**S-98**



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**Annex B (Informative)**

**Validation Checks**

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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).

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| **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. |
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# 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).

# 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.

# 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.

# 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.

# Check Syntax and Operations

## 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’.

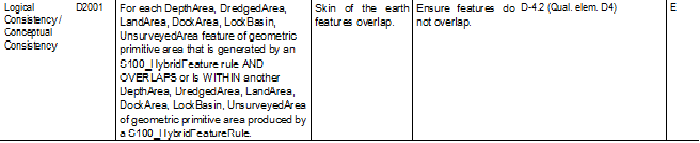


Figure B-1 - Check syntax example

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.

## 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)

## 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.

## 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.

## 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.

# 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.

# 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.
* The datasets referred to in different checks are only for those products covered by the interoperability catalogue (that is, listed in clause 1.2 (Main), which must also be listed in the product dictionary included with the interoperability catalogue).
* The checks listed in this Annex supplement the “S-100 level” checks being developed in the S-100 Working group, which should also be applied to interoperability catalogues where applicable (e.g., checking that there is a corresponding S100\_CatalogueDiscoveryMetadata block in the exchange set containing the IC).

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## 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.** |
| ***Checks for Interoperability Catalogues of all levels*** | | | | | | |
| Completeness / omission | S98\_X001 | 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 |
|  | S98\_X002 | IF the dictionary does not contain any of the data products listed in the PS | Dictionary of products does not conform to S-98 PS | Add missing product to dictionary | Main 4.1.1 | E |
| Completeness / omission | S98\_X003 | IF the value of attribute S100\_‌IC\_‌Interoperability‌Catalogue.interope‌rability‌Level does not match the caalogue level | Interoperability Level not compatible with IC | Correct interoperability Level attribute |  | C |
|  | S98\_X004 | IF the data product versions in the datasets do not match the product versions in the interoperability catalogue | Product versions of datasets incompatible with IC | Update or correct IC |  | E |
|  | S98\_X005 | IF the horizontal CRSs in the datasets are different | Data products use different horizontal datums. | Use products with matching datums |  | E |
|  | S98\_X006 | IF for any dataset there is no dataset from other product in any part of its scale range (from maximum/minimum display scales in discovery metadata) | Datasets have disjoint scale ranges | Add datasets to cover scale gaps, or confirm intent to omit | Overlap throughout the scale ranges is not essential, but a warning should be produced to catch | W |
|  | S98\_X007 | IF for any dataset there is no dataset from other product in any part of its geographic extent (from bounding polygon in discovery metadata). | Datasets have disjoint geographic extents | Add datasets to cover extent gaps, or confirm intent to omit | Overlap for the whole extents is not essential, but a warning should be produced. | W |
|  | S98\_X008 | If overlapping datasets have different vertical datums / sounding datums for depth and water level attributes in the areas of overlap | Data products use different vertical datums for depths | Use datasets with compatible vertical datums | Datasets with different vertical datums for depths and water levels cannot be used for WLA | W |
|  | S98\_X009 | If the populated region of an S-102, S-104, or S-111 dataset overlaps a dry land feature in S-101 | Water data overlaps land feature | Mask the part S-102, S-104, or S-111 overlapping dry land |  | W |
|  | S98\_X010 | The uncertainty in depth / sounding / water level on any one of S-101, S-102, S-104 is too high  (Too high defined as being in a different zone of confidence?) | Uncertainty too high for level adjustment | Use datasets with higher quality data |  | E |
| ***Checks for Level 1 Interoperability Catalogues*** | | | | | | |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
| ***Checks for Level 2 Interoperability Catalogues*** | | | | | | |
|  |  |  |  |  |  |  |
| ***Checks for Level 3 Interoperability Catalogues*** | | | | | | |
| Completeness / omission |  | 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 |
|  |  |  |  |  |  |  |
| ***Checks for Level 4 Interoperability Catalogues*** | | | | | | |
|  |  |  |  |  |  |  |

## Checks for interoperability processing output (OP scope)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Quality measure** | **Check no.** | **Check description** | **Check Message** | **Check solution** | **Conformity** | **Cat.** |
| ***Checks for Interoperability Catalogues of all levels*** | | | | | | |
|  | S98\_X201 | A feature are obscured in output | Obscured Features | Try higher level of interoperabityl |  | W |
| ***Checks for Level 1 Interoperability Catalogues*** | | | | | | |
|  |  |  |  |  |  |  |
| ***Checks for Level 2 Interoperability Catalogues*** | | | | | | |
|  |  |  |  |  |  |  |
| ***Checks for Level 3 Interoperability Catalogues*** | | | | | | |
|  |  |  |  |  |  |  |
| ***Checks for Level 4 Interoperability Catalogues*** | | | | | | |
| 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 |
|  |  |  |  |  |  |  |