

# **Electronic Navigational Chart Validation Checks**

**(Draft) Edition 1.0.0-20241206**

**Aligned to S-101 Edition 2.0.0**

**IHO**



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## Document History

Changes to this Specification are coordinated by the S-101 Project Team (S-101 PT) of the IHO S-100 working Group (S-100 WG). New editions will be made available via the IHO web site. Maintenance of the Specification shall conform to IHO Resolution 2/2007 (as amended).

Version Number	Date	Author/Editor	Purpose
0.1.0	2024-08-23	RM	Initial draft posted in S100 Validation Checks GitHub repository
0.2.0	2024-10-07	RM	Applied check revisions from S-101 PT as of Oct. 7 to list; combined references into single row as per email discussion; added clause to reference applicable generic and interop. checks; corrected typographical errors in list; applied feedback received on Word doc.
0.2.1	2024-11-27	EH RM	Added clarification regarding publishing of implementation version to 1.2 Conformance Updated specification maintenance according to current thinking.
1.0.0	2024-12-06	KÖ	Final draft prepared for HSSC approval

## Summary of Substantive Changes in Edition x.x

Bold references in the Clauses Affected column indicate the principal sections/clauses that are affected by the described change.

Change Summary	Clauses Affected
(To be populated for editions following Edition 1.0.0)	

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# 1 Introduction

This document specifies a set of checks that producers of S-101 Electronic Navigational Chart (ENC) validation tools must implement in their validation software. Validation software is used to ensure that S-101 ENC data are compliant with the S-101 Product Specification. These validation checks are partly derived from the validation checks for S-57 ENCs defined in IHO S-58 (ENC Validation Checks), modified to meet the requirements of S-101, and partly newly developed checks based on new requirements in S-101.

The checks listed in this document are product-specific. They supplement but do not replace the generic S-100 validation checks applicable to all S-100 products which are defined in a separate IHO publication (S-158:100 – Universal Hydrographic Model Validation Checks).

## 1.1 Scope

This document, designated as “S-158:101” by the IHO, specifies validation checks for data products conforming to Edition 2.0.0 of the S-101 (Electronic Navigational Chart) Product Specification.

This document specifies product-specific validation checks for both S-101 datasets and exchange sets containing S-101 datasets.

The checks specified in this document supplement the checks described in Edition 1.0.0 of S-158:100 (Universal Hydrographic Data Model Validation Checks). Both sets of validation checks, those described in S-158:100 as well as those defined in S-158:101, must be applied to test the validity of S-101 datasets and exchange sets. For datasets and exchange sets intended for use on ECDIS, additional cross-product checks, defined in S-158:98, must also be applied.

## 1.2 Conformance

This specification conforms to Edition 1.0.0 of IHO specification S-158 (Validation Checks – Introduction and Structure). Edition 1.0.0 is an Implementation version in accordance with IHO TR2/2007 and there may be revisions issued by the Working Group prior to the Operational Edition 2.0.0 being published.

The validation checks described herein conform to Edition 2.0.0 of IHO Product Specification S-101 (Electronic Navigational Charts).

## 1.3 References

### 1.3.1 Normative references

S-98	<i>Data Product Interoperability in S-100 Navigation Systems, IHO Publication S-98, Edition 2.0.0, ??? 2025. In Preparation.</i>
S-100	<i>IHO Universal Hydrographic Data Model, Edition 5.2.0, June 2024</i>
S-101	<i>Electronic Navigational Chart (ENC) Product Specification, Edition 2.0.0, ??? 2024. In preparation.</i>
S-158	<i>Validation Checks – Introduction and Structure, Edition 1.0.0, ??? 2025. In preparation.</i>
S-158:100	<i>Universal Hydrographic Data Model Validation Checks, Edition 1.0.0, ??? 2025. In preparation.</i>

### 1.3.2 Informative references

ISO 19157:2013	<i>Geographic information – Data Quality. As amended by Amendment 1, 2018</i>
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## 1.4 Terms, definitions and abbreviations

### 1.4.1 Terms and definitions

The terms and definitions listed in S-158 apply to this document. In addition, the following terms and definitions are used:

**aggregation**

special form of association that specifies a whole-part relationship between the aggregate (whole) and a component part (see composition) [ISO 19103]

**association**

semantic relationship between two or more classifiers that specifies connections among their instances [ISO 19103]

NOTE: A binary association is an association among exactly two classifiers (including the possibility of an association from a classifier to itself)

**composition**

form of aggregation association with strong ownership and coincident lifetime as part of the whole [ISO 19103]

NOTE: Parts with non-fixed multiplicity may be created after the composite itself, but once created they live and die with it (that is, they share lifetimes). Such parts can also be explicitly removed before the death of the composite. Composition may be recursive. Synonym: Composite aggregation.

**enumeration**

a fixed list of valid identifiers of named literal values. Attributes of an enumerated type may only take values from this list [??]

**exterior**

difference between the universe and the closure [ISO 19107]

NOTE The concept of exterior is applicable to both topological and geometric complexes

**feature association**

relationship that links instances of one feature type with instances of the same or a different feature type [ISO 19110]

**feature attribute**

characteristic of a feature [ISO 19101]

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

NOTE: In a Feature Catalogue, a feature attribute may include a value domain but does not specify attribute values for feature instances.

EXAMPLE 1: A feature attribute named communication channel may have an attribute value VHF0007 which belongs to the data type text

EXAMPLE 2: A feature attribute named length may have an attribute value 82.4 which belongs to the data type real

**maximum display scale**

the value considered by the data producer to be the maximum (largest) scale at which the data is to be displayed before it can be considered to be "grossly overscaled" [S-101]

**minimum display scale**

the minimum (smallest) scale with which the data is intended to be displayed [S-101]

**multiplicity**

specification of the number of possible occurrences of a property, or the number of allowable elements that may participate in a given relationship [ISO 19103]

EXAMPLES: 1..\* (one to many); 1 (exactly one); 0..1 (zero or one)

**optimum display scale**

the maximum (largest) scale with which the data is intended to be displayed [S-101]

NOTE: Optimum Display Scale may be considered to be the compilation scale for the data, and is the reference for the overscale indication. When the Mariners Selected Viewing Scale (MSVS) is set to a scale that is larger than Optimum Display Scale, this triggers the overscale indication in the end user system.

**overscale**

the viewing scale is larger than the value considered by the Data Producer to be the largest intended (optimum) display scale for the data [S-101]

**relationship**

semantic connection among model elements [ISO 19103]

NOTE: Kinds of relationships include association, generalization, metarelationship, flow, and several kinds grouped under dependency.

**scale minimum**

the smallest scale at which a feature is intended to be displayed (for example, a minor light, with a scale minimum of 1:45,000, would not normally be displayed at a scale of 1:90,000) [S-101]

**skin of the Earth**

a defined set of non-overlapping geographic features of geometric primitive surface, completely covering an area equivalent to that of meta-features Data Coverage. [S-101]

**viewing scale**

The value of the ratio of the linear dimensions of features of a dataset presented in the display and the actual dimensions of the features represented of the dataset [S-101]

**1.4.2 Abbreviations**

This Product Specification uses the abbreviated terms defined in S-158. In addition, the following abbreviations are used:

FOID      Feature Object Identifier

ER file    Update file in the ISO 8211 format specified by S-101

**1.4.3 Symbols**

The symbols used in logical and spatial expressions are defined in S-158 clause 1.3.3 (Symbols).

**1.5 Use of language**

Within this document:

- “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.

## 1.6 General description

S-158:101 is a specification describing product-specific validation checks for S-101 products. There are no data products based directly on this edition of S-158:101 and therefore no general information applicable to data products conforming to it.

## 1.7 Specification metadata and maintenance

### 1.7.1 Specification metadata

This information uniquely identifies this Specification and provides information about its creation and maintenance.

<b>Title:</b>	Electronic Navigational Chart Validation Checks
<b>Version:</b>	1.0.0
<b>Date:</b>	2024-12-05
<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 B.P. 445 Fax: + 377 93 10 81 40 Email: <a href="mailto:info@iho.int">info@iho.int</a>
<b>Role:</b>	Owner
<b>URL:</b>	<a href="https://registry.iho.int">https://registry.iho.int</a>
<b>Identifier:</b>	S-158:101
<b>Maintenance:</b>	Changes to this Specification are coordinated by the S-101 Project Team under the S-100 Working Group (S-100 WG) of the IHO and made available via the IHO Publications website. Maintenance of the Product Specification must conform to IHO Technical Resolution 2/2007 (revised 2010). For reporting issues which need correction, use the contact information.

### 1.7.2 Specification maintenance

#### 1.7.2.1 Introduction

Changes to S-158:101 will be released by the IHO as a New Edition, revision, or clarification.

The list of checks, which accompanies this document is considered part of this Specification and changes to it are considered changes to this Specification.

S-158:101 is not accompanied by separate artefacts such as an XML Schema, Feature or Portrayal Catalogue and therefore this clause does not address the question of changes to such derived artefacts.

#### 1.7.2.2 New Edition

New Editions of S-158:101 include at least one of the following changes:

- introduce a new validation check (of any classification);
- remove an existing validation check (of any classification);
- change the classification of a validation check, whether upgrade (such as Error to Critical) or downgrade (such as Error to Warning);
- extend a validation check to include new features, conditions, etc., in a way that requires validation software manufacturers to change their software.



New Editions are likely to require validation software manufacturers to change their software or invalidate datasets which passed validation according to the previous Edition of S-158:101.

All cumulative revisions and clarifications must be included with the release of approved New Editions.

### 1.7.2.3 Revision

Revisions are defined as substantive semantic changes to S-158:101. Typically, revisions will change S-158:101 to correct factual errors or introduce necessary changes that have become evident as a result of practical experience or changing circumstances. Revisions include corrections of misinterpretations of S-100 or the S-101 Product Specification, or extensions to checks that do not require changes to validation software.

A revision must not be classified as a clarification. All cumulative clarifications must be included with the release of approved revisions.

### 1.7.2.4 Clarification

Clarifications are changes to S-158:101 arising from non-substantive reasons.

Typically, clarifications for non-substantive reasons remove ambiguity; correct grammatical and spelling errors; amend or update cross references; revise check messages or clarify check descriptions without requiring manufacturers to change their software.

### 1.7.2.5 Version numbers

The associated version control numbering to identify changes (n) to S-158:101 must be as follows:

New Editions denoted as **n.0.0**

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

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

## 2 Check Structure

Check structure in S-158:101 includes the fields specified in S-158 plus the additional fields specified in Table 2-1.

**Table 2.1 – Extensions to check structure**

Column Name	Description
S-58 Check(s)	Identifier of check from S-58 Edition 8.0.0 from which this check is derived. EXAMPLES: 519a
Linked Table	A reference to a table where additional information referenced in the check description is provided. EXAMPLE: Table of features with their conditional mandatory attributes.

S-101 also extends the check format by adding separate tables which are referenced in the check description. The information in these tables presents relationships between features and/or attributes which would lead to excessively complex expressions in the basic syntax or excessive duplication of checks. For example, a tabular representation of allowed combinations of values for attributes describing “nature of surface” and relevant qualifying terms:

**Table 2.2 - Tabulation of allowed combinations of values for attributes describing the nature of surface and relevant qualifying terms**

natureOfSurfaceQualifyingTerms	1	2	3	4	5	6	7	8	9
natureOfSurface									
1					x	x	x	x	x
2					x	x	x		
3					x	x	x		
4	x	x	x					x	x
5								x	x
6								x	x
7								x	x
8								x	x
9								x	x
11								x	
14				x		x			
17				x					x
18								x	x

### 3 Check Syntax

The check syntax conforms to the syntax and operators for product-specific checks described in S-158 clause 4.2.

### 4 Organisation

The list of validation checks for this edition of S-158:101 is available separately (see clause 9). The list of checks accompanies this specification and forms an integral part of it.

### 5 Other Applicable Checks

#### 5.1 Generic S-100 checks

S-101 datasets and exchange sets must also be validated using the following subset of the generic S-100 validation checks defined in S-158:100:

**Table 5.1 - Applicability of generic S-100 checks**

Document reference in S-158:100 list	Checks	Apply to	Remarks
Part 1	All	Product Specification	No direct implementation on datasets or exchange sets
Part 2 / 2a	All	Product Specification	No direct implementation on datasets or exchange sets
Part 4a	All	Exchange catalogue	

Document reference in S-158:100 list	Checks	Apply to	Remarks
Part 4b	All	Product Specification	No direct implementation on datasets or exchange sets
Part 5 / 5a	S100_Dev0069	Product Specification	No direct implementation on datasets or exchange sets
	S100_Dev0077 S100_Dev0468 S100_Dev0161 S100_Dev0162 S100_Dev0163 S100_Dev0164 S100_Dev0165 S100_Dev0166 S100_Dev0167 S100_Dev0168 S100_Dev0169 S100_Dev0170 S100_Dev0171	Datasets	
Part 6	S100_Dev0172 S100_Dev0173 S100_Dev0174	Datasets	
Part 7	All checks except those for arc, circle, and spline primitives or Level 3b geometry	Datasets	S-101 uses Level 3a geometry. S-101 does not use arc, spline, and circle spatial primitives
Part 8	None	N/A	Part 8 does not apply to S-101
Part 9 / 9a / 13	?	Product Specification	Validation checks for Portrayal Catalogue
Part 10a	All checks except those applicable to arc, circle, and spline primitives	Dataset	S-101 does not use arc, spline, and circle spatial primitives
Part 10b / 10c	None	N/A	Parts 10b and 10c do not apply to S-101
Part 11	S100_Dev0466	Dataset	There is only one Part 11 generic check, for dataset size
Part 15	?	?	
Part 17	All checks	Exchange catalogue Exchange set	
Other This row should not be needed.	S100_Dev0465	Dataset	This is currently tagged as “Not in 10a” but included among the generic S-100 checks. Suggest making it a product-specific check.

## 5.2 Interoperability checks

S-101 datasets and exchange sets intended for use on ECDIS must also pass the applicable interoperability checks from those listed in S-158:98.

## 6 Check Application Sequence

The check application sequence expands and modifies the application sequence described in S-158.

**Table 6.1 - Suggested application order of validation checks**

Order	Check Collection	Defined in	Apply to
1	S-100 generic checks for datasets	S-158:100	Dataset, in isolation
2	Product-specific checks for datasets	S-158:101	Dataset, in isolation
2.1	???	S-158:101 checks numbered Nxxx	Dataset, in isolation
2.2	???	S-158:101 checks numbered Nxxx	Dataset, in isolation
2.3	???	S-158:101 checks numbered Nxxx	Dataset, in isolation
3	Interoperability checks for single S-101 dataset	S-158:98	Dataset, in isolation
4	Inter-dataset, intra-product checks	S-158:101 checks numbered Nxxx	Adjacent or intersecting datasets
?	Inter-version checks(?)	S-158:101 checked numbered Nxxx	Related datasets for different versions of S-101
5	Interoperability checks for combinations of datasets from different products	S-158:98	S-101 dataset in combination with relevant datasets from other products (e.g., S-102)
6	S-100 generic checks for exchange sets	S-158:100	Exchange set
7	Product-specific checks for exchange sets  (Not applicable? Are checks for conforming to product-specific constraints covered by a generically-phrased S-100 check?)	S-158:101 checks numbered Nxxx	Exchange set
8	Product catalogue checks	S-158:128	S-128 datasets describing S-101 datasets

## 7 Check Classification

The check classification conforms to the scheme described in S-158.

## 8 Geometry and Spatial Operators

Geometry and spatial operators conform to the operators for vector products described in S-158.

For all spatial operators a default tolerance of  $1/CMFX$ ,  $1/CMFY$ , or  $1/CMFZ$  (corresponding to the coordinate axis) should be applied in validation software.

## 9 Other Components of this Specification

The other components of this Specification listed below are provided as separate documents or artefacts accompanying this document and form an integral part of this Specification.

- 1) Spreadsheet of S-101 validation checks named S158\_101\_1\_0\_0

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