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# Ships and marine technology — ECS database

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# Contents

# Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 19379 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 6, *Navigation*.

# Introduction

This standard covers the Content, Quality, Updating and Testing of the Electronic Charting System (ECS) Database. This standard does not cover the system (hardware and operating software) on which the ECS Database is used. Its purpose is to clearly define the *minimum* acceptable requirements for electronic chart data to support a system of electronic charts with maximum safety, efficiency, and convenience. All four of the requirements—contents, quality, updating and testing—seriously impact safety of navigation. Hence the provisions of the Standard that define these requirements are made with care, since safety is the paramount concern of the Standard. All four of the requirements lend themselves to precise description, definition and measurement. Hence it is reasonable to rely on a Standard to assure a major contribution to navigation safety when using a compliant electronic chart.

ECS are Electronic Chart Systems that do not meet all of the requirements of the IMO ECDIS Performance Standard (IMO Resolution A.817(19)).

National maritime regulatory authorities may wish to require compliance with this Standard as a qualification for use in regulated systems of electronic navigation in their countries.

# Ships and marine technology — ECS database

## 1    Scope

This International Standard is applicable to the database produced for use in those systems of electronic charts known as ECS. It covers those elements of the database that contribute directly to safety of navigation when in harbors, pilot waters, approaches to land or coastal areas. These elements are: content, quality, updating and testing.

## 2    Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

**IMO Resolution A. 817 (19)** : *Performance standards for electronic chart display and information systems (ECDIS)*

**IHO S-52** : *Specifications for chart content and display aspects of ECDIS*

**IHO S-57** : *Transfer standard for digital hydrographic data*

**IEC 61174** : *Maritime navigation and radiocommunication equipment and systems – Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results*

RTCM Recommended Minimum Standards for ECS Version 2.1

## 3    Terms and definitions

For the purposes of this standardInternational Standard, the following terms and definitions apply.

**3.1**
**Electronic Chart Display and Information System (ECDIS)**
a navigation information system which with adequate back-up arrangements, can be accepted as complying with the up-to-date chart required by regulation V/20 of the 1974 SOLAS Convention, by displaying selected information from a system electronic navigational chart (SENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and by displaying additional navigation-related information if required

**3.2**
**Electronic Chart System (ECS)**
a navigation information system that electronically displays real-time vessel position and relevant nautical chart data from the ECS database on a display screen, but does not meet all the IMO requirements for ECDIS

**3.3**
**ECS DATABASE**
the database, standardized as to content, quality and updating, issued for use with an ECS. The ECS database must deliver to the mariner at a minimum the same level of information relevant to the safety of navigation available from the latest edition of the nautical chart

**3.4**
**Vector Data Presentation**
a method of representing individual chart features digitally by points, lines and polygons given through their coordinates and appropriate code(s)

**3.5**
**Raster Data Presentation**
a method of representing all, or part, of a chart digitally by a matrix-like scheme of pixels or gridpoints

**3.6**
**Nautical Chart (** or **Nautical Publication)**
a special-purpose map or book, or a specially compiled database from which such a map or book is derived, that is issued officially by or on the authority of a Government, authorized Hydrographic office or other relevant government institution and is designed to meet the requirements of marine navigation

**3.7**
**Working Database**
a database separate from or in addition to the ECS Database, containing additions, changes and updates to the ECS Database

**3.8**
**Conspicuous features**
bjects, either natural or artificial, that are distinctly and notably visible


# 4   Requirements

## 4.1   ECS Database Contents Requirements

### 4.1.1   Contents of the ECS Database

**4.1.1.1**      Data content, information content and accuracy of the ECS Database must deliver to the mariner at a minimum the same level of information relevant to the safety of navigation available from the latest edition of the Nautical Chart of the area.

**4.1.1.2**      The ECS Database may be compiled from multiple sources.

**4.1.1.3**      The Nautical Chart can be integrated with data from other sources provided that such integration does not degrade it and the ECS Database is identified as using data not derived from the Nautical Chart.

**4.1.1.4**      When sources differ in content and/or accuracy, the most accurate and up-to-date shall be used. The ECS Database manufacturer shall maintain a traceable record of sources used.

**4.1.1.5**      Generalisation of the ECS Database, starting from best detail, can be made by the ECS Database producer, provided that the generalised Database cannot be used separate from the non-generalised portion of the ECS Database, i.e. the ECS user can always zoom in to check best detail.

### 4.1.2   Details of Contents

At a minimum the ECS Database shall contain the following elements when available from Nautical Charts?

### 4.1.2.1    Information above and below the High Water Line

a)   Depth contours of 2,5,10 and 20 meters, or in other comparable units.

b)   Spot Soundings.

c)   Indication and details of all isolated dangers.

d)   Navigable canals, navigable rivers.

e)   Boundaries: e.g. fairways, channels and dredged areas.

f)   Drying Line.

g)   Coastline.

h)   Bridges, overhead cables with horizontal and vertical clearances.

### 4.1.2.2    Navigation Aids

a)   Indication of fixed and floating aids to navigation

b)   Details of aids to navigation normally found on paper charts including, but not limited to, navigation markings and numbers.

c)   Ranges with leading lines.

d)   Traffic Routeing Systems and Separation Schemes.

e)   Recommended routes.

f)   Conspicuous features.

### 4.1.2.3    Other Hazardous Features

a)   Submarine cables and pipelines.

b)   Prohibited, restricted and cautionary areas such as;

   1)   Restricted area.

   2)   Fishing prohibited areas.

   3)   Areas to be avoided.

   4)   Military practice area.

   5)   Anchorage prohibited areas.

   6)   Anchorage areas.

   7)   Pipeline areas.

   8)   Cable areas.

   9)   Special areas: e.g. fishing grounds, offshore production areas, dumping areas.

c)   Ferry Routes.

#### 4.1.2.4    Textual Information

a)    Indication and contents of cautionary notes relating to safety of navigation.

b)    Place names.

#### 4.1.2.5    Metadata

a)    ECS database producer and identification of the source Nautical Charts and source Nautical Publications.

b)    Date the ECS database is current to.

c)    Geodetic datum, and the offset to WGS84 if known ("Unknown" if data not available).

d)    Sounding Datum and Vertical Datum.

e)    Scale boundaries or database resolution boundaries if different.

f)    [Identification of Data Quality.

   All parts of the ECS Database compiled from sources with reduced reliability shall contain information useful to generate an appropriate warning for the user. This information may be encoded by one or more of the following means?

   1)    A parameter (i.e. quality indicator or class of use) indicating reduced quality of source data, encoded within the relevant geographical unit of the Database (e.g. the cell or chart file). This solution is applicable to ECS Databases in both vector and raster format.

   2)    A text string with a wording indicating reduced quality of source data, encoded as part of the ECS Database and repeated at appropriate intervals all over the affected areas. This solution is only applicable to ECS Databases in vector format.

   3)    A meta-feature (i.e. a feature with area geometry, containing information for other features), with appropriate attributes indicating reduced quality of source data, encoded as part of the ECS Database and extending all over the affected areas. This solution is only applicable to ECS Databases in vector format, based on an object-oriented data model.

   4)    Other equivalent methods that ensure that the user of the database is informed of the reduced quality of source documents.]

### 4.2   ECS Database Quality Requirements

The concept of database quality incorporates the process by which the ECS Database is produced, the source materials, the resolution and reproduction accuracy of chart features, and the correctness and completeness of data. These items shall be incorporated in the producer's program of Quality Assurance.

#### 4.2.1   Product specification

The producer of the ECS Database shall generate and maintain a product specification for the Database, describing?

a)    The compliance with any industrial, governmental or international standard and regulation, when applicable.

b)    The type-approval or classification certificates issued for the product, when applicable.

c)    The data structure of the ECS Database, i.e. vector or raster.

d) The properties of the ECS Database, especially as regards its quality and reliability: resolution, maximum allowable errors in reproduction accuracy, maximum allowable error in completeness of encoding, etc.

e) The packaging of the ECS Database, including how the various parts, sections or units that the Database consists of are assembled into individual products.

f) The way in which the ECS Database can be updated.

g) Any known limitation in the use of the ECS Database.

### 4.2.2 Process Control

The producer of the ECS Database shall implement a process control, in order to ensure that the Database complies with its own specification. For this purpose, the producer shall generate and maintain the following documents?

a) Written procedures for selection, purchasing, inspection and acceptance of source materials.

b) Written procedures for all critical phases of the process, including registration of source materials, geo-referencing, geo-rectification, conversion to digital format (raster or vector), and compilation into final product.

c) Written procedures for quality control of both intermediate and final products, including handling of non-conformities, preventive and corrective actions.

d) Encoding specifications (vector data only), i.e. rules describing which information is captured from source documents and how it is classified in form of features and geometric primitives in the ECS Database.

### 4.2.3 Source Documents

**4.2.3.1** In the context of this standard, source document is any material, in analog (paper) or digital (electronic) form, used as source of information for compiling the ECS Database. Typical source documents include, but are not limited to, the following?

a) Nautical charts.

b) Nautical publications (e.g. Lists of Lights and Radio Signals, Sailing Directions, Notice to Mariners, etc.).

c) Hydrographic surveys.

d) Topographic surveys.

e) Imagery.

**4.2.3.2** Source documents can be issued by both governmental Agencies (Hydrographic Offices, Coast Guards, Maritime Administrations, Port Authorities, etc.) and private Organizations. Source documents used for compiling the ECS Database shall contain the following information, when applicable?

a) Horizontal datum and offset to WGS-84.

b) Sounding datum.

c) Vertical datum.

d) Scale.

e) Minimum and maximum coordinates of the area covered.

f) All elements needed for geo-referencing (borders with marks, gridlines), when the source is paper chart.

**4.2.3.3**    Exceptions to the above requirements are only permitted for documents representing the sole available source of navigational information in a given area.

**4.2.3.4**    The producer of the ECS Database shall maintain a log of all source documents used for the Database, reflecting the sources actually used for each edition, version, or subset of the Database. The record for each source document shall include as a minimum the following information：

a)  Issuing Authority, Organization, or Company.

b)  Identification according to the issuing body (e.g. catalog number).

c)  Edition (or re-print, or re-issue, etc.) number and date.

**4.2.3.5**    Alternatively, the above can be encoded in the ECS Database itself, in a form such to allow its querying, retrieval and display by appropriate means (e.g. as parameters for logical storage units of the Database, or as meta-data, etc.).

### 4.2.4  Resolution

**4.2.4.1**    Resolution of the ECS Database is a quantity depending on the digitizing hardware and software, encoding procedures, etc. In general, it is the size (at the scale of the source document) of the smallest unit used to store positions. For vector data, it corresponds to the size of the smallest coordinate unit or sub-unit; for raster data, to the size of the pixels that the bitmap consists of. In both cases, the resolution indicates the size of the smallest spatial feature that can be discriminated, or the minimum distance between two spatial features collected as separate entities.

**4.2.4.2**    Resolution of the ECS Database shall be such to ensure that the ECS may generate a detailed, truthful and comprehensible representation of the information derived from source documents, when the ECS Database is displayed at the same scale as the source. In any case, resolution shall be not coarser than 0,2 mm at scale 1:1, or 0,2*N mm at scale 1:N on the source.

### 4.2.5  Reproduction Accuracy

**4.2.5.1**    Reproduction accuracy is defined as the true distance (at the scale of the source document) between the geographic position of a given feature as provided by the source and the position of the corresponding entity as reproduced in the ECS Database.

**4.2.5.2**    In theory, reproduction accuracy should be expressed in units of resolution (meaning that it cannot be better than resolution). For the purpose of this standard however, accuracy requirements are defined by an absolute value.    Reproduction accuracy of any element of the ECS Database shall be not worse than 0,5 mm at scale 1:1, or 0,5*N mm at scale 1:N on the source.

### 4.2.6  Correctness and completeness of encoding (vector data only)

**4.2.6.1**    Correctness and completeness of encoding shall be in accordance with the encoding specifications implemented by the producer of the ECS Database, and shall comply with the following minimal requirements：

a)  The ECS Database shall not contain any encoding error such to endanger safety of navigation. These errors, referred to as critical encoding errors, are listed in the **Table 1**.

b)  Any other encoding error is classified as non-critical. The number of features affected by non-critical encoding errors shall not exceed 1 every 200 features encoded in the ECS Database (corresponding to an acceptance criterion of 99,50%).

**4.2.6.2**    In the context of this standard, an encoding error (either critical or non-critical) is defined as a discrepancy between the ECS Database and the source (or sources) from which it is compiled, including all Notices to Mariners applied to the ECS Database in form of updates.

**4.2.6.3**    The definitions of critical encoding errors are based on the assumption that the relevant information is provided by the source (or sources) from which the ECS Database is compiled.

**Table 1**

| Feature | Critical encoding errors |
|---------|--------------------------|
| Depth contours of 2, 5, 10 and 20 meters, or comparable in other units | ?? Missing feature<br><br>?? Wrong or missing depth value |
| Spot soundings less than 30 meters | ?? Missing feature<br><br>?? Wrong or missing depth value |
| Isolated dangers with depth less than 30 meters (or with depth unknown, when considered dangerous to surface navigation) | ?? Missing feature<br><br>?? Attribution to the wrong feature class (e.g. rock instead of wreck)<br><br>?? Wrong or missing depth value<br><br>?? Wrong or missing indication of water level (e.g. emerged instead of underwater) |
| Navigable canals, navigable rivers | ?? Missing feature<br><br>?? Wrong depth value |
| Fairways, channels, dredged areas | ?? Missing feature<br><br>?? Wrong or missing depth value<br><br>?? Wrong or missing year of dredging |
| Drying line | ?? Missing feature |
| Coastline | ?? Missing feature |
| Bridges, overhead cables on navigable waters | ?? Missing feature<br><br>?? Wrong or missing horizontal or vertical clearance |
| Fixed and floating aids to navigation | ?? Missing feature<br><br>?? For all IALA marks: wrong or missing attribution to IALA class (e.g. cardinal instead of lateral) or sub-class (e.g. port instead of starboard); wrong or missing encoding of functional characteristics (e.g. wrong colour, shape, number)<br><br>?? For all marine or aeromarine lights: wrong or missing colour(s), characteristics (e.g. fixed instead of flashing), signal period, signal group (e.g. Fl instead of Fl(3)), range and sector limits |

| Feature | Critical encoding errors |
|---|---|
| Traffic routing systems and separation schemes | ?? Missing feature<br><br>?? Attribution to wrong feature class (e.g. recommended traffic lane instead of traffic separation scheme lane)<br><br>?? Wrong or missing orientation of traffic separation scheme lanes<br><br>?? Wrong or missing traffic indication (e.g. one-way instead of two ways)<br><br>?? Wrong or missing depth value of deep water routes |
| Recommended routes | ?? Missing feature<br><br>?? Wrong or missing traffic indication (e.g. one-way instead of two ways) |
| Conspicuous features (i.e. objects either natural or artificial that are distinctly and notably visible from seaward) | ?? Missing feature<br><br>?? Wrong description, or attribution to wrong feature class (e.g. chimney instead of mast) |
| Submarine cables and pipelines | ?? Missing feature |
| Prohibited, restricted and cautionary areas | ?? Missing feature<br><br>?? Wrong or missing encoding of the prohibition, restriction, regulation, function or caution relevant to the area |
| Ferry routes | ?? Missing feature |
| Cautionary notes relating to safety of navigation | ?? Missing feature<br><br>?? Wrong encoding of the cautionary note, when this alters the significance of the information (i.e. excluding typos) |

## 4.3   ECS Database Updating Requirements

Every nautical chart must be updated to be useful and safe. The producer of the ECS Database shall be responsible for regularly acquiring and distributing to his customers the updating data that is to be applied to his database. It will be necessary for the producer to provide evidence of an existing procedure currently available to his customers that meets this requirement for updating.

**4.3.1**   The database, when made available by the producer, must be at least as current and up-to-date as the best Nautical Charts for the area, with a timeliness compliant with the standards set herein.

**4.3.2**   Updates to the ECS Database shall be published by the ECS Database producer at least once per month, and contain all Notices to Mariners relevant to the digital Nautical Charts contained in the ECS Database and received by the producer (or made openly available by e.g. publication on the Internet) before the 15th day of the

preceding month. In those areas where updates to the Nautical Charts are less frequent than monthly, updates to the ECS Database may have the same frequency as the updates to the Nautical Charts.

**4.3.3**    The ECS Database producer shall publish an update to the ECS Database, containing the New Edition or the New Chart, within the shortest possible time, in accordance with its production process, the time when the relevant source document(s) are received from the producing Agency, and the total number of New Editions and New Charts to be processed at the same moment.

**4.3.4**    In case that, upon receipt of a Notice to Mariners by which a New Edition or Chart is announced, the ECS Database producer is unable to include the New Edition or Chart in the next update as mentioned in section **4.3.2.** above, the ECS Database producer shall include in the update a note that the affected Nautical Chart (with a reference to the chart number and description of the chart), contained in the ECS Database, is no longer current.

**4.3.5**    Sections **4.3.2** and **4.3.3** may be satisfied by replacing the entire ECS Database.

**4.3.6**    Ensuring the integrity of the updating process (e.g. applying the updates to a database being used by a customer) is left to the ECS Performance Standard.

# 5    Test methods

## 5.1    General

This Section contains specific, quantitative descriptions of the tests to be conducted, the amount of sampling, and the frequency and the extent of re-testing applicable to the ECS Database. The specification is not applicable to the performance of the ECS Equipment.

## 5.2    Documentation

It shall be determined that the ECS database producer has generated and maintained documentation as described in **4.2.1**, **4.2.2** and **4.2.3**.

## 5.3    Test sample

[The test procedure shall frequently and randomly select samples from the ECS database. The selection shall be representative of the size of the ECS database as well as its intended purpose.]

### 5.3.1    Testing tools

**5.3.1.1**    It is the responsibility of the ECS Database producer to prepare and provide the necessary equipment (including any needed hardware and software) to perform the tests to be made on their particular database.

**5.3.1.2**    At a minimum, the producer shall provide an ECS Database Testing Equipment. This is a device, consisting of an ECS, or a dedicated software program executed on a standard PC, capable of performing the following operations?

a)    When a raster image has been used as source, to check that the resolution of the raster image is not coarser than the coarsest value allowed by this standard.

b)    Load the ECS Database in its native format, i.e. the same format in which it is distributed to customers.

c)    Display the ECS Database using colors and symbols such to permit the testing specified by this standard.

d)    Go to a selected geographic position.

e)    Provide information about the current scale of display.

f)   Move a pointer (such as a crosshair) on the representation of the ECS Database, and display the geographic coordinates at each specific position of the pointer.

g)   Measure the distance [in real-world length units] between two positions.

h)   Provide the following information for the test sample that is displayed (reading it from the ECS Database itself) ?

   1)   Reference to the source document(s).

   2)   Horizontal datum, parameters for converting positions to/from WGS-84 if the horizontal datum is different from WGS-84, or the information that the horizontal datum is unknown, when applicable.

   3)   Sounding datum.

   4)   Vertical datum.

   5)   Intended display scale.

   6)   Date to which the test sample is updated.

## 5.3.2   Cartographic framework

Check that the all metadata listed under 4.1.2.5 is included for the test sample.

## 5.3.3   Resolution

### 5.3.3.1   For vector data

Using the tools provided by the database manufacturer?

a)   When a raster image has been used as source, check that the resolution of the raster image is not coarser than the coarsest value allowed by this standard.

b)   Check the resolution of the ECS database, by observing the position of point objects, or of vertexes along lines or polygons, and ensure that they are placed on a grid not coarser than the coarsest resolution allowed by the standard.

### 5.3.3.2   For raster data

Check that the resolution of the raster image is not coarser than the coarsest value allowed by this standard using the tools provided by the database manufacturer.

## 5.3.4   Reproduction accuracy

Testing of reproduction accuracy shall be based on comparing positions on the source document(s) with the corresponding positions in the ECS Database. It is recommended that such test not be conducted by overlapping a print out of the ECS Database over the source when the source is paper. The following methods should be applied for testing of reproduction accuracy?

### 5.3.4.1   Testing Reproduction Accuracy of an ECS Database in Raster Format

**5.3.4.1.1**   For each test sample, reproduction accuracy shall be tested at all intersections of parallels with meridians visible on the source document(s). Points along the chart border (and in particular, the chart's four corners) shall not be tested for reproduction accuracy.

**5.3.4.1.2**   The reproduction accuracy at all intersections shall result equal to or better than the limit set in this standard.

**5.3.4.1.3** For each intersection using the function provided by the ECS Database Testing Equipment verify that the distance [in real world length units] between the position from the source and the position from the ECS Database is equal to or less than 0,5*N mm, where 1:N is the scale at which the ECS Database is currently displayed by the equipment.

### 5.3.4.2 Testing Reproduction Accuracy of an ECS Database in Vector Format

**5.3.4.2.1** Testing of reproduction accuracy for this type of ECS Database shall be based on features other than intersections of parallels with meridians. For this purpose, conspicuous features whose position can be unequivocally identified shall be used. Features that are suitable for testing reproduction accuracy include, but are not limited to, the following？

a) Point features represented on both the source document(s) and the ECS Database by symbols marking their exact position, such as lighthouses, buoys and beacons.

b) Conspicuous vertexes of line/area features, such as sharp corners along man-made shoreline, or corners of restricted/regulated areas.

**5.3.4.2.2** Reproduction accuracy shall be tested, as a minimum, at 20 different locations for each test sample. The reproduction accuracy at all locations shall be equal to or better than the limit set in this standard.

**5.3.4.2.3** The actual testing procedure depends on the process by which the ECS Database is produced. In most cases, the process can be categorized as either of the following types？

a) Paper-to-vector conversion; the paper chart is converted to digital vector format by mean of a digitizing table, with no intermediate step. Reproduction accuracy shall be tested by comparing the geographic coordinates of each feature, measured on the source document, with the coordinates of the corresponding feature as encoded in the ECS Database. For each feature using the function provided by the ECS Database Testing Equipment, verify that the distance [in real world length units] between the position on the source and the position on the ECS Database is equal to or less than 0,5*N mm, where 1:N is the scale of the source.

b) Raster-to-vector (or head-up) digitizing; the paper chart is first converted to digital raster format by mean of a scanner, and the resulting raster image vectorized on a CAD workstation. Reproduction accuracy can be tested using the same procedure as above, or (more conveniently) verifying the reproduction accuracy of the raster image that represents the intermediate stage of the digitizing process, then comparing the geographic coordinates of each feature, measured on the raster chart, with the coordinates of the corresponding feature as encoded in the ECS Database. The following procedure can be used？

   1) Verify the reproduction accuracy of the raster chart, using the same procedure described for ECS Databases in raster format. For this purpose, the ECS Database manufacturer shall provide a dedicated equipment, on which the raster chart can be loaded, and all operations necessary for its verification performed.

   2) Then, for each feature using the function provided by the ECS Database Testing Equipment, verify that the distance [in real world length units] between the position on the source, and the position on the ECS Database is equal to or less than 0,5*N mm, where 1:N is the scale of the source.

### 5.3.4.3 Horizontal datum

In order to check reproduction accuracy of the ECS Database by comparing its coordinates with coordinates in the source document(s), positions must be referred to a common horizontal datum. If the ECS Database has positions referred to a different horizontal datum, the shift values (as stored in the ECS Database) shall be taken into account.

### 5.3.4.4 Alternative testing procedures

Alternative procedures for testing of pre-production accuracy may be required, depending on the type of ECS Database (vector or raster), the production/verification tools implemented by the manufacturer in its own process,

etc. Procedures different from those described above may be accepted, provided that they are found to be equivalent to the procedures described in **5.3.4.1** and **5.3.4.2**.

### 5.3.5 Correctness and completeness of encoding (vector data only)

Compare the contents of the test sample with the contents of the source data and verify for correctness and completeness as specified in **4.2.6.**

### 5.3.6 Updating

By checking the ECS Database Manufacturer's documentation, verify that the ECS Database and its updates comply with the requirements of **4.3.1, 4.3.2,** and **4.3.3**.

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