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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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