

**Annex B (Informative)**

# **Validation Checks**

**Edition 1.0.0 – May 2022**

**IHO**



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Hydrographic  
Organization

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## Document History

Changes to this Specification are coordinated by the IHO S-100 Working Group. New editions will be made available via the IHO website. Maintenance of the Specification shall conform to IHO Resolution 2/2007 (as amended).

Version Number	Date	Approved By	Purpose
0.0.1	28 Aug 2020	RM	First draft. Reviewed by EM.
0.0.2	01 Nov 2021	J.Powell	Numerous revisions to take into account the S-98 Correspondence Group adjudication work.
1.0.0	May 2022	S-100WG	Submission to HSSC14 for approval.
1.0.0	May 2022	HSSC	Initial published version for evaluation and testing.

## B-1 Introduction

This Annex defines validation checks for developers of S-98 Interoperability Catalogues. The checks can be administered at any time during the production phase. They can also be applied downstream in the distribution and end user systems to test the conformance of an Interoperability Catalogue to the rules specified in S-100 Part 16 and S-98.

This Annex also defines tests for validating the operation of an Interoperability Catalogue on the data products to which it applies. As with the conformance checks, they can be applied by developers of Interoperability Catalogues or downstream in the distribution and end user systems.

The checks are based on the data quality measures and elements described in the “S-98 – Main” document (Clause 6) and Parts A/B/C/D (Clause 4 in each).

## B-2 References

- S-58 IHO Publication S-58, *ENC Validation Checks*, Edition 6.1.0, September 2018.
- S-97 Part C IHO Publication S-97, Part C, *IHO Data Quality Checklist*, Edition 1.0.0, [Draft, March 2019].
- S-100 IHO Publication S-100, *Universal Hydrographic Data Model*, Edition 5.0.0, June 2022.

## B-3 Check Classification

Checks are classified as Critical Error, Error, or Warning as described in Table B-1 below.

**Table B-1 - Classification of checks**

C	Critical Error	An error which would make a dataset unusable in ECDIS through not loading or causing an ECDIS to crash; or presenting data which is unsafe for navigation.
E	Error	An error which may degrade the quality of the dataset through appearance or usability but which will not pose a significant danger when used to support navigation.
W	Warning	An error which may be duplication or an inconsistency which will not noticeably degrade the usability of a dataset in ECDIS.

Checks are also categorized according to their scopes (see Clause 6 in “S-98 – Main”), as follows:

- Checks which apply to the Interoperability Catalogue itself are categorized as “IC” checks.
- Checks which apply to the output of interoperability operations in the interoperability catalogue are categorized as interoperability output (“OP”) checks.

## B-4 Check Application

Checks do not apply to dataset terminations or cancellations, except where the check description explicitly states it applies in case of a termination or cancellation.

The Catalogue checks apply to each Interoperability Catalogue file, which is considered in the S-100 sense of “dataset”.

There being no update format defined in S-98 Edition 1.0.x, checks are not designated as applying to “base” or “update” datasets.

## B-5 Check Syntax and Operations

### B-5.1 Check syntax

In order to ensure that checks can be interpreted clearly and consistently a defined syntax has been used for the reworded checks wherever possible. Each check is a statement which generates a Critical Error, Error or Warning if the expression returns 'true'.

Logical Consistency/ Conceptual Consistency	D2001	For each DepthArea, DredgedArea, LandArea, DockArea, LockBasin, UnsurveyedArea feature of geometric primitive area that is generated by an S100_1 hybridFeature rule AND OVERLAPS or is WITHIN another DepthArea, DredgedArea, LandArea, DockArea, LockBasin, UnsurveyedArea of geometric primitive area produced by a S100_1 hybridFeatureRule.	Skin of the earth features overlap.	Ensure features do D-4.2 (Qual. elem. D4) not overlap.	E
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**Figure B-1 - Check syntax example**

In the example in Figure B-1 the check would return true and give an Error if Skin of the Earth features generated by different hybridization rules overlap.

### B-5.2 Comparison and logical operators

The following comparison and logical operators are used:

- Equal
- Not equal
- Less than
- Less than or equal to
- Greater than
- Greater than or equal to
- AND
- OR (inclusive OR)

### B-5.3 Spatial operators

Within this document the spatial operators (EQUALS, DISJOINT, TOUCHES, WITHIN, OVERLAPS, CROSSES, INTERSECTS, CONTAINS, and COINCIDENT), based on those laid out in the ISO standard 19125-1, are used to describe spatial relationships tested within the checks.

For all spatial operators a default tolerance should be applied in validation software which is equivalent to 1 pixel on an ECDIS of the lowest acceptable resolution according to the Performance Standards at the minimum display scale of the S-101 dataset involved in the test.

### B-5.4 Values

The following terms are used for types of values:

- Present – An attribute is present and has been populated with:
  - a value (for attributes not derived from XML string type); or
  - the empty string (for attributes derived from the XML string type); or
  - empty content, and is nilled as specified in the W3C XML Specification.

- Null – An attribute is present and has no content or is nilled as specified in the XML specification.
- notNull – The attribute is present and has been populated with a value.

### **B-5.5 Statements**

The checks must be structured using the following statements:

- If – A conditional statement which determines whether a further statement should be executed.
- For – Repeat a statement until a statement is met (evaluates to “true”). For the purposes of the checks the statement being met generates the Error or Warning specified.

## **B-6 Geometry and Spatial Operators: Terms and Definitions**

The terms and definitions of geometry and spatial operators are as described in IHO Publication S-58, clause 2.

## **B-7 Validation Checks**

This draft contains only selected checks to demonstrate the concept. In the Tables that follow:

- IC means Interoperability Catalogue or “IC scope” depending on context.
- FC means Feature Catalogue.
- PC means Portrayal Catalogue.
- name1.name2 means XML content element “name2” in element “name1”. In the Application Schema, “name1” will be a class and “name2” will be an attribute or role.

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**B-7.1 Checks applicable to Interoperability Catalogues (IC scope)**

Quality measure	Check no.	Check description	Check Message	Check solution	Conformity (X-N.n means clause N.n in Part X of S-98)	Cat.
<b>Checks for Interoperability Catalogues of all levels</b>						
Completeness / omission	X0001	IF there is no file 098CCCCDICTIONARY.XML in the Exchange Set	Dictionary file with list of products must be included	Add products dictionary file	Main-4.1.1; Main-11	C
	X0002					
<b>Checks for Level 1 Interoperability Catalogues</b>						
Completeness / omission	A0001	IF the value of attribute S100_IC_InteroperabilityCatalogue.interoperability Level is not 1	Interoperability Level must be 1 in Level 1 catalogues	Correct interoperability Level attribute	A-3.3, item 4	C
<b>Checks for Level 2 Interoperability Catalogues</b>						
<b>Checks for Level 3 Interoperability Catalogues</b>						
Completeness / omission	C...	If the IC contains an S100_IC_HybridFeature element with outputproduct=HYBRID but there is no hybrid FC in the Exchange Set	Hybrid FC is missing	Add Hybrid FC	Logical consistency	C
<b>Checks for Level 4 Interoperability Catalogues</b>						

**B-7.2 Checks for interoperability processing output (OP scope)**

Quality measure	Check no.	Check description	Check Message	Check solution	Conformity	Cat.
<b>Checks for Interoperability Catalogues of all levels</b>						
<b>Checks for Level 1 Interoperability Catalogues</b>						
<b>Checks for Level 2 Interoperability Catalogues</b>						
<b>Checks for Level 3 Interoperability Catalogues</b>						
<b>Checks for Level 4 Interoperability Catalogues</b>						
Logical Consistency / Conceptual Consistency	D2001	For each DepthArea, DredgedArea, LandArea, DockArea, LockBasin, UnsurveyedArea feature of geometric primitive area that is generated by an S100_HybridFeature rule AND OVERLAPS or is WITHIN another DepthArea, DredgedArea, LandArea, DockArea, LockBasin, UnsurveyedArea of geometric primitive area produced by a S100_HybridFeatureRule.	Skin of the earth features overlap.	Adapt selection criteria or tolerance to ensure features do not overlap.	D-4.2 (Qual. elem. D4)	E