

**S-130**

# **POLYGONAL DEMARCATIIONS OF GLOBAL SEA AREAS**

**Edition 1.0.0 – April 2023**

**IHO**



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### Revision History

Changes to this Product Specification are coordinated by the IHO. New editions will be made available via the IHO website. Maintenance of the Product Specification shall conform to IHO Technical Resolution 2/2007 as amended.

Version Number	Date	Author	Purpose
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## **1 Overview**

### **1.1 Introduction**

This document describes a product specification for the Polygonal Demarcation of Global Sea Areas (PDGSA). It is a vector product specification that is primarily intended for encoding the extent of global sea areas using a system of unique numerical identifiers only. This product specification complies with the IHO S-100 Universal Hydrographic Data Model.

## **2 References**

### **2.1 Normative**

The following normative documents contain provisions that, through reference in this text, constitute provisions of this document.

IHO S-100 IHO Universal Hydrographic Data Model Edition 5.0.0 (December 2022).

ISO 8601:2004. Data elements and interchange formats - Information interchange - Representation of dates and times. 2004.

ISO 3166-1. 1997. Country Codes. 1997.

ISO 19101-2:2008 Geographic Information - Rules for Application Schema

ISO/TS 19103:2005 Geographic Information - Conceptual schema language

ISO 19106:2004 Geographic Information – Profiles

ISO 19107:2003 Geographic Information – Spatial schema

ISO 19109:2005 Geographic Information - Rules for Application Schema

ISO 19111:2003 Geographic Information - Spatial referencing by coordinates

ISO 19115:2003+Corr1 (2006) Geographic Information - Metadata

ISO 19115-2:2009 Geographic Information - Metadata: Extensions for imagery and gridded data

ISO 19123:2005 Geographic Information - Schema for coverage geometry and functions

ISO 19129:2009 Geographic Information - Imagery gridded and coverage data framework

ISO 19131:2007 Geographic Information - Data product specifications

ISO 19136:2007 Geographic Information – Geography Markup Language

ISO 19136-2:2015, Geographic Information – Geography Markup Language.

ISO/TS 19139, Geographic Information – Metadata – XML schema implementation.

### **2.2 Informative**

The following informative documents provide additional information, including background information, but are not required to develop applications for data conforming to this specification.

ISO/IEC 19757-3, Information technology – Document Schema Definition Languages (DSDL) – Part 3: Rule-based validation – Schematron.

IHO S-101 IHO Electronic Navigational Chart Product Specification (Dec. 2018).

### 3 Terms, Definitions and Abbreviations

#### 3.1 Terms and Definitions

The S-100 framework is based on the ISO 19100 series of geographic standards. The terms and definitions provided here are used to standardize the nomenclature found within that framework, whenever possible. They are taken from the references cited in clause 2.1. Modifications have been made when necessary.

**application**

manipulation and processing of data in support of user requirements (ISO 19101)

**application schema**

**conceptual schema** for data required by one or more **applications** (ISO 19101)

**conceptual model**

model that defines concepts of a **universe of discourse** (ISO 19101)

**conceptual schema**

formal description of a **conceptual model** (ISO 19101)

**data product**

**dataset** or **dataset series** that conforms to a **data product specification**

**data product specification**

detailed description of a **dataset** or **dataset series** together with additional information that will enable it to be created, supplied to and used by another party

*NOTE: A data product specification provides a description of the universe of discourse and a specification for mapping the universe of discourse to a dataset. It may be used for production, sales, end-use or other purpose.*

**dataset**

identifiable collection of data (ISO 19115)

*NOTE: A dataset may be a smaller grouping of data which, though limited by some constraint such as spatial extent or feature type, is located physically within a larger dataset. Theoretically, a dataset may be as small as a single feature or feature attribute contained within a larger dataset. A hardcopy map or chart may be considered a dataset.*

**dataset series**

collection of **datasets** sharing the same product specification (ISO 19115)

**domain**

well-defined set (ISO/TS 19103)

*NOTE: Well-defined means that the definition is both necessary and sufficient, as everything that satisfies the definition is in the set and everything that does not satisfy the definition is necessarily outside the set.*

**feature**

abstraction of real world phenomena (ISO 19101)

*NOTE: A feature may occur as a type or an instance. Feature type or feature instance shall be used when only one is meant.*



### **feature association**

relationship that links instances of one **feature** type with instances of the same or a different

### **feature type (ISO19110)**

*NOTE 1: A feature association may occur as a type or an instance. Feature association type or feature association instance is used when only one is meant.*

*NOTE 2: Feature associations include aggregation of features.*

### **feature attribute**

characteristic of a **feature** (ISO 19101)

*NOTE 1: A feature attribute may occur as a type or an instance. Feature attribute type or feature attribute instance is used when only one is meant.*

*NOTE 2: A feature attribute type has a name, a data type and a domain associated to it. A feature attribute for a feature instance has an attribute value taken from the domain.*

### **geographic data**

data with implicit or explicit reference to a location relative to the Earth (ISO 19109)

*NOTE: Geographic information is also used as a term for information concerning phenomena implicitly or explicitly associated with a location relative to the Earth.*

### **metadata**

data about data (ISO 19115)

### **model**

abstraction of some aspects of reality (ISO 19109)

### **quality**

totality of characteristics of a product that bear on its ability to satisfy stated and implied needs (ISO 19101)

### **universe of discourse**

view of the real or hypothetical world that includes everything of interest (ISO 19101)

## **3.2 Abbreviations**

This product specification adopts the following convention for symbols and abbreviated terms:

ASCII	American Standard Code for Information Interchange
GML	Geography Markup Language
IHO	International Hydrographic Organization
IOC	International Oceanographic Commission
ISO	International Organization for Standardization
UML	Unified Modelling Language
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
WGS	World Geodetic System
XML	Extensible Markup Language
XSLT	eXtensible Stylesheet Language Transformations

## **3.3 Use of Language**

Within this document, including appendices and annexes:

- “Must” indicates a mandatory requirement.

- “Should” indicates an optional requirement, that is the recommended process to be followed, but is not mandatory.
- “May” means “allowed to” or “could possibly”, and is not mandatory.

### 3.4 UML Notations

In this document, conceptual schemas are presented in the Unified Modelling Language (UML). Several model elements used in this schema are defined in ISO standards or in IHO S-100 documents. In order to ensure that class names in the model are unique ISO TC/211 has adopted a convention of establishing a prefix to the names of classes that define the TC/211 defined UML package in which the UML class is defined. The IHO standards and this product specification make use of classes derived directly from the ISO standards. This convention is also followed in this document. In the IHO standards class names are identified by the name of the standard, such as "S-100" as the prefix optionally followed by the bi-alpha prefix derived from ISO standard. In order to avoid having multiple classes instantiating the same root classes, the ISO classes and S-100 classes have been used where possible; however, a new instantiated class is required if there is a need to alter a class or relationship to prevent a reverse coupling between the model elements introduced in this document and those defined in S-100 or the ISO model.

## 4 Specification Description

### 4.1 Informal Description of Data Product

This clause contains general information about the data product.

<b>Title:</b>	Polygonal Demarcations of Global Sea Areas
<b>Abstract:</b>	Polygonal Demarcations of Global Sea Areas (PDGSA) datasets support the provision of digital coordinates for limits of oceans and seas to meet the requirements of contemporary geographic information systems. It is a vector product specification that is primarily intended for encoding the extent of global sea areas using a system of unique numerical identifiers only.
<b>Content:</b>	Datasets conforming to this specification will contain all relevant limits of oceans and seas.
<b>Spatial Extent:</b>	Global coverage of sea areas.
<b>Specific Purpose:</b>	Provision of digital coordinates for limits of oceans and seas to meet the requirements of contemporary geographic information systems.

### 4.2 Data product specification metadata

This information uniquely identifies this Product Specification and provides information about its creation and maintenance. For further information on dataset metadata see the metadata clause.

<b>Title:</b>	Polygonal Demarcations of Global Sea Areas
<b>S-100 Version:</b>	5.0.0
<b>S-130 Version:</b>	1.0.0
<b>Date:</b>	2023-04-14

<b>Language:</b>	English
<b>Classification:</b>	Unclassified
<b>Contact:</b>	International Hydrographic Organization, 4 quai Antoine 1er, B.P. 445 MC 98011 MONACO CEDEX Telephone: +377 93 10 81 00 Telefax: + 377 93 10 81 40
<b>URL:</b>	<a href="http://www.iho.int">http://www.iho.int</a>
<b>Identifier:</b>	S-130
<b>Maintenance:</b>	Amendments to this specification will be produced on a needs basis. For reporting issues with this specification which need correction, use the contact information.

## **4.3 Product Specification Maintenance**

### **4.3.1 Introduction**

Changes to S-130 will be released by the IHO as a new edition, a revision, or as a document that includes clarification. These are described below.

### **4.3.2 New Edition**

New Editions introduce significant changes. New Editions enable new concepts, such as the ability to support new functions or applications, or the introduction of new constructs or data types. New Editions are likely to have a significant impact on either existing users or future users of S-130.

### **4.3.3 Revisions**

Revisions are defined as substantive semantic changes. Typically, revisions will introduce changes to correct factual errors or introduce necessary changes that have become evident as a result of practical experience or changing circumstances. A revision must not also be classified as a clarification. Revisions could have an impact on either existing users or future users of this specification. All cumulative clarifications will be included with the release of approved corrections revisions.

Changes in a revision are minor and ensure backward compatibility with the previous versions within the same Edition. Newer revisions, for example, introduce new features and attributes. Within the same Edition, a dataset of one version could always be processed with a later version of the feature catalogues. In most cases a new feature catalogue will result in a revision of this specification.

### **4.3.4 Clarification**

Clarifications are non-substantive changes. Typically, clarifications remove ambiguity; correct grammatical and spelling errors; amend or update cross references; insert improved graphics,

spelling, punctuation and grammar. Clarifications must not cause any substantive semantic changes.

Changes in a clarification are minor and ensure backward compatibility with the previous versions within the same Edition. Within the same Edition, a dataset of one clarification version could always be processed with a later version of the feature catalogue.

### 4.3.5 Version Numbers

The associated version control numbering to identify changes (n) to this specification must be as follows:

New Editions denoted as **n.0.0**

Revisions denoted as **n.n.0**

Clarifications denoted as **n.n.n**

## 4.4 Specification Scope

This product specification describes one data product and therefore requires only one scope which is described below:

<b>Scope ID:</b>	Polygonal Demarcations of Global Sea Areas
<b>Hierarchical level:</b>	MD_ScopeCode – 005 (dataset)
<b>Hierarchical level name:</b>	dataset
<b>Level description:</b>	information applies to the dataset
<b>Extent:</b>	EX_Extent.description: Global coverage of sea areas

## 5 Data product identification

This section describes how to identify data sets that conform to the specification. A dataset that conforms to this Product Specification may be identified by its discovery metadata as defined in clause 14 of this specification. The information identifying the data product may include the following items from S-100 5.0.0 clause 11-6 (adapted from ISO 19115).

<b>Title</b>	Polygonal Demarcations of Global Sea Areas
<b>Abstract</b>	Polygonal Demarcations of Global Sea Areas (PDGSA) datasets support the provision of digital coordinates for limits of oceans and seas to meet the requirements of contemporary geographic information systems. It is a vector product specification that is primarily intended for encoding the extent of global sea areas using a system of unique numerical identifiers only.
<b>Acronym</b>	PDGSA
<b>Content</b>	Datasets conforming to this specification will contain all relevant limits of oceans and seas.
<b>GeographicDescription</b>	<b>EX_GeographicBoundingBox:</b> bounding coordinates of the maximum geospatial extent in decimal degrees

<b>SpatialResolution</b>	MD_Resolution>equivalentScale.denominator (integer) or MD_Resolution>levelOfDetail (CharacterString). E.g.: “All scales”
<b>Purpose</b>	Provision of digital coordinates for limits of oceans and seas to meet the requirements of contemporary geographic information systems, and to allow the producer to exchange global limit of oceans and seas information with interested stakeholders.
<b>Language</b>	EN  Additional values, if any, use CharacterString values from ISO 639-2

## 6 Data Content and Structure

### 6.1 Introduction

The S-130 product is based on the S-100 General Feature Model (GFM), and is a feature-based vector product. The S-130 features classes are derived from one of the abstract classes **FeatureType** in the S-130 application schema, which realize the GFM meta-classes **S100\_GF\_FeatureType** respectively.

S-130 features are encoded as vector entities which conform to S-100 geometry configuration level 3a/b (S-100 section 7-5.3.5) as encoded using S-100 Part 10b. No topology is defined by S-130.

This section contains the Application Schema expressed in UML and an associated Feature Catalogue. The Feature Catalogue is included in Annex B, and provides a full description of each feature type including its attributes, attribute values and relationships in the data product.

### 6.2 Application Schema

The UML model shown below is the overall S-130 application schema, and includes overviews of the feature classes, spatial types, and the relationships between them.

This contains a general overview of the classes and relationships in the S-130 application schema. Detailed information about how to use the feature types and information types to encode PDGSA (Polygonal Demarcation of Global Sea Areas) information is provided in the S-130 Data Classification and Encoding Guide (DCEG).

The following conventions are used in the UML diagrams depicting the application schema:

- Standard UML conventions for classes, associations, inheritance, roles, and multiplicities apply. These conventions are described in Part 1 of S-100.
- Feature class is depicted with green background.
- Information type class is depicted with blue background.
- Complex attributes are depicted with a pink background.
- Enumeration list is depicted with a light green background. The numeric code corresponding to each listed value is shown to its right following an '=' sign.
- No significance attaches to the colour of associations. (Complex diagrams may use different colours to distinguish associations that cross one another.)
- Where the association role or name is not explicitly shown, the default rules for roles and names apply.

The figure below contains all the geographic features in the S-130 application schema with their attributes.

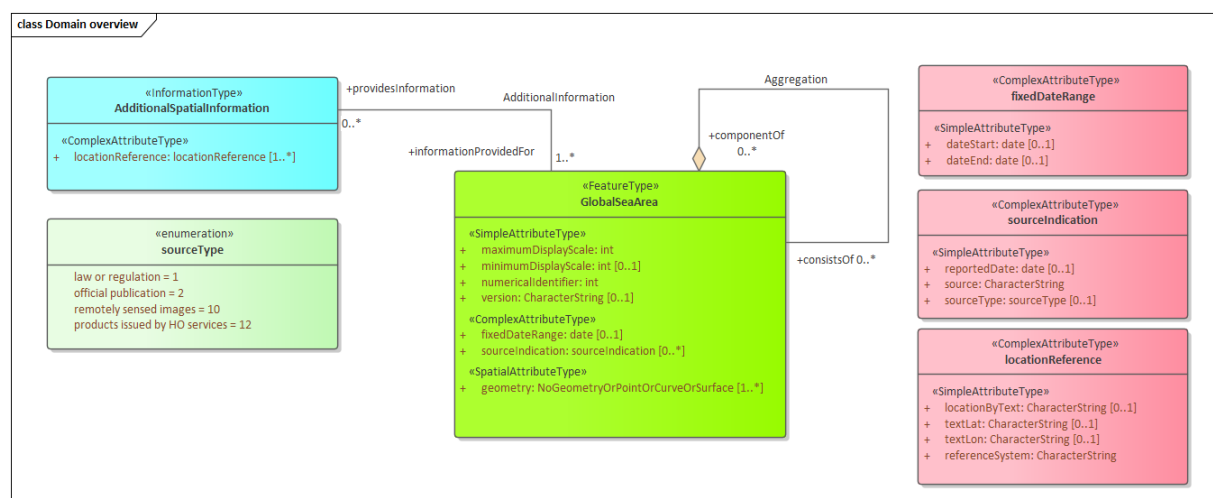


Figure 6.1 - Overview of S-130 Application Schema

Polygonal Demarcation of Global Sea Areas products can include a numerical identifier, version, minimum and maximum display scale, date range, source indication and additional spatial information which represent the limits of oceans and seas. GlobalSeaArea is the Feature type used to encode the extent of global sea areas using a system of unique numerical identifiers. GlobalSeaArea has attributes for numerical identifier identifying the global sea area, version to manage change information, maximumDisplayScale and minimumDisplayScale to display the global sea area layer, fixedDateRange indicating the effective dates of the feature and sourceIndication to describe the origin of the source. Complex attributes fixedDateRange and sourceIndication in the GlobalSeaArea include each detailed attribute types and are defined as a class separately. AdditionalSpatialInformation is the Information type to describe additional spatial information which has a complex attribute for location by text, latitude/longitude by text and reference system. Geographic features use spatial types defined in the geometry package for spatial attributes. The hierarchy of geographic features is designed around the feature association and information association.

## 7 Feature Catalogue

### 7.1 Introduction

The Feature Catalogue describes the feature types, information types, attributes, attribute values, associations and roles which may be used in the product. The S-130 Feature Catalogue is available in an XML document which conforms to the S-100 XML Feature Catalogue Schema and can be downloaded from the IHO Geospatial Information Registry (<https://registry.iho.int/main.do>). Simple attributes used in this specification are listed as below.

**Name:** Polygonal Demarcations of Global Sea Areas  
**Scope:** Ocean, Coastal, Ports, Harbors and Inland waters  
**Version Number:** 1.0.0  
**Version Date:** 2023-04-14  
**Producer:** IHO  
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 B.P. 445  
 MC 98011 MONACO CEDEX

Telephone: +377 93 10 81 00

Telefax: + 377 93 10 81 40

URL <http://www.iho.int>

**Language:** English

## 7.2 Feature Types

Feature types contain descriptive attributes that characterize real-world entities. The word ‘feature’ may be used in one of two senses – feature type and feature instance. A feature type is a class and is defined in a Feature Catalogue. A feature instance is a single occurrence of the feature type and represented as an object in a dataset. A feature instance is located by a relationship to one or more spatial instances. A feature instance may exist without referencing a spatial instance.

### 7.2.1 Geographic

Geographic (Geo) feature types carry the descriptive characteristics of a real-world entity.

### 7.2.2 Meta

Meta features contain information about other features within a dataset. Information defined by meta features override the default metadata values defined by the dataset descriptive records. Meta attribution on individual features overrides attribution on meta features.

### 7.2.3 Feature Relationship

A feature relationship links instances of one feature type with instances of the same or a different feature type.

### 7.2.4 Information Types

Information types are identifiable pieces of information in a dataset that can be shared between other features. They have attributes but have no relationship to any geometry; information types may reference other information types.

### 7.2.5 Attributes

S-130 defines attributes as either simple or complex.

#### 7.2.5.1 Simple Attributes

S-130 uses ten types of simple attributes; they are listed in the following table:

Type	Definition
Enumeration	A fixed list of valid identifiers of named literal values
Boolean	A value representing binary logic. The value can be either True or False. The default state for Boolean type attributes (i.e. where the attribute is not populated for the feature) is False.
Real	A signed Real (floating point) number consisting of a mantissa and an exponent
Integer	A signed integer number. The representation of an integer is encapsulation and usage dependent.
CharacterString	An arbitrary-length sequence of characters including accents and special characters from a repertoire of one of the adopted character sets

Date	A date provides values for year, month and day according to the Gregorian Calendar. Character encoding of a date is a string which must follow the calendar date format (complete representation, basic format) for date specified by ISO 8601. EXAMPLE 19980918 (YYYY-MM-DD)
Time	A time is given by an hour, minute and second. Character encoding of a time is a string that follows the local time (complete representation, basic format) format defined in ISO 8601. EXAMPLE 183059 or 183059+0100 or 183059Z
Date and Time	A DateTime is a combination of a date and a time type. Character encoding of a DateTime shall follow ISO 8601 EXAMPLE 19850412T101530
Codelist	A type of flexible enumeration. A code list type is a list of literals which may be extended only in conformance with specified rules.
Truncated date	One or more components of the Date type are omitted.

Table 7.1 - Simple feature attributes

### 7.3 Complex Attributes

Complex attributes are aggregations of other attributes that are either simple or complex. The aggregation is defined by means of attribute bindings.

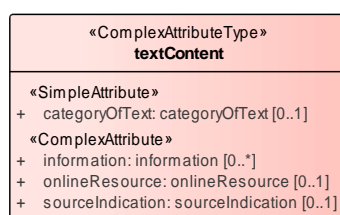


Table 7.2 - textContent - a complex attribute

### 7.4 Units of Measure

The following units of measure are used in Polygonal Demarcations of Global Sea Areas datasets;

- Orientation is given in decimal degrees
- Uncertainty is given in metres
- Distances are given in metres or nautical miles

### 7.5 Geometric Representation

Geometric representation is the digital description of the spatial component of an object as described in S-100 and ISO 19107. This product specification uses three types of geometries (GM\_Point, GM\_OrientableCurve, GM\_OrientableSurface) and NoGeometry.

## 8 Coordinate Reference System (CRS)

### 8.1.1 Horizontal reference system

Spatial data are expressed in latitude and longitude geographic coordinates in reference to a horizontal reference system.



The longitude is stored as a negative number to represent a position west of the prime meridian (0°). Latitude is stored as a negative number to represent a position south of the equator.

Latitude and Longitude may also be stored as textual strings. This is required so that positions may be described in the exact format that they are described in the source document they were extracted from. If a position is described in a source document in degrees, minutes and seconds then this description must be retained in the textual string as degrees, minutes and seconds because a conversion to decimal degrees would constitute a change in format from its defined value. The same latitude and longitude position may also be stored as a set of real numbers within a GIS system so that it can be used digitally. That is, the values used in a source document must be preserved, but points and other geometric primitives may have multiple representations.

Different reference systems are used by various nations. Since data may come from different sources, multiple coordinate reference systems may be used in the same dataset.

### **8.1.2 Projection**

S-130 data products are unprojected.

### **8.1.3 Temporal reference system**

Time is measured by reference to Calendar dates and Clock time in accordance with ISO 19108:2002 Temporal Schema clause 5.4.4.

### **8.1.4 Polygonal Demarcations of Global Sea Areas data and scale**

S-130 data must be compiled in the best applicable scale. The use of the data itself is "scale independent". That means that the data can be used at any scale. S-100 allows the association of multiple spatial attributes to a single feature instance. In principle, each of these spatial attributes can be qualified by maximum and minimum scales.

For example, it is possible, within one dataset, to have a single instance of a feature that has more than one area geometry. Each of these geometries has different scale max/min attributes. Moreover, due to cluttering in smaller scales, the scale minimum attribute may be used to turn off portrayal of some features at smaller scales.

## **9 Data quality**

### **9.1 Introduction to data quality**

Data quality allows users and user systems to assess fitness for use of the provided data. Data quality measures and the associated evaluation are reported as metadata of a data product. This metadata improves interoperability with other data products and provides usage by user groups that the data product was not originally intended for. The secondary users can make assessments of the data product usefulness in their application based on the reported data quality measures.

For S-130 the following Data Quality Elements have been included:

- Conformance to this Product Specification;
- Intended purpose of the data product;
- Completeness of the data product in terms of coverage;
- Logical Consistency;
- Positional Uncertainty and Accuracy;

- Thematic Accuracy;
- Temporal Quality;
- Aggregation measures;
- Validation checks or conformance checks including:
  - General tests for dataset integrity;
  - Specific tests for a specific data model.

## **9.2 Completeness**

### **9.2.1 Commission**

Commission is applicable for S-130.

S-130 products must be tested with Commission checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. It is allowable to publish the data with a quality statement which indicates non-conformance.

In terms of Commission, S-130 products shall at least populate `numberOfExcessItems` that indicates the number of items that should not have been present in the dataset, and `numberOfDuplicateFeatureInstances` that indicates the total number of exact duplications of feature instances within the data.

### **9.2.2 Omission**

Omission is applicable for S-130.

S-130 products must be tested with Omission checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. It is allowable to publish the data with a quality statement which indicates non-conformance.

In terms of Omission, S-130 products shall at least populate `numberOfMissingItems` that is the total number of missing items.

## **9.3 Logical Consistency**

### **9.3.1 Conceptual Consistency**

Conceptual Consistency is applicable for S-130 and follows the guidelines from S-100 Part 1.

S-130 products must be tested with Conceptual Consistency checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. Data should only be published if it passes the test.

In terms of Conceptual Consistency, S-130 products shall at least populate `numberOfInvalidSurfaceOverlaps` that is the total number of erroneous overlaps within the data.

### **9.3.2 Domain Consistency**

Domain Consistency is applicable for S-130 and follows the guidelines from S-100 Part 5.

S-130 products must be tested with Domain Consistency checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. It is allowable to publish the data with a quality statement which indicates non-conformance.

In terms of Domain Consistency, S-130 products shall at least populate `numberOfNonconformantItems` that is a count of all items in the dataset that are not in conformance with their value domain.

### 9.3.3 Format Consistency

Format Consistency is applicable for S-130 and follows the guidelines from S-100 Part 10b. S-130 products must be tested with Format Consistency checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. Data should only be published if it passes the test.

In terms of Format Consistency, S-130 products shall at least populate `physicalStructureConflicts` that is a count of all items in the dataset that are stored in conflict with the physical structure of the dataset.

### 9.3.4 Topological Consistency

Topological Consistency is applicable for S-130 and follows the guidelines from S-100 Part 7. S-130 products must be tested with Topological Consistency checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. Data should only be published if it passes the test.

In terms of Topological Consistency, S-130 products shall at least populate `rateOfFaultyPointCurveConnections` that is the number of faulty link-node connections in relation to the number of supposed link-node connections, `numberOfMissingConnectionsUndershoots` that is a count of items in the dataset within the parameter tolerance that are mismatched due to undershoots, `numberOfMissingConnectionsOvershoots` that is a count of items in the dataset within the parameter tolerance that are mismatched due to overshoots, `numberOfInvalidSlivers` that is a count of all items in the dataset that are invalid sliver surfaces, `numberOfInvalidSelfIntersects` that is a count of all items in the dataset that illegally intersect with themselves, and `numberOfInvalidSelfOverlap` that is all items in the dataset that illegally self-overlap.

## 9.4 Positional Uncertainty and Accuracy

### 9.4.1 Vertical Position Accuracy

Vertical Position Accuracy is not applicable for S-130.

### 9.4.2 Horizontal Position Accuracy

Horizontal Position Accuracy is applicable for S-130 and follows the guidelines from S-100 Part 4c.

S-130 products must be tested with Horizontal Position Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. It is allowable to publish the data with a quality statement which indicates non-conformance.

In terms of Horizontal Position Accuracy, S-130 products shall at least populate `circularError95` that indicates the radius describing a circle in which the true point location lies with the probability of 95%.

### 9.4.3 Gridded Data Positional Accuracy

Gridded Data Position Accuracy is not applicable for S-130.

## **9.5 Thematic Accuracy**

### **9.5.1 Thematic Classification Correctness**

Thematic Classification Correctness is applicable for S-130 and follows the guidelines from S-100 Part 4c.

S-130 products must be tested with Thematic Classification Correctness checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. Data should only be published if it passes the test.

In terms of Thematic Classification Correctness, S-130 products shall at least populate `miscalculationRate` that is the number of incorrectly classified features in relation to the number of features that are supposed to be there.

### **9.5.2 Non-Quantitative Attribute Accuracy**

Non-Quantitative Attribute Accuracy is applicable for S-130 and follows the guidelines from S-100 Part 4c.

S-130 products must be tested with Non-Quantitative Attribute Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. It is allowable to publish the data with a quality statement which indicates non-conformance.

The accuracy of non-quantitative attributes can be correct or incorrect. S-130 products shall at least populate `numberOfIncorrectAttributeValues` that is a count of all attribute values where the value is incorrect.

### **9.5.3 Quantitative Attribute Accuracy**

Quantitative Attribute Accuracy is applicable for S-130 and follows the guidelines from S-100 Part 4c.

S-130 products must be tested with Quantitative Attribute Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. It is allowable to publish the data with a quality statement which indicates non-conformance.

The accuracy of quantitative attributes can be measured in terms of uncertainty intervals. S-130 products shall at least populate `attributeValueUncertainty3Sigma` that is half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 95%.

## **9.6 Temporal Quality**

### **9.6.1 Temporal Consistency**

Temporal Consistency is not applicable for S-130.

### **9.6.2 Temporal Validity**

Temporal Validity is not applicable for S-130.

### **9.6.3 Temporal Accuracy**

Temporal Accuracy is not applicable for S-130.

## **9.7 Aggregation**

Aggregation is not applicable for S-130.

## 9.8 Quality measure elements

The data quality measures recommended in S-97 (Part C) and their applicability in S-130 are indicated in Table 9.1 below. NA indicates the measure is not applicable. The application schema above has indicated how the data quality elements will be related to the data items, and the encoding description below will indicate how the quality elements will be encoded.

No.	Data quality element and sub element	Definition	DQ measure / description	Evaluation scope	Scope in S-130
1	Completeness / Commission	Excess data present in a dataset, as described by the scope.	numberOfExcessItems / This data quality measure indicates the number of items in the dataset, that should not have been present in the dataset.	dataset/ dataset series	All features and info types
2	Completeness / Commission	Excess data present in a dataset, as described by the scope.	numberOfDuplicateFeatureInstances / This data quality measure indicates the total number of exact duplications of feature instances within the data.	dataset/ dataset series	All features and info types
3	Completeness / Omission	Data absent from the dataset, as described by the scope.	numberOfMissingItems / This data quality measure is an indicator that shows that a specific item is missing in the data.	dataset/ dataset series/ spatial object type	All features and info types
4	Logical Consistency / Conceptual Consistency	Adherence to the rules of a conceptual schema.	numberOfInvalidSurfaceOverlaps / This data quality measure is a count of the total number of erroneous overlaps within the data. Which surfaces may overlap and which must not is application dependent. Not all overlapping surfaces are necessarily erroneous.	spatial object / spatial object type	Features with surface geometry; spatial objects of type surface
5	Logical Consistency / Domain Consistency	Adherence of the values to the value domains.	numberOfNonconformantItems / This data quality measure is a count of all items in the dataset that are not in conformance with their value domain.	spatial object / spatial object type	All features and info types

6	Logical Consistency / Format Consistency	Degree to which data is stored in accordance with the physical structure of the data set, as described by the scope	physicalStructureConflicts / This data quality measure is a count of all items in the dataset that are stored in conflict with the physical structure of the dataset.	dataset/ dataset series	All features and info types
7	Logical Consistency / Topological Consistency	Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope.	rateOfFaultyPointCurveConnections / This data quality measure indicates the number of faulty link-node connections in relation to the number of supposed link-node connections. This data quality measure gives the erroneous point-curve connections in relation to the total number of point-curve connections.	spatial object / spatial object type	Features with curve geometry; spatial objects of curve types
8	Logical Consistency / Topological Consistency	Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope.	numberOfMissingConnectionsUndershoots / This data quality measure is a count of items in the dataset within the parameter tolerance that are mismatched due to undershoots.	spatial object / spatial object type	Features with curve geometry; spatial objects of curve types
9	Logical Consistency / Topological Consistency	Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope.	numberOfMissingConnectionsOvershoots / This data quality measure is a count of items in the dataset within the parameter tolerance that are mismatched due to overshoots.	spatial object / spatial object type	Features with curve geometry; spatial objects of curve types
10	Logical Consistency / Topological Consistency	Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope.	numberOfInvalidSlivers / This data quality measure is a count of all items in the dataset that are invalid sliver surfaces. A sliver is an unintended area that occurs when adjacent surfaces are not digitized properly. The borders of the adjacent surfaces may unintentionally gap or overlap to cause a topological error.	dataset / dataset series	Features with surface geometry; spatial objects of type surface

11	Logical Consistency / Topological Consistency	Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope.	numberOfInvalidSelfIntersects / This data quality measure is a count of all items in the dataset that illegally intersect with themselves.	spatial object / spatial object type	Features with surface geometry; spatial objects of type surface
12	Logical Consistency / Topological Consistency	Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope.	numberOfInvalidSelfOverlap / This data quality measure is a count of all items in the dataset that illegally self-overlap.	spatial object / spatial object type	Features with surface geometry; spatial objects of type surface
13	Positional Accuracy / Vertical Position Accuracy	Closeness of reported coordinative values to values accepted as or being true.	linearMapAccuracy2Sigma / Half length of the interval defined by an upper and lower limit in which the true value lies with probability 95%.	spatial object / spatial object type	NA. S-130 does not include vertical measurements.
14	Positional Accuracy / Horizontal Position Accuracy	Closeness of reported coordinative values to values accepted as or being true.	circularError95 / Radius describing a circle in which the true point location lies with the probability of 95%.	spatial object / spatial object type	Objects that have a horizontal coordinate values associated.
15	Positional Accuracy / Gridded Data Position Accuracy	Closeness of reported coordinative values to values accepted as or being true.	RMSerrorofplanimetry / Radius of a circle around the given point, in which the true value lies with probability P.	spatial object / spatial object type	NA.
16	Temporal Quality / Temporal Consistency	Correctness of ordered events or sequences, if reported.	chronologicalOrder/ This data quality measure that indicate that an event is incorrectly ordered against the other events. [Adapted from ISO 19157]	dataset/ dataset series/ spatial object type	NA.

17	Thematic Accuracy / Thematic Classification Correctness	Comparison of the classes assigned to features or their attributes to a universe of discourse.	miscalculationRate / This data quality measure indicates the number of incorrectly classified features in relation to the number of features that are supposed to be there. [Adapted from ISO 19157] This is a RATE which is a ratio, and is expressed as a REAL number representing the rational fraction corresponding to the numerator and denominator of the ratio. For example, if there are 1 items that are classified incorrectly and there are 100 of the items in the dataset then the ratio is 1/100 and the reported rate = 0.01.	dataset/ dataset series/ spatial object type	All features and info types
23	Thematic Accuracy / Non-Quantitative Attribute Accuracy	Correctness of non-quantitative attribute.	numberOfIncorrectAttributeValues / This data quality measure is count of the total number of erroneous attribute values within the relevant part of the dataset. It is a count of all attribute values where the value is incorrect. [Adapted from ISO 19157]	dataset/ dataset series/ spatial object type	All features and info types
24	Thematic Accuracy / Quantitative Attribute Accuracy	Accuracy of a quantitative attribute.	attributeValueUncertainty3Sigma / This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 95%. [Adapted from ISO 19157]	dataset/ dataset series/ spatial object type	All features and info types
18	Aggregation Measures / Aggregation Measures	In a data product specification, several requirements are set up for a product to conform to the specification.	DataProductSpecificationPassed / This data quality measure is a boolean indicating that all requirements in the referred data product specification are fulfilled.	dataset/ dataset series/ spatial object type	NA



19	Aggregation Measures / Aggregation Measures	In a data product specification, several requirements are set up for a product to conform to the specification.	DataProductSpecificationFailRate / This data quality measure is a number indicating the number of data product specification requirements that are not fulfilled by the current product/dataset in relation to the total number of data product specification requirements.	dataset/dataset series/spatial object type	NA
----	---	---	---	--	----

Table 9.1 - IHO recommended quality elements and their relevance to S-130

## 10 Data Capture and Classification

The production process used to generate S-130 products may be described in the dataset metadata.

Item Name	Description	Multiplicity	Type
dataSource	Identification of the kinds of data sources usable to product datasets compliant with the considering specification	0..*	CharacterString
productionProcess	Link to a textual description of the production process (including encoding guide) applicable to the datasets compliant with the considering specification	0..*	CharacterString (URL)

Table 10.1 - Data capture information

### 10.1 Data Encoding and Product Delivery

#### 10.1.1 Data Encoding

The principal encoding will be the Open Geospatial Consortium (OGC), Geography Markup Language (GML) format. GML is an XML grammar designed to express geographical features. It serves as a modelling language for geographic systems as well as an open interchange format for geographic transactions. The GML encoding is in conformance with S-100 Part 10b.

#### 10.1.2 Types of Datasets

A dataset is a grouping of features, attributes, geometry and metadata which comprises a specific coverage. The following types of S-130 dataset may be produced and contained within an exchange set:

Dataset	Explanations
New dataset (base dataset):	Data for an area different (in coverage and/or extent) to existing datasets.
New Edition of a dataset:	A re-issue plus new information which has not been previously distributed by Updates. Each New Edition of a dataset must have the same name as the dataset that it replaces and should have the same spatial extents. The edition number in

	the dataset discovery metadata shall increment up by one from the previous edition.
Cancellation	Used to cancel dataset.

Table 10.2 - S-130 dataset types

## 10.2 Numeric Attribute Encoding

Floating point and integer attribute values must not contain leading zeros. Floating point attribute values must not contain non-significant trailing zeros.

## 10.3 Text Attribute Values

Character strings must be encoded using the character set defined in ISO 10646-1, in Unicode Transformation Format-8 (UTF-8).

## 10.4 Mandatory Attribute Values

All mandatory attributes are identified in the Feature Catalogue and summarised in Annex A – Data Classification and Encoding Guide.

## 10.5 Unknown Attribute Values

When a mandatory attribute code or tag is present but the attribute value is missing, it means that the producer wishes to indicate that this attribute value is unknown. Missing mandatory attributes must be “nilled”.

Optional attributes must be omitted altogether if the value is unknown or missing. They must not be “nilled.”

**EXAMPLE** A landmark feature has unknown category of landmark (mandatory attribute) and function (optional attribute). The feature could be coded as:

```
<Landmark>
  <categoryOfLandmark xsi:nil="true"/>
  <function>radio</function>
  ... other attributes...
  ... <status> is NOT coded ...
</Landmark>
```

## 10.6 Structure of dataset files

### 10.6.1 Sequence of objects

The order of data objects in each dataset file is described below:

Dataset Identification Information

Dataset structure information

Spatial records for by-reference geometries

Point

Curve

Composite Curve

Surface

Information objects

Feature objects (Geometry may be encoded inline or by reference.)

Meta features

Geo features

## 10.7 Object identifiers

A unique worldwide identifier of feature records is provided through a feature attribute (numericalIdentifier). The intention is to move to MRN Persistent Unique Identifiers if there is no compelling reason not to.

Features, information types, collection objects, meta features, and geometries (inline or external) are all required by the schema to have a **gml:id** attribute with a value that is unique within the dataset. The **gml:id** values must be used as the reference for the object from another object in the same dataset or another dataset.

## 10.8 Data coverage

All areas of a dataset must be covered by a DataCoverage meta feature.

An update dataset must not change the limit of a Data Coverage feature for the base dataset. Where the limit of a Data Coverage feature for a base dataset is to be changed, this must be done by issuing a new edition of the dataset.

## 10.9 Data overlap

S-130 datasets shall not overlap other S-130 datasets.

# 11 Data Delivery

## 11.1 Data Product Delivery Information

This data product specification defines GML as the primary format in which S-130 data products are delivered. The delivery format is described by the following items (from ISO 19131:2005): format name, version, specification, language, character set.

Name	ISO 19131 Elements	Value
Format name	DPS_DeliveryInformation.deliveryFormat > DPS_DeliveryFormat.formatName	GML*
Version	DPS_DeliveryInformation.deliveryFormat > DPS_DeliveryFormat.version	3.2.1
Specification description	DPS_DeliveryInformation.deliveryFormat > DPS_DeliveryFormat.specification	GML*
Language	DPS_DeliveryInformation.deliveryFormat > DPS_DeliveryFormat.language	English
Character set	DPS_DeliveryInformation.deliveryFormat > DPS_DeliveryFormat.characterSet > MD_CharacterSetCode	004 – utf8

Table 11.1 - Data product delivery

\* GML is an XML encoding for the transport and storage of geographic information, including both the geometry and the properties of geographic features, between distributed systems. The XML Schema for the GML application schema is provided in a schema document S130.xsd which imports other schema(s) defining common types. Feature instance shall validate against S130.xsd and conform to all other requirements specified in this data product specification including all constraints not captured in the XML Schema document.



The main part forms an identifier where:

- 130 - the first 3 characters identify the dataset as an S-130 dataset (mandatory).
- CCCC - the fourth to seventh characters identify the producer code of the issuing agency. Where the producer code is derived from a 2 or 3 character format, the missing characters of the producer code must be populated with zeros ("00" or "0" respectively) for the sixth and seventh characters of the dataset file name, as required.
- ØØØØØØØØØØ - the eighth to the maximum seventeenth characters are optional and may be used in any way by the producer to provide the unique file name. The following characters are allowed in the dataset name: A to Z, 0 to 9 and the special character \_ (underscore).
- .GML – new datasets and new editions.

## 12 Data Maintenance

### 12.1 Introduction

Datasets are maintained as needed and must include mechanisms for S-130 updating. Data updates will be made by new editions. The maintenance and update frequency of S-130 datasets should be defined by the producers implementing this specification.

Data Producers must use applicable sources to maintain and update data and provide a brief description of the sources that were used to produce the dataset in the appropriate metadata field.

The data product shall provide information on how the data is maintained and should describe the principles and criteria applied in maintenance regime. This should specify the expected frequency of updates.

Item Name	Description	Multiplicity	Type
maintenanceAndUpdateFrequency	Frequency with which changes and additions are made to the data product (per update scope)	1..*	MD_MaintenanceInformation (ISO 19115)
dataSource	Identification of the kinds of data sources usable to produce datasets	1..*	LI_Source (ISO 19115)
productionProcess	Textual description of the production process applicable to the datasets (per scope or data source)	1..*	LI_ProcessStep (ISO 19115)

Table 12.1 - Maintenance and update frequency

### 12.2 Production process for base and update datasets

Data Producers should follow their established production processes for maintaining and updating datasets. Data is produced against the DCEG and checked against the appropriate set of validation rules.

### 12.3 Dataset updates and cancellation

The purpose of issue of the dataset is indicated in the "purpose" field of the dataset discovery metadata. In order to terminate a dataset, an update dataset file is created for which the edition number must be set to 0. This convention is only used to cancel a base dataset file.

Where a dataset is cancelled and its name is reused at a later date, the issue date must be greater than the issue date of the cancelled dataset.

When the dataset is cancelled it must be removed from the system.

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

## **12.4 Support file updates**

The purpose of issue is indicated in the “purpose” field of the support file discovery metadata. Support files carrying the “deletion” flag in metadata must be removed from the system. When a feature or information type pointing to a text, picture or application file is deleted or updated so that it no longer references the file, the system software must check to see whether any other feature or information type references the same file, before that file is deleted.

Updates or deletions of a support file may require concurrent updates to feature or information type instance attributes that depend on the file, e.g., pictorialRepresentation, fileReference and fileLocator attributes.

## **12.5 Feature catalogues**

For each new version of the S-130 Product Specification a new feature catalogue will be released. The system must be able to manage datasets and their catalogues that are created on different versions of the S-130 product specification.

## **12.6 Feature history, versions and change tracking**

If applications or production systems require versioning of individual instances of feature or information types, maintenance of histories, or change tracking, the methods for versioning, history management, and change tracking and display are left to the application or production system.

# **13 Portrayal**

No specific portrayal implementation is included within this Product Specification.

# **14 Metadata**

## **14.1 Introduction**

The S-130 metadata description is based on the S-100 metadata document section, which is a profile of the ISO 19115 standard. S-130 implements the metadata structure and encoding as defined in S-100 Edition 5.0.0 Part 17. These documents provide a structure for describing digital geographic data and define metadata elements, a common set of metadata terminology, definitions and extension procedures.

## **14.2 Dataset Metadata**

Dataset metadata is intended to describe information about a dataset. It facilitates the management and exploitation of data and is an important requirement for understanding the characteristics of a dataset. Whereas dataset metadata is usually fairly comprehensive, there is also a requirement for a constrained subset of metadata elements that are usually required

for discovery purposes. Discovery metadata are often used for building web catalogues, and can help users determine whether a product or service is fit for purpose and where they can be obtained.

Name	Cardinality	Value	Type	Remarks
S-100_DataSetDiscoveryMetadata				
fileName	1		CharacterString	Dataset file name (see 10.11.6)
filePath	1		CharacterString	Full path from the exchange set root directory
description	1		CharacterString	
copyright	0..1		MD_LegalConstraints >MD_RestrictionCode <copyright> (ISO 19115)	
classification	0..1		Class MD_SecurityConstraints>MD_ClassificationCode (codelist)	1. unclassified 2. restricted 3. confidential 4. secret 5. top secret
purpose	1	{1}, {2}	CharacterString	1. New dataset 2. New edition
specificUsage	1		MD_USAGE>specificUsage (character string) MD_USAGE>userContactInfo (CI_ResponsibleParty)	brief description of the resource and/or resource series usage
editionNumber	1	{1}	Integer	When a dataset is initially created, the edition number “1” is assigned to it. The edition number is increased by one with each new edition.
issueDate	1		Date	Date on which the dataset was generated.
productSpecification	1	S-130 version N.n	CharacterString	This must be encoded as S130.N.n
producingAgency	1		CI_ResponsibleParty	Party responsible for generating the dataset.
horizontalDatumReference	1	WGS84	CharacterString	EPSG
horizontalDatumValue	1	WGS84	Integer	4326
dataType	1	GML	CharacterString	
dataTypeVersion	1	3.2.1	CharacterString	
dataCoverage	1..*		S100_DataCoverage	
comment	0..1		CharacterString	Any additional Information

Table 14.1 - Dataset metadata

### 14.3 Update and Cancellation Dataset Metadata

Update dataset metadata is intended to describe information about an update dataset. It facilitates the management and exploitation of data and is an important requirement for understanding the characteristics of an update dataset. Whereas dataset metadata is usually fairly comprehensive, metadata for update datasets only describe the issue date and sequential relation to the base dataset.

Name	Cardinality	Value	Type	Remarks
S100_DataSetDiscoveryMetadata				
fileName	1		CharacterString	Dataset file name (see 11.7)
filePath	1		CharacterString	Full path from the exchange set root directory
description	1		CharacterString	Brief description of the update.
copyright	0..1		MD_LegalConstraints ->MD_RestrictionCode <copyright> (ISO 19115)	Value must be same as base dataset.
classification	0..1		Class MD_SecurityConstraints>MD_ClassificationCode (codelist)	Value must be same as base dataset.
purpose	1	{3}, {4}	CharacterString	3. Update 4. Cancellation
specificUsage	1		MD_USAGE>specificUsage (character string) MD_USAGE>userContactInfo (CI_ResponsibleParty)	Brief description of the resource and/or resource series usage
editionNumber	1		Integer	Value must be same as base dataset.
updateNumber	1		CharacterString	Update sequence number, must match file name.
issueDate	1		Date	Date on which the dataset was generated.
productSpecification	1	S-130 version N.n	CharacterString	Value must be same as base dataset.
producingAgency	1		CI_ResponsibleParty	Party responsible for generating the dataset.
horizontalDatumReference	1	WGS84	CharacterString	EPSG
horizontalDatumValue	1	WGS84	Integer	4326
dataType	1	GML	CharacterString	
dataTypeVersion	1	3.2.1	CharacterString	
dataCoverage	1..*		S100_DataCoverage	
comment	0..1		CharacterString	Any additional Information

Table 14.2 - Update dataset metadata