Product Specification for Inland ENCs

Contents

1   Introduction

This Product Specification for Inland ENC (IENC) is a set of specifications intended to enable ENC manufacturers to produce consistent IENC, and to use data efficiently in applications. An IENC shall be produced in accordance with the regulations defined in:

this Product Specification for Inland ENC

the Feature Catalogue for Inland ENC edition

1.0 the Encoding Guide for Inland ENC edition

1.0

The numbering correlates to the ENC Product Specification, S-57 Appendix B.1, Edition 2.0

2   General Information

2.1   Navigational purpose (usage)

IENC data is compiled for a variety of navigational purposes. The navigational purpose for which an individual IENC 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. The following codes are used:

Nr.		Navigational purpose (usage)	Intended use
1	S57	Overview	For route planning and oceanic crossing.
2	S57	General	For navigating oceans, approaching coasts and route planning.
3	S57	Coastal	For navigating along the coastline, either inshore or offshore.
4	S57	Approach	Navigating the approaches to ports or mayor channels or through intricate or congested waters.
5	S57	Harbour	Navigating within ports, harbours, bays, rivers and canals, for anchorages.
6	S57	Berthing	Detailed data to aid berthing.
7	new	*River*	*Navigating the inland waterways (skin cell).*
8	new	*River harbour*	*Navigating within ports and harbours on inland waterways (skin cell).*
9	new	*River berthing*	*Detailed data to aid berthing manoeuvring in inland navigation (skin cell).*
L	new	*Overlay*	*Overlay cell to be displayed in conjunction with skin cells*

The navigational purposes 1 to 8 and L may be used by authorities as well as private bodies. Navigational purpose 9 should be used by private bodies only.

It is allowed to assign a range of usages to overlay cells (see clause 5.6.3).

Overlay cells may not contain skin-of-the-earth features (see clause 3.10).

2.2   Cells

In order to facilitate the efficient processing of ENC 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 ENC 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.

The coordinates of the borders of the cell are encoded in decimal degrees in the "Catalogue Directory" [CATD] field.

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.

In IENC, skin-of-the-earth features (group 1) within two overlapping cells with the same navigational purpose must not overlap. Features of overlay cells (always group 2) are allowed to overlap other features in other cells.

The minimum size of coverage at both sides of the waterway should be outside the radar coverage.

2.3   Topology

ENC data must be encoded using chain-node topology (see S-57 Part 2, clause 2.2.1.2).

3   Features 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 IENC the feature object identifier may be used to identify multiple instances of the same feature. For example, the same feature may appear in different usages, or an feature may be split by the cell structure. In these circumstances each instance of this feature may have the same identifier. Feature object identifiers must not be reused, even when a feature has been deleted.

3.2   Standard features and attributes

Only features, attributes and enumerations which are defined in the IENC Feature Catalogue at

http://ienc.openecdis.org may be used in an IENC.

3.3   Features permitted for use in IENC and their geometric primitives

The geometric primitives of the features permitted for use in IENC can be found in the Inland ENC Encoding Guide.

3.4   Meta features

The maximum use must be made of meta features to reduce the attribution on individual features. In a base data set (EN Application profile, see clause 6.3), some meta features are mandatory (see Inland ENC Encoding Guide).

3.5   Geo and meta feature attributes

3.5.1   Missing enumerations

In a base data set (EN application profile), when an attribute code is present but the enumeration is missing, it means that the producer wishes to indicate that this enumeration is unknown.

In a revision data set (ER application profile), when an attribute code is present but the enumeration is missing it means:

   that the enumeration of this attribute is to be replaced by an unknown enumeration if it was present in the original data set,

   that an unknown enumeration is to be inserted if the attribute was not present in the original data set.

In both cases the missing enumeration is encoded by the means described in S-57 Part 3, clause 2.1.

3.5.2   Mandatory attributes

For mandatory attributes of features see Inland ENC Encoding Guide.

3.5.3   Prohibited attributes

not applicable.

3.5.4   Numeric enumerations

Floating point or integer enumerations must not be padded by non-significant zeroes.

E.g.: For a signal period of 2.5 sec, the enumeration of SIGPER must be 2.5 and not 02.500.

3.5.5   Text enumerations

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 feature attributes,

meta feature attributes that supersede the data set subfields (see clauses 6.3.2 and 6.4.2).

Field	Subfield	Meta feature class	Meta feature	Geo or spatial feature attribute
DSPM	VDAT	m_vdat	Verdat	verdat
DSPM	SDAT	m_sdat	Verdat	verdat
DSPM	CSCL	M_CSCL	CSCALE	
		m_nsys	Marsys	marsys
		M_QUAL	CATZOC	POSACC,SOUACC and TECSOU
		M_QUAL	SOUACC	SOUACC
		M_QUAL	POSACC	POSACC
		M_SREL	QUASOU	QUASOU
		M_SREL	SURATH	SORIND
		M_SREL	SUREND	SORDAT
		M_SREL	SURSTA	SORDAT
		M_SREL	TECSOU	TECSOU

When there is no meta feature attribute, an individual attribute can supersede a data set subfield.

It is prohibited to use an attribute on an individual feature, if this attribute has the same enumeration as the general enumeration defined by the meta feature or the equivalent data set subfield.

It is prohibited to use a meta feature, if the information given by this meta feature is the same as the enumeration given by the equivalent data set subfield.

3.6 Cartographic features

not applicable.

3.7 Time varying features

The IENC may contain information about magnetic variation, tides, tidal streams and currents. The IENC may contain time independent depth information in accordance with the Inland ENC Encoding Guide.

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 IENC.

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

There are two ways to define relationships between features:

   nominated master feature record,

   collection features of classes "aggregation" (C_AGGR), or "association"

(C_ASSO). The use of the Catalogue Cross Reference record is prohibited.

All hierarchical relationships (master to slave) must be encoded by using a nominated "master" feature record carrying the pointers to the "slave" features in the "Relationship Indicator" [RIND] subfield in the "Feature Record to Feature Object Pointer" [FFPT] field with the value {2} = slave.

All association or aggregation relationships using collection features 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 the Encoding Guide.

3.10 Groups

There are two groups defined for IENC. These are Group 1 (skin of the earth) and Group 2 for all other geo feature objects.

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

field.

3.10.1 Group 1 (skin of the earth)

Each area covered by a meta feature M_COVR with CATCOV = 1 must be totally covered by a set of geo features of type area that do not overlap each other (the skin of the earth).

These features make up Group 1.

The list below contains the features that must always be in Group 1, if they appear in the dataset and if they are of type area.

DEPARE, depare, DRGARE, FLODOC, HULKES, LNDARE, PONTON, UNSARE;

flodoc, hulkes and ponton are not Group 1 features.

3.10.2 Group 2 (all other features)

All feature objects which are not in Group 1 are in Group 2.

3.11 Language and alphabet

3.11.1 Language

See Inland ENC Encoding Guide.

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}.

The mariner may have to display information other than IENC data and IENC updates. In cases where this information is based on a horizontal datum other than WGS 84, it can be converted to WGS 84 by means of the meta feature Horizontal datum shift parameter (M_HOPA).

In the case that the data are transformed to WGS-84 from a local datum the responsible authority shall define the area where the local transformation parameters apply. Within this area, the difference between transformed coordinates and the surveyed WGS-84 coordinates may not exceed 0.5 m. For approval purposes, the responsible authority shall define appropriate reference points (surveyed WGS-84 coordinates) preferably exactly at the limit line of two adjacent areas. Reference points, transformation parameters and the algorithm shall be published and shall be the basis for IENC production for that area.

4.2 Vertical and sounding datum

The various levels which are used on paper charts for elevations and soundings 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 IENC 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 Feature Catalogue.

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 $0.0001°$ (10^{-4}), then the value of COMF is 10 000 (10^4).

A longitude = $34.5678°$ is converted into XCOO = longitude * COMF = 34.5678*10 000 =

345678. 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 decimetre, so the value of SOMF must be 10 encoded in binary form.

5. Provision of data

5.1 Implementation

The binary implementation of S-57 must be used for IENC. 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

IENC data may be protected from unauthorised use, possibly by the use of encryption algorithms.

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 IENC 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. For format of these files see Encoding Guide.
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. 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 called ENC_ROOT. The catalogue file for the exchange set must be in the ENC_ROOT directory of the first volume of the exchange set. The ENC_ROOT 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 A is V01X02
Directory of A:\ENC_ROOT

.                      <DIR>                09-15-96   12:40p      .
..                     <DIR>                09-15-96   12:40p      ..
CATALOG     031           1,584            09-15-96   12:46p      CATALOG.031
NL600021    000          45,584            09-15-96   12:50p      NL600021.000
NL600021    001           1,095            09-15-96   12:54p      NL600021.001
NL600021    002             722            09-15-96   12:54p      NL600021.002
README      TXT             504            09-15-96   12:44p      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 NL600021.000 file shown in the example is NL600021.000.

5.5   Data sets

Four kinds of data sets may be produced:

new data set: no IENC data has previously been produced for this area and for the same navigational purpose.

update: changing some information in an existing data set.

re-issue of a data set: including all the updates applied to the original data set up to the date of the reissue. A re-issue does not contain any new information additional to that previously issued by updates.

new edition of a data set: including new information which has not been previously distributed by updates.

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

A data set containing updates to one base cell file is called an update 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 the currently [2006] used edition (3.1).

No   other   file   may   be   named CATALOG.

5.6.3   Data set files

A valid data set file must be uniquely identified world wide by its name.

The data set files are named according to the specifications given below:

```
CCPRRRRR.EEE
 |  |  |         |
 |  |  |         |-----    EEE     = update number
 |  |  |
 |   |   |----------------          RRRRR = waterway code and waterway distance
 (kilometre)
 |   |--------------------        P           = navigational purpose
 (usage)
 |------------------------     CC         = producer
 code
```

The main part   forms an eight-character identifier where:

The first two characters (CC) identify the producer. This list is published at www.openecdis.org. The list includes all producers which aren't already mentioned in IHO S-62.

The third character (P) indicates the navigational purpose (see clause 2.1).

The letter "L" (in the position "usage") indicates, that the cell is displayed as overlay over other cells within a range of usages. The range of usages of overlay cells is indicated in the Data Set Identification Field of

the header of the overlay cell (see S57, Part 3, Data Structure, ch. 7.3.1.1). The 8th bit of the intended

usage

subfield (INTU) has to be set. The other seven bits describe the range:

Definition of range	from	to
Mathematical description	(INTU-128) div 10	(INTU-128) mod 10
Example (INTU=207)	(207-128) div 10 = 7	(207-128) mod 10 = 9

The fourth to eighth characters (RRRRR) identify the waterway and the waterway

distance. For waterways with a length of more than 999 km: e.g. D1923

For waterways with a length of more than 99 km: e.g. RH123

For waterways with a length of more than 9 km: e.g. DCC23

The use of the fourth to eighth characters is only a recommendation.

The primarily produced base cell file has the <u>extension</u> (EEE) 000.

The extension is used for updating. Update cell files have the same name as the original base cell file, with an extension number greater than or equal to 001. They cover the same geographical area as the base cell file to which they apply.

5.6.4   Text and picture files

The text and picture files must be named according to the Inland ENC Encoding Guide.

5.7   Updating

In order to ensure that updates 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. For update cell files the extension is the number of the update, ranging from "001" to "999". These numbers must be used sequentially, without omission. Number "001" is the first update after a new data set or a new edition, but not after a re- issue. The update sequence is not interrupted by a re-issue. After a re-issue, subsequent updates may be incorporated into the SENC created from this re- issue or to the SENC created from the original data and kept continuously updated.

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. Edition number remains the same for a re-issue.

update number update number 0 is assigned to a new data set. The first update cell file associated with this new data set must have update number 1. The update number must be increased by one for each consecutive update, until a new edition is released. The new edition must have update number 0. A re-issue of a data set must have the update number of the last update applied to the data set. In the case of an update cell file the file extension is the same as the update number.

update application this date is only used for the base cell files (i.e. new data sets, re-issue and new edition), not update cell files. All updates dated on or before this date must have been applied by the producer.

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

Table 5.1 gives examples of the way to manage the file extension, the "Edition Number" [EDTN], the "Update Number" [UPDN], the "Update Application Date" [UADT] and the "Issue Date" [ISDT] subfields.

Event	File extension	EDTN	UPDN	UADT	ISDT
New data set	.000	1	0	19950104	19950104
Update 1	.001	1	1	prohibited	19950121
Update 2	.002	1	2	prohibited	19950225
...					
Update 31	.031	1	31	prohibited	19950905
Re-issue of a data set	.000	1	31	19950905	19950910
Update 32	.032	1	32	prohibited	19951023
...					
Update 45	.045	1	45	prohibited	19951112
New edition	.000	2	0	19951201	19951201
Update 1 to edition 2	.001	2	1	prohibited	19960429

...

This example table relates to the specifications given in S-52 App 1, *"Guidance on Updating the Electronic*

Navigational Chart", in the following way:

The update information encoded in each individual cell file is called a sequential update.

The collection of the update information encoded in the update cell files which have been issued since the last new data set, the last re-issue of a data set or since the last update was applied to the SENC is called a cumulative update. In the example, the cumulative update for the new data set starts with update number 1. The cumulative update for the re-issue of a data set starts with update number 32. The cumulative update for a data set to which update number n has been applied starts with update number n+1.

The update information which has been incorporated in a re-issue of a data set is called a compilation update.

Each re-issue or new edition of a data set must have the same name as the base cell file which it replaces.

The update mechanism is described in S-57 Part 3, clause 8.

In order to delete a data set, an update cell file is created, containing only the Data Set General Information record with the "Data Set Identifier" [DSID] field. The "Edition Number" [EDTN] subfield must be set to 0. This message is only used to cancel a base cell file.

To inform the mariner that a new edition is available, an update cell file is created, containing only the Data Set General Information record with the "Data Set Identifier" [DSID] field. The "Edition Number" [EDTN] subfield must contain a value one higher than the current edition number.

In order to modify a text, picture or application file, a new file with the same name is created.

When an feature pointing to a text, picture or application file is deleted or updated so that it no longer references the file, the ECDIS software should check to see whether any other feature reference the same file, before that file is deleted.

An exchange set may contain base cell files and update cell files for the same cells. Under these circumstances the update cell files must follow on in the correct sequential order from the last update applied to the base cell file.

The record version of each feature or vector record is indicated in the "Record Version" [RVER] subfield of the "Feature Record Identifier" [FRID] field or the "Vector Record Identifier" [VRID] field. At each update of a record, this version number is incremented by 1.

5.8   Media

Data must be made available on CD-ROM . It may also be made available on any other physical media by private arrangement.

Data may be provided via telecommunication links.

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 (=IEEE Standards for Local Area Networks, Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications).

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 Annex B of the ENC Product Specification.

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 (SG3D)
        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 enumerations 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 has the same structure for EN and ER application profiles.

6.2.1   Catalogue file structure

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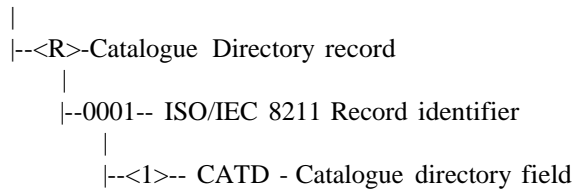
6.2.2   Catalogue Directory field - CATD

NB : All subfield values are encoded as ASCII.

Tag	subfield name	use	value	comment
RCNM	Record name	M	CD	
RCID	Record identification	M		
FILE	File name	M		full path from ENC_ROOT directory
LFIL	File long name			
VOLM	Volume	M		name of volume on which file appears
IMPL	Implementation	M	AS C BIN TX T	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
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			

6.3   EN application profile

The EN application profile applies to any base cell file (i.e. new data set, re-issue 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
   |               --or--- |
   |                        |--<R>--SG3D*   - 3-D Coordinate (Sounding array) 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.

IENCs are considered as an independent product besides ENCs. To recognise a S-57 dataset as an IENC the content of the subfields PRSP and PRED differs from S-57.

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	**{1} to {9}, {L}**	Navigational purpose, see clause 2.1 and 5.6.3, binary
DSNM	Data set name	M		File name with extension excluding path, ASCII
EDTN	Edition number	M		See clause 5.7, ASCII
UPDN	Update number	M		ASCII
UADT	Update application date	M		ASCII
ISDT	Issue date	M		ASCII
STED	Edition number of S-57	M	**03.1**	ASCII
PRSP	Product Specification	M	**{10}**	= IENC, binary
PSDN	Product specification description	P		Empty, ASCII
PRED	Product Specification Edition Number	M	**2.0**	=ASCII
PROF	Application profile iden- tification	M	**{1}**	= EN, binary
AGEN	Producing agency	M		Binary
COMT	Comment			ASCII

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	
NALL	NATF lexical level	M	{0}, {1} or {2}	
NOMR	Number of meta records	M		
NOCR	Number of cartographic	M	{0}	cartographic records are not permitted
NOGR	Number of geo record	M		
NOLR	Number of collection	M		
NOIN	Number of isolated node	M		

Tag	subfield name	use	value	comment
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

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	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	M	{1}	=metres, binary
PUNI	Units of positional accuracy	M	{1}	=metres, binary
COUN	Coordinate units	M	{1}	= lat/long, binary
COMF	Coordinate multiplication	M		binary, see clause 4.4
SOMF	3-D (sounding) multiplication factor	M	{10}	binary, see clause 4.4
COMT	Comment			ASCII

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	M		
RVER	Record version	M		
RUIN	Record update instruction	M	{1}	= insert

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	Enumeration	M		ASCII value. Missing enumeration = attribute is relevant but value is unknown.

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

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)

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)

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	M		
PRIM	Feature 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	Feature label	M		binary code for an feature class
RVER	Record version	M		
RUIN	Record update instruction	M	{1}	= insert

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	M		
FIDS	Feature identification	M		

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	Enumeration			ASCII value. Missing enumeration = attribute is relevant but value is unknown.

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	Enumeration			ASCII value. Missing enumeration = attribute is relevant but value is unknown

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

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
MASK	Masking indicator	M	{1} or {2} or {255}	= mask = show = null

6.4   ER application profile

The ER application profile only applies to update cell files.

6.4.1   Update cell file structure

```
Update 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
  |
  |--<R>--Vector record
  |    |
  |    |--0001 - ISO/IEC 8211 Record identifier
  |        |
  |        |--<1>--VRID - Vector Record Identifier field
  |                    |
  |                    |--<R>--ATTV*  - Vector Record Attribute field
  |                    |
  |                    |--<1>--VRPC   - Vector Record Pointer Control field
  |                    |
  |                    |--<R>--VRPT*  - Vector Record Pointer field
  |                    |
  |                    |--<1>--SGCC   - Coordinate Control field
  |                    |
  |                    |       |--<R>--G2D* - 2-D Coordinate field
  |                    |---or-- |
  |                            |--<R>--G3D* - 3-D Coordinate (Sounding array) 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
                    |
                    |--<1>--FFPC    - Feature Record to Feature Object Pointer Control field
                    |
                    |--<R>--FFPT*   - Feature Record to Feature Object Pointer field
                    |
                    |--<1>--FSPC    - Feature Record to Spatial Record Pointer Control field
                    |
                    |--<R>--FSPT*   - Feature Record to Spatial Record Pointer field
```

6.4.2 Field content (ER)

6.4.2.1 Data Set Identification Field - DSID

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

IENCs are considered as an independent product besides ENCs. To recognise a S-57 dataset as an IENC the content of the subfields PRSP and PRED differs from S-57.

tag	subfield name	use	value	comment
RCNM	Record name	M	{10}	= DS, binary
RCID	Record identification number	M		Binary
EXPP	Exchange purpose	M	{2}	Data set is a revision, binary
INTU	Intended usage	M	{1} to {9}, {L}	Navigational purpose, see clause 2.1 and 5.6.3, binary
DSNM	Data set name	M		File name with extension excluding path, ASCII
EDTN	Edition number	M		See clause 5.7, ASCII
UPDN	Update number	M		ASCII
UADT	Update application date	M		ASCII
ISDT	Issue date	M		ASCII
STED	Edition number of S-57	M	03.1	ASCII
PRSP	Product Specification	M	{10}	= IENC, binary
PSDN	Product specification description	P		Empty, ASCII
PRED	Product Specification Edition Number	M	2.0	= ASCII
PROF	Application profile iden- tification	M	{2}	= ER, binary
AGEN	Producing agency	M		Binary
COMT	Comment			ASCII

6.4.2.2 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	
NALL	NATF lexical level	M	{0} or {1}	
NOMR	Number of meta records	M		
NOCR	Number of cartographic	M	{0}	cartographic records are not permitted
NOGR	Number of geo records	M		
NOLR	Number of collection	M		
NOIN	Number of isolated node	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

6.4.2.3 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	M		
RVER	Record version	M		
RUIN	Record update instruction	M	{1} or {2} or {3}	= insert = delete = modify

6.4.2.4 Vector 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	Enumeration			ASCII value, missing enumeration = enumeration is deleted or unknown (see

6.4.2.5 Vector Record Pointer Control field - VRPC

NB : All subfield values are encoded as binary.

Tag	subfield name	use	value	comment
VPUI	Vector record pointer update instruction	M	{1} or {2} or {3}	= insert = delete = modify
VPIX	Vector record pointer index	M		
NVPT	Number of vector record	M		

6.4.2.6 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

6.4.2.7 Coordinate Control field - SGCC

NB : All subfield values are encoded as binary.

Tag	subfield name	use	value	comment
CCUI	Coordinate update instruction	M	{1} or {2} or {3}	= insert = delete = modify
CCIX	Coordinate index	M		
CCNC	Number of coordinates	M		

6.4.2.8 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)

6.4.2.9 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)

6.4.2.10 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	M		
PRIM	Feature 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	Feature label	M		binary code for an feature class
RVER	Record version	M		
RUIN	Record update instruction	M	{1} or {2} or {3}	= insert = delete = modify

6.4.2.11 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	M		
FIDS	Feature identification	M		

6.4.2.12 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	Enumeration			ASCII value. Missing enumeration = enumeration is deleted or unknown (see

6.4.2.13 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	Enumeration			ASCII value. Missing enumeration = enumeration is deleted.

6.4.2.14 Feature Record to Feature Object Pointer Control field - FFPC

NB: All subfield values are encoded as binary.

Tag	subfield name	use	value	Comment
FFUI	Feature object pointer update instruction	M	{1} or {2} or {3}	= insert = delete = modify
FFIX	Feature object pointer index	M		
NOPT	Number of feature object	M		

6.4.2.15 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

6.4.2.16 Feature Record to Spatial Record Pointer Control field - FSPC

NB : All subfield values are encoded as binary.

Tag	subfield name	use	value	Comment
FSUI	Feature to spatial record pointer update instruction	M	{1} or {2} or {3}	= insert = delete = modify
FSIX	Feature to spatial record pointer index	M		
NSPT	Number of feature to spatial record pointers	M		

6.4.2.17 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
MASK	Masking indicator	M	{1} or {2} or {255}	= mask = show = null

7   Maintenance

Every member of the Inland ECDIS Expert Group or the Inland ENC Harmonization Group (IEHG) is entitled to publish proposals for amendments or changes of

- this Product Specification for Inland ENCs

  including the IENC Feature Catalogue and

- the IENC Encoding Guide

on the IEHG discussion forum at http://ienc.openecdis.org. Each proposal has to contain an explanation, why the amendment or the change is needed.

Proposals for amendments of the IENC Feature Catalogue have to include a proposal for an amendment of the IENC Encoding Guide with regard to the use of these amendments.

The members of the Inland ECDIS Expert Group and the IEHG are requested to react as soon as possible. A veto against a proposal has to contain an explanation for the objection. If there is no veto within six weeks, the proposal is adopted. If there is a veto, there are the following possibilities to proceed:

The party, which has transmitted the proposal, can decide to withdraw the proposal.

If an updated proposal is transmitted, it is handled as a new proposal.

If the party, which has transmitted the proposal, wants to keep up the original proposal without any changes, the proposal will be discussed and decided upon at the next meeting of the IEHG.

The members of the IEHG discussion forum, who have actively participated in the development of the Product Specification and its annexes within the twelve months before a meeting of the IEHG, are entitled to take part in this meeting.

Each new version of the Feature Catalogue for Inland ENC results in a new version of the Product Specification for Inland ENCs.