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**Underkeel Clearance Management Validation Checks**

**(Draft) Edition 1.0.0-20250411**

**Aligned to S-129 Edition 2.0.0**

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Document History

Changes to this Specification are coordinated by the S-129 Project Team (S-129 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).

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| --- | --- | --- | --- |
| **Version Number** | **Date** | **Author/Editor** | **Purpose** |
| 0.1.0 | 2024-09-30 | RM | Initial draft for S100 Validation Checks GitHub repository |
| 0.2.0 | 2024-12-04 | RM | Extended conformance statement; revised maintenance clause |
| 0.3.0 | 2025-04-08 | JR | Updates to Clauses 1, 2, 6, 8, and 9.  Added Clause 4.1.  Updated spreadsheet list of S-158:129 Validation Checks to add new checks, while removing duplicate generic checks. Also re-ordered the list in accordance with refined check application sequence. |
| 1.0.0 | 2025-04-11 | JR | Versioned to 1.0.0. No changes from 0.3.0 |
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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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Contents Page

[1 Introduction 1](#_Toc195024859)

[1.1 Scope 1](#_Toc195024860)

[1.2 Conformance 1](#_Toc195024861)

[1.3 References 1](#_Toc195024862)

[1.3.1 Normative references 1](#_Toc195024863)

[1.3.2 Informative references 1](#_Toc195024864)

[1.4 Terms, definitions and abbreviations 2](#_Toc195024865)

[1.4.1 Terms and definitions 2](#_Toc195024866)

[1.4.2 Abbreviations 3](#_Toc195024867)

[1.4.3 Symbols 3](#_Toc195024868)

[1.5 Use of language 3](#_Toc195024869)

[1.6 General description 3](#_Toc195024870)

[1.7 Specification metadata and maintenance 3](#_Toc195024871)

[1.7.1 Specification metadata 3](#_Toc195024872)

[1.7.2 Specification maintenance 4](#_Toc195024873)

[2 Check Structure 5](#_Toc195024874)

[3 Check Syntax 5](#_Toc195024875)

[4 Organisation 5](#_Toc195024876)

[4.1 Check numbers 5](#_Toc195024877)

[5 Other Applicable Checks 6](#_Toc195024878)

[5.1 Generic S-100 checks 6](#_Toc195024879)

[5.2 Interoperability checks 7](#_Toc195024880)

[6 Check Application Sequence 7](#_Toc195024881)

[7 Check Classification 8](#_Toc195024882)

[8 Geometry and Spatial Operators 8](#_Toc195024883)

[9 Other Components of this Specification 8](#_Toc195024884)

# Introduction

This document specifies a set of checks that producers of S-129 Underkeel Clearance Management (UKC) validation tools must implement in their validation software. Validation software is used to ensure that S-129 UKC data are compliant with the S-129 Product Specification. The initial list of checks for S-129 was compiled by the S-129 Project Team for the IHO.

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-158:129” by the IHO, specifies validation checks for data products conforming to Edition(s) 2.0.x of the S-129 (Underkeel Clearance Management) Product Specification.

This document specifies product-specific validation checks for both S-129 datasets and exchange sets containing S-129 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-158:129, must be applied to test the validity of S-129 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.

## 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-129 (Underkeel Clearance Management).

Edition 1.0.0 is an Implementation version in accordance with IHO TR 2/2007 and there may be revisions issued by the Working Group prior to the Operational Edition 2.0.0 being published.

## References

### Normative references

S-98 *Data Product Interoperability in S-100 Navigation Systems, IHO Publication S-98, Edition 2.0.0, ??? 2025*. In Preparation.

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

S-129 *Underkeel Clearance Management Product Specification, Edition 2.0.0, ??? 2024*. In preparation.

S-158 *Validation Checks – Introduction and Structure, Edition 1.0.0, ??? 2025.* In preparation.

S-158:100 *Universal Hydrographic Data Model Validation Checks, Edition 1.0.0, ??? 2025*. 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:

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

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)

relationship

semantic connection among model elements [ISO 19103]

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

### Abbreviations

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

### 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-158:129 is a specification describing product-specific validation checks for S-129 products. There are no data products based directly on this edition of S-158:129 and therefore no general information applicable to data products conforming to it.

## Specification metadata and maintenance

### Specification metadata

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

**Title:** Underkeel Clearance Management Validation Checks

**Version:** 0.3.0

**Date:** 2025-03-31

**Language:** English

**Classification:** Unclassified

**Contact:** International Hydrographic Organization.

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**Role:** Owner

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

**Identifier:** S-158:129

**Maintenance:** Changes to this Specification are coordinated by the S-129 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.

### Specification maintenance

#### Introduction

Changes to S-158:129 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-158:129 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-158:129 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-158:129.

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-158:129. Typically, revisions will change S-158:129 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-129, 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.

#### Clarification

Clarifications are changes to S-158:129 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.

#### Version numbers

The associated version control numbering to identify changes (n) to S-158:129 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-158:129 includes the fields specified in S-158 plus the additional fields specified in Table 2-1.

The optional Data Quality Measures column is not used in S-158:129.

Table 2-1 – Extensions to check structure

| **Column Name** | **Description** |
| --- | --- |
| Apply To | An indicator of check applicability by type of dataset:  See Table 2-2 for the codes and their meanings. |

Table 2-2 - Indicators for "Apply To" column

| **Code** | **Subject of check** | **Description** |
| --- | --- | --- |
| B | Base | Apply check to new dataset, new edition, and post-update dataset (after updates have been applied to the base). |
| U | Update | Apply check to update datasets in isolation. |
| S | Post-update | Apply check only to a post-update dataset (i.e. subsequent to application of all available updates). |

# 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-158:129 is available separately (see clause 8). The list of checks accompanies this specification and forms an integral part of it.

## Check numbers

Checks are assigned unique check identifiers in the format 129\_<checkNumber><optionalAlphaSuffix>.

* The prefix “129\_” is common to all the S-129 specific checks defined in this Specification.
* <checkNumber> is a 4-digit number assigned to each check. There is no significance attached to the value of this number.
* A modified check will generally retain the same <checkNumber> as their predecessor.
* If a check is deleted, its number is not reused for later different checks, but may be re-introduced if the original check is revived either with or without modification.
* <optionalAlphaSuffix> is an optional single lower case alphabetic letter suffix in the range a-z. It is used only when a check is split into two or more checks.

EXAMPLES: 129\_1002, 129\_2036a, 129\_2036b.

# Other Applicable Checks

## Generic S-100 checks

S-129 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 | N/A | Product Specification | No direct implementation on datasets or exchange sets |
| Part 2 / 2a | N/A | Product Specification | No direct implementation on datasets or exchange sets |
| Part 4a | All Collection A checks | Exchange catalogue |  |
| Part 4b | N/A | Product Specification | No direct implementation on datasets or exchange sets |
| Part 5 / 5a | S100\_Dev0069 (not applied to datasets or exchange sets | 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 | Only checks in Collection A, if any | Datasets |  |
| Part 7 | All checks in Collection A except those for arc, circle, and spline primitives or Level 3b geometry | Datasets | S-129 uses Level 3a geometry.  S-129 does not use arc, spline, and circle spatial primitives |
| Part 8 | None | N/A | Part 8 does not apply to S-129 |
| Part 9 / 9a / 13 | N/A | Product Specification | Validation checks for Portrayal Catalogue |
| Part 10a | None | N/A | S-129 does not use the ISO 8211 format |
| Part 10b | All checks in Collection A | Dataset | Generic validation checks for the S-100 GML format |
| Part 10c | None | N/A | S-129 does not use the S-100 HDF5 format |
| Part 11 | S100\_Dev0466 | Dataset | There is only one Part 11 generic check, for dataset size |
| Part 15 | All collection A checks | Exchange catalogue  Exchange set |  |
| Part 17 | All checks in Collection A except those applying to elements not used in S-129 | Exchange catalogue  Exchange set |  |

## Interoperability checks

S-129 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-158:129 | Dataset, in isolation |
| 2.1 | Spatial integrity checks | S-158:129 checks numbered 1xxx | Dataset, in isolation |
| 2.2 | Thematic integrity checks | S-158:129 checks numbered 2xxx | Dataset, in isolation |
| 2.3 | Association integrity checks | S-158:129 checks numbered 3xxx | Dataset, in isolation |
| 2.4 | Dataset structural conformance | S-158:129 checks numbered 4xxx | Dataset, in isolation |
| 3 | Interoperability checks for single S-129 dataset | S-158:98 | Dataset, in isolation |
| 4 | Interoperability checks for combinations of datasets from different products | S-158:98 | S-129 dataset in combination with relevant datasets from other products (e.g., S-102) |
| 5 | S-100 generic checks for exchange sets | S-158:100 | Exchange set |
| 6 | Product-specific checks for exchange sets | S-158:129 checks numbered 5xxx | Exchange set |
| 7 | Product catalogue checks | S-158:128 | S-128 datasets describing S-129 datasets |

# Check Classification

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

# Geometry and Spatial Operators

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

For all spatial operators the following default tolerance should be applied in validation software, in accordance with S-158:100 Edition 1.0.0, Clause 7.2:

* 10-7 degrees if the axis unit is decimal degrees
* 10-2 metres when the axis unit is metres

# 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-129 validation checks named S158\_129\_1\_0\_0\_20250411