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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.

Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

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 electronically display real-time vessel position and relevant nautical chart data and information from the ECS Database on a display screen, but do not meet all of the IMO requirements for ECDIS.

National regulatory authorities may wish to require compliance with this standard as guidance for data used in ECS or other systems of electronic navigation regulated in their countries.

Ships and marine technology — ECS database

1   Scope

In general, this standard applies to the production of an ECS Database by an entity other than a government. It covers those elements of the database that contribute directly to safety of navigation. These elements are: content, quality, updating and testing.

2   Normative references

The following normative documents contain provisions that, 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)*

3   Terms and definitions

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

3.1
Electronic Chart Display and Information System (ECDIS)
a navigation information system which is defined in the IMO Performance Standard for ECDIS (IMO Resolution A.817(19)), as amended.

3.2
Electronic Chart System (ECS)
a navigation information system that electronically displays vessel position and relevant nautical chart data and information 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.

3.4
Vector Data Presentation
a method of representing individual chart features digitally by points, lines and polygons and text given through their coordinates, attributes 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
objects, 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 The ECS Database must contain, at a minimum, the same level of data and information relevant to the safety of navigation (identified in Section **4.1.2**) that is available from the latest edition of the Nautical Chart.

4.1.1.2 The ECS Database may be compiled from multiple sources.

4.1.1.3 Data and information derived from the Nautical Chart can be integrated with data from other sources, provided that such integration does not degrade the data or information from the Nautical Chart and the ECS Database is identified as using data or information 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

See Sections 5.2.2 and 5.2.5 for test provisions related to 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) All depth contours up to and including a depth of 50 meters

b) All spot soundings up to and including a depth of 50 meters.

c) Indication and details of all isolated dangers with a depth less than 50 meters (or with depth unknown, when considered dangerous to surface navigation), for example: wrecks, rocks, obstructions, offshore platforms, breakers, etc.

d) Navigable canals, navigable rivers.

e) Boundaries, for example: fairways, channels dredged areas and swept areas.

f) Drying Line.

g) Coastline.

h) Bridges, overhead pipelines and cables with horizontal and vertical clearances over navigable water.

4.1.2.2   Navigation Aids

a) Indication and details of all fixed and floating aids to navigation including, navigation markings and numbers.

b) Navigation lines.

c) Traffic Routeing Systems and Separation Schemes.

d) Recommended routes.

e) Conspicuous features.

4.1.2.3   Other Features

a) Submarine cables and pipelines.

b) Areas for which special conditions exist such as;

    1) Anchorage areas and anchorage prohibited areas

    2) Restricted areas, for example: cautionary areas, prohibited areas, fishing prohibited areas, areas to be avoided.

    3) Regulated areas, for example: fishing grounds, offshore production areas, dumping areas.

    4) Military practice areas.

    5) International boundaries and national limits.

c) Ferry Routes.

d) Nature of the seabed, for example: sand, mud, rocks, sponge, etc.

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 Chart. All parts of the ECS Database compiled from sources other than the Nautical Chart or from other official government sources shall contain information in the metadata that the ECS manufacturer may use to generate an appropriate warning to the user.

b) Date the ECS Database is current through. If the database is produced from multiple Nautical Charts, then the date the ECS Database is current through should be the date associated with the latest update to the least up-to-date Nautical Chart.

c) The horizontal geodetic datum of a vector format ECS Database must be WGS-84. The horizontal geodetic datum of a raster format ECS Database should be WGS84, but it may be produced in its source datum provided the offset to WGS84 is provided in the metadata.   If the ECS Database includes an area for which the datum is unknown, an indication shall be provided in the metadata.

d) Sounding Datum and Vertical Datum.

e) Scale boundaries or database resolution boundaries, if different

f) An indication of the suitability of the ECS Database for a specific intended navigational purpose, based upon the scale and positional accuracy of the source data and the reproduction accuracy, that may be used by the ECS manufacturer to notify the user that the ECS Database is suitable for use in conjunction with a continuous positioning system of an accuracy consistent with the requirements of safe navigation, as follows:

Table 1. Suitability of the Database for Various Purposes

Navigational Purpose	Scale of Source Data	Horizontal Tolerance of ECS Database
Can be used in restricted waters	$\geq$ 1:20,000	$\leq$ 10 meters
Can be used to approach a harbour	$\geq$ 1:50,000	$\leq$ 50 meters
Can be used for coastal navigation	$\geq$ 1:100,000	$\leq$ 100 meters
Should not be used in conjunction with a continuous positioning system		> 100 meters

4.1.2.6   Other Information

The ECS Database should include other information necessary for the ECS manufacturer to work with the ECS Database such as horizontal and vertical units of measurement, etc.

4.2 ECS Database Quality Requirements

4.2.1   Product specification.

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.

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 such as vector, raster, both vector and raster, or other.

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 ECS Database producer shall have in place a recognized quality system, for example: **ISO 9000**. Within the producer's quality system, there shall be procedures to assure that the ECS Database complies with the producer's product specification and with the requirements of this standard, including the following:

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 internal quality assurance 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 and notices (e.g. Lists of Lights and Radio Signals, Sailing Directions, Notice to Mariners, etc.),

c) hydrographic surveys,

d) topographic surveys, and

e) imagery.

4.2.3.2 Source documents can be issued by both governmental Agencies (for example: Hydrographic Offices, Coast Guards, Maritime Administrations, Port Authorities) 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 (for example: borders with marks, gridlines, projection, etc.), 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

See Section 5.2.3 for test provisions relating to 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. For example:

Table 2. Resolution of the Database

Scale	Ground Resolution not worse than:
1:1,000 1:10,000 1:50,000	0.2 meter 2.0 meter 10.0 meter

4.2.5   Reproduction Accuracy

See Section 5.2.4 for test provisions relating to 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   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

See Sections 5.2.2 and 5.2.5 for test provisions relating to completeness of encoding

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 that might endanger safety of navigation. These errors, referred to as critical encoding errors, are listed in the **Table 3**.

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 3. Critical Encoding Errors

Feature	Critical encoding errors
Depth contours up to and including a depth of 50 meters.	• Missing feature • Wrong or missing depth value
Spot soundings up to and including a depth of 50 meters.	• Missing feature • Wrong or missing depth value
Indication and details of isolated dangers with a depth less than 50 meters (or with depth unknown, when considered dangerous to surface navigation)	• Missing feature • Attribution to the wrong feature class (e.g. rock instead of wreck) • Wrong or missing depth value • Wrong or missing indication of water level (e.g. emerged instead of underwater)
Navigable canals, navigable rivers	• Missing feature • Wrong depth value
Boundaries	• Missing feature • Wrong or missing depth value • Wrong or missing year of dredging
Drying line	• Missing feature

Feature	Critical encoding errors
Coastline	• Missing feature
Bridges, overhead pipelines and cables with horizontal and vertical clearances over navigable water.	• Missing feature • Wrong or missing horizontal or vertical clearance
Indication and details of fixed and floating aids to navigation	• Missing feature • 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) • 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
Navigation lines	• Missing feature
Traffic routing systems and separation schemes	• Missing feature • Attribution to wrong feature class (e.g. recommended traffic lane instead of traffic separation scheme lane) • Wrong or missing orientation of traffic separation scheme lanes • Wrong or missing traffic indication (e.g. one-way instead of two ways) • Wrong or missing depth value of deep water routes
Recommended routes	• Missing feature • Wrong or missing traffic indication (e.g. one-way instead of two ways)
Conspicuous features	• Missing feature • Wrong description, or attribution to wrong feature class (e.g. chimney instead of mast)
Submarine cables and pipelines	• Missing feature

Feature	Critical encoding errors
Areas for which special conditions exist	• Missing feature • Wrong or missing encoding of the prohibition, restriction, regulation, function or caution relevant to the area
Ferry routes	• Missing feature
Nature of the seabed	• Missing feature • Wrong encoding of the nature of the seabed
Indication and contents of cautionary notes relating to safety of navigation	• Missing feature • Wrong encoding of the cautionary note, when this alters the significance of the information (excluding typos) for example: exclusion of cautionary notes outside the "neatline" of the paper Nautical Chart in the raster database.
Metadata	• Missing encoding of the ECS Database producer • Missing or wrong encoding of the source Nautical Chart • Missing or wrong encoding of the date the ECS Database is current through • Missing or wrong encoding of the horizontal geodetic datum or offset to WGS84 • Missing or wrong encoding of the sounding datum • Missing or wrong encoding of the vertical datum • Missing or wrong encoding of scale boundaries or database resolution boundaries • Missing or wrong encoding of the navigational purpose • Missing or wrong encoding of the database suitability

4.3 ECS Database Updating Requirements

The producer of the ECS Database shall be responsible for regularly acquiring and making available to his customers the updating data that is to be applied to the customers' 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. See Section 5.2.6 for test provisions relating to 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 timeliness compliant with the standards set herein.

4.3.2   The ECS Database producer shall publish a list of current updates to each ECS Database and the dates that they were issued, and make it available at least once per month.

4.3.3   The ECS Database producer shall publish updates to the ECS Database and make them available at least once per month. The updates shall contain all Notices to Mariners relevant to the 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.

4.3.4   The ECS Database producer shall publish an update to the ECS Database, containing the New Edition or the New Chart, and make it available 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.

4.3.5   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.

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

4.3.7   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 Testing of final product

Testing of the final product shall be based on sampling in accordance with recognized procedures, for example: **ISO 2859**.

5.2.1   Testing tools

5.2.1.1   Testing is performed through use of an ECS Database Testing Device. 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 colours 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 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.

5.2.1.2   The ECS Database producer shall maintain an ECS Test Database produced using INT 3 (from IHO publication M-4) as the source Nautical Chart.

5.2.2 Cartographic framework

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

5.2.3 Resolution

See Section 4.2.4 for requirements relating to Resolution

5.2.3.1 For vector data

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.

5.2.3.2 For raster data

Check that the resolution of the raster image is not coarser than the coarsest value allowed by this standard.

5.2.4 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. See Section 4.2.5 for requirements relating to Reproduction Accuracy. The following methods should be applied for testing of reproduction accuracy:

5.2.4.1 Testing Reproduction Accuracy of an ECS Database in Raster Format

5.2.4.1.1   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.

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

5.2.4.1.3   For each intersection using the function provided by the ECS Database Testing Device verify that the distance 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.

5.2.4.2 Testing Reproduction Accuracy of an ECS Database in Vector Format

5.2.4.2.1   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.

5.2.4.2.2   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.

5.2.4.2.3   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 Device, verify that the distance 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 by 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 Device, verify that the distance 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.

5.2.4.3 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.

5.2.4.4   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 **5.2.4.1** and **5.2.4.2**.

5.2.5   Correctness and completeness of encoding (vector data only). Compare the Details of Contents of the test sample, as required in Section 4.1.2, with the contents of the source data and verify for correctness and completeness as specified in 4.2.6.

5.2.6   Updating

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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