and narrative descriptions explaining all conditional symbology procedures which have been developed to date.

Some of the diagrams describe the presentation of Mariners' navigational objects. See Part II of the Presentation Library for further details and definitions of the Mariners' navigational object classes.

13.1.2 UML Constructs

13.1.3 Standards terms and definitions

The following terms and their definitions are used in the UML CSPs.

Comparison and Logical Operators

Operators	Notation	Definition
Equal	==	Operator results true if both operands represent the same value
Not equal	!=	Operator results true if both operands do not represent the same value
Less than	<	Operator results true if the left value is less than the right value
Less than or equal to	<=	Operator results true if the left value is less than or equal to the right value
Greater than	>	Operator results true if the left value is greater than the right value
Greater than or equal to	>=	Operator results true if the left value is greater than or equal to the right value
AND	&&	A Boolean operator that gives the value true if and only if both operands are true and otherwise has a value of false.
OR	||	A Boolean operator that gives the value true if at least one operand has a value of true, and otherwise has a value of false.
NOT	!	A Boolean operator with one operand that returns the value true if the operand has the value false and vice versa.

Feature Object Attribute Values

Feature Object Attribute Values	Notation	Definition
Present	Present	An attribute is present either with or without a value
Null	Null	An attribute is present but the value has not been populated (the HO wants to indicate that the value is unknown)
Has Value	Has Value	An attribute is present and has a value

Statements

Statement	Definition
Condition	A conditional statement which evaluates an logical expression and depending on the result executes either the statements in the THAN branch or the statements in the ELSE branch.
Loop	Repeats a statement until an end condition indicates the end of the loop.

13.1.4 CSP arrangement

Each of the following CSP contains;

Title	CSP title used in S-52 lookup tables
Applies to	Lists the S-57 feature objects which the procedure applies to
Spatial Object(s)	Defines the geometric primitives: Point, line and area
Attribute(s) used	Lists all the S-57 feature attributes used in the procedure (and any sub-procedures)
ECDIS User Parameter(s)	Settings that are generated by the end user.
Local Variables	Defines any local variables used within the procedure together with their initial values – also, whether they're required for sub-procedures.
Return Values	Overview of the results returned by the CSP
Remarks	General guide to the procedure saying how it works and what it does

13.1.5 List of Conditional Symbology Procedures

13.2.1	Depth area colour fill and dredged area pattern fill (S-57)	DEPARE03
13.2.2	Depth contours, including safety contour (S-57)	DEPCNT03
13.2.3	Depth value (S-57)	DEPVAL02
13.2.4	Light flares, light sectors & light coverage (S-57)	LIGHTS06
10.6.3	Light description text string (S-57)	LITDSN02
13.2.5	Obstructions and rocks (S-57)	OBSTRN07
13.2.6	Quality (accuracy) of position (S-57)	QUAPOS01
13.2.7	Quality of position of line objects (S-57)	QUALIN01
13.2.8	Quality of position of point and area objects (S-57)	QUAPNT02
13.2.9	Restricted areas - object class RESARE (S-57)	RESARE04
13.2.10	Entry procedure for restrictions (S-57)	RESTRN01
13.2.11	Restrictions – attribute RESTRN (S-57)	RESCSP02
13.2.12	Contour labels, including safety contour (S-57)	SAFCON01
13.2.13	Shoreline constructions, including accuracy of position.	SLCONS04
13.2.14	Colour fill for depth areas (S-57)	SEABED01
13.2.15	Symbolizing soundings, including safety depth (S-57)	SNDFRM04
13.2.16	Entry procedure for symbolizing soundings (S-57)	SOUNDG03
13.2.17	Symbolizing encoded objects specified by IMO	SYMINS02
13.2.18	Topmarks (S-57)	TOPMAR01
13.2.19	Isolated dangers in general that endanger own ship (S-57)	UDWHAZ05
13.2.20	Wrecks (S-57)	WRECKS05

13.1.6 Mariners' selections

The following global parameters carrying Mariners' selections are used by the procedures:

SAFETY_DEPTH	- selected safety depth (meters) [IMO PS [2]]
SHALLOW_CONTOUR	- selected shallow water contour (meters) (optional)
SAFETY_CONTOUR	- selected safety contour (meters) [IMO PS [2]]
DEEP_CONTOUR	- selected deep water contour (meters) (optional)
TWO_SHADES	- flag indicating selection of two depth shades (on/off)
SHALLOW_PATTERN	- flag indicating selection of shallow water highlight (on/off) (optional)
SHIPS_OUTLINE	- flag indicating selection of ship's scale symbol (on/off) [IMO PS [2]]
DISTANCE_TAGS	- selected spacing of "distance to run" tags at a route (nm)
TIME_TAGS	- selected spacing of time tags at the pasttrack (min)
FULL_SECTORS	- show full length light sector lines

13.1.7 Shared sub-procedures

Some basic procedures are used in more than one application. For example, SNDFRMnn is called by soundings, wrecks, rocks and obstructions to compose depth values into soundings.

Such shared sub-procedures can only be accessed through a calling procedure; they cannot be called directly from the look-up table. When necessary, an entry procedure is set up solely to give this access; e.g., RESTRNnn is used to give access to shared procedure RESCSPnn.

The following table explains these relationships (the suffix 'nn' refers to the current edition of the CSP):

S-57 Object (Geometry)	CSP name	Sub-Procedure name	Notes
DEPARE(a)	**DEPAREnn**	***RESCSPnn***	*sub-procedure also called by* **RESTRNnn**
		SEABEDnn	
DRGARE(a)		***SAFCONnn***	
DEPARE(l)	**DEPCNTnn**	***SAFCONnn***	
DEPCNT(l)			
LIGHTS(p)	**LIGHTSnn**	***LITDSNnn***	
OBSTRN(pla)	**OBSTRNnn**	***DEPVALnn***	*sub-procedure also called by* **WRECKSnn**
		QUAPNTnn	*sub-procedure also called by* **QUAPOSnn** *&* **WRECKSn**
UWTROC(p)		***SNDFRMnn***	*sub-procedure also called by* **SOUNDGnn** *&* **WRECKSnn**
		UDWHAZnn	*sub-procedure also called by* **WRECKSnn**
LNDARE(pl)	**QUAPOSnn**	***QUAPNTnn***	*sub-procedure also called by* **OBSTRNnn** *&* **WRECKSnn**
COALNE(l)		***QUALINnn***	
RESARE(a)	**RESAREnn**		*this procedure includes the effect of* RESTRN
ACHARE(a)	**RESTRNnn**	***RESCSPnn***	*sub-procedure also called by* **DEPAREnn**
CBLARE(a)			

DMPGRD(a)			
DWRTPT(a)			
FAIRWY(a)			
ICNARE(a)			
ISTZNE(a)			
MARCUL(a)			
MIPARE(a)			
OSPARE(a)			
PIPARE(a)			
PRCARE(a)			
SPLARE(a)			
SUBTLN(a)			
TESARE(a)			
TSSCRS(a)			
TSSLPT(a)			
TSSRON(a)			
SOUNDG(p)	**SOUNDGnn**	***SNDFRMnn***	*sub-procedure also called by* **OBSTRNnn** *&* **WRECKSnn**
WRECKS(pa)	**WRECKSnn**	***DEPVALnn***	*sub-procedure also called by* **OBSTRNnn**
		QUAPNTnn	*sub-procedure also called by* **QUAPOSnn** *&* **OBSTRNnn**
		SNDFRMnn	*sub-procedure also called by* **OBSTRNnn** *&* **SOUNDGnn**
		UDWHAZnn	*sub-procedure also called by* **OBSTRNnn**

13.2.1 Conditional Symbology Procedure DEPARE03

Applies to: S-57 Object Class "depth area" (DEPARE)
S-57 Object Class "dredged area" (DRGARE)

Spatial Object(s): Area only.

Relation(s) used: Adjacency of DEPARE/DRGARE objects with group 1 objects.

Attribute(s) used: "depth range value 1" (DRVAL1); "depth range value 2" (DRVAL2)

Defaults: Display Priority given by look-up table
OVERRADAR priority given by look-up table
Display Category given by look-up table
Viewing Group given by look-up table

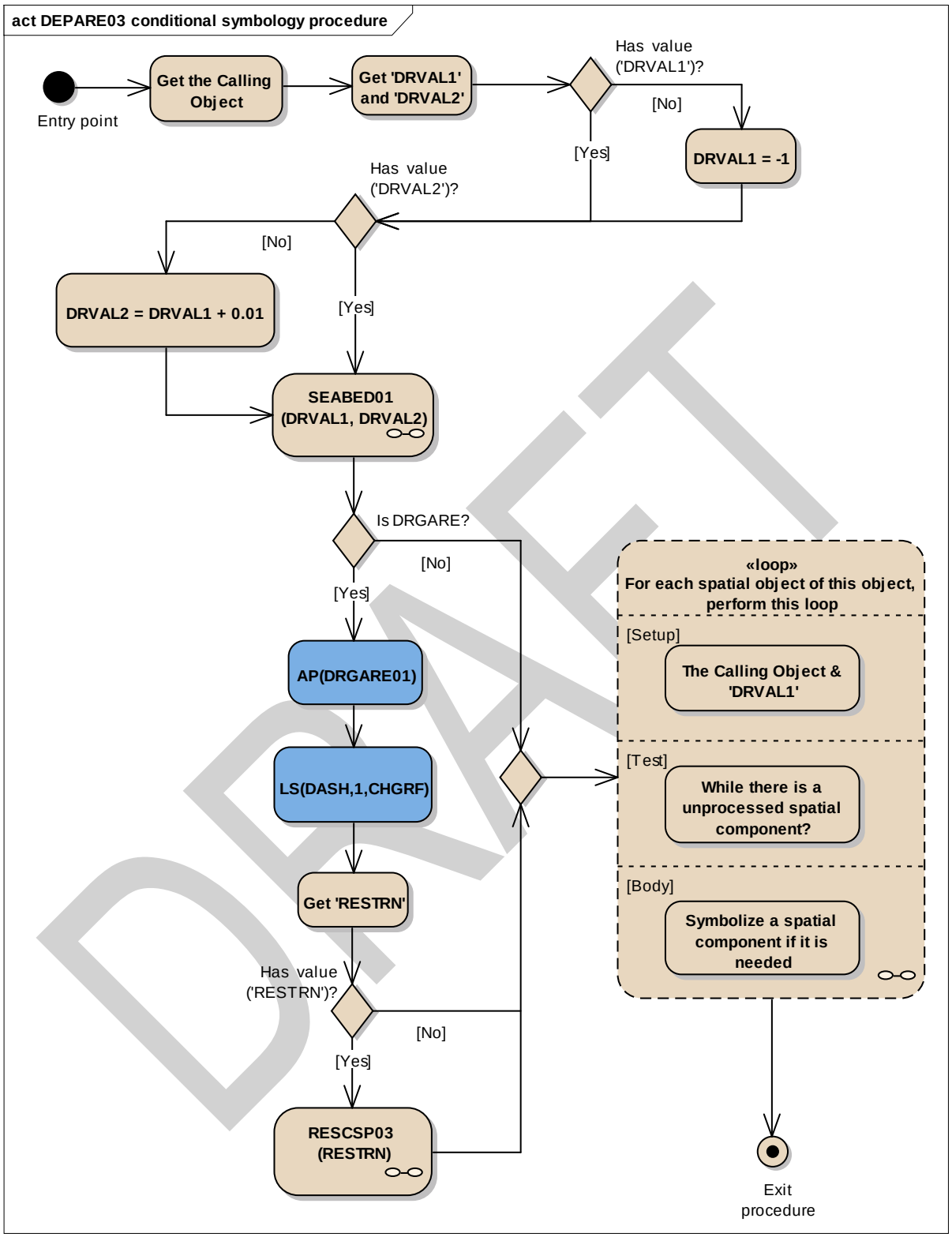
Required ECDIS SAFETY_CONTOUR. The manufacturer is responsible for setting the SAFETY_CONTOUR to startup value 30 metres. This value should stay in operation until the mariner decides to select another safety contour.

Remarks: An object of the class "depth area" is coloured and covered with fill patterns according to the mariners selections of shallow contour, safety contour and deep contour. This requires a decision making process provided by the sub-procedure "SEABED01" which is called by this symbology procedure. Objects of the class "dredged area" are handled by this routine as well to ensure a consistent symbolization of all areas that represent the surface of the seabed.

The safety contour will be constructed using the edges of the DEPARE and DRGARE objects. The safety contour may be labelled at the request of the mariner using sub-procedure “SAFCON01”.

Based on the safety contour value entered by the mariner (see IMO PS [2]), the edges that make up the safety contour must be shown under all circumstances. But, while the mariner is free to enter any safety contour depth value that he thinks is suitable for the safety of his ship, the SENC only contains a limited choice of depth contours. This symbology procedure examines each edge of the DEPARE/DRGARE object to see if it falls between safe and unsafe water. If it does, that edge will represent the safety contour selected, or the next deeper contour if the selected contour is not available. It is highlighted as the safety contour and put in DISPLAYBASE. Note that this procedure will also detect the need for a safety contour at the edge of non-navigable rivers, canals or docks which must have a LNDARE or UNSARE under them, (UOC 4.6.6.3, 4.6.6.5, 4.7.6, 4.7.8 and 4.8.1 remarks 2 etc.), as well as at another DEPARE/DRGARE edge.
The procedure also checks whether the edge has a ‘QUAPOS’ value indicating unreliable positioning, and if so symbolizes it with a double dashed line.

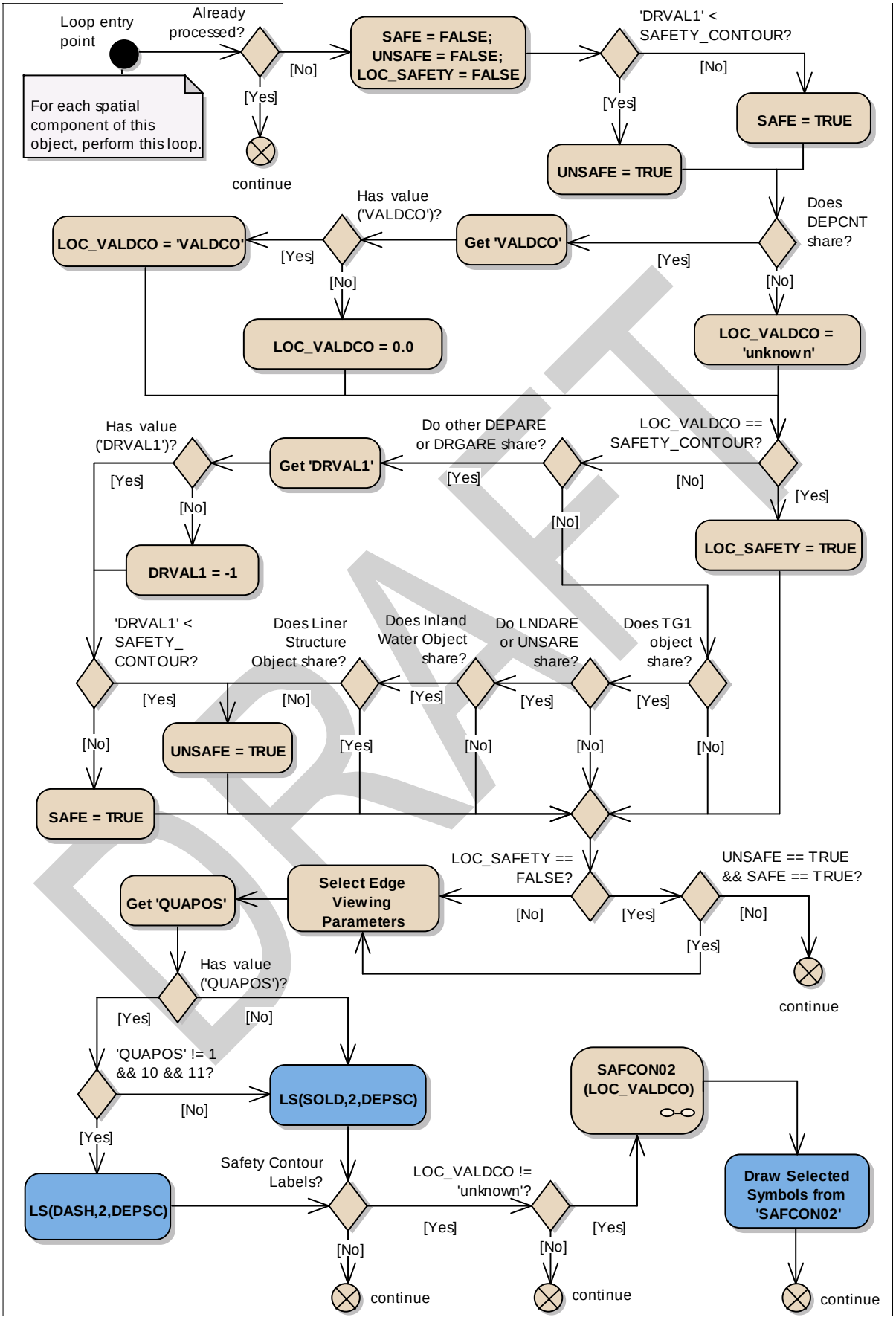
Figure 1 DEPARE03 conditional symbology procedure



Entry point	Entry to the symbology procedure.
Get the Calling Object	Get the object which is calling this procedure. DEPARE or DRGARE Areas
Get 'DRVAL1' and 'DRVAL2'	Get the value of the attributes: 'Depth range value 1' (DRVAL1) 'Depth range value 2' (DRVAL2)

	and assign local variables 'DRVAL1' and 'DRVAL2' accordingly.
Has value ('DRVAL1')?	Is the value of the attribute 'DRVAL1' given?
DRVAL1 = -1	Assign local variable 'DRVAL1' =-1 m. This is above low water line as fail safe to ensure the default colour is 'DEPIT' (intertidal area)
Has value ('DRVAL2')?	Is the value of the attribute 'DRVAL2' given?
SEABED01 (DRVAL1, DRVAL2)	Perform the symbology sub-procedure to symbolize this area object , see “13.2.14 Conditional Symbology Procedure SEABED01
DRVAL1	- input parameter - value of the local variable pass from the main procedure
DRVAL2	- input parameter - value of the local variable pass from the main procedure
DRVAL2 = DRVAL1 + 0.01	Assign local variable DRVAL2 = DRVAL1 + 0.01 m.
Is DRGARE?	Is the calling object of the class DRGARE?
AP(DRGARE01)	Draw the area pattern 'DRGARE01' from the symbol library and show it on top of the area's colour fill.
LS(DASH,1,CHGRF)	Symbolize the boundary with a dashed line, 1 unit wide colour 'CHGRF'
Get 'RESTRN'	Get the value of the attribute 'Restriction' (RESTRN).
Has value ('RESTRN')?	Is the value of the attribute 'RESTRN' given?
RESCSP02 (RESTRN)	Perform the symbology sub-procedure to complete the symbolization of 'DRGARE', see '13.2.11 Conditional Symbology Procedure RESCSP02'.
RESTRN value	- input value
Loop for each spatial object of this object, perform this loop	DEPARE03 CONTINUATION A and B **Setup** - the Calling Object and 'DRVAL1' value **Test** - while there is a unprocessed spatial component. **Body** - to symbolize a spatial component if it is needed.
Exit procedure	Symbolization is finished

Figure 2 DEPARE03 Continuations A and B



Loop entry point	For each spatial component of this object, perform this loop.
Already processed?	In order to make this algorithm efficient, the manufacturer should keep track of which spatial objects have already been processed to eliminate the need for testing lines more than once.
continue	Go to the next spatial component
SAFE = FALSE; **UNSAFE = FALSE;** **LOC_SAFETY = FALSE**	set local SAFE to the default (FALSE) set local UNSAFE to the default (FALSE) set local LOC_SAFETY to the default (FALSE)
'DRVAL1' < SAFETY_CONTOUR?	Is the attribute 'DRVAL1' value of the calling object is less SAFETY_CONTOUR?
UNSAFE = TRUE	Set the local variable 'UNSAFE' as TRUE.
SAFE = TRUE	Set the local variable 'SAFE' as TRUE.
Does DEPCNT share?	Is the spatial component shared by a 'DEPCNT' (Depth contour) object?
Get 'VALDCO'	Get the value of the attribute "Value of depth contour" (VALDCO) from the object DEPCNT coincided with the spatial component.
Has value ('VALDCO')?	Is the value of the attribute 'VALDCO' given?
LOC_VALDCO = 'VALDCO'	Set the local variable LOC_VALDCO equal to 'VALDCO' value.
LOC_VALDCO = 0.0	Set the local variable LOC_VALDCO equal to 0.0 m.
LOC_VALDCO = 'unknown'	Set the local variable LOC_VALDCO equal to 'unknown' value
LOC_VALDCO == SAFETY_CONTOUR?	Is LOC_VALDCO equal to the value of the safety contour?
LOC_SAFETY = TRUE	We are certain the edge belongs to the safety contour. Set local variable 'LOC_SAFETY' to TRUE
Do other DEPARE or DRGARE share?	Is the spatial object shared by other DEPARE (DRGARE) object?
Get 'DRVAL1'	Get the value of the attribute "Depth range value 1" (DRVAL1) from the object DEPARE or DRGARE sharing the checked spatial object.
Has value ('DRVAL1')?	Is the value of the attribute 'DRVAL1' given in the object DEPARE(DRGARE) coincided with the spatial component?
DRVAL1 = -1	Set the local variable DRVAL1 as -1.
'DRVAL1' < SAFETY_ CONTOUR?	Is the value DRVAL1 less the value of the safety contour?
UNSAFE = TRUE	Set the local variable 'UNSAFE' as TRUE.
SAFE = TRUE	Set the local variable 'SAFE' as TRUE.
Does TG1 object share?	Is the spatial object shared by another Group1 object?
Do LNDARE or UNSARE share?	Is the other Group1 object a LNDARE or an UNSARE?
Does Inland Water Object share?	Is the spatial object shared by a RIVERS, LAKARE, CANALS, LOKBSN or DOCARE object?
Does Liner Structure Object share?	Is the spatial object shared by at least one of the linear objects: - LNDARE, GATCON or DAMCON - SLCONS or CUSWAY with WATLEV=1, 2, 6 or empty.
LOC_SAFETY == FALSE?	Is the variable LOC_SAFETY equal to FALSE?
UNSAFE == TRUE && SAFE == TRUE?	Are the values of the local variables 'UNSAFE' and 'SAFE' equal to TRUE?
continue	If 'No', go to the next spatial component.
Select Edge Viewing Parameters	Make sure the contour is shown at all scales (Attribute 'SCAMIN' equals 'infinite') Include this edge in the category:
	Display Priority | 8
	Radar Flag | OVERRADAR
	Display Group | Displaybase
	Viewing Group | 13010
Get 'QUAPOS'	Get the value of the attribute 'QUAPOS' of the current spatial component

Has value ('QUAPOS')?	Is the value of the attribute 'QUAPOS' given?
LS(SOLD,2,DEPSC)	Symbolize the line object with a solid line 2 units wide, colour 'DEPSC'
'QUAPOS' != 1 && 10 && 11?	Does the value of attribute 'QUAPOS' equal to neither of the following values: '1', '10', and '11'?
LS(DASH,2,DEPSC)	Symbolize the line object with a dashed line (2 units wide, colour 'DEPSC')
Safety Contour Labels?	Has the mariner chosen to display Safety Contour Labels by used of selection of viewing group 33021?
continue	If 'No', go to the next spatial component
LOC_VALDCO != 'unknown'?	Is the local variable 'LOC_VALDCO' set?
continue	IF 'No', go to the next spatial component
SAFCON01 (LOC_VALDCO)	Perform the symbology sub-procedure to symbolize the safety contour label, see '13.2.12 Conditional Symbology Procedure SAFCON01'
LOC_VALDCO	input parameter
List of Selected Symbols	output parameter
Draw Selected Symbols from 'SAFCON01'	Draw the symbols that were returned by 'SAFCON01' at the centre of the run-length of the line. Symbols must be displayed upright with respect to the screen borders and not aligned along the contour.
continue	Go to the next spatial component

13.2.2 Conditional Symbology Procedure DEPCNT03

Applies to: S-57 Object Class "depth contour" (DEPCNT)

Spatial Object(s): Line

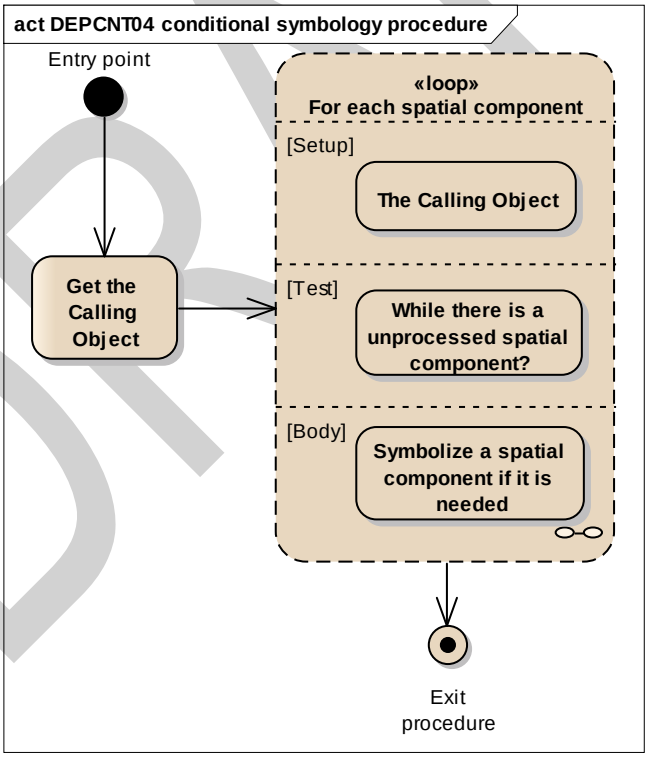
Attribute(s) used: "value of depth contour" (VALDCO)

Parameter(s): Object to be symbolized from SENC

Output Defaults: Display Priority given by look-up table,
OVERRADAR priority given by look-up table,
Display Category given by look-up table,
Viewing Group given by look-up table

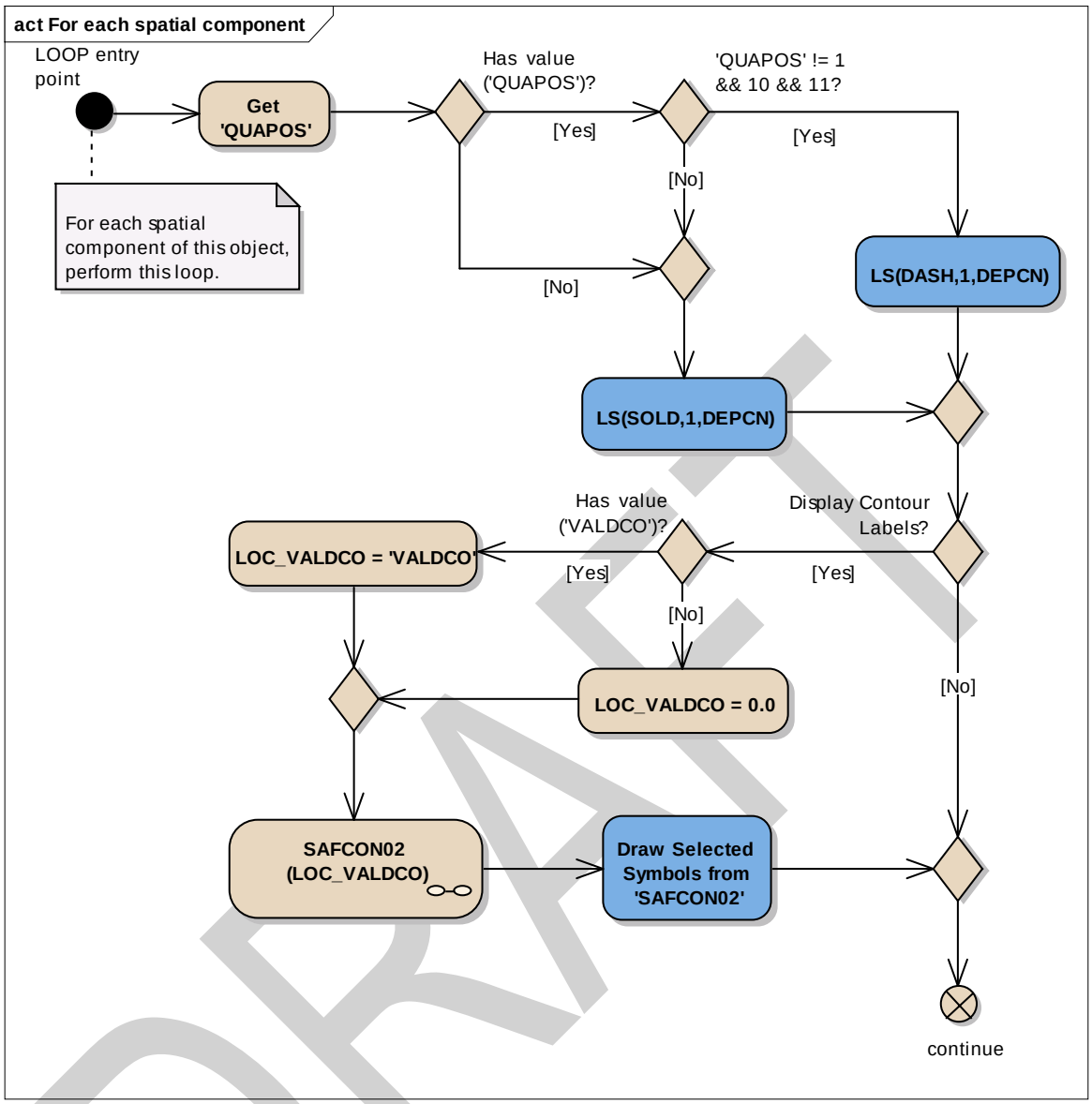
Remarks: This procedure symbolizes contours, identifies any line segment of the spatial object that has a 'QUAPOS' value indicating unreliable positioning and symbolizes it with a dashed line, and labels the value of the contour on demand by the Mariner.
The contour may be labelled at the request of the Mariner using sub-procedure “SAFCON01”.
Spatial Component line definition

Figure 3 DEPCNT03 conditional symbology procedure



Entry point	Entry to the symbology procedure.
Get the Calling Object	Get the object which is calling this procedure.
Loop for each spatial component	For each spatial component of the object, perform this loop: Setup - the Calling Object Test - while there is a unprocessed spatial component. Body - to symbolize a spatial component if it is needed.
Exit procedure	Symbolization is complete

Figure 4 For each spatial component



LOOP entry point	For each spatial component of this object, perform this loop.
Get 'QUAPOS'	Get the value of the Attribute 'QUAPOS' of the current spatial component
Has value ('QUAPOS')?	Is the value of the attribute 'QUAPOS' given?
'QUAPOS' != 1 && 10 && 11?	Does the value of attribute 'QUAPOS' equal to neither of the following values: '1', '10', and '11'?
LS(DASH,1,DEPCN)	Symbolize the line with a dashed line, 1 unit wide, colour 'DEPCN'.
LS(SOLD,1,DEPCN)	Symbolize the line with a solid line, 1 unit wide, colour 'DEPCN'.
Display Contour Labels?	Has the mariner chosen to display contour labels by used of selection of viewing group 33022?
Has value ('VALDCO')?	Is the value of the attribute 'VALDCO' given?
LOC_VALDCO = 'VALDCO'	Set the local variable 'LOC_VALDCO' equal to 'VALDCO' value.
LOC_VALDCO = 0.0	Set the local variable LOC_VALDCO equal to 0.0 m.
SAFCON01 (LOC_VALDCO)	Perform the symbology procedure 'SAFCON01' to symbolize the contour label. Pass the value of local variable 'LOC_VALDCO' to 'SAFCON01'. A list of symbols is returned.

LOC_VALDCO	- input parameter
List of Symbols	- output parameter
Draw Selected Symbols from 'SAFCON01'	Draw the symbols that were returned by 'SAFCON01' at the centre of the run-length of the line. Symbols must be displayed upright with respect to the screen borders and not aligned along the contour.
continue	Go to the next spatial component.

13.2.3 Conditional Symbology Procedure DEPVAL02

Note that this is a sub-procedure called by procedures OBSTRNnn and WRECKSnn

Applies to: OBSTRN, UWTROC, WRECKS objects called the main procedures OBSTRNnn and WRECKSnn

Spatial Object(s): Point, line, area

Relation(s) used: Common parts of overlapping area objects

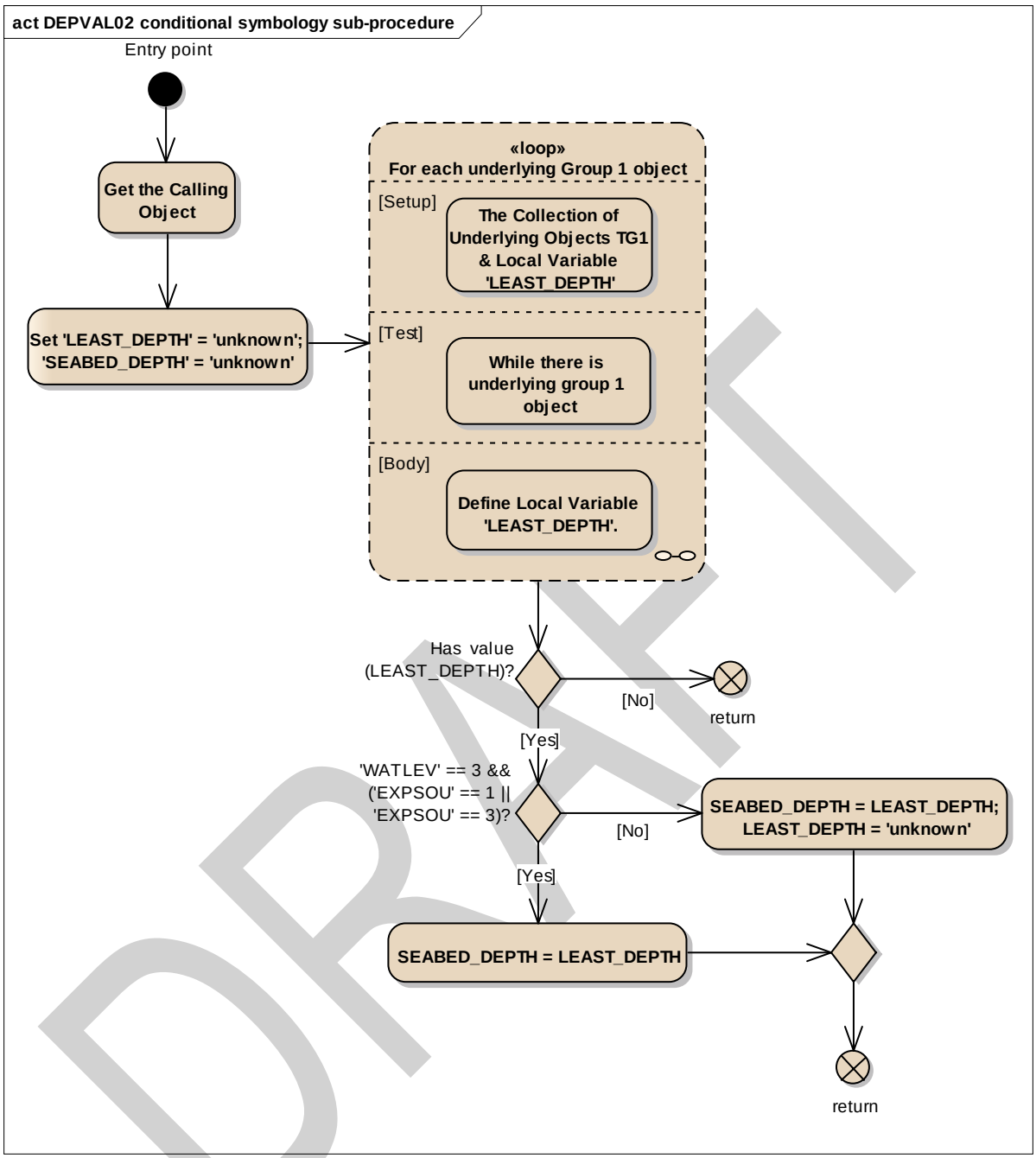
Attribute(s) used: "depth range value" DRVAL1;
"water level" (WATLEV);
"exposure of sounding" (EXPSOU)

Parameter(s): Object to be symbolized from SENC. Any overlapped DEPARE or UNSARE objects
The procedure returns local variables 'LEAST_DEPTH' and 'SEABED_DEPTH'.

Defaults: Return to main program for defaults

Remarks: If the value of the attribute VALSOU for a wreck, rock or obstruction is missing/unknown, CSP DEPVAL will establish a default 'LEAST DEPTH' from the attribute DRVAL1 of the underlying depth area, and pass it to conditional procedures OBSTRN and WRECKS. However this procedure is not valid if the value of EXPSOU for the object is 2 (object is shoaler than the DRVAL1 of the surrounding depth area), or is unknown. It is also not valid if the value of WATLEV for the object is other than 3 (object is always underwater). In either of these cases the default procedures in conditional procedures OBSTRN and WRECKS are used.

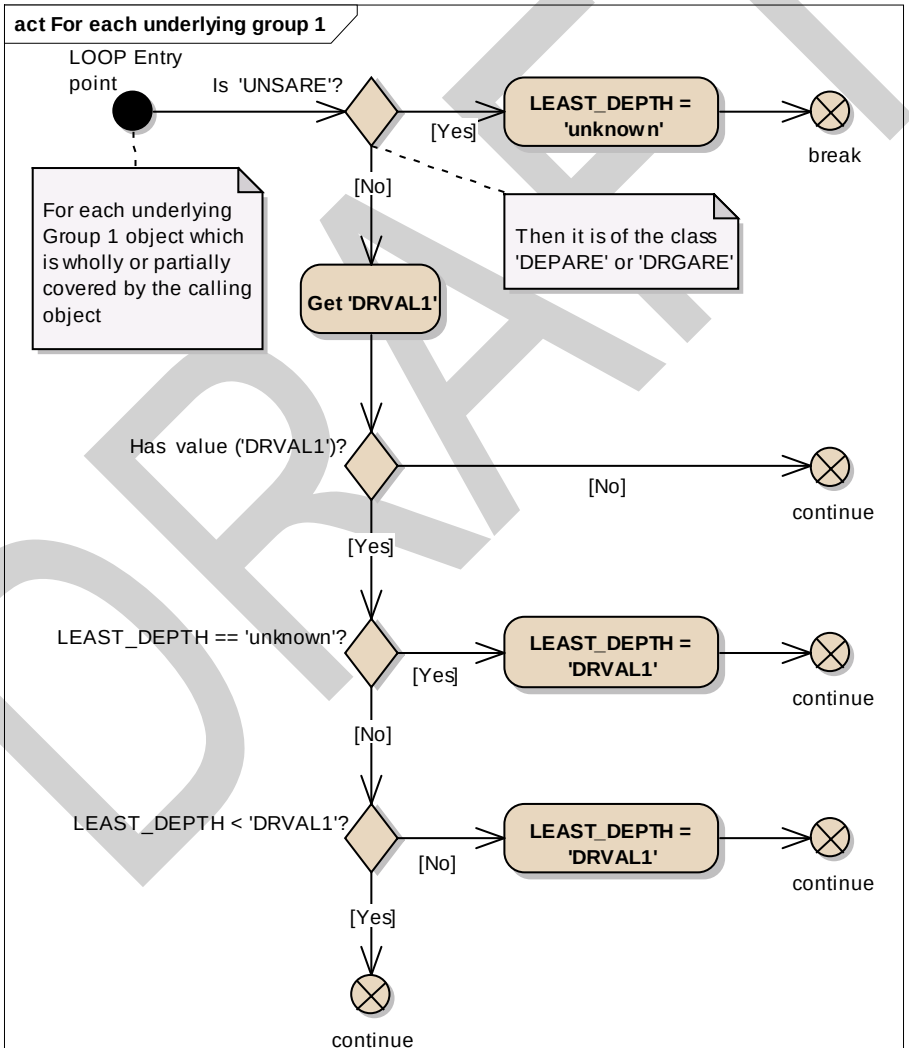
Figure 5 DEPVAL02 conditional symbology sub-procedure



Entry point	Entry to the symbology sub-procedure with values of the attributes WATLEV and EXPSOU passed from the calling procedures.
Get the Calling Object	Get the object which is calling this procedure.
Set 'LEAST_DEPTH' = 'unknown'; 'SEABED_DEPTH' = 'unknown'	Set the local variable 'LEAST_DEPTH' equal to 'unknown'. Set the local variable 'SEABED_DEPTH' equal to 'unknown'.
Loop for each underlying Group 1 object	For each underlying group 1 object which is wholly or partially covered by the calling object, perform this loop to establish a default value for the local variable 'LEAST_DEPTH'. Setup - The collection of underlying objects TG1 and the local variable 'LEAST_DEPTH'; Test - While there is underlying group 1 object;

	Body - Define Local Variable 'LEAST_DEPTH'.
Has value (LEAST_DEPTH)?	Does the local variable 'LEAST_DEPTH" have a value?
return	If 'No', return to the calling procedure with the value of the Local variables 'LEAST_DEPTH' and 'SEABED_DEPTH'
'WATLEV' == 3 && ('EXPSOU' == 1 || 'EXPSOU' == 3)?	Is the attribute value for 'WATLEV' equal to 3 (underwater) and is the attribute value for 'EXPSOU' equal to '1' (within the range of depth of the surrounding depth area) or '3' (deeper than the range of depth of the surrounding depth area)?
SEABED_DEPTH = LEAST_DEPTH; LEAST_DEPTH = 'unknown'	Set the local variable 'SEABED_DEPTH' equal to 'LEAST_DEPTH' value Set the local variable 'LEAST_DEPTH' equal to 'unknown'
SEABED_DEPTH = LEAST_DEPTH	Set the local variable 'SEABED_DEPTH' equal to 'LEAST_DEPTH' value.
return	Return to the calling procedure with the value of the Local variables 'LEAST_DEPTH' and 'SEABED_DEPTH'

Figure 6 Loop for each underlying group 1 object



LOOP Entry point	For each underlying Group 1 object
Is 'UNSARE'?	Is the underlying group 1 object of the class 'UNSARE' (unsurveyed area)?
LEAST_DEPTH = 'unknown'	Set the local variable 'LEAST_DEPTH' equal to 'unknown' value.

break	Exit loop.
DRVAL1 missing or unknown?	Is the value of the underlying object's attribute 'DRVAL1' missing or unknown?
Get 'DRVAL1'	Get the value of the attribute "Depth range value 1" (DRVAL1) of the underlying object?
Has value ('DRVAL1')?	Is the value of the attribute 'DRVAL1' given in the underlying object DEPARE(DRGARE)?
continue	If 'No', go to the next found Group 1 object.
LEAST_DEPTH == 'unknown'?	Is the value of the local variable 'LEAST_DEPTH' unknown?
continue	go to the next found Group 1 object.
LEAST_DEPTH = 'DRVAL1'	Set the value of the local variable 'LEAST_DEPTH' equal to 'DRVAL1'.
LEAST_DEPTH < 'DRVAL1'?	Is the value of the local variable 'LEAST_DEPTH' less than the value of 'DRVAL1'?
continue	go to the next found Group 1 object.
LEAST_DEPTH = 'DRVAL1'	Set the value of the local variable 'LEAST_DEPTH' equal to 'DRVAL1'
continue	go to the next found Group 1 object.

13.2.4 Conditional Symbology Procedure LIGHTS06

Light flares, light sectors & light coverage (S-57)

Applies to: S-57 Object Class "light" (LIGHTS)

Spatial Object(s): Point

Spatial Relation(s): Point objects at identical location

Attribute(s) used: "colour" (COLOUR); "category of light" (CATLIT); "sector 1" (SECTR1); "sector 2" (SECTR2); «orientation» (ORIENT) "visibility of light" (LITVIS); "value of nominal range" (VALNMR)

Parameter(s): Object to be symbolized from SENC

User parameters: Show full length leg lines.

Defaults: Display Priority given by look-up table;
OVERRADAR priority given by look-up table;
Display Category given by look-up table;
Viewing Group given by look-up table

Remarks: A light is one of the most complex S-57 objects. Presentation depends on whether it is a light on a floating or fixed platform, range, colour etc. This conditional symbology procedure derives the correct presentation from these parameters and also generates an area that shows the coverage of the light.

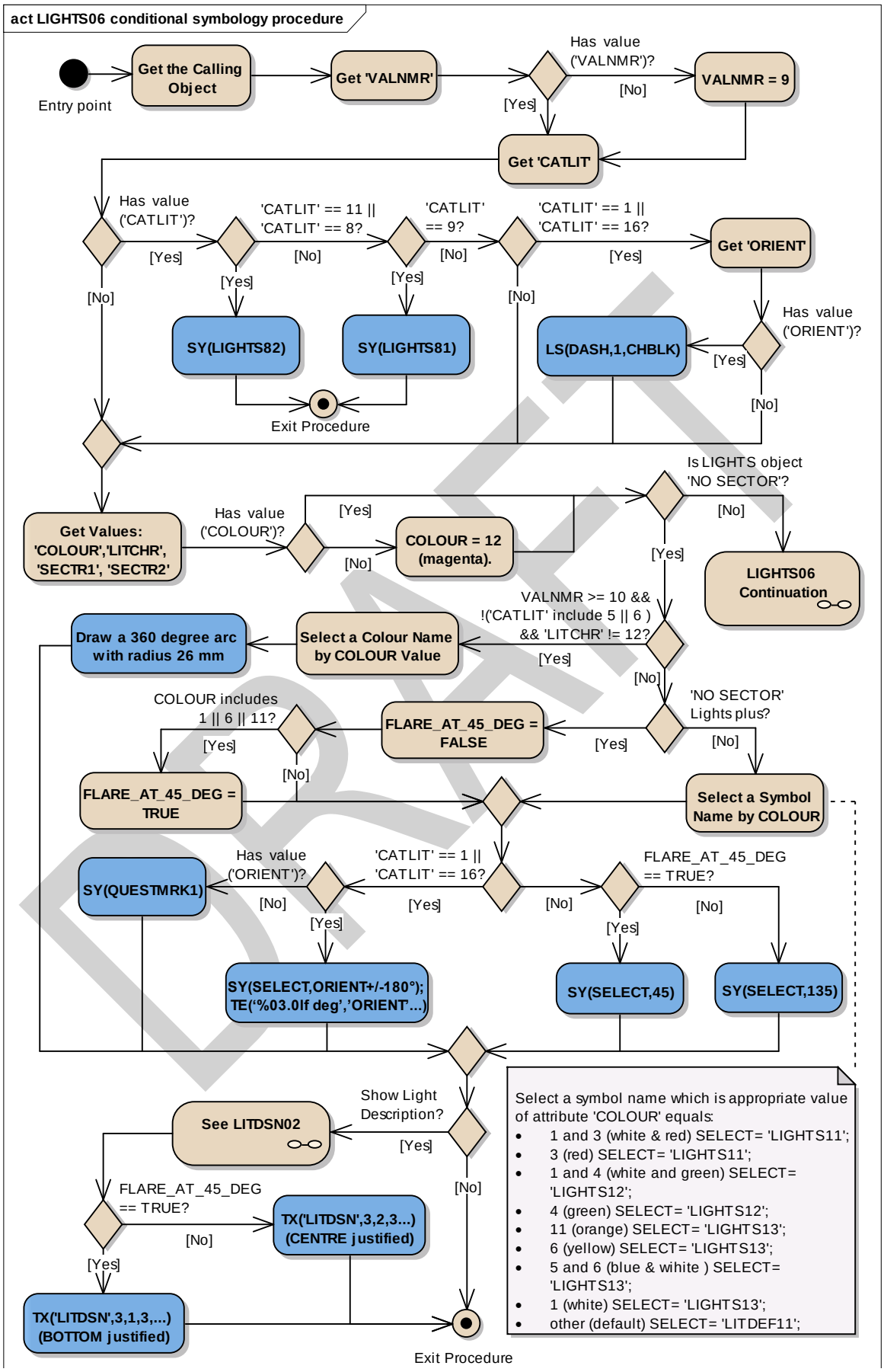
Notes on light sectors:

1.) The radial leg-lines defining the light sectors are normally drawn to only 25mm from the light to avoid clutter (see continuation B). However, the mariner should be able to select «full light-sector lines» and have the leg-lines extended to the nominal range of the light (VALMAR).

2.) Continuation of this procedure symbolizes the sectors at the light itself. In addition, it should be possible, upon request, for the mariner to be capable of identifying the colour and sector limit lines of the sectors affecting the ship even if the light itself is off the display.

Further note: The sub-procedure LITDSN02, which generates the light description text-string, is provided as a descriptive narrative.

Figure 7 LIGHTS06 conditional symbology procedure

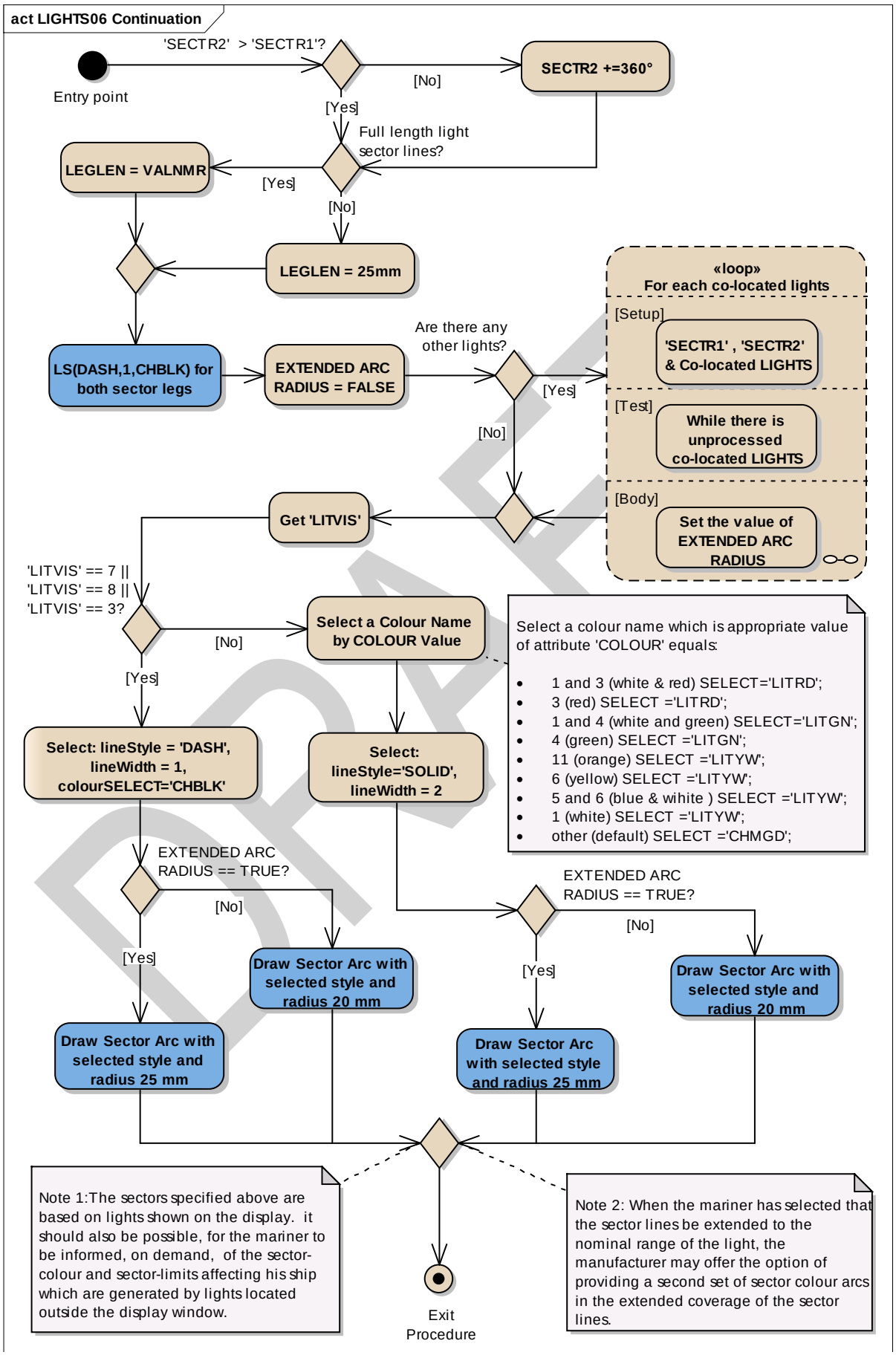


Entry point	Entry to the symbology procedure.	
Get the Calling Object	Get the object which is calling this procedure.	
Get 'VALNMR'	Get the value of the attribute 'Value of nominal range' (VALNMR).	
Has value ('VALNMR')?	Is the value of the attribute 'VALNMR' given?	
VALNMR = 9	Set local variable 'VALNMR' equal to 9 M	
Get 'CATLIT'	Get the value of the attribute 'Category of light' (CATLIT).	
Has value ('CATLIT')?	Is the value of the attribute 'CATLIT' given?	
'CATLIT' == 11 || 'CATLIT' == 8?	Does the value of the attribute 'CATLIT' equal to 8 (floodlight) or 11 (spotlight)?	
SY(LIGHTS82)	Draw symbol 'LIGHTS82' at the calling object's location.	
'CATLIT' == 9?	Does the value of the attribute 'CATLIT' equal 9 (strip light)?	
SY(LIGHTS81)	Draw symbol 'LIGHTS81' at the calling object's location.	
Exit Procedure	Symbolization is finished	
'CATLIT' == 1 || 'CATLIT' == 16?	Does the value of the attribute 'CATLIT' equal 1 (directional) or 16 (moiré effect)?	
Get 'ORIENT'	Get the value of the attribute 'Orientation' (ORIENT).	
Has value ('ORIENT')?	Is the value of the attribute 'ORIENT' given?	
LS(DASH,1,CHBLK)	Draw the direction marked by the light as defined by the attribute 'ORIENT'. Remember that this is the bearing from seaward. It means the start point is at sea and the end point is at the calling object's location. Draw a line equal in length to the value of attribute 'VALNMR'. Symbolize as follows: 'LS(DASH, 1, CHBLK)'	
Get Values: 'COLOUR','LITCHR', 'SECTR1', 'SECTR2'	Get the values of the following attributes used for next analysing: - 'Colour' (COLOUR); - 'Sector limit one' (SECTR1); - 'Sector limit two' (SECTR2); - 'Light characteristic' (LITCHR).	
Has value ('COLOUR')?	Is the value of the attribute 'COLOUR' given?	
COLOUR = 12 (magenta).	Assume the value of the 'COLOUR' is '12' (magenta)	
Is LIGHTS object 'NO SECTOR'?	Is the attributes 'SECTR1' (sector limit one) or 'SECTR2' (sector limit two) values absent, or does their difference equal zero degrees, or do they equal to 0.00 and 360.00 correspondingly in the object which is calling this procedure?	
LIGHTS06 Continuation	If 'No', go to 'LIGHTS06 Continuation'. It describes the sector lights showing its line legs and arcs. Input values of the attributes 'SECTR1', 'SECTR2', 'COLOUR' of the calling object and local variable 'VALNMR'. *See Figure 8 'LIGHTS06 Continuation'*	
VALNMR >= 10 && !('CATLIT' include 5 || 6) && 'LITCHR' != 12?	Check whether this is a major light: Is the value of 'VALNMR' greater or equal to 10 nautical miles? AND Does the value of 'CATLIT' not include '5' (aero light) or 6 (air obstruction light)? AND Does the value of 'LITCHR' not equal '12' (Morse)?	
Select a Colour Name by COLOUR Value	Select a colour name which is appropriate value of attribute 'COLOUR' equals:	
	1 and 3 (white & red)	SELECT= 'LITRD';
	3 (red)	SELECT ='LITRD';
	1 and 4 (white and green)	SELECT ='LITGN';
	4 (green)	SELECT ='LITGN';
	11 (orange)	SELECT ='LITYW';
	6 (yellow)	SELECT ='LITYW';
	5 and 6 (blue & yellow)	SELECT ='LITYW';
	1 (white)	SELECT ='LITYW';
	other (default)	SELECT ='CHMGD';
Draw a 360 degree arc with radius 26 mm	First symbolize a 360 degree arc with a solid line, 4 units wide, COLOUR OUTLW; then symbolize a 360 degree arc with a solid line,	

	2 units wide, COLOUR as selected above. The centre of the arc is the calling object location. The radius of the arc on the display is 26 mm.	
'NO SECTOR' Lights plus?	Is there any 'No Sector' lights located at the same point as the calling object?	
FLARE_AT_45_DEG = FALSE	Set the local variable 'FLARE AT 45 DEGREES' to 'FALSE'	
COLOUR includes 1 || 6 || 11?	Does the calling object COLOUR include 1 (white) or 6 (yellow) or 11 (orange)?	
FLARE_AT_45_DEG = TRUE	Set local variable 'FLARE AT 45 DEGREES' to 'TRUE'	
Select a Symbol Name by COLOUR	Select a symbol name which is appropriate value of attribute 'COLOUR' equals:	
	1 and 3 (white & red)	SELECT= 'LIGHTS11';
	3 (red)	SELECT= 'LIGHTS11';
	1 and 4 (white and green)	SELECT= 'LIGHTS12';
	4 (green)	SELECT= 'LIGHTS12';
	11 (orange)	SELECT= 'LIGHTS13';
	6 (yellow)	SELECT= 'LIGHTS13';
	1 (white)	SELECT= 'LIGHTS13';
	5 and 6 (blue & yellow)	SELECT= 'LIGHTS13';
	other (default)	SELECT= 'LITDEF11';
'CATLIT' == 1 || 'CATLIT' == 16?	Does the value of the attribute 'CATLIT' equal to '1' (directional) or '16' (moiré)?	
Has value ('ORIENT')?	Is the value of the attribute 'ORIENT' given?	
SY(SELECT,ORIENT+/-180°); TE('%03.0lf deg','ORIENT'...)	Draw the selected symbol at the calling object's location rotated in the direction as defined by the attribute 'ORIENT' +/- 180° (ORIENT is direction from seaward), and write the direction from seaward at the light as follows: "TE('%03.0lf deg','ORIENT', 3,3,3, '15110', 3,1, CHELK, 23)"	
SY(QUESTMRK1)	Draw the symbol 'QUESTMRK1' at the calling object's location	
FLARE_AT_45_DEG == TRUE?	Is 'FLARE AT 45 DEGREES' set to TRUE?	
SY(SELECT,45)	Draw the selected symbol with a rotation of 45 degrees from upright at the position where the object which was calling the procedure is located.	
SY(SELECT,135)	Draw the selected symbol with a rotation of 135 degrees from upright at the position where the object which was calling the procedure is located.	
Show Light Description?	Have the mariner selected viewing of light descriptions? (text group 23).	
See LITDSN02	Pass on to this procedure the attributes: 'CATLIT', 'LITCHR', 'SIGGRP', 'COLOUR', 'SIGPER', 'HEIGHT', 'VALNMR', 'STATUS'. This procedure constructs a text string for the light description. This string is returned as the argument 'LITDSN'. Note: previous version of the presentation library provided c-code that enabled the building of light description text strings for presentation on the ECDIS chart display. Version 4 of the presentation library has now removed the c-code and textual description of how light description should be constructed is provided	
FLARE_AT_45_DEG == TRUE?	Is 'FLARE AT 45 DEGREES' set to TRUE?	
TX('LITDSN',3,1,3,...) (BOTTOM justified)	Write the returned text string 'LITDSN'' as follows: TX('LITDSN', 3,1,3, '15110', 2,-1, CHBLK, 23)	
TX('LITDSN',3,2,3...)	Write the returned text string 'LITDSN'' as follows:	

(CENTRE justified)	TX('LITDSN', 3,2,3, '15110', 2,0, CHBLK, 23)
Exit Procedure	Symbolization is finished

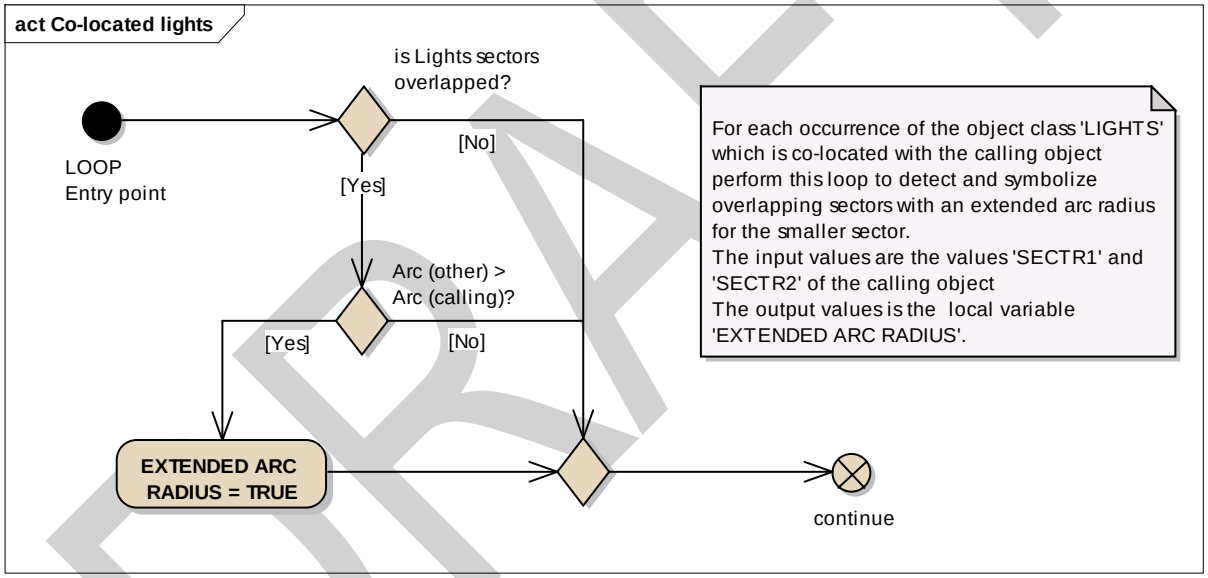
Figure 8 LIGHTS06 Continuation describes the sector lights showing its line legs and arcs.



Entry point	Entry to the continuation of symbology procedure LIGHTS06.	
'SECTR2' > 'SECTR1'?	The value 'SECTR2' greater than the value of 'SECTR1'?	
SECTR2 +=360°	Add 360 degrees to the local value of 'SECTR2'.	
Full length light sector lines?	Has the mariner selected full length light sector lines?	
LEGLEN = VALNMR	Set local variable 'LEGLEN' equal to length (in mm) of 'VALNMR' value in the scale of ECDIS display.	
LEGLEN = 25mm	Set the local variable 'LEGLEN' equal to 25mm in the scale of the ECDIS display.	
LS(DASH,1,CHBLK) for both sector legs	Draw both sector legs by symbology instruction 'LS(DASH, 1, CHBLK)'. Start the legs the position where the light object which was calling the procedure is located. Show the sector legs in the directions which are defined by 'SECTR1' and 'SECTR2'. Do not forget to reverse the sector values (+/- 180 degrees) since the values are given from seaward; Use LEGLEN from the step above. (The LITDSN text string is not used for sector lights because it would cause clatter).	
EXTENDED ARC RADIUS = FALSE	Set the value of local variable 'EXTENDED ARC RADIUS' to 'FALSE' by default	
Are there any other lights?	Is there any other 'LIGHTS' object located at the same point as the calling objects?	
Loop for each co-located lights	For each occurrence of the object class 'LIGHTS' which is co-located with the calling object perform this loop to detect and symbolize overlapping sectors with an extended arc radius for the smaller sector. Setup - the input values are the values 'SECTR1' and 'SECTR2' of the calling object and the collection of the co-located LIGHTS object. Test - While there is unprocessed co-located LIGHTS object, Body - Set the output values is the local variable 'EXTENDED ARC RADIUS'. *See Figure 9 Loop for co-located lights objects*	
Get 'LITVIS'	Get the value of the attribute "Light visibility" (LITVIS) from the calling object.	
'LITVIS' == 7 || 'LITVIS' == 8 || 'LITVIS' == 3?	Does the value of the attribute 'LITVIS' (visibility of light) equal '7' (obscured) or '8' (partially obscured) or '3' (faint)?	
Select: lineStyle ='DASH', lineWidth = 1, colourSELECT= 'CHBLK'	Select the simple dashed linestyle, 1 units wide, colour 'CHBLK'	
EXTENDED ARC RADIUS == TRUE?	Is the local variable 'EXTENDED ARC RADIUS' equal to 'TRUE'	
Draw Sector Arc with selected style and radius 25 mm	Draw the sector arc: colour, linestyle, line width as selected above. Radius on the display is 25mm.	
Draw Sector Arc with selected style and radius 20 mm	Draw the sector arc: colour, linestyle, line width as selected above. Radius on the display is 20 mm.	
Select a Colour Name by COLOUR Value	Select a colour name which is appropriate value of attribute 'COLOUR' equals:	
	1 and 3 (white & red)	SELECT= 'LITRD';
	3 (red)	SELECT ='LITRD';
	1 and 4 (white and green)	SELECT ='LITGN';
	4 (green)	SELECT ='LITGN';
	11 (orange)	SELECT ='LITYW';
	6 (yellow)	SELECT ='LITYW';
	5 and 6 (blue & yellow)	SELECT ='LITYW';

	1 (white)	SELECT ='LITYW';
	other (default)	SELECT ='CHMGD';
Select: lineStyle='SOLID', lineWidth = 2	Select the simple solid linestyle, 2 units wide.	
EXTENDED ARC RADIUS == TRUE?	Is the local variable 'EXTENDED ARC RADIUS' equal to 'TRUE'	
Draw Sector Arc with selected style and radius 25 mm	First symbolize the Arc with a solid line, 4 units wide, COLOUR OUTLW; then symbolize the Arc with the COLOUR, linestyle and linewidth selected above. Radius on the display is 25mm.	
Draw Sector Arc with selected style and radius 20 mm	First symbolize the Arc with a solid line, 4 units wide, COLOUR OUTLW; then symbolize the Arc with the COLOUR, linestyle and linewidth selected above. Radius on the display is 20mm.	
Exit Procedure	Symbolization is finished	

Figure 9 Loop for co-located lights objects



LOOP Entry point	For each occurrence of the object class 'LIGHTS' which is co-located with the calling object perform this loop
is Lights sectors overlapped?	Does the other 'LIGHTS' object overlap the sector of the calling object? ('SECTR1' and/or 'SECTR2' of the other 'LIGHTS' falls between 'SECTR1' and 'SECTR2' of the calling object) or ('SECTR1' and/or 'SECTR2' of the calling object falls between 'SECTR1' and 'SECTR2' of the other 'LIGHTS' object).
Arc (other) > Arc (calling)?	Is the ARC ('SECTR2' - 'SECTR1') of the other object larger that the sector ARC of the calling object?
EXTENDED ARC RADIUS = TRUE	Set local variable 'EXTENDED ARC RADIUS' to TRUE.
continue	Go to next co-located light object.

13.2.5 Conditional Symbology Procedure OBSTRN07

Applies to: S-57 Object Class "obstruction" (OBSTRN);
S-57 Object Class "under water rock" (UWTROC)

Spatial Object(s): Point, Line, Area.

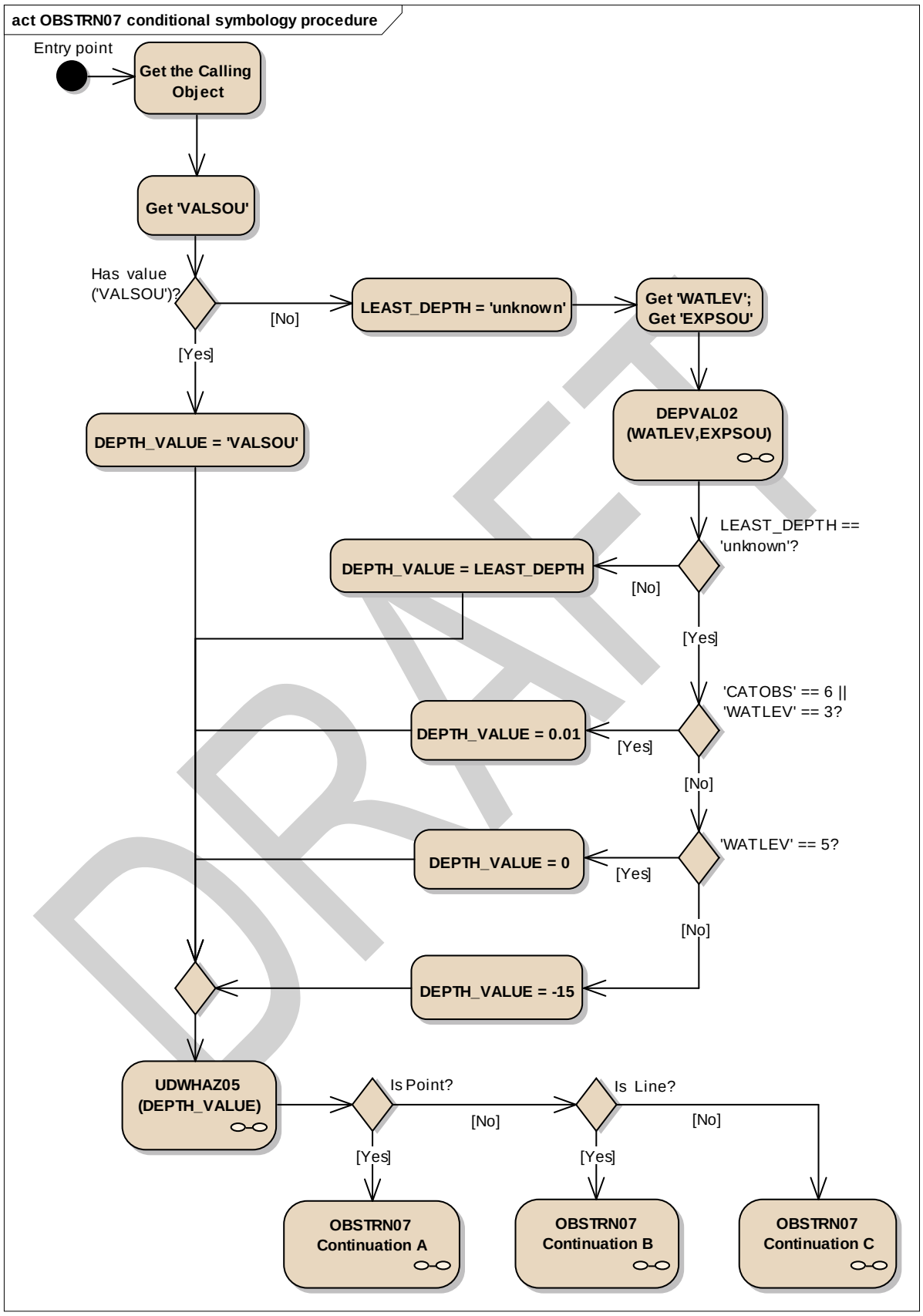
Attribute(s) used: "value of sounding" (VALSOU);
"water level" (WATLEV);
"exposure of sounding" (EXPSOU);

Parameter(s): Object to be symbolized from SENC

Defaults: Display Priority given by look-up table; OVERRADAR priority by look-up table; Display Category given by look-up table; Viewing Group given by look-up table; Area Colour fill from underlying 'DEPARE' or 'UNSARE';

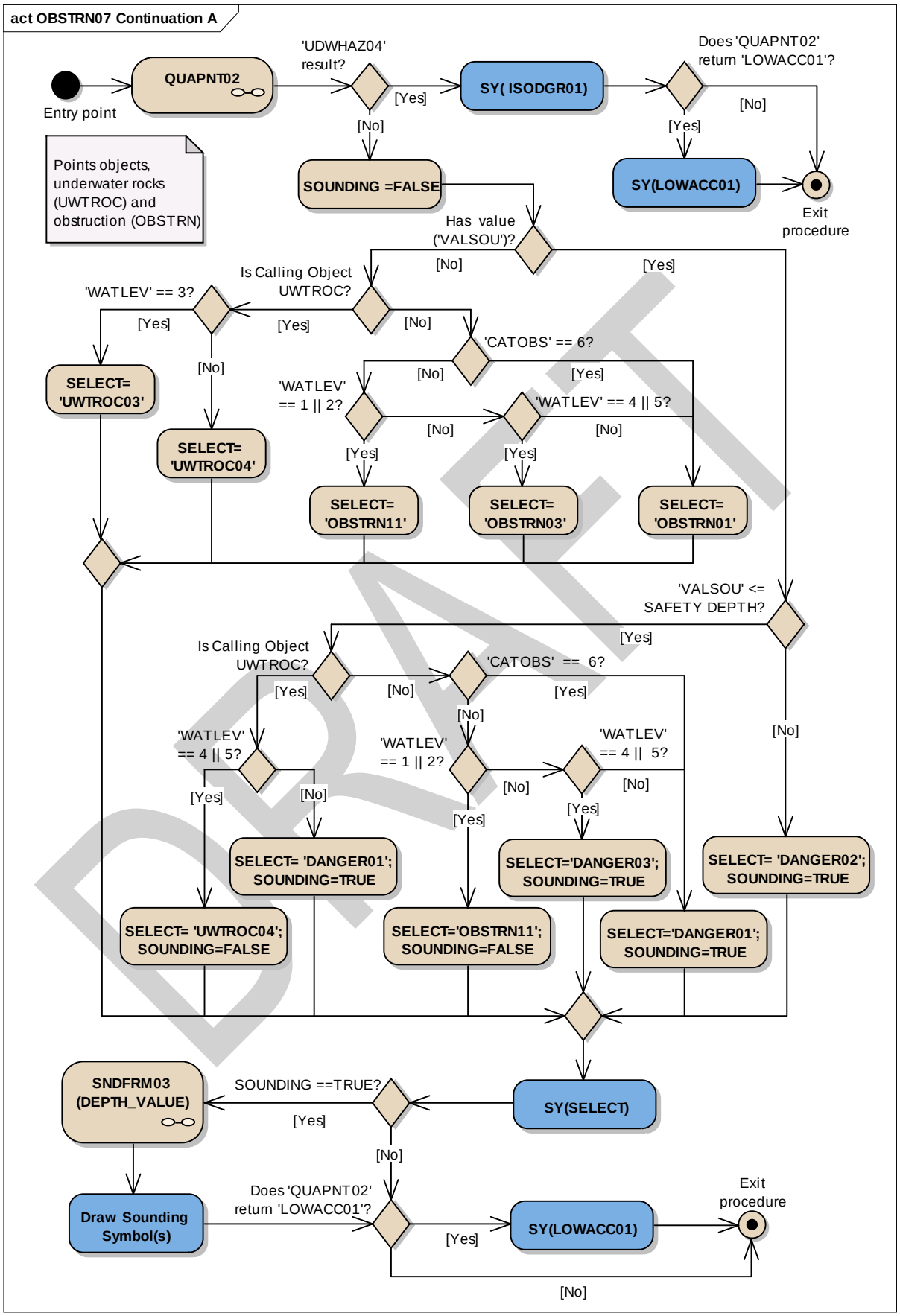
Remarks: Obstructions or isolated underwater dangers of depths less than he safety contour which lie within the safe waters defined by the safety contour are to be presented by a specific isolated danger symbol and put in IMO category "DISPLAY BASE" (see IMO Performance Standard for ECDIS [2]). This task is performed by the most recent edition of sub-procedure UDWHAZnn which is called by this symbology procedure. Objects of the class "under water rock" are handled by this routine as well to ensure a consistent symbolization of isolated dangers on the seabed.
The current UDWHAZnn also allows the mariner the option of displaying isolated dangers in the waters between the safety contour and the zero metre line.
In the case that the value of attribute VALSOU for this object is unknown, the most recent edition of sub-procedure DEPVALnn is called. This will provide a default 'least_depth' from the DRVAL1 of the underlying depth area on condition that the value of attribute EXPSOU is not 2 (shoaler than the depth area), and the value of attribute WATLEV is 3 (always underwater).

Figure 10 OBSTRN07 conditional symbology procedure



Entry point	Entry to the symbology procedure.
Get the Calling Object	Get the object which is calling this procedure.
Get 'VALSOU'	Get the value of the attribute 'Value of sounding' (VALSOU) of the calling object
Has_value ('VALSOU')?	Is the value of the attribute 'VALSOU' given?
DEPTH_VALUE = 'VALSOU'	Set the local variable 'DEPTH_VALUE' equal to 'VALSOU'. Set the viewing group to 34051.
LEAST_DEPTH = 'unknown'	Set the local variable 'LEAST_DEPTH' equal to 'unknown' value.
Get 'WATLEV'; Get 'EXPSOU'	Get the value of the attributes 'Water level effect' (WATLEV) and 'Exposition of sounding' (EXPSOU) of the calling object.
DEPVAL02 (WATLEV,EXPSOU)	Performs the symbology sub-procedure 'DEPVAL02' which returns a value for the local variables 'LEAST_DEPTH' and 'SEABED_DEPTH'. Pass attributes 'WATLEV and EXPSOU' on to it Note: 'SEABED_DEPTH' is returned from "DEPVAL02' but is not used by this procedure.
'WATLEV'	- input parameter
'EXPSOU'	- input parameter
'LEAST_DEPTH'	- output parameter
'SEABED_DEPTH'	- output parameter
LEAST_DEPTH == 'unknown'?	Is the value of the local variable 'LEAST_DEPTH' equal to 'unknown'?
DEPTH_VALUE = LEAST_DEPTH	Set the local variable 'DEPTH_VALUE' equal to the local variable 'LEAST_DEPTH'.
'CATOBS' == 6 || 'WATLEV' == 3?	Is the value of 'CATOBS' equal to '6' OR 'WATLEV' equal to '3'?
DEPTH_VALUE = 0.01	Set the local variable 'DEPTH_VALUE' = 0.01 m to a fail-safe depth based on the value of the attribute 'CATOBS'=6:
'WATLEV' == 5?	Is the value of 'WATLEV' equal to '5'?
DEPTH_VALUE = 0	Set the local variable 'DEPTH_VALUE'=0 to a fail-safe depth based on the value of the attribute WATLEV'=5:
DEPTH_VALUE = -15	Set the local variable 'DEPTH_VALUE' to a fail-safe depth based on the value of the attribute WATLEV' or by default if 'WATLEV'=4 (covers and uncovers) OR 'WATLEV'=1 OR 'WATLEV'= 2 (always dry) OR 'WATLEV'=' ' (unknown or missing) then 'DEPTH_VALUE'=-15m else default
UDWHAZ05 (DEPTH_VALUE)	Performs the symbology sub-procedure 'UDWHAZ05' which returns a flag indicating whether or not to display the ISOLATED DANGER SYMBOL [IMO PS App.2 1.3] and the selected symbol. Pass 'DEPTH_VALUE' on to it. Return: - selected symbol name 'ISODRG01'; - parameters presentation: SCAMIN, DISPLAY MODE, PRIORITY, RADAR FLAG, VIEWING GROUP if they are changed.
DEPTH_VALUE	- input parameter
ISOLATED DANGER SYMBOL message	- output parameter
Is Point?	Is the calling object of type point?
OBSTRN07 Continuation A	Point objects, underwater rocks (UWTROC) and obstructions (OBSTRN)
Is Line?	Is the calling object of type line?
OBSTRN07 Continuation B	Geometry type is line.
OBSTRN07 Continuation C	Geometry type is area.

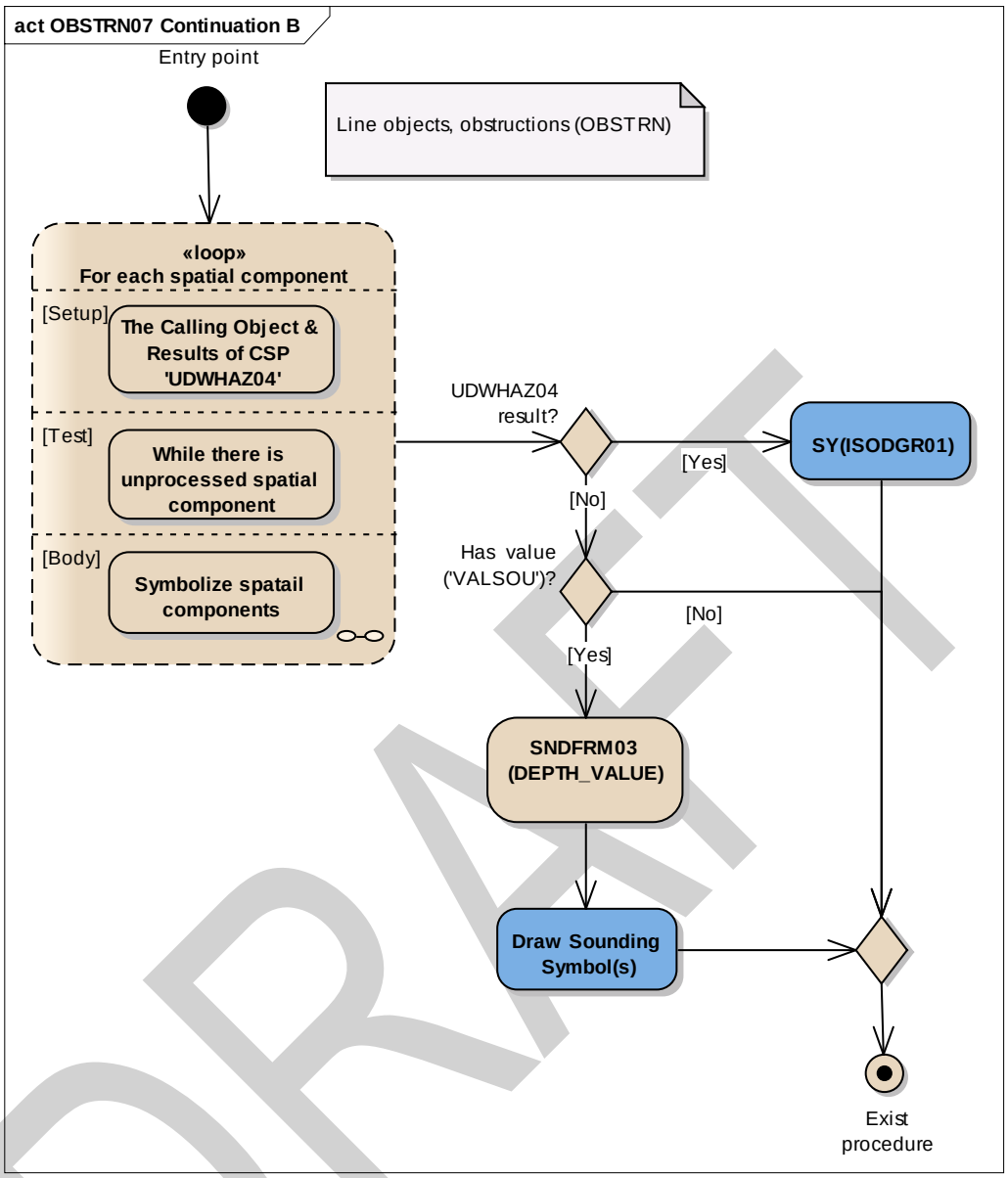
Figure 11 OBSTRN07Continuation A.Points objects, underwater rocks (UWTROC) and obstruction (OBSTRN)



Entry point	Entry to the continuaton A of symbology procedure with a point object: underwater rocks (UWTROC) or obstructions (OBSTRN)
QUAPNT02	Performs the symbology sub-procedure 'QUAPNT02' which returns a flag indicating whether or not to display the LOW ACCURACY SYMBOL and returns the selected symbol name 'LOWACC01'. See Conditional Symbology Procedure QUAPNT02
'UDWHAZ05' result?	Has the procedure 'UDWHAZ05' indicated the Isolated danger symbol shall be shown?
SY(ISODGR01)	Draw the 'ISODGR01' symbol with the set presentation parameters selected by 'UDWHAZ05' at the calling objects location
Does 'QUAPNT02' return 'LOWACC01'?	Is the symbol 'LOWACC01' selected by the procedure 'QUAPNT02'?
SY(LOWACC01)	If so indicated by the procedure 'QUAPNT02', draw the returned low accuracy symbol 'LOWACC01' with the set presentation parameters selected by 'UDWHAZ05' at the calling object's location.
Exit procedure	Symbolization is finished
SOUNDING =FALSE	
Has value ('VALSOU')?	Is the value of the attribute 'VALSOU' given in the calling object?
Is Calling Object UWTROC?	Is the calling object of the class 'UWTROC'?
'WATLEV' == 3?	Is the value of the attribute 'WATLEV' equal to '3' given in the calling object?
SELECT= 'UWTROC03'	Select symbol name SELECT='UWTROC03'
SELECT= 'UWTROC04'	Select symbol name SELECT='UWTROC04' by default.
'CATOBS' == 6?	Calling object must be of the class 'OBSTRN'. Is the value of the attribute 'CATOBS' equal to '6' given in the calling object?
SELECT= 'OBSTRN01'	Select symbol name SELECT='OBSTRN01', if 'CATOBS'=6 (foul area) OR WATLEV=no equal to 1,2,4 OR 5.
'WATLEV' == 4 || 5?	Is the value of the attribute 'WATLEV' equal to '4' or '5' given in the calling object?
SELECT= 'UWTROC04'; SOUNDING=FALSE	if 'WATLEV'=4 (covers and uncovers) OR 'WATLEV'=5 (awash)then select symbol name SELECT='UWTROC04' and set the local variable 'SOUNDING' equal to FALSE
SELECT= 'DANGER01'; SOUNDING=TRUE	If attribute 'WATLEV' has any value except 4 and 5, <unknown> or missed then select symbol name SELECT='DANGER01' and set the local variable 'SOUNDING' equal to TRUE
'CATOBS' == 6?	Calling object must be of the class 'OBSTRN'. Is the value of the attribute 'CATOBS' equal to '6' given in the calling object?
'WATLEV' == 1 || 2?	Is the value of the attribute 'WATLEV' equal to '1' or '2' given in the calling object?
SELECT= 'OBSTRN11'	Select symbol name SELECT='OBSTRN11' if 'WATLEV'=1 (partially submerged of HW) or 2 (always dry).
'WATLEV' == 4 || 5?	Is the value of the attribute 'WATLEV' equal to '4' or '5' given in the calling object?
SELECT= 'OBSTRN03'	Select symbol name SELECT='OBSTRN03' if 'WATLEV'=4 (covers and uncovers) or 5 (awash).
'VALSOU' <= SAFETY DEPTH?	Is the value of the attribute 'VALSOU' less than or equal to SAFETY DEPTH?
SELECT= 'DANGER02'; SOUNDING=TRUE	Select symbol name SELECT='DANGER02' and set the local variable 'SOUNDING' equal to TRUE
Is Calling Object UWTROC?	Is the calling object of the class 'UWTROC'?
'WATLEV' == 1 || 2?	Is the value of the attribute 'WATLEV' equal to '1' or '2' given in the calling object?
SELECT='OBSTRN11'; SOUNDING=FALSE	Select symbol name SELECT='OBSTRN11' 'if 'WATLEV'=1 (partially submerged of HW) or 2 (always dry). Set the local variable 'SOUNDING' equal to FALSE

'WATLEV' == 4 || 5?	Is the value of the attribute 'WATLEV' equal to '4' or '5' given in the calling object?
SELECT='DANGER03'; SOUNDING=TRUE	Select symbol name SELECT='DANGER03' 'if 'WATLEV'=(covers and uncovers) or 5 (awash). Set the local variable 'SOUNDING' equal to TRUE
SELECT='DANGER01'; SOUNDING=TRUE	Select symbol name SELECT='DANGER01' and set the local variable 'SOUNDING' equal to TRUE if 'CATOBS' equal to '6' (foul area) or 'WATLEV' no equal to 1,2,4 OR 5.
SY(SELECT)	Draw the selected symbol at the calling object's location.
SOUNDING ==TRUE?	is the local variable 'SOUNDING' equal to TRUE
SNDFRM04 (DEPTH_VALUE)	Perform the symbology sub-procedure which returns a list of sounding symbols. Pass 'DEPTH_VALUE' on to it. Remember the SOUNDING SYMBOL(S)
DEPTH_VALUE	Input parameter
Sounding Symbols List	Output parameter
Draw Sounding Symbol(s)	Draw the sounding symbol(s) returned from 'SNDFRM03' at the calling object's location.
Does 'QUAPNT02' return 'LOWACC01'?	Is the symbol 'LOWACC01' selected by the procedure 'QUAPNT02'?
SY(LOWACC01)	If so indicated by the procedure 'QUAPNT02', draw the returned low accuracy symbol 'LOWACC01' at the calling object's location.
Exit procedure	Symbolization is finished

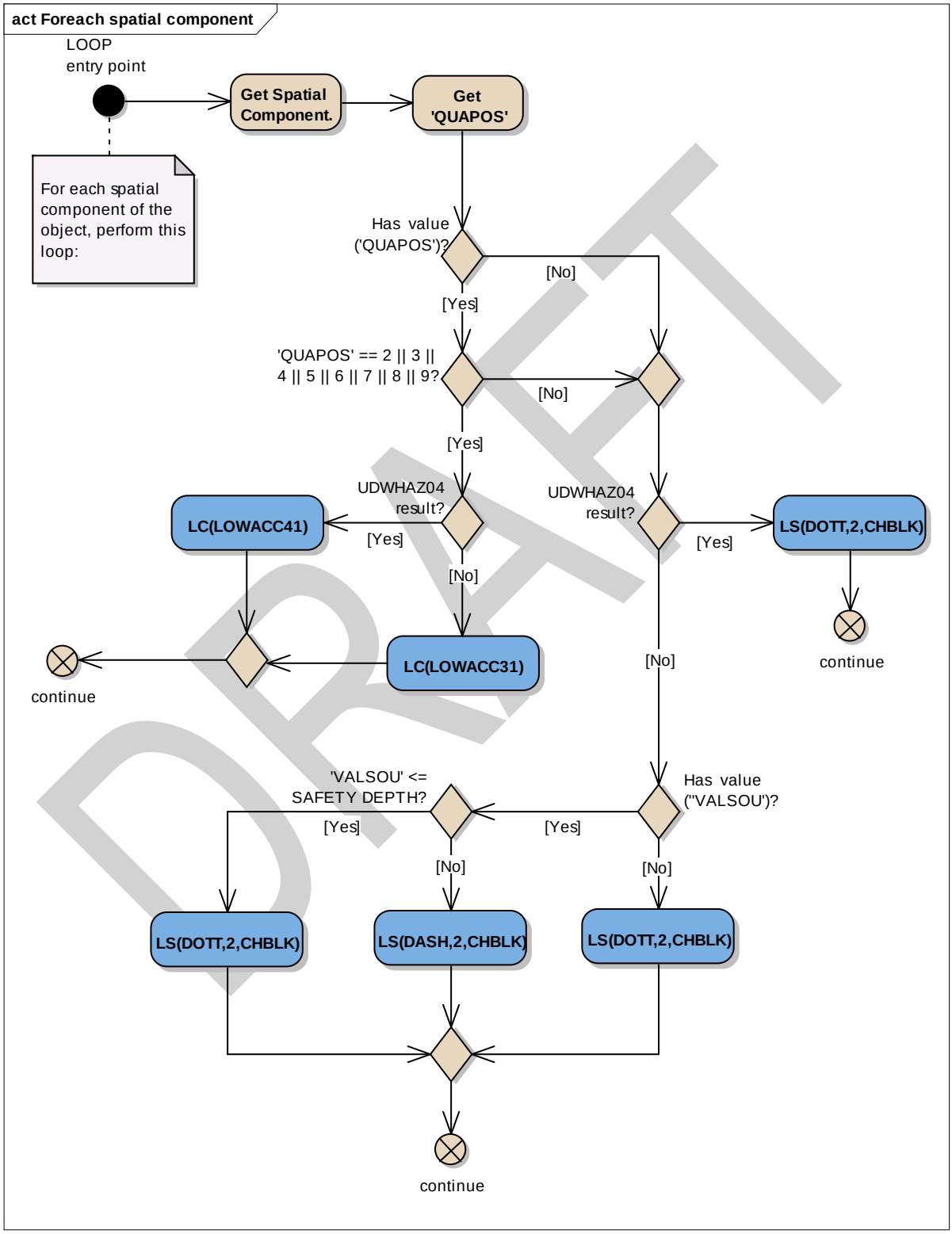
Figure 12 OBSTRN07 Continuation BLine objects, obstructions (OBSTRN)



Entry point	Entry to the continuation of symbology procedure with a line object, obstructions (OBSTRN)
Loop for each spatial component	Setup - The Calling Object & Results of CSP 'UDWHAZ05' Test - While there is unprocessed spatial component Body - to symbolize a spatial component if it is needed. See Figure Loop for each spatial component of the object
UDWHAZ05 result?	Has the procedure 'UDWHAZ05' indicated the Isolated danger symbol shall be shown?
SY(ISODGR01)	Draw isolated danger symbol 'ISODRG01' at the midpoint of the line with the set presentation parameters selected by 'UDWHAZ05' CSP
Has value ('VALSOU')?	Is the value of the attribute 'VALSOU' given?
SNDFRM04 (DEPTH_VALUE)	Perform the symbology sub-procedure which returns a list of sounding symbols. Pass 'DEPTH_VALUE' on to it. Remember the SOUNDING SYMBOL(S)
DEPTH_VALUE	Input parameter
Sounding Symbols List	Output parameter

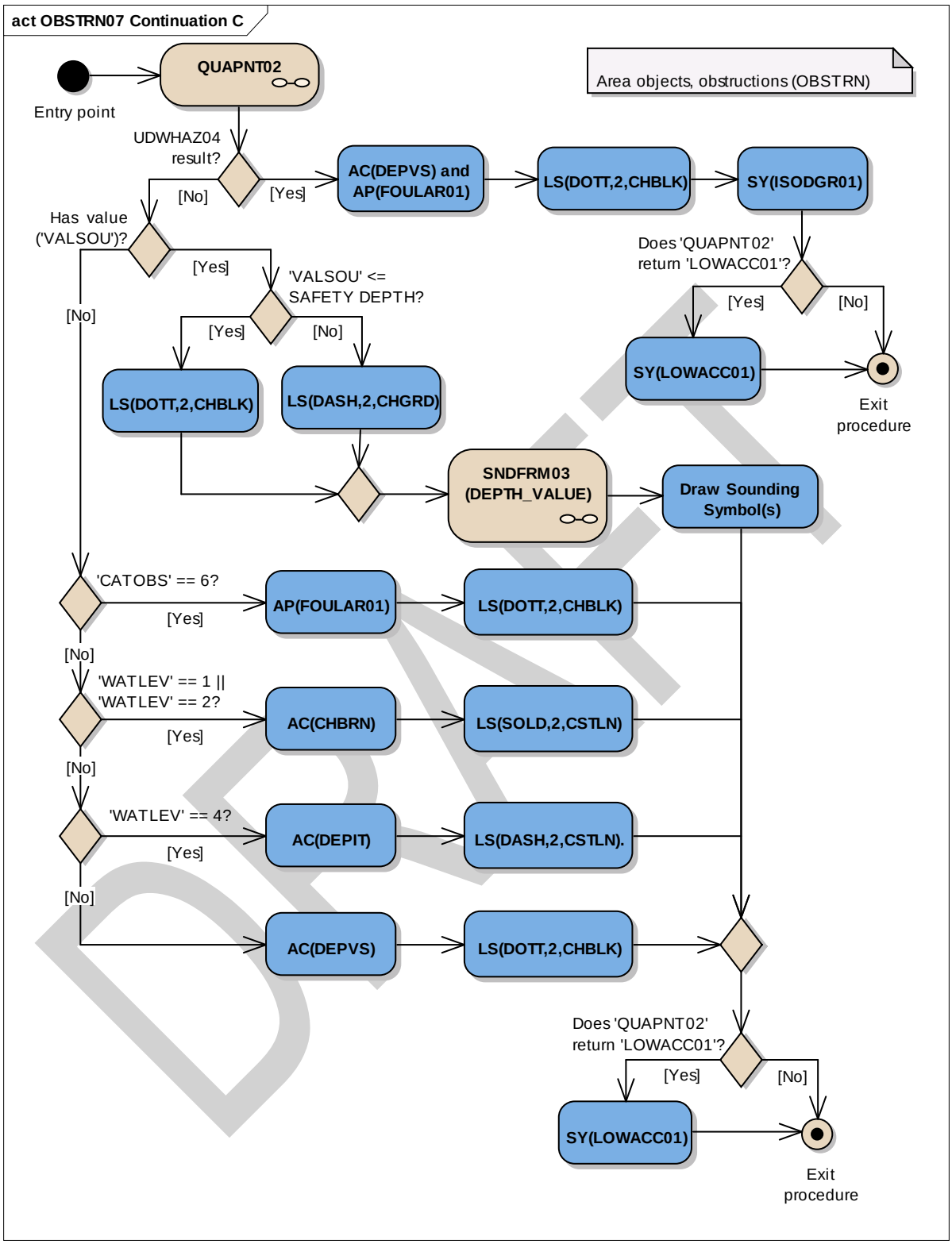
Draw Sounding Symbol(s)	Draw the sounding symbol(s) returned from 'SNDFRM04' at the middle point of the line.
Exist procedure	Symbolization is finished

Figure 13 Loop for each spatial component of the object



LOOP entry point	For each spatial component of this object, perform this loop.
Get Spatial Component.	Get next spatial component of the calling object.
Get 'QUAPOS'	Get the value of the attribute 'Quality of position' (QUAPOS) of the current spatial component
Has value ('QUAPOS')?	Is the value of the attribute 'QUAPOS' given?
'QUAPOS' == 2 || 3 || 4 || 5 || 6 || 7 || 8 || 9?	Does the value of the attribute 'QUAPOS' equal to one of the following values: '2', '3', '4', '5', '6', '7', '8' or '9'?
UDWHAZ05 result?	Has the procedure 'UDWHAZ05' indicated the isolated danger symbol shall be shown?
LC(LOWACC41)	Draw the line with a complex line style 'LOWACC41' at the spatial component with the set presentation parameters selected by 'UDWHAZ05' CSP
LC(LOWACC31)	Draw the line with a complex line style 'LOWACC31' at the spatial component
continue	Go to the next spatial component
UDWHAZ05 result?	Has the procedure 'UDWHAZ05' indicated the isolated danger symbol shall be shown?
LS(DOTT,2,CHBLK)	Draw the line with a dotted line, 2 units wide, colour 'CHBLK' at the spatial component with the set presentation parameters selected by 'UDWHAZ05' CSP
Has value (''VALSOU')?	Is the value of the attribute 'VALSOU' given in the calling object?
LS(DOTT,2,CHBLK)	Draw the line with a dotted line, 2 units wide, colour 'CHBLK' at the spatial component.
'VALSOU' <= SAFETY DEPTH?	Is the value of the attribute 'VALSOU' less than or equal to SAFETY DEPTH?
LS(DOTT,2,CHBLK)	Draw the line with a dotted line, 2 units wide, colour 'CHBLK' at the spatial component
LS(DASH,2,CHBLK)	Draw the line with a dashed line, 2 units wide, colour 'CHBLK' at the spatial component.
continue	Go to the next spatial component

Figure 14 OBSTRN07 Continuation CArea objects, obstructions (OBSTRN)



Entry point	Entry to the continuation of symbology procedure with an area object, obstructions (OBSTRN)
QUAPNT02	Performs the symbology sub-procedure 'QUAPNT02' which returns a flag indicating whether or not to display the LOW ACCURACY SYMBOL and returns the selected symbol.
UDWHAZ05 result?	Has the procedure 'UDWHAZ05' indicated the Isolated danger

	symbol shall be shown?
AC(DEPVS) and AP(FOULAR01)	Draw the area object with an opaque colour fill with the colour 'DEPVS', and the area pattern 'FOULAR01' with the set presentation parameters selected by 'UDWHAZ05' CSP
LS(DOTT,2,CHBLK)	Draw the area boundary as a dotted line, 2 units wide, in the colour 'CHBLK' with the set presentation parameters selected by 'UDWHAZ05' CSP
SY(ISODGR01)	Draw the isolated symbol 'ISODGR01' with the set presentation parameters returned by 'UDWHAZ05' in the centre of the area.
Does 'QUAPNT02' return 'LOWACC01'?	Is the symbol 'LOWACC01' selected by the procedure 'QUAPNT02'?
SY(LOWACC01)	If so indicated by the procedure 'QUAPNT02', draw the returned low accuracy symbol 'LOWACC01' in the centre of the area with the set presentation parameters selected by 'UDWHAZ05' CSP
Exit procedure	Symbolization is finished
Has value ('VALSOU')?	Is the value of the attribute 'VALSOU' given?
'VALSOU' <= SAFETY DEPTH?	Is the value of the attribute 'VALSOU' less than or equal to SAFETY DEPTH?
LS(DOTT,2,CHBLK)	Draw the area boundary as a dotted line, 2 units wide, in the colour 'CHBLK'.
LS(DASH,2,CHGRD)	Draw the area boundary as a dashed line, 2 units wide, in the colour 'CHGRD'.
SNDFRM04 (DEPTH_VALUE)	Perform the Symbology Procedure which returns a list of sounding symbols. Pass 'DEPTH_VALUE' on to it. Remember the SOUNDING SYMBOL(S)
DEPTH_VALUE	Input parameter
Sounding Symbols List	Output parameter
Draw Sounding Symbol(s)	Draw the sounding symbol(s) returned from 'SNDFRM03' in the centre of the area
'CATOBS' == 6?	Is the value of attribute 'CATOBS' equal to '6' (foul area)?
AP(FOULAR01)	Draw the area object with the area pattern 'FOULAR01'.
LS(DOTT,2,CHBLK)	Draw the area boundary as a dotted line, 2 units wide, in the colour 'CHBLK' LS(DOTT, 2, CHBLK).
'WATLEV' == 1 || 'WATLEV' == 2?	Is the value of attribute 'WATLEV' equal to '1' (partly submerged at HW) or '2' (always dry)?
AC(CHBRN)	Draw the area object with an opaque colour fill with the colour 'CHBRN'
LS(SOLD,2,CSTLN)	Draw the area boundary as solid line, 2 units wide, in the colour 'CSTLN' LS(SOLD, 2, CSTLN).
'WATLEV' == 4?	Is the value of attribute 'WATLEV' equal to '4' (covers and uncovers)?
AC(DEPIT)	Draw the area object with an opaque colour fill with the colour 'DEPIT'
LS(DASH,2,CSTLN).	Draw the area boundary as a dashed line, 2 units wide, in the colour 'CSTLN' LS(DASH, 2, CSTLN).
AC(DEPVS)	Draw the area object with an opaque colour fill with the colour 'DEPVS'
LS(DOTT,2,CHBLK)	Draw the area boundary as a dotted line, 2 units wide, in the colour 'CHBLK' LS(DOTT, 2, CHBLK).
Does 'QUAPNT02' return 'LOWACC01'?	Is the symbol 'LOWACC01' selected by the procedure 'QUAPNT02'?
SY(LOWACC01)	If so indicated by the procedure 'QUAPNT02' draw the returned low accuracy symbol at the centre of the area.
Exit procedure	Symbolization is finished

13.2.6 Conditional Symbology Procedure QUAPOS01

Applies to: S-57 Object Class "land area" (LNDARE), as point and line;
S-57 Object Class “coast line” (COALNE), line only;

Spatial Object(s): Point, Line

Attribute(s) used: Spatial attribute QUAPOS

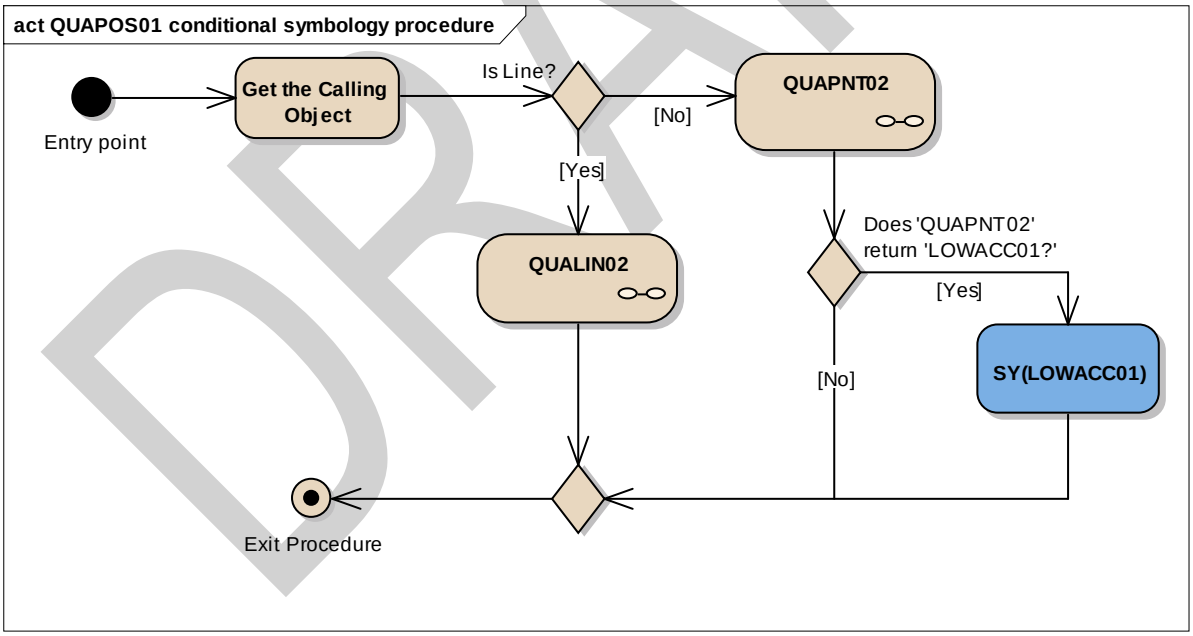
Parameter(s): Object to be symbolized from SENC

User Parameters: Show low accuracy symbol.

Defaults: Symbolization given by the look-up table;
Display Priority given by look-up table;
OVERRADAR priority given by look-up table;
Display Category given by look-up table;
Viewing Group given by look-up table

Remarks: The attribute QUAPOS, which identifies low positional accuracy, is attached to the spatial object, not the feature object. This procedure passes the object to procedure QUALINnn or QUAPNTnn, which examines the spatial attributes, and returns the appropriate symbolization to QUAPOSnn.

Figure 15 QUAPOS01 conditional symbology procedure



Entry point	Entry to the symbology procedure.
Get the Calling Object	Get the object which is calling this procedure.
Is Line?	Is the calling object of type line?
QUALIN01	Perform the symbology sub-procedure 'QUALIN01' which symbolizes lines based on the spatial object's attribute 'QUAPOS' , see “13.2.7 Conditional Symbology Procedure QUALIN0”
Calling Object	- input parameter
QUAPNT02	Perform the symbology sub-procedure 'QUAPNT02' which returns a flag indicating whether or not to display the low accuracy symbol and

Calling Object LOWACC01	returns the selected symbol 'LOWACC01', see “13.2.8 Conditional Symbology Procedure QUAPNT02”
	- input parameter
	- output parameter
Does 'QUAPNT02' return 'LOWACC01?'	Is the symbol 'LOWACC01' selected by the procedure 'QUAPNT02'?
SY(LOWACC01)	Draw the low accuracy symbol 'LOWACC01' if so indicated by the procedure 'QUAPNT02' at the calling object location.
Exit Procedure	Symbolization is finished

13.2.7 Conditional Symbology Procedure QUALIN01

(Note that this is called as a sub-procedure by QUAPOSnn).

Applies to: S-57 Object Class land area (LNDARE) as line;
S-57 Object Class coastline (COALNE) line only.

Spatial primitive(s): Line;

Spatial operations: Separate a line into its component edges.

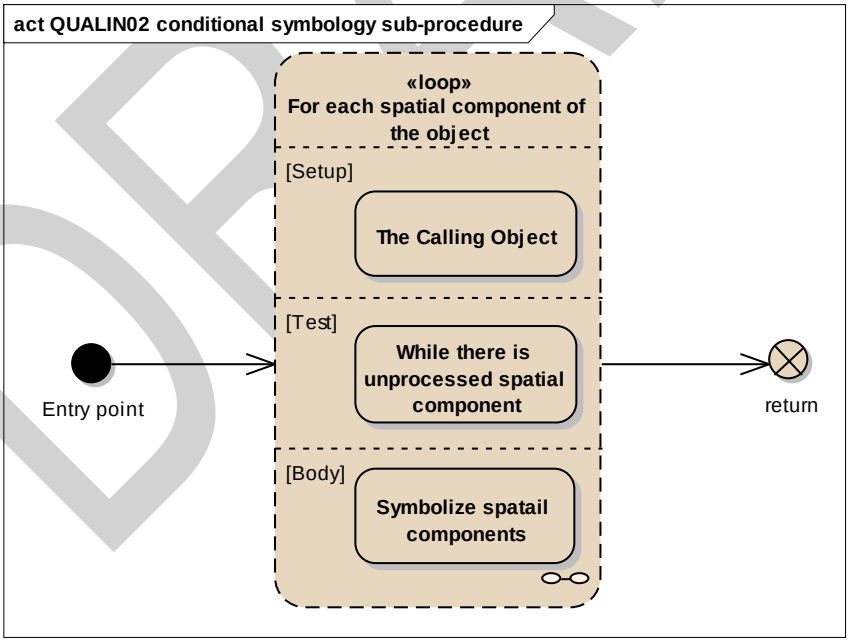
Attribute(s) used: Spatial attribute QUAPOS

Parameter(s): Object to be symbolised from SENC.

Defaults: Display Priority given by look-up table;
OVERRADAR priority given by look-up table;
Display Category given by look-up table;
Viewing Group given by look-up table;

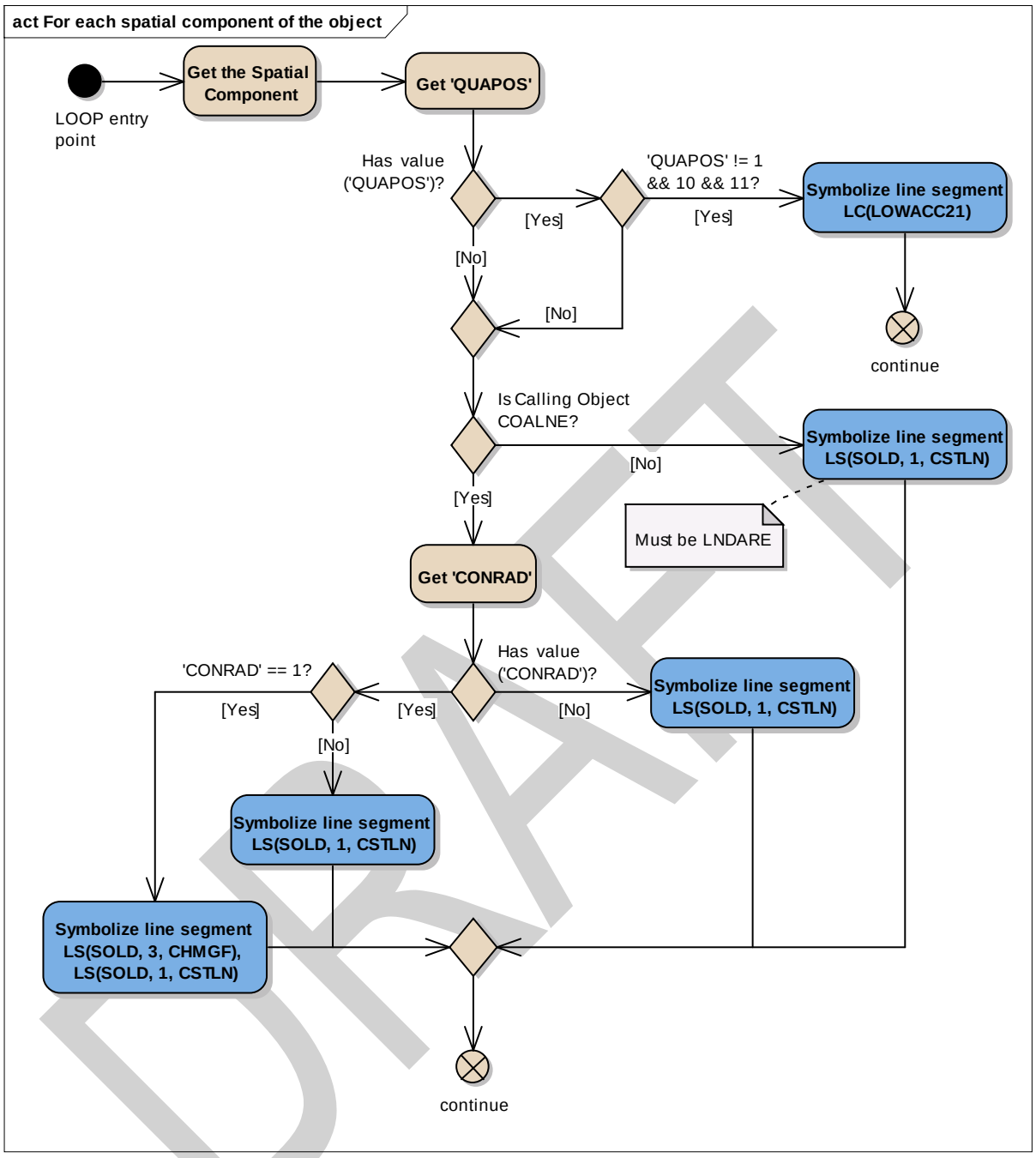
Remarks: The attribute QUAPOS, which identifies low positional accuracy, is attached only to the spatial component(s) of an object. A line object may be composed of more than one spatial components. This procedure looks at each of the spatial components, and symbolizes the line according to the positional accuracy.

Figure 16 QUALIN01 conditional symbology sub-procedure



Entry point	Entry from the main conditional procedure 'QUAPOS01' with the calling object
Loop for each spatial component of the object	Loop for each spatial component of the object Setup - The Calling Object Test - While there is unprocessed spatial component Body - Symbolize spatial components if it is needed.
return	Return to the calling procedure 'QUAPOS01'

Figure 17 Loop for each spatial component of the object



LOOP entry point	For each spatial component of this object, perform this loop.
Get the Spatial Component	Get the next spatial component (edge) of the calling object.
Get 'QUAPOS'	Get the value of the attribute 'Quality of position' (QUAPOS) of the current spatial component
Has value ('QUAPOS')?	Is the value of the attribute 'QUAPOS' given?
'QUAPOS' != 1 && 10 && 11?	Does the value of attribute 'QUAPOS' equal to neither of the following values: '1', '10', and '11'?
Symbolize line segment LC(LOWACC21)	Symbolize the line segment (edge) with the pattern line 'LOWACC21'
continue	go to the next spatial component of the calling object
Is Calling Object COALNE?	Is the calling objects of class COALNE?

Symbolize line segment LS(SOLD, 1, CSTLN)	Symbolize the line segment (edge) with a solid line, 1 unit wide, colour 'CSTLN'
Get 'CONRAD'	Get the value of the attribute 'Conspicuous, radar' (CONRAD) of the calling object
Has value ('CONRAD')?	Is the value of the attribute 'CONRAD' given?
Symbolize line segment LS(SOLD, 1, CSTLN)	Symbolize the line segment (edge) with a solid line, 1 unit wide, colour 'CSTLN'
'CONRAD' == 1?	Does the value of the attribute 'CONRAD' equal to '1' (radar consp.)?
Symbolize line segment LS(SOLD, 1, CSTLN)	Symbolize the line segment (edge) with a solid line, 1 unit wide, colour 'CSTLN'
Symbolize line segment LS(SOLD, 3, CHMGF), LS(SOLD, 1, CSTLN)	Symbolize the line segment (edge) with a solid line, 3 units wide, colour 'CHMGF' and symbolize the same line segment (edge) with a solid line, 1 unit wide, colour 'CSTLN'
continue	go to the next spatial component of the calling object

13.2.8 Conditional Symbology Procedure QUAPNT02

Quality of position of point and area objects (S-57) Conditional Symbology Procedure for additional symbology for point and area objects when positional accuracy is low. (Note that this is called as a sub-procedure by OBSTRNnn, QUAPOSnn, SLCONSnn, WRECKSnn).

Applies to: S-57 Object Class "Land area" (LNDARE) as point;
S-57 Object Class "Obstruction" (OBSTRN) as point and area;
S-57 Object Class "Shoreline construction" (SLCONS) as point;
S-57 Object Class "Wrecks" (WRECKS) as point and area.
S-57 Object Class "Under water rock" (UWTROC) as point.

Spatial Object(s): Point, Area.

Attribute(s) used: Spatial attribute QUAPOS

Parameter(s): Object to be symbolized from SENC.

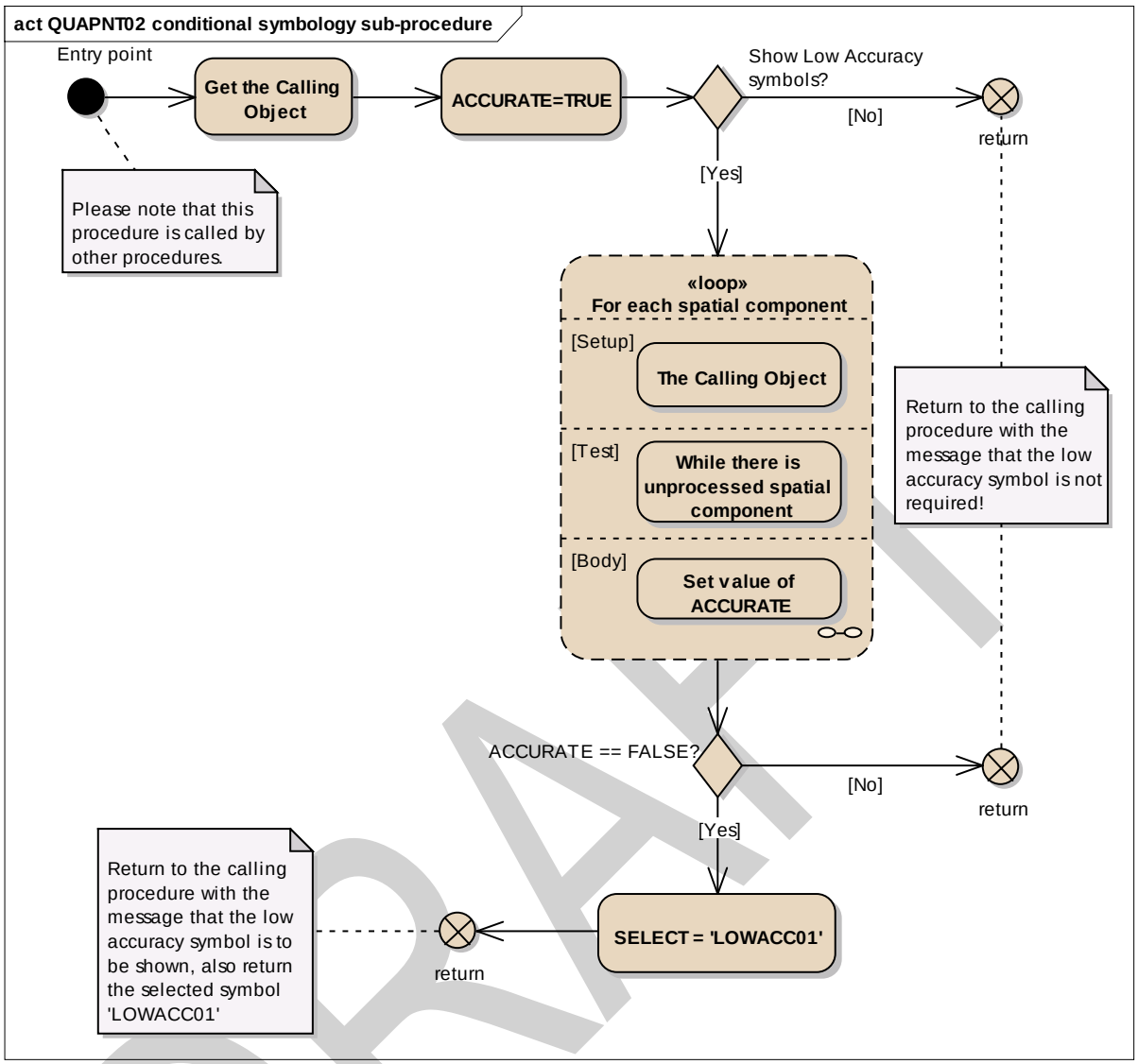
User Parameters: View low accuracy symbols.

Defaults: Symbolization given by the look-up table:
Display Priority given by look-up table;
OVERRADAR priority given by look-up table;
Display Category given by look-up table;
Viewing Group given by look-up table

Remarks: The attribute QUAPOS, which identifies low positional accuracy, is attached only to the spatial component(s) of an object.

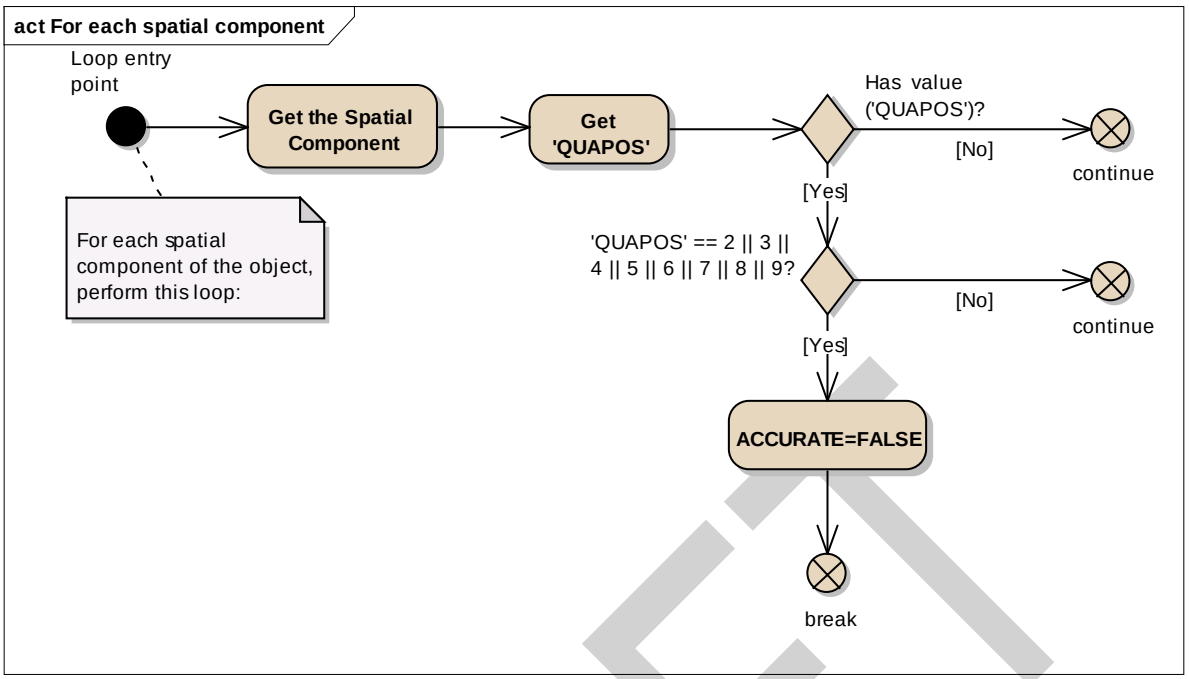
This procedure checks whether the mariner has requested that the symbol SY(LOWACC01) is to be shown; retrieves any QUAPOS attributes; and returns the appropriate symbols to the calling procedure.

Figure 18 QUAPNT02 conditional symbology sub-procedure



Entry point	Entry from the calling conditional procedure.
Get the Calling Object	Get the object which is calling this procedure.
ACCURATE=TRUE	Set local variable 'ACCURATE' equal to true.
Show Low Accuracy symbols?	Has the mariner chosen to view the low accuracy symbols (LOWACC01) (i.e. viewing group equals 31011)?
return	If 'No', return to the calling procedure with the message that the low accuracy symbol is not required!
Loop for each spatial component	For each spatial component of the object perform this loop
ACCURATE == FALSE?	Is the local variable 'ACCURATE' set to 'FALSE?
return	If 'No', return to the calling procedure with the message that the low accuracy symbol is not required.
SELECT = 'LOWACC01'	Select the 'Low Accuracy' symbol 'LOWACC01' Return to the calling procedure.
return	Return to the calling procedure with the message that the low accuracy symbol is to be shown, also return the selected symbol 'LOWACC01'.

Figure 19 Loop for each spatial component



Loop entry point	For each spatial component of the object, perform this loop:
Get the Spatial Component	Get the next spatial component of the calling object.
Get 'QUAPOS'	Get the value of the attribute 'Quality of position' (QUAPOS) of the current spatial component
Has value ('QUAPOS')?	Is the value of the attribute 'QUAPOS' given?
continue	If 'No', go to the next spatial component of the calling object.
'QUAPOS' == 2 || 3 || 4 || 5 || 6 || 7 || 8 || 9?	Does the value of the attribute 'QUAPOS' equal to one of the following values: '2', '3', '4', '5', '6', '7', '8' or '9'?
continue	If 'No', go to the next spatial component of the calling object.
ACCURATE=FALSE	Set local variable 'ACCURATE'='FALSE'.
break	Loop by spatial components

13.2.9 Conditional Symbology Procedure RESARE04

Applies to: S-57 objects of class Restricted Area (RESARE)

Spatial Object(s): Area

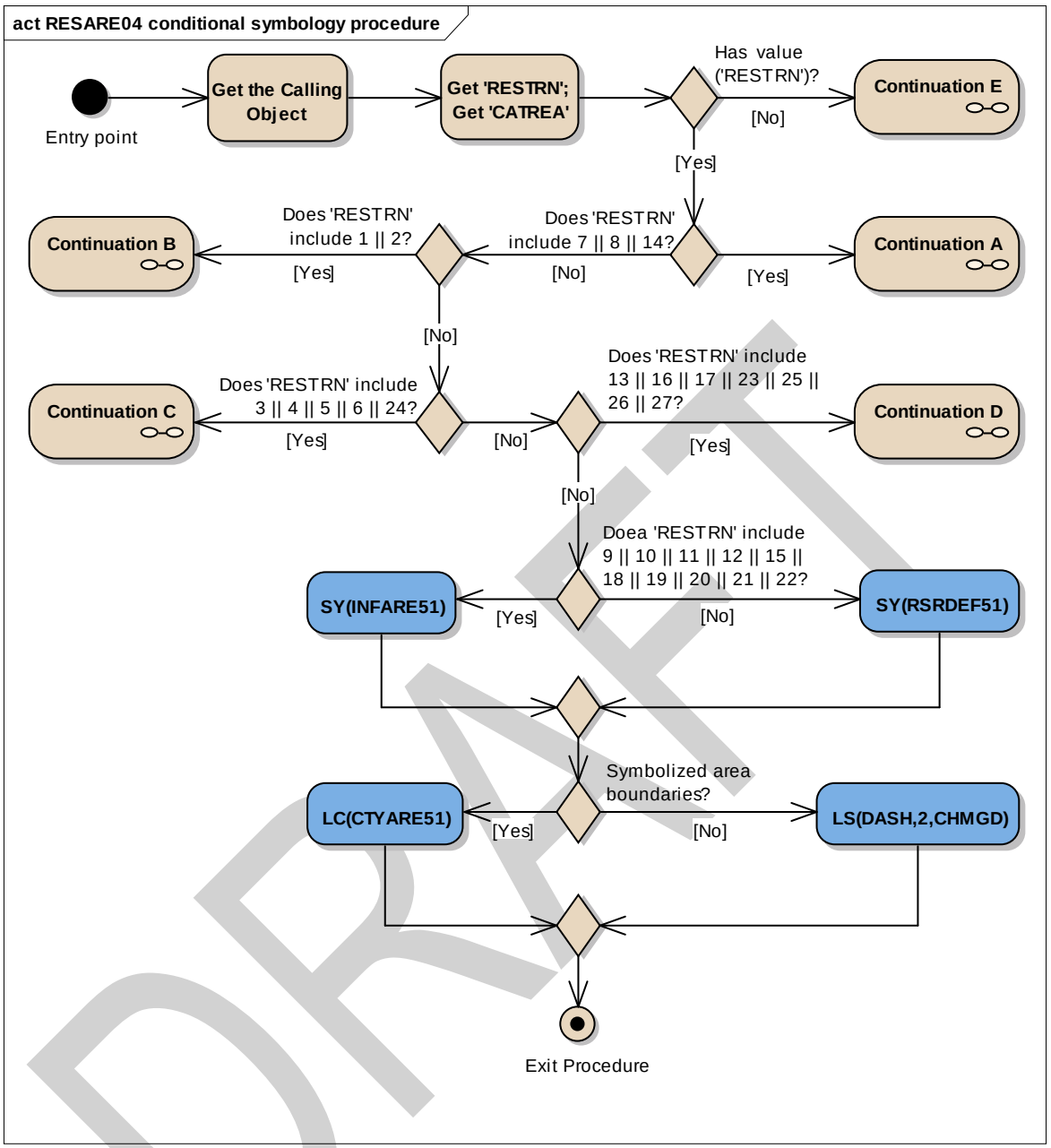
Attribute(s) used: CATREA, RESTRN (List-type)

User Parameters: “Symbolized Area Boundaries”.

Defaults: Display priority given by look-up table;
OVERRADAR priority given by look-up table;
Display category given by look-up table;
Viewing group given by look-up table.

Remarks: A list-type attribute is used because an area of the object class RESARE may have more than one category attribute (CATREA). For example an inshore traffic zone might also have fishing and anchoring prohibition and a prohibited area might also be a bird sanctuary or a mine field.
This conditional procedure is set up to ensure that the categories of most importance to safe navigation are prominently symbolized, and to pass on all given information with minimum clutter. Only the most significant restriction is symbolized, and an indication of further limitations is given by a subscript "!" or "i". Further details are given under conditional symbology procedure RESTRNnn.
Other object classes with attribute RESTRN are handled by conditional symbology procedure RESTRNnn.

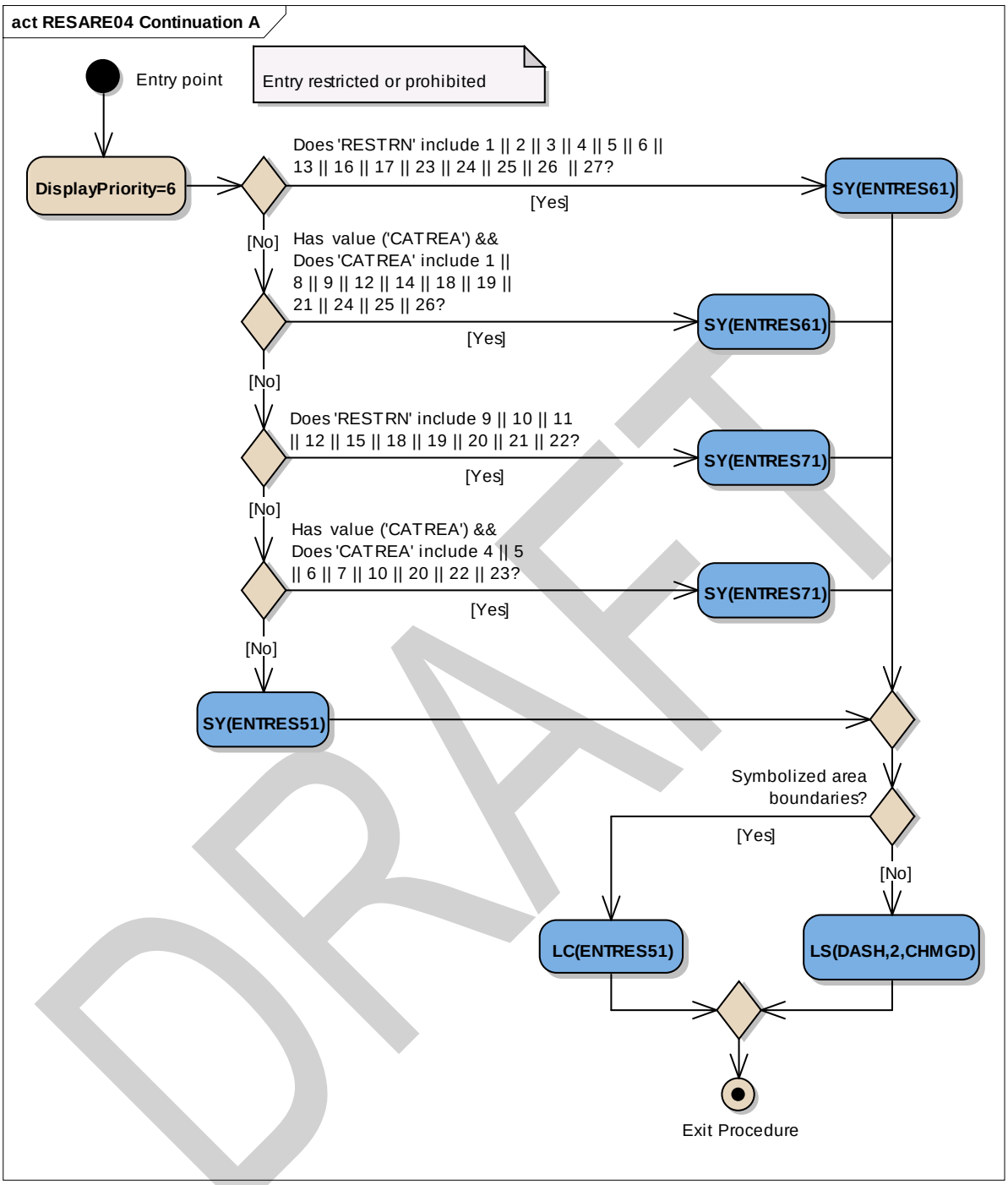
Figure 20 RESARE04 conditional symbology procedure



Entry point	Entry to the symbology procedure.
Get the Calling Object	Get the object which is calling this procedure.
Get 'RESTRN'; Get 'CATREA'	Get the values of the attributes 'Restriction' (RESTRN) and 'Category of restricted area' (CATREA) from the calling object
Has value ('RESTRN')?	Is the value of the attribute 'RESTRN' given?
Continuation E	If 'No', RESARE04 Continuation E. See Figure
Does 'RESTRN' include 7 || 8 || 14?	Does the value of the attribute 'RESTRN' include '7' (entry prohibited) and/or '8' (entry restricted) and/or '14' (area to be avoided)?
Continuation A	RESARE04 Continuation A
Does 'RESTRN' include 1 || 2?	Does the value of the attribute 'RESTRN' include '1' (anchoring prohibited) and/or '2' (anchoring restricted)?
Continuation B	RESARE04 Continuation B

Does 'RESTRN' include 3 || 4 || 5 || 6 || 24?	Does the value of the attribute 'RESTRN' include '3' (fishing prohibited) and/or '4' (fishing restricted) and/or '5' (trawling prohibited) and/or 6 (trawling restricted) and/or '24' (dragging prohibited)?
Continuation C	RESARE04 Continuation C
Does 'RESTRN' include 13 || 16 || 17 || 23 || 25 || 26 || 27?	Does the value of 'RESTRN' include '13' (no wake area) and/or '16' (discharging prohibited) and/or '17' (discharging restricted) and/or '23' (lightering prohibited) and/or '25' (stopping prohibited) and/or '26' (landing prohibited) and/or '27' (speed restricted)?
Continuation D	RESARE04 Continuation D
Does 'RESTRN' include 9 || 10 || 11 || 12 || 15 || 18 || 19 || 20 || 21 || 22?	Does the value of the attribute 'RESTRN' include '9' (dredging prohibited) and/or '10' (dredging restricted) and/or '11' (diving prohibited) and/or '12' (diving restricted) and/or '15' (construction prohibited) and/or '18' (development prohibited) and/or '19' (development restricted) and/or '20' (drilling prohibited) and/or '21' (drilling restricted) and/or '22' (removing artifacts prohibited)?
SY(INFARE51)	Draw the symbol 'INFARE51' in the centre of the visible part of the calling object area.
SY(RSRDEF51)	Draw the symbol 'RSRDEF51' in the centre of the visible part of the calling object area.
Symbolized area boundaries?	Has the mariner selected symbolized area boundaries?
LC(CTYARE51)	Symbolize area boundary with the line pattern 'CTYARE51'.
LS(DASH,2,CHMGD)	Symbolize area boundary with the dash line with width 2 and colour 'CHMGD'.
Exit Procedure	Symbolization is finished.

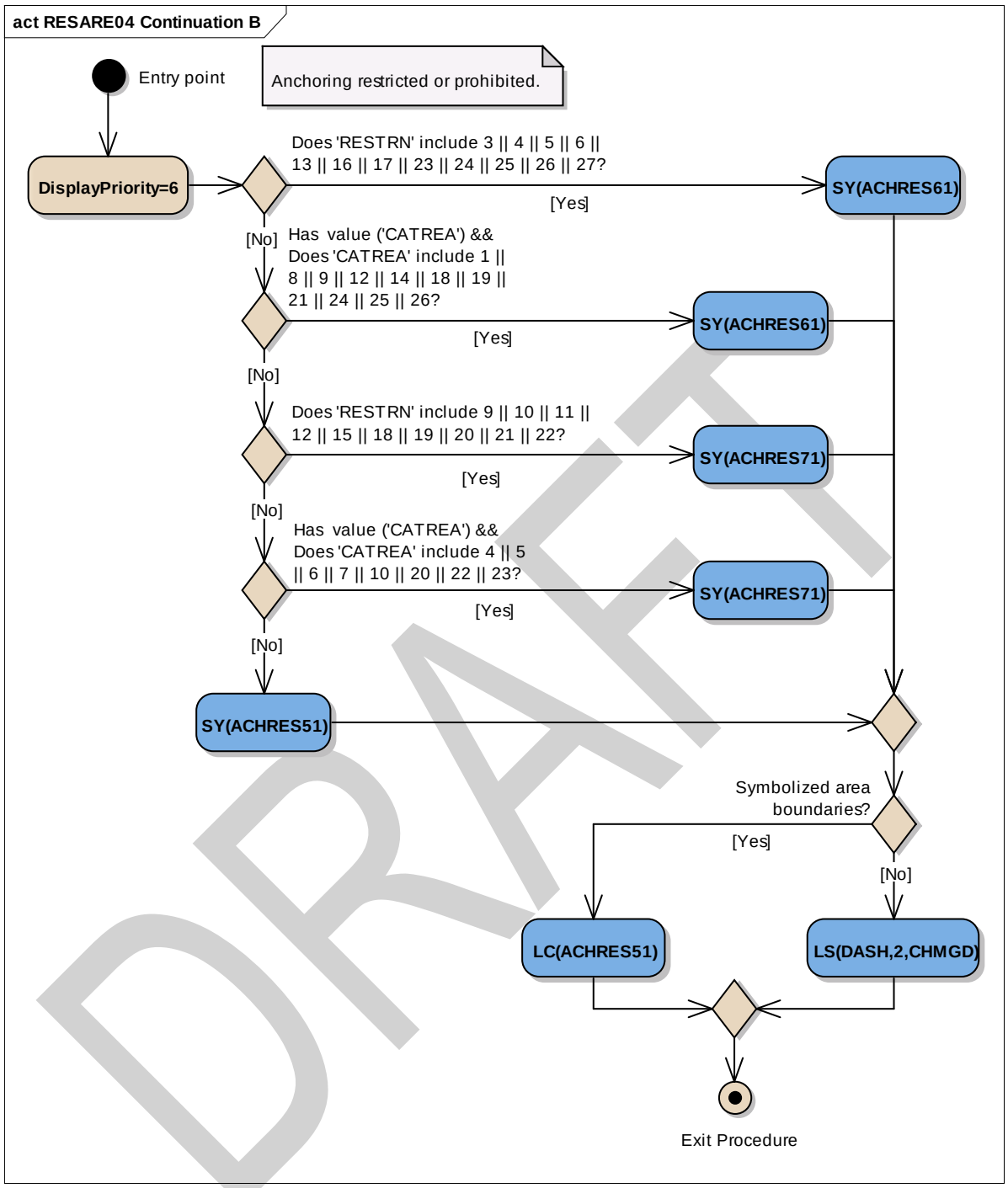
Figure 21 RESARE04 Continuation A. Entry restricted or prohibited



Entry point	The checking of 'Entry Restricted or Prohibited'
DisplayPriority=6	Set 'Display Priority' parameter equal to '6' for the follow-up symbolization.
Does 'RESTRN' include 1 || 2 || 3 || 4 || 5 || 6 || 13 || 16 || 17 || 23 || 24 || 25 || 26 || 27?	Does the value of the attribute 'RESTRN' include '1' (anchoring prohibited) and/or '2' (anchoring restricted) and/or '3' (fishing prohibited) and/or '4' (fishing restricted) and/or '5' (trawling prohibited) and/or '6' (trawling restricted) and/or '13' (no wake area) and/or '16' (discharging prohibited) and/or '17' (discharging restricted) and/or '23' (lightering prohibited) and/or '24' (dragging prohibited) and/or '25' (stopping prohibited) and/or '26' (landing prohibited) and/or '27' (speed restricted)?

SY(ENTRES61)	Draw the symbol 'ENTRES61' in the centre of the visible part of the calling object area.
Has value ('CATREA') && Does 'CATREA' include 1 || 8 || 9 || 12 || 14 || 18 || 19 || 21 || 24 || 25 || 26?	Is the value of the attribute 'CATREA' given and does it include '1' (offshore safety zone) and/or '8' (degaussing area) and/or '9' (military area) and/or '12' (navigation aid safety zone) and/or '14' (minefield) and/or '18' (swimming area) and/or '19' (waiting area) and/or '21' (dredging area) and/or '24' (no wake area) and/or '25' (swinging area) and/or '26' (water skiing area)?
SY(ENTRES61)	Draw the symbol 'ENTRES61' in the centre of the visible part of the calling object area.
Does 'RESTRN' include 9 || 10 || 11 || 12 || 15 || 18 || 19 || 20 || 21 || 22?	Does the value of the attribute 'RESTRN' include '9' (dredging prohibited) and/or '10' (dredging restricted) and/or '11' (diving prohibited) and/or '12' (diving restricted) and/or '15' (construction prohibited) and/or '18' (development prohibited) and/or '19' (development restricted) and/or '20' (drilling prohibited) and/or '21' (drilling restricted) and/or '22' (removing artefacts prohibited)?
SY(ENTRES71)	Draw the symbol 'ENTRES71' in the center of the visible part of the calling object area.
Has value ('CATREA') && Does 'CATREA' include 4 || 5 || 6 || 7 || 10 || 20 || 22 || 23?	Is the value of the attribute 'CATREA' given and does it include '4' (nature reserve) and/or '5' (bird sanctuary) and/or '6' (game preserve) and/or '7' (seal sanctuary) and/or '10' (historic wreck) and/or '20' (research area) and/or '22' (fish sanctuary) and/or '23' (ecological reserve)?
SY(ENTRES71)	Draw the symbol 'ENTRES71' in the centre of the visible part of the calling object area.
SY(ENTRES51)	Draw the symbol 'ENTRES51' in the centre of the visible part of the calling object area.
Symbolized area boundaries?	Has mariner selected Symbolized Area Boundaries?
LC(ENTRES51)	Symbolize area boundary with the pattern line 'ENTRES51'
LS(DASH,2,CHMGD)	Symbolize area boundary with the dash line with the width '2' and colour 'CHMGD'.
Exit Procedure	Symbolization is finished. Exit from procedure.

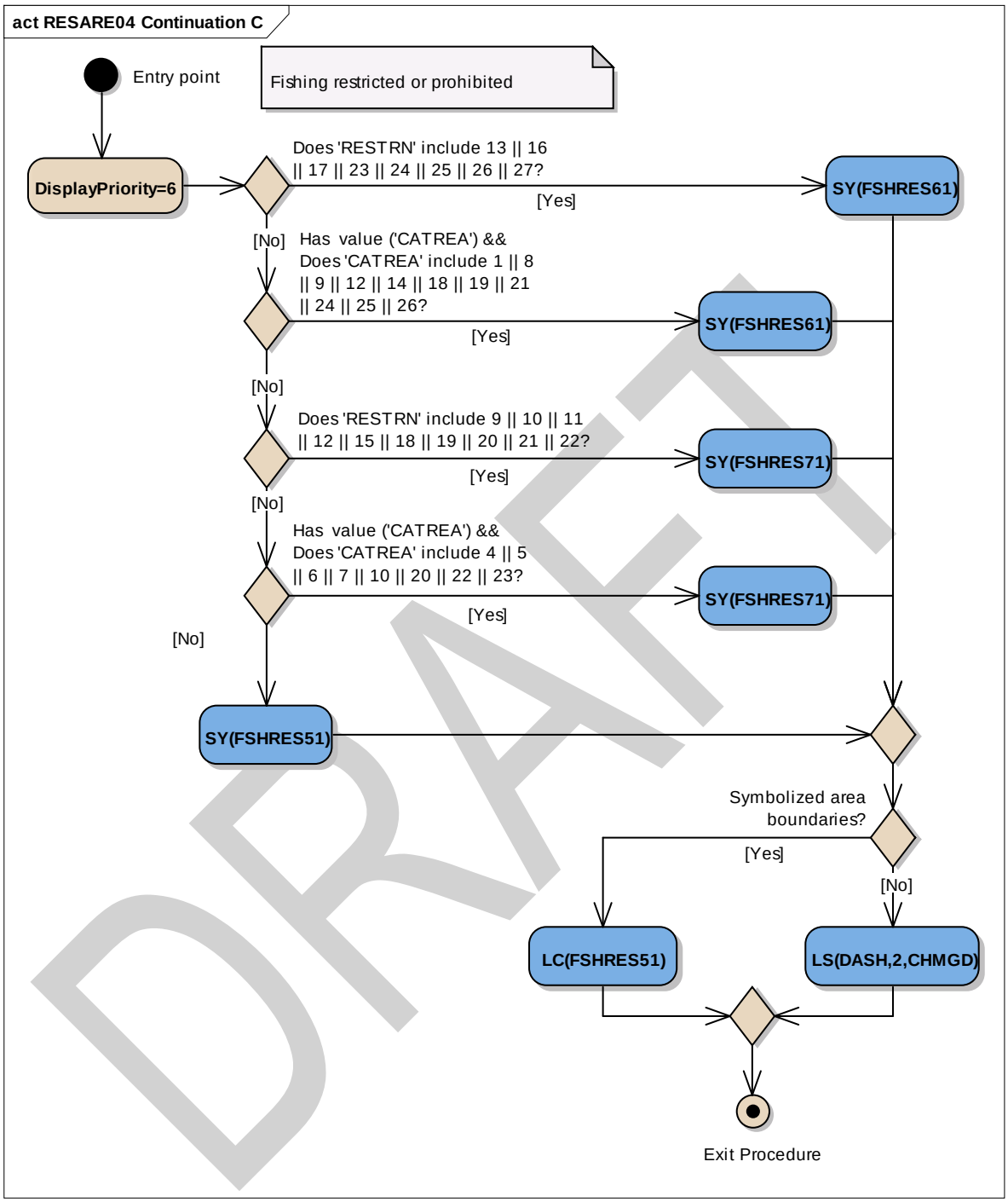
Figure 22 RESARE04 Continuation BAnchoring restricted or prohibited.



Entry point	The checking of 'Anchoring Restricted or Prohibited'.
DisplayPriority=6	Set display priority equal to 6 for the follow-up symbolization.
Does 'RESTRN' include 3 || 4 || 5 || 6 || 13 || 16 || 17 || 23 || 24 || 25 || 26 || 27?	Does the value of the attribute 'RESTRN' include '3' (fishing prohibited) and/or '4' (fishing restricted) and/or '5' (trawling prohibited) and/or '6' (trawling restricted) and/or '13' (no wake area) and/or '16' (discharging prohibited) and/or '17' (discharging restricted) and/or '23' (lightering prohibited) and/or '24' (dragging prohibited) and/or '25' (stopping prohibited) and/or '26' (landing prohibited) and/or '27' (speed restricted)?
SY(ACHRES61)	Draw the symbol 'ACHRES61' in the centre of the visible part of the

	calling object area.
Has value ('CATREA') && Does 'CATREA' include 1 || 8 || 9 || 12 || 14 || 18 || 19 || 21 || 24 || 25 || 26?	Is the value of the attribute 'CATREA' given and does it include '1' (offshore safety zone) and/or '8' (degaussing area) and/or '9' (military area) and/or '12' (navigation aid safety zone) and/or '14' (minefield) and/or '18' (swimming area) and/or '19' (waiting area) and/or '21' (dredging area) and/or '24' (no wake area) and/or '25' (swinging area) and/or '26' (water skiing area)?
SY(ACHRES61)	Draw the symbol 'ACHRES61' in the centre of the visible part of the calling object area.
Does 'RESTRN' include 9 || 10 || 11 || 12 || 15 || 18 || 19 || 20 || 21 || 22?	Does the value of the attribute 'RESTRN' include '9' (dredging prohibited) and/or '10' (dredging restricted) and/or '11' (diving prohibited) and/or '12' (diving restricted) and/or '15' (construction prohibited) and/or '18' (development prohibited) and/or '19' (development restricted) and/or '20' (drilling prohibited) and/or '21' (drilling restricted) and/or '22' (removing artefacts prohibited)?
SY(ACHRES71)	Draw the symbol 'ACHRES71' in the centre of the visible part of the calling object area.
Has value ('CATREA') && Does 'CATREA' include 4 || 5 || 6 || 7 || 10 || 20 || 22 || 23?	Is the value of the attribute 'CATREA' given and does it include '4' (nature reserve) and/or '5' (bird sanctuary) and/or '6' (game preserve) and/or '7' (seal sanctuary) and/or '10' (historic wreck) and/or '20' (research area) and/or '22' (fish sanctuary) and/or '23' (ecological reserve)?
SY(ACHRES71)	Draw the symbol 'ACHRES71' in the centre of the visible part of the calling object area.
SY(ACHRES51)	Draw the symbol 'ACHRES51' in the centre of the visible part of the calling object area.
Symbolized area boundaries?	Has mariner selected Symbolized Area Boundaries?
LC(ACHRES51)	Symbolize area boundary with the pattern line 'ACHRES51'
LS(DASH,2,CHMGD)	Symbolize area boundary with the dash line with the width '2' and the colour 'CHMGD'.
Exit Procedure	Symbolization is finished. Exit from procedure.

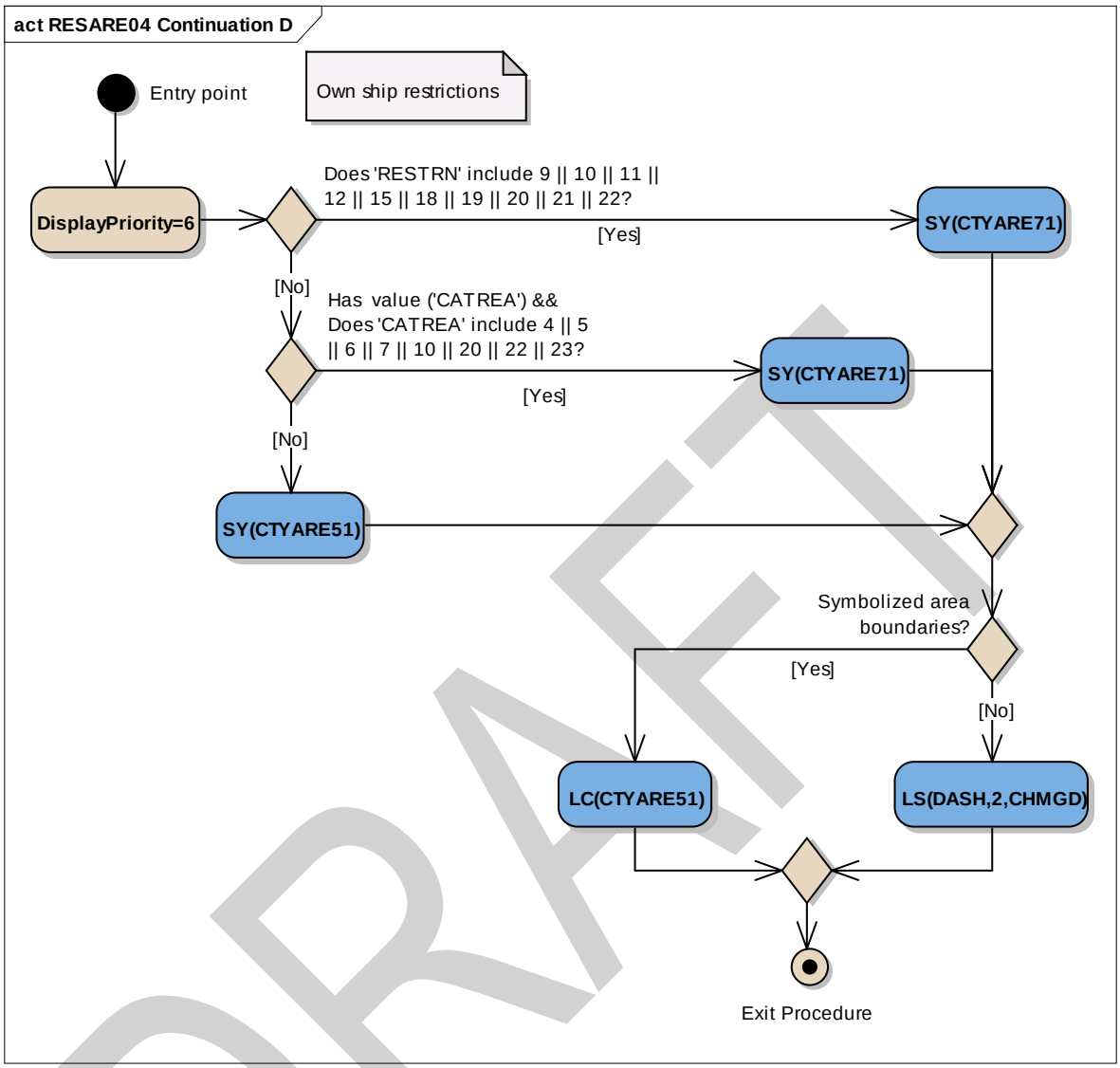
Figure 23 RESARE04 Continuation CFishing restricted or prohibited



Entry point	The checking of Fishing restricted or prohibited
DisplayPriority=6	Set display priority equal to 6 for the follow-up symbolization.
Does 'RESTRN' include 13 || 16 || 17 || 23 || 24 || 25 || 26 || 27?	Does the value of the attribute 'RESTRN' include '13' (no wake area) and/or '16' (discharging prohibited) and/or '17' (discharging restricted) and/or '23' (lightering prohibited) and/or '24' (dragging prohibited) and/or '25' (stopping prohibited) and/or '26' (landing prohibited) and/or '27' (speed restricted)?
SY(FSHRES61)	Draw the symbol 'FSHRES61' in the centre of the visible part of the calling object area.

Has value ('CATREA') && Does 'CATREA' include 1 || 8 || 9 || 12 || 14 || 18 || 19 || 21 || 24 || 25 || 26?	Is the value of the attribute 'CATREA' given and does it include '1' (offshore safety zone) and/or '8' (degaussing area) and/or '9' (military area) and/or '12' (navigation aid safety zone) and/or '14' (minefield) and/or '18' (swimming area) and/or '19' (waiting area) and/or '21' (dredging area) and/or '24' (no wake area) and/or '25' (swinging area) and/or '26' (water skiing area)?
SY(FSHRES61)	Draw the symbol 'FSHRES61' in the centre of the visible part of the calling object area.
Does 'RESTRN' include 9 || 10 || 11 || 12 || 15 || 18 || 19 || 20 || 21 || 22?	Does the value of the attribute 'RESTRN' include '9' (dredging prohibited) and/or '10' (dredging restricted) and/or '11' (diving prohibited) and/or '12' (diving restricted) and/or '15' (construction prohibited) and/or '18' (development prohibited) and/or '19' (development restricted) and/or '20' (drilling prohibited) and/or '21' (drilling restricted) and/or '22' (removing artefacts prohibited)?
SY(FSHRES71)	Draw the symbol 'FSHRES71' in the centre of the visible part of the calling object area.
Has value ('CATREA') && Does 'CATREA' include 4 || 5 || 6 || 7 || 10 || 20 || 22 || 23?	Is the value of the attribute 'CATREA' given and does it include '4' (nature reserve) and/or '5' (bird sanctuary) and/or '6' (game preserve) and/or '7' (seal sanctuary) and/or '10' (historic wreck) and/or '20' (research area) and/or '22' (fish sanctuary) and/or '23' (ecological reserve)?
SY(FSHRES71)	Draw the symbol 'FSHRES71' in the centre of the visible part of the calling object area.
SY(FSHRES51)	Draw the symbol 'FSHRES51' in the centre of the visible part of the calling object area.
Symbolized area boundaries?	Has mariner selected Symbolized Area Boundaries?
LC(FSHRES51)	Symbolize area boundary with the pattern line 'FSHRES51'
LS(DASH,2,CHMGD)	Symbolize area boundary with the dash line with the width '2' and the colour 'CHMGD'.
Exit Procedure	Symbolization is finished. Exit from procedure.

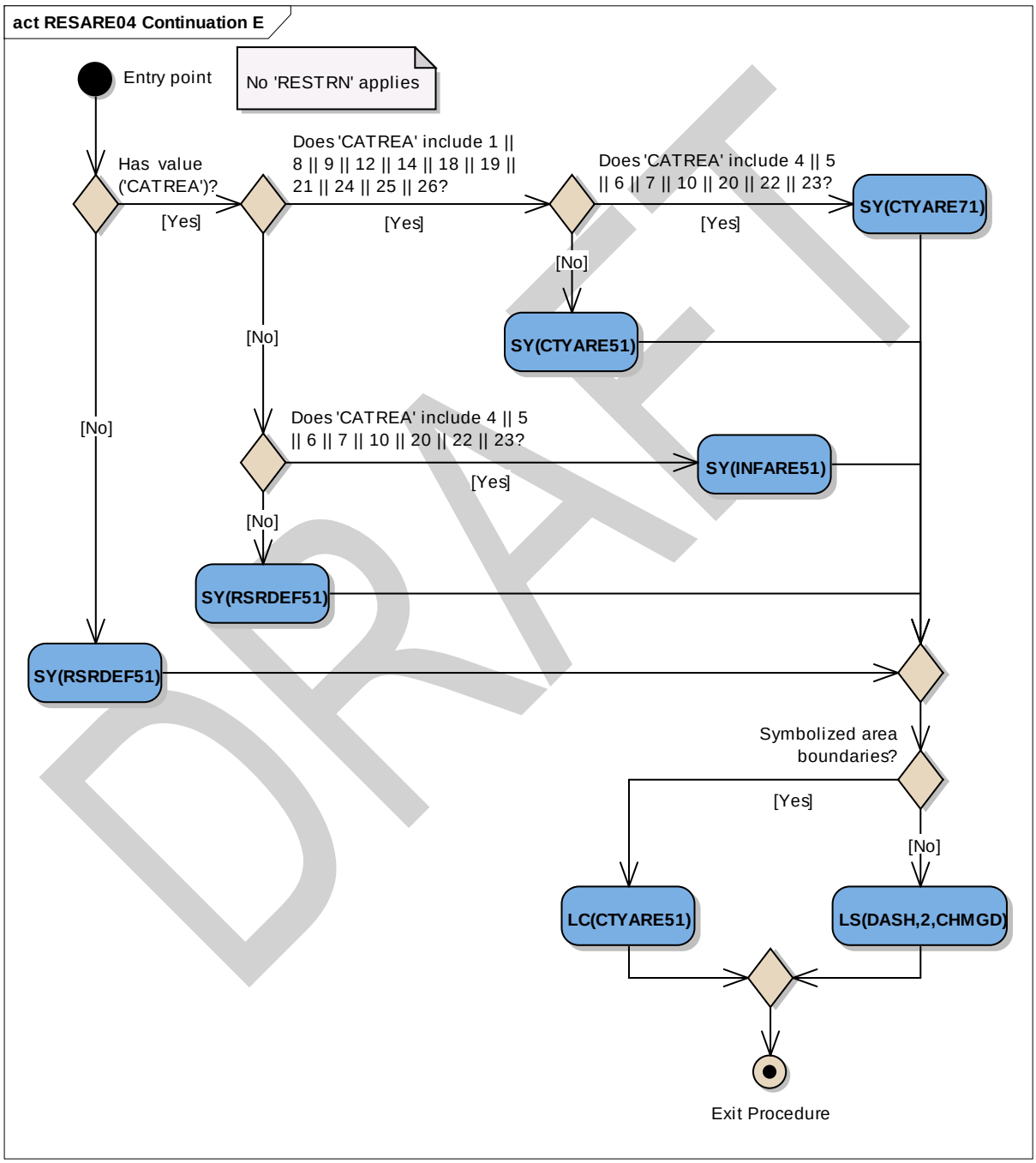
Figure 24 RESARE04 Continuation DOwn ship restrictions



Entry point	The checking of 'Own ship restrictions'
DisplayPriority=6	Set display priority equal to 6 for the follow-up symbolization.
Does 'RESTRN' include 9 || 10 || 11 || 12 || 15 || 18 || 19 || 20 || 21 || 22?	Does the value of the attribute 'RESTRN' include '9' (dredging prohibited) and/or '10' (dredging restricted) and/or '11' (diving prohibited) and/or '12' (diving restricted) and/or '15' (construction prohibited) and/or '18' (development prohibited) and/or '19' (development restricted) and/or '20' (drilling prohibited) and/or '21' (drilling restricted) and/or '22' (removing artefacts prohibited)?
SY(CTYARE71)	Draw the symbol 'CTYARE71' in the centre of the visible part of the calling object area.
Has value ('CATREA') && Does 'CATREA' include 4 || 5 || 6 || 7 || 10 || 20 || 22 || 23?	Is the value of the attribute 'CATREA' given and does it include '4' (nature reserve) and/or '5' (bird sanctuary) and/or '6' (game preserve) and/or '7' (seal sanctuary) and/or '10' (historic wreck) and/or '20' (research area) and/or '22' (fish sanctuary) and/or '23' (ecological reserve)?
SY(CTYARE71)	Draw the symbol 'CTYARE71' in the centre of the visible part of the calling object area.
SY(CTYARE51)	Draw the symbol 'CTYARE51' in the centre of the visible part of the

	calling object area.
Symbolized area boundaries?	Has mariner selected Symbolized Area Boundaries?
LC(CTYARE51)	Symbolize area boundary with the pattern line 'CTYARE51'
LS(DASH,2,CHMGD)	Symbolize area boundary with the dash line with the width '2' and the colour 'CHMGD'.
Exit Procedure	Symbolization is finished. Exit from procedure.

Figure 25RESARE04 Continuation ENo 'RESTRN' applies



Entry point	The checking 'No RESTRN applies'
Has value ('CATREA')?	Is the value of the attribute 'CATREA' given?
SY(RSRDEF51)	If 'No', draw the symbol 'RSRDEF51' in the centre of the visible part

	of the calling object area.
Does 'CATREA' include 1 || 8 || 9 || 12 || 14 || 18 || 19 || 21 || 24 || 25 || 26?	Is the value of the attribute 'CATREA' given and does it include '1' (offshore safety zone) and/or '8' (degaussing area) and/or '9' (military area) and/or '12' (navigation aid safety zone) and/or '14' (minefield) and/or '18' (swimming area) and/or '19' (waiting area) and/or '21' (dredging area) and/or '24' (no wake area) and/or '25' (swinging area) and/or '26' (water skiing area)?
Does 'CATREA' include 4 || 5 || 6 || 7 || 10 || 20 || 22 || 23?	Does the value of the attribute 'CATREA' include '4' (nature area) and/or '5' (bird sanctuary) and/or '6' (game preserve) and/or '7' (seal sanctuary) and/or '10' (historic wreck) and/or '20' (research area) and/or '22' (fish sanctuary) and/or '23' (ecological reserve)?
SY(CTYARE71)	Draw the symbol 'CTYARE71' in the centre of the visible part of the calling object area.
SY(CTYARE51)	Draw the symbol 'CTYARE51' in the centre of the visible part of the calling object area.
Does 'CATREA' include 4 || 5 || 6 || 7 || 10 || 20 || 22 || 23?	Does the value of the attribute 'CATREA' include '4' (nature area) and/or '5' (bird sanctuary) and/or '6' (game preserve) and/or '7' (seal sanctuary) and/or '10' (historic wreck) and/or '20' (research area) and/or '22' (fish sanctuary) and/or '23' (ecological reserve)?
SY(INFARE51)	Draw the symbol 'INFARE51' in the centre of the visible part of the calling object area.
SY(RSRDEF51)	An unrecognized value of 'CATREA'' was given. Draw the symbol 'RSRDEF51' in the centre of the visible part of the calling object area.
Symbolized area boundaries?	Has mariner selected Symbolized Area Boundaries?
LC(CTYARE51)	Symbolize area boundary with the pattern line 'CTYARE51'
LS(DASH,2,CHMGD)	Symbolize area boundary with the dash line with the width '2' and the colour 'CHMGD'.
Exit Procedure	Symbolization is finished. Exit from procedure.

13.2.10 Conditional Symbology Procedure RESTRN01

Applies to: The following S-57 Object Class objects, but only when they carry the attribute RESTRN:
TSSLPT, TSSRON, TSSCRS, DWRTPT, PRCARE, ISTZNE;FAIRWAY, DRGARE, ACHARE; CBLARE, PIPARE, DMPGRD, MARCUL; OSPARE, SUBTLN, SPLARE, MIPARE, ICNARE; TESARE.

Spatial Object(s): Area

Attribute(s) used: RESTRN (passed on to sub procedure RESCSPnn)

User Parameter(s): Symbolize Area Boundaries (used by sub procedure RESCSPnn)

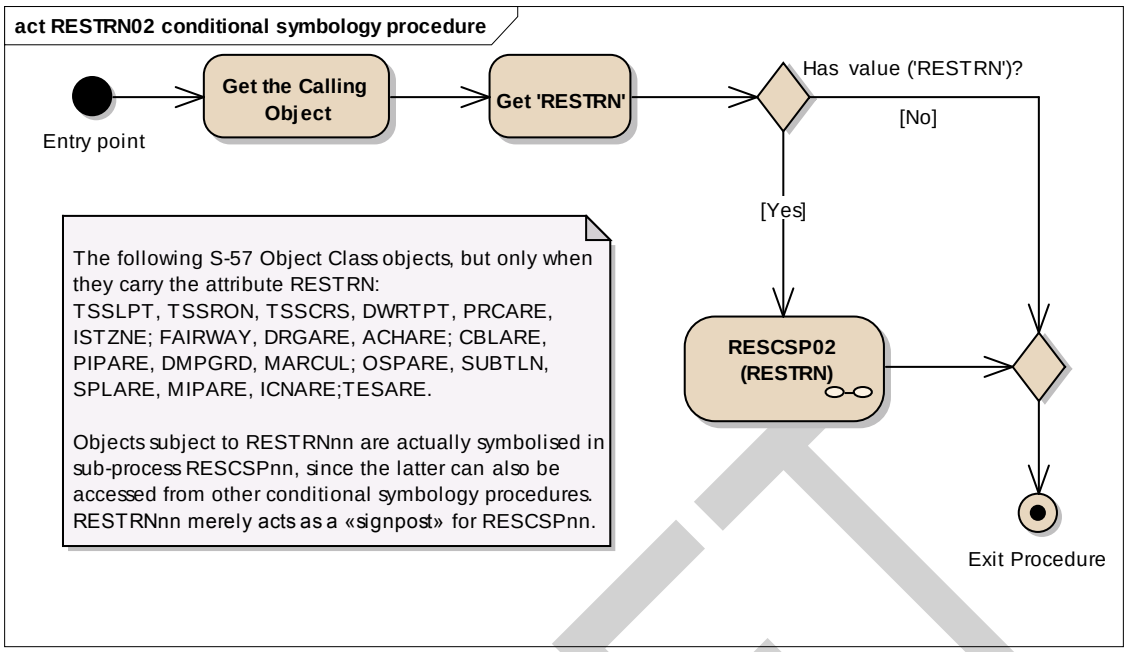
Defaults: Display Priority given by look-up table; OVERRADAR priority given by look-up table; Display Category given by look-up table; Viewing Group given by look-up table.

Remarks: Objects subject to RESTRNnn are actually symbolised in sub-process RESCSPnn, since the latter is also be accessed from other conditional symbology procedures. RESTRNnn merely acts as a "signpost" for RESCSPnn.
Object class RESARE is symbolised for the effect of attribute RESTRN in a separate conditional symbology procedure called RESAREnn.
Since many of the areas concerned cover shipping channels, the number of symbols used is minimised to reduce clutter. To do this, values of RESTRN are ranked for significance as follows:
"Traffic Restriction" values of RESTRN:

1. RESTRN 7,8: entry prohibited or restricted
2. RESTRN 14: IMO designated «area to be avoided» part of a TSS
3. RESTRN 1,2: anchoring prohibited or restricted
4. RESTRN 3,4,5,6: fishing or trawling prohibited or restricted
5. "Other Restriction" values of RESTRN are:
   - RESTRN 9,10: dredging prohibited or restricted,
   - RESTRN 11, 12: diving prohibited or restricted,
   - RESTRN 13: no wake area.

Note: Unlike all other originators of conditional symbology procedures, RESTRN is an attribute, not an object class. It is therefore not possible to provide viewing groups for the restrictions it imposes without creating undesirable complications in the procedure.

Figure 26 RESTRN01 conditional symbology procedure



Entry point	Entry to the symbology procedure.
Get the Calling Object	Get the object which is calling this procedure
Get 'RESTRN'	Get the values of the attributes 'Restriction' (RESTRN) from the calling object
Has value ('RESTRN')?	Is the value of the attribute 'RESTRN' given?
RESCSP02 (RESTRN)	Perform the sub-procedure to draw symbology of restrictions in the area object, see “ 13.2.11 Conditional Symbology Procedure RESCSP02”
RESTRN	Input parameter – value of RESTRN attribute of the calling object
Exit Procedure	Symbolization is finished.

13.2.11 Conditional Symbology Procedure RESCSP02

Note that this is called as a sub-procedure by DEPAREnn and RESTRNnn

Applies to: Applies to the following S-57 Object Classes, but only when they carry the attribute RESTRN: TSSLPT, TSSRON, TSSCRS, DWRTPT, PRCARE, ISTZNE; FAIRWAY, DRGARE, ACHARE; CBLARE, PIPARE, DMPGRD, MARCUL; OSPARE, SUBTLN, SPLARE, MIPARE, ICNARE; TESARE;

Spatial Object(s): Area

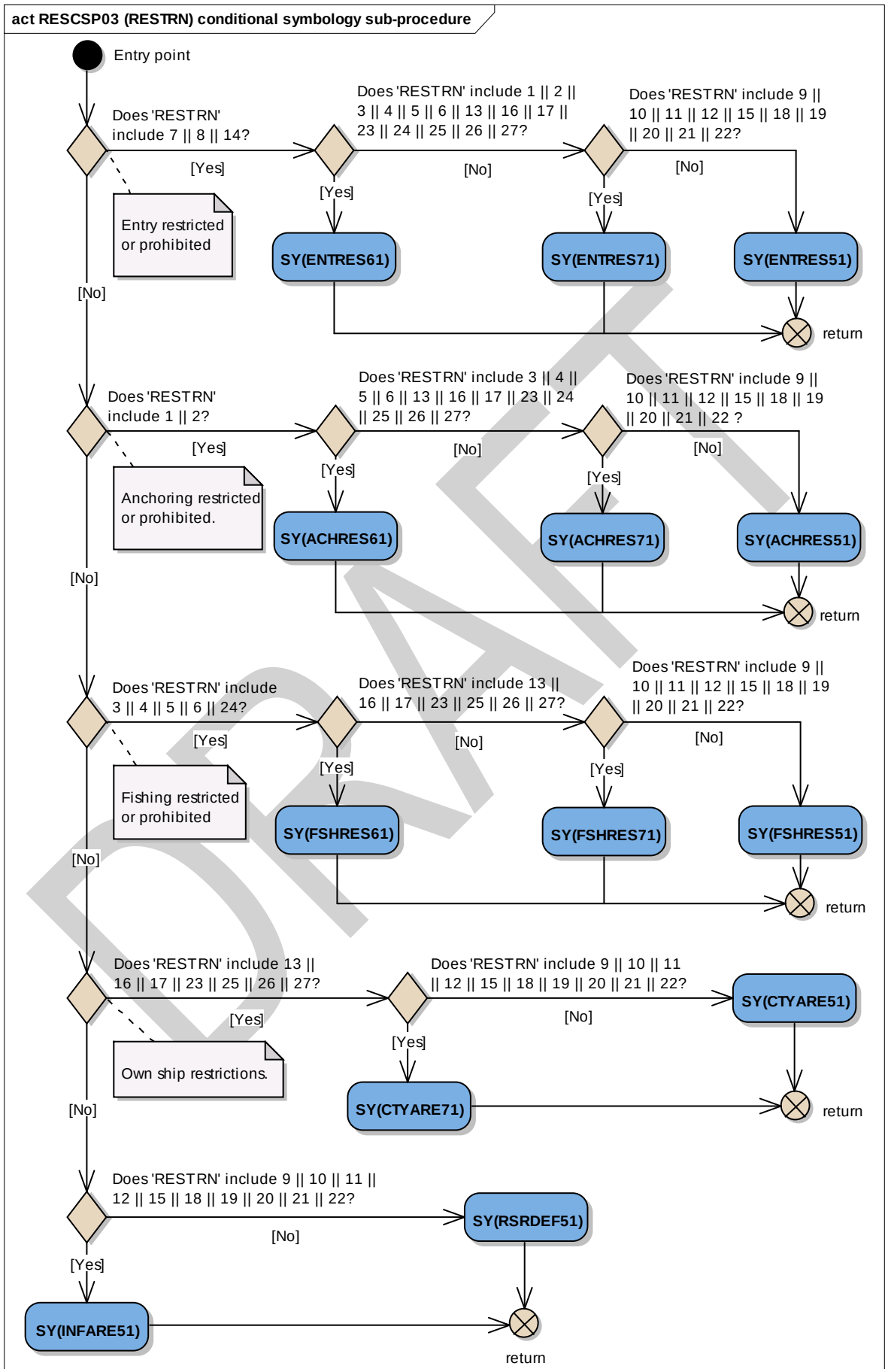
Parameter(s): Object to be symbolised from ENC.

Attribute(s) used: The attribute 'RESTRN' value is passed on to this procedure by the calling procedure.

Defaults: Symbolization given by the look-up table;
Display Priority given by look-up table;
OVERRADAR priority given by look-up table;
Display Category given by look-up table;
Viewing Group given by look-up table.

Remarks: See procedure RESTRNnn

Figure 27 RESCSP02 (RESTRN) conditional symbology sub-procedure



Entry point	For all objects having the attribute 'RESTRN'. The attribute 'RESTRN' value is passed on to this procedure by the calling procedure.
Does 'RESTRN' include 7 || 8 || 14?	Does the value of the attribute RESTRN include '7' (entry prohibited) ADN/OR '8' (entry restricted) AND/OR '14' (area to be avoided)?
Does 'RESTRN' include 1 || 2 || 3 || 4 || 5 || 6 || 13 || 16 || 17 || 23 || 24 || 25 || 26 || 27?	Does the value of the attribute RESTRN include '1' (anchoring prohibited) AND/OR '2' (anchoring restricted) AND/OR '3' (fishing prohibited) AND/OR '4' (fishing restricted) AND/OR '5' (trawling prohibited) AND/OR '6' (trawling restricted) AND/OR '13' (no wake area) AND/OR '16' (discharging prohibited) AND/OR '17' (discharging restricted) AND/OR '23' (lightering prohibited) AND/OR '25' (stopping prohibited) AND/OR '24' (dragging prohibited) AND/OR '26' (landing prohibited) AND/OR '27' (speed restricted)?
SY(ENTRES61)	Draw the symbol 'ENTRES61' in the centre of the visible part of the calling object area.
Does 'RESTRN' include 9 || 10 || 11 || 12 || 15 || 18 || 19 || 20 || 21 || 22?	Does the value of the attribute RESTRN include '9' (dredging prohibited) AND/OR '10' (dredging restricted) AND/OR '11' (diving prohibited) AND/OR '12' (diving restricted) AND/OR '15' (construction prohibited) AND/OR '18' (development prohibited) AND/OR '19' (development restricted) AND/OR '20' (drilling prohibited) AND/OR '21' (drilling restricted) AND/OR '22' (removing artifacts prohibited)?
SY(ENTRES71)	Draw the symbol 'ENTRES71' in the centre of the visible part of the calling object area.
SY(ENTRES51)	Draw the symbol 'ENTRES51' in the centre of the visible part of the calling object area.
return	to the calling procedure
Does 'RESTRN' include 1 || 2?	Does the value of the attribute RESTRN include '1' (anchoring prohibited) ADN/OR '2' (anchoring restricted) ?
Does 'RESTRN' include 3 || 4 || 5 || 6 || 13 || 16 || 17 || 23 || 24 || 25 || 26 || 27?	Does the value of the attribute RESTRN include '3' (fishing prohibited) AND/OR '4' (fishing restricted) AND/OR '5' (trawling prohibited) AND/OR '6' (trawling restricted) AND/OR '13' (no wake area) AND/OR '16' (discharging prohibited) AND/OR '17' (discharging restricted) AND/OR '23' (lightering prohibited) AND/OR '24' (dragging prohibited) AND/OR '25' (stopping prohibited) AND/OR '26' (landing prohibited) AND/OR '27' (speed restricted)?
SY(ACHRES61)	Draw the symbol 'ACHRES61' in the centre of the visible part of the calling object area.
Does 'RESTRN' include 9 || 10 || 11 || 12 || 15 || 18 || 19 ||	Does the value of the attribute RESTRN include '9' (dredging prohibited) AND/OR

20 || 21 || 22 ?	'10' (dredging restricted) AND/OR '11' (diving prohibited) AND/OR '12' (diving restricted) AND/OR '15' (construction prohibited) AND/OR '18' (development prohibited) AND/OR '19' (development restricted) AND/OR '20' (drilling prohibited) AND/OR '21' (drilling restricted) AND/OR '22' (removing artifacts prohibited)?
SY(ACHRES71)	Draw the symbol 'ACHRES71' in the centre of the visible part of the calling object area.
SY(ACHRES51)	Draw the symbol 'ACHRES51' in the centre of the visible part of the calling object area.
return	to the calling procedure
Does 'RESTRN' include 3 || 4 || 5 || 6 || 24?	Does the value of the attribute RESTRN include '3' (fishing prohibited) ADN/OR '4' (fishing restricted) AND/OR '5' (trawling prohibited) ADN/OR '6' (trawling restricted) AND/OR '24' (dragging prohibited)?
Does 'RESTRN' include 13 || 16 || 17 || 23 || 25 || 26 || 27?	Does the value of the attribute RESTRN include '13' (no wake area) AND/OR '16' (discharging prohibited) AND/OR '17' (discharging restricted) AND/OR '23' (lightering prohibited) AND/OR '25' (stopping prohibited) AND/OR '26' (landing prohibited) AND/OR '27' (speed restricted)?
SY(FSHRES61)	Draw the symbol 'FSHRES61' in the centre of the visible part of the calling object area.
Does 'RESTRN' include 9 || 10 || 11 || 12 || 15 || 18 || 19 || 20 || 21 || 22?	Does the value of the attribute RESTRN include '9' (dredging prohibited) AND/OR '10' (dredging restricted) ADN/OR '11' (diving prohibited) AND/OR '12' (diving restricted) ADN/OR '15' (construction prohibited) AND/OR '18' (development prohibited) ADN/OR '19' (development restricted) AND/OR '20' (drilling prohibited) ADN/OR '21' (drilling restricted) AND/OR '22' (removing artifacts prohibited)?
SY(FSHRES71)	Draw the symbol 'FSHRES71' in the centre of the visible part of the calling object area.
SY(FSHRES51)	Draw the symbol 'FSHRES51' in the centre of the visible part of the calling object area.
return	to the calling procedure
Does 'RESTRN' include 13 || 16 || 17 || 23 || 25 || 26 || 27?	Does the value of the attribute RESTRN include '13' (no wake area) AND/OR '16' (discharging prohibited) AND/OR '17' (discharging restricted) AND/OR '23' (lightering prohibited) AND/OR '25' (stopping prohibited) AND/OR '26' (landing prohibited) AND/OR '27' (speed restricted)?
Does 'RESTRN' include 9 || 10 || 11 || 12 || 15 || 18 || 19 || 20 || 21 || 22?	Does the value of the attribute RESTRN include '9' (dredging prohibited) AND/OR '10' (dredging restricted) ADN/OR '11' (diving prohibited) AND/OR '12' (diving restricted) ADN/OR

	'15' (construction prohibited) AND/OR '18' (development prohibited) ADN/OR '19' (development restricted) AND/OR '20' (drilling prohibited) ADN/OR '21' (drilling restricted) AND/OR '22' (removing artifacts prohibited)?
SY(CTYARE71)	Draw the symbol 'CTYARE71' in the centre of the visible part of the calling object area.
SY(CTYARE51)	Draw the symbol 'CTYARE51' in the centre of the visible part of the calling object area.
return	to the calling procedure
Does 'RESTRN' include 9 || 10 || 11 || 12 || 15 || 18 || 19 || 20 || 21 || 22?	Does the value of the attribute RESTRN include '9' (dredging prohibited) AND/OR '10' (dredging restricted) ADN/OR '11' (diving prohibited) AND/OR '12' (diving restricted) ADN/OR '15' (construction prohibited) AND/OR '18' (development prohibited) ADN/OR '19' (development restricted) AND/OR '20' (drilling prohibited) ADN/OR '21' (drilling restricted) AND/OR '22' (removing artifacts prohibited)?
SY(INFARE51)	Draw the symbol 'INFARE51' in the centre of the visible part of the calling object area.
SY(RSRDEF51)	An unknown value of 'RESTRN' was given. Draw the symbol 'RSRDEF51' in the centre of the visible part of the calling object area.
return	to the calling procedure.

13.2.12 Conditional Symbology Procedure SAFCON01

Note that this is called as a sub-procedure by DEPAREnn and DEPCNTnn

Applies to: symbolize edges that are part of the safety contour and depth contours.

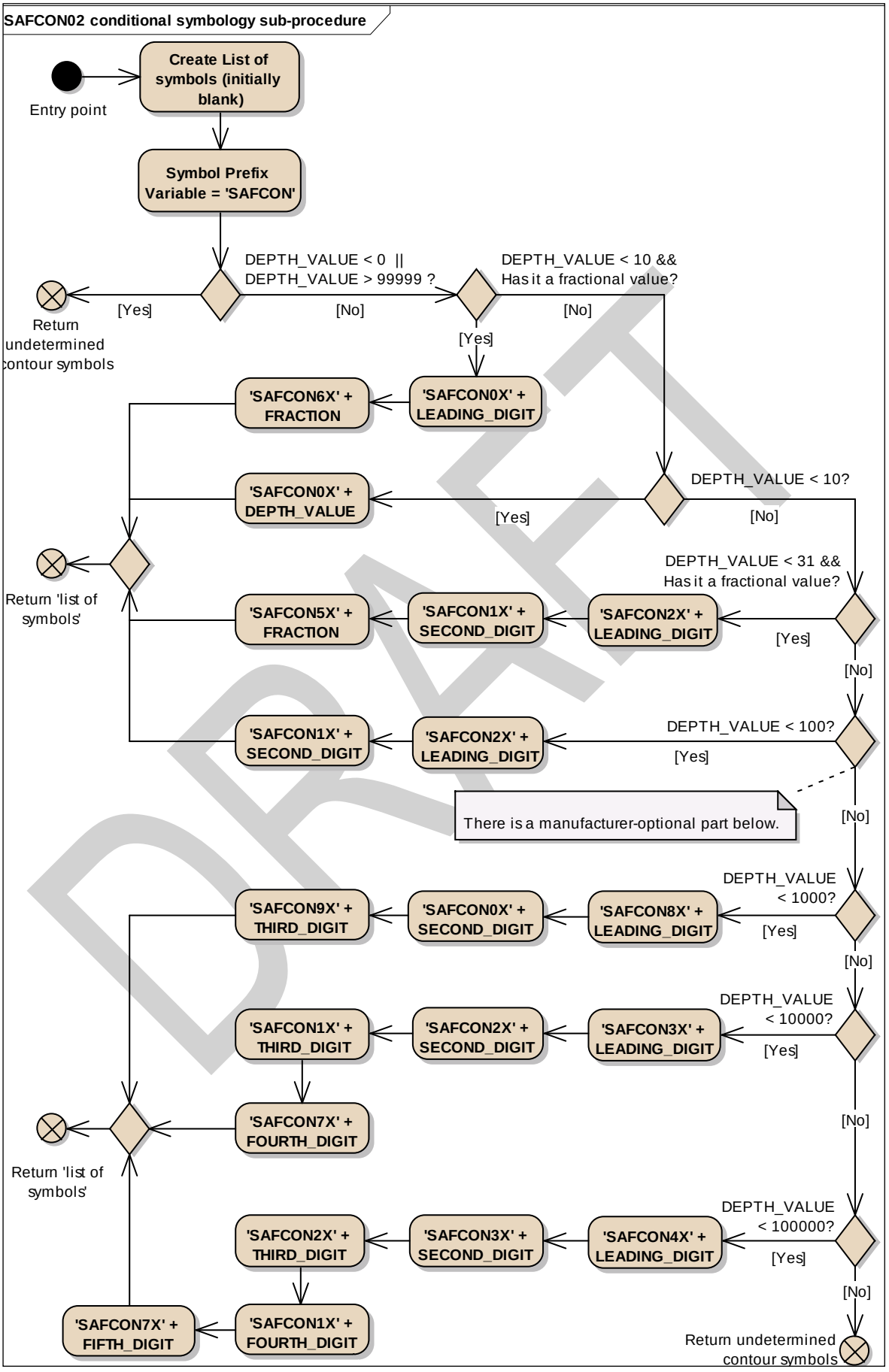
Spatial Object(s): Line

Parameter(s): Input parameter is the local variable 'DEPTH_VALUE' passed from the called procedure. A list of symbols is returned.

Remarks: This conditional procedure will create a list of symbols name selected that will be displayed at the mid-point of the edge.

Note: The contours symbolization of 100 meters and deeper is manufacturer-optional. The symbols required are contained in the digital version of the Symbol Library, but are not contained in the man-readable version.

Figure 28 SAFCON01 conditional symbology sub-procedure



Entry point	The symbology sub-procedure is called by other procedure. Pass the local variable DEPTH_VALUE.
Create List of symbols (initially blank)	Create a 'list of symbols' to be presented at the position of the contour label. This list is initially blank.
Symbol Prefix Variable = 'SAFCON'	Set the symbol prefix variable to 'SAFCON'.
DEPTH_VALUE < 0 || DEPTH_VALUE > 99999 ?	Is the local variable DEPTH_VALUE less than 0 or greater than 99999 metres?
Return undetermined contour symbols	Return to the calling procedure indicating that the contour symbols could not be determined
DEPTH_VALUE < 10 && Has it a fractional value?	Is the local variable DEPTH_VALUE less than 10 metres and has it a fractional value?
'SAFCON0X' + LEADING_DIGIT	Isolate 'LEADING_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '00' + 'LEADING_DIGIT' to 'SYMBOL_PREFIX' (e.g. 3.6 metres - isolate '3' and create 'SAFCON03'). Add this symbol name to the 'list of symbols' to be presented.
'SAFCON6X' + FRACTION	Isolate 'FRACTION' of 'DEPTH_VALUE' and multiply by 10. Truncate all digits after the decimal. Do not round up. Create symbol name by adding '60' + 'FRACTION' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
DEPTH_VALUE < 10?	Is the local variable DEPTH_VALUE less than 10 metres?
'SAFCON0X' + DEPTH_VALUE	Create symbol name by adding '00' + 'DEPTH_VALUE' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
DEPTH_VALUE < 31 && Has it a fractional value?	Is the local variable DEPTH_VALUE less than 31 metres and has it a fractional value? (Note: common practice in hydrography is to show fractions of a depth value up to 30 metres depth).
'SAFCON2X' + LEADING_DIGIT	Isolate 'LEADING_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '20' + 'LEADING_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
'SAFCON1X' + SECOND_DIGIT	Isolate 'SECOND_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '10' + 'SECOND_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
'SAFCON5X' + FRACTION	Isolate 'FRACTION' of 'DEPTH_VALUE' and multiply by 10. Truncate all digits after the decimal. Do not round up. Create symbol name by adding '50' + 'FRACTION' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
DEPTH_VALUE < 100?	Is the local variable DEPTH_VALUE less than 100 metres?
'SAFCON2X' + LEADING_DIGIT	Isolate 'LEADING_DIGIT' of 'DEPTH_VALUE'/ Create symbol name by adding '20' + 'LEADING_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
'SAFCON1X' + SECOND_DIGIT	Isolate 'SECOND_DIGIT' of 'DEPTH_VALUE'. Create symbol nmae by adding '10' + 'SECOND_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
Return 'list of symbols'	Return to the calling procedure with the 'List of Symbols' which were selected.
Note: the following routine is manufacturer-optional.	
DEPTH_VALUE < 1000?	Is the local variable DEPTH_VALUE less than 1000 metres?
'SAFCON8X' + LEADING_DIGIT	Isolate 'LEADING_DIGIT' of 'DEPTH_VALUE'/ Create symbol name by adding '80' + 'LEADING_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.

'SAFCON0X' + SECOND_DIGIT	Isolate 'SECOND_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '00' + 'SECOND_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
'SAFCON9X' + THIRD_DIGIT	Isolate 'THIRD_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '90' + 'THIRD_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
DEPTH_VALUE < 10000?	Is the local variable DEPTH_VALUE less than 10000 metres?
'SAFCON3X' + LEADING_DIGIT	Isolate 'LEADING_DIGIT' of 'DEPTH_VALUE'/ Create symbol name by adding '30' + 'LEADING_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
'SAFCON2X' + SECOND_DIGIT	Isolate 'SECOND_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '20' + 'SECOND_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
'SAFCON1X' + THIRD_DIGIT	Isolate 'THIRD_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '10' + 'THIRD_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
'SAFCON7X' + FOURTH_DIGIT	Isolate 'FOURTH_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '70' + 'FOURTH_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
DEPTH_VALUE < 100000?	Is the local variable DEPTH_VALUE less than 100 000 metres?
Return undetermined contour symbols	If 'No', return to the calling procedure indicating that the contour symbols could not be determined
'SAFCON4X' + LEADING_DIGIT	Isolate 'LEADING_DIGIT' of 'DEPTH_VALUE'/ Create symbol name by adding '40' + 'LEADING_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
'SAFCON3X' + SECOND_DIGIT	Isolate 'SECOND_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '30' + 'SECOND_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
'SAFCON2X' + THIRD_DIGIT	Isolate 'THIRD_DIGIT' of 'DEPTH_VALUE'. Create symbol nmae by adding '20' + THIRD_DIGIT to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
'SAFCON1X' + FOURTH_DIGIT	Isolate 'FOURTH_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '10' + 'FOURTH_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
'SAFCON7X' + FIFTH_DIGIT	Isolate 'FIFTH_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '70' + 'FIFTH_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the 'list of symbols' to be presented.
Return 'list of symbols'	Return to the calling procedure with the 'List of Symbols' which were selected.

13.2.13 Conditional Symbology Procedure SLCONS04

Applies to: S-57 Object Class "shoreline construction" (SLCONS)

Spatial Object(s): Point, Line, Area

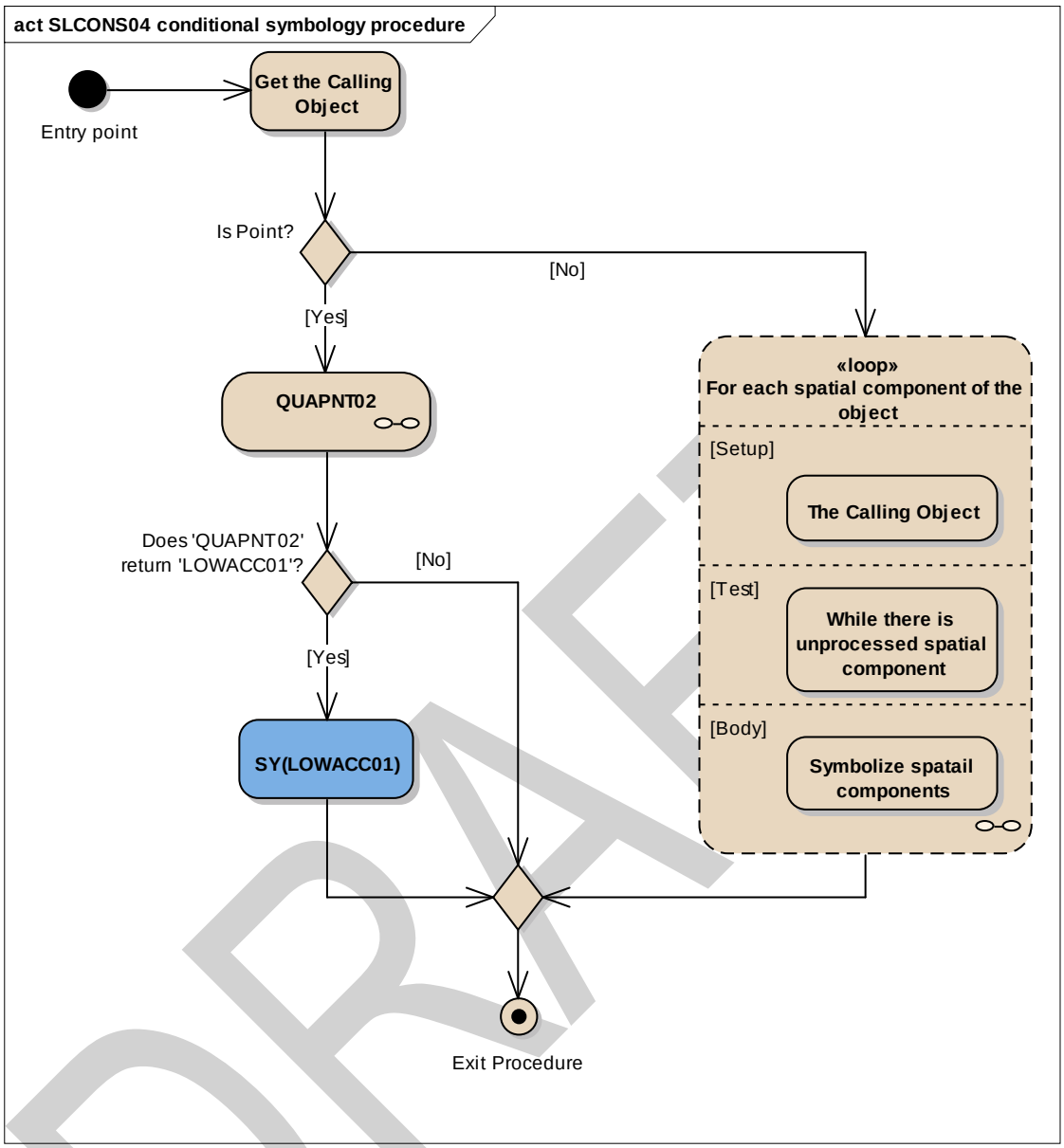
Attribute(s) used: S-57 object attributes: (CATSLC, CONDTN, WATLEV). Spatial attribute QUAPOS

User Parameter(s): None.

Defaults: Display Priority given by look-up table; OVERRADAR priority given by look-up table; Display Category given by look-up table; Viewing Group given by look-up table. Note these parameters may vary depending on the feature's geometric primitive.

Remarks: Shoreline construction objects which have a QUAPOS attribute on their spatial component indicating that their position is unreliable are symbolized by a special linestyle in the place of the varied linestyles normally used. Otherwise this procedure applies the normal symbolization.

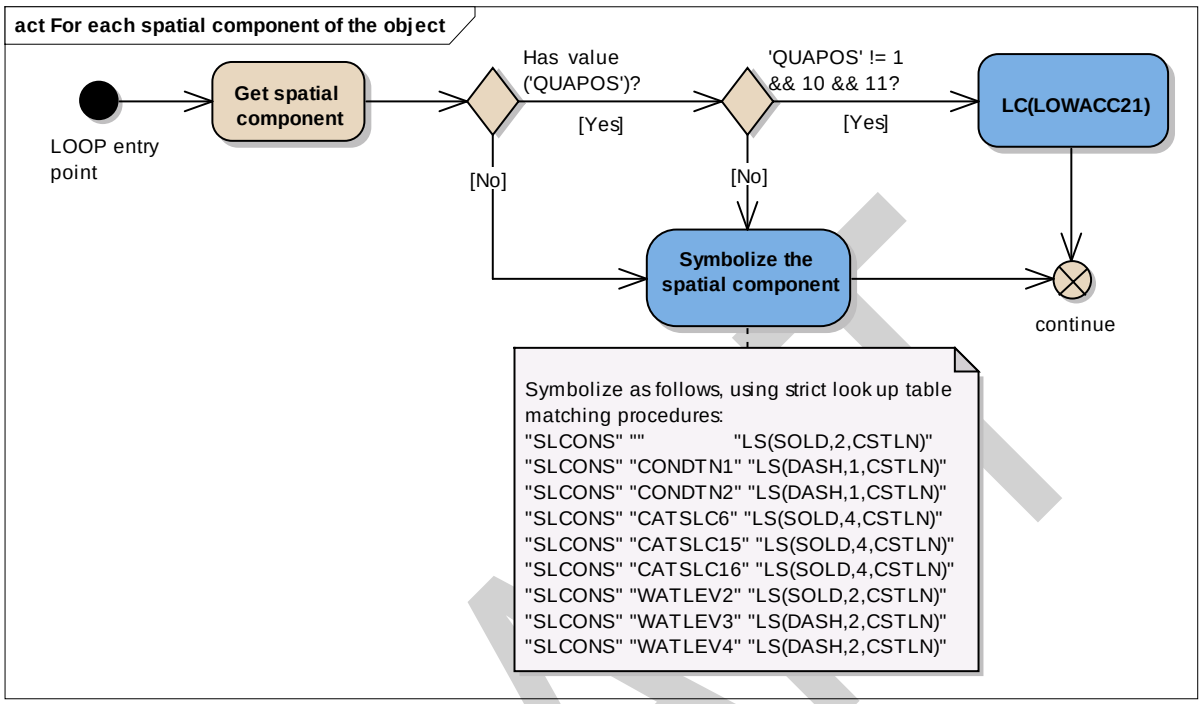
Figure 29 SLCONS04 conditional symbology procedure



Entry point	The calling Shoreline Construction object.
Is Point?	Is the calling object type Point?
QUAPNT02	Perform the symbology procedure 'QUAPNT02' which returns a flag indicating whether or not to display the low accuracy symbol and returns the selected symbol 'LOWACC01'. It happens if the attribute 'QUAPOS' of the spatial object equal one of the following values: '2', '3', '4', '5', '6', '7', '8' or '9'.
Calling Object	Input parameter
LOWACC01	Output parameter
Does 'QUAPNT02' return 'LOWACC01'?	Is the symbol 'LOWACC01' selected by the procedure 'QUAPNT02'?
SY(LOWACC01)	If so indicated by the procedure 'QUAPNT02', draw the returned low accuracy symbol 'LOWACC01' at the calling object's location in the viewing group 31011
Loop for each spatial component of the object	Loop for each spatial component of the calling object: Setup - The Calling Object.

	Test - While there is unprocessed spatial component Body - Symbolize spatial components
Exit Procedure	Symbolization is finished

Figure 30 Loop for each spatial component of area and line SLCONS object



LOOP entry point	Spatial components of the calling object.
Get spatial component	Get the next spatial component of the calling object.
Has value ('QUAPOS')?	Is the value of the attribute 'QUAPOS' given?
'QUAPOS' != 1 && 10 && 11?	Does the value of attribute 'QUAPOS' equal to neither of the following values: '1', '10', and '11'?
LC(LOWACC21)	Draw spatial component with line pattern 'LOWACC21'
Symbolize the spatial component	Symbolize the spatial component with as follows, using strict look-up table matching procedures: "SLCONS" "" "LS(SOLD,2,CSTLN)" "SLCONS" "CONDTN1" "LS(DASH,1,CSTLN)" "SLCONS" "CONDTN2" "LS(DASH,1,CSTLN)" "SLCONS" "CATSLC6" "LS(SOLD,4,CSTLN)" "SLCONS" "CATSLC15" "LS(SOLD,4,CSTLN)" "SLCONS" "CATSLC16" "LS(SOLD,4,CSTLN)" "SLCONS" "WATLEV2" "LS(SOLD,2,CSTLN)" "SLCONS" "WATLEV3" "LS(DASH,2,CSTLN)" "SLCONS" "WATLEV4" "LS(DASH,2,CSTLN)"
continue	Go to the next spatial component of the object.

13.2.14 Conditional Symbology Procedure SEABED01

(Note that this is a sub-procedure called by DEPAREnn)

Applies to: Symbolization of areas that form the seabed

Remarks: This conditional procedure will create a Colour fill for depth areas (S-57)

Spatial Object(s): Area

Parameter(s):

- DRVAL1 (minimum depth) passed from calling procedure
- DRVAL2 (maximum depth) passed from calling procedure
- SHALLOW_CONTOUR depth value selected by the mariner
- SAFETY_CONTOUR depth value selected by the mariner
- DEEP_CONTOUR depth value selected by the mariner

Required User parameters: The following ECDIS user parameters are required in the procedure. The manufacturer is responsible for setting default values as shown in square brackets.:

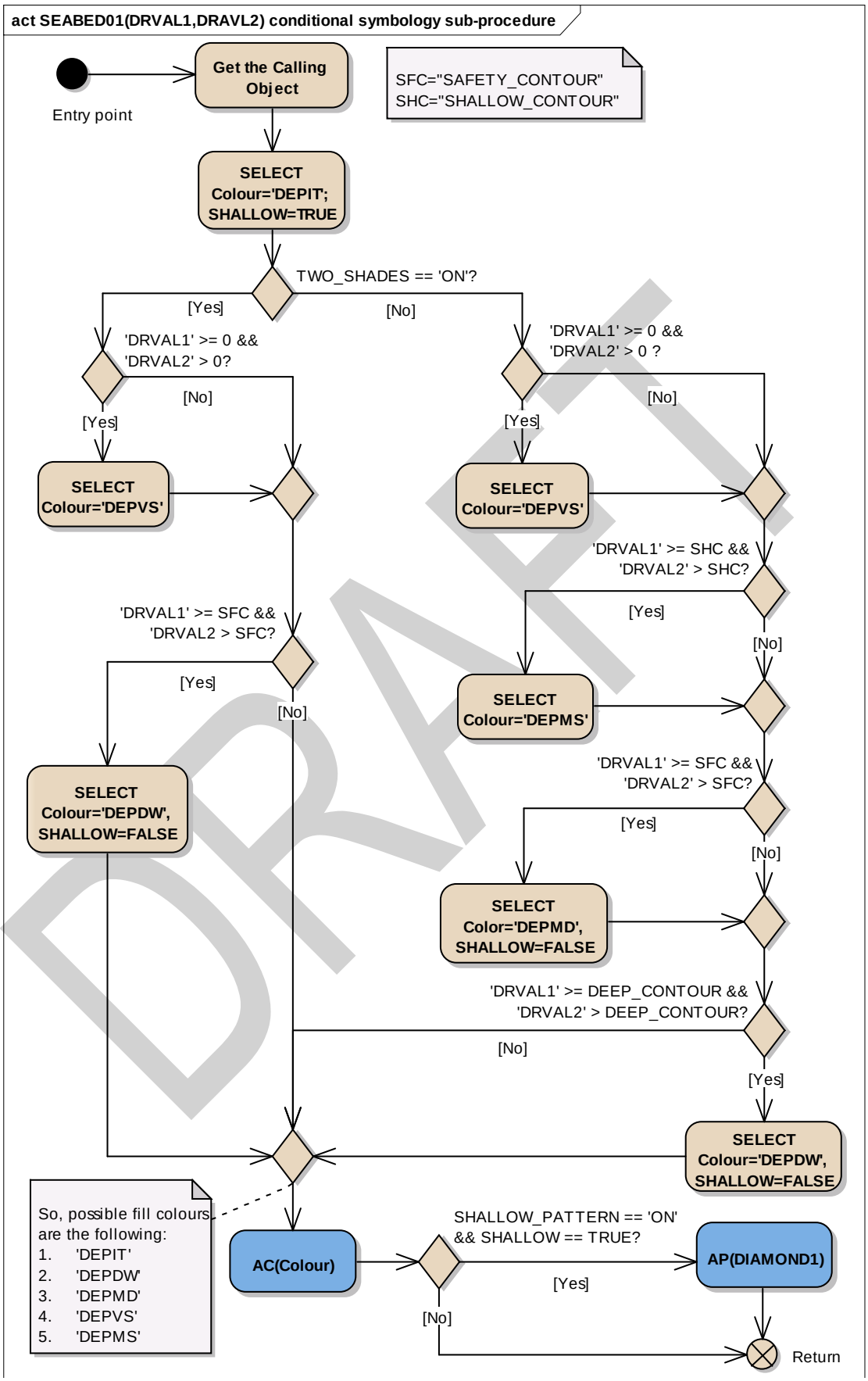
- SHALLOW_CONTOUR = 2.0 [2 metres] (referred to as “SHC” in the diagrams).
- DEEP_CONTOUR = 30.0 [30 metres]
- SAFETY_CONTOUR = 30.0 [30 metres] (referred to as “SFC” in the diagrams)
- TWO_SHADES [default = on] - flag selected by the mariner (TWO_SHADES 'on' draws 2 depth area colour shades, 'off' draws 4)
- SHALLOW_PATTERN = [default = off] - flag selected by the mariner («optional»)

The default values must stay in operation until the mariner decides to select other parameters.

Note: The requirement to show four depth shades is not mandatory. However the requirement to for ECDIS to have the ability to display the shallow pattern is now mandatory.
In addition the following local variables are used by the procedure:

- COLOUR
- SHALLOW

Figure 31 SEABED01(DRVAL1,DRAVL2) conditional symbology sub-procedure



Entry point	Entry from the calling conditional procedure. DRVAL1 and DRVAL2 are passed from the calling procedure
Get the Calling Object	Get the object which is calling main procedure DEPARE03 and input parameters DRVAL1 and DRVAL2
TWO_SHADES == 'ON'?	Has the mariner selected the 'two-colour shading' for depth zones?
'DRVAL1' >= 0 && 'DRVAL2' > 0?	Is 'DRVAL1' greater than or equal to '0' metres (low water line) and is 'DRVAL2' greater than '0' metres?
SELECT Colour='DEPVS'	Select colour name 'DEPVS'
'DRVAL1' >= SFC && 'DRVAL2 > SFC?	Is 'DRVAL1' greater than or equal to the value of the 'SAFETY CONTOUR' as selected by the mariner and is 'DRVAL2' greater than the value of the 'SAFETY CONTOUR'?
SELECT Colour='DEPDW', SHALLOW=FALSE	Select colour name 'DEPDW' and set local variable SHALLOW equal to 'FALSE'
SELECT Colour='DEPIT'; SHALLOW=TRUE	Select colour name 'DEPIT' (intertidal area) and set local variable SHALLOW equal to 'TRUE'.
'DRVAL1' >= 0 && 'DRVAL2' > 0 ?	Is 'DRVAL1' greater than or equal to '0' metres (low water line) and is 'DRVAL2' greater than '0' metres?
SELECT Colour='DEPVS'	Select colour name 'DEPVS'
'DRVAL1' >= SHC && 'DRVAL2' > SHC?	Is 'DRVAL1' greater than or equal to the value of the 'SHALLOW CONTOUR' as selected by the mariner and is 'DRVAL2' greater than the value of the 'SHALLOW CONTOUR'?
SELECT Colour='DEPMS'	Select colour name 'DEPMS'
'DRVAL1' >= SFC && 'DRVAL2' > SFC?	Is 'DRVAL1' greater than or equal to the value of the 'SAFETY CONTOUR' as selected by the mariner and is 'DRVAL2' greater than the value of the 'SAFETY CONTOUR'?
SELECT Color='DEPMD', SHALLOW=FALSE	Select colour name 'DEPMD' and set local variable SHALLOW=FALSE
'DRVAL1' >= DEEP_CONTOUR && 'DRVAL2' > DEEP_CONTOUR?	Is 'DRVAL1' greater than or equal to the value of the DEEP_CONTOUR as selected by the mariner and is 'DRVAL2' greater than the value of the DEEP_CONTOUR?
SELECT Colour='DEPDW', SHALLOW=FALSE	Select colour name 'DEPDW' and set local variable SHALLOW=FALSE
AC(Colour)	Draw the area object with an opaque colour fill. Use the colour which was selected last.
SHALLOW_PATTERN == 'ON' && SHALLOW == TRUE?	Has the mariner decided to make shallow areas more prominent ('SHALLOW_PATTERN' on) and is 'SHALLOW' set to true?
AP(DIAMOND1)	Draw the fill pattern 'DIAMOND1' from the symbol library and show it on top of the area's colour fill.
Return	Return to the calling procedure

13.2.15 Conditional Symbology Procedure SNDFRM04

(Note that this is a sub-procedure called by SOUNDGnn, OBSTRNnn, and WRECKSnn)

Applies to: Symbolization of depth values. It formats the passed value into a sounding form.

Spatial Object(s): Point

Parameter(s):

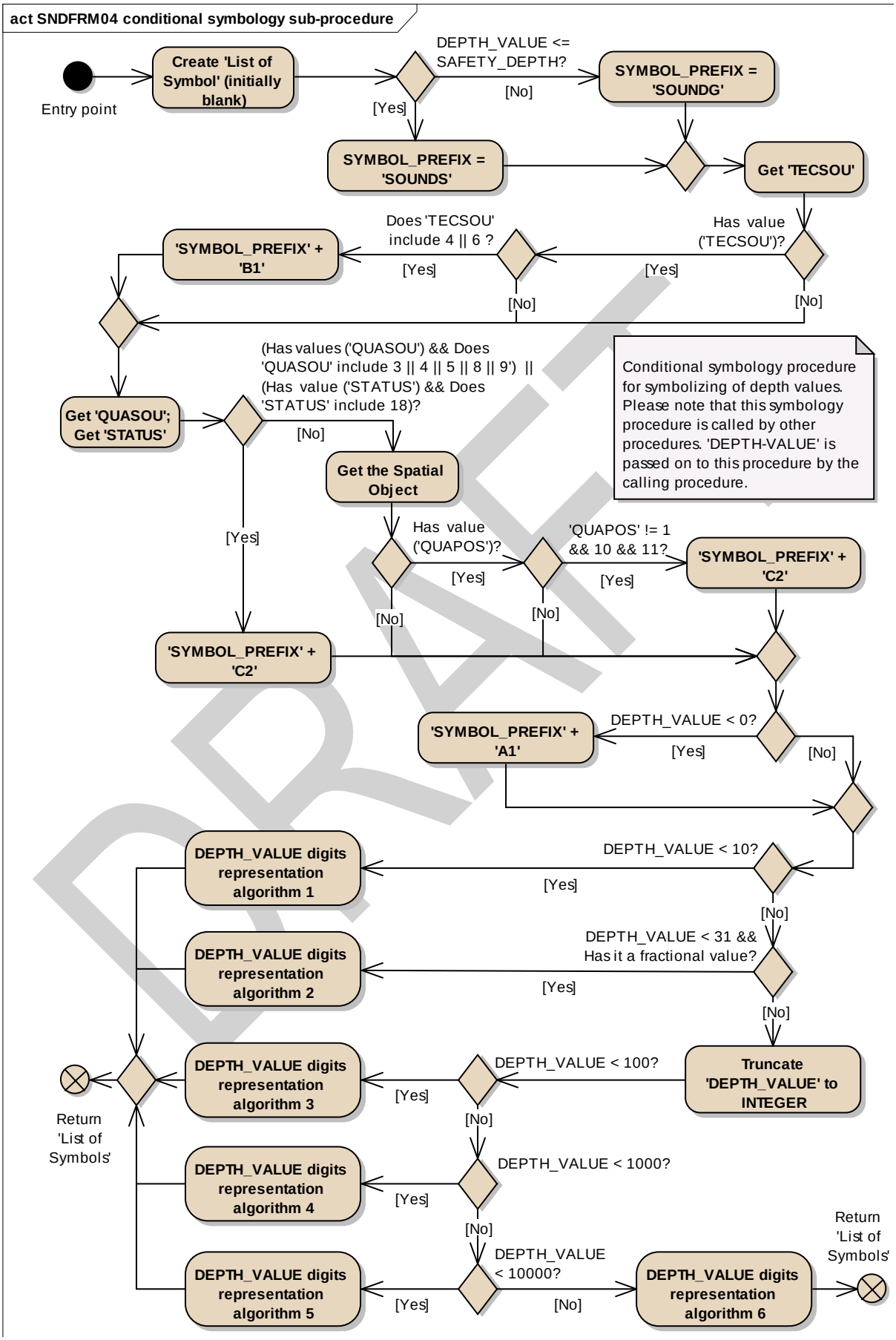
- DEPTH_VALUE passed from calling procedure;
- QUAPOS of the spatial objects and QUASOU, TECSOU and STATUS of the object that are calling the main procedure

Required ECDIS parameters:

SAFETY_DEPTH selected by the mariner The manufacturer is responsible for setting the SAFETY_DEPTH to 30 meters (see also conditional symbology procedures "DEPAREnn" and "DEPCNTnn"). This value should stay in operation until the mariner decides to select another safety depth.

Remarks: Soundings differ from plain text because they have to be readable under all circumstances and their digits are placed according to special rules and according to the location of the feature object. This conditional symbology procedure accesses a set of carefully designed sounding symbols provided by the symbol library and compiles them into sounding labels. It also symbolizes swept depth and special symbols representing low reliability as indicated by attributes QUASOU, TECSOU, STATUS and QUAPOS.

Figure 32 SNDFRM04 conditional symbology sub-procedure



Entry point	'DEPTH_VALUE' is passed on to this procedure by the calling procedure.
Create 'List of Symbol' (initially blank)	Create 'List of Symbols' to be presented at the position of the sounding This list is initially blank.
DEPTH_VALUE <= SAFETY_DEPTH?	Is the DEPTH_VALUE equal or LESS than the value of 'SAFETY_DEPTH' that was selected by the mariner?
SYMBOL_PREFIX = 'SOUNDS'	Set local variable 'SYMBOL_PREFIX' to 'SOUNDS' (SOUNDing - Shallow). (Note: all sounding symbols with dominant colour have that prefix). [IMO PS 3.7]
SYMBOL_PREFIX = 'SOUNDG'	Set local variable 'SYMBOL_PREFIX' to 'SOUNDG'. (SOUNDing - General) (Note: all sounding symbols with faint colour have that prefix).
Get 'TECSOU'	Get the value of the calling object's attribute 'Technique of sounding measurement' (TECSOU).
Has value ('TECSOU')?	Is the value of the attribute 'TECSOU' given?
Does 'TECSOU' include 4 || 6 ?	Does the attribute 'TECSOU' include '4' (found by diver) or '6' (swept depth)?
'SYMBOL_PREFIX' + 'B1'	Create symbol name: 'SYMBOL_PREFIX' + 'B1' (i.e. 'SOUNDSB1' or 'SOUNDGB1'). Add this symbol name to the list of symbols to be presented.
Get 'QUASOU'; Get 'STATUS'	Get the value of the object's attributes 'QUASOU' and 'STATUS'. (Attribute 'QUAPOS' is on the spatial object).
(Has values ('QUASOU') && Does 'QUASOU' include 3 || 4 || 5 || 8 || 9') || (Has value ('STATUS') && Does 'STATUS' include 18)?	Is the value of the attribute 'QUASOU' given and does it include '3','4','5','8' or '9' AND/OR Is the value of the attribute 'STATUS' given and does it include '18' (uncertain sounding)?
'SYMBOL_PREFIX' + 'C2'	Create symbol name: 'SYMBOL_PREFIX' + 'C2' (i.e. SOUNDSC2' or 'SOUNDGC2'). Add this symbol to the 'List of symbols' to be presented.
Get the Spatial Object	Get the corresponding spatial object of the calling object.
Has value ('QUAPOS')?	Is the value of the attribute 'QUAPOS' given?
'QUAPOS' != 1 && 10 && 11?	Does the value of attribute 'QUAPOS' equal to neither of the following values: '1', '10', and '11'?
'SYMBOL_PREFIX' + 'C2'	Create symbol name: 'SYMBOL_PREFIX' + 'C2' (i.e. SOUNDSC2' or 'SOUNDGC2'). Add this symbol to the 'List of symbols' to be presented.
DEPTH_VALUE < 0?	Is 'DEPTH_VALUE' less than zero meters?
'SYMBOL_PREFIX' + 'A1'	Create symbol name: 'SYMBOL_PREFIX' + 'A1' (i.e. SOUNDSA1'). Add this symbol to the 'List of symbols' to be presented.
DEPTH_VALUE < 10?	Is 'DEPTH_VALUE' less than 10 meters?
DEPTH_VALUE digits representation algorithm 1	Isolate 'LEADING_DIGIT' of 'DEPTH_VALUE'. Set 'LEADING_DIGIT' to positive value. Create symbol name by adding '10' + 'LEADING_DIGIT' to 'SYMBOL_PREFIX' (e.g. 3.6 metres - isolate the '3' and create either 'SOUNDS13' or 'SOUNDG13'). Add this symbol name to the list of symbols to be presented. Isolate 'FRACTION' of 'DEPTH_VALUE' and multiply by 10. Truncate all digits after the decimal. Do not round up. Create symbol name by adding '50' + 'FRACTION' to 'SYMBOL_PREFIX' (e.g. 3.6 metres - isolate the '6' and create either 'SOUNDS56' or 'SOUNDG56'). Add this symbol name to the list of symbols to be presented.
DEPTH_VALUE < 31 && Has it a fractional value?	Is 'DEPTH_VALUE' less than 31 metres and has it a fractional value? (Note: common practice in hydrography is to show fractions of a

	depth value up to 30 metres depth)
DEPTH_VALUE digits representation algorithm 2	Isolate 'LEADING_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '20' + 'LEADING_DIGIT' to 'SYMBOL_PREFIX' (e.g. 26.7 metres - isolate the '2' and create either 'SOUNDS22' or 'SOUNDG22'). Add this symbol name to the list of symbols to be presented. Isolate 'SECOND_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '10' + 'SECOND_DIGIT' to 'SYMBOL_PREFIX' (e.g. 26.7 metres - isolate the '6' and create either 'SOUNDS16' or 'SOUNDG16'). Add this symbol name to the list of symbols to be presented. Isolate 'FRACTION' of 'DEPTH_VALUE' and multiply by 10. Truncate all digits after the decimal. Do not round up. Create symbol name by adding '50' + 'FRACTION' to 'SYMBOL_PREFIX' (e.g. 26.7 metres - isolate the '7' and create either 'SOUNDS57' or 'SOUNDG57'). Add this symbol name to the list of symbols to be presented.
Truncate 'DEPTH_VALUE' to INTEGER	Truncate 'DEPTH_VALUE' to integer. Do not round up
DEPTH_VALUE < 100?	Is 'DEPTH_VALUE' less than 100 meters?
DEPTH_VALUE digits representation algorithm 3	Isolate 'LEADING_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '10' + 'LEADING_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the list of symbols to be presented. Isolate 'SECOND_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '00' + 'SECOND_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the list of symbols to be presented.
DEPTH_VALUE < 1000?	Is 'DEPTH_VALUE' less than 1000 meters?
DEPTH_VALUE digits representation algorithm 4	Isolate 'LEADING_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '20' + 'LEADING_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the list of symbols to be presented. Isolate 'SECOND_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '10' + 'SECOND_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the list of symbols to be presented. Isolate 'LAST_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '00' + 'LAST_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the list of symbols to be presented.
DEPTH_VALUE < 10000?	Is 'DEPTH_VALUE' less than 10 000 meters?
DEPTH_VALUE digits representation algorithm 5	Isolate 'LEADING_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '20' + 'LEADING_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the list of symbols to be presented. Isolate 'SECOND_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '10' + 'SECOND_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the list of symbols to be presented. Isolate 'THIRD_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '00' + 'THIRD_DIGIT' to

	'SYMBOL_PREFIX'. Add this symbol name to the list of symbols to be presented. Isolate 'LAST_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '40' + 'LAST_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the list of symbols to be presented.
Return 'List of Symbols'	Return to the calling procedure with the 'List of Symbols' which were selected.
DEPTH_VALUE digits representation algorithm 6	Isolate 'LEADING_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '30' + 'LEADING_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the list of symbols to be presented. Isolate 'SECOND_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '20' + 'SECOND_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the list of symbols to be presented. Isolate 'THIRD_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '10' + 'THIRD_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the list of symbols to be presented. Isolate 'FOURTH_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '00' + 'FOURTH_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the list of symbols to be presented. Isolate 'LAST_DIGIT' of 'DEPTH_VALUE'. Create symbol name by adding '40' + 'LAST_DIGIT' to 'SYMBOL_PREFIX'. Add this symbol name to the list of symbols to be presented.
Return 'List of Symbols'	Return to the calling procedure with the 'List of Symbols' which were selected.

12.2.16 Conditional Symbology Procedure SOUNDG03

Applies to: S-57 Object Class "soundings" (SOUNDG)

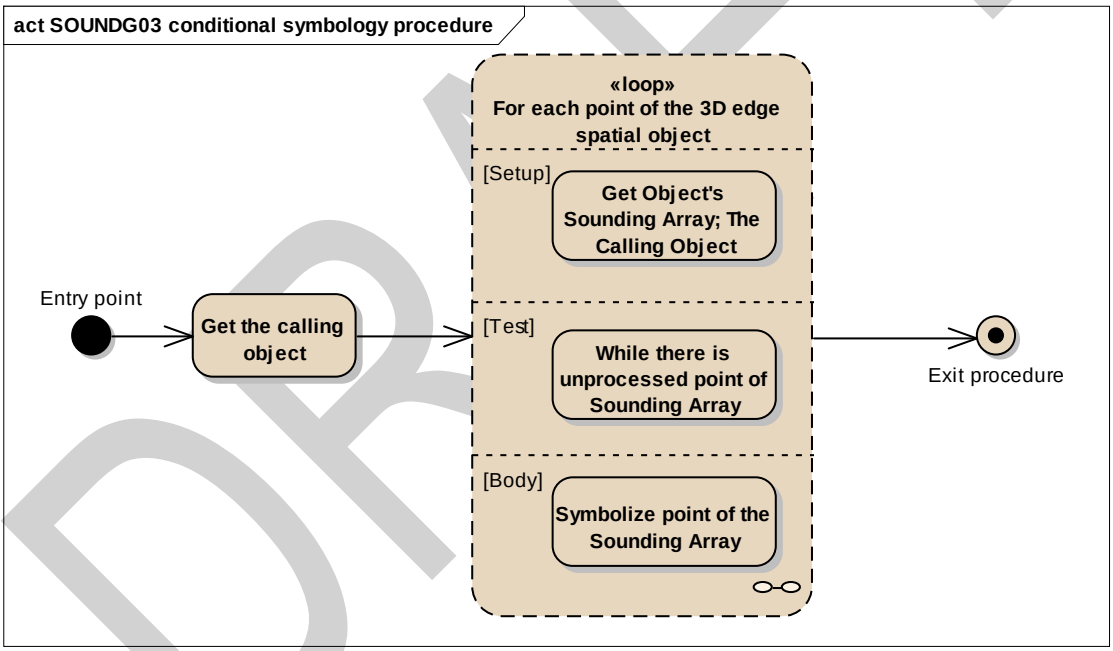
Spatial Object(s): 3D Edge (the array of points with three coordinates)

ECDIS Parameter(s):

Defaults: Display Priority given by look-up table;
OVERRADAR priority given by look-up table;
Display Category given by look-up table;
Viewing group given by look-up table.

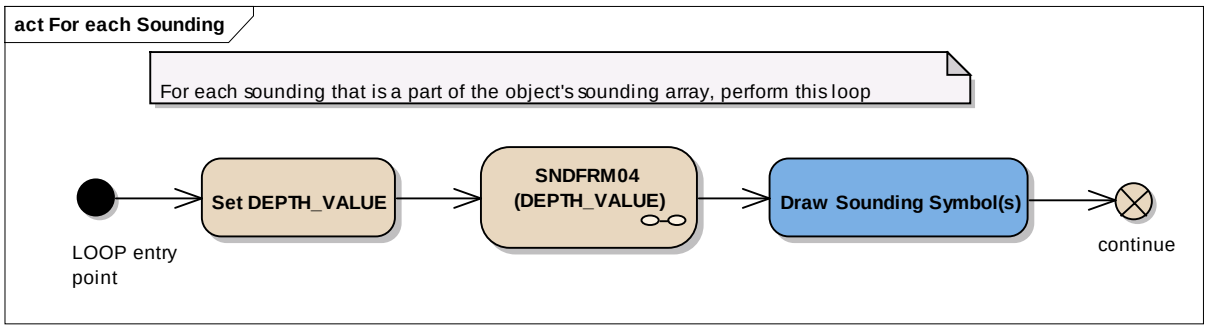
Remarks: In S-57 soundings are elements of sounding arrays rather than individual objects. Thus this conditional symbology procedure examines each sounding of a sounding array one by one. To symbolize the depth values it calls the procedure SNDFRM04 which in turn translates the depth values into a set of symbols to be shown at the soundings position.

Figure 33 SOUNDG03 conditional symbology procedure



Entry point	The calling object SOUNDG
Get the calling object	Get the object which is calling this procedure.
Loop for each point of the 3D edge spatial object	Perform the loop for each spot sounding that is point (vertex) of the 3D edge spatial object. Setup - Get Object's Sounding Array; The Calling Object. Test - While there is unprocessed point of Sounding Array Body - Symbolize point of the Sounding Array
Exit procedure	Symbolization is finished

Figure 34 Loop for each Spot Sounding



LOOP entry point	For each sounding that is a part of the object's sounding array, perform this loop
Set DEPTH_VALUE	Get the depth value of the spot sounding from 3D edge vertex of the spatial object that is currently examined and set it to the local variable DEPTH_VALUE.
SNDFRM04 (DEPTH_VALUE)	Perform the symbology sub-procedure 'SNDFRM04 to select symbols to draw the depth value. Pass the value of the local variable DEPTH_VALUE, the calling object and attributes of spatial objects on to 'SNDFRM04'. A list of symbols is returned
DEPTH_VALUE	Input parameter
Sounding Symbols List	Output parameter
Draw Sounding Symbol(s)	Draw the symbols which were selected by 'SNDFRM04'. Place them at the position which is given by the currently examined spot sounding.
continue	Go to the next point of the 3D Edge spatial object.

13.2.17 Conditional Symbology Procedure SYMINS02

Applies to: S-57 (Edition 3.1.1) Object Class "New Object" (NEWOBJ)

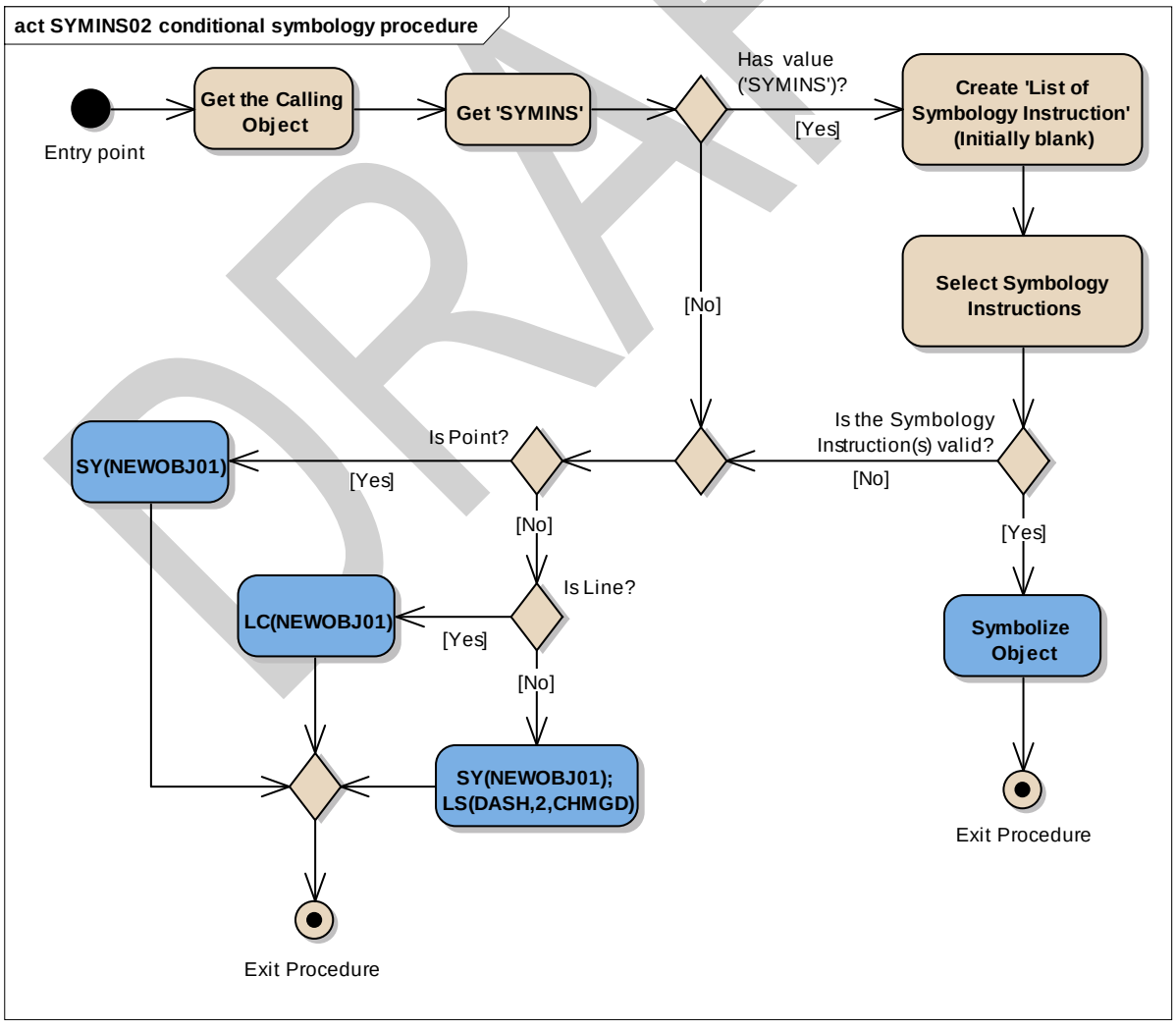
Attribute used: "Symbol Instruction" (SYMINS)

Parameter(s): Object to be symbolized from SENC

Defaults: Display Priority given by look-up table, OVERRADAR priority given by look-up table, Display Category given by look-up table, Viewing Group given by look-up table, Area colour fill from underlying DEPARE or UNSARE

Remarks: The 'New Object' feature object class has been included in order to cater for possible future requirements of the IMO that affects safety of navigation which cannot adequately be encoded by any existing object class. It must not be used unless approved by the Transfer Standard Maintenance and Application Development Working Group (TSMAD) and the Colours and Symbols Maintenance Working Group (CSMWG) and issued as an ENC Encoding Bulletin.

Figure 35 SYMINS02 conditional symbology procedure



Entry point	Entry to the symbology procedure with the calling 'New Object'
Get the Calling Object	Get the object which is calling this procedure
Get 'SYMINS'	Get the value of the attribute 'Symbol Instruction' (SYMINS)
Has value ('SYMINS')?	Is the value of the attribute 'SYMINS' given?
Create 'List of Symbology Instruction' (Initially blank)	Create 'List of Symbology Instructions' to be presented at the position of the calling object. This list is initially blank.
Select Symbology Instructions	Select Symbology instruction(s) from the value of 'SYMINS' to the 'List of Symbology Instructions'. There can be: AC(); AP(); LS(); LC(); SY(); TX(); TE(). The symbology instructions have to be added to the list in the order as they are in the SYMINS attribute value. The symbology instruction must not be added in selected list if: - it is not recognized as symbology instruction; - it calls an invalid symbology name; - it has invalid symbology parameters; - it cannot be implemented for the calling object geometry (e.g. line symbology instructions for point object and etc.)
Is the Symbology Instruction(s) valid?	Is the List of Symbology Instructions empty? (i.e. the previous Action could not select the correct symbology instructions from the value of 'SYMINS').
Symbolize Object	Using the selected Symbology Instruction(s) from the list to symbolize the calling object according to its geometry. Point symbolization (i.e. SY(), TX() and TE()) have to be drawn in the middle point of the line or in the area centre of the calling object.
Exit Procedure	Symbolization is finished
Is Point?	Is the object of type point?
SY(NEWOBJ01)	Draw the symbol 'NEWOBJ01' at the location of the calling object.
Is Line?	Is the object of type line?
LC(NEWOBJ01)	Symbolize area boundary with the line pattern 'NEWOBJ01'.
SY(NEWOBJ01); LS(DASH,2,CHMGD)	Draw the symbol 'NEWOBJ01' in the centre of the calling area object. Draw the area boundary as a dashed line, 2 units wide, in the colour 'CHMGD'.
Exit Procedure	Exit from the procedure with default symbolization

13.2.18 Conditional Symbology Procedure TOPMAR01

Applies to: S-57 Object Class "top mark" (TOPMAR)

Spatial Object(s): Point

Relation(s) used: Point objects at identical location

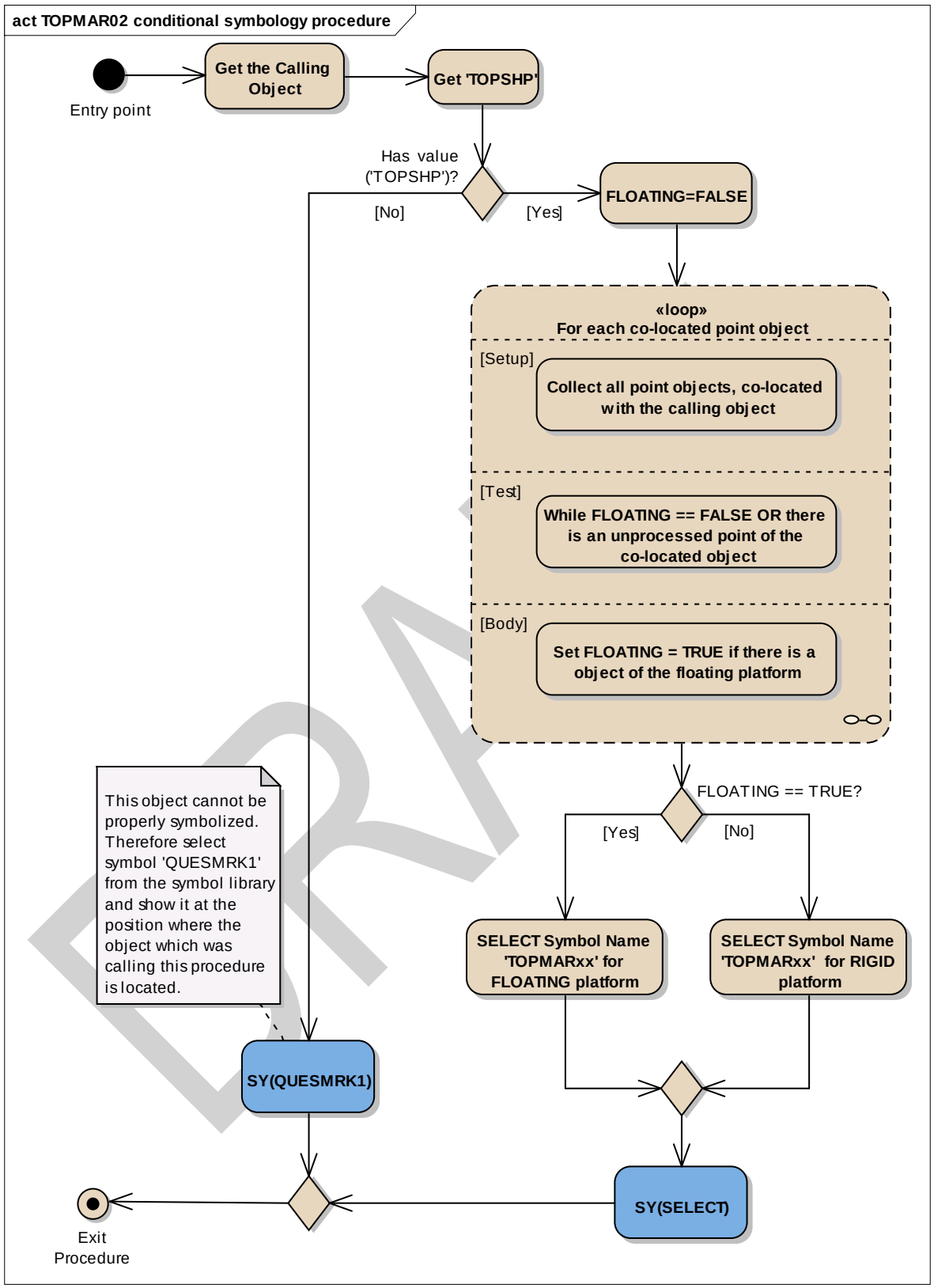
Attribute(s) used: "shape of topmark" (TOPSHP)

Parameter(s): Object to be symbolized from SENC

Defaults: Display Priority given by look-up table
OVERRADAR priority given by look-up table
Display Category given by look-up table
Viewing Group given by look-up table.
This procedure is only used in traditional symbology – the simplified symbology does not have separate topmark display.

Remarks: Topmark objects are to be symbolized through consideration of their platforms e.g. a buoy. Therefore this conditional symbology procedure searches for platforms by looking for other objects that are located at the same position. Based on the finding whether the platform is rigid or floating, the respective upright or sloping symbol is selected and presented at the objects location. Buoy symbols and topmark symbols have been carefully designed to fit to each other when combined at the same position. The result is a composed symbol that looks like the traditional symbols the mariner is used to.

Figure 36 TOPMAR01 conditional symbology procedure



Entry point	Entry to the symbology procedure with the calling 'Topmark'
Get the Calling Object	Get the object which is calling the procedure.
Get 'TOPSHP'	Get the value of the object's attribute 'Topmark/daymark shape' (TOPSHP).

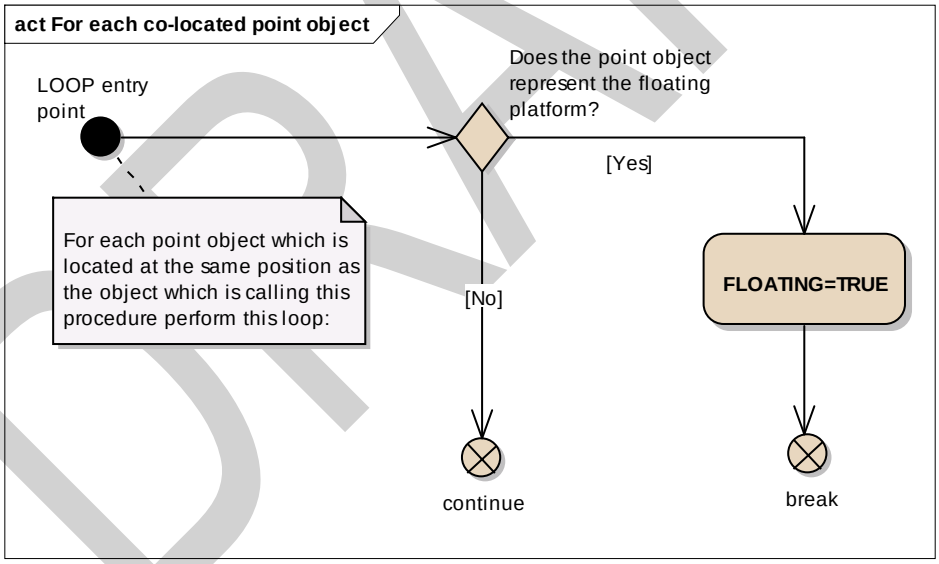
Has value ('TOPSHP')?	Is the value of the attribute 'TOPSHP' given?
SY(QUESMRK1)	If 'No', this object cannot be properly symbolized therefore draw symbol 'QUESMRK1' from the symbol library at the position where the object which was calling this procedure is located.
FLOATING=FALSE	Set local variable 'FLOATING' equal to FALSE as default value. It means there is one of the following object of the rigid platform: 'BCN...', 'BRIDGE', 'BUISGL','DAYMAR', 'LNDMRK', 'MORFAC without CATMOR=7', 'OFSPLF', 'PILPNT', 'SLCONS', 'CRANES', 'FLODOC', 'FORSTC', 'FSHFAC', 'HULKES', 'PONTON', 'OBSTRN', 'PYLONS', 'SILTNK' and 'WRECKS'.
Loop for each co-located point object	Loop for each point object which is located at the same position as the object which is calling this procedure. the value of local variable 'FLOATING' is returned. Setup - Collect all point objects, co-located with the calling object; Test –While FLOATING == FALSE OR there is an unprocessed point of the co-located object; Body - Set FLOATING = TRUE if there is an object of the floating platform
FLOATING == TRUE?	Is the object with a topmark sitting on top of a floating platform ('FLOATING' equals 'TRUE')?
SELECT='TOPMARxx' for FLOATING platform	Select appropriate symbol name depends on the attribute 'TOPSHP' value for floating platform a buoys, light float or Light vessel, see table below
SELECT='TOPMARxx' for RIGID platform	Select appropriate symbol name depends on the attribute 'TOPSHP' value for rigid platform a beacons, day marks or land marks or etc. see table below

TOPSHP Value	FLOATING Symbol Name	RIGID Symbol Name
1	TOPMAR02	TOPMAR22
2	TOPMAR04	TOPMAR24
3	TOPMAR10	TOPMAR30
4	TOPMAR12	TOPMAR32
5	TOPMAR13	TOPMAR33
6	TOPMAR14	TOPMAR34
7	TOPMAR65	TOPMAR85
8	TOPMAR17	TOPMAR86
9	TOPMAR16	TOPMAR36
10	TOPMAR08	TOPMAR28
11	TOPMAR07	TOPMAR27
12	TOPMAR14	TOPMAR14
13	TOPMAR05	TOPMAR25
14	TOPMAR06	TOPMAR26
15	TMARDEF2	TOPMAR88
16	TMARDEF2	TOPMAR87
17	TMARDEF2	TMARDEF1
18	TOPMAR10	TOPMAR30
19	TOPMAR13	TOPMAR33
20	TOPMAR14	TOPMAR34

21	TOPMAR13	TOPMAR33
22	TOPMAR14	TOPMAR34
23	TOPMAR14	TOPMAR34
24	TOPMAR02	TOPMAR22
25	TOPMAR04	TOPMAR24
26	TOPMAR10	TOPMAR30
27	TOPMAR17	TOPMAR86
28	TOPMAR18	TOPMAR89
29	TOPMAR02	TOPMAR22
30	TOPMAR17	TOPMAR86
31	TOPMAR14	TOPMAR14
32	TOPMAR10	TOPMAR30
33	TMARDEF2	TMARDEF1
Default	TMARDEF2	TMARDEF1

SY(SELECT)	Draw the selected symbol at the calling object's location.
Exit Procedure	Symbolization is finished

Figure 37 Loop for each co-located point object



LOOP entry point	The point object which is located at the same position as the object which is calling this procedure.
Does the point object represent the floating platform?	Is the point object of a class which represents a floating platform: 'LITFLT', 'LITVES' or 'BOY...' or MORFAC with CATMOR=7?
continue	If 'No', get the next point object
FLOATING=TRUE	Set the local variable 'FLOATING' equal to TRUE.
break	Stop examining point objects at the same location.

13.2.19 Conditional Symbology Procedure UDWHAZ05

Applies to: Underwater hazards of all kinds encoded by S-57 Object Class: “obstruction” (OBSTRN), “underwater rock” (UWTROC) and “wreck” (WRECKS).

Spatial Object(s): Point, Line, Area

Spatial Operations used: adjacency, intersection or coverage of areas and areas with line; location of point objects within areas

Attribute(s) used: "depth range value1" (DRVAL1); water level effect (WATLEV)

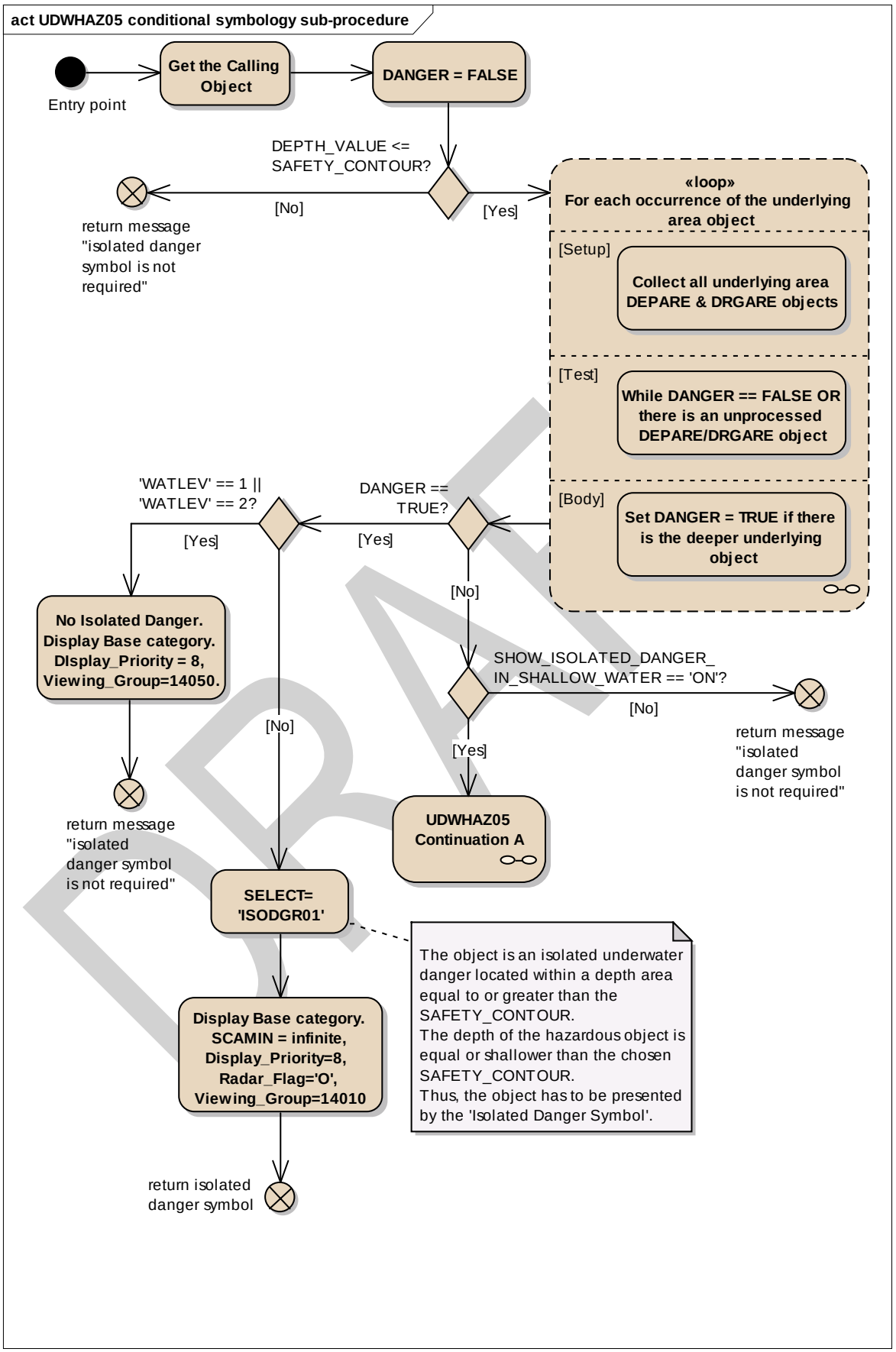
ECDIS Parameter(s): SAFETY_CONTOUR (SFC) depth value selected by the mariner; DEPTH_VALUE passed in by calling procedure.
SHOW_ISOLATED_DANGERS_IN_SHALLOW_WATERS (sub procedure?).
The manufacturer is responsible for setting the SAFETY_CONTOUR to 30 meters (see also conditional symbology procedure “DEPAREnn”). This value must stay in operation until the mariner decides to select another safety contour.

Defaults: Display Priority given by look-up table;
OVERRADAR priority given by look-up table;
Display Category given by look-up table;
Viewing Group given by look-up table.

Remarks: This procedure covers “Isolated dangers in general that endanger own ship (S-57)” (def?) (Note that this is a sub procedure called by OBSTRNnn and WRECKSnn). Obstructions or isolated underwater dangers of depths less than the safety contour which lie within the safe waters defined by the safety contour are to be presented by a specific isolated danger symbol as hazardous objects. They are then put in IMO category “DISPLAY BASE” (see IMO Performance Standards for ECDIS [2]).
In addition, if the mariner selects the option "show isolated dangers in shallow water", this procedure will highlight with the isolated danger symbol all rocks, wrecks, obstructions, which lie in 'unsafe' shallow waters between the safety contour and the drying line, putting them in IMO category STANDARD. This option is provided in case the mariner is forced by circumstances to navigate in waters shallower than the safety contour shown on the display (for example, if the safety contour should default to a value much deeper than that preferred by the mariner).

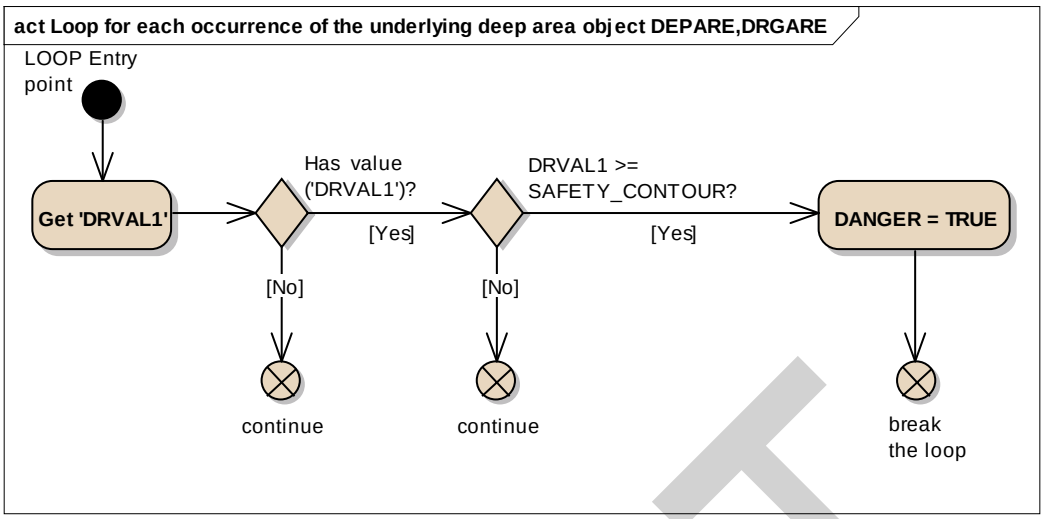
Note: In this procedure the term “safety contour” refers to the safety contour selected by the mariner, as distinct from the safety contour shown on the display (which may be a default value).

Figure 38 UDWHAZ05 conditional symbology sub-procedure



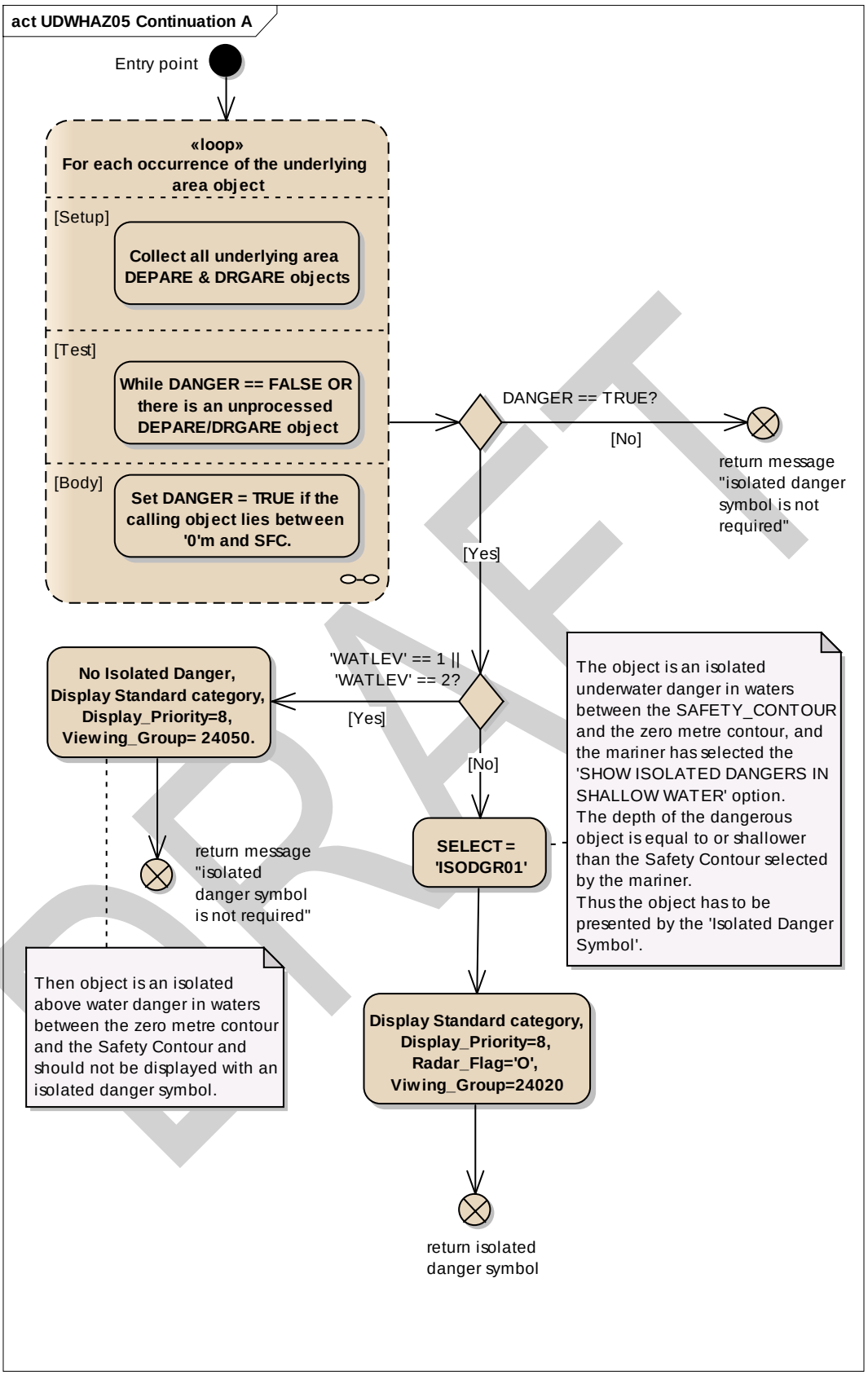
Entry point	The calling object and the local variable 'DEPTH_VALUE' are passed from the calling procedure.	
Get the Calling Object	Get the object which is calling this procedure	
DANGER = FALSE	Set the local variable 'DANGER', which will indicate is the object is an isolated danger or not, to 'FALSE'.	
DEPTH_VALUE <= SAFETY_CONTOUR?	Is 'DEPTH_VALUE' less than or equal to the value of the SAFETY_CONTOUR selected by the mariner?	
return message "isolated danger symbol is not required"	If 'No', return to the calling procedure with the message that Isolated Danger Symbol is not required.	
Loop for each occurrence of the underlying area object	For each occurrence of the object classes 'DEPARE' and 'DRGARE' which intersects or includes the location of this object, perform this loop to find out if it deeper than the Safety Contour. If so, it changes local variable 'DANGER' to TRUE Setup - Collect all underlying area DEPARE & DRGARE objects; Test - While DANGER == FALSE OR there is an unprocessed underlying DEPARE/DRGARE object; Body - Set DANGER = TRUE if there is the deeper underlying object	
DANGER == TRUE?	Is the local variable DANGER equal TRUE?	
'WATLEV' == 1 || 'WATLEV' == 2?	Is the value of attribute 'WATLEV' 1 or 2 in the calling object?	
No Isolated Danger. Display Base category. DIsplay_Priority = 8, Viewing_Group=14050.	Object is an isolated above water danger, and is in own ship safe water and should be 'DISPLAYBASE' with no isolated danger symbol.	
	Display Category	DISPLAYBASE
	Display Priority	8
	Viewing Group	14050
return message "isolated danger symbol is not required"	Return to the calling procedure with the message that Isolated Danger Symbol is not required.	
SELECT= 'ISODGR01'	The object is an isolated underwater danger located within a depth area equal to or greater than the safety contour. The depth of the hazardous object is equal or shallower than the chosen Safety Contour. Thus, the object has to be presented by the 'Isolated Danger Symbol'. Select symbol name 'ISODGR01'	
Display Base category. SCAMIN = infinite, Display_Priority=8, Radar_Flag='O', Viewing_Group=14010	Set SCAMIN (minimum scale) attribute to infinite.	
	Display Category	DISPLAYBASE
	Display Priority	8
	Radar Flag	OVERRADAR
	Viewing Group	14010
return isolated danger symbol	Return to the calling procedure with the message that Isolated Danger Symbol is to be drawn. Also return the selected symbol name and presentation parameters.	
SHOW_ISOLATED_DANGER_ IN_SHALLOW_WATER == 'ON'?	Has the mariner selected 'SHOW_ISOLATED_DANGER_IN_SHALLOW_WATER' option?	
UDWHAZ05 Continuation A	UDWHAZ05 Continuation A	
return message "isolated danger symbol is not required"	Return to the calling procedure with the message that Isolated Danger Symbol is not required.	

Figure 39 Loop for each occurrence of the underlying deep area object DEPARE,DRGARE



LOOP Entry point	The area DEPARE or DRGARE object which intersects or includes the location of the calling object.
Get 'DRVAL1'	Get the attribute 'DRVAL1' value of the examined object 'DEPARE' or 'DRGARE'.
Has value ('DRVAL1')?	Is the value of the attribute DRVAL1 given in the object DEPARE(DRGARE) ?
continue	Get the next object DEPARE or DRGARE which intersects or includes the location of the calling object because we consider empty 'DRVAL1' or <unknown> as always less than SAFETY_CONTOUR
DRVAL1 >= SAFETY_CONTOUR?	Is the value of the attribute 'DRVAL1' greater than or equal to the value of the SAFETY_CONTOUR?
continue	Get the next object DEPARE or DRGARE which intersects or includes the location of the calling object because the current one is shallower SAFETY_CONTOUR.
DANGER = TRUE	Set value of the local variable DANGER equal to TRUE.
break the loop	Stop examining area objects. End loop.

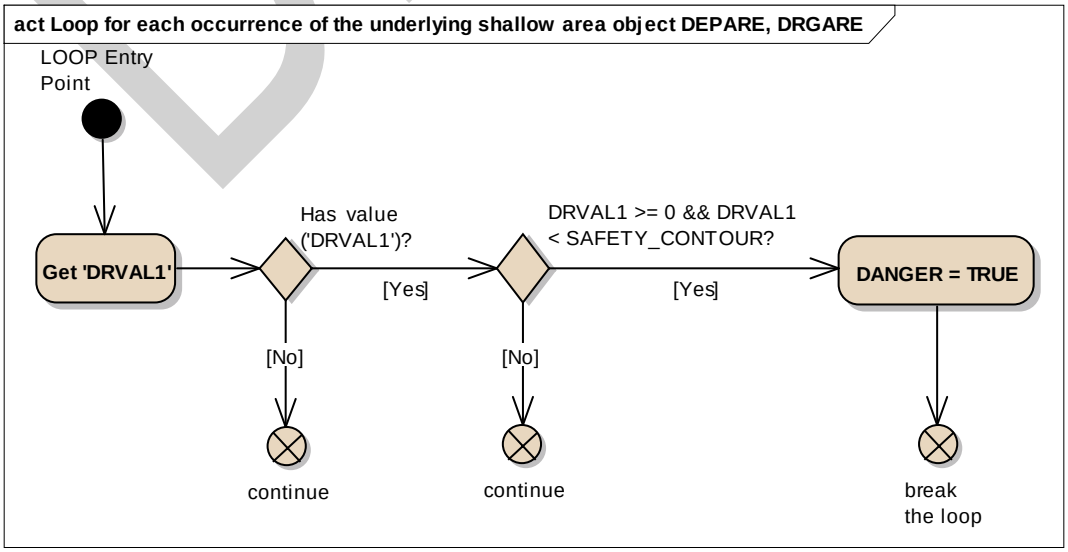
Figure 40 UDWHAZ05 Continuation A



Entry point	The calling object and the local variable 'DANGER' are passed from the calling procedure.

Loop for each occurrence of the underlying area object	For each occurrence of the object classes 'DEPARE' and 'DRGARE' which intersects or includes the location of this object, perform this loop to find out if it lies between the zero metre contour and the Safety Contour. Setup - Collect all underlying area DEPARE & DRGARE objects; Test - While DANGER == FALSE OR there is an unprocessed underlying DEPARE/DRGARE object; Body - Set DANGER = TRUE if the calling object lies between '0'm and SAFETY CONTOUR.	
DANGER == TRUE?	Is the local variable DANGER equal TRUE?	
return message "isolated danger symbol is not required"	If 'No', return to the calling procedure with the message that Isolated Danger Symbol is not required.	
'WATLEV' == 1 || 'WATLEV' == 2?	Is the value of attribute 'WATLEV' equal to 1 or 2 in the calling object?	
No Isolated Danger, Display Standard category, Display_Priority=8, Viewing_Group= 24050.	Then object is an isolated above water danger in waters between the zero metre contour and the Safety Contour and should not be displayed with an isolated danger symbol.	
	Display Category	STANDARD
	Display Priority	8
	Viewing Group	24050
return message "isolated danger symbol is not required"	Return to the calling procedure with the message that Isolated Danger Symbol is not required.	
SELECT = 'ISODGR01'	The object is an isolated underwater danger in waters between the Safety Contour and the zero metre contour, and the mariner has selected the 'Show isolated dangers in shallow water' option. The depth of the dangerous object is equal to or shallower than the Safety Contour selected by the mariner. Thus the object has to be presented by the 'Isolated Danger Symbol'.	
Display Standard category, Display_Priority=8, Radar_Flag='O', Viwing_Group=24020	Set presentation parameters of the calling object :	
	Display Category	STANDARD
	Display Priority	8
	Radar Flag	OVERRADAR
	Viewing Group	24020
return isolated danger symbol	Return to the calling procedure with the message that the Isolated Danger Symbol is to be shown. Also return the Selected symbol and the parameters of presentation.	

Figure 41 Loop for each occurrence of the underlying shallow area object DEPARE, DRGARE



LOOP Entry Point	The area DEPARE or DRGARE object which intersects or includes the location of the calling object.
Get 'DRVAL1'	Get the attribute 'DRVAL1' value of the examined object 'DEPARE' or 'DRGARE'.
Has value ('DRVAL1')?	Is the value of the attribute 'DRVAL1' given in the object DEPARE(DRGARE) ?
continue	If there is no an explicit value, get the next underlying area object. If the attribute 'DRVAL1' presents but there is no a value, it means that is intertidal area.
DRVAL1 >= 0 && DRVAL1 < SAFETY_ CONTOUR?	Is the value of the attribute 'DRVAL1' greater than or equal to the ZERO metre contour and less than the SAFETY_CONTOUR?
continue	Get the next underlying area object because the current one is deeper than SAFETY_CONTOUR.
DANGER = TRUE	Object is an isolated danger. Set local variable 'DANGER' to TRUE.
break the loop	Stop examining area objects. End loop.

13.2.20 Conditional Symbology Procedure WRECKS05

Applies to: S-57 Object Class "wrecks" (WRECKS)

Spatial Object(s): Point, Area

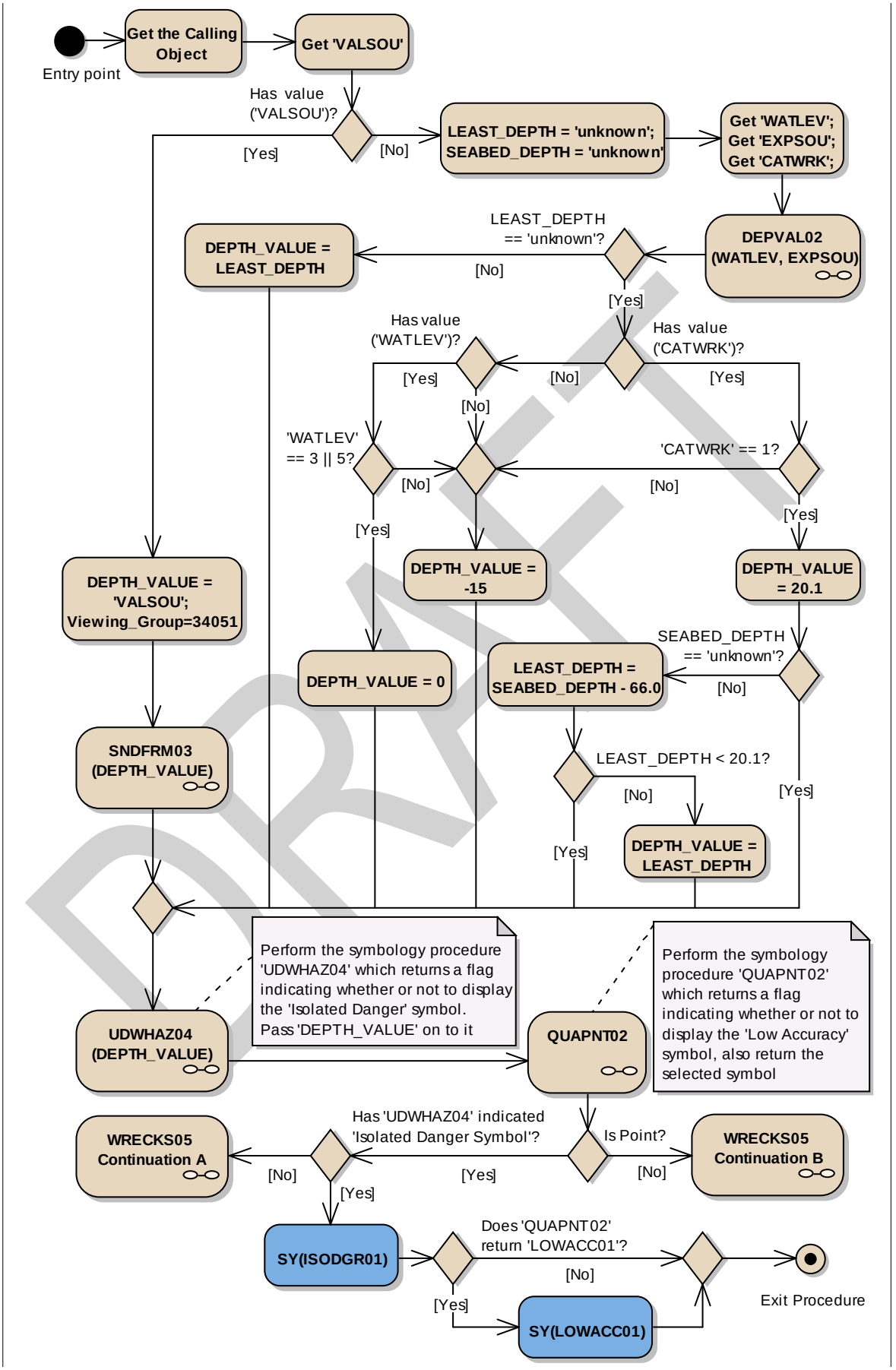
Attribute(s) used: "value of sounding" (VALSOU); "category of wreck" (CATWRK); "water level" (WATLEV); "exposition of sounding" (EXPSOU)

User Parameter(s):

Defaults: Display Priority given by look-up table;
OVERRADAR priority given by look-up table;
Display Category given by look-up table;
Viewing Group given by look-up table;
Area colour fill from underlying DEPARE or UNSARE.

Remarks: Wrecks of depths less than the safety contour which lie within the safe waters defined by the safety contour are to be presented by a specific isolated danger symbol and put in IMO category “DISPLAY BASE” (see IMO Performance Standards for ECDIS [2]). This task is performed by the sub-procedure “UDWHAZnn” which is called by this symbology procedure.
CSP "UDWHAZnn" also allows the mariner the option of displaying isolated dangers in the waters between the safety contour and the zero metre line.
In the case that the value of attribute VALSOU for the wreck is unknown, sub-procedure "DEPVALnn” is called. This will provide a return value for 'LEAST_DEPTH', the default for which is the DRVAL1 of the underlying depth area, but only on condition that the value of attribute EXPSOU is not 2 (shoaler than the depth area) or unknown, and the value of attribute WATLEV is 3 (always underwater). For the case that a wreck of unknown VALSOU lies in deep water, sub-procedure 'DEPVAL' also provides the DRVAL1 of the underlying depth area as the 'SEABED_DEPTH' for use in calculating a 'safe clearance depth' over the wreck in accordance with IHO publication S-4, appendix to specification B-422.7.

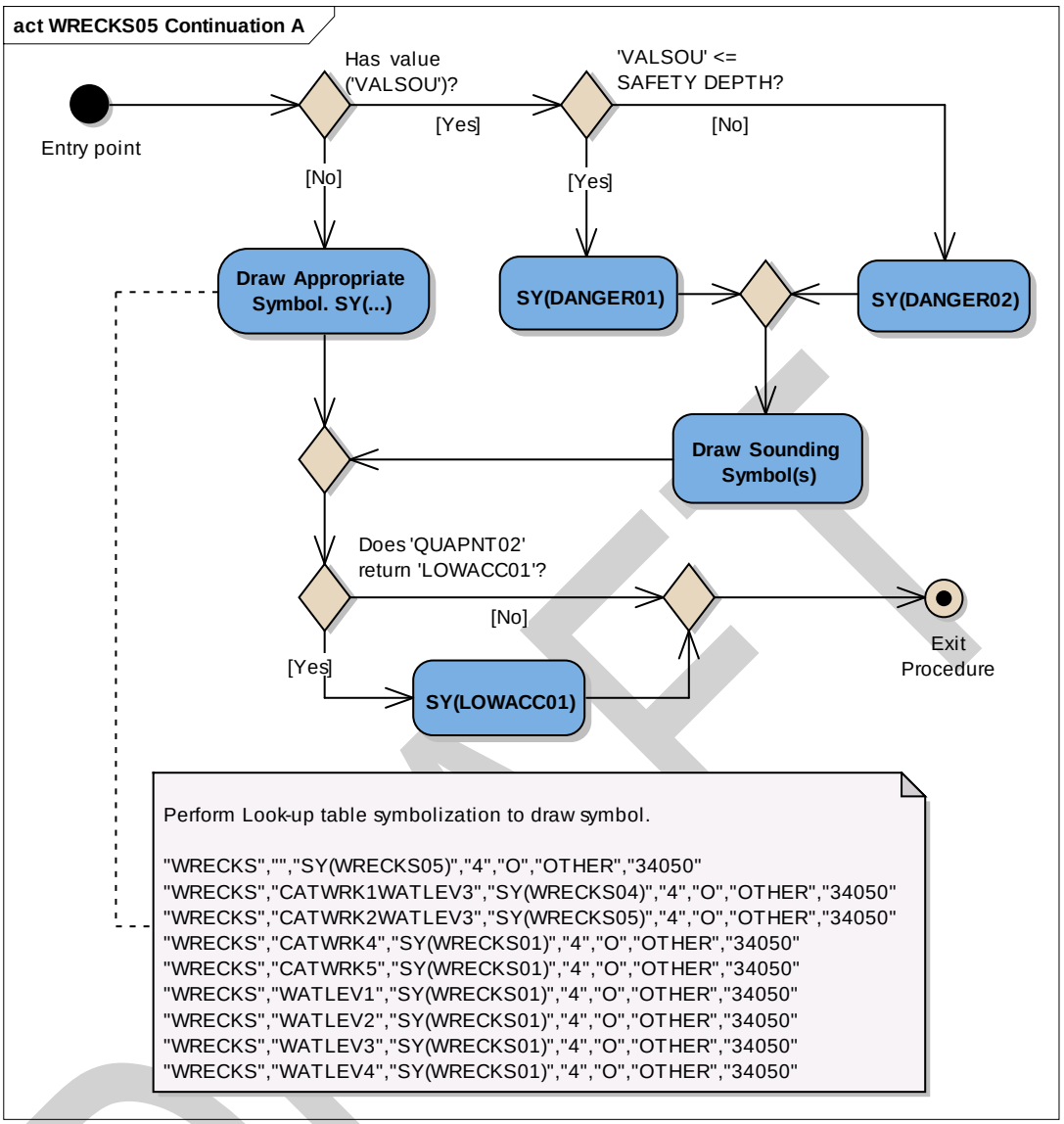
Figure 42 WRECKS05 conditional symbology procedure



Entry point	Entry to the continuation of symbology procedure with a object, wrecks (WRECKS)
Get the Calling Object	Get the object which is calling this procedure.
Get 'VALSOU'	Get the value of the attribute 'Value of sounding' (VALSOU) of the calling object
Has value ('VALSOU')?	Is the value of the attribute 'VALSOU' given?
DEPTH_VALUE = 'VALSOU'; Viewing_Group=34051	Set the local variable 'DEPTH_VALUE' equal to 'VALSOU'. Set the viewing group to 34051 for all presentation object.
SNDFRM04 (DEPTH_VALUE)	perform the symbology sub-procedure 'SNDFRM03' which symbolizes depth values. Pass 'DEPTH_VALUE' and the calling object on to it. A list of symbols is returned. Remember the Sounding Symbol(s)
DEPTH_VALUE	Input parameter
Sounding Symbols List	Output parameter
LEAST_DEPTH = 'unknown'; SEABED_DEPTH = 'unknown'	Set the local variable 'LEAST_DEPTH' equal to 'unknown' value. Set the local variable 'SEABED_DEPTH' equal to 'unknown' value.
Get 'WATLEV'; Get 'EXPSOU'; Get 'CATWRK';	Get the value of the attributes 'Water level effect' (WATLEV), 'Exposition of sounding' (EXPSOU) and 'Category of wreck' (CATWRK) of the calling object.
DEPVAL02 (WATLEV, EXPSOU)	Performs the symbology sub-procedure 'DEPVAL02' which returns a value for the local variables 'LEAST_DEPTH' and 'SEABED_DEPTH'. Pass attributes 'WATLEV and EXPSOU' on to it.
WATLEV	Input parameter
EXPSOU	Input parameter
LEAST_DEPTH	Output parameter
SEABED_DEPTH	Output parameter
LEAST_DEPTH == 'unknown'?	Is the value of the local variable 'LEAST_DEPTH' equal to 'unknown'?
DEPTH_VALUE = LEAST_DEPTH	Set the local variable 'DEPTH_VALUE' equal to the local variable 'LEAST_DEPTH'.
Has value ('CATWRK')?	Is the value of the attribute 'CATWRK' given?
'CATWRK' == 1?	Does the value of the attribute 'CATWRK' = 1 (non-dangerous wreck)?
DEPTH_VALUE = 20.1	Set value of the local variable 'DEPTH_VALUE' equal to 20.1 m
SEABED_DEPTH == 'unknown'?	Is the local variable 'SEABED_DEPTH' equal to 'unknown'?
LEAST_DEPTH = SEABED_DEPTH - 66.0	Set the local variable 'LEAST_DEPTH' equal to (SEABED_DEPTH - 66.0)
LEAST_DEPTH < 20.1?	Is the local variable 'LEAST_DEPTH' less than 20.1?
DEPTH_VALUE = LEAST_DEPTH	Set the local variable 'DEPTH_VALUE' equal to 'LEAST_DEPTH'
Has value ('WATLEV')?	Is the value of the attribute 'WATLEV' given?
'WATLEV' == 3 || 5?	Is the attribute 'WATLEV' value equal to 3 (always underwater) or 5 (awash of low water)? Else 'WATLEV' is equal to other values.
DEPTH_VALUE = 0	IF 'WATLEV'='3' (always underwater) or 'WATLEV'='5' (... at low water) THEN set value of the local variable 'DEPTH_VALUE' equal to '0'.
DEPTH_VALUE = -15	If 'WATLEV' is unknown/undefined OR 'WATLEV' is not equal '3' or '5' OR 'CATWRK' is not equal '1', set value of the local variable 'DEPTH_VALUE' equal to '-15'm
UDWHAZ05 (DEPTH_VALUE)	Performs the symbology sub-procedure 'UDWHAZ05' which returns a flag indicating whether or not to display the ISOLATED DANGER SYMBOL [IMO PS App.2 1.3] and the selected symbol. Pass 'DEPTH_VALUE' on to it.

	Return: selected symbol name 'ISODGR01'; Parameters presentation: SCAMIN, DISPLAY MODE, PRIORITY, RADAR FLAG, VIEWING GROUP if they are changed.
DEPTH_VALUE	Input parameter
'Isolated Danger Symbol'	Output parameter
QUAPNT02	Perform the symbology sub-procedure 'QUAPNT02' which returns a flag indicating whether or not to display the low accuracy symbol and returns the selected symbol 'LOWACC01'
'Low Accuracy Symbol'	Output parameter
Is Point?	Is the calling object of type point?
WRECKS05 Continuation B	Area objects, wrecks (WRECKS). Pass the list of selected symbols from 'UDWHAZ05', 'SNDFRM04' and 'QUAPNT02' sup-procedures, values of 'VALSOU' attribute if they are.
Has 'UDWHAZ05' indicated 'Isolated Danger Symbol'?	Has the procedure 'UDWHAZ05' indicated that the isolated danger symbol shall be drawn?
WRECKS05 Continuation A	Symbolization of point objects "wreck" (WRECKS) without 'Isolated Danger Symbol'. Pass the list of selected symbols from SNDFRM04 and QUAPNT02 sup-procedures, values of 'VALSOU' attribute if they are.
SY(ISODGR01)	Draw the selected symbol 'ISODGR01' (isolated danger) at the calling object's location.
Does 'QUAPNT02' return 'LOWACC01'?	Is the symbol 'LOWACC01' selected by the procedure 'QUAPNT02'?
SY(LOWACC01)	If so indicated by the procedure 'QUAPNT02', draw the returned low accuracy symbol 'LOWACC01' at the calling object's location.
Exit Procedure	Symbolization is finished.

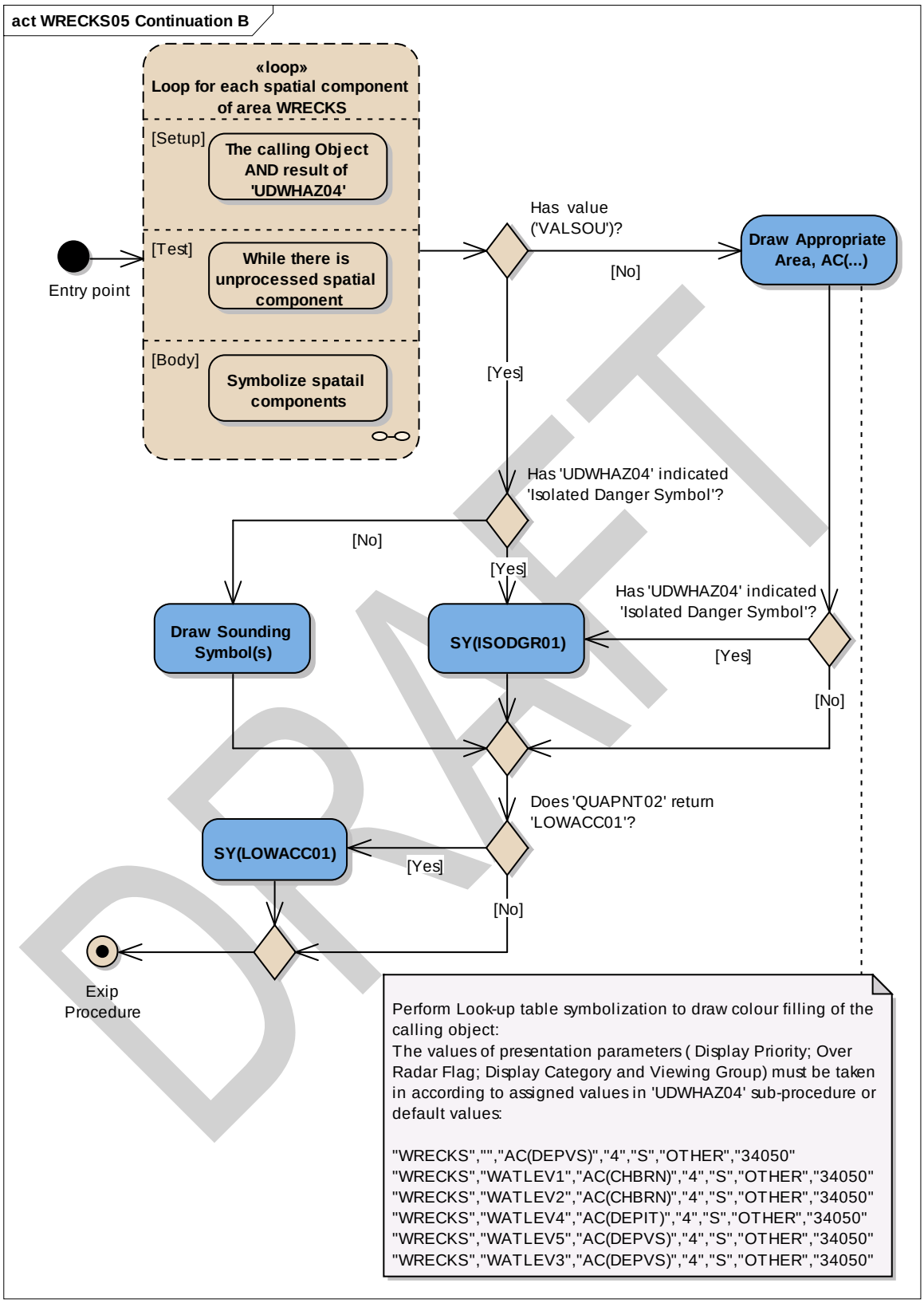
Figure 43 WRECKS05 Continuation A



Entry point	The calling object and lists of selected symbols from SNDFRM04 and QUAPNT02 sup-procedures are passed from the calling procedure.
Has value ('VALSOU')?	Is the value of the attribute 'VALSOU' given?
'VALSOU' <= SAFETY DEPTH?	Is the value of the attribute 'VALSOU' less than or equal to SAFETY DEPTH?
SY(DANGER01)	Draw the symbol 'DANGER01' at the calling object's location.
SY(DANGER02)	Draw the symbol 'DANGER02' at the calling object's location.
Draw Sounding Symbol(s)	Draw the sounding symbol(s) returned from 'SNDFRM04' on top at the calling object's location.
Draw Appropriate Symbol. SY(...)	Perform Look-up table symbolization to draw symbol. The values of presentation parameters (Display Priority; Over Radar Flag; Display Category and Viewing Group) must be taken in according to assigned values in 'UDWHAZ05' sub-procedure or default values: "WRECKS","","SY(WRECKS05)","4","O","OTHER","34050" "WRECKS","CATWRK1WATLEV3","SY(WRECKS04)","4","O","OTHER","34050" "WRECKS","CATWRK2WATLEV3","SY(WRECKS05)","4","O","OTHER","34050"

	"WRECKS","CATWRK4","SY(WRECKS01)","4","O","OTHER","34050" "WRECKS","CATWRK5","SY(WRECKS01)","4","O","OTHER","34050" "WRECKS","WATLEV1","SY(WRECKS01)","4","O","OTHER","34050" "WRECKS","WATLEV2","SY(WRECKS01)","4","O","OTHER","34050" "WRECKS","WATLEV3","SY(WRECKS01)","4","O","OTHER","34050" "WRECKS","WATLEV4","SY(WRECKS01)","4","O","OTHER","34050"
Does 'QUAPNT02' return 'LOWACC01'?	Is the symbol 'LOWACC01' selected by the procedure 'QUAPNT02'?
SY(LOWACC01)	If so indicated by the procedure 'QUAPNT02', draw the returned low accuracy symbol 'LOWACC01' at the calling object's location.
Exit Procedure	Symbolization is Finished

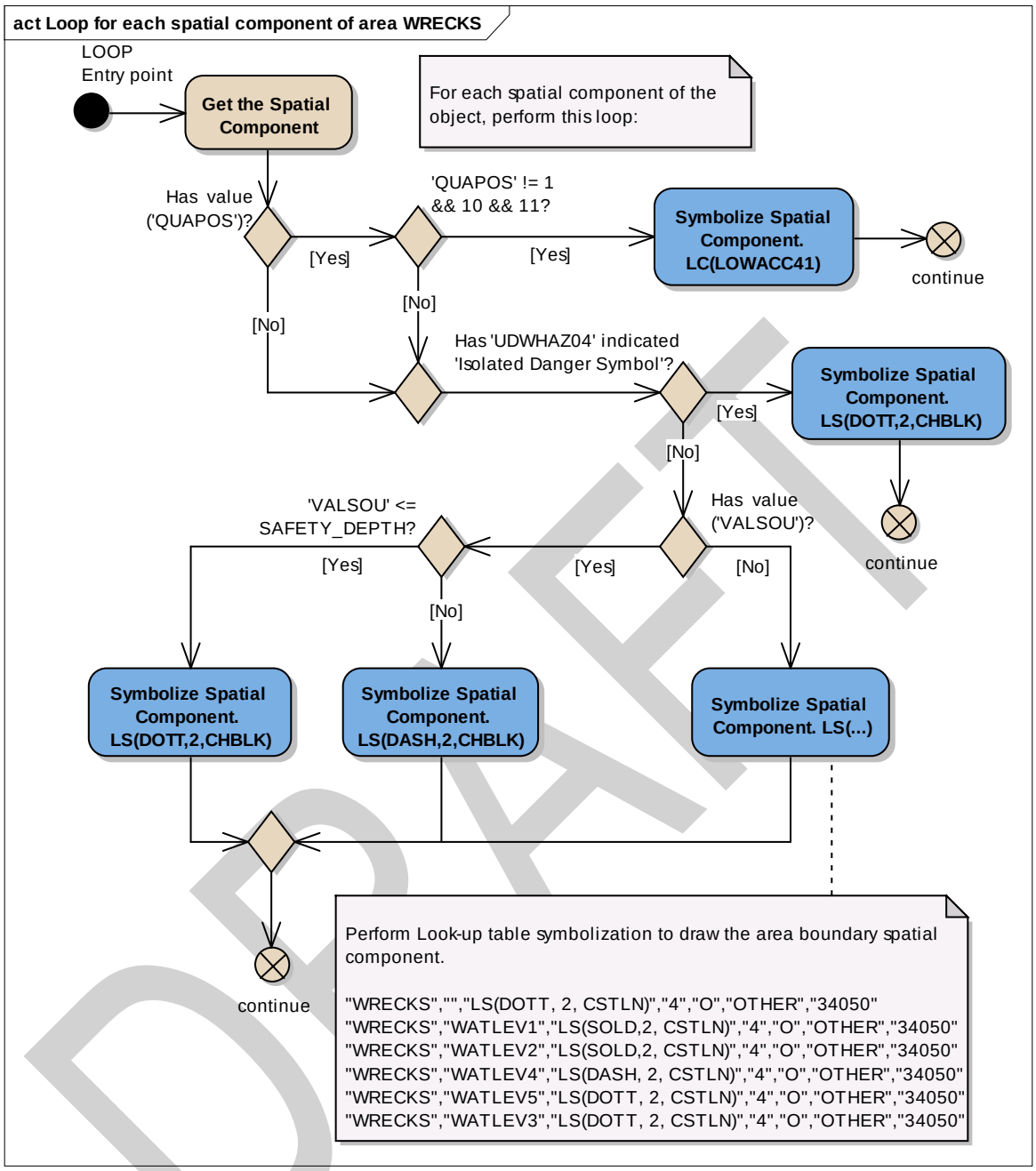
Figure 44 WRECKS05 Continuation B



Entry point	The calling object and lists of selected symbols from SNDFRM04, UDWHAZ05 and QUAPNT02 sup-procedures are passed from the calling procedure.

Loop for each spatial component of area WRECKS	For each spatial component of area WRECKS perform this loop. Setup - The Calling Object AND results of 'UDWHAZ05' Test - While there is unprocessed spatial component Body - to symbolize a spatial component if it is needed.
Has value ('VALSOU')?	Is the value of the attribute 'VALSOU' given?
Has 'UDWHAZ05' indicated 'Isolated Danger Symbol'?	Has the procedure 'UDWHAZ05' indicated that the isolated danger symbol shall be shown?
SY(ISODGR01)	Draw the selected symbol 'ISODGR01' returned by 'UDWHAZ05' in the centre of the area.
Draw Sounding Symbol(s)	Draw the sounding symbol(s) returned from 'SNDFRM04' at the centre of the area
Draw Appropriate Area, AC(...)	Perform Look-up table symbolization to draw colour filling of the calling object. The values of presentation parameters (Display Priority; Over Radar Flag; Display Category and Viewing Group) must be taken in according to assigned values in 'UDWHAZ05' sub-procedure or default values: "WRECKS","","AC(DEPVS)","4","S","OTHER","34050" "WRECKS","WATLEV1","AC(CHBRN)","4","S","OTHER","34050" "WRECKS","WATLEV2","AC(CHBRN)","4","S","OTHER","34050" "WRECKS","WATLEV4","AC(DEPIT)","4","S","OTHER","34050" "WRECKS","WATLEV5","AC(DEPVS)","4","S","OTHER","34050" "WRECKS","WATLEV3","AC(DEPVS)","4","S","OTHER","34050"
Has 'UDWHAZ05' indicated 'Isolated Danger Symbol'?	Has the procedure 'UDWHAZ05 indicated that the isolated danger symbol shall be shown?
Does 'QUAPNT02' return 'LOWACC01'?	Has the procedure 'QUAPNT02' indicated that the quality of position symbol shall be shown?
SY(LOWACC01)	Draw the selected symbol 'LOWACC01' returned by 'QUAPNT02' in the centre of the area.
Exit Procedure	Symbolization is finished

Figure 45 Loop for each spatial component of area WRECKS



LOOP Entry point	The spatial components of the calling object.
Get the Spatial Component	Get the next spatial object (edge) of the calling object.
Has value ('QUAPOS')?	Is the spatial attribute 'QUAPOS' given?
'QUAPOS' != 1 && 10 && 11?	Does the value of attribute 'QUAPOS' equal to neither of the following values: '1', '10', and '11'?
Symbolize Spatial Component. LC(LOWACC41)	Symbolize the area boundary spatial component with 'LC(LOWACC41)'
continue	go to the next spatial component.
Has 'UDWHAZ05' indicated 'Isolated Danger Symbol'?	Has the procedure 'UDWHAZ05' indicated that the isolated danger symbol shall be shown?
Symbolize Spatial Component.	Symbolize the area boundary spatial component with a dotted line, 2 units wide, colour 'CHBLK'

LS(DOTT,2,CHBLK)	The values of presentation parameters (Display Priority; Radar Flag; Display Category and Viewing Group) must be taken in according to assigned values in 'UDWHAZ05' sub-procedure.
continue	go to the next spatial component.
Has value ('VALSOU')?	Is the value of the attribute 'VALSOU' given?
'VALSOU' <= SAFETY_DEPTH?	Is the value of the attribute 'VALSOU' less than or equal to SAFETY_DEPTH?
Symbolize Spatial Component. LS(DOTT,2,CHBLK)	Symbolize the area boundary spatial component with a dotted line, 2 units wide, colour 'CHBLK'
Symbolize Spatial Component. LS(DASH,2,CHBLK)	Symbolize the area boundary spatial component with a dashed line, 2 units wide, colour 'CHBLK'
Symbolize Spatial Component. LS(...)	Perform Look-up table symbolization to draw the area boundary spatial component. "WRECKS","","LS(DOTT, 2, CSTLN)","4","O","OTHER","34050" "WRECKS","WATLEV1","LS(SOLD,2, CSTLN)","4","O","OTHER","34050" "WRECKS","WATLEV2","LS(SOLD,2, CSTLN)","4","O","OTHER","34050" "WRECKS","WATLEV4","LS(DASH, 2, CSTLN)","4","O","OTHER","34050" "WRECKS","WATLEV5","LS(DOTT, 2, CSTLN)","4","O","OTHER","34050" "WRECKS","WATLEV3","LS(DOTT, 2, CSTLN)","4","O","OTHER","34050"
continue	go to the next spatial component.

14 Tables

14.1 Colour Tables

The colour tables are designed for different conditions of ambient illumination on the bridge.

The colours are defined in CIE (Commission Internationale de l'Eclairage) values. The ECDIS manufacturer is responsible for computing the correct RGB values for the monitor he uses, from CIE values.

ECDIS manufacturers must refer to section 4 of S-52 for details for the design and use of the colour tables.

There are 63 colours in these tables. With the addition of the transparent colour (TRNSP) there are 64 colour tokens.

14.2 Viewing Group Layers

Numbering scheme for viewing groups *(Mariners' information in italics)*

DISPLAY BASE	STANDARD DISPLAY	OTHER INFORMATION
00000-09999 reserved for administrative purposes		
10000 reserved *40000 reserved*	20000 reserved *50000 reserved*	30000 reserved *60000 reserved*
11000 A,B information about the chart display *41000 tools*	21000 A,B 51000 tool	31000 A,B *61000 tools*
12000 C, D, E, F land features *42000 own ship, planned route*	22000 C, D, E, F *52000 own ship etc.*	32000 C, D, E, F *62000 own ship etc.*
13000 H, I depths & currents *43000 Mariners' features*	23000 H,I *53000 Mariners' features*	33000 H,I *63000 Mariners' features*
14000 J,K,L obstructions, pipelines *44000 other vessels*	24000 J,K,L *54000 other vessels*	34000 J,K,L *64000 other vessels*
15000 M traffic, routes *45000 manufacturers' features*	25000 M *55000 manufacturers' features*	35000 M *65000 manufacturers' features*
16000 N special areas *46000 Mariners' assignments*	26000 N *56000 Mariners' assignments*	36000 N *66000 Mariners' assignments*
17000 P,Q,R,S buoys, beacons, lights, radar *47000 reserved for Mariners' information*	27000 P,Q,R,S *57000 reserved*	37000 P,Q,R,S *67000 reserved*
18000 T,U services & small craft facilities	28000 T,U *58000 reserved*	38000 T,U *68000 reserved*

48000 reserved for Mariners' information		
19000-19999 reserved *49000-49999 reserved*	29000-29999 reserved *59000-59999 reserved*	39000-39999 reserved *69000-69999 reserved*
70000-99999 reserved for future use.		

Note: These viewing groups reflect the display category, but they do not set it. Display Category is set by field 6 of the look-up table.

Gaps between sets and groups have been left deliberately to allow for future expansion. "na" means that a particular set or group is not yet assigned

CHART INFORMATION - DISPLAY BASE

RESERVED	
10000-10999	Reserved for chart information
A, B	CHART FURNITURE
11000	Information about the Chart Display
11010 11020	cursor [symbol SY(CURSRA01)] na (not assigned)
11030	scalebar, latitude scale [SY(SCALEB10),SY(SCALEB11)]
11040	north arrow [SY(NORTHAR1)]
11050	no data [colour NODTA, AP(NODATA03)], unsurveyed (UNSARE), incompletely surveyed area
11060	Non-HO data boundary LC(NONHODAT)
C, D, E, F	TOPOGRAPHY AND INFRASTRUCTURE
12000	Land area
12010	land area (LANDARE)
12200	Dangers above water
12210	bridge (BRIDGE), pylon (PYLONS), overhead cable (CBLOHD), conveyor (CONVYR), overhead pipeline (PIPOHD), offshore platform (OFSPLF)
12400	Shoreline
12410	coastline (COALNE), ice shelf, glacier (ICEARE), shoreline construction (SLCONS), tie-up wall, dolphin (MORFAC), gate (GATCON, pile (PILPNT), crib, wellhead, ice boom (OBSTRN), floating dock (FLODOC), hulk (HULKES), pontoon (PONTON), oil boom (OILBAR), log boom (LOGPON), flood barrage (DAMCON, CATDAM3)
12420	dock (DOCARE), lock (LOKBSN), canal (CANALS), river (RIVERS)
H, I	HYDROGRAPHY
13000	Safety Contour
13010	safety contour (from conditional symbology procedure DEPCNT03)
13020	na
13030	depth area (DEPARE), dredged area (DRGARE),
J, K, L	SUBSEA FEATURES
14000	Dangers under water
14010	isolated underwater dangers in water deeper than the displayed safety contour (rocks, wrecks, obstructions, mooring cables from conditional symbology procedure)
M	TRACKS AND ROUTES
15000-15999	na (not assigned)
N	SPECIAL AREAS
16000-16999	na (not assigned)
P, Q, R, S	AIDS TO NAVIGATION
17000-17999	na (not assigned)
T, U	SERVICES
18000-18999	na (not assigned)
RESERVED	
19000-19999	Reserved for chart information

The groupings are given to illustrate the contents of the Display Base. All objects of this category must be permanently retained on the ECDIS display.

CHART INFORMATION - STANDARD DISPLAY

RESERVED	
20000	Reserved for chart information
A, B	INFORMATION ABOUT THE CHART DISPLAY
21000	Information about the Chart Display
21010	Unknown object (magenta question mark)
21020	Generic Object (NEWOBJ01)
21030	Chart scale boundary, overscale data [AP(OVERSCO1)]
21040	na
21050	na
21060	Place-holder for geographic names (LNDRGN, SEAARE)
C, D, E, F	NATURAL & MAN-MADE FEATURES, PORT FEATURES
22000	Major Coastal Features
22010	Lake (LAKARE), sloping ground (SLOGRD), slope top (SLOTOP), dyke (DYKCON), causeway (CAUSWY), dam (DAMCON),
22200	Conspicuous landmarks:
22210	Radar conspicuous object - (any object with attribute CONRAD 1)
22220	Visually conspicuous object (any object with attribute CONVIS 1)
22230	na
22240	Built up area (BUAARE)
H, I	DEPTHS, CURRENTS, etc.
23000	Depths
23010	Area of depth less than the safety contour (DIAMON01 pattern)
23020	na
23030	Swept area (SWPARE)
J, K, L	SEABED, OBSTRUCTIONS, PIPELINES
24000	Seabed dangers
24010	Mooring cables (MORFAC, CATMOR6), (CBLSUB, CATCBL6), tunnel on Seabed (TUNNEL, BURDEP=0), sandwaves (SNDWAV)
M	TRAFFIC ROUTES
25000	Routes and Tracks
25010	Leading line, clearing line (NAVLNE), traffic lane (TSSLPT), deep water route (DWRTPT), traffic separation area (TSEZNE), traffic separation line (TSELNE), traffic roundabout (TSSRON), traffic crossing (TSSCRS), precautionary area (PRCARE), traffic separation scheme boundary (TSSBND), deep water route centre line (DWRTCL), two way route part (TWRTPT), inshore traffic zone (ISTZNE).
25020	Recommended track (RECTRC), recommended traffic lane (RCTLPT), recommended route centreline (RCRTCL)
25030	Ferry route (FERYRT)
25040	Radar line (RADLNE), limit of shore radar (RADRNG)
25060	Radio calling in point (RDOCAL)

N	SPECIAL AREAS
26000	Restricted and Cautionary Areas
26010	Restricted area (RESARE)
26020	na
26030	na
26040	Submarine transit lane (SUBTLN), military practice area (MIPARE), sea plane landing area (SPLARE), offshore production area (OSPARE)
26050	Fairway (FAIRWY)
26150	Caution area (CTNARE)
26200	Information Areas. Protected Areas
26210	Fishing ground (FSHGRD), marine farm (MARCUL),Fishing Facility(FSHFAC)
26220	Anchorage area (ACHARE), anchor berth (ACHBRT),
26230	na
26240	Dumping ground (DMPGRD),
26250	Cargo transhipment (CTSARE), incineration (ICNARE)
26260	Archipelagic sea lane (ASLXIS, ARCSLN)
P, Q, R, S	BUOYS & BEACONS, LIGHTS, FOG SIGNALS, RADAR
27000	Buoys, Beacons, Topmarks, Lights, Fog Signals
27010	Buoy (BOYxxx), light float (LITFLT), mooring buoy (MORFAC, CATMOR7)
27011	Light vessel (LITVES)
27020	Beacon (BCNxxx)
27025	Daymark (DAYMAR)
27030	Distance mark (DISMAR)
27040	Direction of buoyage IALA buoyage regions (M_NSYS)
27050	topmarks (TOPMAR) - for paper chart symbols
27060	gridiron (GRIDRN)
27070	light (LIGHTS)
27080	fog signal (FOGSIG), retro-reflector (RETRFL)
27200	Radar
27210	racon (RTPBCN)
27220	na
27230	radar reflector (RADRFL)
T, U	SERVICES & SMALL CRAFT FACILITIES
28000	Services
28010	pilot boarding point (PILBOP)
28020	signal station, traffic (SISTAT), sig. stn. warning (SISTAW)
RESERVED	
29000	reserved for chart information

OTHER CHART INFORMATION

RESERVED	
30000	reserved for chart information
A, B	INFORMATION ABOUT THE CHART DISPLAY
31000	Information about the Chart Display
31010	accuracy of data (M_ACCY), survey reliability (M_SREL), quality of data (M_QUAL)

31011	symbol LOWACC01, identifying low accuracy data, applied to the spatial object of point and area wrecks, rocks and obstructions and to point land areas
31020	nautical publication (M_NPUB)
31030	Additional Information INFORM,NINFOM
31031	Additional Documents NTXTDS, TXTDSC, PICREP
31040	data scale and coverage (M_CSCL, M_COVR)
31050	na
31060	na
31070	na
31080	magnetic variation (MAGVAR), local magnetic anomaly (LOCMAG)
C, D, E, F	NATURAL & MAN-MADE FEATURES, PORT FEATURES
32000	Natural Features
32010	dunes , hills (SLOGRD), ridge, clifftop (SLOTOP), contours and elevation (LNDELV)
32020	na
32030	trees , vegetation, mangrove (VEGATN), marsh (LNDRGN)
32040	na
32050	river (RIVERS) or lake (LAKARE); also rapids (RAPIDS), waterfall (WATFAL)
32060	Na
32070	tideway (TIDWAY)
32080	na
32200	Shore Structures
32210	na
32220	any of the following not classified as CONVIS1 (conspicuous): landmark (LNDMRK), building (BUISGL), tank, silo, water tower (SILTNK), wall (FNCLNE), fort (FORSTC)
32230	na
32240	airport (AIRARE), runway (RUNWAY)
32250	railway (RAILWY), road (ROADWY), tunnel (TUNNEL), control point (CTRPNT)
32260	na
32270	quarry, refinery, power station, tank farm, wind farm, factory, timber yard (PRDARE)
32280	na
32400	Port Features
32410	harbour type (HRBFAC), customs check point (CHKPNT) [note: "small craft facilities" (SMCFAC) is in group 38210]
32420	na
32430	na
32440	berth number (BERTHS), mooring facility (such as bollard) (MORFAC), , gate (such as lock gate) (GATCON) , dry dock (DRYDOC), crane (CRANES)
32450	na
32460	na
H, I	DEPTHS, CURRENTS ETC
33000	Depths, Currents, Tide rips, etc.
33010	Soundings (SOUNDG)

33020	depth contours (DEPCNT) other than the safety contour
33021	label for the safety contour
33022	label for contours other than the safety contour
33030	na
33040	water turbulence (WATTUR)
33050	tidal information (T_HMON, T_NHMN, T_TIMS)
33060	current and tidal stream information (CURENT, TS_FEB, TS_PAD, TS_PNH, TS_PRH, TS_TIS)
J, K, L	SEABED, OBSTRUCTIONS, PIPELINES
34000	Seabed Information: rocks, wrecks & obstructions, pipes & cables
34010	nature of seabed (SBDARE)
34020	spring (SPRING), sea weed (WEDKLP)
34030	Pipeline area (PIPARE), cable area (CBLARE)
34040	na
34050	rocks (UWTROC), wrecks (WRECKS), obstructions (OBSTRN), which are not a danger to own-ship's navigation (these are all Display Base if a danger to own-ship)
34051	non-dangerous rocks (UWTROC), wrecks (WRECKS) and obstructions (OBSTRN) which have a VALSOU attribute and are not a danger to own-ship's navigation (these objects are all Display Base if a danger to own-ship)
34060	na
34070	submarine cable (CBLSUB), submarine pipeline (PIPSOL)
M	TRAFFIC ROUTES
35000	Routes
35010	na
N	SPECIAL AREAS
36000	Administrative Areas, (by cursor enquiry)
36010	continental shelf (COSARE),
36020	harbour area (HRBARE) free port area (FRPARE), customs zone (CUSZNE)
36030	na
36040	fishery zone (FSHZNE)
36050	contiguous zone (CONZNE), exclusive economic zone (EXEZNE), national territorial area (NATARE), territorial sea (TESARE), territorial sea baseline (STSLNE), administration area (ADMARE)
P, Q, R, S	BUOYS & BEACONS, LIGHTS, FOG SIGNALS, RADAR
37000-37999	na
T, U	SERVICES & SMALL CRAFT FACILITIES
38000	Services
38010	radar station (RADSTA), radio station (RDOSTA)
38020	na
38030	coastguard station (CGUSTA), rescue station (RSCSTA)
38200	Small craft facilities
38210	small craft facilities (SMCFAC)
RESERVED	
39000	reserved for chart information

MARINERS' INFORMATION - DISPLAY BASE

RESERVED	
40000	Reserved for Mariners' information
TOOLS	
41000-41999	na
OWN-SHIP, PLANNED ROUTES, PAST TRACKS	
42000	Own ship
42010	Own ship (ownship), symbol or scaled version, together with heading line, beam bearing line and course and speed vector
42200	Selected Planned Route
42210	legline (leglin, select 1), way points (waypnt, select 1)
42220	Course to make good for selected leglines
MARINERS' FEATURES	
43000	na
OTHER VESSELS	
44000	na
MANUFACTURERS' FEATURES	
45000-45999	Manufacturers' Features
MARINERS' ASSIGNMENTS TO DISPLAY BASE	
46000-46999	Mariners' and manufacturers' objects assigned to Display Base by the Mariner
RESERVED	
47000-49999	reserved for Mariners' information

MARINERS' INFORMATION - STANDARD DISPLAY

RESERVED	
50000	reserved for Mariners' information
TOOLS	
51000-51999	na
OWN-SHIP, PLANNED ROUTES, PAST TRACKS	
52000	Notations on Selected Planned Route
52010	wheel-over line (wholin), selected route
52020	course to make good on leglines (leglin, select 1) of selected route
52030	planned position (pinpos), distance to go, and other notations on selected planned route
52200	Alternate Planned Route
52210	leglin (leglin, select 2), waypoint (waypnt, select 2) of alternate planned route
52220	na
52230	wheel-over line (wholin), alternate route
52240	other notations, alternate route
52400	Past Track
52410	event (events)
52420	na
52430	primary past track (pastrk, catpst 1)
52440	notations on primary past track

52450	na
52460	secondary past track (pastrk catpst 2)
MARINERS' FEATURES	
53000	Mariners' features
53010	danger highlight (dnghlt)
53030	Mariners' information note (marnot catnot 1)
53040	Mariners' cautionary note (marnot catnot 2)
53050	Mariners' feature (marfea)
53060	na
53070	na
53080	tidal current observed (tidcur, catcur 2), tidal current predicted (tidcur, catcur 1)
OTHER VESSELS	
54000	Other Ships
54010	other ships (vessels) from radar
54020	notations on other ships (acqsta)
54030	other ships from other sources or undefined sources

MANUFACTURERS' FEATURES	
55000	Manufacturers’ Features
55010	manufacturers' feature (mnufea, catnot 1)
55020	manufacturers' feature (mnufea, catnot 2)
MARINERS' ASSIGNMENTS TO STANDARD DISPLAY	
56000-66999	Mariners' and manufacturers' Objects Assigned to Standard Display by the Mariner
RESERVED	
57000-59999	reserved for Mariners’ information

OTHER MARINERS' INFORMATION

RESERVED	
60000	reserved for Mariners’ information
TOOLS	
61000	Tools
61010	electronic bearing line (ebline), variable range marker (vrmark)
61020	na
61030	range rings (rngrng)
61040	cursor, style B (cursor, cursty2)
61050	cursor reference point (refpnt)
OWN-SHIP, PLANNED ROUTES, PAST TRACKS	
62000	Position fixes
62010	position fix (positn)
62020	position line (poslin)
MARINERS' FEATURES	
63000-63999	na
OTHER VESSELS	
64000-64999	na

MANUFACTURERS' FEATURES	
65000-65999	Manufacturers' Features
MARINERS' ASSIGNMENTS TO OTHER INFORMATION	
66000-66999	Mariners' and manufacturers' objects assigned to other information by the Mariner
RESERVED	
67000-69999	reserved for Mariners' information

14.3 ECDIS Viewing Group Implementation

For standardization of the ECDIS Human Machine Interface (HMI) and to facilitate generic training of Mariners as a minimum the following viewing group layers must be implemented to control display of charted objects. An ECDIS may provide more display on/off controls than are available in this table, but OEMs must use the viewing group layer names contained in this table. The viewing group names are derived from the IMO PS.

Viewing Group Layer	Name of viewing group layer in the ECDIS	Viewing groups included
1	Display Base	10000 - 19999
Standard Display:		
2	Drying line	22010
3	Buoys, beacons, aids to navigation	21020, 22200 – 22240, 27000, 27010, 27011, 27020, 27025, 27040, 27050, 27070, 27080, 27200, 27210, 27230, 27030, 27060
3.1	Buoys, beacons, structures	21010, 21020, 22200 - 22240, 27000-27050, 27080, 27200 – 27230, 27030, 27060
3.2	Lights	27070
4	Boundaries and limits	23030, 26050, 26220, 26240, 26250
5	Prohibited and restricted areas	26000, 26010, 26040
6	Chart scale boundaries	21030
7	Cautionary notes	26150
8	Ships' routeing systems and ferry routes	25010-25060
9	Archipelagic sea lanes	26260
10	Miscellaneous	Switches on and off all not covered objects by viewing group layers 20000-29999
Other		
11	Spot soundings	33010
12	Submarine cables and pipelines	34030, 34070
13	All isolated dangers	34050, 34051
14	Magnetic variation	31080
15	Depth contours	33020
16	Seabed	34010, 34020, 33040
17	Tidal	33050, 33060
18	Miscellaneous	Switches on and off all not covered objects by viewing group

		layers 30000-39999 or not covered cases by independent mariner selections (see 10.3.4.4)

14.4 Text Groupings

Value of Text Group	Text Group Description	S-57 Object and Attribute Acronyms
00-10	reserved for future assignment by IHO.	
IMPORTANT Text		
10		
11	Vertical Clearance of Bridges	BRIDGE, VERCLR, VERCCL VERCOP, VERCSA
	Vertical Clearance of Overhead Cable	CBLOHD, VERCLR
	Vertical Clearance of Overhead Pipeline	PIPOHD, VERCLR
	Vertical Clearance of Conveyor	CONVYR, VERCLR
	Bearing of Navline	NAVLNE, ORIENT
	Recommended Route	RCRTCL
	Deep Water Route Centreline Line	DWRTCL
	Recommended Track	RECTRC
	Name and Communications Channel of Radio Calling-In Point	RDOCAL, OBJNAM, COMCHA
Other Text		
20		
21	Name or Number of Buoys	BOYxxx, OBJNAM
	Name or Number of Beacons	BCNxxx, OBJNAM
	Name or Number Daymarks	DAYMAR, OBJNAM
	Name or Number Light Vessel	LITVES, OBJNAM
	Name or Number Light Float	LITFLT, OBJNAM
	Name or Number Offshore Platform	OFSPLF, OBJNAM
22	Na (Not Allocated)	
23	Light Description String	
24	Note on chart data (INFORM) or nautical publication (TXTDSC)	See 10.6.1.1
25	Nature of Seabed	SBDARE, NATSUR
26	Geographic Names	ACHARE, OBJNAM
		BRIDGE, OBJNAM
		BUAARE, OBJNAM
		BUISGL, OBJNAM
		DOCARE, OBJNAM
		FAIRWY, OBJNAM
		LNDARE, OBJNAM
		LNDMRK, OBJNAM
		LNDRGN, OBJNAM
		SEAARE, OBJNAM
		TIDEWY, OBJNAM
		PILBOP, OBJNAM
27	Value of Magnetic Variation	MAGVAR, VALMAG

	Value of Swept Depth	SWPARE, DRVAL1
28	Height of Islet Or Land Feature	LNDARE,HEIGHT
29	Berth Number	BERTHS, OBJNAM
		ACHBRT, OBJNAM
30	Na	
*31	National Language Text	NOBJNM
32-49	Reserved For IHO	
50-69	Mariners' Text, Including Planned Speed Etc.	
70-79	Manufacturer's Text	
80-99	Future Requirements	

14.5 ECDIS Text Group Implementation

To enable the Mariner to make selections regarding the text visible in the chart display the ECDIS must use the individual text groups collected under text group layer.

For standardization of the ECDIS Human Machine Interface (HMI) and to facilitate generic training of Mariners as a minimum the following text group layers must be implemented to control the display of text. An ECDIS may provide more textual on/off controls than are available in this table, but OEMs must use the names of text group layer contained in this table.

An example of more detailed selections;

The table has text group layer "Other text". An OEM may wish to subdivide this category into "names", "light description" and "other".

Text Group Layer	Name of Text group layer in the ECDIS	Text groups included
1	Important text	11
2	Other text	20-49, 0-10
2.1	Names	21, 26, 29
2.2	Light description	23
2.3	All other	0-10, 25, 27, 28, 32-49

NOTE: *National text is a supplementary option for ECDIS. If used, the style must be similar to that of the Presentation Library.

14.6 Abbreviations

The abbreviations in sections 14.6.1 through 14.6.3 are used on the ECDIS display. The meaning of each abbreviation must be readily available to the mariner through the pick report.

14.6.1 'TE' text command abbreviations

The following abbreviations are used with the "TE" command word:

Prefixes	Suffixes	'C' Format Command
bn = beacon (INT1)	kn = knots (INT1)	% = instruction follows,

by = buoy clr = overhead clearance clr cl = clearance closed clr op = clearance open sf clr = safe clearance No = number (INT1) Plt = pilot Prod = offshore production (INT1) LtV = light vessel Varn = magnetic variation ch = communication channel NMT = not more than “CLEARING BEARING” NLT = not less than “CLEARING BEARING”	deg = degrees	%s = text string, %d = integer number, %n.mlf = floating point number with n characters (including the decimal), m of which come after the decimal point.

14.6.2 Nature of seabed abbreviations ('TX')

The following abbreviations for values of NATSUR - nature of seabed:

Attribute ID	Description	ECDIS Abbreviation
1	mud	M
2	clay	Cy
3	silt	Si
4	sand	S
5	stones	St
6	gravel	G
7	pebbles	P
8	cobbles	Cb
9	rock	R
11	lava	R
14	coral	Co
17	shells	Sh
18	boulder	R

To reduce undue clutter in the ECDIS chart display, it is recommended that ECDIS manufacturers use the abbreviations of the NATSUR attribute.

The description of the ECDIS abbreviations in 14.6.1 and 14.6.2 must be made available to the Mariner via the pick report.

14.6.3 Light Description abbreviations

See section 10.6.3 for details.

15 Symbol Library for use on ECDIS

15.1 Introduction

This 'hard-copy' Symbol Library (Addendum) is a paper based human-readable translation of the digital Symbol Library in the .DAI file of the PresLib ed 4.0.0 (2014). The digital symbol library was previously the only source of the IHO ECDIS symbols since the first publication of the Presentation Library in 1992. From the publication of ed. 3.3 of the PresLib. this 'hard-copy' becomes the official version and takes priority over the digital version in the case of any discrepancies.

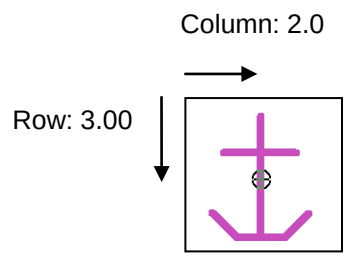
This section gives a description of the diagrams followed by examples for a point / centred area symbol, a linestyle symbol and an area pattern symbol.
Approximately 600 individual diagrams of the symbols are contained in the Addendum to the Presentation Library.

15.2 Symbol Diagrams

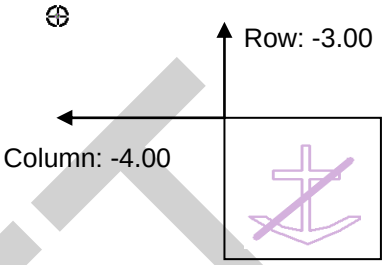
15.2.1 Description of the symbol diagrams

Symbol name	The name of the symbol is the name used for the call up in the lookup table, conditional procedure or PresLib Manual.. The symbol of a pattern is the base unit of the pattern which fills an area. Point symbols are identified by the suffix 'SY', complex linestyles by 'LC' and area patterns by 'AP'.
Reference number (RN)	The reference number is used to link the numbered symbols on the pages of digital ECDIS Chart 1 (tiff format) to the diagram in the Symbol Library which specifies their exact size, shape and colour
Symbol Explanation	This short and simple description of the symbol meaning is used in the response to cursor picking on an object since it gives the Mariner quick an understandable information which is not always obvious from the object class and attribute information
Look-up table affected *	This entry indicates the look-up table in which the symbol is used.
Called by CSP etc.	This entry indicates a reference, whether and what CSP or other procedure calls this symbol to be drawn.
Bounding Box **	The box which exactly encloses the symbol (it is tangential to the extremities of the symbol) and whose upper left corner is the origin for the coordinates which describe the symbol. The column number (x-coordinate) is positive to the right and the row number (y-coordinate) is positive downwards. (See section 8, fig. 2)
Pivot Point	In drawing the symbol on the display the pivot point is placed on the actual geographic position of the object being symbolized. Usually the pivot point is plotted on the diagrams, but it is not shown when it falls outside the area covered by the diagram. For symbols which are rotated by the ORIENT attribute (such as the traffic arrows, e.g. SY(TSSLPT51)), the symbol is rotated about the pivot point. For symbols which are offset

	(such as SY(ACHRESnn)), the pivot point is offset from the bounding box in such a way as to avoid overwriting the symbol on the master object or any other slave symbol surrounding it. (See section 8.5.1, fig. 4)
Pivot Point Column / Row	This values in **millimetres** give the position of the pivot point of the symbol relative to the top left corner of the bounding box. Column number (horizontal, x coordinate) is positive to the right and row number (vertical, y coordinate) is positive downwards.

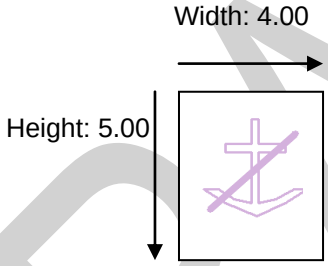


Example: Pivot point outside of the bounding box

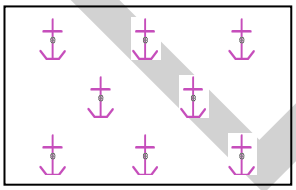


Example: Pivot point inside of the bounding box

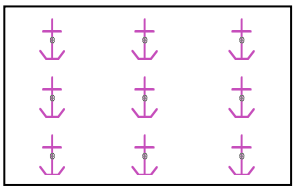
Width / Height of Bounding Box	This values in millimetre give the size of the Bounding Box.



Symbol colours	This entry gives the colour tokens which are used on this symbol and an example of the colour using the Day colour table.
Pattern	This entry gives a pattern name if there is a specific pattern used for filling any area of the symbol.
Pattern Type	Fill patterns use widely spaced symbols. These symbols may be drawn either **staggered** or **linear**.

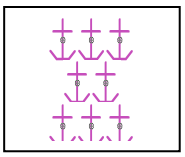


Example: **staggered**

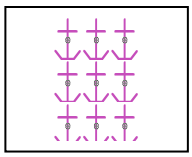


Example: **linear**

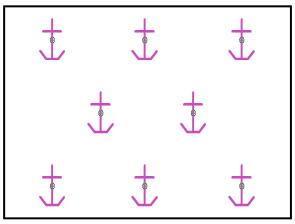
Pattern Spacing	This entry gives the type of spacing between drawn symbols. The symbols can be drawn with **constant** or **scale dependent spacing**. The related values are given in **Maximum / Minimum Distance**. For Ed. 3.3 as well as for all preceding editions of the PresLib all pattern symbols are drawn with **constant** spacing.



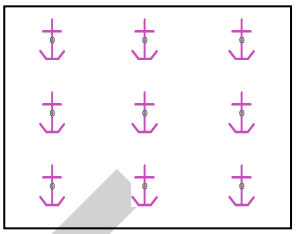
Staggered with **constant** space=0



Linear with **constant** space=0



Staggered with **constant** space>0



Linear with **constant** space>0

Minimum Distance	This value gives the minimum vertical and horizontal distance between the symbols (including pivot point) drawn, in **millimetres**.
Maximum Distance	This value gives the maximum vertical and horizontal distance between the symbols (including pivot point) drawn, in **millimetres**. This value is only valid in case of **Pattern Spacing** type **scale dependent spacing**.
Comments ***	This entry gives any comments for meaning, implementation and use of the symbol, which are not covered by the other description items.
Example on ENC	This field may contain examples of this symbol on an ECDIS display.
References	This entry gives a reference to the corresponding S-57 Objects and the INT 1 [1] descriptions.

15.2.2 Notes on the symbol descriptions

* **'N/A'** under 'look-up table affected' means "Not Applicable".

** **'Bounding box'**: in order to show the details clearly, many of the diagrams are enlarged over the true size, by as much as ten times for small symbols, with the result that the edges of the symbol sometimes overflow the bounding box (see for example symbol SY(BUISGL11)). This does not invalidate the drawing instructions.

*** **'Comments'**:If an area is "transparent filled" the description means percentage given applies to the transparent part. Example: 75% transparency means that of four adjacent pixels, three are transparent.

15.2.3 Instructions on the symbol diagrams

'Line Weight', as used in the symbol descriptions, is equivalent to "line width". It is derived from the following requirement for screen resolution given in S-52, section 5.1 and repeated in IEC 61174 [7], clause 5.8.2:

> "*Minimum lines per mm (L) is given by L = 864/s, where s is the smaller dimension of the chart display area (e.g. for the minimum chart area, s = 270 mm and the resolution is L = 3.20 lines per mm, giving a "Picture Unit" size of 0.312 mm).*"

The term 'Picture Unit' used above is the general form of the earlier concept of pixels of about 0.3 mm size. Hence a Line weight of 0.3 mm represents a line or dot of one-pixel width; a line weight of 0.6 mm represents a two-pixel line or four-pixel dot, and so on.

15.3 Instructions for Symbolising Points

15.3.1 Reference to PresLib Manual

Please read section 9, particularly:

9.2 on symbol rotation (note particularly "Symbols with no rotation must always be drawn upright with respect to the screen borders"). Contour labels must be drawn upright, for ease of reading, not aligned with the direction of the contour as on the paper chart.

9.4 and 9.2 on area symbolisation by a centred symbol, and symbol offsets.

15.4 Instructions for Symbolising Lines

15.4.1 Reference to PresLib Manual

Linestyles symbolise (a) line objects such as routes and (b) area boundaries. There are two types of line styles, simple linestyles and complex linestyles. Please read sections 8 and 9, particularly:

8.2 on the usage of complex linestyles,
9.3 on line symbology in general,
9.3 on the "predefined line style", i.e. the simple linestyles.

15.4.2 Direction of drawing the line

Some complex linestyles are 'directional', either to indicate the direction of traffic in a route or to define the inside of an area by the foot of 'T' or 'V' symbols built into the line.

Whereas point symbols and centred area symbols may be oriented by means of the ORIENT attribute, directional linestyle symbols are always oriented in the direction of the digitised line they represent.

It is essential that the direction of drawing lines coincides with the direction of digitising of the line in the ENC (that is in the direction of a one way traffic route or track, or clockwise around an area).

Examples are given in the following table using LC(DWRTCL07) and LC(ENTRES51):

Linestyle	Direction of digitising	Direction of symbol
DWRTCL07	090 deg	arrow points 090 deg., as illustrated
	180 deg	arrow points 180 deg.
	270 deg	arrow points 270 deg.
ENTRES51	090 deg	'T' points 180 deg, as illustrated
	180 deg	'T' points 270 deg.

	270 deg	'T' points 0 deg.

15.4.3 Laying out the symbols along the line

The pivot point determines the spacing between individual symbols of the complex linestyle. The pivot point of the first line symbol must be placed on the start of the line and the pivot point of each successive symbol must be placed on the end of the preceding symbol (see section 8.2).

15.4.4 Curved Lines

In order to fit all digitised lines (including curved lines), the complex linestyle is designed to bend around curves (for example, in order to symbolise the boundary of a circular anchorage area.) If the curve is too sharp for the ECDIS to follow the digitised line exactly for part, or all, of the run-length of the line, the linestyle must default to a dashed line of the same colour and lineweight as the original line style symbol (see section 8.2).

15.4.5 Symbols or Text for Lines

The pivot point of symbols or text associated with a line must be located at the midpoint of the run-length of the line (see section 9.1).

15.5 Instructions for symbolising areas

15.5.1 Reference to PresLib Manual

Areas are symbolised (a) by boundary linestyles (if the look-up table for symbolized boundaries is used); (b) by centred symbols; (c) by colour fill; or (d) by special area fill patterns. See section 8.4.

15.5.2 Centred Symbols for areas

The pivot point of centred symbols must be located at or near the centre of gravity of the area displayed. See section 8.5 for details.

15.5.3 Pattern spacing for area fill patterns

It is critically important to maintain the correct spacing between the symbols of certain area fill patterns. For example too wide a spacing between the grey dots of AP(DRGARE01) will effectively make the pattern invisible, while too close a spacing will cause clutter. Another example: the difference between the open spacing of the grey dashes of AP(PRTSUR) and the closely spaced dashes of AP(NODATA03) symbolizes the difference between a partly surveyed area with little data and an unsurveyed area with no data at all.

15.6 Examples of Symbol Diagrams

Examples for a **point symbol** SY(ACHARE51), a **line symbol** LC(ACHARE51) and an **area symbol** AP(RCKLDG01) are given below:

a) Point Symbol

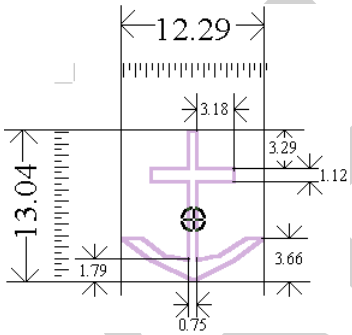
Symbol Name:	SY(**ACHARE51**)	RN:	2

Symbol Explanation: anchorage area

Look-up table affected: area symbols with plain boundaries
area symbols with symbolized boundaries

Pivot Point Column: 6.29
Pivot Point Row: 7.79

Width of Bounding Box: 12.29
Height of Bounding Box: 13.04

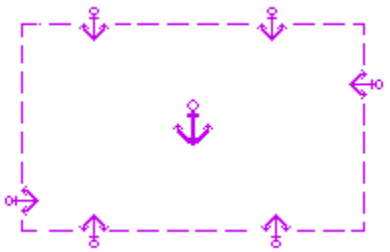


Symbol Colours: CHMGF

Comments: Line weight 0.3 mm

Examples on ENC: N/A

References:

S-57	INT 1	
ACHARE (centred symbol)	IN 12.1-9	(IN 12.1) 

b) Line Symbol

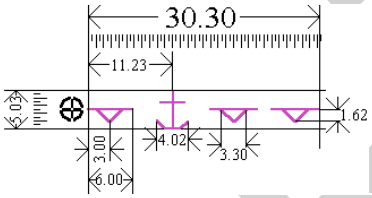
Symbol Name:	LC(**ACHARE51**)	RN: 469

Symbol Explanation: boundary of an anchorage area

Look-up table affected: area symbols with symbolized boundaries

Pivot Point Column: -1.98
Pivot Point Row: 2.42

Width of Bounding Box: 30.30
Height of Bounding Box: 5.03



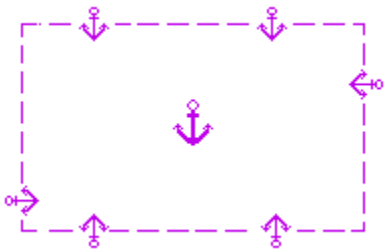
Symbol Colours: CHMGD

Comments: Line weight 0.3 mm;
Anchor symbol dimensions like point symbol **ACHARE02**

Examples on ENC: N/A

References:

S-57	INT 1	
ACHARE	IN 12.1-9;	(IN 12.1)



c) Area Symbol

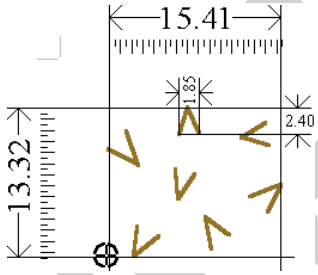
Symbol Name:	AP(**RCKLDG01**)	RN: 464

Symbol Explanation: rock or coral drying ledges

Look-up table affected: area symbols with plain boundaries
area symbols with symbolized boundaries

Pivot Point Column: -0.06
Pivot Point Row: 13.38

Width of Bounding Box: 15.41
Height of Bounding Box: 13.32



Symbol Colours: LANDF

Pattern Type: Linear
Pattern Spacing: Constant

Minimum Distance: 0.00
Maximum Distance: 0.00

Comments: Line weight 0.3 mm
The seven “v” symbols in the box illustrated must form a continuous uniform pattern over the area of the object being symbolized.

Examples on ENC: N/A

References:

S-57	INT 1	
SBDARE	IJ 1-11;30-39,	

16 ECDIS Chart 1, Symbol Plots & Colour Test Diagrams

16.1 Introduction

This section of the Presentation Library contains the following:

16.2 ECDIS Chart 1
16.3 Colour Differentiation Test Diagram
16.4 Plots of Symbols Arranged Alphabetically

The ECDIS Chart 1 and its indexing list of symbol names and meanings arranged numerically, together with the colour differentiation test diagrams, are intended for the Mariner's use. The use of the Colour Differentiation Test Diagrams is described in section 18

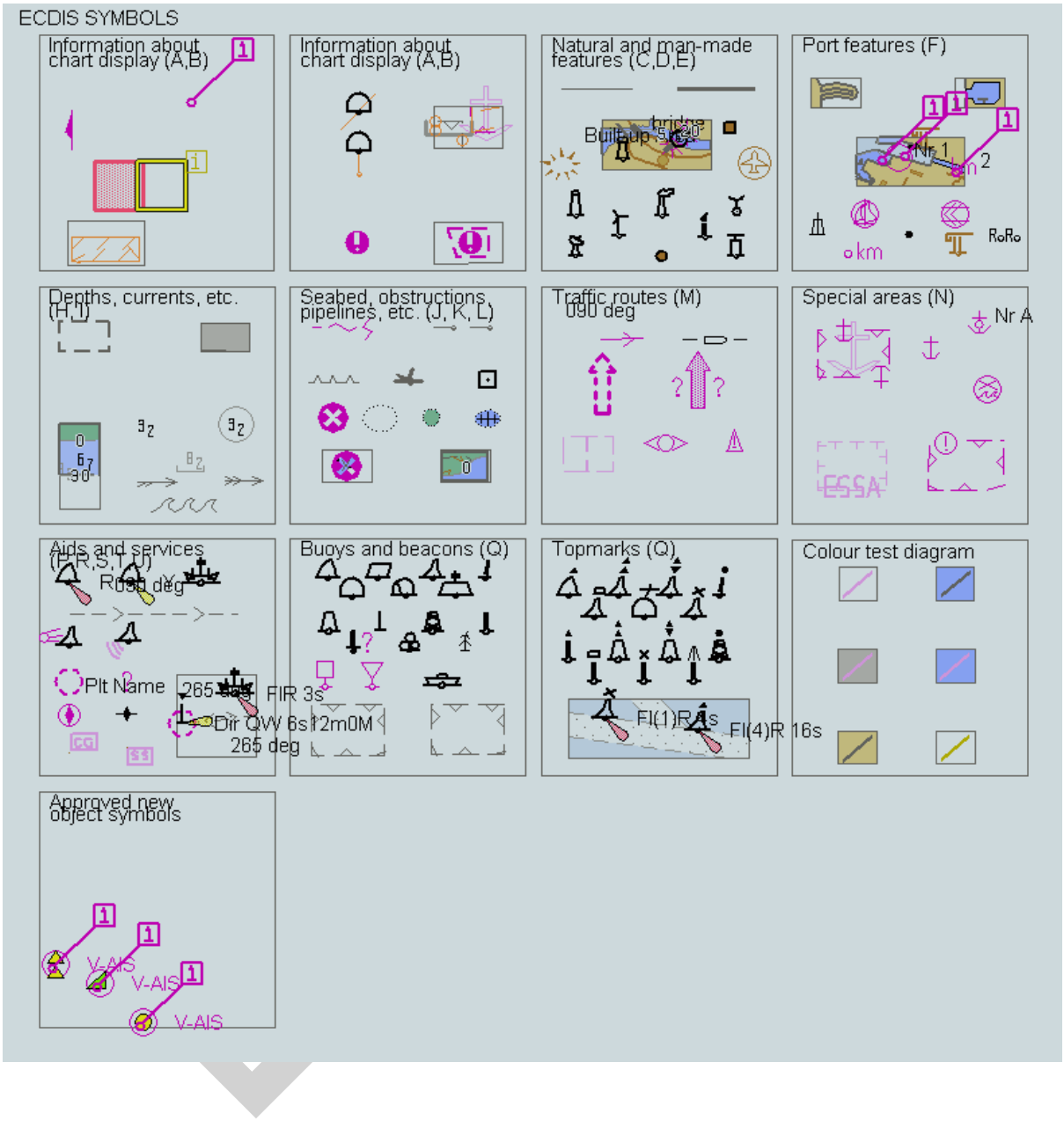
The plot of symbols arranged alphabetically and its indexing list of symbol names and meanings arranged alphabetically are intended for the manufacturer's use.

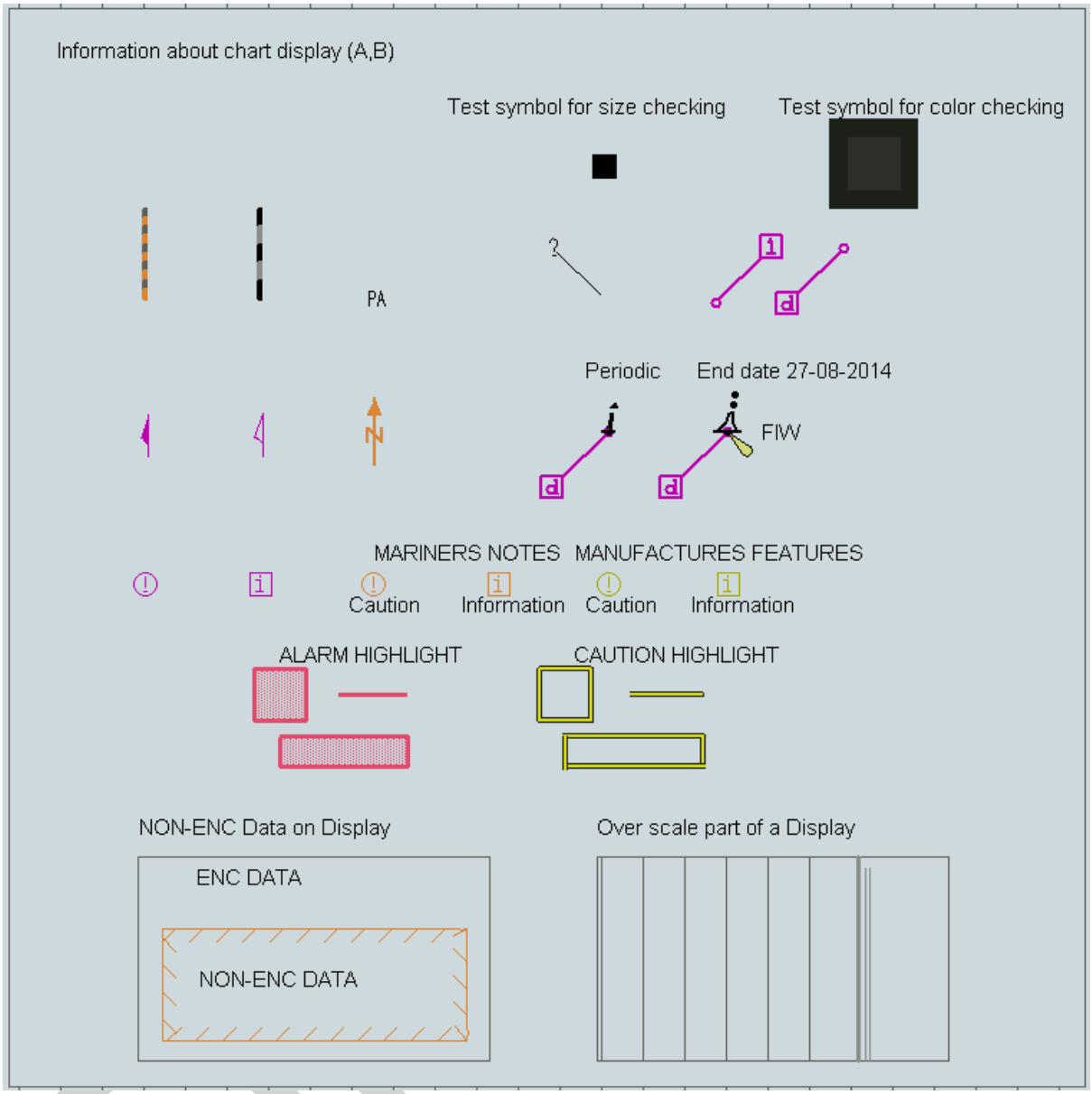
Note that because colour printing and copying is not completely true to the original, this hard-copy version does not accurately represent the colour requirements of the IHO Colour and symbol Specifications.

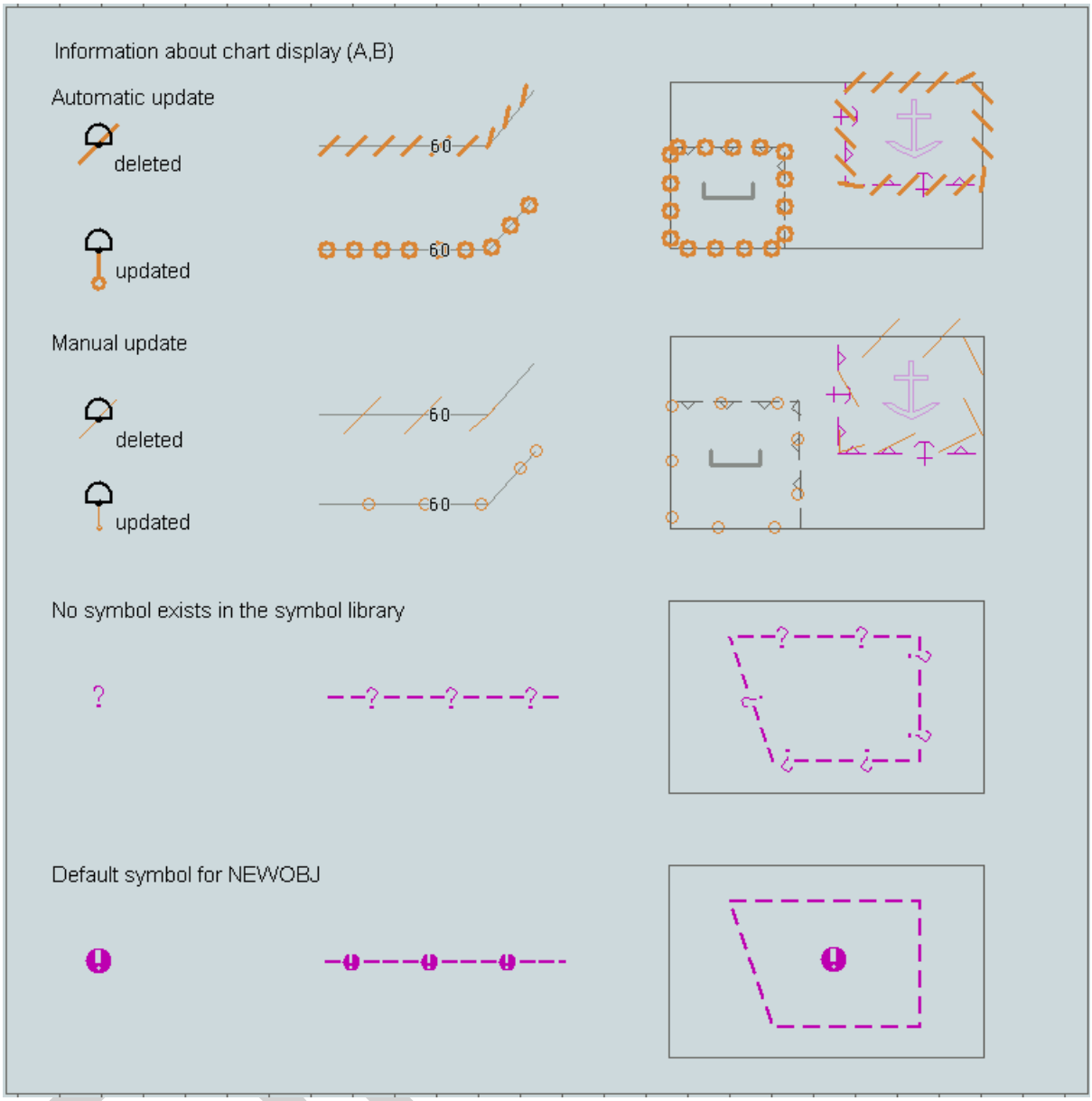
In addition, symbol size may change in copying. To ensure correct size, all symbols illustrated must be scaled by the factor required to make symbol CHKSYM01 measure 5mm by 5mm.

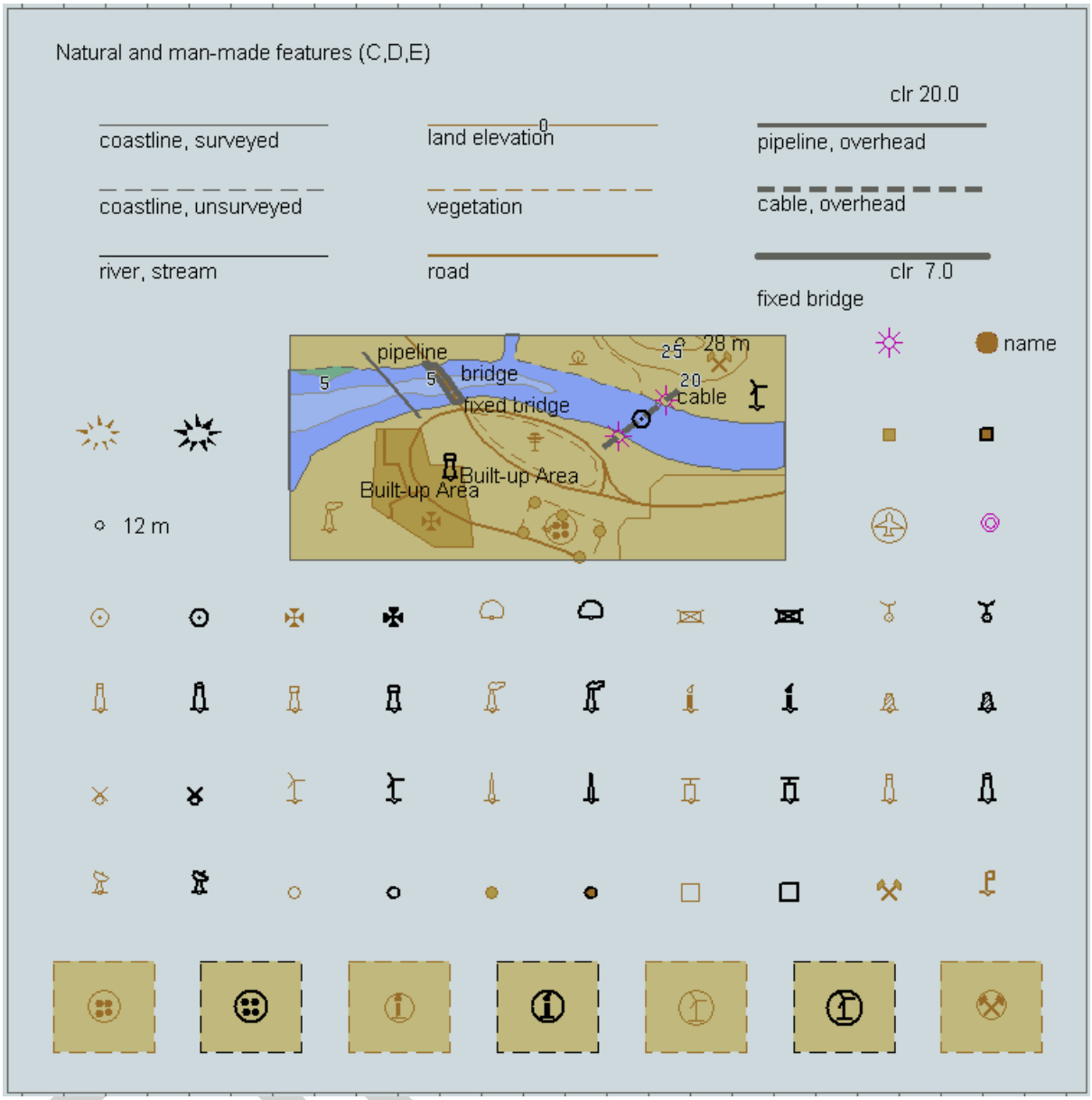
16.2 ECDIS Chart 1

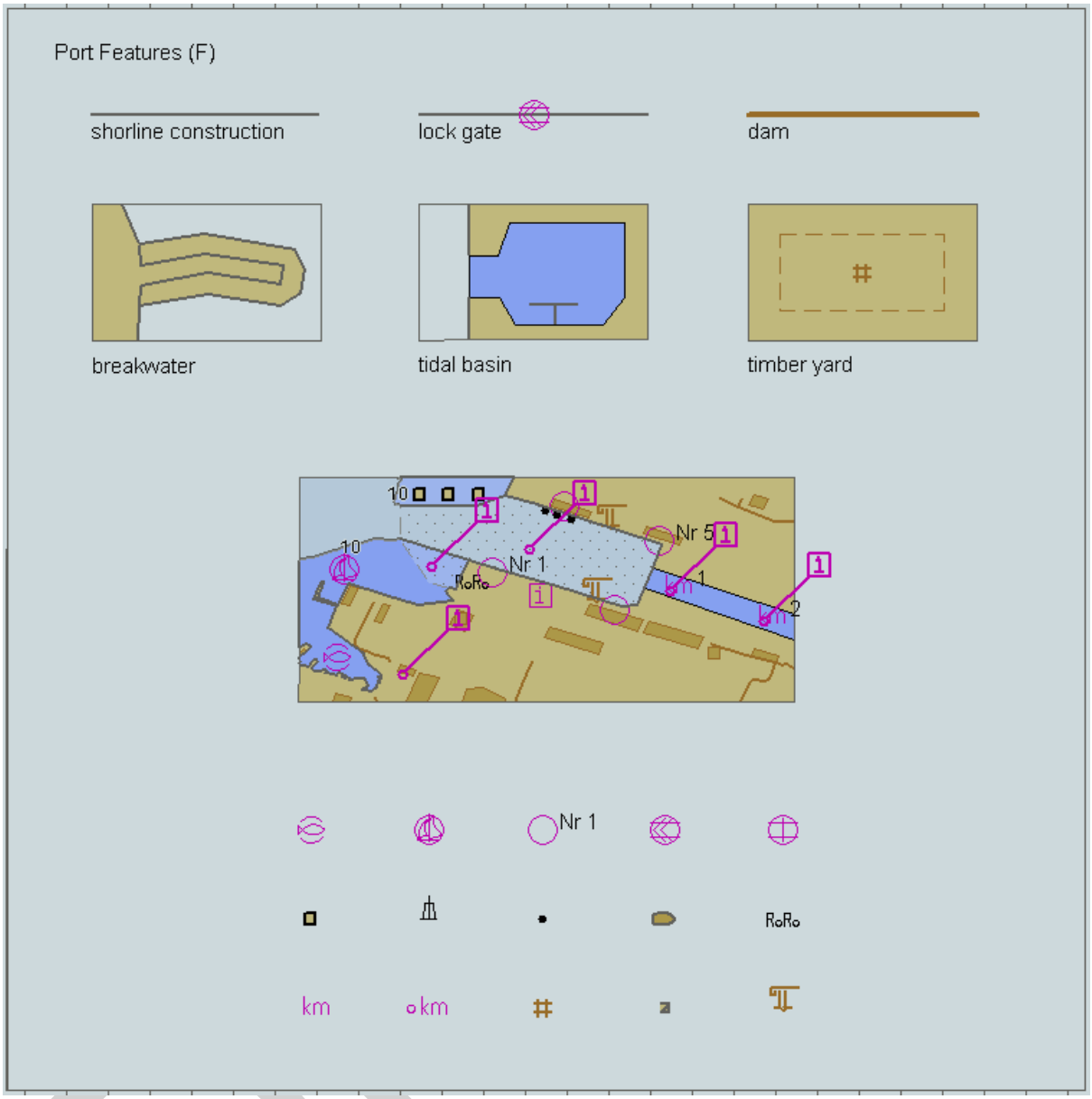
ECDIS Chart 1 symbols

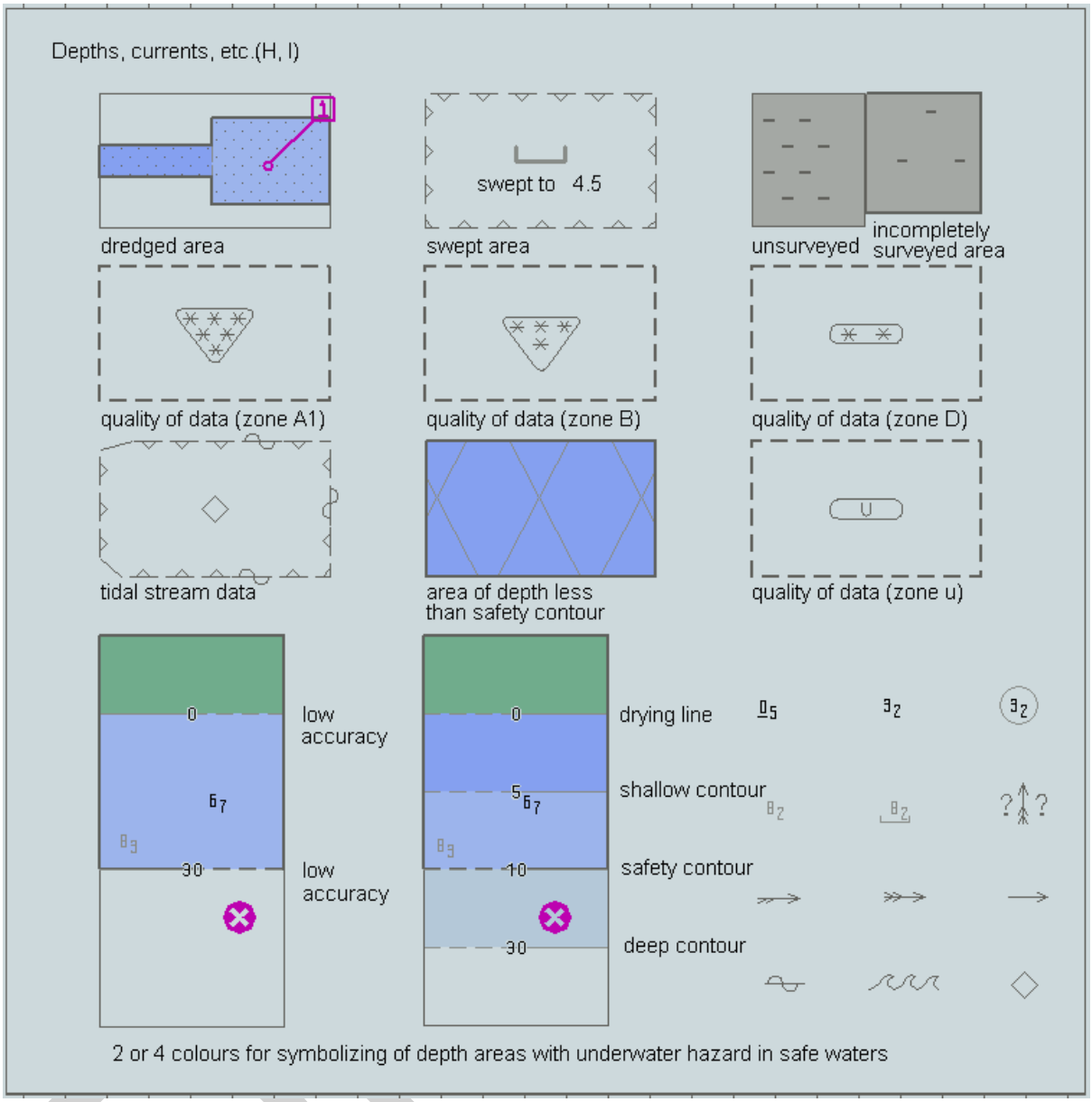


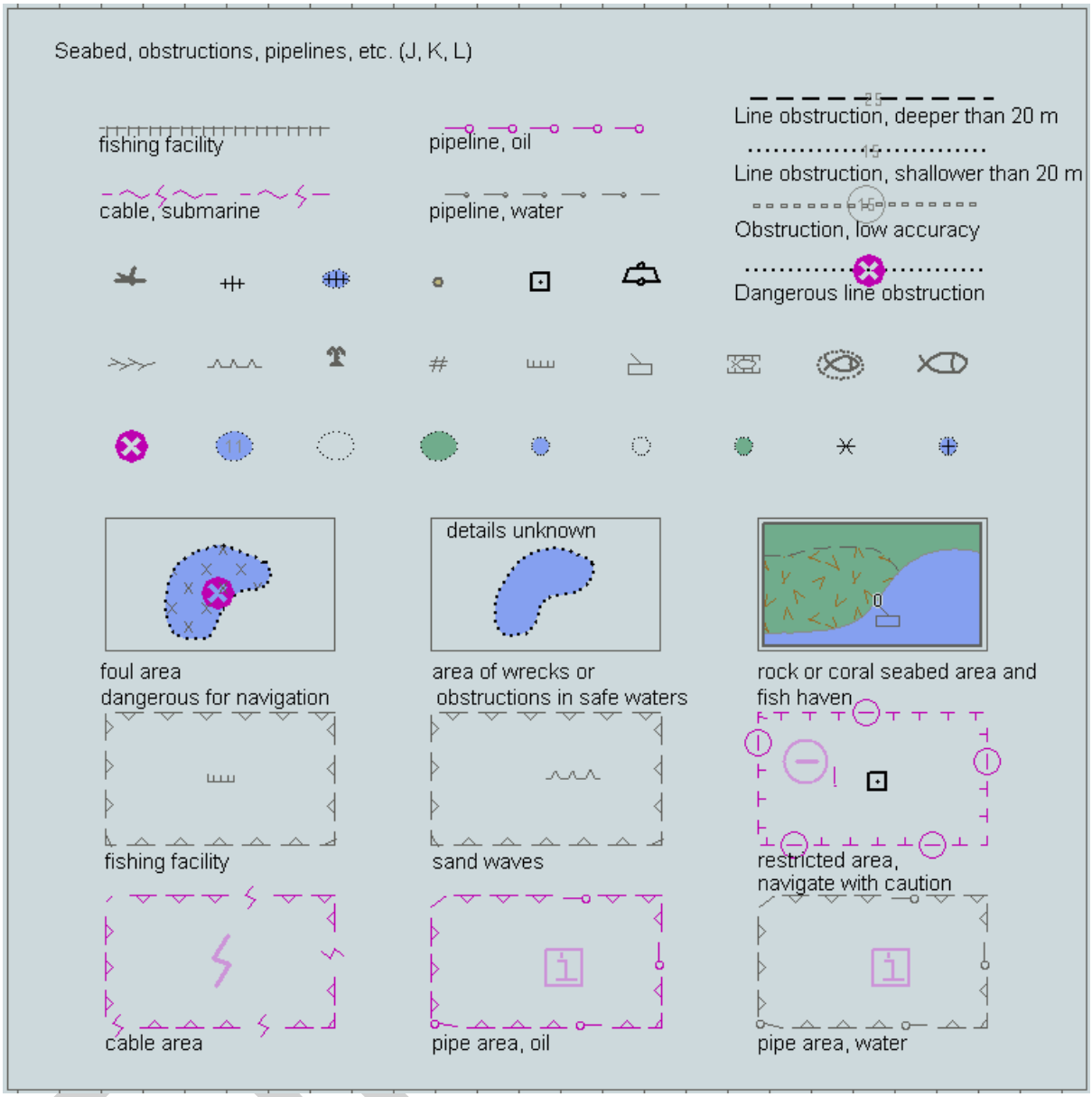

Information about chart display (A,B)
Test symbol for size checking
Test symbol for color checking
PA
Periodic
End date 27-08-2014
FIW
MARINERS NOTES
MANUFACTURES FEATURES
Caution
Information
Caution
Information
ALARM HIGHLIGHT
CAUTION HIGHLIGHT
NON-ENC Data on Display
ENC DATA
NON-ENC DATA
Over scale part of a Display

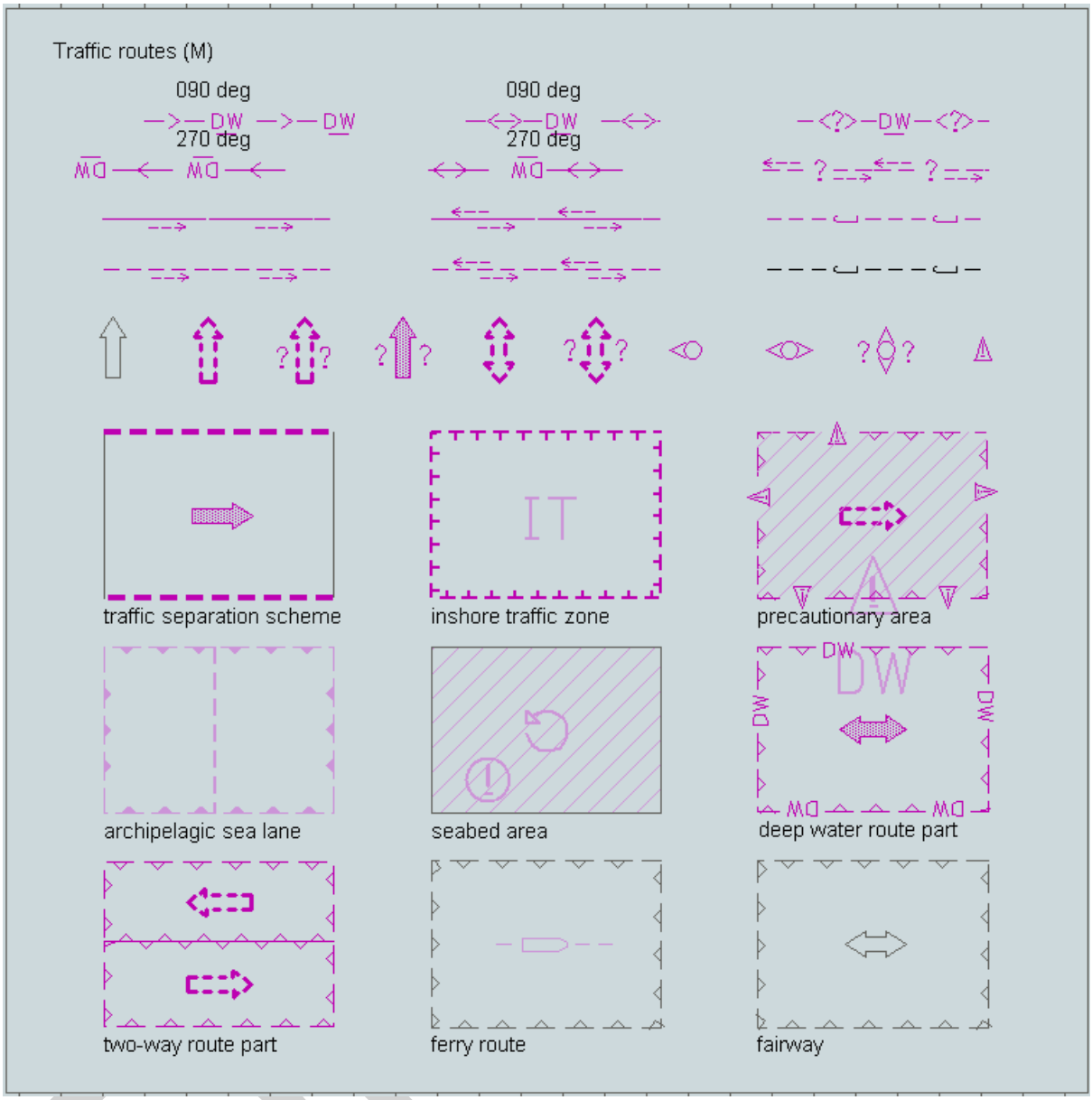

Information about chart display (A,B)
Automatic update
deleted
updated
60
60
Manual update
deleted
updated
60
60
No symbol exists in the symbol library
?
Default symbol for NEWOBJ

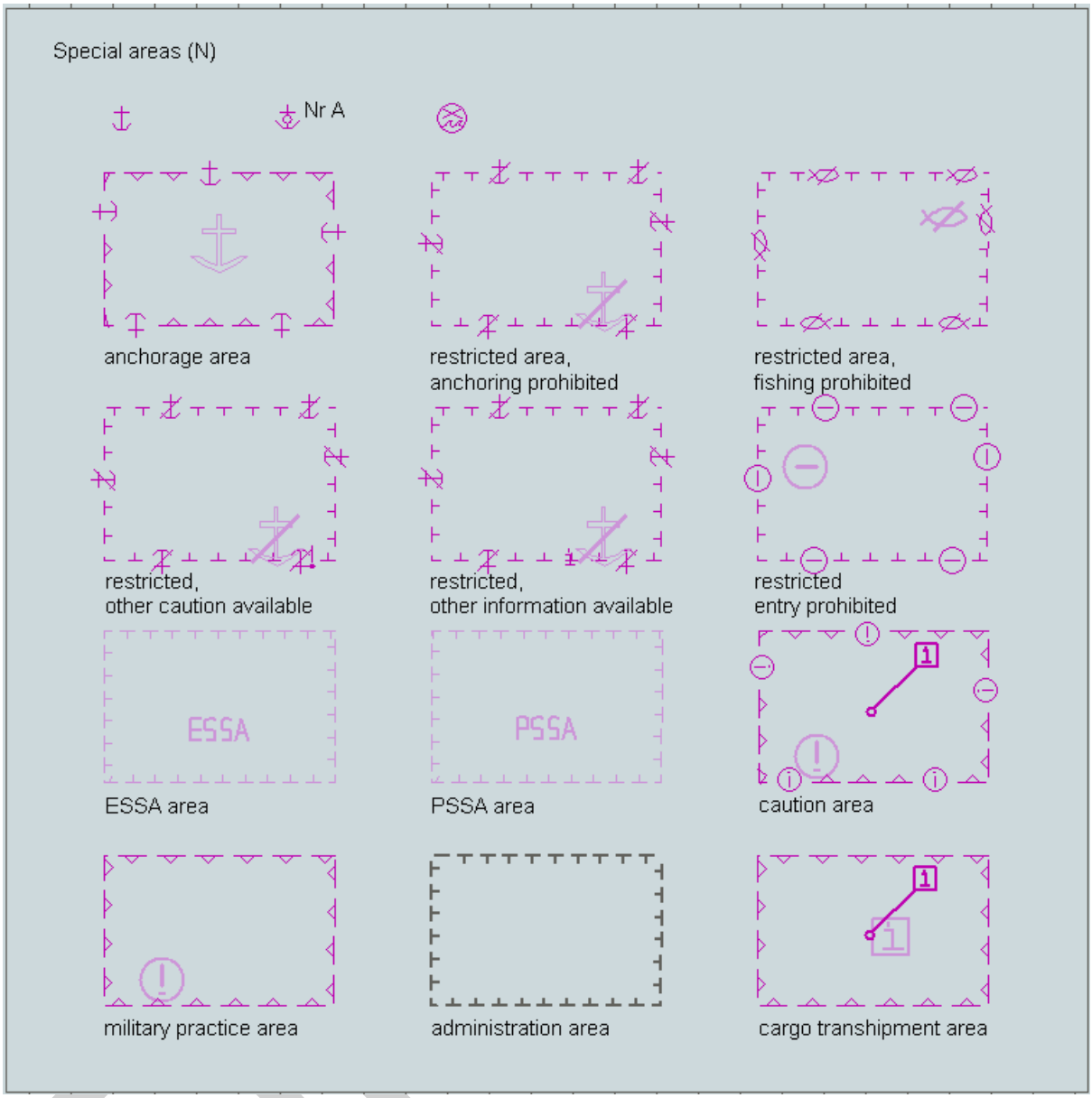

Natural and man-made features (C,D,E)
clr 20.0
coastline, surveyed
land elevation
0
pipeline, overhead
coastline, unsurveyed
vegetation
cable, overhead
river, stream
road
clr 7.0
fixed bridge
pipeline
bridge
fixed bridge
28 m
25
20
cable
5
5
Built-up Area
Built-up Area
name
12 m

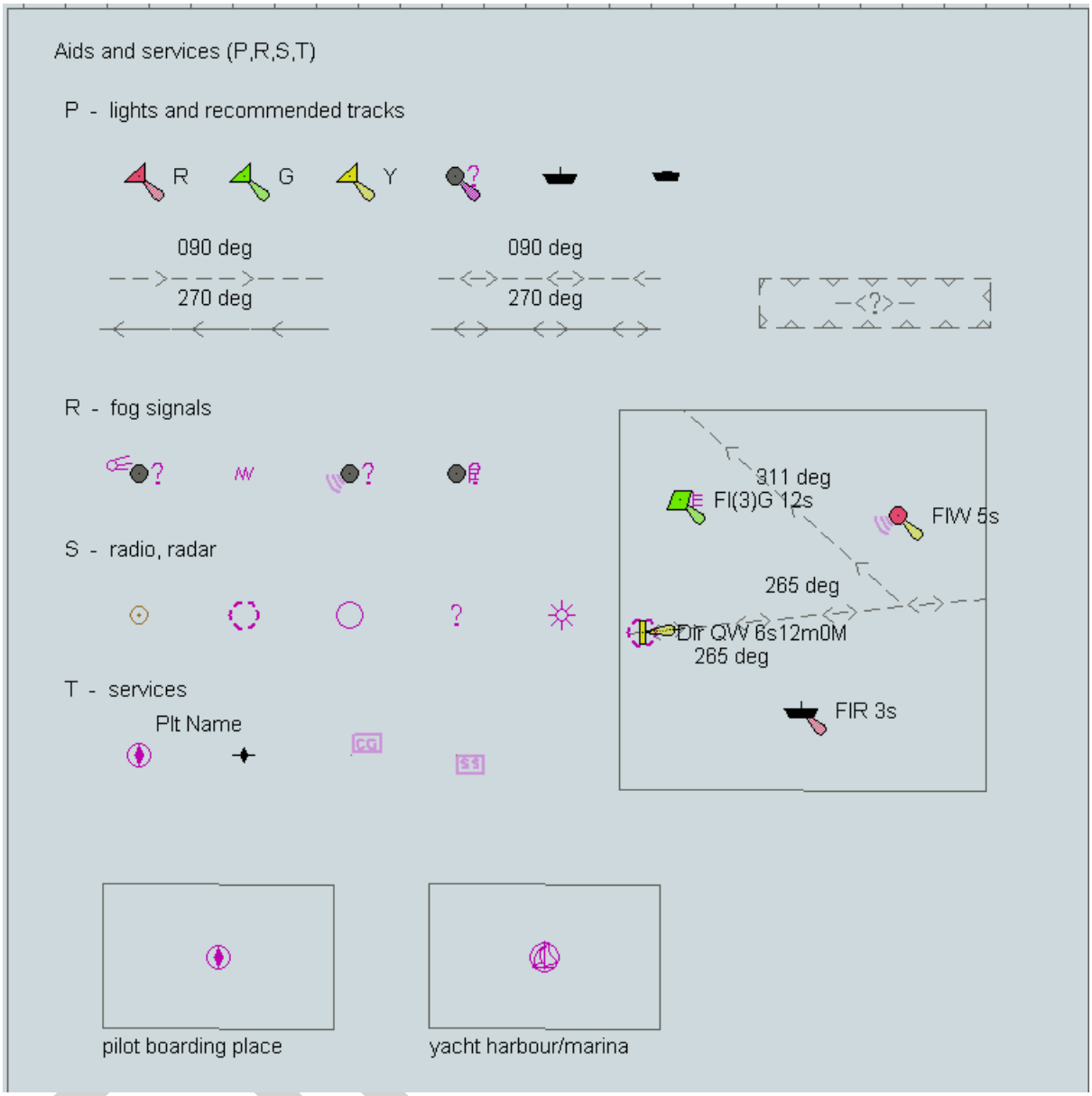

Port Features (F)
shorline construction
lock gate
dam
breakwater
tidal basin
timber yard
10
10
Nr 1
RoRo
Nr 5
1
2
Nr 1
RoRo
km
km

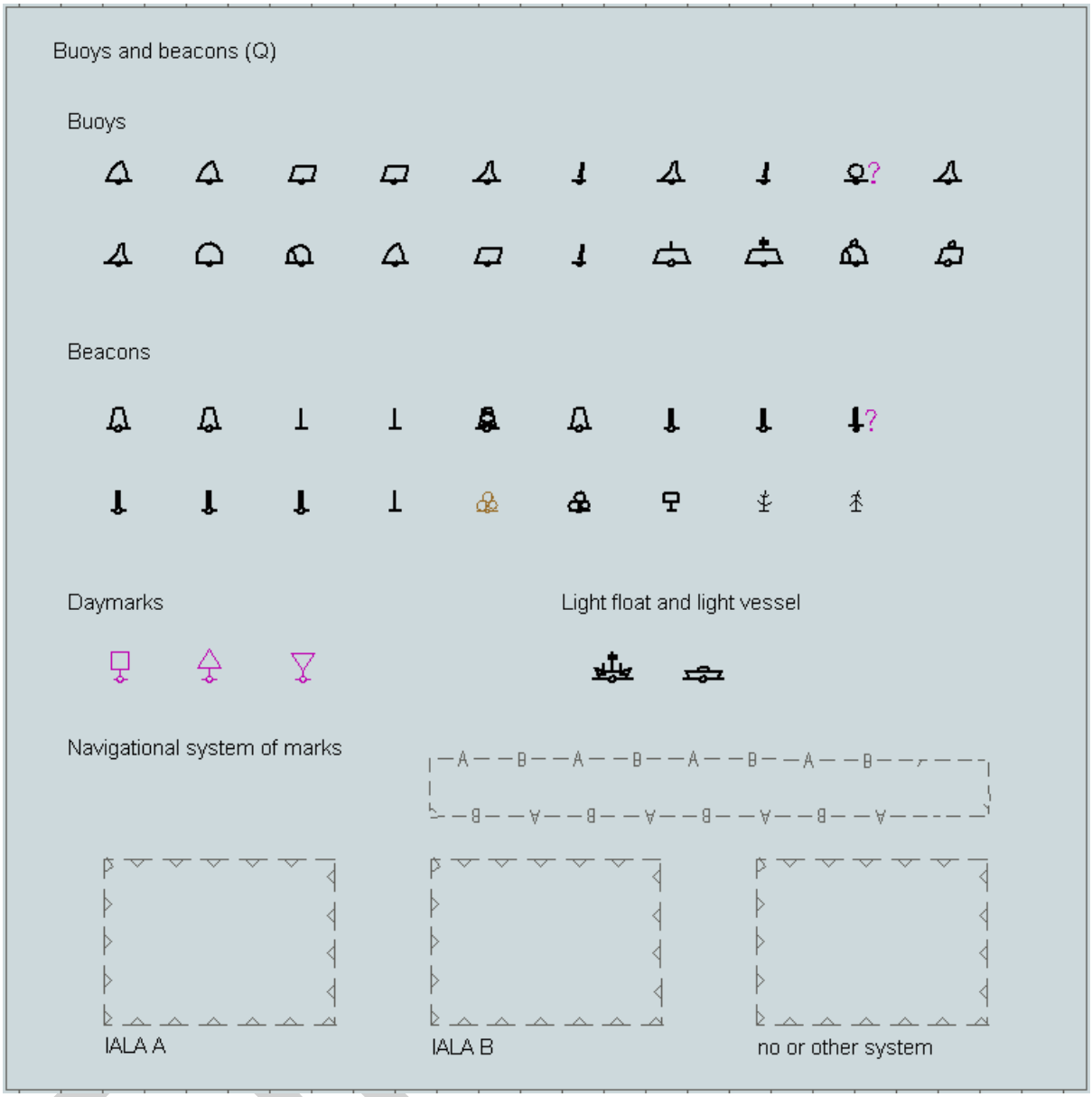

Depths, currents, etc.(H, I)
dredged area
swept to 4.5
swept area
unsurveyed
incompletely surveyed area
quality of data (zone A1)
quality of data (zone B)
quality of data (zone D)
tidal stream data
area of depth less than safety contour
quality of data (zone u)
0
low accuracy
low accuracy
drying line
shallow contour
safety contour
deep contour
2 or 4 colours for symbolizing of depth areas with underwater hazard in safe waters

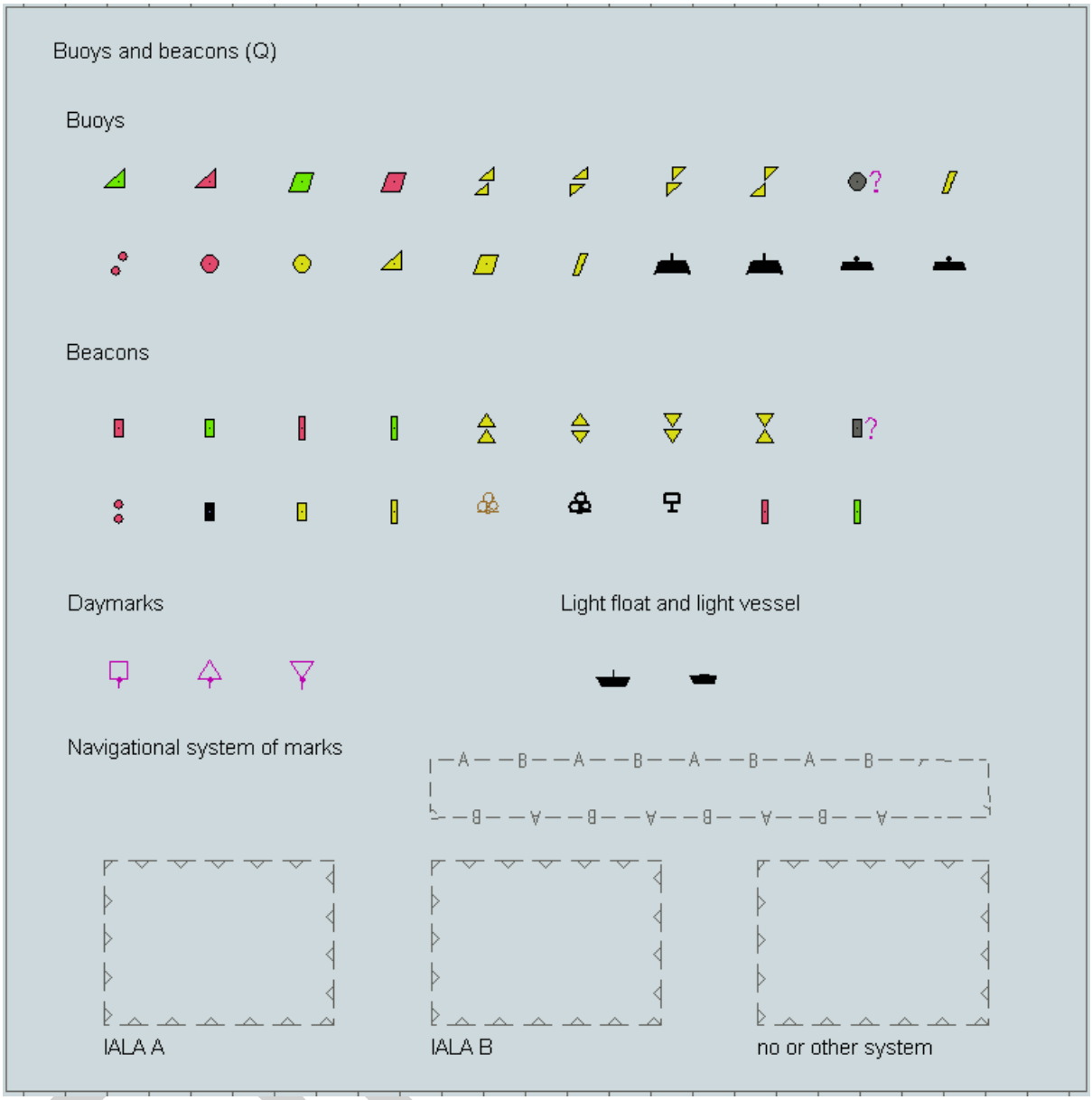

Seabed, obstructions, pipelines, etc. (J, K, L)
fishing facility
pipeline, oil
Line obstruction, deeper than 20 m
Line obstruction, shallower than 20 m
cable, submarine
pipeline, water
Obstruction, low accuracy
Dangerous line obstruction
details unknown
foul area
dangerous for navigation
area of wrecks or
obstructions in safe waters
rock or coral seabed area and
fish haven
fishing facility
sand waves
restricted area,
navigate with caution
cable area
pipe area, oil
pipe area, water

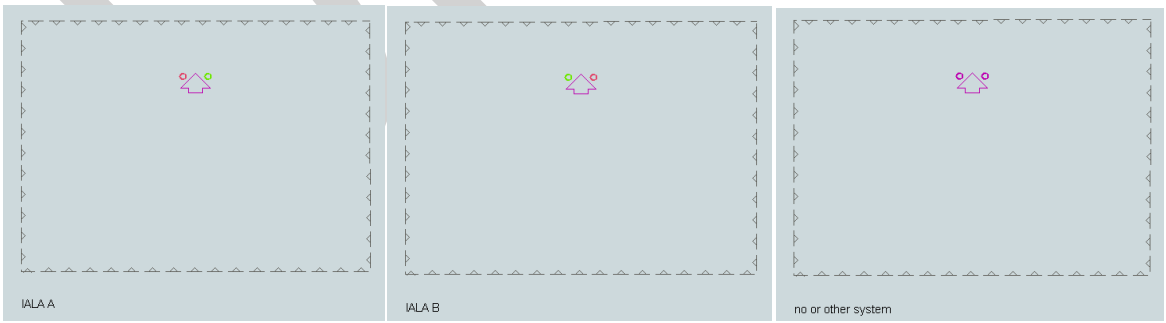

Traffic routes (M)
090 deg
270 deg
DW
traffic separation scheme
IT
inshore traffic zone
precautionary area
archipelagic sea lane
seabed area
deep water route part
two-way route part
ferry route
fairway


Special areas (N)
Nr A
anchorage area
restricted area,
anchoring prohibited
restricted area,
fishing prohibited
restricted,
other caution available
restricted,
other information available
restricted
entry prohibited
ESSA
PSSA
ESSA area
PSSA area
caution area
military practice area
administration area
cargo transhipment area


Aids and services (P,R,S,T)
P - lights and recommended tracks
R
G
Y
090 deg
270 deg
090 deg
270 deg
R - fog signals
S - radio, radar
T - services
Plt Name
311 deg
Fl(3)G 12s
FlW 5s
265 deg
Dir QW 6s12m0M
265 deg
FlR 3s
pilot boarding place
yacht harbour/marina


Buoys and beacons (Q)
Buoys
Beacons
Daymarks
Light float and light vessel
Navigational system of marks
IALA A
IALA B
no or other system



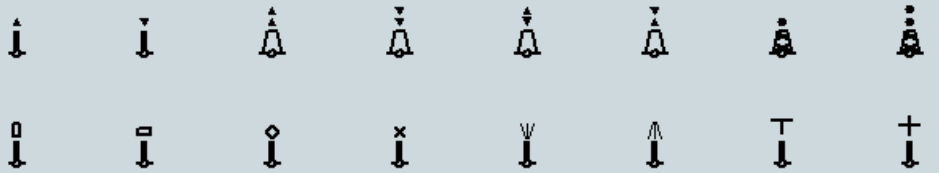


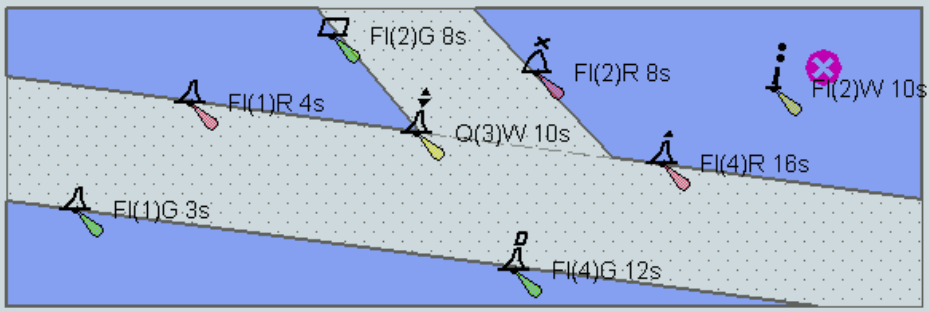
IALA A at 1:5000 IALA B at 1:5000 No or other system at 1:5000

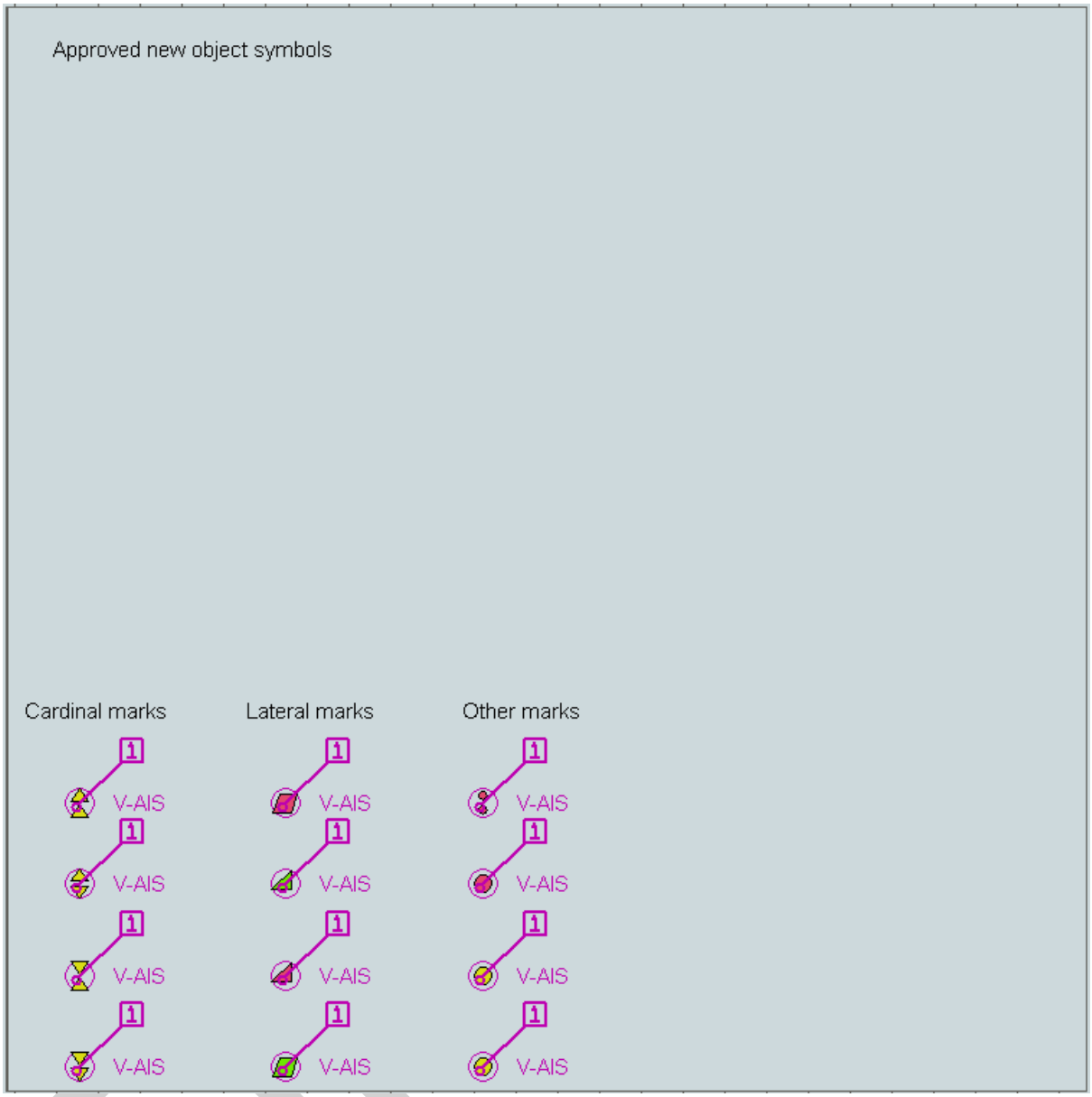
Topmarks (Q)

Buoys Topmarks

Beacon topmarks



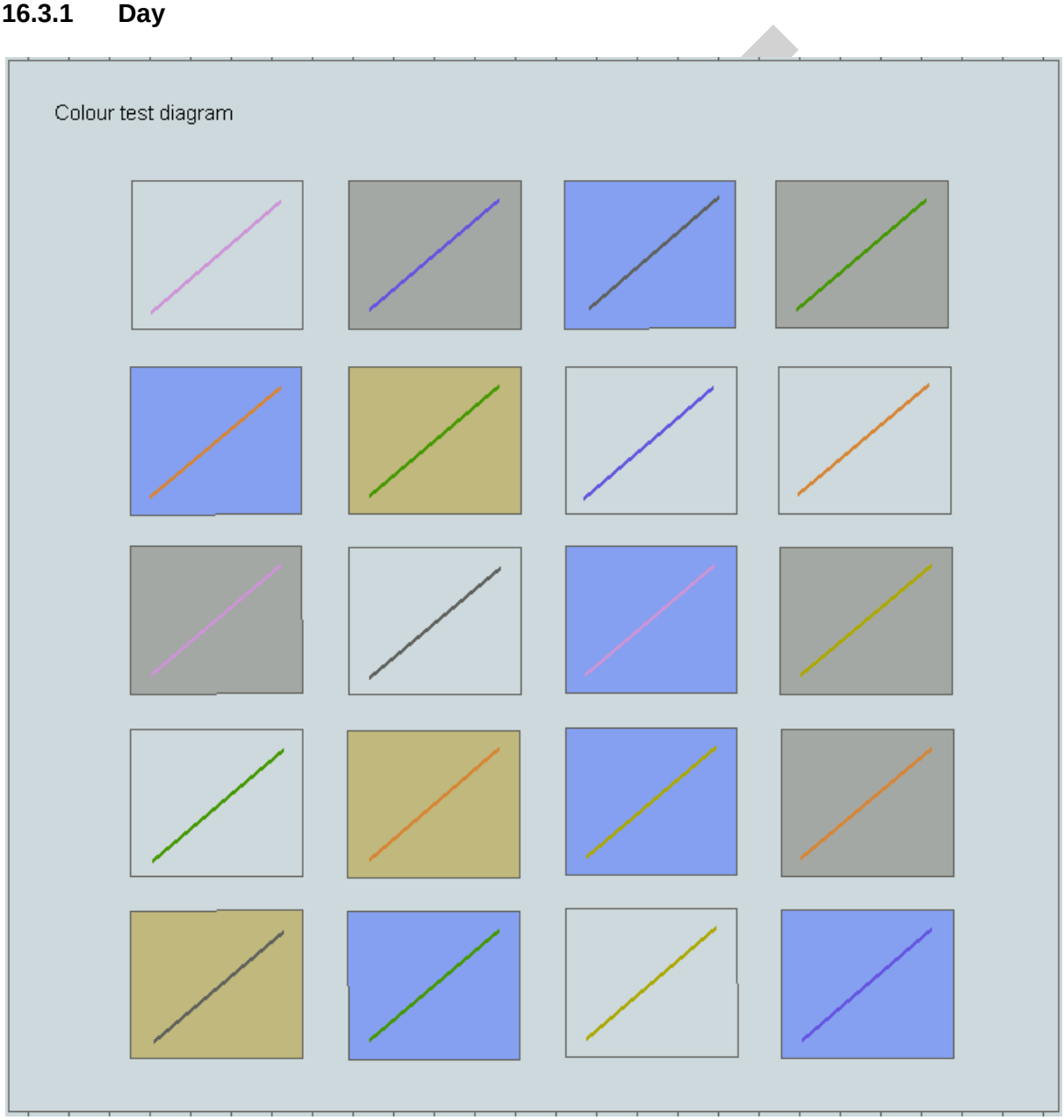



Approved new object symbols
Cardinal marks
Lateral marks
Other marks
1
V-AIS

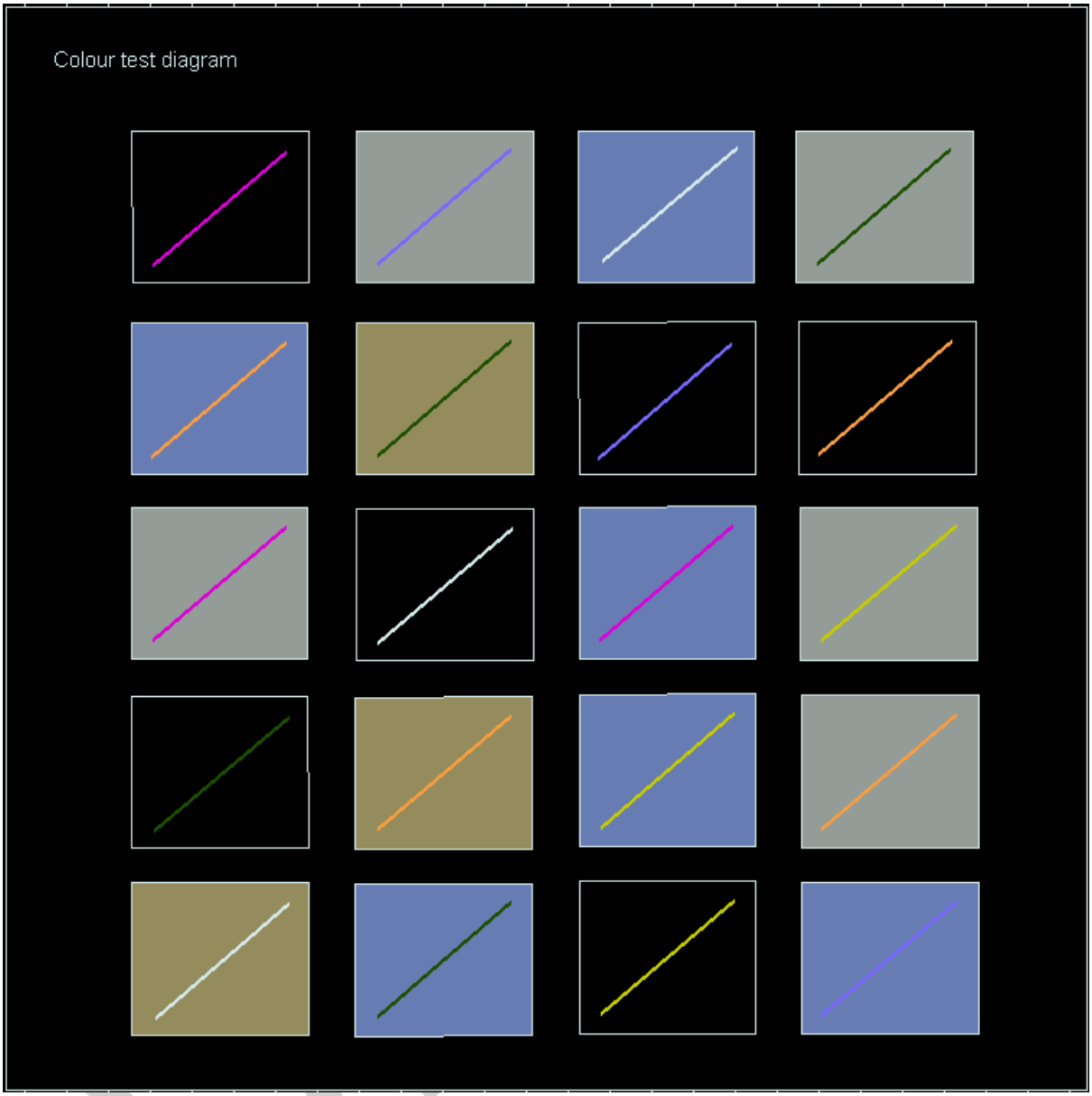
16.3 Colour Differentiation Test Diagram

The following diagram is required in "Day" and "Dusk" colours so that the Mariner can verify that his ECDIS display monitor has the colour differentiation capability needed to distinguish between the various colour-coded areas, lines and point symbols of the ECDIS display. The diagrams will not be true to colour unless they are projected on a calibrated monitor and are generated in a manner which correctly reproduces the colour tokens of the PresLib, as described in section 18.3. Section 18.3 also describes the use of these diagrams.

16.3.1 Day



16.3.2 Dusk



16.4 List of symbol names & meanings

Point symbols & centred area symbols (SY)

SY(ACHARE02)	CHMGD	anchorage area as a point at small scale, or anchor points of mooring trot at large scale
SY(ACHARE51)	CHMGF	anchorage area
SY(ACHBRT07)	CHMGD	designated anchor berth for a single vessel
SY(ACHRES51)	CHMGF	area where anchoring is prohibited or restricted
SY(ACHRES61)	CHMGF CHMGD	area where anchoring is prohibited or restricted, with other cautions
SY(ACHRES71)	CHMGF CHMGD	area where anchoring is prohibited or restricted, with other information
SY(AIRARE02)	LANDF	symbol for airport as a point
SY(AISSLP01)	ARPAT	sleeping AIS target
SY(AISVES01)	ARPAT	active AIS target showing vector and/or heading
SY(ARPATG01)	ARPAT	ARPA target
SY(ARPONE01)	ARPAT	one minute mark on ARPA vector
SY(ARPSIX01)	ARPAT	six minute mark on ARPA vector
SY(BCNCAR01)	CHYLW OUTLW	cardinal beacon, north, simplified
SY(BCNCAR02)	CHYLW OUTLW	cardinal beacon, east, simplified
SY(BCNCAR03)	CHYLW OUTLW	cardinal beacon, south, simplified
SY(BCNCAR04)	CHYLW OUTLW	cardinal beacon, west, simplified
SY(BCNDEF13)	CHMGD CHGRD OUTLW	default symbol for a beacon, simplified
SY(BCNGEN01)	CHBLK	beacon in general, paper-chart
SY(BCNGEN03)	CHMGD CHBLK	default symbol for beacon, paper-chart
SY(BCNISD21)	CHRED OUTLW	isolated danger beacon, simplified
SY(BCNLAT15)	CHRED OUTLW	major lateral beacon, red, simplified
SY(BCNLAT16)	CHGRN OUTLW	major lateral beacon, green, simplified
SY(BCNLAT21)	CHRED OUTLW	minor lateral beacon, red, simplified
SY(BCNLAT22)	CHGRN OUTLW	minor lateral beacon, green, simplified
SY(BCNLTC01)	CHBLK	lattice beacon, paper-chart
SY(BCNSAW13)	CHBLK DEPVS OUTLW	major safe water beacon, simplified
SY(BCNSAW21)	CHBLK DEPVS OUTLW	minor safe water beacon, simplified
SY(BCNSPP13)	CHYLW OUTLW	major special purpose beacon, simplified
SY(BCNSPP21)	CHYLW OUTLW	minor special purpose beacon, simplified
SY(BCNSTK02)	CHBLK	minor, stake or pole beacon, paper-chart
SY(BCNTOW01)	CHBLK	beacon tower, paper-chart
SY(BOYBAR01)	CHBLK	barrel buoy, paper-chart
SY(BOYCAN01)	CHBLK	can buoy, paper-chart
SY(BOYCAR01)	CHYLW OUTLW	cardinal buoy, north, simplified
SY(BOYCAR02)	CHYLW OUTLW	cardinal buoy, east, simplified
SY(BOYCAR03)	CHYLW OUTLW	cardinal buoy, south, simplified
SY(BOYCAR04)	CHYLW OUTLW	cardinal buoy, west, simplified
SY(BOYCON01)	CHBLK	conical buoy, paper-chart
SY(BOYDEF03)	CHMGD CHGRD OUTLW	default symbol for buoy, simplified
SY(BOYGEN03)	CHMGD CHBLK	default symbol for buoy, paper-chart
SY(BOYINB01)	CHBLK	installation buoy, paper-chart
SY(BOYISD12)	OUTLW CHRED	isolated danger buoy, simplified
SY(BOYLAT13)	CHGRN OUTLW	conical lateral buoy, green, simplified
SY(BOYLAT14)	CHRED OUTLW	conical lateral buoy, red, simplified
SY(BOYLAT23)	CHGRN OUTLW	can shape lateral buoy, green, simplified
SY(BOYLAT24)	CHRED OUTLW	can shape lateral buoy, red, simplified
SY(BOYMOR01)	CHBLK	mooring buoy, barrel shape, paper-chart
SY(BOYMOR03)	CHBLK	mooring buoy, can shape, paper-chart
SY(BOYMOR11)	CHBLK	installation buoy and mooring buoy, simplified
SY(BOYPIL01)	CHBLK	pillar buoy, paper-chart
SY(BOYSAW12)	CHRED OUTLW	safe water buoy, simplified
SY(BOYSPH01)	CHBLK	spherical buoy, paper-chart
SY(BOYSPP11)	CHYLW OUTLW	special purpose buoy, spherical or barrel shaped, or default

		symbol for special purpose buoy, simplified
SY(BOYSPP15)	CHYLW OUTLW	special purpose TSS buoy marking the starboard side of the traffic lane, simplified
SY(BOYSPP25)	CHYLW OUTLW	special purpose TSS buoy marking the port side of the traffic lane, simplified
SY(BOYSPR01)	CHBLK	spar buoy, paper-chart
SY(BOYSUP01)	CHBLK	super-buoy, paper-chart
SY(BOYSUP02)	CHBLK	super-buoy ODAS & LANBY, simplified
SY(BOYSUP03)	CHBLK	LANBY, super-buoy, paper-chart
SY(BRIDGE01)	CHMGD	symbol for opening bridge
SY(BRTHNO01)	CHMGD	berth number symbol
SY(BUAARE02)	LANDF	built-up area
SY(BUIREL01)	LANDF	non-conspicuous religious building, Christian
SY(BUIREL04)	LANDF	non-conspicuous religious building, non-Christian
SY(BUIREL05)	LANDF	mosque or minaret
SY(BUIREL13)	CHBLK	conspicuous religious building, Christian
SY(BUIREL14)	CHBLK	conspicuous religious building, non-Christian
SY(BUIREL15)	CHBLK	conspicuous mosque or minaret
SY(BUISGL01)	LANDF CHBRN	single building
SY(BUISGL11)	LANDF CHBLK	conspicuous single building
SY(CAIRNS01)	LANDF	Caim
SY(CAIRNS11)	CHBLK	conspicuous cairn
SY(CBLARE51)	CHMGF	cable area
SY(CGUSTA02)	LANDF CHWHT CHMGF	coastguard station
SY(CHCRDEL1)	CHCOR	this object has been manually deleted or modified
SY(CHCRID01)	CHCOR	this object has been manually updated
SY(CHIMNY01)	LANDF	Chimney
SY(CHIMNY11)	CHBLK	conspicuous chimney
SY(CHINFO06)	CHMGD	HO caution note
SY(CHINFO07)	CHMGD	HO information note
SY(CHINFO08)	NINFO	mariner's information note
SY(CHINFO09)	NINFO	mariners caution note
SY(CHINFO10)	ADINF	manufacturer's information note
SY(CHINFO11)	ADINF	manufacturer's caution note
SY(CHKSYM01)	CHBLK OUTLW	test symbol for checking symbol sizes, must measure 5mm by 5mm
SY(CLRLIN01)	NINFO	arrow head for mariner's clearing line
SY(CRANES01)	LANDF	Cranes
SY(CTNARE51)	TRFCF	caution area, a specific caution note applies
SY(CTYARE51)	TRFCF	cautionary area (e.g. ferry area) navigate with caution
SY(CTYARE71)	TRFCF CHMGD	cautionary area with further information
SY(CURDEF01)	CHGRD	current or tidal stream whose direction is not known
SY(CURENT01)	CHGRD	non-tidal current
SY(CURSRA01)	CURSR	ordinary cursor
SY(CURSRB01)	CURSR	cursor with open centre
SY(DANGER01)	CHBLK DEPVS	underwater hazard with a defined depth
SY(DANGER02)	CHBLK	underwater hazard with depth greater than 20 metres
SY(DAYSQR01)	CHMGD	square or rectangular daymark, simplified
SY(DAYSQR21)	CHMGD	square or rectangular daymark, paper chart
SY(DAYTRI01)	CHMGD	triangular daymark, point up, simplified
SY(DAYTRI05)	CHMGD	triangular daymark, point down, simplified
SY(DAYTRI21)	CHMGD	triangular daymark, point up, paper chart
SY(DAYTRI25)	CHMGD	triangular daymark, point down, paper chart
SY(DIRBOYA1)	CHMGD CHRED CHGRN	direction and colour of buoyage for approaching harbour in IALA region A (red to port)
SY(DIRBOYB1)	CHMGD CHGRN CHRED	direction and colour of buoyage for approaching harbour in IALA region B (green to port)
SY(DISMAR03)	CHMGD	distance mark
SY(DISMAR04)	CHMGD	distance point with no mark
SY(DNGHILIT)	DNGHL	transparent danger highlight for mariner's use

SY(DOMES001)	LANDF	Dome
SY(DOMES011)	CHBLK	conspicuous dome
SY(DSHAER01)	LANDF	dish aerial
SY(DSHAER11)	CHBLK	conspicuous dish aerial
SY(DWRTPT51)	TRFCF	part of deep water route
SY(EBBSTR01)	CHGRD	ebb stream, rate at spring tides
SY(EBLVRM11)	NINFO	point of origin for an offset EBL or VRM
SY(ENTRES51)	TRFCF	area where entry is prohibited or restricted or to be avoided
SY(ENTRES61)	TRFCF CHMGD	area where entry is prohibited or restricted or to be avoided, with other cautions
SY(ENTRES71)	TRFCF CHMGD	area where entry is prohibited or restricted or to be avoided, with other information
SY(ERBLTIK1)	NINFO	range mark for an ERBL
SY(EVENTS02)	NINFO	mariner's event mark
SY(FAIRWY51)	CHGRD	fairway with one-way traffic in direction indicated
SY(FAIRWY52)	CHGRD	fairway with two-way traffic
SY(FLASTK01)	LANDF	flare stack
SY(FLASTK11)	CHBLK	conspicuous flare stack
SY(FLDSTR01)	CHGRD	flood stream, rate at spring tides
SY(FLGSTF01)	LANDF	flagstaff, flagpole
SY(FOGSIG01)	CHMGF	fog signal
SY(FORSTC01)	LANDF	fortified structure
SY(FORSTC11)	CHBLK	conspicuous fortified structure
SY(FOULGND1)	CHGRD	foul area of seabed safe for navigation but not for anchoring
SY(FRYARE51)	CHMGF	ferry area
SY(FRYARE52)	CHBLK	cable ferry area
SY(FSHFAC02)	CHGRD	fish trap, fish weir, tunny net
SY(FSHFAC03)	CHGRD	fish stakes
SY(FSHGRD01)	CHGRD	fishing ground
SY(FSHHAV01)	CHGRD	fish haven
SY(FSHRES51)	CHMGF	area where fishing or trawling is prohibited or restricted
SY(FSHRES61)	CHMGF CHMGD	area where fishing or trawling is prohibited or restricted, with other cautions
SY(FSHRES71)	CHMGF CHMGD	area where fishing or trawling is prohibited or restricted, with other information
SY(GATCON03)	TRFCD	navigable lock gate
SY(GATCON04)	TRFCD	non-navigable lock gate
SY(HILTOP01)	LANDF	hill or mountain top
SY(HILTOP11)	CHBLK	conspicuous hill or mountain top
SY(HRBFAC09)	CHMGD	fishing harbour
SY(HULKES01)	CSTLN CHBRN	Hulk
SY(INFARE51)	CHMGF	area with minor restrictions or information notices
SY(INFORM01)	CHMGD	this object has additional information available by cursor query
SY(ISODGR01)	ISDNG	isolated underwater danger of depth less than the mariner's selected safety contour
SY(ITZARE51)	CHMGF	area of inshore traffic
SY(LITDEF11)	CHMGD OUTLW	light flare
SY(LIGHTS11)	LITRD OUTLW	light flare, red
SY(LIGHTS12)	LITGN OUTLW	light flare, green
SY(LIGHTS13)	LITYW OUTLW	light flare, white or yellow
SY(LIGHTS81)	CHMGD	strip light
SY(LIGHTS82)	CHMGD	Floodlight
SY(LITFLT01)	CHBLK	light float, paper-chart
SY(LITFLT02)	CHBLK	light float, simplified
SY(LITVES01)	CHBLK	light vessel, paper-chart
SY(LITVES02)	CHBLK	light vessel, simplified
SY(LNDARE01)	LANDA CSTLN	land as a point at small scale
SY(LOCMAG01)	CHMGD	cursor pick site for a magnetic anomaly at a point or along a line
SY(LOCMAG51)	CHMGF	cursor pick site for a magnetic anomaly over an area

SY(LOWACC01)	CHBLK	point feature or area of low accuracy
SY(MAGVAR01)	CHMGD	cursor pick site for magnetic variation at a point
SY(MAGVAR51)	CHMGF	cursor pick site for magnetic variation along a line or over an area
SY(MARCUL02)	CHGRD	fish farm
SY(MONUMT02)	LANDF	Monument
SY(MONUMT12)	CHBLK	conspicuous monument
SY(MORFAC03)	LANDA CHBLK	mooring dolphin
SY(MORFAC04)	CHBLK	deviation mooring dolphin
SY(MSTCON04)	LANDF	Mast
SY(MSTCON14)	CHBLK	conspicuous mast
SY(NORTHAR1)	SCLBR	north arrow
SY(NOTBRD11)	CHBLK	conspicuous notice board
SY(OBSTRN01)	DEPVS CHBLK	obstruction, depth not stated
SY(OBSTRN02)	CHBLK	obstruction in the intertidal area
SY(OBSTRN11)	CSTLN LANDA	obstruction in the water which is always above water level
SY(OFSPLF01)	CHBLK	offshore platform
SY(OSPONE02)	SHIPS	one minute mark for ownship vector
SY(OSPSIX02)	SHIPS	six minute mark for ownship vector
SY(OWNSHP01)	SHIPS	own ship symbol, constant size
SY(OWNSHP05)	SHIPS	own ship drawn to scale with conning position marked
SY(PASTRK01)	PSTRK	time mark on past track
SY(PASTRK02)	SYTRK	time mark on secondary past track
SY(PILBOP02)	CHMGD	pilot boarding place
SY(PILPNT02)	CHBLK	pile or bollard
SY(PLNPOS01)	PLRTE	surrounding ellipse for arrival date and time at planned position
SY(PLNPOS02)	PLRTE	cross line for planned position
SY(PLNSPD03)	PLRTE	box for speed to make good, planned route
SY(PLNSPD04)	APLRT	box for speed to make good, alternate route
SY(POSGEN01)	LANDF	position of a point feature
SY(POSGEN03)	CHBLK	position of a conspicuous point feature
SY(POSGEN04)	CHBLK	position of an elevation or control point
SY(POSITN02)	NINFO	own ship position fix
SY(PRCARE12)	TRFCD	point symbol for traffic precautionary area
SY(PRCARE51)	TRFCD	traffic precautionary area
SY(PRDINS02)	LANDF CHBRN	mine, quarry
SY(PRICKE03)	CHBLK	withy, port-hand, paper-chart
SY(PRICKE04)	CHBLK	withy, starboard-hand, paper-chart
SY(QUAPOS01)	CHBLK	position approximate
SY(QUARRY01)	LANDF	Quarry
SY(QUESMRK1)	CHMGD	object which is not sufficiently described to be symbolized, or for which no symbol exists in the symbol library
SY(RACNSP01)	CHMGD	symbol indicating this object is radar conspicuous
SY(RADRFL03)	CHMGD	radar reflector
SY(RASCAN01)	LANDF	radar scanner
SY(RASCAN11)	CHBLK	Conspicuous radar scanner
SY(RCLDEF01)	CHMGD	radio calling-in point whose direction is not known
SY(RCTLPT52)	TRFCD	Recommended traffic direction between parts of a traffic separation scheme, or for ships not needing a deep water route
SY(RDOCAL02)	TRFCD	radio calling-in point for traffic in one direction only
SY(RDOCAL03)	TRFCD	radio calling-in point for traffic in both directions
SY(RDOSTA02)	CHMGD	radio station
SY(RECDEF51)	CHGRD	Recommended track as an area, direction not defined in data
SY(RECTRC55)	CHGRD	Recommended two-way track as an area, not based on fixed marks
SY(RECTRC56)	CHGRD	Recommended two-way track as an area, based on fixed marks
SY(RECTRC57)	CHGRD	Recommended one-way track as an area, not based on fixed marks
SY(RECTRC58)	CHGRD	Recommended one-way track as an area, based on fixed marks

SY(REFPNT02)	NINFO	reference point, 'ghost cursor' (user interface)
SY(RETRFL01)	CHMGD	retro reflector, paper chart
SY(RETRFL02)	CHMGD	retro reflector, simplified
SY(RFNERY01)	LANDF	Refinery
SY(RFNERY11)	CHBLK	Conspicuous refinery
SY(ROLROL01)	CHBLK	RoRo terminal
SY(RSCSTA02)	CHBLK	rescue station
SY(RSRDEF51)	TRFCF CHMGD	area in which undefined restrictions exist
SY(RTLDEF51)	TRFCD CHMGD	Recommended route between parts of a traffic separation scheme, or for ships not needing a deep water route, with the direction not specified in the data
SY(RTPBCN02)	CHMGD	radar transponder beacon
SY(SCALEB10)	SCLBR CHGRD	one mile scalebar for display scales larger than 1/80,000
SY(SCALEB11)	SNDG2 SNDG1	10 mile latitude scale for display scales smaller than 1/80,000
SY(SILBUI01)	LANDF CHBRN	Silo
SY(SILBUI11)	LANDF CHBLK	Conspicuous silo
SY(SISTAT02)	CHWHT LANDF CHMGF	signal station
SY(SMCFAC02)	CHMGD	yacht harbour, marina
SY(SNDWAV02)	CHGRD	sand waves
SY(SOUNDG00)	SNDG1	deep soundings, greater than safety depth
SY(SOUNDG01)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG02)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG03)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG04)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG05)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG06)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG07)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG08)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG09)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG10)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG11)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG12)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG13)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG14)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG15)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG16)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG17)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG18)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG19)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG20)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG21)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG22)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG23)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG24)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG25)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG26)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG27)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG28)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG29)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG30)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG31)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG32)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG33)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG34)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG35)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG36)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG37)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG38)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG39)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG40)	SNDG1	for deep soundings, greater than safety depth

SY(SOUNDG41)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG42)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG43)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG44)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG45)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG46)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG47)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG48)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG49)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG50)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG51)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG52)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG53)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG54)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG55)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG56)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG57)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG58)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDG59)	SNDG1	for deep soundings, greater than safety depth
SY(SOUNDGB1)	SNDG1	symbol for swept sounding, used for deep soundings greater than safety depth
SY(SOUNDGC2)	SNDG1	sounding of low accuracy
SY(SOUNDS00)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS01)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS02)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS03)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS04)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS05)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS06)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS07)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS08)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS09)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS10)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS11)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS12)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS13)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS14)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS15)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS16)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS17)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS18)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS19)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS20)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS21)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS22)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS23)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS24)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS25)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS26)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS27)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS28)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS29)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS30)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS31)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS32)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS33)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS34)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS35)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS36)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS37)	SNDG2	shallow soundings, less than or equal to the safety depth

SY(SOUNDS38)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS39)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS40)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS41)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS42)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS43)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS44)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS45)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS46)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS47)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS48)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS49)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS50)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS51)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS52)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS53)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS54)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS55)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS56)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS57)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS58)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDS59)	SNDG2	shallow soundings, less than or equal to the safety depth
SY(SOUNDSA1)	SNDG2	symbol for drying height, used for shallow soundings, less than or equal to safety depth
SY(SOUNDSB1)	SNDG2	symbol for swept sounding, used for shallow soundings, less than or equal to safety depth
SY(SOUNDSC2)	SNDG1	sounding of low accuracy
SY(SPRING02)	CHGRD	Spring
SY(SWPARE51)	CHGRF	swept area
SY(TIDCUR01)	NINFO	predicted tidal stream or current direction
SY(TIDCUR02)	NINFO	actual tidal stream or current direction
SY(TIDCUR03)	NINFO	box for current strength
SY(TIDEHT01)	CHGRD	point for which tide height information is available
SY(TIDSTR01)	CHGRD	point or area for which a tidal stream table is available
SY(TMARDEF1)	CHBLK	topmark for beacons, flag or other shape, paper-chart
SY(TMARDEF2)	CHBLK	topmark for buoys, flag or other shape, paper-chart
SY(TMBYRD01)	LANDF	timber yard
SY(TNKCON02)	LANDF	Tank
SY(TNKCON12)	CHBLK	Conspicuous tank
SY(TNKFRM01)	LANDF	tank farm
SY(TNKFRM11)	CHBLK	Conspicuous tank farm
SY(TOPMAR02)	CHBLK	topmark for buoys, cone point up, paper-chart
SY(TOPMAR04)	CHBLK	topmark for buoys, cone point down, paper-chart
SY(TOPMAR05)	CHBLK	topmark for buoys, 2 cones point upward, paper-chart
SY(TOPMAR06)	CHBLK	topmark for buoys, 2 cones point downward, paper-chart
SY(TOPMAR07)	CHBLK	topmark for buoys, 2 cones base to base, paper-chart
SY(TOPMAR08)	CHBLK	topmark for buoys, 2 cones point to point, paper-chart
SY(TOPMAR10)	CHBLK	topmark for buoys, sphere, paper-chart
SY(TOPMAR12)	CHBLK	topmark for buoys, 2 spheres, paper-chart
SY(TOPMAR13)	CHBLK	topmark for buoys, cylinder, paper-chart
SY(TOPMAR14)	CHBLK	topmark for buoys, board, paper-chart
SY(TOPMAR16)	CHBLK	topmark for buoys, cube point up, paper-chart
SY(TOPMAR17)	CHBLK	topmark for buoys, flag or other shape, paper-chart
SY(TOPMAR18)	CHBLK	topmark for buoys, T-Shape, paper-chart
SY(TOPMAR22)	CHBLK	topmark for beacons, cone point up, paper-chart
SY(TOPMAR24)	CHBLK	topmark for beacons, cone point down, paper-chart
SY(TOPMAR25)	CHBLK	topmark for beacons, 2 cones point upward, paper-chart
SY(TOPMAR26)	CHBLK	topmark for beacons, 2 cones point downward, paper-chart
SY(TOPMAR27)	CHBLK	topmark for beacons, 2 cones base to base, paper-chart
SY(TOPMAR28)	CHBLK	topmark for beacons, 2 cones point to point, paper-chart

SY(TOPMAR30)	CHBLK	topmark for beacons, sphere, paper-chart
SY(TOPMAR32)	CHBLK	topmark for beacons, 2 spheres, paper-chart
SY(TOPMAR33)	CHBLK	topmark for beacons, cylinder, paper-chart
SY(TOPMAR34)	CHBLK	topmark for beacons, board, paper-chart
SY(TOPMAR36)	CHBLK	topmark for beacons, cube point up, paper-chart
SY(TOPMAR65)	CHBLK	topmark for buoys, x-shape, paper-chart
SY(TOPMAR85)	CHBLK	topmark for beacons, x-shape, paper-chart
SY(TOPMAR86)	CHBLK	topmark for beacons, upright cross, paper-chart
SY(TOPMAR87)	CHBLK	topmark for beacons, besom point down, paper-chart
SY(TOPMAR88)	CHBLK	topmark for beacons, besom point up, paper-chart
SY(TOPMAR89)	CHBLK	topmark for beacons, T-shape, paper-chart
SY(TOWERS01)	LANDF	Tower
SY(TOWERS02)	LANDF	water tower
SY(TOWERS03)	CHBLK	Conspicuous tower
SY(TOWERS05)	LANDF	radio, television tower
SY(TOWERS12)	CHBLK	Conspicuous water tower
SY(TOWERS15)	CHBLK	Conspicuous radio, television tower
SY(TREPNT04)	LANDF	general symbol for a tree
SY(TREPNT05)	LANDF	Mangrove
SY(TSLDEF51)	TRFCD CHMGD	one way lane of a traffic separation scheme, with the direction not defined in the data
SY(TSSCRS51)	TRFCF	traffic crossing area
SY(TSSLPT51)	TRFCD	traffic direction in a one way lane of a traffic separation scheme
SY(TSSRON51)	TRFCF	traffic roundabout
SY(TWRDEF51)	TRFCD CHMGD	two-way route of a traffic separation scheme, with the direction not defined in the data
SY(TWRTPT52)	TRFCD	reciprocal traffic directions in a two-way route of a traffic separation scheme
SY(TWRTPT53)	TRFCD	single traffic direction in a two-way route part of a traffic separation scheme
SY(UWTROC03)	DEPVS CHBLK	dangerous underwater rock of uncertain depth
SY(UWTROC04)	CHBLK	rock which covers and uncovers or is awash at low water
SY(VECGND01)	SHIPS	arrowhead for own ship vector for course and speed over the ground
SY(VECGND21)	ARPAT	arrowhead for ARPA or AIS vector for course and speed over the ground
SY(VECWTR01)	SHIPS	arrowhead for own ship vector for course and speed through the water
SY(VECWTR21)	ARPAT	arrowhead for ARPA vector for course and speed through the water
SY(WATTUR02)	CHGRD	overfalls, eddies and breakers
SY(WAYPNT01)	PLRTE	waypoint on planned route
SY(WAYPNT03)	APLRT	waypoint on alternate planned route
SY(WAYPNT11)	PLRTE	next waypoint on planned route
SY(WEDKLP03)	CHGRD	weed, kelp
SY(WIMCON01)	LANDF	Windmotor
SY(WIMCON11)	CHBLK	Conspicuous windmotor
SY(WNDFRM51)	LANDF	wind generator farm
SY(WNDFRM61)	CHBLK	Conspicuous wind generator farm
SY(WNDMIL02)	LANDF	Windmill
SY(WNDMIL12)	CHBLK	Conspicuous windmill
SY(WRECKS01)	CHGRD	wreck showing any portion of hull or superstructure at level of chart datum
SY(WRECKS04)	CHBLK	non-dangerous wreck, depth unknown
SY(WRECKS05)	DEPVS CHBLK	dangerous wreck, depth unknown

Area pattern symbols (AP)

AP(AIRARE02)	LANDF	pattern of symbols for an airport area

AP(DIAMOND1)	DEPCN	area of depth less than the safety contour
AP(DQUALA11)	CHGRD	pattern of symbols for a chart of 5m accuracy with full seafloor coverage
AP(DQUALA21)	CHGRD	pattern of symbols for a chart with 20m accuracy with full seafloor coverage
AP(DQUALB01)	CHGRD	pattern of symbols for a chart with 50m accuracy from standard survey based on lines of continuous soundings
AP(DQUALC01)	CHGRD	pattern of symbols for a low accuracy or incomplete chart
AP(DQUALD01)	CHGRD	pattern of symbols for an unreliable chart
AP(DQUALU01)	CHGRD	pattern of symbols for a chart with quality not assessed
AP(DRGARE01)	CHGRD	dredged area
AP(FOULAR01)	CHGRD	foul area, not safe for navigation
AP(FSHFAC03)	CHGRD	pattern of symbols for an area with fishing stakes
AP(FSHFAC04)	CHGRD	pattern of symbols for an area with fish traps, fish weirs, tunny nets
AP(FSHHAV02)	CHGRD	pattern of symbols for a fish haven
AP(ICEARE04)	CHGRD	continuous pattern for an ice area (glacier, etc.)
AP(MARCUL02)	CHGRD	pattern of symbols for a marine farm
AP(MARSHES1)	CHBRN	pattern of symbols for a marsh
AP(NODATA03)	CHGRD	area of no chart data
AP(OVERSC01)	CHGRD	overscale part of a display containing data from more than one navigation purpose
AP(PRTSUR01)	CHGRD	incompletely surveyed area
AP(QUESMRK1)	CHMGD	pattern of symbols for an area which is not sufficiently described to be symbolized, or for which no symbol exists in the symbol library
AP(RCKLDG01)	LANDF	rock or coral drying ledges
AP(SNDWAV01)	CHGRD	pattern of symbols for sand waves
AP(TSSJCT02)	TRFCF	precautionary area or a traffic separation scheme crossing or roundabout
AP(VEGATN03)	LANDF	pattern of symbols for wooded areas
AP(VEGATN04)	LANDF	pattern of symbols for mangroves

Complex linestyles

LC(ACHARE51)	CHMGD	boundary of an anchorage area
LC(ACHRES51)	CHMGD	boundary of an area where anchoring is prohibited or restricted
LC(ADMARE01)	CHGRD	jurisdiction boundary
LC(CBLARE51)	CHMGD	boundary of a submarine cable area
LC(CBLSUB06)	CHMGD	submarine cable
LC(CHCRDEL1)	CHCOR	this line has been deleted by a manual update
LC(CHCRID01)	CHCOR	this line has been manually updated
LC(CTNARE51)	CHMGD	boundary of area with a specific caution
LC(CTYARE51)	CHMGD	boundary of area to be navigated with caution
LC(DWLDEF01)	TRFCD	deep water route centreline, direction not defined in the data
LC(DWRTCL05)	TRFCD	two--way deep water route centreline, not based on fixed marks
LC(DWRTCL06)	TRFCD	two--way deep water route centreline, based on fixed marks
LC(DWRTCL07)	TRFCD	one--way deep water route centreline, not based on fixed marks
LC(DWRTCL08)	TRFCD	one--way deep water route centreline, based on fixed-marks
LC(DWRUTE51)	TRFCD	boundary of a deep water route
LC(ENTRES51)	CHMGD	boundary of an area where entry is prohibited or restricted
~~LC(ERBLNA01)~~	~~NINFO~~	~~electronic range/bearing line, dash~~
LC(FERYRT01)	CHMGD	ferry route
LC(FERYRT02)	CHBLK	cable ferry route
LC(FSHFAC02)	CHGRD	fishing stakes
LC(FSHRES51)	CHMGD	boundary of an area where trawling or fishing is prohibited or restricted
LC(NONHODAT)	NINFO	boundary of non-HO data
LC(LOWACC01)	DEPSC	safety contour of low accuracy in position
LC(LOWACC11)	DEPCN	contour of low accuracy in position
LC(LOWACC21)	CSTLN	coastline or shoreline construction of low accuracy in position
LC(LOWACC31)	CHGRD	area of wrecks or obstructions of low accuracy
LC(LOWACC41)	CHBLK	danger line of low accuracy surrounding a foul area
LC(MARSYS51)	CHGRD	boundary between IALA--A and IALA--B systems of lateral buoys and beacons
LC(NAVARE51)	CHGRD	boundary of a navigation feature such as a fairway, magnetic anomaly, etc.
LC(PIPARE51)	CHMGD	boundary of a submarine pipeline area with potentially dangerous contents
LC(PIPARE61)	CHGRD	boundary of a submarine pipeline area with generally non--dangerous contents
LC(PIPSOL05)	CHMGD	oil, gas pipeline, submerged or on land
LC(PIPSOL06)	CHGRD	water pipeline, sewer, etc.
~~LC(PLNRTE03)~~	~~PLRTE~~	~~planned route for own ship~~
LC(PRCARE51)	CHMGD	boundary of a precautionary area
LC(QUESMRK1)	CHMGD	object which is not sufficiently described to be symbolized, or for which no symbol exists in the symbol library
LC(RCRDEF11)	TRFCD	regulated recommended route centreline, details not defined

LC(RCRTCL11)	TRFCD	regulated two-way recommended route centreline, not based on fixed marks
LC(RCRTCL12)	TRFCD	regulated one-way recommended route centreline, not based on fixed marks
LC(RCRTCL13)	TRFCD	regulated two-way recommended route centreline, based on fixed-marks
LC(RCRTCL14)	TRFCD	Regulated one-way recommended route centreline, based on fixed marks
LC(RECDEF02)	CHGRD	non—regulated recommended track, direction not defined in data
LC(RECTRC09)	CHGRD	non--regulated recommended two--way track, not based on fixed marks
LC(RECTRC10)	CHGRD	non—regulated recommended two--way track, based on fixed-marks
LC(RECTRC11)	CHGRD	non--regulated recommended one--way track, not based on fixed marks
LC(RECTRC12)	CHGRD	non—regulated recommended one--way track, based on fixed marks
LC(RESARE51)	CHMGD	boundary of a restricted area
LC (SCLBDY51)	CHGRF	chart scale boundary, the double line indicates the larger scale
LC(TIDINF51)	CHGRD	boundary of an area for which there is tidal information

Symbols added since Edition 3.0

SY(DIRBOY01)	CHMGD	direction of buoyage
SY(DWRUTE51)	TRFCD	reciprocal traffic directions in a two-way part of a deep-water route
SY(BLKADJ01)	BKAJ1 BKAJ2	Symbol for checking and adjusting the brightness and contrast
SY(FLTHAZ02)	CHMGD	floating hazard to navigation
SY(DANGER03)	DEPIT CHBLK	underwater hazard which covers and uncovers
SY(OBSTRN03)	DEPIT CHBLK	obstruction which covers and uncovers
SY(BOYSPP35)	CHYLW OUTLW	special purpose ice buoy or spar or pillar shaped buoy, simplified
SY(SAFCON00)	DEPDW SNDG2	contour label
SY(SAFCON01)	DEPDW SNDG2	contour label
SY(SAFCON02)	DEPDW SNDG2	contour label
SY(SAFCON03)	DEPDW SNDG2	contour label
SY(SAFCON04)	DEPDW SNDG2	contour label
SY(SAFCON05)	DEPDW SNDG2	contour label
SY(SAFCON06)	DEPDW SNDG2	contour label
SY(SAFCON07)	DEPDW SNDG2	contour label
SY(SAFCON08)	DEPDW SNDG2	contour label
SY(SAFCON09)	DEPDW SNDG2	contour label
SY(SAFCON10)	DEPDW SNDG2	contour label
SY(SAFCON11)	DEPDW SNDG2	contour label
SY(SAFCON12)	DEPDW SNDG2	contour label

SY(SAFCON13)	DEPDW SNDG2	contour label
SY(SAFCON14)	DEPDW SNDG2	contour label
SY(SAFCON15)	DEPDW SNDG2	contour label
SY(SAFCON16)	DEPDW SNDG2	contour label
SY(SAFCON17)	DEPDW SNDG2	contour label
SY(SAFCON18)	DEPDW SNDG2	contour label
SY(SAFCON19)	DEPDW SNDG2	contour label
SY(SAFCON20)	DEPDW SNDG2	contour label
SY(SAFCON21)	DEPDW SNDG2	contour label
SY(SAFCON22)	DEPDW SNDG2	contour label
SY(SAFCON23)	DEPDW SNDG2	contour label
SY(SAFCON24)	DEPDW SNDG2	contour label
SY(SAFCON25)	DEPDW SNDG2	contour label
SY(SAFCON26)	DEPDW SNDG2	contour label
SY(SAFCON27)	DEPDW SNDG2	contour label
SY(SAFCON28)	DEPDW SNDG2	contour label
SY(SAFCON29)	DEPDW SNDG2	contour label
SY(SAFCON50)	DEPDW SNDG2	contour label
SY(SAFCON51)	DEPDW SNDG2	contour label
SY(SAFCON52)	DEPDW SNDG2	contour label
SY(SAFCON53)	DEPDW SNDG2	contour label
SY(SAFCON54)	DEPDW SNDG2	contour label
SY(SAFCON55)	DEPDW SNDG2	contour label
SY(SAFCON56)	DEPDW SNDG2	contour label
SY(SAFCON57)	DEPDW SNDG2	contour label
SY(SAFCON58)	DEPDW SNDG2	contour label
SY(SAFCON59)	DEPDW SNDG2	contour label
SY(SAFCON60)	DEPDW SNDG2	contour label
SY(SAFCON61)	DEPDW SNDG2	contour label
SY(SAFCON62)	DEPDW SNDG2	contour label
SY(SAFCON63)	DEPDW SNDG2	contour label
SY(SAFCON64)	DEPDW SNDG2	contour label
SY(SAFCON65)	DEPDW SNDG2	contour label
SY(SAFCON66)	DEPDW SNDG2	contour label
SY(SAFCON67)	DEPDW SNDG2	contour label
SY(SAFCON68)	DEPDW SNDG2	contour label
SY(SAFCON69)	DEPDW SNDG2	contour label
~~SY(AISDGR01)~~	~~DNGHL~~	~~dangerous AIS target~~
~~SY(AISLST01)~~	~~RESBLU~~	~~lost AIS target~~
~~SY(AISSEL01)~~	~~RESBLU~~	~~selected AIS target~~
~~SY(AISTRN01)~~	~~RESBLU~~	~~AIS target turning to starboard~~
~~SY(AISTRN02)~~	~~RESBLU~~	~~AIS target turning to port~~
SY(ESSARE01)	CHMGF	environmentally sensitive sea area
SY(NEWOBJ01)	CHMGD	new object
SY(PSSARE01)	CHMGF	particularly sensitive sea area

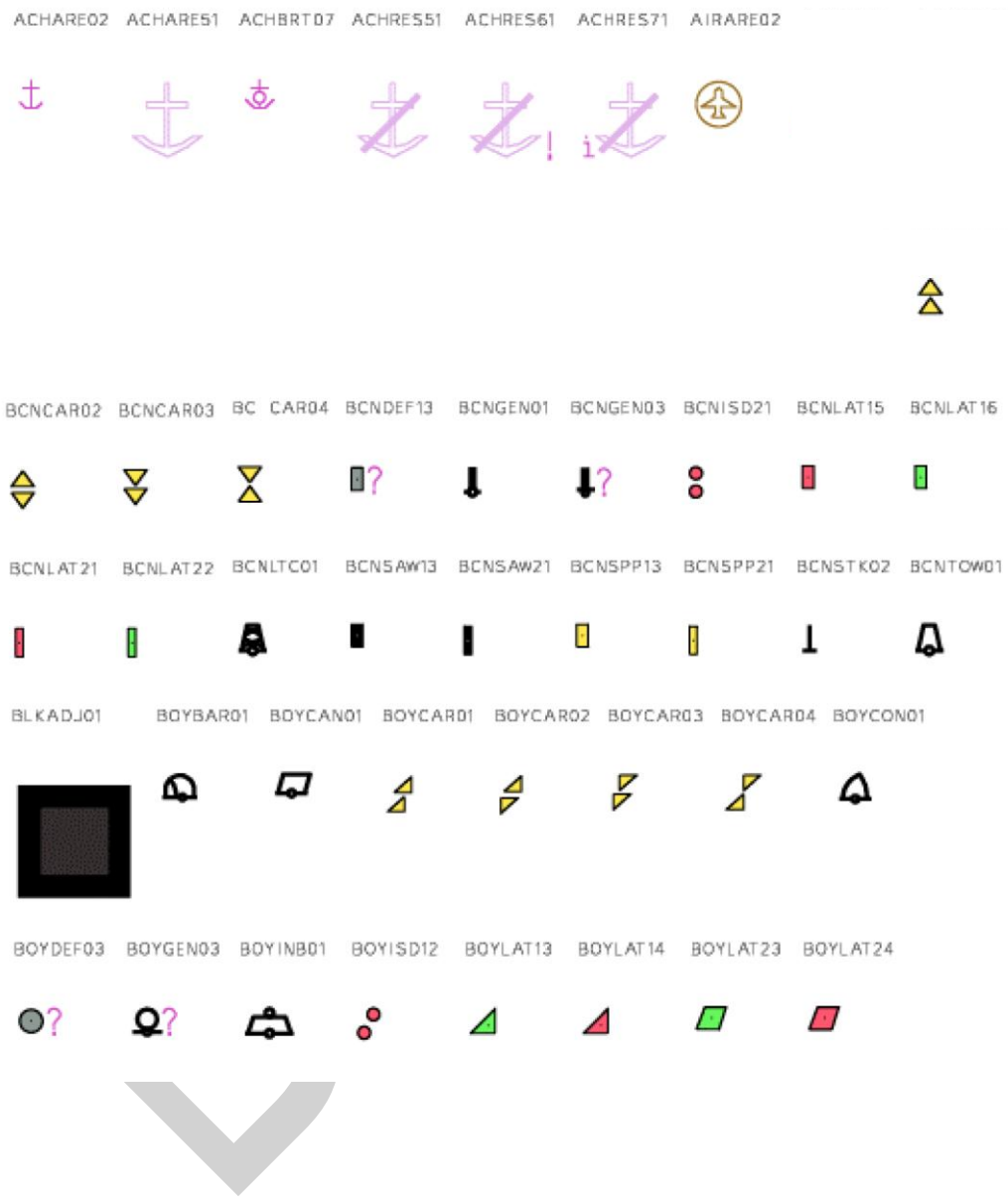
LC(ARCSLN01)	CHMGF	boundary of archipelagic sea lane
LC(NEWOBJ01)	CHMGD	new object
SY(DRFSTA01)	CHMGD	DGPS Base station
~~SY(AISATN01)~~	~~RESBLU~~	~~AIS based aid to navigation~~

Symbols added in edition 4

SY(CHDATD01)	CHMGD	marker for date dependant objects
SY(CHRVDEL1)	CHCOR	this object has been automatically deleted or modified
SY(CHRVID01)	CHCOR	this object has been automatically inserted or modified
SY(INDHLT01)	BKAJ1, CHYLW	indication highlight for mariner's use
LC(CHRVDEL2)	CHCOR	this object has been automatically deleted or modified
LC(CHRVID02)	CHCOR	this object has been automatically inserted or modified
LC(INDHLT02)	BKAJ1, CHYLW	indication highlight for mariner's use

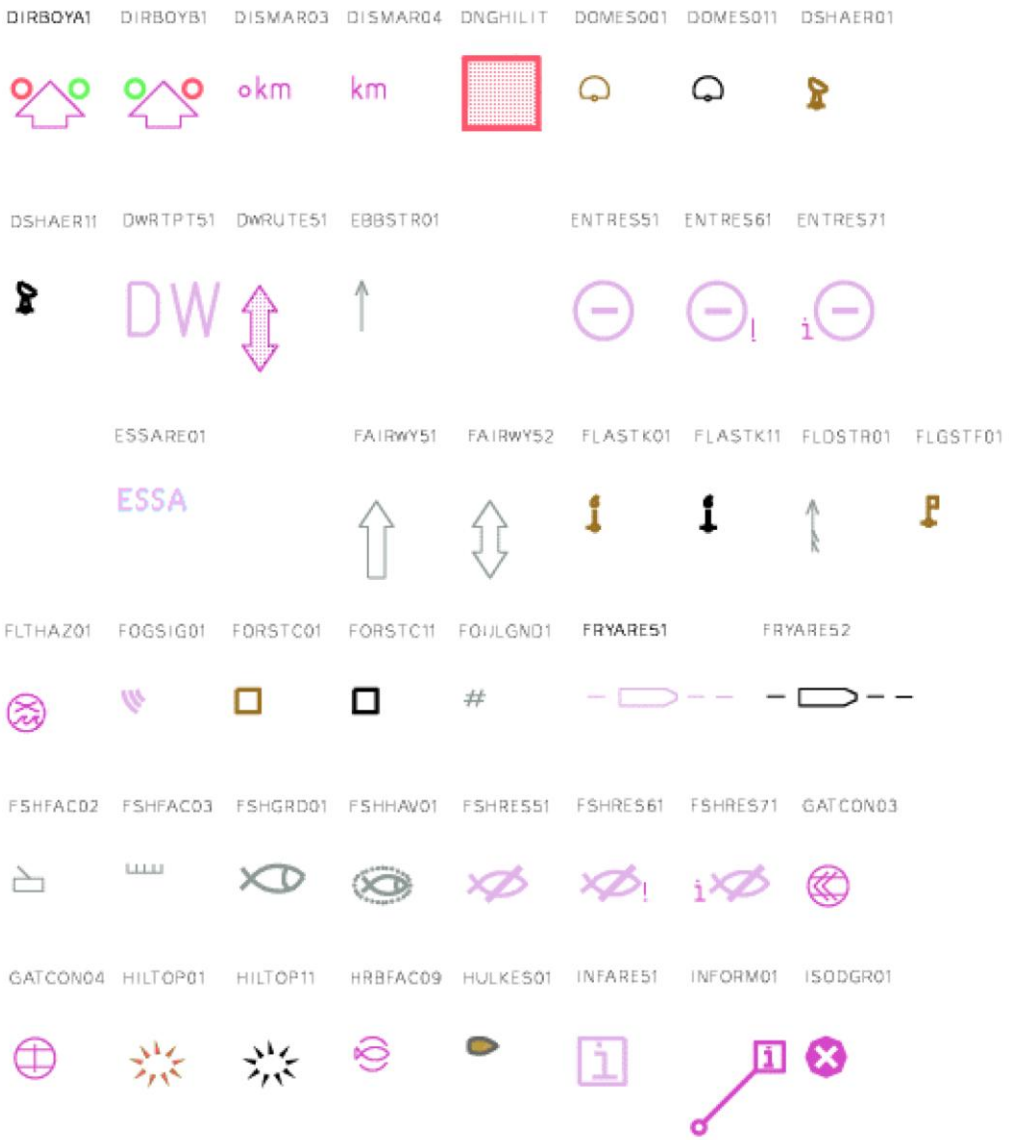
16.4 Plots of Symbols

Point symbols and centred areas symbols (SY)

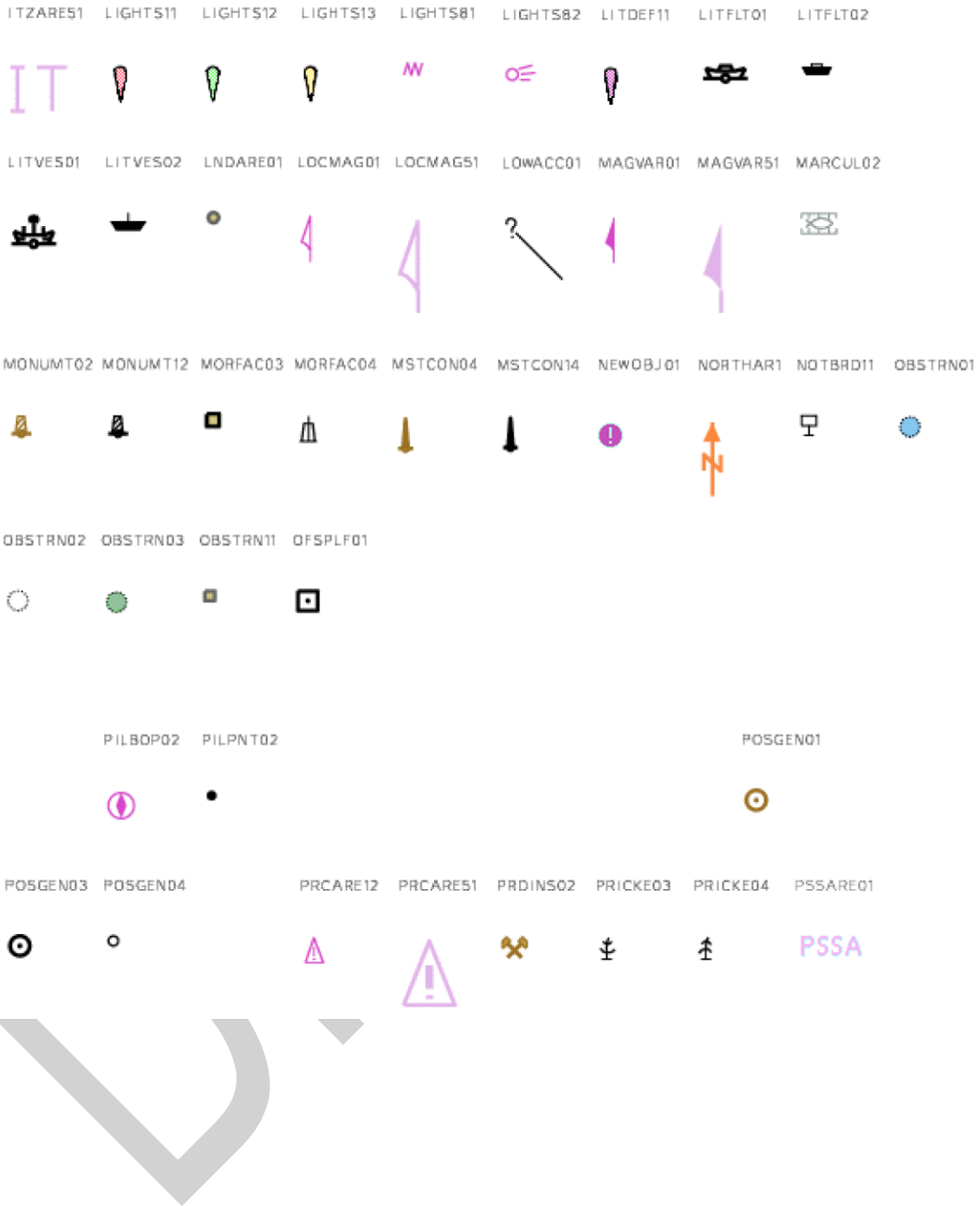


Point symbols and centred areas symbols (SY)

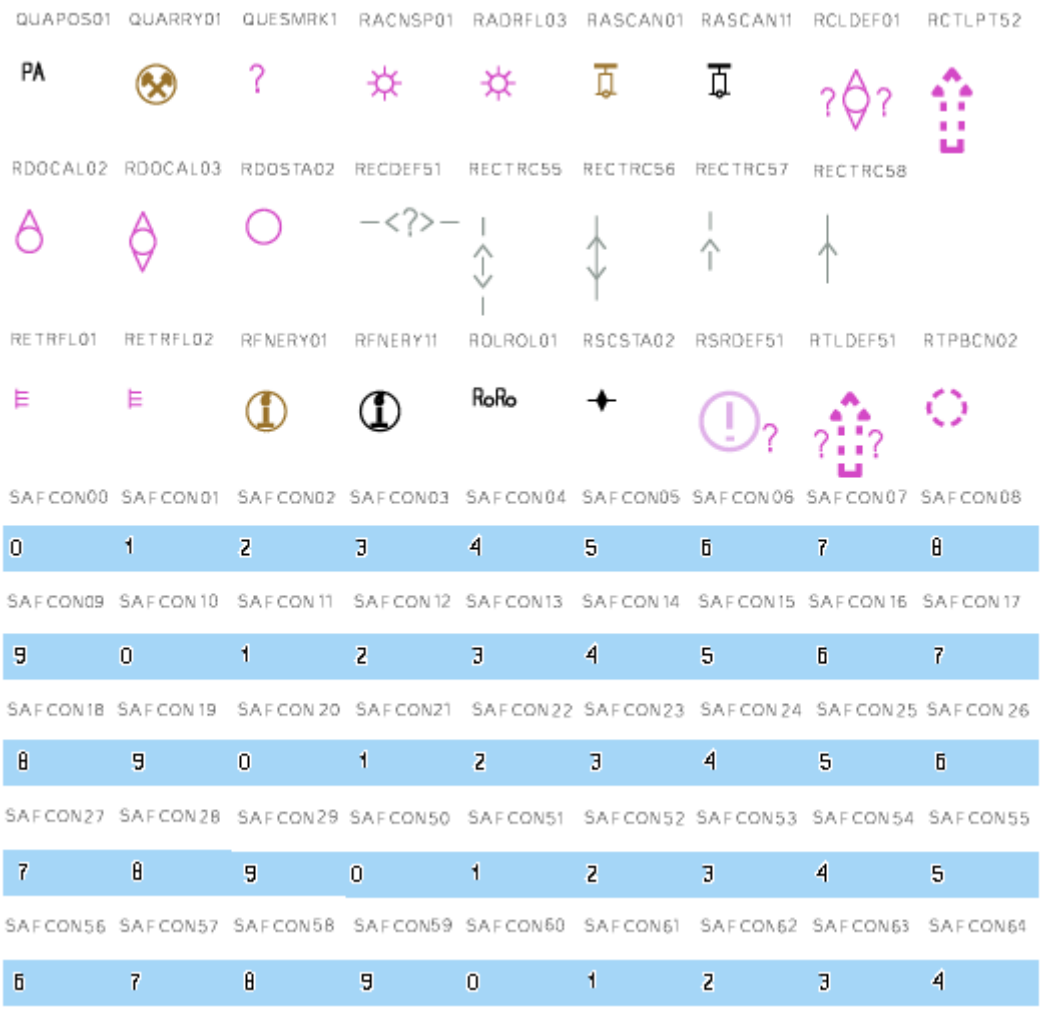
Point symbols and centred areas symbols (SY)



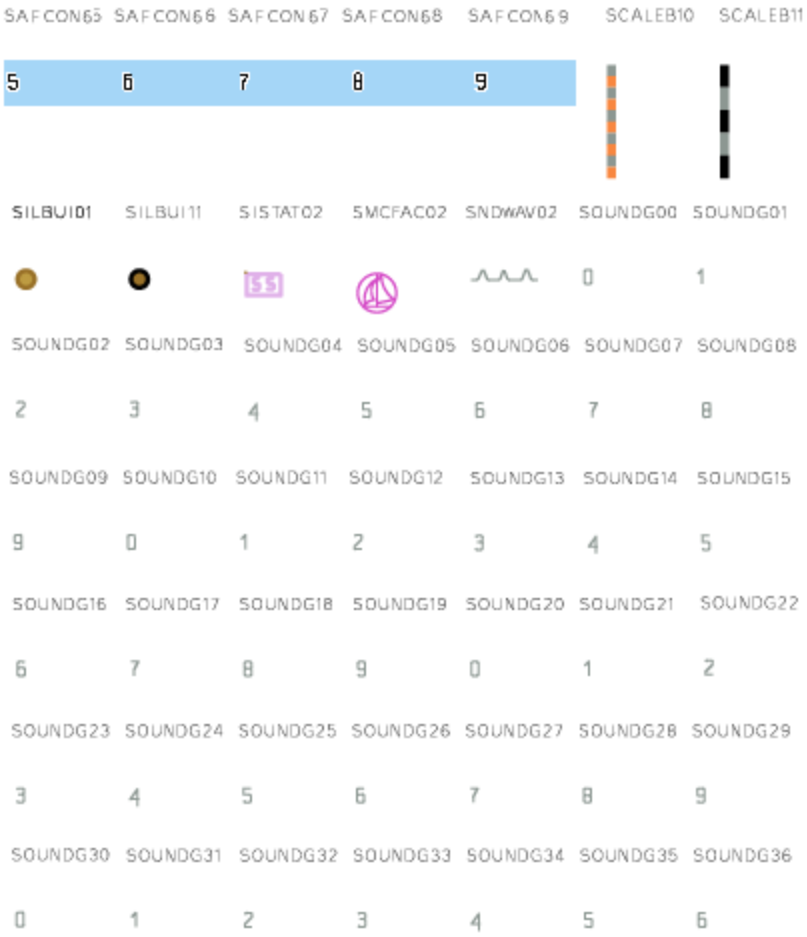
Point symbols and centred areas symbols (SY)



Point symbols and centred areas symbols (SY)

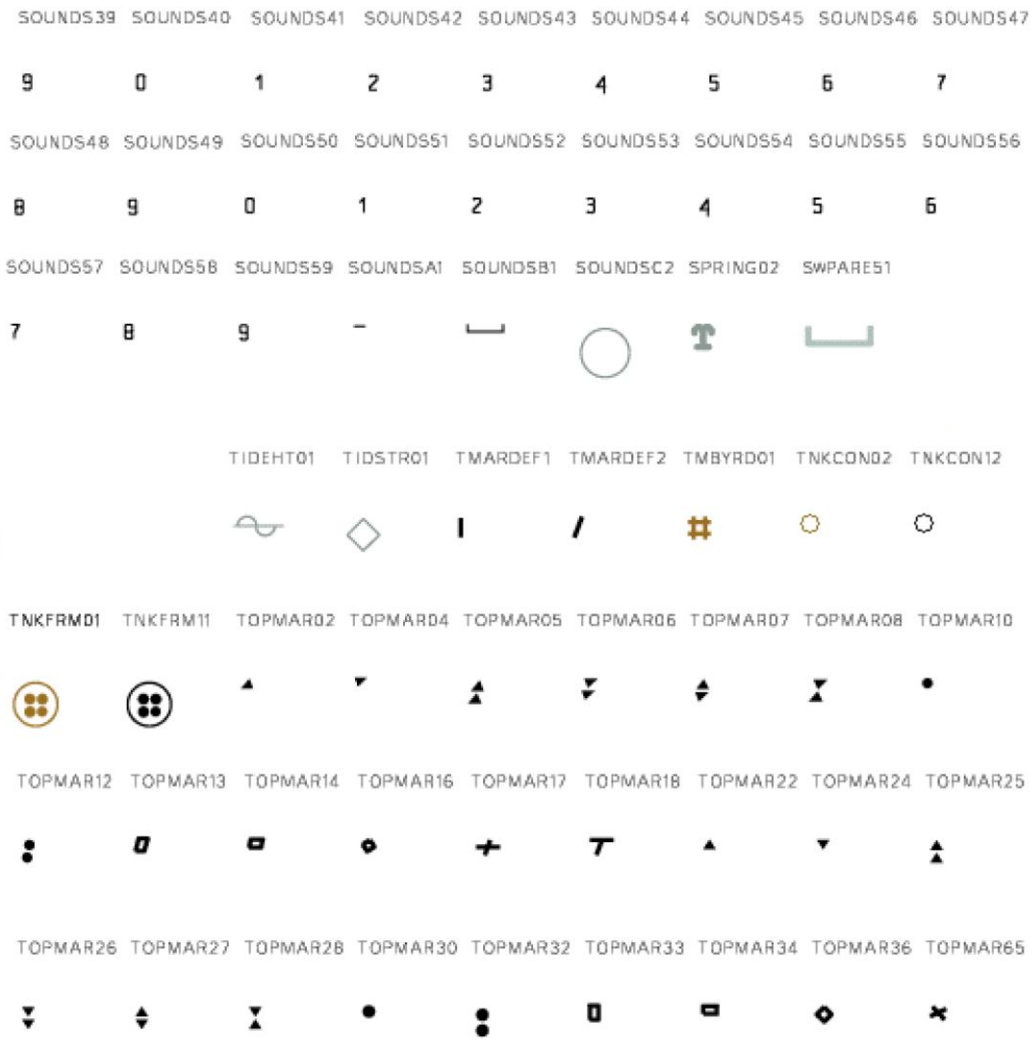


Point symbols and centred areas symbols (SY)

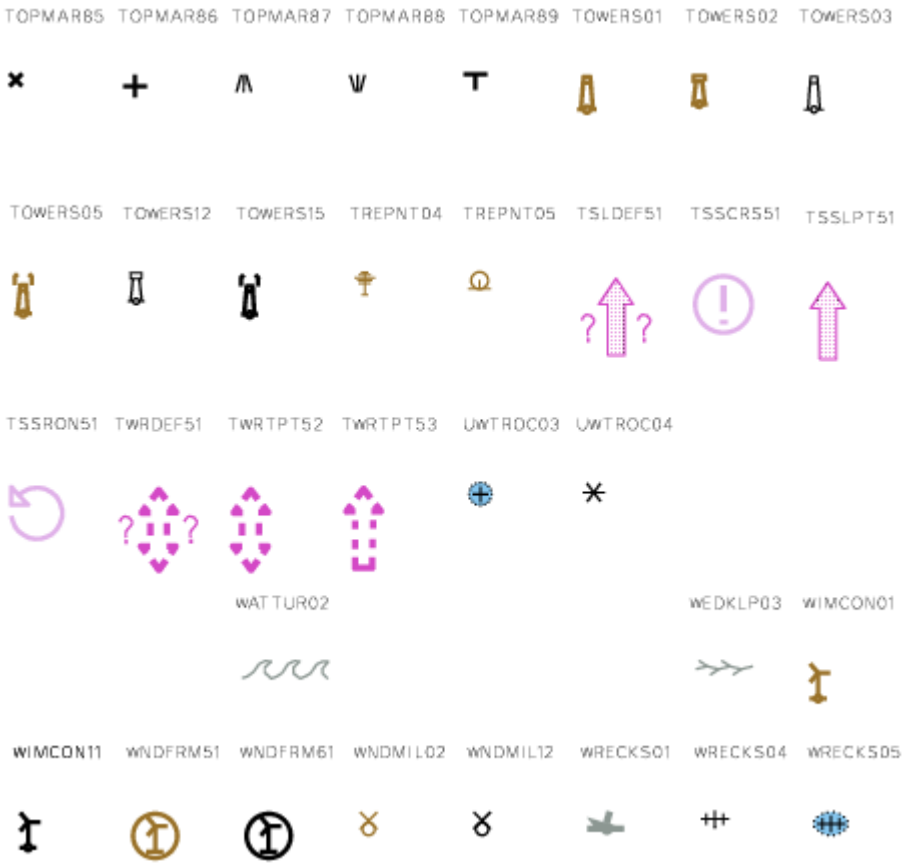


Point symbols and centred areas symbols (SY)

Point symbols and centred areas symbols (SY)

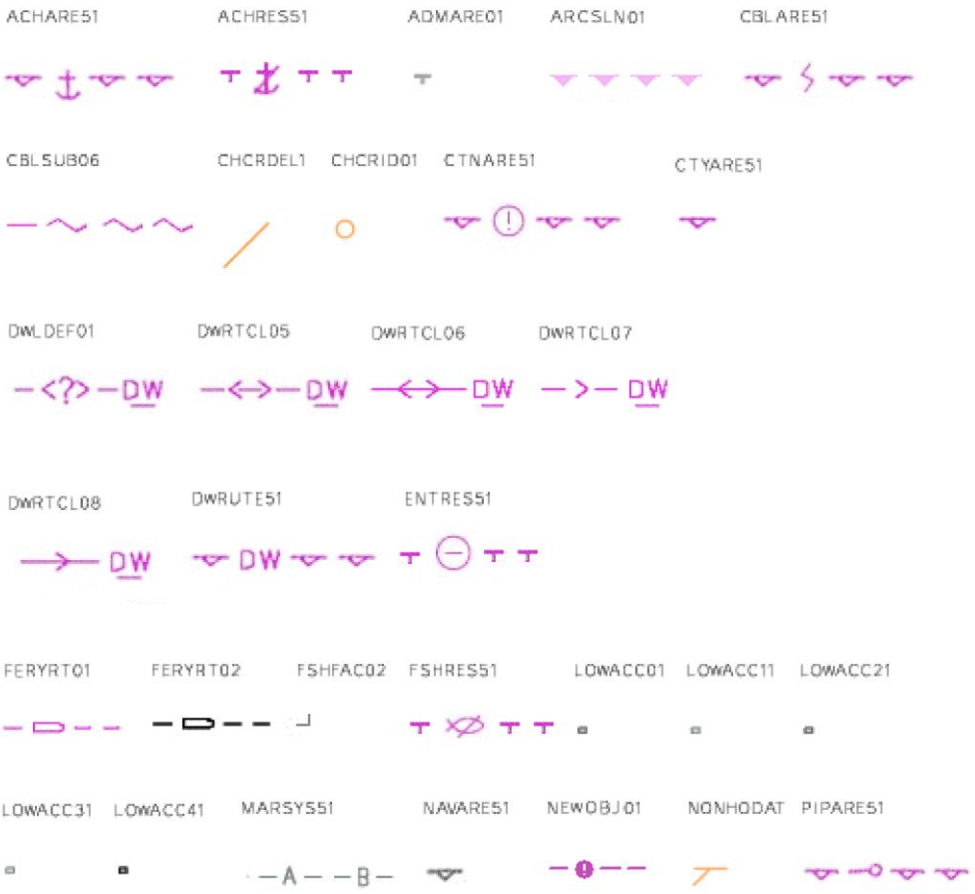


Point symbols and centred areas symbols (SY)

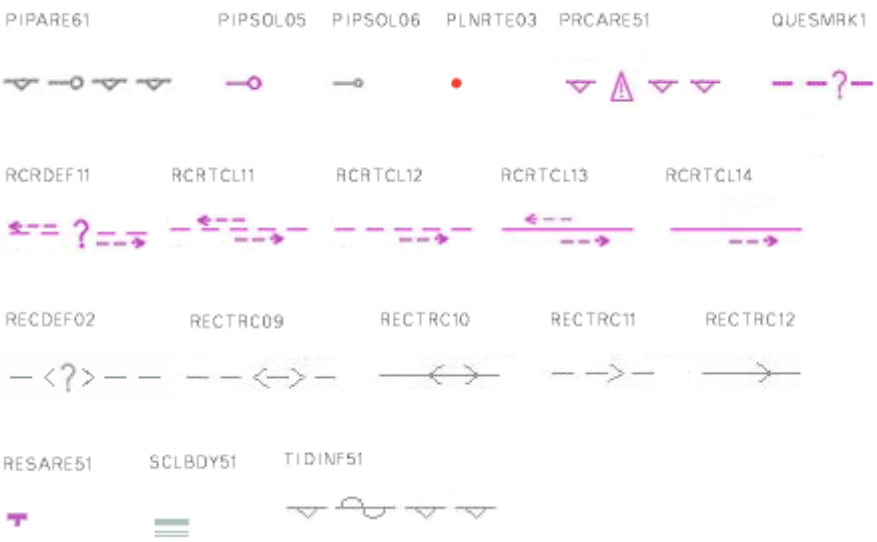


Area patterns (AP)

Complex linestyles (LC)



Complex linestyles (LC)



16.4.1 New symbols introduced in S-52 PresLib 4.0.0

16.4.2 New complex linestyles introduced in S-52 PresLib 4.0.0

17 Contents of the Digital Presentation Library

From edition 3.3 onwards the word-processed version is the "official" version of the Presentation Library. The digital version in .dai format described in this section is provided as a manufacturer's option for edition 4.0.0. However the S-57 format Colour Differentiation Test Diagram file will continue to be provided so that this diagram can be displayed using the ECDIS colour tables, as described in section 18.3, in order to test the colour differentiation capability of the display screen.

Please see README file on individual disks for file/data extraction and specific contents.

17.1 Digital Presentation Library

The optional digital Presentation Library is supplied in ".dai" format, the name on the disk being PSLBmm_n.dai, where mm_n is the edition number. This file is formatted in accordance with the description given in section 12 and appendices B to F, and contains look-up tables, colour tables and symbol descriptions. This file may not be up-dated and may not be available for future editions.

17.2 Test Edition of the Presentation Library

The ECDIS is no longer required to receive amendments to the Presentation Library at sea. Consequently, the Test Edition is no longer required.

17.3 Look-up Table sets

The digital form of the look-up tables are included in the above-described PSLBmm_n.dai file. This file may not be up-dated and may not be available for future editions.

17.4 Colour Tables

The CIE colour tables are included in the above-described PSLBmm_n.dai file. This file may not be up-dated and may not be available for future editions.

17.5 Symbols, Patterns and Linestyles

The official symbols, patterns and linestyles are provided in the PSLBmm_n.dai file. This file may not be up-dated and may not be available for future editions.

17.6 Official Presentation Library

The official Presentation Library, in the form of a word processed file, is contained on the Presentation Library CD. The content of the Presentation Library is given in section 4.

17.7 ECDIS Chart 1

An ECDIS Chart 1 is available for use by the Mariner, off-line, as described in S-52, section 3.1.4. This is in section 16.2 and as graphics files on the Presentation Library CD.

In addition to the above, the digital Presentation Library contains a set of 13 pseudo S-57 files named AANC1XXX.000 ("N" is the navigational purpose), with AGEN code 1810. These cells carry the representation of the ECDIS Chart 1 as a collection of all symbols coded as NEWOBJ using the SYMINS attribute and similarly arranged as INT1 [1] for paper charts.

Detailed specifications for these diagrams and their use are given in section 18.

17.8 Colour Differentiation Test Diagram

A Colour Differentiation Test Diagram is provided to enable the Mariner to check the colour performance of his ECDIS screen, off-line, as described in S-52, section 5.2.5. It is illustrated in section 16.3 and fully described in sections 18.2 and 18.3.

17.9 CSPs in UML

In addition to the graphical form of the CSPs provided in this document they are also provided for use as a digital set of diagrams in Enterprise Architect form.

18 Use of ECDIS Chart 1 & Colour Test Diagram

18.1 Introduction

The digital part of the IHO ECDIS Presentation Library carries supplementary features intended to aid the manufacturer in implementing the IHO Colour & Symbol Specifications, and the Mariner in using them. These consist of:

- An ECDIS Chart 1, as pseudo S-57 files, to help familiarise the Mariner with the colour and symbol coding used by ECDIS and to aid in picking the appropriate symbol for manual chart correction. (Note that the digital version of the ECDIS Chart 1 described here will be available in edition 4.0.0 of the Presentation Library, but may not be updated in the future. The ECDIS Chart 1 is also presented in section 16.2.)

- A Colour Differentiation Test Diagram, as an S-57 file, to enable the Mariner to test whether his screen is still capable of differentiating the main colours used in ECDIS, and also to assist him in setting the brightness and contrast controls. (This digital version of the colour differentiation test diagram must be supplied with the ECDIS as the diagrams are intended to test whether an aging ECDIS screen is still capable of showing colour differences clearly.)

18.2 Specification for ECDIS Chart 1 and the Colour Test Diagram

18.2.1 Definition (for this specification only)

A Chart 1 data cell must be displayed so as to fill all of the standard ECDIS display area. (i.e. the min 270 x 270 mm chart area).

18.2.2 Description and purpose

The ECDIS Chart 1 and the Colour Differentiation Test are diagrams for use by the Mariner which are provided in the form of ENC-like S-57 files.

The ECDIS chart 1 is intended to familiarise the Mariner with the symbology used on ECDIS. The Mariner must be able to display each cell, and by cursor-pick get a read-out of the meaning of any symbol shown.

The Colour Differentiation Test diagram is intended for display using the day or dusk colour tables so that the Mariner can check that the ECDIS monitor is providing adequate colour performance. It is also used in type-approval testing. Instructions for its use are given in the sections below.

The ECDIS chart 1 includes the CHKSYM which is intended for checking the correct size of the symbols during the type approval. The width and height of the CHKSYM is 5.0 mm.

The line width of the diagonal line in the Colour Differentiation Test diagram is specified as 0.6 mm wide (i.e. 2 pixel wide with a monitor with 0.3 mm pixel pitch). The line width must be checked during the type approval.

18.2.3 Mode of use

These diagrams are supplementary features of the ECDIS, intended for use off-line or during route planning. Because they occupy the entire display they must not be used during route monitoring. If the Mariner needs to find the meaning of a symbol during route monitoring, he must use cursor-picking.

The operation of these diagrams is not subject to the draw-speed requirements of route monitoring.

18.2.4 Content and Encoding

The Chart 1 / Colour Test package consists of the thirteen S-57 cell files described below. The S-57 files of the ECDIS Chart 1 consists of eleven detail cells and an the index cell. The detail cells contain all of the symbols used on ECDIS, excluding Mariners' Navigational Objects, plus some explanatory diagrams. They are organised in displays that follow the classification used for INT 1 [1] for the paper chart (e.g. the first display is "AB - Information about the chart display.")

The S-57 file of the Colour Differentiation Test Diagram consists of one display cell (C1WOO) containing twenty squares, each with a different background/foreground colour combination.

The cells are identified as follows:

cell code	INT 1	Name	comp. Scale	“N”
C1AB1	AB	information about the chart display	1/14 000	5
C1AB2	AB	information about the chart display	1/14 000	5
C1CDE	CDE	natural and man-made features	1/14 000	5
C1FOO	F	port features	1/14 000	5
C1HIO	HI	depths, currents etc.	1/14 000	5
C1JKL	JKL	seabed, obstructions, pipelines etc.	1/14 000	5
C1MOO	M	traffic routes	1/14 000	5
C1NOO	N	special areas	1/14 000	5
C1PRS	PQRSTU	aids and services	1/14 000	5
C1QO1	Q	paper chart buoys and beacons	1/14 000	5
C1QO2	Q	topmarks	1/14 000	5
C1WOO	-	colour differentiation test diagram	1/14 000	5
C1XOO	-	index covering all of above detail cells excluding Mariners navigational objects	1/42 000	4

The file name uses the IHO Producer Code (AA), followed by the navigational purpose and the individual cell code given above. Revision will be by new edition, and so the update number is always ".000". An example of a full file name is:

"AA5C1AB1.000"

Spatially, the "harbour" scale Chart 1 detail cells ("N"=5) are laid out in a 3 x 3 matrix with the Colour Test display cell below (to the south), and all are covered by the index cell on the "approach" scale ("N"=4). They are located in the West African desert at 15 degrees north, 5

degrees west, where there shall be no danger of their being called up as real chart cells (unless river traffic on the R. Niger above Timbuktu increases drastically.)

The EN Application Profiles of S-57 Appendix B1 are used, with arbitrary values entered for certain items (such as vertical datum) which do not apply to Chart 1. (This is done to minimise the changes to ECDIS software needed in order to process these special purpose Chart 1 files in an ECDIS.)

The IHO agency code (1810) is used in the AGEN sub-field of the DSID field, and the PRSP field is given the value {3} to distinguish it from the values used for the ENC Product Specification.

18.2.5 Revisions

Revisions will be made by whole file replacement, i.e. by issuing a new edition, as indicated in the EDTN sub-field of the DSID field.

18.2.6 Packaging

The pseudo S-57 data files are part of the Digital Presentation Library.

18.2.7 Presentation

The Chart 1 files are symbolized by the NEWOBJ look-up table entries triggered by the SYMINS attribute of the generic object NEWOBJ introduced by the supplement No. 1 of S-57 Edition 3.1.1.

The README files give some specific Mariner settings, such as safety contour, that are required to give the correct display.

The ECDIS Chart 1 and Colour Test diagram cells must be displayed full-screen (270 x 270 mm), i.e. at or larger than the compilation scale. Otherwise features such as centred symbols may not be correctly illustrated.

The Mariner must be able to cursor-pick on any symbol on the Chart 1 display and get a text read-out of the symbol meaning (LXPO field of the symbol library).

18.3 Displaying the Colour Test Diagram

18.3.1 Introduction; providing the diagram

The colour generating capability of any type of display screen will deteriorate with age and the Colour Differentiation Test diagram is provided to enable the Mariner to verify that his display screen still retains the colour differentiation capability needed to distinguish between the various colour-coded areas, lines and point symbols of the ECDIS display.

The diagram will not be true to colour unless it is projected on a calibrated monitor and is generated using the colour tables of Appendix A.

Two methods of providing the diagram are:

a) Use the S-57 format file labelled “C1WOO” containing the Colour Differentiation Test Diagram, which is included on the Presentation Library distribution CD. This file must be drawn so that the extent of the imaginary chart data covers the entire ECDIS display. Because the file uses pseudo-S-57 cartographic objects it must be displayed using the special look-up provided for the digital ECDIS Chart 1.

b) Use the graphics file illustrated in section 16.3 as a model. Based on this model, reproduce the same pattern of rectangles and lines on the screen, but present them in the correct colours using the colour tokens given immediately below and the colour tables of Appendix A.

The diagram consists of twenty numbered squares extending over the whole of a 270 x 270 mm screen. Each square is coloured with one of the four main background area shades (such as shallow water blue, DEPVS), and each carries a two-pixel wide diagonal line in one of the important line or symbol foreground colours (such as planned route red, PLRTE). These are arranged as follows:

Four main background colours:

DEPVS	(shallow water blue)	squares 3, 5, 11, 15, 18, 20.
DEPDW	(deep water, white or black)	squares 1, 7, 8, 10, 13, 19.
LANDA	(land colour)	squares 6, 14, 17.
NODTA	(no data shade: radar, navigation safety lines and chartwork must be visible on the no-data part of a display)	squares 2, 4, 9, 12, 16.

Six important foreground colours:

DEPSC	(safety contour grey)	squares 3, 10, 17.
NINFO	(orange, Mariner's information)	squares 5, 8, 14, 16.
ADINF	(yellow, manufacturer's information)	squares 12, 15, 19.
TRFCD	(magenta, traffic lanes and area boundaries)	squares 1, 9, 11.
RADLO	(the lower luminance radar green)	squares 4, 6, 13, 18.
RESBL	(blue, provisionally reserved for traffic info from transponder, VTS etc.)	squares 2, 7, 20.

Note: Remember that a tif, .pdf or other source will not be true to colour unless it has been specifically modified to access the colour tokens and colour tables used by the ECDIS.

Although originally designed for use on CRTs, this test must be extended to LCD and other screens.

18.3.2 Using the diagram

The Colour Test must be applied on the day and dusk colour tables.

Before the Colour Test diagram is used, the black-adjust symbol SY(BLKADJ01) must be brought up on the screen and the contrast and brightness controls (or equivalent controls for an LCD) must be adjusted as follows:

1. First, set contrast to a maximum, brightness to a minimum. Look at the black-adjust symbol. Then either:

2A. If the centre square is not visible, turn up the brightness until it just appears.

OR:

2B. If the centre square is clearly visible (with contrast at maximum, brightness at minimum), turn the contrast down until the inner square disappears, then turn contrast back up until the inner square is just visible again.

(If the above adjustment is not successful, select a more appropriate colour table and repeat this procedure).

The "black level" is then correctly set. If a brighter display is required use the contrast control, but preferably do not adjust the controls unless lighting conditions on the bridge change.

The test consists of being able to distinguish the background colours and to pick out the like foreground colours, i.e. to say that squares 3, 5, 11, 15, 18 and 20 all have a shallow water blue background, and that squares 3, 10 and 17 have a grey line.

NOTE: The test above uses the black-adjust symbol for the purpose of a type approval test. The other purpose of the black-adjust symbol SY(BLKADJ01) is to allow the mariner to adjust the display for ambient illumination on the bridge of a ship. An ECDIS must have the black-adjust symbol displayed whenever the mariner is adjusting the display (i.e. depending on the technology of the display brilliance, brightness, contrast, etc.), as required by section 4.2.4.5 of S-52 e6.1.0.

18.4 Grey Scale

A grey scale may be used by service technicians to detect display ageing or other display performance issues.

Eight grey strips are recommended, spaced between the minimum and the maximum luminance for each of the five mandatory colour tables.

The bit levels or signal levels producing the grey levels are evenly spaced from the level producing white to the level producing black. In order to select the appropriate grey level from a large set of available grey levels, use one of the following models:

1. ***Bit Levels in Software:*** Given n levels of grey that can be displayed on a screen, with 0 for black and $w = n - 1$ for white. We want to select a subset of m levels that are as evenly spaced as possible. The interval between the n levels to create m levels is $\Delta V = w/(m-1)$, which may not be an integer. So, the levels to select are the (integer) values of $V_i = \text{int}[(i-1)\ \Delta V]$ for $i = 1, 2, ..., m$, or $V_i = 0, \text{int}(\Delta V), \text{int}(2\Delta V), \text{int}(3\Delta V), ..., \text{int}[(m-1)\ \Delta V]$, with $\text{int}[(m-1)\ \Delta V] = w$ for white. For example, if there are $n = 256 = 2^8$ levels from which we select $m = 8$ levels, white is $w = 255$; the interval is $\Delta V = 36.4286$, and the chosen levels are: 0, 36, 73,109, 146, 182, 219, 255.

2. ***Analog Signal Levels:*** For analog signals, if V_w is the white level and V_b is the black level, then for m levels the signal step size is $\Delta V = (V_w - V_b)/m$ and $V_j = V_b + j\Delta V$.

19 Supply and Amendment of the Digital Presentation Library

The word-processed version of the Presentation Library is the "official" version. A limited digital version in .dai format is provided on the CD-ROM containing the word-processed Presentation Library as a manufacturer's option for edition 4.0.0, but may not be provided for succeeding editions. This digital version consists of look-up tables; symbols; and colour tables and is supplied in ASCII format in the .dai file.

The edition number appears in the LBID line at the start of the .dai file where it is coded digitally and also spelled out in plain language.

19.1 Amending the digital Presentation Library

(See also S-52, sections 1.2.3 and 1.2.4)

Amendments to the Presentation Library, if available, will be posted on the IHO website (www.iho.int > Standards & Publications > Download > Maintenance Section).

An immediate amendment (but not a deferred amendment) will change the edition number of the Presentation Library.

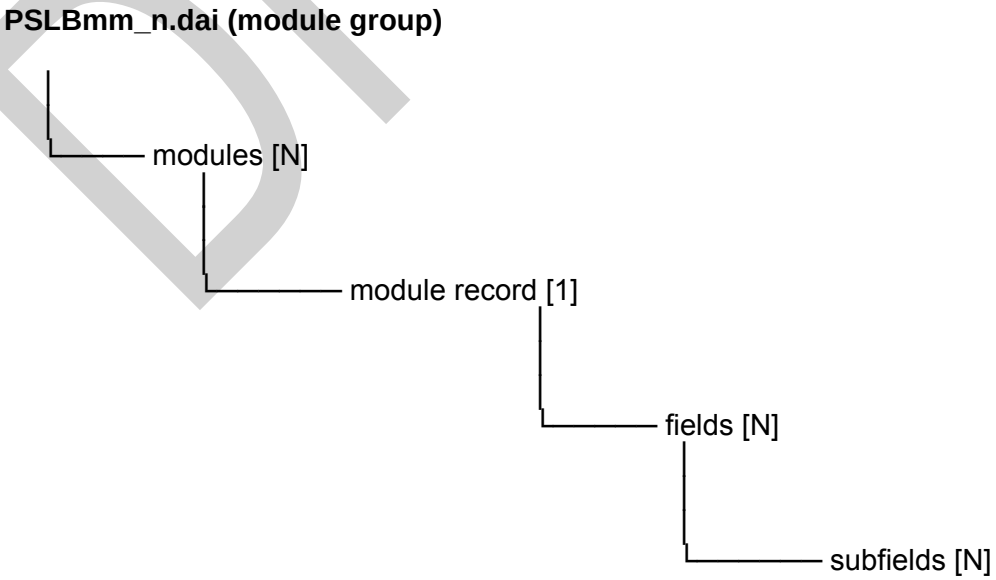
The edition number of the PresLib installed must be available to the Mariner on request.

19.2 Internal Structure of the Transfer File

The PSLBmm_n.dai file has a particular internal structure. In the format description (see section 12), several constructs (modules, fields, etc.) are used to convey colour tables, look-up tables, symbols, patterns and linestyles.

The transfer file is formed of one or more modules. Each module is formed of one module record. Each module record is formed of one or more fields which in turn is formed of one or more subfields.

This structure is explained below:



The lowest level construct, the subfield, must only contain one elementary data item, for example, one colour coordinate or one symbology instruction. Formatted subfields, such as the subfields that contain the vector image definitions, must be further resolved by an application program. In this specification, subfields are not divisible.

The field tag is a unique 4 character field type which links an instance of a field type in a data record to the data descriptive record that defines the syntax of that field type.

The subfield label is a 4 character label, present only in the data descriptive record of a file, required to identify the subfields within a field type. A label preceded by an "*" signifies that that subfield, and any subsequent ones, repeat within the field. This, therefore, indicates the presence of an array or table, for which the subfield labels provide the column headings.

Subfield data type codes uses data types as follows:

A signifies character data,
I signifies implicit point representation (integer),
R signifies explicit point representation (real or float),

An extent of X(n) indicates a fixed length subfield of length n. An extent of X(1/15) indicates a variable length subfield terminated by the delimiter "1/15" (that is ASCII 1F hexa-decimal or 31 decimal).