Marine Information Overlays
Ice Coverage

Product Specification

Edition 1.0
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This document is based on IHO S-57, Edition 3.1.1

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Contents

1. Introduction

1.1 Definitions

Cell A cell is a geographical area containing MIO data.

MIO Marine Information Overlays (MIOs) consist of supplementary information to be used with an Electronic Chart Display and Information System (ECDIS) that are not Electronic Navigational Chart (ENC) objects or specified navigational elements or parameters. Supplementary means additional, non-mandatory information not already covered by existing International Maritime Organisation (IMO), International Hydrographic Organisation (IHO), and International Electrotechnical Commission (IEC) standards or specifications.

MIO Content Specification The set of specifications intended to enable relevant organisations to produce a consistent MIO, and manufacturers to use that data efficiently in an ECDIS that satisfies the IMO Performance Standards for ECDIS. An MIO must be produced in accordance with the rules defined in this Specification and must be encoded using the rules described in the Ice MIO Encoding Guide.

1.2 Contents of the document

The MIO Content Specification contains an MIO application profile for the basic MIO used to populate the SENC (System ENC).

1.3 References

The following documents affect the MIO content:

IHO S-57	*"IHO Transfer Standard for Digital Hydrographic Data"*
IHO S-52	*"Specifications for Chart Content and Display Aspects of ECDIS"*
S-52 App 1	*"Guidance on Updating the Electronic Navigational Chart"*
S-52 App 2	"*Colours & Symbols Specifications for ECDIS"*
IMO Resolution A.817(19)	*"Performance Standards for Electronic Chart Display and Information Systems (ECDIS)"*
ANSI/IEEE 802.3	*"IEEE Standards for Local Area Networks, Carrier Sense Multiple Access with Collision Detection (CSMA/CD)Access Method and Physical Layer Specifications"*
Ice Objects 4.0	*“ECDIS Ice Objects Catalogue Version 4.0”*

2. General information

2.1 Navigational purpose

MIO data is compiled for a variety of informational purposes. The navigational purpose for which an individual Ice MIO has been compiled is indicated in the “Data Set Identification" [DSID] field, "Intended Usage" [INTU] subfield and in the name of the data set files. MIO is normally compiled as non-scaled vector data. As such, the INTU = 100 and the filename navigational purpose is “zero” (0). The following codes may used:

Subfield content	Navigational purpose
100	non-scaled
1	overview
2	general
3	coastal
4	approach
5	harbour
6	berthing

It is recognised that Ice coverage information may come from multiple sources, as such the best source should be used as a guide when making this determination.

2.2 Cells

In order to facilitate the efficient processing of Ice MIO data the geographic coverage of a given usage must be split into cells. Each cell of data must be contained in a physically separate, uniquely identified file on the transfer medium, known as a data set file (see clauses 5.4 and 5.6.3). The geographic extent of the cell must be chosen by the Ice MIO producer to ensure that the resulting data set file contains no more than 5 Megabytes of data. Subject to this consideration, the cell size must not be too small in order to avoid the creation of an excessive number of cells.

Cells must be rectangular (i.e. defined by 2 meridians and 2 parallels).
The coordinates of the borders of the cell are encoded in decimal degrees in the "Catalogue Directory"[CATD] field.

The area within the cell which contains data must be indicated by a meta object M_COVR with CATCOV = 1. Any other area not containing data must be indicated by a meta object M_COVR with CATCOV = 2.

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.

Point or line feature objects which are at the border of two cells with the same navigational purpose must be part of only one cell. They are put in the south or west cell (i.e. north and east borders of the cell are part of the cell, south and west borders are not).

When a feature object exists in several cells its geometry must be split at the cell boundaries and its complete attribute description must be repeated in each cell.

2.3 Topology

Ice MIO data must be encoded using chain-node topology (see S57 Part 2, clause 2.2.1.2).

3. Objects and attributes

3.1 Feature object identifiers

Each feature object must have a unique world-wide identifier. This identifier, called the feature object identifier, is formed by the binary concatenation of the contents of the subfields of the "Feature Object Identifier" [FOID] field.

For MIO the feature object identifier may be used to identify multiple instances of the same object. For example, the same object may appear in different usages, or an object may be split by the cell structure. In these circumstances each instance of this object may have the same identifier.

Feature object identifiers must not be reused, even when a feature has been deleted.

3.2 Standard object classes and attributes

Only object classes, attributes and attribute values which are defined in the MIO Object Catalogue and the IHO Object Catalogue (S57, Appendix A) may be used in an MIO.

3.3 Objects permitted for use in MIO and their geometric primitives

The following is a list of those object classes allowed in an Ice MIO and the geometric primitives allowed for each of them (P = point, L = line, A = area, N = none).

brglne		L		
M_COVR			A	

icedft	P			
M_ACCY			A	

RCRTCL		L		
M_NPUB			A	

seaice			A	

3.3.1 Mandatory Objects

The only object mandatory in an Ice Coverage MIO is the meta object M_COVR.

3.4 Meta objects

The maximum use must be made of meta objects to reduce the attribution on individual objects.
In a base data set (EN Application profile, see clause 6.3), some meta objects are mandatory. Each of these object classes must provide an exhaustive, non-overlapping coverage of the part of the cell containing data.
These classes are in the following list:

M_COVR

The meta object M_COVR must also cover any part of the cell that does not contain geographical data.

3.5 Geo and meta object attributes

3.5.1 Missing attribute values

In a base data set, when an attribute code is present but the attribute value is missing, it means that the producer wishes to indicate that this attribute value is unknown.

The missing attribute value is encoded by the means described in S57 Part 3, clause 2.1.

3.5.2 Mandatory attributes

There are three reasons why an attribute may be considered to be mandatory :

- some attributes are necessary, as they determine whether an object is in the display base,

- some objects make no sense without certain attributes,
- some attributes are necessary to determine which symbol is to be displayed.

The following table gives the attributes which are mandatory for each object class. When an object class is not in the list it means that there are no mandatory attributes for this class.

Object Class	**Attributes**						
icedft	iceddr	ORIENT	SORIND	SORDAT	*At least one of:*	icedis	icedsp
RCRTCL	CATTRK	TRAFIC	SORIND	SORDAT			
seaice	iceact	icesod	iceflz	SORIND	SORDAT		
M_ACCY	*At least one of:*	HORACC	POSACC	SOUACC	VERACC	SORIND	SORDAT
M_COVR	CATCOV						

3.5.3 Prohibited attributes

There are no prohibited attributes for Ice MIO objects.

3.5.4 Numeric attribute values

Floating point or integer attribute values must not be padded by non-significant zeroes.
E.g. : For a signal period of 2.5 sec, the value of SIGPER must be 2.5 and not 02.500.

3.5.5 Text attribute values

The lexical level used for the “Feature Record Attribute” [ATTF] field must be 1 (ISO 8859-1). Lexical level 1 or 2 may be used for the “Feature Record National Attribute” [NATF] field. Format effecting (C0) characters as defined in S-57 Part 3, Annex B are prohibited. The delete character is only used in the update mechanism (see S-57 part 3, clause 8.4.2.2.a and 8.4.3.2.a).

3.5.6 Hierarchy of meta data

The following table indicates :

- individual attributes that supersede meta object attributes

Meta object class	Meta object attribute	Geo or spatial object attribute
M_ACCY	HORACC	HORACC
M_ACCY	POSACC	POSACC
M_ACCY	SOUACC	SOUACC
M_ACCY	VERACC	VERACC

3.5.7 New Attribute Values in Edition 3.1

[Not applicable. Heading included to align with ENC Product Specification]

3.5.8 Ice MIO Object and Attribute Codes

New objects and attributes specifically developed for Ice MIOs have been assigned codes that fall within the range 30300 - 30399. Assignations are detailed in the *Objects* and *Attributes* Catalogue documents.

3.6 Cartographic objects

The use of cartographic objects is prohibited.

3.7 Time varying objects

Ice MIO's contains information about time varying objects such as ice coverage.

3.8 Geometry

Edges must be encoded using SG2D fields only. ARCC fields (curves) must not be used.
Despite the saving in data volume offered by the use of arcs/curves, the disadvantages are such (e.g. during updating, generating warnings/alarms) that they must not be used for MIO.
Linear features must not be encoded at a point density greater than 0.3 mm at compilation scale.

The presentation of symbolised lines may be affected by line length. Therefore, the encoder must be aware that splitting a line into numerous small edges may result in poor symbolisation.
In certain circumstances, the symbolisation of an edge may need to be suppressed. This is done using the value {1} in the "Masking Indicator" [MASK] subfield of the "Feature Record to Spatial Record Pointer" [FSPT] field. If the value in the "Usage Indicator" [USAG] subfield is set to {3} (exterior boundary truncated by the data limit), the MASK subfield must be set to {255} (null), in all other cases it must set to {2}.

3.9 Relationships

Only one method to define relationships between objects is used in Ice MIO :

- collection objects of classes, "association" (C_ASSO).

The use of the Catalogue Cross Reference record is prohibited.
The use of the collection object class C_STAC is prohibited.

All association relationships using collection objects are assumed to be peer to peer. The "Relationship Indicator" [RIND] subfield of these collection feature records must be {3} = peer.

The use of these relationships is described in Appendix B1, Annex A "Use of the Object Catalogue for ENC".

3.10 Groups

There is one group defined for MIO. This is Group 2 for all geographic feature objects.

The group number is indicated in the "Group" [GRUP] subfield of the "Feature Record Identifier" [FRID] field.

The Group 1 (Skin of the Earth) must not be used in an MIO.

3.11 Language and alphabet

3.11.1 Language

The exchange language must be English. Other languages may be used as a supplementary option.
In general this means that, when a national language is used in textual national attributes (NINFOM, NOBJNM,), the English translation must exist in the international attributes (INFORM, OBJNAM,). However, national geographic names do not need to be translated in the international attributes; they may be left in their original national language form or may be transliterated or transcribed.

3.11.2 Use of lexical level 2

If the national language cannot be expressed in lexical levels 0 or 1, the following rules apply:

- the exact spelling in the national language is encoded in the "National Attributes" [NATF] field using lexical level 2.
- Translated text, including transliterated or transcribed national geographic names is encoded in the "International Attributes" [ATTF] field using lexical level 0 or 1.

Where possible international standards should be used for the transliteration of non-Latin alphabets.

4. Cartographic framework

4.1 Horizontal datum

The horizontal datum must be WGS 84. Therefore, the "Horizontal Geodetic Datum" [HDAT] subfield in the "Data Set Parameter" [DSPM] field must have the value of {2}.

4.2 Vertical and sounding datum

The various levels which are used in the data source for elevations and depths will be used. The default values are encoded in the "Vertical Datum" [VDAT] subfield and the "Sounding Datum" [SDAT] subfield in the "Data Set Parameter" [DSPM] field.

4.3 Projection

No projection is used, therefore the "Data Set Projection" [DSPR] field must not be used. Coordinates must be encoded as geographical positions (latitude, longitude).

4.4 Units

Units to be used in an MIO are:

- Position: latitude and longitude in decimal degrees (converted into integer values, see below).
- Depth: metres.
- Height: metres.
- Positional accuracy: metres.
- Distance: nautical miles and decimal miles, or metres as defined in the IHO Object Catalogue (see S-57, Appendix A).

The default values for depth units, height units and positional accuracy units are encoded in the "Units of Depth Measurement" [DUNI], “Units of Height Measurement" [HUNI] and "Units of Positional Accuracy" [PUNI] subfields in the “Data Set Parameter” [DSPM] field.

Latitude and longitude values are converted from decimal degrees to integers by means of the "Coordinate Multiplication Factor" [COMF] subfield value in the"Data Set Parameter" [DSPM] field. The integer values are encoded in the "Coordinate in Y-axis" [YCOO] subfield and the "Coordinate in X-axis" [XCOO] subfield. The number of decimal digits is chosen by the data producer and is valid through out the data set.

E.g.: If the producer chooses a resolution of 0.0000001° (10^{-7}), then the value of COMF is 10 000 000 (10^{7}).
A longitude = 34.5678° is converted into XCOO = longitude * COMF = 34.5678*10 000 000 = 345678000.
The integer value of the converted coordinate is encoded in binary form.

Depths are converted from decimal meters to integers by means of the "3-D (Sounding) Multiplication Factor" [SOMF] subfield value in the "Data Set Parameter" [DSPM] field. The integer values are encoded in the "3-D (Sounding) Value" [VE3D] subfield. Soundings are never encoded with a resolution greater than one decimeter, so the value of SOMF must be 10 encoded in binary form.

5. Provision of data

5.1 Implementation

The binary implementation of S57 must be used for an Ice MIO. Therefore, the "Implementation" [IMPL] subfield of the "Catalogue Directory" [CATD] field must be set to "BIN" for the data set files.

5.2 Compression

The use of compression algorithms is prohibited.

5.3 Encryption

Similar to ENCs, a security scheme can be used (e.g., IHO S-63). However, this would be specified in the Ice MIO Encoding Guide and is not mandatory.

5.4 Exchange set

5.4.1 Content of the exchange set

The records defined in the main part of this standard are grouped in two file types: catalogue and data set files.

An exchange set is composed of one and only one catalogue file and at least one data set file.

Text and picture files may also be included in the Ice MIO exchange set. These files may be included in an exchange set by a data producer to provide additional information such as that normally contained in sailing directions or coastal pilots. These files must be in ASCII text format or TIF format. Files in other formats (including application files which may be used to manipulate text or picture files) may be included in an exchange set by private agreement between the producer and the receiver.

An exchange set may also contain a README file.

Exchange set
- |
- |--<1>-- README file
- |
- |--<1>-- Catalogue file
- |
- |--<R>-- Data set file
- |
- |--<R>-- Text file
- |
- |--<R>-- Picture file

The README file is an optional ASCII file of general information.

The catalogue file acts as the table of contents for the exchange set.

Each data set file contains data for one cell (see clause 2.2). This includes:
- data set descriptive information that is specific to the data set,
- the description and location of the real-world entities.

Text and picture files do not conform to ISO/IEC 8211 and are not described in the main body of S57. These files are specific to this Product Specification.

5.4.2 Volume naming

An exchange set may be split across several media volumes, therefore, each media volume must be uniquely identified within the exchange set. A file must not be split across volumes. Individual volumes must conform to the following naming convention:

VSSXNN

where:

V	is the mandatory first character.
SS	is the sequence number of the specific volume within the exchange set.
X	is the mandatory separator character.
NN	is the total number of media volumes within the exchange set.

For example, volume one of a three volume exchange set would be named V01X03.

5.4.3 Directory structure

The following directory structure is mandatory.

On each volume within an exchange set there must be a root directory. The catalogue file for the exchange set must be in the root directory of the first volume of the exchange set. The directory of the first volume may also contain a README file, containing ASCII text. Further directories and sub-directories may be defined under the root directory on any volume in the exchange set. The following example shows an example directory structure for a MS-DOS volume:

```
Volume in drive D is V01X02
Directory of D:\ANAL_GSL_20080228_1800Z

.              <DIR>         20-01-09 12:00p .
..             <DIR>         20-01-09 12:00p ..
CATALOG.031            1,584 20-01-09 12:06p CATALOG.031
4IMI0GSL.000          45,584 20-01-09 12:00p 4IMI0GSL.000
4IMI0GSL.001           1,095 20-01-09 12:04p 4IMI0GSL.001
4IMI0GSL.002             722 20-01-09 12:04p 4IMI0GSL.002
README.TXT               504 20-01-09 12:04p README.TXT
        5 file(s)         49,489 bytes
        2 dir(s)       1,405,952 bytes free
```

For each file in the exchange set the catalogue file must contain the name of the volume on which it is held and the full path name relative to the root directory of that volume. The full path name relative to the root directory must be encoded in the FILE subfield of the “Catalogue Directory” [CATD] field. The LFIL subfield of the CATD field may be used for other purposes. The full path name of the *4IIM0GSL.000* file shown in the example is *4IIM0GSL.000*.

In the interests of efficient processing, it is recommended that a sub-directory contains no more than sixty-four files.

5.4.4 Exchange Set Naming

Exchange Set naming is left to the discretion of the data provider.
It is suggested that a naming scheme be developed based on geographical areas and/or date dissemination requirements.

An example is an Exchange Set for ice analysis datasets in the Gulf of St Lawrence, released 28th February 2008 at 18:00:

ANAL_GSL_20080228_1800Z

5.5 Data sets

Two kinds of data sets may be produced:

- new data set : no ENC data has previously been produced for this area and for the same navigational purpose.
- new edition of a data set : including new information which has not been previously distributed by updates.

Each new data set, or new edition is called a base cell file.

5.6 File naming

5.6.1 README file

README.TXT is the mandatory name for this file.

5.6.2 Catalogue file

The catalogue file of the exchange set must be named CATALOG.EEE.
Where EEE is the edition number of S-57 used for this exchange set, i.e. 031 for this edition (3.1).
No other file may be named CATALOG.

5.6.3 Data set files

MIO data set files follow the same basic approach that is used for ENC and AML (8 characters). More specifically, they are named according to the following convention:

```
CCMMSXXX.EEE
|   |    | |      |----- EEE = update number
|   |    | |------------ XXX = individual cell code
|   |    |-------------- S = scale band
|   |------------------- M+M = MIO category
|----------------------- CC = producer code
```

# characters	
2	Producer Code (from IHO S-62[1] or OEF Producer Code Register[2])
2	MIO category (M + MIO sub-category as a capital letter)*
1	Scale band (most will be non-scale = zero)
3	Unique MIO number (a producer organisation develops its own scheme)
8	

* the Ice MIO sub-category is:
I **I**ce coverage

Example:

4IMI0GSL	(an Ice MIO for Gulf of St Lawrence, Canada)
4I	Producer Code for Canadian Ice Service
MI	MIO category = **M** (for **M**IO) + **I** (for **I**ce Coverage)
0	Scale band = zero (**0**)
GSL	**G**ulf of **S**t **L**awrence geographic area

A valid base cell file must be uniquely identified world wide by its name, and have the extension 000.

5.6.4 Text and picture files

The text and picture files must be named according to the specifications given below :

---

1 IHO S-62, Edition. 2.1 (June 2005) lists the codes for hydrographic agencies/organizations that produce ENC data.

2 The Open ECDIS Forum [www.openecdis.org] provides a registration service/current listing of non-hydrographic agencies/private companies who produce S-57 data conforming to the ENC Product Specification.

```
CCXXXXXX.EEE
  |    |          |
  |    |          |-------  EEE      = usual extension code (.TIF and .TXT)
  |    |-------------------  XXXXX    = individual file code
  |------------------------  CC       = producer code
```

The main part forms an eight character identifier where :

- the first two characters identify the producer. This list is given in IHO S-62 or OEF Producer Code Register.
- the third to eighth characters can be used in any way by the producer to provide the unique file name. If characters other than numbers are used only uppercase letters are allowed.
- The extension is used to identify the type of the file. It must be the usual extension for these types of files, i.e. TXT for ASCII files and .TIF for picture files. These three characters are also indicated in the “Implementation” [IMPL] subfield of the “Catalogue Directory” [CATD] field.

Files in other formats, provided through private agreements, should follow the same general naming convention and use the appropriate file extension to indicate their format.

5.7 Updating

Only new data sets and new editions are allowed.
In order to ensure that editions are incorporated into the SENC in the correct sequence without any omission, the file extension and a number of subfields in the “Data Set Identification” [DSID] field are used in the following way :

file extension every new data set, re-issue or new edition must have a “000” extension.

edition number when a data set is initially created, the edition number 1 is assigned to it. The edition number is increased by 1 at each new edition.

issue date date on which the data was made available by the data producer.

Each Re-Issue or New Edition of a data set must have the same name as the base cell file which it replaces.

5.8 Media

MIOs can be provided on any standard type storage media (e.g., CD-ROM), or can be provided via Internet or telecommunication links (e.g., AIS).

5.9 Error detection

File integrity checks are based on the CRC-32 algorithm (a 32 bit Cyclic Redundancy Check algorithm) as defined in ANSI/IEEE Standard 802.3, the reference for which is given in clause 1.3.

5.9.1 Implementation

The checksums for each data set are held in the “CRC” [CRCS] subfield of the “Catalogue Directory” [CATD] field. They allow the integrity of each file in the exchange set to be checked on receipt. The CRC value computed on the received file must the same as the CRC value transmitted.

The CRC values are recorded in ASCII as a hexadecimal number least significant byte first.

5.9.2 Processing

Encoding is defined by the following generating polynomial:

$$G(x) = x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^{8} + x^{7} + x^{5} + x^{4} + x^{2} + x + 1$$

Processing is applied to relevant files as they appear in the exchange set.

The CRC value of the file is defined by the following process :

1. The first 32 bits of the data are complemented.
2. The n bits of the data are then considered to be the coefficients of a polynomial M(x) of degree n-1
3. M(x) is multiplied by x^{32} and divided by G(x), producing a remainder R(x) of degree <31.
4. The coefficients of R(x) are considered to be a 32-bit sequence.
5. The bit sequence is complemented and the result is the CRC.

The hexadecimal format of CRCs are converted to ASCII characters and stored in the “Catalogue Directory” [CATD] field.

An example of coding in C language is given in S-57 Appendix B.1 Annex B.

6. Application profiles

6.1 General

The application profiles define the structure and content of the catalogue file and data set file in an exchange set.

6.1.1 Catalogue and data set files

These files are composed of the records and fields defined in the following tree structure diagrams (see clauses 6.2.1, 6.3.1 and 6.4.1).

The order of data in each base or update cell file is described below :

Data set file
- Data set general information record
- Data set geographic reference record (for EN application profile)
- Vector records
  - Isolated nodes (SG2D)
  - Connected nodes
  - Edges
- Feature records
  - Meta features
  - Geo features (ordered from slave to master)
  - Collection features

This order of records will enable the import software to check that the child record exists each time the parent record references it (i.e. it will already have read the child record so it will know if it exists or not).

6.1.2 Records

Records and fields that do not appear in the following tree structure diagrams are prohibited. The order of records in the files must be the same as that described in these tree structure diagrams.
The combination of the file name and the “Name” of the record must provide a unique world-wide identifier of the record.

6.1.3 Fields

For base cell files, some fields may be repeated (indicated by <R>) and all of their content may be repeated (indicated by *). In order to reduce the volume of data, the encoder should repeat the sequence of subfields, in preference to creating several fields.

6.1.4 Subfields

Mandatory subfields must be filled by a non-null value.
Prohibited subfields must be encoded as missing subfields values (see S-57 Part 3, clause 2.1).
The exact meaning of missing attribute values is defined in clause 3.5.1.

In the tables following the tree structure diagrams, mandatory subfields are shown by “M” in the “use” column and prohibited subfields by “P” in the same column. If there is nothing in this column, it means that the use of this subfield is optional. When a subfield value is prescribed, it is indicated in the “value” column. The “comment” column contains general comments and an indication of whether the subfield is ASCII or binary coded.

6.2 Catalogue file

The catalogue structure is for EN application profile.

6.2.1 Catalogue file structure

Catalogue file
|
|--<R>-Catalogue Directory record
|
|--0001-- ISO/IEC 8211 Record identifier
|
|--<1>-- CATD - Catalogue directory field

6.2.2 Catalogue Directory field - CATD

NB : All subfield values are encoded as ASCII.

Tag	subfield name	use	value	comment
RCNM	Record name	M	CD	
RCID	Record identification number	M		
FILE	File name	M		full path from the root directory
LFIL	File long name			
VOLM	Volume	M		name of volume on which file appears
IMPL	Implementation	M	ASC BIN TXT TIF ...	for the catalogue file for the data set files for ASCII text files (including the README.TXT file) for picture files or any other usual file extension for file provided through private agreements (see clause 5.6.4)
SLAT	Southernmost latitude			mandatory for data set files
WLON	Westernmost longitude			mandatory for data set files
NLAT	Northernmost latitude			mandatory for data set files
ELON	Easternmost longitude			mandatory for data set files
CRCS	CRC	M		except for README and catalogue files
COMT	Comment	M		This field must contain text indicating the 'valid from' date of the dataset and the updating schedule: "*This dataset is valid at 2008-02-28 18:00Z. This product will be reissued in 24 hours.*"

table 6.1

6.3 EN application profile

The EN application profile applies to any base cell file (i.e. new data set and new edition of a data set).

6.3.1 Base cell file structure

Base cell file

```
  |
  |--<1>--Data Set General Information record
  |     |
  |     |--0001 - ISO/IEC 8211 Record Identifier
  |           |
  |           |--<1>-- DSID - Data Set Identification field
  |                       |
  |                       |--<1>--DSSI     - Data Set Structure Information field
  |
  |--<1>--Data Set Geographic Reference record
  |     |
  |     |--0001 - ISO/IEC 8211 Record Identifier
  |           |
  |           |--<1>--DSPM - Data Set Parameter field
  |
  |--<R>--Vector record
  |     |
  |     |--0001 - ISO/IEC 8211 Record Identifier
  |           |
  |           |--<1>--VRID - Vector Record Identifier field
  |                       |
  |                       |--<R>--ATTV*   - Vector Record Attribute field
  |                       |
  |                       |--<R>--VRPT*  - Vector Record Pointer field
  |                       |
  |                       |-------  |--<R>--SG2D*   - 2-D Coordinate field
  |
  |
  |--<R>--Feature record
        |
        |--0001 - ISO/IEC 8211 Record Identifier
              |
              |--<1>--FRID - Feature Record Identifier field
                          |
                          |--<1>--FOID     - Feature Object Identifier field
                          |
                          |--<R>--ATTF*   - Feature Record Attribute field
                          |
                          |--<R>--NATF*   - Feature Record National Attribute field
                          |
                          |--<R>--FFPT*   - Feature Record to Feature Object Pointer field
                          |
                          |--<R>--FSPT*   - Feature Record to Spatial Record Pointer field
```

6.3.2 Field content (EN)

6.3.2.1 Data Set Identification field - DSID

NB : Subfield values are encoded as ASCII or binary as indicated.

Tag	subfield name	use	value	comment
RCNM	Record name	M	{10}	= DS, binary
RCID	Record identification number	M		binary
EXPP	Exchange purpose	M	{1}	data set is new, binary
INTU	Intended usage	M	{100} or {1} to {6}	navigational purpose, see clause 2.1, binary
DSNM	Data set name	M		file name with extension excluding path, ASCII
EDTN	Edition number	M		see clause 5.7, ASCII
ISDT	Issue date	M		ASCII
STED	Edition number of S-57	M	3.1	ASCII
PRSP	Product specification	M	{60}	= MIO, binary
PSDN	Product specification description	P		empty, ASCII
PRED	Product specification edition number	M	1.0	ASCII
PROF	Application profile identification	M	{1}	= EN, binary
AGEN	Producing agency	M		binary
COMT	Comment			ASCII

table 6.2

6.3.2.2 Data Set Structure Information field - DSSI

NB : All subfield values are encoded as binary.

Tag	subfield name	use	value	comment
DSTR	Data structure	M	{2}	= chain node
AALL	ATTF lexical level	M	{0} or {1}	
NALL	NATF lexical level	M	{0}, {1} or {2}	
NOMR	Number of meta records	M		
NOCR	Number of cartographic records	M	{0}	cartographic records are not permitted
NOGR	Number of geo record	M		
NOLR	Number of collection records	M		

Tag	subfield name	use	value	comment
NOIN	Number of isolated node records	M		
NOCN	Number of connected node records	M		
NOED	Number of edge records	M		
NOFA	Number of face records	M	{0}	faces are not permitted in chain node structure

table 6.3

6.3.2.3 Data Set Parameter field - DSPM

NB : Subfield values are encoded as ASCII or binary as indicated.

Tag	subfield name	use	value	comment
RCNM	Record name	M	{20}	= DP, binary
RCID	Record identification number	M		binary
HDAT	Horizontal geodetic datum	M	{2}	= WGS 84, binary
VDAT	Vertical datum	M		binary
SDAT	Sounding datum	M		binary
CSCL	Compilation scale of data	M		binary
DUNI	Units of depth measurement	M	{1}	=metres, binary
HUNI	Units of height measurement	M	{1}	=metres, binary
PUNI	Units of positional accuracy	M	{1}	=metres, binary
COUN	Coordinate units	M	{1}	= lat/long, binary
COMF	Coordinate multiplication factor	M		binary, see clause 4.4
SOMF	3-D (sounding) multiplication factor	M	{10}	binary, see clause 4.4
COMT	Comment			ASCII

table 6.4

6.3.2.4 Vector Record Identifier field - VRID

NB: All subfield values are encoded as binary.

Tag	subfield name	use	value	comment
RCNM	Record name	M	{110} or {120} or {130}	= VI, isolated node = VC, connected node = VE, edge
RCID	Record identification number	M		
RVER	Record version	M		
RUIN	Record update instruction	M	{1}	= insert

table 6.5

6.3.2.5 Vector Record Attribute field - ATTV

NB : Subfield values are encoded as ASCII or binary as indicated.

Tag	subfield name	use	value	comment
ATTL	Attribute label/code	M		binary code for an attribute
ATVL	Attribute value	M		ASCII value. Missing attribute value = attribute is relevant but value is unknown.

table 6.6

6.3.2.6 Vector Record Pointer field - VRPT

NB : All subfield values are encoded as binary.

Tag	subfield name	use	value	comment
NAME	Name	M		
ORNT	Orientation	M	{255}	= null
USAG	Usage indicator	M	{255}	= null
TOPI	Topology indicator	M	{1} or {2}	= beginning node = end node
MASK	Masking indicator	M	{255}	= null

table 6.7

6.3.2.7 2-D Coordinate field - SG2D

NB : All subfield values are encoded as binary.

Tag	subfield name	use	value	comment
YCOO	Coordinate in Y axis	M		latitude (see clause 4.4)
XCOO	Coordinate in X axis	M		longitude (see clause 4.4)

table 6.8

6.3.2.8 3-D Coordinate (Sounding array) field - SG3D

NB : All subfield values are encoded as binary.

Tag	subfield name	use	value	comment
YCOO	Coordinate in Y axis	M		latitude (see clause 4.4)
XCOO	Coordinate in X axis	M		longitude (see clause 4.4)
VE3D	3-D (sounding) value	M		value of sounding (see clause 4.4)

table 6.9

6.3.2.9 Feature Record Identifier field - FRID

NB : All subfield values are encoded as binary.

Tag	subfield name	use	value	comment
RCNM	Record name	M	{100}	= FE
RCID	Record identification number	M		
PRIM	Object geometric primitive	M	{1} or {2} or {3} or {255}	= point = line = area = no geometry
GRUP	Group	M	{1} or {2}	Group 1, see clause 3.10.1 Group 2, see clause 3.10.2
OBJL	Object label	M		binary code for an object class
RVER	Record version	M		
RUIN	Record update instruction	M	{1}	= insert

table 6.10

6.3.2.10 Feature Object Identifier field - FOID

NB : All subfield values are encoded as binary.

Tag	subfield name	use	value	comment
AGEN	Producing agency	M		
FIND	Feature identification number	M		
FIDS	Feature identification subdivision	M		

table 6.11

6.3.2.11 Feature Record Attribute field - ATTF

NB : Subfield values are encoded as ASCII or binary as indicated.

Tag	subfield name	use	value	comment
ATTL	Attribute label/code	M		binary code for an attribute
ATVL	Attribute value			ASCII value. Missing attribute value = attribute is relevant but value is unknown.

table 6.12

6.3.2.12 Feature Record National Attribute field - NATF

NB : Subfield values are encoded as ASCII or binary as indicated.

Tag	subfield name	use	value	comment
ATTL	Attribute label/code	M		binary code for an attribute
ATVL	Attribute value			ASCII value. Missing attribute value = attribute is relevant but value is unknown

table 6.13

6.3.2.13 Feature Record to Feature Object Pointer field - FFPT

NB : Subfield values are encoded as ASCII or binary as indicated.

Tag	subfield name	use	value	comment
LNAM	Long name	M		binary
RIND	Relationship indicator	M	{2} or {3}	= slave, binary = peer, binary
COMT	Comment			ASCII

table 6.14

6.3.2.14 Feature Record to Spatial Record Pointer field - FSPT

NB : All subfield values are encoded as binary.

Tag	subfield name	use	value	comment
NAME	Name	M		
ORNT	Orientation	M	{1} or {2} or {255}	= forward = reverse = null
USAG	Usage indicator	M	{1} or {2} or {3} or {255}	= exterior = interior =exterior boundary, truncated by the data limit = null
MASK	Masking indicator	M	{1} or {2} or {255}	= mask = show = null

table 6.15

Marine Information Overlays
Ice Coverage

Object Catalogue - Objects

Edition 1.0

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Introduction

The Object Catalogue is the data schema for “S-57 - The IHO Transfer Standard for Digital Hydrographic Data”. Its primary function is to provide a means of describing real world entities. That is entities which actually exist (either physically such as a beacon or legally such as an anchorage area) in the real world. The Object Catalogue is based on the theoretical model described in Part 2 of the S-57 Standard. The model assumes that real world entities can be categorised into a finite number of types, such as lights, wrecks, built up areas etc. These entity types are termed feature object classes in the Object Catalogue. An instance of a feature object class, referred to as a feature object, (that is one specific light or wreck or built up area) can be more precisely described by assigning to it a number of attributes and then specifying values for those attributes. A particular real world entity is encoded by specifying the appropriate feature object class, attributes and attribute values. For example, a red lateral buoy would be encoded as follows:- feature object class: buoy lateral; attribute: colour; attribute value: red.

The data model defines four types of feature object:

Geo	containing the descriptive characteristics of a real world entity.
Meta	containing information about other objects (eg. compilation scale, vertical datum).
Collection	containing information about the relationships between other objects.
Cartographic	containing information about the cartographic representation of a real world entity.

Object Catalogue - Objects (this document) contains a description of each feature object class. This includes a definition of the class and a list of the attributes that are allowed for that class. Instructions on how to interpret the information associated with each feature object class are given in the introduction.

The Object Catalogue does not mandate the use of any attributes. However, for each instance of a feature object, a particular attribute may only be used once. In general terms it is up to the encoder to select from the appropriate list the attributes that are relevant to a particular object instance. However, for some applications, certain attributes may be designated as mandatory for specific object classes. These attributes will be listed in the appropriate product specification.

A description of each attribute is contained in the accompanying document *Object Catalogue - Attributes*. This includes a definition of the attribute and, where appropriate, a list of allowable values, also with definitions. Instructions on how to interpret the information associated with each attribute are given in the introduction to *Attributes*.

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CONTENTS

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1 Introduction

Each object class is specified in a standardised way, under the following headings:

- Object Class: object class name
- Acronym: six character code for the object class
- Code: integer code to be used in the coding of data
- For each object class the set of relevant attributes is defined. This set is divided into three subsets:
  - * subset ‘Attribute_A’: Attributes in this subset define the individual characteristics of an object;
  - * subset ‘Attribute_B’: Attributes in this subset provide information relevant to the use of the data, e.g. for presentation or for an information system;
  - * subset ‘Attribute_C’: Attributes in this subset provide administrative information about the object and the data describing it;

  Each subset shows a list of ASCII attribute acronyms. For the description of each attribute see *Object Catalogue - Attributes*.
- Definition: Where possible each object class is defined and the source of the definition is quoted.
- References:
  - * INT 1: reference to the number of the paper chart feature in the ‘International Chart Series INT 1 Symbols, Abbreviations, Terms used on Charts’. INT 1 was one of the major guidelines for the definition of object classes.
  - * M-4: reference to the paragraph number in the ‘Chart Specifications of the IHO’, publication M-4. This was another guideline used in the definition and description of object classes.
- Remarks: Under ‘Remarks’ further comments and notes are given. Related but separate object classes are listed under the heading ‘Distinction’.

1.2 Geo Object Classes

GEO OBJECT CLASSES

Object Class: **Iceberg Limit**

Acronym: **brgIne** Code: **30300**

Set Attribute_A: NOBJNAM; OBJNAM

Set Attribute_B: INFORM; NINFOM; NTXTDS; PICREP; SCAMAX; SCAMIN; TXTDSC;

Set Attribute_C: SORDAT; SORIND;

Definition:

Limit of all known Icebergs

References:

Canadian Ice Service MANICE", 9th edition, June, 2005

Remarks:

Distinction :

GEO OBJECT CLASSES

Object Class: **Ice Drift**

Acronym: **icedft** Code: **30301**

Set Attribute_A: iceddr; icedis; icedsp; NOBJNM; OBJNAM; ORIENT;

Set Attribute_B: INFORM; NINFOM; NTXTDS; PICREP; SCAMAX; SCAMIN; TXTDSC;

Set Attribute_C: SORDAT; SORIND;

Definition:

Motion of an ice field or floe as a result of forces such as wind and currents.

References:

"International System of Sea-Ice Symbols", WMO No. 259, TP. 145, Supplement No. 4, 1970.

Remarks:

The ORIENT attribute must match the direction given in the iceddr attribute.

Example: iceddr = 6 (Ice Drift to SW)

ORIENT = 225.00

Distinction :

GEO OBJECT CLASSES

Object Class: **Recommended Route Centerline**

Acronym: **RCRTCL** Code: **108**

Set Attribute_A: CATTRK; DATEND; DATSTA; DRVAL1; DRVAL2; NOBJNM; OBJNAM; ORIENT; PEREND; PERSTA; QUASOU; SOUACC; STATUS; TECSOU; TRAFIC; VERDAT;

Set Attribute_B: INFORM; NINFOM; NTXTDS; PICREP; SCAMAX; SCAMIN; TXTDSC;

Set Attribute_C: SORDAT; SORIND;

Definition:

A recommended route is a route of undefined width, for the convenience of ships in transit, which is often marked by centerline buoys. (IHO Dictionary, S-32, 5th Edition, 4448)

The recommended route centerline indicates the >centerline= of a recommended route.

References:

INT 1: IM 28.1;

M-4: 435.4;

Remarks:

A recommended route describes the regulation of navigation for non-hydrographic reasons such as the prevention of collision or the avoidance of navigation risks. It is generally laid down by a national or international authority other than the hydrographic authority. (IHO Chart Specifications, M-4)

Distinction :

GEO OBJECT CLASSES

Object Class: **Sea Ice**

Acronym: **seaice** Code: **30302**

Set Attribute_A: iceact; iceapc; icesod; iceflz; NOBJNM; OBJNAM;

Set Attribute_B: INFORM; NINFOM; NTXTDS; PICREP; SCAMAX; SCAMIN; TXTDSC;

Set Attribute_C: SORDAT; SORIND;

Definition:

Sea Ice is an area at sea that is covered, in whole or in part, with ice.

References:

"Workshop on International Standards for Ice Information in ECDIS," June 27-29, 1995, Canada/Germany/United States.

“Ice in ECDIS Workshop,” June 3-4, 2000, St. John’s, Canada.

“International System of Sea-Ice Symbols”, WMO No. 259, TP. 145, Supplement No. 4, 1970.

“SIGRID-3: A Vector Archive Format for Sea Ice Charts”, JCOMM Technical Report No. 23, 2004

Remarks:

Sea Ice ‘objects’ can also encode numerous other information that are traditionally shown on Ice Egg Codes. These are to be encoded as a text string in the INFORM attribute.

Distinction :

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1.3 Meta Object Classes

META OBJECT CLASSES

Object Class: **Accuracy of data**

Acronym: **M_ACCY** Code: **300**

Set Attribute_A: HORACC; POSACC; SOUACC; VERACC;

Set Attribute_B: INFORM; NINFOM; NTXTDS; TXTDSC;

Set Attribute_C: SORDAT; SORIND;

Definition:

An area within which the best estimate of the overall accuracy of the data is uniform. The overall accuracy takes into account for example the source accuracy, chart scale, digitising accuracy etc.

References:

INT 1: not specified;

M-4: not specified;

Remarks:

Distinction:

META OBJECT CLASSES

Object Class: **Coverage**

Acronym: **M_COVR** Code: **302**

Set Attribute_A: CATCOV;

Set Attribute_B: INFORM; NINFOM;

Set Attribute_C: SORDAT; SORIND;

Definition:

A geographical area that describes the coverage and extent of spatial objects.

References:

INT 1: not specified;

M-4: not specified;

Remarks:

This object class is intended to support an indication of coverage.

META OBJECT CLASSES

Object Class: **Nautical publication information**

Acronym: **M_NPUB** Code: **305**

Set Attribute_A:

Set Attribute_B: INFORM; NINFOM; NTXTDS; PICREP; PUBREF; TXTDSC;

Set Attribute_C: SORDAT; SORIND;

Definition:

Used to relate additional nautical information or publications to the data.

References:

INT 1: not specified

M-4: not specified

Remarks:

For example, geographic areas may be defined that relate to sections in Sailing Directions (Coast Pilots).

1.4 Collection Object Classes

COLLECTION OBJECT CLASSES

Object Class: **Association**

Acronym: **C_ASSO** Code: **401**

Set Attribute_A:	NOBJNM; OBJNAM;
Set Attribute_B:	INFORM; NINFOM; NTXTDS; PICREP; SCAMAX; SCAMIN; TXTDSC;
Set Attribute_C:	SORDAT; SORIND;

Definition:

Used to identify an association between two or more objects. The association may be named.

Remarks:

For example: an association relationship may be used to indicate that a recommend route marks the best way through sea ice.

Distinction :

Marine Information Overlays
Ice Coverage

Object Catalogue - Attributes

Edition 1.0

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CONTENTS

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2.1 Introduction

Each attribute is specified in a standardised way, under the following headings:

- Attribute: Attribute name.
- Acronym: six character code for the Attribute.
- Code: integer code to be used in the coding of data.
- Attribute type: one character code for the Attribute type (see below)

  Each Attribute is assigned to one of six types:

  * enumerated ('E'): The expected input is a number selected from a list of pre-defined attribute values. Exactly one value must be chosen. The abbreviation for this type is 'E'.

  * list ('L'): The expected input is a list of one or more numbers selected from a list of pre-defined attribute values. Where more than one value is used, they must normally be separated by commas but in special cases slashes ("/") may be used. The abbreviation for this type is 'L'.

    Note: In some cases, dependency exists between different attributes of a given object e.g. a bridge (BRIDGE) may have the values 'concreted' and 'iron/steel' for the attribute NATCON (Nature of Construction) and the values 'red' and 'green' for the attribute COLOUR. Even if it is known that the concreted part of the bridge is red and the iron/steel part is green, the Object Catalogue provides no means of indicating this relationship. However, such relationships may be formalised for a given application in which case the relationship must be described in the appropriate Product Specification.

  * float ('F'): The expected input is a floating point numeric value with defined range, resolution, units and format. The abbreviation for this type is 'F'.

  * integer ('I'): The expected input is an integer numeric value with defined range, units and format. The abbreviation for this type is 'I'.

  * coded string ('A'): The expected input is a string of ASCII characters in a predefined format. The information is encoded according to defined coding systems e.g.: the nationality will be encoded by a two character field specified by ISO 3166 'Codes for the Representation of Names of Countries', e.g. Canada => 'CA' (refer to S-62). The abbreviation for this type is 'A'.

  * free text ('S'): The expected input is a free format alphanumeric string. It may be a file name which points to a text or graphic file. The abbreviation for this type is 'S'.

- Expected input:

  Depending on the attribute type, the expected input is defined in the following ways:

  For 'E' and 'L' type attributes a list of ID numbers with associated, defined, meanings is given. Where an attribute value which appeared in a previous edition of the Standard is no longer used, it is retained in the list but is struck-through.
  For 'A', 'F', 'I' and 'S'type attributes the expected input is indicated in accordance with the type (see above).

  In certain circumstances, it may be necessary to indicate to the recipient of a data set that the value of a certain attribute for an instance of an object class is unknown. This fact is encoded by a zero length attribute value sub-field, e.g. COLOUR∇ (where ∇ is the subfield delimiter). This applies to all attribute types (see S-57 Part 3 clause 2.1).

- Definitions: a definition of the Attribute, or in the case of ‘E’ or ‘L’ type Attributes, a definition of each value of an Attribute.

- References:

  * INT 1: Reference to the system of numbering for the paper chart feature as used in the ‘International Chart Series INT 1 Symbols, Abbreviations, Terms used on Charts’. INT 1 was one of the major guidelines for the definition of attributes

  * M-4: Reference to the paragraph number in the ‘Chart Specifications of the IHO’, M-4. This was another guideline for the definition and description of the attributes..

- Minimum Value: The minimum value for the expected input is indicated for floating point and integer attributes.

- Maximum Value: The maximum value for the expected input is indicated for floating point and integer attributes.

- Remarks: Under ‘Remarks’, further comments and notes may be given.

Depending on the type of attribute, the following information is provided:

- Indication: For coded string type attributes (S) it indicates the construction of the string.

  For integer (I) and floating point (F) type attributes it indicates the units and resolution of the input.

- Format The ‘Format’ statement indicates the recommended standard input template. Attributes that are identified as requiring a mandatory format, are indicated by the term **(mandatory)**. For other attributes, the format can be either implied by the domain of valid attribute values or will be variable in length depending on the attribute and its data type

- Example: an example of coded input.

There are three National Language Attributes which are defined in Section 3. These are all string type attributes intended to hold text in a national language.

There are two Attributes that are defined as attributes of spatial objects. For further information see Section 4.

2.2 Feature Object Attributes

FEATURE OBJECT ATTRIBUTES

Attribute: **Category of coverage**

Acronym: **CATCOV** Code: **18**

Attribute type: E

Expected input:

ID	Meaning
1	coverage available
2	no coverage available

Definitions:

coverage available:	continuous coverage of spatial objects is available within this area.
no coverage available:	an area containing no spatial objects.

Remarks:

No remarks.

FEATURE OBJECT ATTRIBUTES

Attribute: **Category of recommended track**

Acronym: **CATTRK** Code: **54**

Attribute type: E

Expected input:

ID	Meaning	INT 1	M-4
1	based on a system of fixed marks	IM 3;	434.1-2;
2	not based on a system of fixed marks	IM 4;	434.1-2;

Definitions:

based on a system of fixed marks:
a straight route (known as a recommended track, range or leading line), which comprises at least two structures (usually beacons or daymarks) and/or natural features, which may carry lights and/or top-marks. The structures/features are positioned so that when observed to be in line, a vessel can follow a known bearing with safety. (adapted from International Association of Lighthouse Authorities - IALA Aids to Navigation Guide, 1990)

not based on a system of fixed marks:
a route (known as a recommended track or preferred route) which is not based on a series of structures or features in line.

Remarks:

No remarks.

FEATURE OBJECT ATTRIBUTES

Attribute: **Date end**

Acronym: **DATEND** Code: **85**

Attribute type: A

Indication:

the ‘date, end’ should be encoded using 4 digits for the calendar year (CCYY), 2 digits for the month (MM) (e.g. April = 04) and 2 digits for the day (DD), according to ISO 8601: 1988.

Format:

CCYYMMDD **(mandatory)**

Example:

19961007 for 07 October 1996 as ending date.

Remarks:

The attribute ‘date end’ indicates the latest date on which an object (e.g. a buoy) will be present.

This attribute is to be used to indicate the removal or cancellation of an object at a specific date in the future. See also ‘periodic date end’

FEATURE OBJECT ATTRIBUTES

Attribute: **Date start**

Acronym: **DATSTA** Code: **86**

Attribute type: A

Indication:

The ‘date, start’ should be encoded using 4 digits for the calendar year (CCYY), 2 digits for the month (MM) (e.g. April = 04) and 2 digits for the day (DD), according to ISO 8601: 1988.

Format:

CCYYMMDD **(mandatory)**

Example:

19960822 for 22 August 1996 as starting date.

Remarks:

The attribute ‘date, start’ indicates the earliest date on which an object (e.g. a buoy) will be present.

This attribute is to be used to indicate the deployment or implementation of an object at a specific date in the future. See also ‘periodic date start’.

FEATURE OBJECT ATTRIBUTES

Attribute: **Depth range value 1**

Acronym: **DRVAL1** Code: **87**

Attribute type: F

Definition:

The minimum (shoalest) value of a depth range.

References:

INT 1: II 21; IM 6;
M-4: 414; 432.4; 434.3-4;

Indication:

Unit: defined in the DUNI subfield of the DSPM record.

Resolution: 0.1 m or 0.1 fm or 0.1 ft

Format:

sxxxxx.x
s: sign, negative values only.

Example:

50 for a minimum depth of 50 metres.

Remarks:

Where the area dries, the value is negative.

FEATURE OBJECT ATTRIBUTES

Attribute: **Depth range value 2**

Acronym: **DRVAL2** Code: **88**

Attribute type: F

Definition:

The maximum (deepest) value of a depth range.

References:

INT 1: II 21; IM 6;
M-4: 414; 432.4; 434.3-4;

Indication:

Unit: defined in the DUNI subfield of the DSPM record.

Resolution: 0.1 m or 0.1 fm or 0.1 ft

Format:

sxxxxx.x
s: sign, negative values only.

Example:

100 for a minimum depth of 100 metres.

Remarks:

Where the area dries, the value is negative.

FEATURE OBJECT ATTRIBUTES

Attribute: **Horizontal accuracy**

Acronym: **HORACC** Code: **97**

Attribute type: F

Definition:

The best estimate of the horizontal accuracy of horizontal clearance and distances.

Minimum value: 0

Indication:

Unit:	defined in the HUNI subfield of the DSPM record or in the HUNITS attribute of the M_UNIT meta object class, e.g. metre (m)
Resolution:	0.1 m or 0.1 ft

Format:

xx.x

Example:

0.5	for an error of 0.5 metre.

Remarks:

The expected input is the radius of the two-dimensional error.

The error is assumed to be positive and negative. The plus/minus character shall not be encoded.

FEATURE OBJECT ATTRIBUTES

Attribute: **Ice Attribute Total Concentration**

Acronym: **iceact** Code: **30300**

Attribute type: E

Expected Input:

ID	Meaning
1	Ice Free
2	Open Water (< 1/10 ice)
3	Bergy Water
10	1/10 ice
12	1/10 to 2/10 ice
13	1/10 to 3/10 ice
20	2/10 ice
23	2/10 to 3/10 ice
24	2/10 to 4/10 ice
30	3/10 ice
34	3/10 to 4/10 ice
35	3/10 to 5/10 ice
40	4/10 ice
45	4/10 to 5/10 ice
46	4/10 to 6/10 ice
50	5/10 ice
56	5/10 to 6/10 ice
57	5/10 to 7/10 ice
60	6/10 ice
67	6/10 to 7/10 ice
68	6/10 to 8/10 ice
70	7/10 ice
78	7/10 to 8/10 ice
79	7/10 to 9/10 ice
80	8/10 ice
81	8/10 to 10/10
89	8/10 to 9/10; ice
90	9/10 ice
91	9/10 to 10/10 ice
92	10/10 ice

Definition:

Ice Attribute Total Concentration specifies the total concentration of ice in an area (‘Ct’).

References:

"Workshop on International Standards for Ice Information in ECDIS," June 27-29, 1995, Canada/Germany/United States.

"SIGRID-3: A Vector Archive Format for Sea Ice Charts", JCOMM Technical Report No. 23, 2004

Remarks:

This attribute represents the ratio expressed in tenths describing the total area of the water surface covered by ice as a fraction of the whole area.

FEATURE OBJECT ATTRIBUTES

Attribute: **Ice Attribute Partial Concentration**

Acronym: **iceapc** Code: **30301**

Attribute type: L

Expected Input:

ID	Meaning
1	Ice Free
2	Open Water (< 1/10 ice)
3	Bergy Water
10	1/10 ice
12	1/10 to 2/10 ice
13	1/10 to 3/10 ice
20	2/10 ice
23	2/10 to 3/10 ice
24	2/10 to 4/10 ice
30	3/10 ice
34	3/10 to 4/10 ice
35	3/10 to 5/10 ice
40	4/10 ice
45	4/10 to 5/10 ice
46	4/10 to 6/10 ice
50	5/10 ice
56	5/10 to 6/10 ice
57	5/10 to 7/10 ice
60	6/10 ice
67	6/10 to 7/10 ice
68	6/10 to 8/10 ice
70	7/10 ice
78	7/10 to 8/10 ice
79	7/10 to 9/10 ice
80	8/10 ice
81	8/10 to 10/10
89	8/10 to 9/10; ice
90	9/10 ice
91	9/10 to 10/10 ice
92	10/10 ice

Definition:

Ice Attribute Partial Concentration specifies the partial concentrations of ice in an area (‘Ca, Cb and Cc’).

References:

"Workshop on International Standards for Ice Information in ECDIS," June 27-29, 1995, Canada/Germany/United States.

“Ice in ECDIS Workshop,” June 3-4, 2000, St. John’s, Canada.

“SIGRID-3: A Vector Archive Format for Sea Ice Charts”, JCOMM Technical Report No. 23, 2004

Remarks:

Partial concentrations of ice are reported in order of decreasing thickness and are represented as an S-57 List attribute. Values are separated by a comma.

When only one ice type is present the partial concentration shall not be indicated.

Missing values are represented by the absence of any value of the attribute, which in ISO 8211 encoding of S57, would be adjacent commas.

FEATURE OBJECT ATTRIBUTES

Attribute: **Ice Drift Direction**

Acronym: **iceddr** Code: **30302**

Attribute type: E

Expected Input:

ID	Meaning
1	No Ice Motion
2	Ice Drift to NE (45°)
3	Ice Drift to E (90°)
4	Ice Drift to SE (135°)
5	Ice Drift to S (180°)
6	Ice Drift to SW (225°)
7	Ice Drift to W (270°)
8	Ice Drift to NW (315°)
9	Ice Drift to N (0°)
10	Variable

Definition:

Ice drift direction indicates the direction in which an ice mass is drifting.

References:

"Workshop on International Standards for Ice Information in ECDIS," June 27-29, 1995, Canada/Germany/United States.

"Ice in ECDIS Workshop," June 3-4, 2000, St. John's, Canada.

"International System of Sea-Ice Symbols", WMO No. 259, TP. 145, Supplement No. 4, 1970.

Remarks:

FEATURE OBJECT ATTRIBUTES

Attribute: **Ice Drift Distance**

Acronym: **icedis** Code: **30306**

Attribute type: I

Definitions:

Ice drift distance describes the total distance which an ice mass is forecast to travel in the next 24 hours.

References:

MANICE (Manual of Standard Procedures for Observing and Reporting Ice Conditions), Canadian Ice Service, Meteorological Service of Canada, Revised Ninth Edition, June 2005

Indication:

Unit: nautical miles (nm)
Resolution: 1nm

Format:

xx

Example:

16 for a distance of 16 nautical miles.

Remarks:

A numeric value of the expected distance an ice mass will travel expressed in nautical miles.

Distinction:

Ice drift speed

FEATURE OBJECT ATTRIBUTES

Attribute: **Ice Drift Speed**

Acronym: **icedsp** Code: **30303**

Attribute type: F

Definitions:

Ice drift speed describes the speed at which an ice mass is traveling.

References:

"Workshop on International Standards for Ice Information in ECDIS," June 27-29, 1995, Canada/Germany/United States.

"Ice in ECDIS Workshop," June 3-4, 2000, St. John's, Canada.

"International System of Sea-Ice Symbols", WMO No. 259, TP. 145, Supplement No. 4, 1970.

Indication:

Unit: knot (kt)
Resolution: 0.1kt

Format:

xx.x

Example:

1.6 for a velocity of 1.6 knots.

Remarks:

A numeric value of the speed of an ice mass expressed in knots.

Distinction:

Ice drift distance

FEATURE OBJECT ATTRIBUTES

Attribute: **Floe Sizes**

Acronym: **iceflz** Code: **30304**

Attribute type:L

Expected Input:

ID	Meaning
1	Pancake Ice (30 cm to 3m across)
2	Shuga/Small Ice Cake; Brash Ice (<2m across)
3	Ice Cake (<20m across)
4	Small Floe (20 to <100m across)
5	Medium Floe (100 to 500m)
6	Big Floe (500 to <2000m across)
7	Vast Floe (2000 to10000m across)
8	Giant Floe (>10000m across)
9	Fast Ice
10	Growlers, Floebergs or Floebits
11	Icebergs

Definition:

Floe Sizes describe the predominate forms of ice floe sizes (‘Fa,Fb and Fc) corresponding to the ice Stages of Development Sa, Sb and Sc respectively. Optionally, predominant (Fp) and secondary (Fs) floe size can be reported independently from Sa, Sb, and Sc.

References:

"Workshop on International Standards for Ice Information in ECDIS," June 27-29, 1995, Canada/Germany/United States.”

Ice in ECDIS Workshop,” June 3,4, 2000, St. John’s, Canada.

“SIGRID-3: A Vector Archive Format for Sea Ice Charts”, JCOMM Technical Report No. 23, 2004

Remarks:

The "Floe Sizes" Attribute indicates the floe size corresponding to the respective stage identified in the Stages of Development Attribute and reported as a single enumerated value or as a set of values represented as an S-57 List (or repeating) attribute.

FEATURE OBJECT ATTRIBUTES

Attribute: **Ice Stage of Development**

Acronym: **icesod** Code: **30305**

Attribute type: L

Expected Input:

ID	Meaning
1	Ice Free
80	No stage of development
81	New Ice (<10 cm)
82	Nilas Ice Rind (<10 cm)
83	Young Ice (10 to <30 cm)
84	Grey Ice (10 to <15 cm)
85	Grey – White Ice (15 to <30 cm)
86	First Year Ice (30 to 200 cm)
87	Thin First Year Ice (30 to <70 cm)
88	Thin First Year Ice Stage 1 (30 to <50 cm)
89	Thin First Year Ice Stage 2 (50 to <70 cm)
91	Medium First Year Ice (70 to 120 cm)
93	Thick First Year Ice (>120 cm)
95	Old Ice
96	Second Year Ice
97	Multi-Year Ice
98	Glacier Ice (Icebergs)

Definition:

Ice Stage of Development describe the ages and thicknesses of the ice (‘So,Sa,Sb,Sc and Sd’).

References:

"Workshop on International Standards for Ice Information in ECDIS," June 27-29, 1995, Canada/Germany/United States.

“Ice in ECDIS Workshop,” June 3-4, 2000, St. John’s, Canada.

“SIGRID-3: A Vector Archive Format for Sea Ice Charts”, JCOMM Technical Report No. 23, 2004

Remarks:

Partial concentration Stage of Development is reported in order from the thickest to the thinnest. The following categories are defined:
So – Stage of Development of ice thicker than Sa but having a concentration of less than 1/10.
Sa - Thickest/oldest; Stage of Development of ice concentration C_a.
Sb - Second thickest/oldest; Stage of Development of ice concentration C_b.
Sc - Third thickest/oldest; Stage of Development of ice concentration C_c.
Sd – Stage of Development of any other remaining class.

FEATURE OBJECT ATTRIBUTES

Attribute: **Information**

Acronym: **INFORM** Code: **102**

Attribute type: S

Definition:

Textual information about the object.

References:

INT 1: IA 16;

M-4: 242.35;

Remarks:

The textual information could be, for example, a list, a table or a text.

This attribute should be used, for example, to hold the information that is shown on paper charts by cautionary and explanatory notes.

No formatting of text is possible within INFORM. If formatted text is required, then the attribute TXTDSC must be used.

FEATURE OBJECT ATTRIBUTES

Attribute: **Object name**

Acronym: **OBJNAM** Code: **116**

Attribute type: S

Definition:

The individual name of an object.

References:

INT 1: ID 7, IF 19, IN 12.23;

M-4: 371; 323.12; 431.23; 431.5;

Remarks:

No remarks.

FEATURE OBJECT ATTRIBUTES

Attribute: **Orientation**

Acronym: **ORIENT** Code: **117**

Attribute type: F

Definition:

The angular distance measured from true north to the major axis of the object. (Digital Geographic Information Working Group -DGIWG, Oct.87)

References:

INT 1:	IM 1-4, 40; IP 20.1-2, 21, 30.1-2, 31; IS 3.5, 11;
M-4:	433.2-6; 434.1-2; 475.6-8; 487.2; 488;

Minimum Value: 0

Maximum Value: 360

Indication:

Unit:	degree (°)
Resolution:	0.01 degree

Conversion factor: one tenth of a second = 0.000028 degree

Format:

xxx.xx

Example:

225.00 for an orientation of 225 degrees (ie South West)

Remarks

No remarks.

FEATURE OBJECT ATTRIBUTES

Attribute: **Periodic date end**

Acronym: **PEREND** Code: **118**

Attribute type: A

Definition:

The end of the active period for a seasonal object (e.g. a buoy). See also ‘date end’.

References:

INT 1: IQ71;

M-4: 460.5;

Indication:

the ‘periodic date end’ should be encoded using 4 digits for the calendar year (CCYY), 2 digits for the month (MM) (e.g. April = 04) and 2 digits for the day (DD). When no specific year is required (ie the object is removed at the same time each year) the following two cases may be considered:

- same day each year: --MMDD
- same month each year: --MM

This conforms to ISO 8601: 1988.

Format:

CCYYMMDD	(full date, **mandatory**)
--MMDD	(same day each year, **mandatory**)
--MM	(same month each year, **mandatory**)

Example:

--1015 for an ending date of 15 October each year.

Remarks:

No remarks.

FEATURE OBJECT ATTRIBUTES

Attribute: **Periodic date start**

Acronym: **PERSTA** Code: **119**

Attribute type: A

Definition:

The start of the active period for a seasonal object (e.g. a recommended route). See also ‘date start’.

References:

INT 1: IQ71;

M-4: 460.5;

Indication:

the ‘periodic date, start’ should be encoded using 4 digits for the calendar year (CCYY), 2 digits for the month (MM) (e.g. April = 04) and 2 digits for the day (DD). When no specific year is required (ie the object is deployed at the same time each year) the following two cases may be considered:

- same day each year: --MMDD
- same month each year: --MM

This conforms to ISO 8601: 1988.

Format:

CCYYMMDD (full date, **mandatory**)
--MMDD (same day each year, **mandatory**)
--MM (same month each year, **mandatory**)

Example:

--04 for an operation starting in April each year.

Remarks:

No remarks.

FEATURE OBJECT ATTRIBUTES

Attribute: **Pictorial representation**

Acronym: **PICREP** Code: **120**

Attribute type: S

Definition:

Indicates whether a pictorial representation of the object is available.

References:

INT 1: IE 3.12;

M-4: 456.5; 457.3;

Indication:

the string encodes the file name of an external graphic file (pixel/vector)

Remarks:

The ‘pictorial representation’ could be a drawing or a photo.

FEATURE OBJECT ATTRIBUTES

Attribute: **Quality of sounding measurement**

Acronym: **QUASOU** Code: **125**

Attribute type: L

Expected input:

ID	Meaning	INT 1	M-4
1	depth known		
2	depth unknown	IK 40;	422.9;
3	doubtful sounding	II 2;	417; 424.4;
4	unreliable sounding	II 14;	412.4;
5	no bottom found at value shown	II 13;	412.3;
6	least depth known	IK 26-27;	422.3-4;
7	least depth unknown, safe clearance at value shown	IK 30;	422.7;
8	value reported (not surveyed)	II 3.1;	417, 424.5;
9	value reported (not confirmed)	II 4;	
10	maintained depth	II 23;	414.2;
11	not regularly maintained		

Definitions:

depth known: the depth from chart datum to the bottom is a known value.

depth unknown: the depth from chart datum to the bottom is unknown.

doubtful sounding: a depth that may be less than indicated. (adapted from IHO Dictionary, S-32, 5th Edition, 4840)

unreliable sounding: a depth that is considered to be an unreliable value.

no bottom found at value shown: upon investigation the bottom was not found at this depth. (adapted from IHO Dictionary, S-32, 5th Edition, 4848)

least depth known: the shoalest depth over a feature is of known value. (adapted from IHO Dictionary, S-32, 5th Edition, 2705)

least depth unknown, safe clearance at depth shown: the least depth over a feature is unknown, but there is considered to be safe clearance at this depth.

value reported (not surveyed): depth value obtained from a report, but not fully surveyed.

value reported (not confirmed): depth value obtained from a report, which it has not been possible to confirm.

maintained depth: the depth at which a channel is kept by human influence, usually by dredging. (IHO Dictionary, S-32, 5th Edition, 3057)

not regularly maintained:
depths may be altered by human influence, but will not be routinely maintained.

Remarks:

The attribute ‘quality of sounding measurement’ indicates the reliability of the value of depth measurement.

FEATURE OBJECT ATTRIBUTES

Attribute: **Scale maximum**

Acronym: **SCAMAX** Code: **132**

Attribute type: I

Definition:

The maximum scale at which the object may be used e.g. for ECDIS presentation.

Minimum Value: 1

Indication:

the modulus of the scale is indicated, that is 1:25 000 is encoded as 25000;

Unit: none
resolution: 1

Format:

xxxxxxxx

Example:

If a particular maximum scale is specified as 1:25 000 (encoded as 25000), an example of a larger scale would be 1:20 000 (encoded as 20000);

Remarks:

No remarks.

FEATURE OBJECT ATTRIBUTES

Attribute: **Scale Minimum**

Acronym: **SCAMIN** Code: **133**

Attribute type: I

Definition:

The minimum scale at which the object may be used e.g. for ECDIS presentation.

Minimum Value: 1

Indication:

the modulus of the scale is indicated, that is 1:1 250 000 is encoded as 1250000;

Unit: none
resolution: 1

Format:

xxxxxxxx

Example:

If a particular minimum scale is specified as 1:1 250 000 (encoded as 1250000), and an example of a smaller scale would be 1:2 000 000 (encoded as 2000000);

Remarks:

No remarks.

FEATURE OBJECT ATTRIBUTES

Attribute: **Sounding accuracy**

Acronym: **SOUACC** Code: **144**

Attribute type: F

Expected input:

The maximum of the one-dimensional error.

The error is assumed to be positive and negative. The plus/minus character shall not be encoded.

Definition:

The best estimate of the accuracy of the sounding data.

Minimum value: 0

Indication:

Unit:	defined in the DUNI subfield of the DSPM record or in the DUNITS attribute of the M_UNIT meta object class, e.g. metre (m)
Resolution:	0.1 m or 0.1 fm or 0.1 ft

Format:

xx.x

Example:

0.3	for a maximum error of 0.3 metre.

Remarks:

No remarks

FEATURE OBJECT ATTRIBUTES

Attribute: **Source date**

Acronym: **SORDAT** Code: **147**

Attribute type: A

Definition:

The production date of the source, e.g. the date of measurement.

Indication:

The source should be encoded using 4 digits for the calendar year (CCYY), 2 digits for the months (MM) and 2 digits for the Day (DD), according to ISO 8601: 1988.

Format:

CCYYMMDD **(mandatory)**

Example:

19820506 for 6 May 1982 as source date.

Remarks:

No remarks.

FEATURE OBJECT ATTRIBUTES

Attribute: **Source indication**

Acronym: **SORIND** Code: **148**

Attribute type: A

Definition:

Information about the source of the object.

Indication:

Country (c2): **(mandatory)**	Two letter code from ISO 3166 (S-62)
Authority (c2): **(mandatory)**	A string of two alphanumeric characters (refer to S-62 and OpenECDIS.org), e.g. Canadian Ice Service = 4I; German Bundesamt für Seeschiffahrt und Hydrographie = DE
Source (c5):	Graphic e.g. plotting sheet, paper chart = graph Report e.g. wreck report = reprt Satellite Imagery = image
IDCode (c...):	e.g. Code of paper chart or report

Format:

c2,**c2**,c5,c…

Example:

CA,4I,image,12345

FEATURE OBJECT ATTRIBUTES

Attribute: **Status**

Acronym: **STATUS** Code: **149**

Attribute type: L

Expected input:

ID	Meaning	INT 1	M-4
1	permanent		
2	occasional	IP 50;	473.2;
3	recommended	IN 10;	431.1;
4	not in use	IL 14, 44;	444.7;
5	periodic/intermittent	IC 21; IQ 71;	353.3; 460.5;
6	reserved	IN 12.9;	
7	temporary	IP 54;	
9	mandatory		

Definitions:

permanent:	intended to last or function indefinitely. (The Concise Oxford Dictionary, 7th Edition)
occasional:	acting on special occasions; happening irregularly. (The Concise Oxford Dictionary, 7th Edition)
recommended:	presented as worthy of confidence, acceptance, use, etc. (The Macquarie Dictionary, 1988)
not in use:	no longer used for the purpose intended; disused.
periodic/intermittent:	recurring at intervals. (The Concise Oxford Dictionary, 7th Edition)
reserved:	set apart for some specific use. (adapted from The Concise Oxford Dictionary, 7th Edition)
temporary:	meant to last only for a time. (The Concise Oxford Dictionary)
mandatory:	compulsory; enforced. (The Concise Oxford Dictionary, 7th Edition)

Remarks:

No remarks.

FEATURE OBJECT ATTRIBUTES

Attribute: **Technology of Sounding measurement**

Acronym: **TECSOU** Code: **156**

Attribute type: L

INT 1 Reference: II 24; IK 2, 27, 42;

Chart Specification: 415; 415.1-2; 422.3-4; 422.9;

Expected input:

ID	Meaning	INT 1	M-4
1	found by echo-sounder		
2	found by side scan sonar		
3	found by multi-beam		
4	found by diver		
5	found by lead-line		
6	swept by wire-drag	II 24;IK 2,27,42;	415; 422.3; 422.9;
7	found by laser		
8	swept by vertical acoustic system		
9	found by electromagnetic sensor		
10	photogrammetry		
11	satellite imagery		
12	found by levelling		
13	swept by side-scan sonar		
14	computer generated		

Definitions:

found by echo-sounder: the depth was determined by using an instrument that determines depth of water by measuring the time interval between emission of a sonic or ultrasonic signal and return of its echo from the bottom. (adapted from IHO Dictionary, S-32, 1547)

found by side-scan-sonar: the depth was computed from a record produced by active sonar in which fixed acoustic beams are directed into the water perpendicularly to the direction of travel to scan the bottom and generate a record of the bottom configuration. (adapted from IHO Dictionary, S-32, 4710)

found by multi-beam: the depth was determined by using a wide swath echo sounder that uses multiple beams to measure depths directly below and transverse to the ship=s track. (adapted from IHO Dictionary, S-32, 3339)

found by diver: the depth was determined by a person skilled in the practice of diving. (adapted from IHO Dictionary, S-32, 1422)

found by lead-line: the depth was determined by using a line, graduated with attached marks and fastened to a sounding lead. (adapted from IHO Dictionary, S-32, 2698)

swept by wire-drag: the given area was determined to be free from navigational dangers to a certain depth by towing a buoyed wire at the desired depth by two launches, or a least depth was identified using the same technique. (adapted from IHO Dictionary, S-32, 5248, 6013)

found by laser: the depth was determined by using an instrument that measures distance by emitting timed pulses of laser light and measuring the time between emission and reception of the reflected pulses. (adapted from IHO Dictionary, S-32, 2763)

swept by vertical acoustic system:
the given area has been swept using a system comprised of multiple echo sounder transducers attached to booms deployed from the survey vessel.

found by electromagnetic sensor:
the depth was determined by using an instrument that compares electromagnetic signals. (adapted from IHO Dictionary, S-32, 1571)

photogrammetry: the depth was determined by applying mathematical techniques to photographs. (adapted from IHO Dictionary, S-32, 3791)

satellite imagery: the depth was determined by using instruments placed aboard an artificial satellite. (adapted from IHO Dictionary, S-32, 4509)

found by levelling: the depth was determined by using levelling techniques to find the elevation of the point relative to a datum. (adapted from IHO Dictionary, S-32, 2741)

swept by side-scan-sonar:
the given area was determined to be free from navigational dangers to a certain depth by towing a side-scan-sonar. (adapted from IHO Dictionary, S-32, 5248, 4710) [415.2]

computer generated: the sounding was determined from a bottom model constructed using a computer.

Remarks:

No remarks.

FEATURE OBJECT ATTRIBUTES

Attribute: **Traffic flow**

Acronym: **TRAFIC** Code: **172**

Attribute type: E

Expected input:

ID Meaning

1 : inbound
2 : outbound
3 : one-way
4 : two-way

Definitions:

inbound: traffic flow in a general direction toward a port or similar destination.

outbound: traffic flow in a general direction away from a port or similar point of origin.

one-way: traffic flow in one general direction only.

two-way: traffic flow in two generally opposite directions.

References:

INT 1: IM 40;

M-4: 488;

Remarks:

No remarks.

FEATURE OBJECT ATTRIBUTES

Attribute: **Textual description**

Acronym: **TXTDSC** Code: **158**

Attribute type: S

Indication:

The string encodes the file name of an external text file that contains the text in English.

Remarks:

The attribute ‘textual description’ indicates that a file containing text extracted from relevant pilot books or navigational publications is available.

FEATURE OBJECT ATTRIBUTES

Attribute: **Vertical accuracy**

Acronym: **VERACC** Code: **180**

Attribute type: F

Expected input:

The one-dimensional error.

The error is assumed to be positive and negative. The plus/minus character shall not be encoded.

Definition:

The best estimate of the vertical accuracy of heights, vertical distances and vertical clearances, excluding sounding measurements.

Minimum value: 0

Indication:

Unit: defined in the HUNI subfield of the DSPM record or in the HUNITS attribute of the M_UNIT meta object class, e.g. metre (m)

Resolution: 0.1 m or 0.1 ft

Format:

xx.x

Example:

1.2 for an error of 1.2 metres.

Remarks:

No remarks.

FEATURE OBJECT ATTRIBUTES

Attribute: **Vertical Datum**

Acronym: **VERDAT** Code: **185**

Attribute type: E

Expected input:

ID	Meaning
1	Mean low water springs
2	Mean lower low water springs
3	Mean sea level
4	Lowest low water
5	Mean low water
6	Lowest low water springs
7	Approximate mean low water springs
8	Indian spring low water
9	Low water springs
10	Approximate lowest astronomical tide
11	Nearly lowest low water
12	Mean lower low water
13	Low water
14	Approximate mean low water
15	Approximate mean lower low water
16	Mean high water
17	Mean high water springs
18	High water
19	Approximate mean sea level
20	High water springs
21	Mean higher high water
22	Equinoctial spring low water
23	Lowest astronomical tide
24	Local datum
25	International Great Lakes Datum 1985
26	Mean water level
27	Lower low water large tide
28	Higher high water large tide
29	Nearly highest high water
30	Highest astronomical tide (HAT)

Definitions:

mean low water springs:
(MLWS) - the average height of the low waters of spring tides. Also called spring low water. (IHO Dictionary, S-32, 5th Edition, 3150)

mean lower low water springs:
(MLLWS) - the average height of lower low water springs at a place. (IHO Dictionary, S-32, 5th Edition, 3146)

mean sea level: (MSL) - the average height of the surface of the sea at a tide station for all stages of the tide over a 19-year period, usually determined from hourly height readings measured from a fixed predetermined reference level. (IHO Dictionary, S-32, 5th Edition, 3156)

lowest low water: an arbitrary level conforming to the lowest tide observed at a place, or some what lower. mean low water: (MLW) - the average height of all low waters at a place over a 19-year period. (IHO Dictionary, S-32, 5th Edition, 3147)

lowest low water springs:
an arbitrary level conforming to the lowest water level observed at a place at spring tides during a period of time shorter than 19 years. (Hydrographic Service, Royal Australian Navy)

approximate mean low water springs:
an arbitrary level, usually within " 0.3m from that of mean low water springs (MLWS). (Hydrographic Service, Royal Australian Navy)

Indian spring low water:(ISLW) -
an arbitrary tidal datum approximating the level of the mean of the lower low water at spring tides. Also called Indian tidal plane. (IHO Dictionary, S-32, 5th Edition, 2427)

A tidal datum approximating the lowest water level observed at a place, originated by G.H. Darwin for the tides of India at a level below MSL being equal to the sum of amplitudes of the harmonic constituents M2, S2, K1 and O1; usually below that of the lower low water at spring tides. Also called Indian tide plane. (Hydrographic Service, Royal Australian Navy).

low water springs: an arbitrary level, approximating that of mean low water springs (MLWS). (Hydrographic Service, Royal Australian Navy)

approximate lowest astronomical tide:
an arbitrary level, usually within " 0.3m from that of lowest astronomical tide (LAT). (Hydrographic Service, Royal Australian Navy)

nearly lowest low water:
an arbitrary level approximating the lowest water level observed at a place, usually equivalent to the Indian spring low water (ISLW). (Hydrographic Service, Royal Australian Navy)

mean lower low water: (MLLW) - the average height of the lower low waters at a place over a 19-year period. (IHO Dictionary, S-32, 5th Edition, 3145)

low water: an approximation of mean low water adopted as the reference level for a limited area, irrespective of better determinations at a later date. Used mostly in harbour and river engineering.

used in inland (non-tidal) waters. It is generally defined as a level which the daily mean water level would fall below less than 5% of the time and by no more than 0.2 metres during the navigation season. A single level surface is usually chosen as the low water datum for a whole lake. On a river, low water datum is a sloping surface which approximates the river surface at a low state. (Canadian Hydrographic Service)

approximate mean low water:
an arbitrary level, usually within " 0.3m from that of mean low water (MLW). (Hydrographic Service, Royal Australian Navy)

approximate mean lower low water:
an arbitrary level, usually within " 0.3m from that of mean lower low water (MLLW). (Hydrographic Service, Royal Australian Navy)

mean high water: (MHW) - the average height of all high waters at a place over a 19-year period. (IHO Dictionary, S-32, 5th Edition, 3141)

mean high water springs:
(MHWS) - the average height of the high waters of spring tides. Also called spring high water. (IHO Dictionary, S-32, 5th Edition, 3144)

high water: the highest level reached at a place by the water surface in one tidal cycle. Also called high tide. (IHO Dictionary, S-32, 5th Edition, 2251)

when used on inland (non-tidal) waters it is generally defined as a level which the daily mean water level exceeds less than 5% of the time.

approximate mean sea level:
an arbitrary level, usually within " 0.3m from that of mean sea level (MSL). (Hydrographic Service, Royal Australian Navy)

high water springs: an arbitrary level, approximating that of mean high water springs (MHWS). (Hydrographic Service, Royal Australian Navy)

mean higher high water:
(MHHW) - the average height of higher high waters at a place over a 19-year period. (IHO Dictionary, S-32, 5th Edition, 3140)

equinoctial spring low water:
the level of low water springs near the time of an equinox.

lowest astronomical tide:
(LAT) - the lowest tide level which can be predicted to occur under average meterological conditions and under any combination of astronomical conditions. (IHO Dictionary, S-32, 5th Edition, 2936)

local datum: an arbitrary datum defined by a local harbour authority, from which levels and tidal heights are measured by this authority.

international great lakes datum 1985:
(IGLD 1985) - a vertical reference system with its zero based on the mean water level at Rimouski/Pointe-au-Père, Quebec, over the period 1970 to 1988.

mean water level: the average of all hourly water levels over the available period of record.

lower low water large tide:
(LLWLT) - the average of the lowest low waters, one from each of 19 years of observations.

higher high water large tide:
(HHWLT) - the average of the highest high waters, one from each of 19 years of observations.

nearly highest high water:
an arbitrary level approximating the highest water level observed at a place, usually equivalent to the high water springs.

highest astronomical tide:

(HAT) the highest tidal level which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions. (IHO Dictionary, S-32, 5th Edition, 2244).

Remarks:

This attribute is used to specify the datum to which both heights (vertical datum, see S-57 Part 3) and soundings (sounding datum, see S-57 Part 3) are referred.

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2.3 National Language Attributes

NATIONAL LANGUAGE ATTRIBUTES

Attribute: **Information in national language**

Acronym: **NINFOM** Code: **300**

Attribute type: S

References:

INT 1: IA 16;

M-4: 242.35;

Indication:

Text (c...): Textual information in national language characters

Format:

c...

Remarks:

The attribute ‘information in national language’ encodes any textual information about an object using a specified national language.

The textual information could be, for example, a list, a table or a text.

This attribute should be used, for example, to hold the information that is shown on paper charts by cautionary and explanatory notes.

NATIONAL LANGUAGE ATTRIBUTES

Attribute: **Object name in national language**

Acronym: **NOBJNM** Code: **301**

Attribute type: S

References:

INT 1: ID 7, IF 19, IN 12.23;

M-4: 371; 323.12; 431.23; 431.5;

Indication:

Name of object (c...):string of national language characters

Format:

c...

Remarks:

The attribute ‘object name in national language’ encodes the individual name of an object in the specified national language.

NATIONAL LANGUAGE ATTRIBUTES

Attribute: **Textual description in national language**

Acronym: **NTXTDS** Code: **304**

Attribute type: S

Indication:

the string encodes the file name of an external text file that contains the text in a national language.

Remarks:

The attribute ‘textual description in national language’ indicates whether a text file containing text extracted from relevant pilot books or navigational publications is available.

2.4 Spatial and Meta Object Attributes

Some attributes qualify the location of an object, as opposed to defining the characteristics of the individual object itself.

Attributes specifying the accuracy and quality of a position (x,y coordinates) and the reference datum for horizontal measurement are considered to be attributes of spatial objects.

Within a data set encoded according to S-57, the attributes of spatial objects are held in the Spatial Record Attribute field (refer to S-57 Part 3).

SPATIAL AND META OBJECT ATTRIBUTES

Attribute: **Positional Accuracy**

Acronym: **POSACC** Code: **401**

Attribute type: F

Expected input:

The expected input is the maximum of the two-dimensional error.

The error is assumed to be positive and negative. The plus/minus character shall not be encoded.

Definition:

The best estimate of the accuracy of a position.

Minimum value: 0

Indication:

Unit: defined in the PUNI subfield of the DSPM record, e.g. metre (m)
Resolution: 0.1 m or 0.1 mm

Format:

xxxx.x

Example:

25 for an error of 25 metres.

Remarks

No remarks

SPATIAL AND META OBJECT ATTRIBUTES

Attribute: **Quality of position**

Acronym: **QUAPOS** Code: **402**

Attribute type: E

Expected input:

ID		Meaning	INT 1	M-4
1	:	surveyed	IC 1;	310.1;
2	:	unsurveyed	IC 2; II 25;	311; 410;
3	:	inadequately surveyed	II 25;	410;
4	:	approximate	IB 7, 33; IC 12; II 31;	305.1; 351.4; 411.2;
5	:	position doubtful	II 1;	424.3;
6	:	unreliable		
7	:	reported (not surveyed)		
8	:	reported (not confirmed)	II 3.1-2, 4;	
9	:	estimated		
10	:	precisely known		
11	:	calculated		

Definitions:

surveyed: the position(s) was(were) determined by the operation of making measurements for determining the relative position of points on, above or beneath the earth's surface. Survey implies a regular, controlled survey of any date. (adapted from IHO Dictionary, S-32, 5195, & IHO Chart Specifications, M-4, 175.2)

unsurveyed: survey data is does not exist or is very poor. (adapted from IHO Dictionary, S-32, 5732)

inadequately surveyed: position data is of a very poor quality. (adapted from IHO Dictionary, S-32, 5732)

approximate: a position that is considered to be less than third-order accuracy, but is generally considered to be within 30.5 metres of its correct geographic location. Also may apply to an object whose position does not remain fixed. (adapted from IHO Dictionary, S-32, 213, 3967, & IHO Specifications, M-4, 424.1)

position doubtful: an object whose position has been reported but which is considered to be doubtful.

unreliable: an object's position obtained from questionable or unreliable data.

reported (not surveyed): an object whose position has been reported and its position confirmed by some means other than a formal survey such as an independent report of the same object.

reported (not confirmed): an object whose position has been reported and its position has not been confirmed.

estimated: the most probable position of an object determined from incomplete data or data of questionable accuracy. (adapted from IHO Dictionary, S-32, 3960)

precisely known: a position that is of a known value, such as the position of an anchor berth or other defined object.

calculated: a position that is computed from data.

Remarks:

No remarks.

Marine Information Overlays
Ice Coverage

Portrayal

Edition 1.0

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Table of Contents

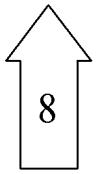
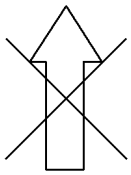
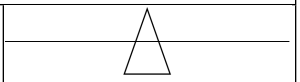
1. Introduction

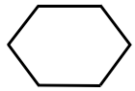
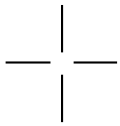
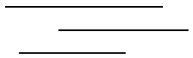
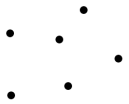
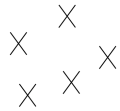
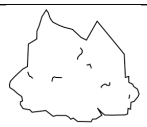
This document is intended to provide guidance for the Portrayal of Ice Coverage Marine Information Overlays (MIO). It is formatted as a supplemental addition to the IHO ECDIS presentation library and in this format is intended to be used in conjunction with S-52. However, it is recognised that not all systems use the strict S-52 rules as their presentation libraries and so it contains information on the size, shape and colour of symbols to be used. This should provide the software developer with the information they need to translate the relatively abstract description of an Ice MIO object into an effective ECDIS display.

This document is to be used in conjunction with the *Ice Coverage MIO Object Catalogue - Objects* & *Attributes* documents. Attribute conditions and combinations required for the correct display of objects are given. Developers using this guide will need to ensure they have covered every attribute combination possible.

This document assumes, that the reader fully understands the fundamentals of computer graphics and that he or she has carefully studied in advance the various standards for ECDIS, i.e., IHO S-52/S-57 (4,5,6,7) and IMO Performance Standard (3). Note that the Presentation Library does not cover all aspects of the ECDIS display. Therefore the IMO Performance Standard (3) as well as the C&S Specifications and IEC publication 61174 (9) must be studied.

2. Ice Coverage Marine Information Overlay Portrayal

Ice MIO Object	Primitive	Condition and/or S-52 rule	Symbol or Colour
icedft - Ice Drift	Ice Drift is shown as an outline arrow containing a digit. The direction of the arrow shows the direction of drift, the superimposed digit gives the forecast drift distance.		
	Point	*direction of arrow = ORIENT* *text = icedis*	
	Point	iceddr = 1 or 10 (ie ORIENT = UNKNOWN)	
brglne - Ice Berg Limit	Ice Berg Limit is a line overlaid by regulary spaced triangles. The direction of the triangles shows the direction of the ice.		
	Line	The ice is always to the left of the digitisation direction.	

Ice MIO Object	Primitive	Condition and/or S-52 rule	Symbol or Colour
seaice - Sea Ice	Sea Ice is portrayed using a combination of two attributes. The repeating pattern of the area shows the Ice Stage of development (icesod), the closer the pattern the denser the ice. The colour of the pattern shows the Total Ice Concentration (iceact). There is one special case for Fast Ice (iceflz=9) where it is always shown and takes precedence over other attributes.		
	Area - Pattern Symbol	icesod = 80 or 81 or 82 or 83 or 84 or 85 80 = 18mm spacing 81 = 15 mm 82 = 12 mm 83 = 9 mm 84 = 6 mm 85 = 3 mm	
		icesod = 86 or 87 or 88 or 89 or 91 or 93 86 = 18mm spacing 87 = 15 mm 88 = 12 mm 89 = 9 mm 91 = 6 mm 93 = 3 mm	
		icesod = 95	
		icesod = 96	
		icesod = 97	
		icesod = 98	
		icesod = UNKNOWN	
	Area - Pattern Colour	iceact = 10 or 12 or 13 or 20 or 23 or 30	
		iceact = 24 or 34 or 35 or 40 or 45 or 46 or 50 or 56 or 60	
		iceact = 57 or 67 or 68 or 70 or 78 or 80	
		iceact = 79 or 81 or 89 or 90 or 91 or 92	
	Area - Special case	iceflz = 9 Solid colour over entire area	

3. S-52 Symbol reference

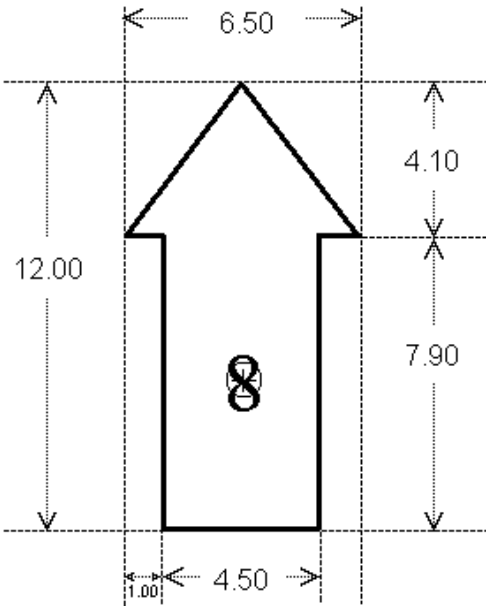
Symbol Name:	SY(**icedft01**)

Symbol Explanation: Ice Drift with drift direction and distance text

Look up table affected: point symbols

Pivot Point Column: 3.25
Pivot Point Row: 7.00

Width of Bounding Box: 6.50
Height of Bounding Box: 12.00



Symbol Colours: CHBLK

Comments: Line weight 0.6 mm
Text is drawn at the Pivot Point

Examples on ENC: N/A

References:

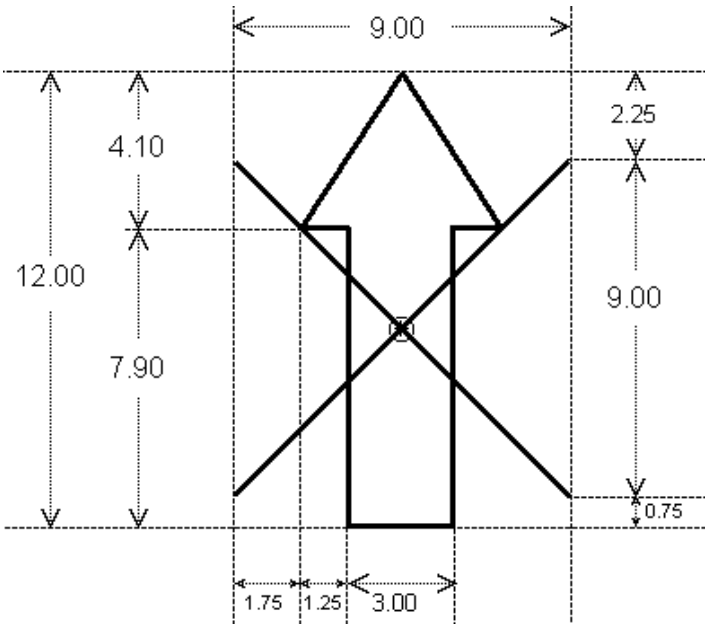
Symbol Name:	SY(**icedft02**)

Symbol Explanation: Ice Drift with *None*, *Variable* or *Unknown* direction

Look up table affected: point symbols

Pivot Point Column: 4.50
Pivot Point Row: 7.00

Width of Bounding Box: 9.00
Height of Bounding Box: 12.00



Symbol Colours: CHBLK

Comments: Line weight 0.6 mm

Examples on ENC: N/A

References:

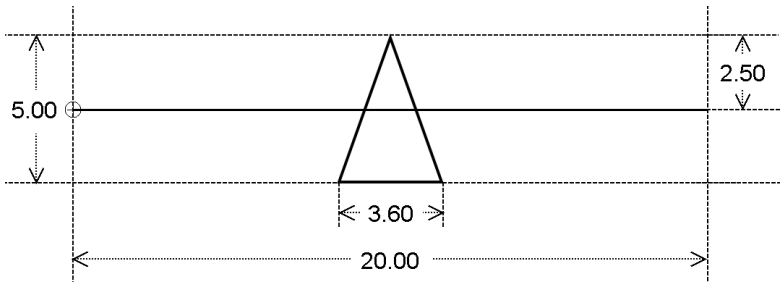
Symbol Name:	LC(**icelim01**)

Symbol Explanation: Ice Berg Limit Line

Look up table affected: line symbols

Pivot Point Column: 0.00
Pivot Point Row: 2.50

Width of Bounding Box: 20.00
Height of Bounding Box: 5.00



Symbol Colours: CHBLK

Comments: Line weight 0.6 mm

Examples on ENC: N/A

References:

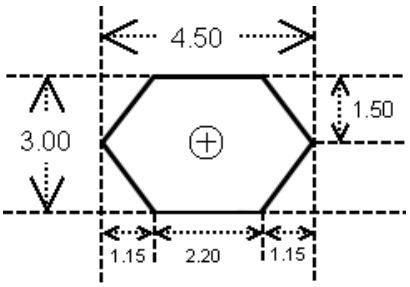
Symbol Name:	AP(**ice80, ice81, ice82, ice83, ice84, ice85**)

Symbol Explanation: Sea Ice pattern for New to Grey-White ice

Look up table affected: Area symbols

Pivot Point Column: 2.25
Pivot Point Row: 1.50

Width of Bounding Box: 4.50
Height of Bounding Box: 3.00



Symbol Colours: Variable, see section 2.

Pattern Type: Linear

Pattern Spacing: Constant

Distance: For each variation the symbol is the same, but the denser the ice the tighter the pattern spacing. See section 2.

Comments: Line weight 0.3 mm
The symbol in the box illustrated should form a continuous uniform pattern over the area of the object being symbolised.

Examples on ENC: N/A

References:

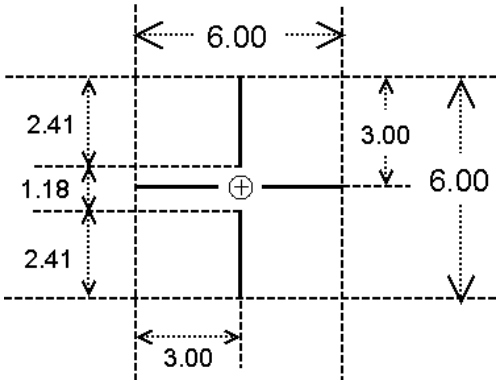
Symbol Name:	AP(**ice86, ice87, ice88, ice89, ice91, ice93**)

Symbol Explanation: Sea Ice pattern for First Year Ice

Look up table affected: Area symbols

Pivot Point Column: 3.00
Pivot Point Row: 3.00

Width of Bounding Box: 6.00
Height of Bounding Box: 6.00



Symbol Colours: Variable, see section 2.

Pattern Type: Linear

Pattern Spacing: Constant

Distance: For each variation the symbol is the same, but the denser the ice the tighter the pattern spacing. See section 2.

Comments: Line weight 0.3 mm
The symbol in the box illustrated should form a continuous uniform pattern over the area of the object being symbolised.

Examples on ENC: N/A

References:

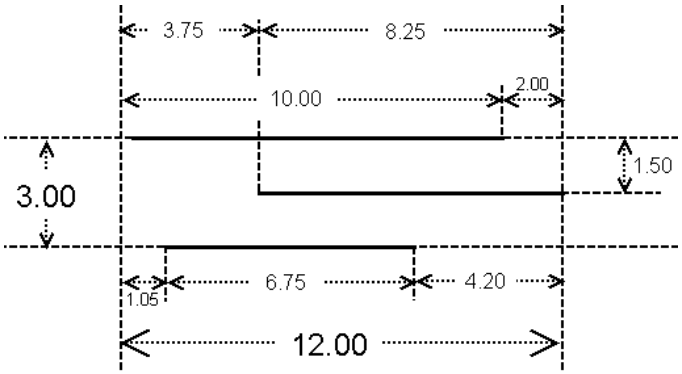
Symbol Name:	AP(**ice95**)

Symbol Explanation: Sea Ice pattern for Old Ice

Look up table affected: Area symbols

Pivot Point Column: 4.75
Pivot Point Row: 8.35

Width of Bounding Box: 12.00
Height of Bounding Box: 3.00



Symbol Colours: Variable, see section 2.

Pattern Type: Linear

Pattern Spacing: Constant

Distance: 14.00

Comments: Line weight 0.3 mm
The symbol in the box illustrated should form a continuous uniform pattern over the area of the object being symbolised.

Examples on ENC: N/A

References:

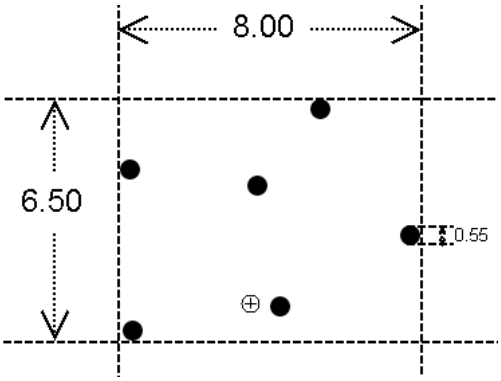
Symbol Name:	AP(**ice96**)

Symbol Explanation: Sea Ice pattern for Second year Ice

Look up table affected: Area symbols

Pivot Point Column: 3.80
Pivot Point Row: 5.40

Width of Bounding Box: 8.00
Height of Bounding Box: 6.50



Symbol Colours: Variable, see section 2.

Pattern Type: Linear

Pattern Spacing: Constant

Distance: 0.00

Comments: The 6 ‘dot’ symbols in the box illustrated should form a continuous uniform pattern over the area of the object being symbolised.

Examples on ENC: N/A

References:

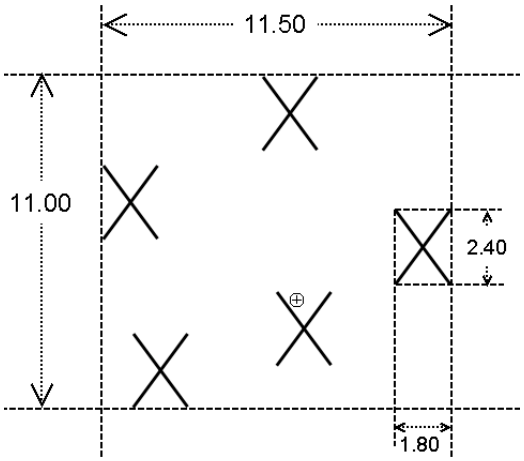
Symbol Name:	AP(**ice97**)

Symbol Explanation: Sea Ice pattern for Multi-Year Ice

Look up table affected: Area symbols

Pivot Point Column: 6.30
Pivot Point Row: 7.65

Width of Bounding Box: 11.50
Height of Bounding Box: 11.00



Symbol Colours: Variable, see section 2.

Pattern Type: Linear

Pattern Spacing: Constant

Distance: 3.00

Comments: Line weight 0.3 mm
The 5 ‘X’ symbols in the box illustrated should form a continuous uniform pattern over the area of the object being symbolised.

Examples on ENC: N/A

References:

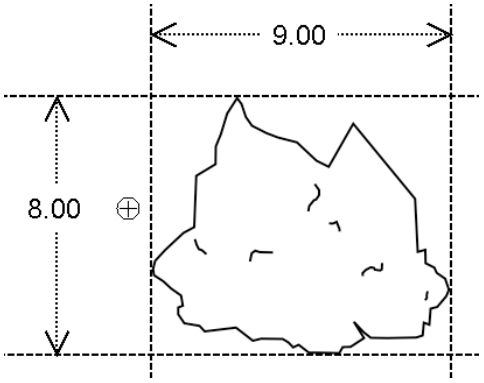
Symbol Name:	AP(**ice98**)

Symbol Explanation: Sea Ice pattern for Glacier Ice (Icebergs)

Look up table affected: Area symbols

Pivot Point Column: -0.75
Pivot Point Row: 3.45

Width of Bounding Box: 9.00
Height of Bounding Box: 8.00



Symbol Colours: Variable, see section 2.

Pattern Type: Linear

Pattern Spacing: Constant

Distance: 8.00

Comments: Line weight 0.3 mm
The symbol in the box illustrated should form a continuous uniform pattern over the area of the object being symbolised.

Examples on ENC: N/A

References:

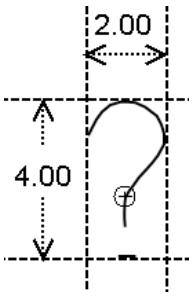
Symbol Name:	AP(**iceundf**)

Symbol Explanation: Sea Ice pattern for UNKNOWN Stage of Development

Look up table affected: Area symbols

Pivot Point Column: 3.00
Pivot Point Row: 3.00

Width of Bounding Box: 6.00
Height of Bounding Box: 6.00



Symbol Colours: Variable, see section 2.

Pattern Type: Linear

Pattern Spacing: Constant

Distance: 14.00

Comments: Line weight 0.3 mm
The symbol in the box illustrated should form a continuous uniform pattern over the area of the object being symbolised.

Examples on ENC: N/A

References:

4. Portrayal Example - seaice