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**Water Level Information for Surface Navigation Validation Checks**

**(Draft) Edition 0.1.0-20241023**

**Aligned to S-104 Edition 1.1.0**

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Document History

Changes to this Specification are coordinated by the IHO Tides, Water Level, and Cuirrents Working Group S-104 Project Team. New editions will be made available via the IHO web site. Maintenance of the Specification shall conform to IHO Resolution 2/2007 (as amended).

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| --- | --- | --- | --- |
| **Version Number** | **Date** | **Author/Editor** | **Purpose** |
| 0.1.0 | 2024-10-23 | RM | Initial draft for S100 Validation Checks GitHub repository. Based on the 2023 “combined” checks from the S-104 PT, which are aligned to S-104 Edition 1.1.0 and S-111 Edition 1.2.0. |
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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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# Introduction

This document specifies a set of checks that producers of S-104 Water Level Information for Surface Navigation validation tools must implement in their validation software. Validation software is used to ensure that S-104 data are compliant with the S-104 Product Specification. The initial list of checks for S-104 was compiled by the IHO S-104 Project Team of the IHO Tides, Water Level and Currents Working Group (TWCWG).

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).

## Scope

This document, designated as “S-158:104” by the IHO, specifies validation checks for data products conforming to Edition(s) 2.0.x of the S-104 (Water Level Information for Surface Navigation) Product Specification.

This document specifies product-specific validation checks for both S-104 datasets and exchange sets containing S-104 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-158:104, must be applied to test the validity of S-104 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.

The checks described are intended for production systems designed to produce S-104 datasets. The checks can be administered at any time during the production phase. All checks should be considered as warnings, even though more severe classifications are available, due to the status of the development and lack of experience with system use of S-104 datasets, it is considered premature to classify any checks as error or critical error at this time. All operators and spatial expressions are defined in Annex A.

## Conformance

This specification conforms to Edition 1.0.0 of IHO specification S-158 (Validation Checks – Introduction and Structure).

The validation checks described herein conform to Edition(s) 2.0.x of IHO Product Specification S-104 (Water Level Information for Surface Navigation).

## References

### Normative references

S-98 *Data Product Interoperability in S-100 Navigation Systems, IHO Publication S-98, Edition 2.0.0, ??? 2024*. In Preparation.

S-100 *IHO Universal Hydrographic Data Model*, Edition 5.2.0, June 2024

S-104 Water Level Information for Surface Navigation *Product Specification, Edition 2.0.0, ??? 2024*. In preparation.

S-158 *Validation Checks – Introduction and Structure, Edition 1.0.0, ??? 2024.* In preparation.

S-158:100 *Universal Hydrographic Data Model Validation Checks, Edition 1.0.0, ??? 2024*. In preparation.

### Informative references

ISO 19157:2013 *Geographic information – Data Quality.* As amended by Amendment 1, 2018

## Terms, definitions and abbreviations

### Terms and definitions

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

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 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

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)

### Abbreviations

This Specification uses the abbreviated terms defined in S-158.

In addition, this Specification uses the following abbreviated terms:

DCF Data Coding Format. Indicates the coverage type (see S-100 Part 10c clause 10c-10.1 – Data Coding Format). For S-104 Edition 2.0.0 the only coverage type is regular grids (DCF 2).

FDG Feature Data Group. The values group specified in S-100 Part 10c and represented by Level 3 and Level 4 in S-104 Table 10-2 (Overview of an S-104 data product).

FIDS Feature Information Dataset in “Group\_F” - see S-100 Part 10c. See S-104 Table 10-2 (Overview of an S-104 data product) and clause 10.2.2.2.

FINST Feature Instance. Instance of WaterLevel in S-104. Represents the WaterLevel.nn groups within the WaterLevel feature type group.

FTYPE Feature Type. Represents the container group WaterLevel in S-104. See Level 1 of S-104 Table 10-2 (Overview of an S-104 data product).

FTYPE.N Feature instance groups. “N” denotes the N-th Feature instance group in the dataset. See Level 2 of S-104 Table 10-2 (Overview of an S-104 data product).

FX Feature code. The alphanumeric code for a feature type, as specified in the feature catalogue. For S-104 Edition 2.0.0 there is a single feature type, whose feature code is “WaterLevel”.

<code> The code for an particular attribute in the values record. Codes for attributes defined in the Product Specification can also be found in the feature catalogue as well as in Group\_F in the HDF5 file. (Mismatches between the values record and the feature catalogue or Group\_F are errors.)

<name> The name of an attribute. Can be found in the feature catalogue as well as Group\_F in the HDF5 file.

### Symbols

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

## 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.

## General description

S-158:104 is a specification describing product-specific validation checks for S-104 products. There are no data products based directly on this edition of S-158:104 and therefore no general information applicable to data products conforming to it.

The validation checks are intended for production systems designed to produce S-104 Water Level Information for Surface Navigation datasets. The checks can be administered at any time during the production phase.

~~General information about data products conforming to this specification.~~

**~~Title:~~** ~~S-158:104 Water Level Information for Surface Navigation Validation Checks~~

**~~Abstract:~~** ~~This document describes validation checks for S-104 data products.~~

**~~Content:~~** ~~Not applicable~~

**~~Spatial Extent:~~**  ~~N/A~~

**~~Temporal Extent:~~** ~~N/A~~

**~~Specific Purpose:~~** ~~Validation of S-104 datasets and exchange sets.~~

## Specification metadata and maintenance

### Specification metadata

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

**Title:** Naviational Warnings Validation Checks

**Version:** 0.1.0

**Date:** 2024-10-21

**Language:** English

**Classification:** Unclassified

**Contact:** International Hydrographic Organization.

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**Role:** Owner

**URL:** <https://registry.iho.int>

**Identifier:** S-158:104

**Maintenance:** Changes to this Specification are coordinated by the IHO S-104 Project Team of the IHO Tides, Water Level and Currents Working Group 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.

### Specification maintenance

#### Introduction

Changes to S-158:104 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-158:104 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.

#### New Edition

*New Editions* of S-158:104 introduce significant changes. *New Editions* enable new concepts, such as the ability to support new functions or applications, the introduction of new constructs or data types, or significant changes to the basic information or check structure arising from a new edition of S-158. *New Editions* are likely to have a significant impact on either existing users or future users of S-104 and S-158:104. All cumulative *revisions* and *clarifications* must be included with the release of approved New Editions.

#### Revision

*Revisions* are defined as substantive semantic changes to S-158:104. Typically, *revision*s will change S-158:104 to correct factual errors or introduce necessary changes that have become evident as a result of practical experience or changing circumstances, including support for new revisions of S-158. A *revision* must not be classified as a clarification. *Revisions* could have an impact on either existing users or future users of S‑158:104. All cumulative *clarifications* must be included with the release of approved revisions.

Changes in a revision of S-158:104 may or may not correspond to the same revision+edition number of S-104.

#### Clarification

*Clarifications* are changes to S-158:104 arising from non-substantive reasons or from introduction of a new edition or revision of S-104.

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; or revise classifications of checks as critical/error/warning. A *clarification* must not cause any substantive semantic change to S-158:104.

Clarifications to S-158:104 for alignment to a new edition or revision of S-104 may update validation checks or add new validation checks. Validation checks for older but still active editions or revisions of S-104 wil be retained but may be marked as *Deleted* for the new edition/revision of S-104.

#### Version numbers

The associated version control numbering to identify changes (n) to S-158:104 must be as follows:

New Editions denoted as **n**.0.0

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

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

# Check Structure

Check structure in S-158:104 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** |
| --- | --- |
| Prerequisites | Checks which must succeed (check condition evaluates to FALSE) before this check can be executed.  Trivial prerequisites are omitted from this column (such as requiring the presence of an attribute before using it in a condition). |
| Terminate if failure | Whether failure of the check (the check condition evaluates to TRUE) will force termination of check processing before all validation checks can be executed. Valid values are TRUE, FALSE, or none (equivalent to FALSE).  The HDF5 format is hierarchical and the validity or even the existence of certain parts of the dataset depends on structure or content required to be provided in the dataset. Validation checks for such fundamental structure or content have this field set to TRUE so that subsequent checks which depend on that structure or content are not unnecessarily attempted if the fundamental sturucture or content fails its own validation check.  For example, checks on groups which are members of another group are not attempted if the container group is missing. |
| Context | Sets the context for a check, such as a particular coverage type (which is indicated by the value of an HDF5 attribute as specified in S-100), a group, or other element (e.g., an HDF5 array), or test the value of a metadata attribute. |

Termination of check processing need not be immediate, but is recommended at the end of the validation phase during which the failure occurs. Validation phases are explained in clause 4.

# Check Syntax

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

# Organisation

The list of validation checks for this edition of S-158:104 is available separately (see clause 9). The list of checks accompanies this specification and forms an integral part of it.

The numeric component of the check ID is a 4-digit number whose first digit indicates the phase to which the check belongs (see Table 4-1 below).

Table 4-1 - Division of product-specific checks into processing phases

| **Phase** | **Check Numbers** | **Name** | **Description** |
| --- | --- | --- | --- |
| 1 | S104\_Dev1xxx | Validate Dataset Root and Feature Information | Validation of root group of HDF5 file and feature type information. |
| 2 | S104\_Dev2xxx | Validate Feature Container Groups | Validation of metadata and structure for each feature type (“Feature Container”). In S-104 there is one feature container so this set of checks is executed only once. |
| 3 | S104\_Dev3xxx | Validate Feature Instance Groups | Validation of feature instances. This set of checks, along with Phase 4 checks, must be executed once for each feature instance group contained within a feature container. |
| 4 | N/A | Validate Positioning Groups | There are no Phase 4 checks for S-104, which does not use positioning groups. This phase is mentioned in this table only for compatibility with S-158:1xx for coverages which do use positioning groups. |
| 5 | S104\_Dev5xxx | Validate Values Datasets | Validation of data values. This set of checks is applied to the values group in a feature instance group. |
| 6 | S104\_Dev9xxx | Validate Exchange Catalogue | This set of checks relates to product-specific requirements for exchange catalogues |

Dataset validation checks the structure and content of individual HDF5 data files. The checks for each HDF5 dataset file are divided into four phases

# Other Applicable Checks

## Generic S-100 checks

S-104 datasets and exchange sets must also be validated using the following subset of the generic S-100 validation checks defined in S-158:100:

| **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 |  |
| 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 | Datasets | Inapplicable:  S100\_Dev0168  S100\_Dev0169  S100\_Dev0170  S100\_Dev0171 |
| Part 6 | S100\_Dev0172  S100\_Dev0173  S100\_Dev0174 | Datasets |  |
| Part 7 | Only checks for polygons | Domain extent polygons | S-104 uses vector geometry only for domain extent polygons. Note also that domain extent polygons as used in S-104 do not have interior boundaries. |
| Part 8 | Only checks applicable to regular grid coverages | Dataset |  |
| Part 9 / 9a / 13 | ? | Product Specitication | Validation checks for Portrayal Catalogue |
| Part 10a | None | N/A | S-104 does not use the ISO 8211 format |
| Part 10b | None | N/A | S-104 does not use the S-100 GML format |
| Part 10c | Only checks applicable to regular grid coverages | Dataset | S-104 uses only the regular grid coverage type |
| Part 11 | S100\_Dev0466 | Dataset | There is only one Part 11 generic check, for dataset size |
| Part 15 | ? | ? |  |
| Part 17 | All checks except those applying to metadata elements not used in S-104 | Exchange catalogue  Exchange set |  |

[ALTERNATIVE clause 5.1]

S-104 datasets and exchange sets must also be validated using the subset of generic S-100 validation checks listed in [insert location – sheet, file, etc.]

## Interoperability checks

S-104 datasets and exchange sets intended for use on ECDIS must also pass the applicable interoperability checks from those listed in S-158:98.

# 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-158:104 | Dataset, in isolation |
| 2.1 | Root group checks | S-158:104 checks numbered S104\_Dev1xxx | Dataset, in isolation |
| 2.2 | Feature Container group checks | S-158:104 checks numbered S104\_Dev2xxx | Dataset, in isolation |
| 2.3 | Feature Instance group checks | S-158:104 checks numbered S104\_Dev3xxx | Dataset, in isolation |
| 2.4 | Values group checks | S-158:104 checks numbered S104\_Dev5xxx | Dataset, in isolation |
| 3 | Interoperability checks for single S-104 dataset | S-158:98 | Dataset, in isolation |
| ~~4~~ | Inter-dataset, intra-product checks | S-158:104 checks numbered Nxxx | Adjacent or intersecting datasets |
| ? | Inter-version checks(?) | S-158:104 checked numbered Nxxx | Related datasets for different versions of S-104 |
| 5 | Interoperability checks for combinations of datasets from different products | S-158:98 | S-104 dataset in combination with relevant datasets from other products (e.g., S-104) |
| 6 | S-100 generic checks for exchange sets | S-158:100 | Exchange set |
| 7 | Product-specific checks for exchange sets | S-158:104 checks numbered S104\_Dev9xxx | Exchange set |
| 8 | Product catalogue checks | S-158:128 | S-128 datasets describing S-104 datasets |

# Check Classification

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

# Geometry and Spatial Operators

S-104 Edition 2.0.0 datasets use vector geometry only for domain extent polygons. Any spatial operators mentioned in checks on domain extent polygons conform to the operators for vector products described in S-158.

For all spatial operators a default tolerance of [??? - PT to decide] should be applied in validation software.

# 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-104 validation checks named S158\_104\_0\_1\_0\_YYYYMMDD of the latest build date. (The build date is the YYYYMMDD suffix in the file name.)