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Paper for Consideration by TSMAD

Lights Modelling in S-101

Submitted by:	S-101 Data Classification and Encoding Guide Coordinator
Executive Summary:	The modelling for the encoding of lights in S-101 has changed significantly from the single LIGHTS object in S-57. This paper describes the changes made so far, summarises some of the discussion and reasoning behind these changes, and poses questions for TSMAD and possible scope for a lights modelling "workshop" to finalise encoding guidance for lights in the "baseline" DCEG.
Related Documents:	S-101 Appendix A – Data Classification and Encoding Guide.
Related Projects:	S-101 Development.

Introduction / Background

S-101 Appendix A – Data Classification and Encoding Guide (DCEG) will be the document for S-101 ENC compilers describing the binding of S-100 features, attributes and enumerates as contained in the corresponding S-101 Feature Catalogue, as well as providing guidance as to why and how to encode data for S-101 compliant ENC's so as to provide optimum, consistent navigational information to the mariner.

Experience with S-57, as well as additional functionality available in S-100 (such as the introduction of complex attributes), has resulted in significant discussion and development of revised modelling for lights in S-101. However, the discussions to date have indicated that in some aspects of the re-modelling of lights in S-101, there are different approaches that could be taken, each having their own advantages and disadvantages. It is considered that wider TSMAD discussion is required in order to determine the "best" solution.

Analysis / Discussion

When discussing the re-modelling of lights for S-101, the TSMAD DCEG Sub-Working Group considered the following factors:

- Reduce the complexity of rules for encoding lights that currently exist in S-57 (e.g. reduce the number of "conditional" mandatory attribute requirements);
- Devise more logical and efficient modelling for the different types of marine navigational lights;
- Remove the requirement to encode multiple lights to define a single physical light (e.g. sectored lights); and
- Reduce/eliminate S-52 Conditional Symbology Procedures for the display of lights in ECDIS.

As a result of DCEG Sub-Working Group discussions to date, the single **LIGHTS** object class in S-57 has been separated out to four distinct S-101 light features:

- Light All Around;
- Light Sectored;
- Light Fog Detector; and
- Light Air Obstruction.

The latest DCEG draft section for encoding lights is included at Attachment 1 to this Paper.

Based on the work of the DCEG Sub-Working Group, the following are some of the issues/questions that have been raised:

1. Lights feature types:

Do the four lights types adopted in the draft DCEG fit the IALA view of marine navigation lights?

2. Directional lights:

Original S-101 modelling included a separate light feature for directional lights. The issue of having to encode multiple S-57 **LIGHTS** objects to define each sector of a sectored light has been resolved by including a complex attribute "light sector" (current multiplicity [0,*]) for the Light Sectored feature. However, it was determined that having two separate feature types for sectored light and directional light resulted in additional complexity in encoding (e.g. encoding a multi-sectored light having a central directional "sector"), and for some scenarios resulted in the possibility of encoding the same real world instance in more than one way (e.g. a light not having an associated directional line, but a "narrow" sector considered to be directional). It has therefore been decided to include the encoding of directional lights using the sectored light feature type.

To allow for the encoding of directional lights, the current modelling for Light Sectored as reflected at Attachment 1 includes a Boolean attribute "directional" [0,1] and a complex attribute "directional character" [0,1] nested within the complex attribute "light sector":

Light sector			C	1,*
Colour	(COLOUR)	1 : white 3 : red 4 : green 5 : blue 6 : yellow 9 : amber 10 : violet 11 : orange	(S) EN	1,*
Exhibition condition of light	(EXCLIT)	1 : light shown without change of character 2 : daytime light 3 : fog light 4 : night light	(S) EN	0,1
Directional			(S) BO	0,1
Directional character			(S) C	0,1
Moiré effect			BO	0,1
Orientation			(S) C	1,1
Orientation uncertainty			(S) RE	0,1
Orientation value	*(ORIENT)*		(S) RE	1,1
Light visibility	(LITVIS)	1 : high intensity 2 : low intensity 3 : faint 4 : intensified 5 : unintensified 6 : visibility deliberately restricted 8 : partially obscured 9 : visible in line of range	(S) EN	0,*

The intention of this modelling is that if the Boolean “directional” is populated as “true”, the production software flags the “directional character” complex attribute as mandatory and the “sector limit” sub-complex attribute as optional. If the Boolean “directional” is not populated (i.e. is “false”), the production software flags the “directional character” sub-complex attribute as redundant and the “sector limit” sub-complex attribute as mandatory. The issue with this modelling is that the sub-complex attributes “directional character” and “light sector” are “conditional” mandatory attributes, however the presence of the Boolean “directional” allows for this to be potentially managed within the production software.

As an alternative to this modelling, it has been suggested that the directional sector be removed from the complex attribute “light sector” and included as a discrete complex attribute “directional sector” for the Light Sectored feature type:

Directional sector			C	0,1
Colour	(COLOUR)	1 : white 3 : red 4 : green 5 : blue 6 : yellow 9 : amber 10 : violet 11 : orange	(S) EN	1,*
Exhibition condition of light	(EXCLIT)	1 : light shown without change of character 2 : daytime light 3 : fog light 4 : night light	(S) EN	0,1
Light visibility	(LITVIS)	1 : high intensity 2 : low intensity 3 : faint 4 : intensified 5 : unintensified 6 : visibility deliberately restricted 8 : partially obscured 9 : visible in line of range	(S) EN	0,*
Moiré effect			BO	0,1
Orientation			(S) C	1,1
Orientation uncertainty			(S) RE	0,1
Orientation value	*(ORIENT)*		(S) RE	1,1
Rhythm of light			(S) C	1,1
Light characteristic	(LITCHR)	1 : fixed 2 : flashing 3 : long-flashing 4 : quick-flashing 5 : very quick-flashing 6 : ultra quick-flashing 7 : isophased 8 : occulting 9 : interrupted quick-flashing 10 : interrupted very quick flashing 11 : interrupted ultra quick flashing 12 : morse 13 : fixed and flash 14 : flash and long-flash 15 : occulting and flash 16 : fixed and long-flash 17 : occulting alternating 18 : long-flash alternating	(S) EN	1,1

		19 : flash alternating 25 : quick-flash plus long-flash 26 : very quick-flash plus long flash 27 : ultra quick-flash plus long flash 28 : alternating 29 : fixed and alternating flashing		
Signal group	(SIGGRP)		(S) TE	0,* (ordered)
Signal period	(SIGPER)		(S) RE	0,1
Signal sequence	*(SIGSEQ)*		(S) C	0,* (ordered)
Signal duration			(S) RE	1,1
Signal status		1 : lit 2 : eclipsed	(S) EN	1,1
Sector limit			(S) C	0,1
Sector limit one	(SECTR1)		(S) RE	1,1
Sector limit two	(SECTR2)		(S) RE	1,1
Value of nominal range	(VALNMR)		(S) RE	0,1
Information			(S) C	0,*
Language		ISO 639-3	(S) TE	0,1
Text	*(INFORM)* *(NINFOM)*		(S) TE	1,1
Sector extension			IN	0,1

The issue with this revised modelling is that “at least one of” the complex attributes “light sector” or “directional sector” must be populated for an instance of Light Sectored (i.e. “conditional” mandatory attributes).

Other options that may be considered are:

- Re-introducing the feature type Light Directional and removing directional attributes from Light Sectored. This would require careful consideration of rigid encoding rules so as to ensure that the issue of encoding the same scenario in more than one way is not being introduced.
- “Simplifying” the current modelling by removing the Boolean “directional” from the “light sector” complex, resulting in “at least one of” the sub-complex attributes “directional character” or “sector limit” being required for each instance of the complex “light sector”.
- ……..?

3. Characteristics of light sectors:

The modelling for Light Sectored at Attachment 1 has been amended from the draft DCEG submitted for TSMAD review (October 2013) to nest the complex attribute “rhythm of light” as a sub-complex within the “light sector” complex. This allows for the encoding of different light characteristics for each sector of a sectored light, e.g. for complex (oscillating) directional lights with multiple sectors. As a result of this change, “rhythm of light” may require population multiple times with identical values for its sub-attributes for “simpler” sector lights (e.g. Fl WRG). This is considered a necessary duplication in order to ensure that all encoding scenarios can be covered.

4. Lights obscured/partially obscured by obstructions:

The current S-101 modelling for obscured or partially obscured light sectors is summarised as follows:

- In all cases, any light having an obscured sector (whether deliberately obscured or obscured by an obstruction) or a partially obscured sector is considered to be a Sectored Light (i.e. is not considered to be an "all around light with an obscured/partially obscured sector"). This is consistent with the current definitions for Light All Around ("An all around light is a light that is visible over the whole horizon of interest to marine navigation and having no change in the characteristics of the light") and Light Sectored ("A sectored light is a light having one or more sectors, which have different characteristics across, and sometimes within, each sector").
- For any sector within which the light is completely obscured over the whole horizon of interest to marine navigation, an instance of the complex attribute "light sector" is not encoded for the Light Sectored feature (the enumerate value *7* (obscured) has been removed as an allowable value for the sub-attribute "light visibility").
- For any sector within which the intensity of the light is reduced due to partial obstruction, an instance of the complex attribute "light sector" is encoded with appropriate values for the sub-attribute "light visibility" (e.g. *3,8* (faint, partially obscured)).
- For any sector within which the light is obscured in the navigable area beyond an offshore obstruction (see sector (b) in figure A at clause 18.3.1.1 in Attachment 1 below), an instance of the complex attribute "light sector" is encoded with the sub-attribute "value of nominal range" populated with the value corresponding to the distance from the light to the offshore obstruction, and the sub-attribute "light visibility" populated with value *3* (partially obscured). If the offshore obstruction is at an elevation that is lower then the elevation of the light, such that the light may be visible at a distance beyond the obstruction due to the vertical line of sight angle, this may be populated using the sub-complex attribute "information" for the "light sector" complex.

Another modelling option that has been discussed is the addition of an "obscured sector" complex attribute, bound to the Light All Around feature type, to encode all obscured/partially obscured sectors caused by an obstruction:

Obscured sector			C	0,*
Partially obscured			(S) BO	0,1
Sector limit			(S) C	1,1
Sector limit one	*(SECTR1)*		(S) RE	1,1
Sector limit two	*(SECTR2)*		(S) RE	1,1
Information			(S) C	0,*
Language		ISO 639-3	(S) TE	0,1
Text	*(INFORM)* *(NINFOM)*		(S) TE	1,1

With this revised modelling, sectors that are deliberately obscured would be treated as in the current modelling, i.e. a Light Sectored encoded having no sector corresponding to the deliberately obscured sector.

An issue with this approach is the possibility for encoding the same real world instance in more than one way (e.g. an obscured sector could be encoded as a Light All Around or a Light Sectored). However, this suggested revised modelling resulted in the question being asked as to whether there is a "better" way to model obscured/partially obscured sectors of lights.

5. Directional lines:

The S-57 UOC includes a work-around for encoding directional lights having an associated recommended track and/or navigation line. The current draft DCEG has retained this work-around. Is there a requirement to address this work-around in the modelling, or can it be done in the portrayal?

6. Strip lights:

The S-57 UOC includes a work-around for encoding a strip light that serves the purpose of a navigational light. The current draft DCEG has removed this work-around, but to date no revised modelling has been suggested for strip lights that are considered to be navigation lights. It has, however, been suggested that this can be addressed in portrayal, but there needs to be some mechanism in the data to distinguish between a non-navigational strip light and a navigational strip light.

Conclusion

The questions/issues raised above are a few of the many that have been raised by the S-101 DCEG Sub-Working Group over the past few years. The resultant discussions have ended in numerous iterations for the modelling of lights in the draft DCEG. The DCEG Sub-Working Group concedes that there is a degree of compromise that will need to be applied in regard to the modelling of lights in S-101, and considers that a more focussed effort is required in order to find the "best" compromise considering all discussions so far, and any additional "fresh" input. It is also expected that additional improvements to the modelling will be identified through testing of the baseline S-101.

Recommendations

1. That TSMAD establish a focus group of interested participants to "workshop" the current modelling of lights feature types in S-101, through a breakout meeting during TSMAD27. Any amendments made to the modelling at the end of TSMAD27 should be considered to be the "baseline" modelling from which S-101 test beds are developed in regard to lights. Further work post-TSMAD27 to be conducted by correspondence, with consultation with local lights authorities and IALA as required.

Justification and Impacts

While the modelling for lights in the current draft S-101 DCEG may be considered to be adequate, sufficient alternate modelling proposals have been raised to warrant more focussed discussion in order to optimise the modelling of lights in S-101 Edition 1.0.0. Such discussions will impact on the baseline version of S-101 in the short term and the IHO Geospatial Information Registry and S-101 Edition 1.0.0 in the longer term.

Action required of TSMAD

TSMAD is invited to:

a. Agree to the formation of a focus group to complete the baseline modelling of lights for S-101; and
b. Approve a breakout meeting during TSMAD27 to discuss the issues raised in this paper and apply appropriate changes to the current modelling for lights in S-101.

18 Lights

For the purpose of encoding lights in ENC, the following features must be used, depending on the type of light:

- **Light All Around** (see clause X.X) for lights having the same character over the whole horizon of interest to marine navigation (all-round lights)), excluding fog detector and air obstruction lights;
- **Light Sectored** (see clause X.X) for lights having one or more sectors which have different characteristics, including directional lights and lights having obscured or partially obscured sectors;
- **Light Fog Detector** (see clause X.X) for lights used to automatically determine conditions of visibility which warrant the turning on or off of a sound signal; and
- **Light Air Obstruction** (see clause X.X) for lights marking an obstacle which constitutes a danger to air navigation.

When encoding a light, the combination of the character and purpose of the light must be evaluated in order to determine the most appropriate light feature from the above list.

18.1 Lights: General

18.1.1 Rhythms of lights (see S-4 – B-471.2)

The principal character of a light is its rhythm (although, strictly, fixed lights and some alternating lights are not “rhythmic”).

If it is required to encode the rhythms of lights, this must be done using the complex attribute **rhythm of light**, sub-attributes **light characteristic** and **signal group**. When populating **rhythm of light**, the sub-attributes **signal group**, **signal period** and **signal sequence** are only valid for non-fixed lights (i.e. sub-attribute **light characteristic** ≠ *1* (fixed)), with **signal group** and **signal period** being mandatory.

The use of these sub-attributes is defined in the following table; it contains the most common examples of coding; other coding combinations are possible:

Rhythms of lights	F	Oc	Oc(2)	Oc(2+3)	Iso	Fl	Fl(3)	LFl
light characteristic	*1*	*8*	*8*	*8*	*7*	*2*	*2*	*3*
signal group	*prohibited*	*(1)*	*(2)*	*(2+3)*	*(1)*	*(1)*	*(3)*	*(1)*

Rhythms of lights	Q	Q(3)	IQ	VQ	VQ(3)	IVQ	UQ	IUQ
light characteristic	*4*	*4*	*9*	*5*	*5*	*10*	*6*	*11*
signal group	*(1)*	*(3)*	*( )*	*(1)*	*(3)*	*( )*	*(1)*	*( )*

Rhythms of lights	Mo(K)	FFl	Q(6)+LFl	VQ(6)+LFl	Al.WR	Al.Fl.WR	Al.Fl(2W+1R)	Al.Oc(4)WR
light characteristic	*12*	*13*	*25*	*26*	*28*	*19*	*19*	*17*
signal group	*(K)*	*()(1)*	*(6)(1)*	*(6)(1)*	*( )*	*(1)*	*(2+1)*	*(4)*

Some lights recently constructed may appear to the mariner as "fixed and flashing - FFL" by night, while the real-world feature actually comprises two separate lights vertically disposed, one fixed and the other flashing (F&Fl). When it is known that two separate features actually exist, they must be encoded as separate light features, in this case two **Light All Around** features, one with complex attribute **rhythm of light**, sub-attribute **light characteristic** = *1* (fixed) and the other with **light characteristic** = *2* (flashing), and not as one **Light All Around** with **light characteristic** = *13* (fixed/flash).

18.1.2 Elevations of lights (see S-4 – B-471.6)

The elevation of a light is the vertical distance between the light source and the plane of reference for heights for the ENC data (see clause X.X).

If it is required to encode the elevation of a light on a fixed structure, it must be done using the attribute **height**.

If it is required to encode the height above the water surface of a light on a floating structure, it must be done using the complex attribute **information** on the relevant light feature.

18.1.3 Colours of lights (see S-4 – B-471.6)

18.1.4 Times of exhibition and exhibition conditions (see S-4 – B-473)

18.1.4.1 Night lights

If it is required to encode a night light, it must be done using the attribute **exhibition condition of light** = *4* (night light) on the light feature.

Unwatched lights (see S-4 – B-473.1)

This information should not be encoded, but unwatched (unmanned) lights, with no standby or emergency arrangements, may be encoded using attribute **status** = *17* (unwatched).

18.1.4.2 Occasional lights (see S-4 – B-473.2)

If it is required to encode an occasional light, it must be done using attribute **status** = *2* (occasional). If it is required to encode a private light that is not regularly exhibited, it must be done using **status** = *2,8* (occasional, private).

18.1.4.3 Daytime lights (see S-4 – B-473.4)

If it is required to encode a light shown throughout 24 hours without change of character, it must be done using attribute **exhibition condition of light** = *1* (light shown without change of character).

If it is required to encode a light having characteristics shown by day different to those shown at night, it must be done by encoding two light features sharing the same point spatial instance:

- one light feature with **exhibition condition of light** = *2* (daytime light),
- one light feature with **exhibition condition of light** = *4* (night light).

18.1.4.4 Fog lights (see S-4 – B-473.5)

If it is required to encode a light which is exhibited in fog or conditions of reduced visibility, it must be done using a light feature, with attributes **exhibition condition of light** = *3* (fog light) and **status** = *2* (occasional).

If it is required to encode a light having characteristics shown in fog that are different to those shown in conditions of normal visibility, it must be done by encoding two light features sharing the same point spatial instance:

- one light feature with **exhibition condition of light** = *3* (fog light) and **status** = *2* (occasional)
- one light feature with **exhibition condition of light** = *2* (daytime light) or *4* (night light) and complex attribute **information** (sub-attribute **text**) = *Character of the light changes in fog*.

Note the distinction between fog lights and fog detector lights, which are lights used to automatically determine conditions of visibility which warrant the turning on or off of a sound signal. Fog detector lights must be encoded, where required, using the feature **Light Fog Detector** (see clause X.X).

18.1.5 Leading lights (see S-4 – B-475.6)

If it is required to encode a leading light, it must be done using an appropriate light feature feature, with attribute:

category of light = *4,12* - front leading light
4,13 - rear leading light
4,14 - lower leading light
4,15 - upper leading light

Remarks:

- The complex attribute **orientation** must not be used for leading lights, except for directional lights (see clause X.X).
- Even if, on the source, the leading lights are merged into a single symbol, a light feature must be created for each light. These lights must be placed in their true position, i.e. where the source (e.g. paper chart) shows a single light with a legend such as *2F.Bu*, further investigation must be done in order to determine the true position of each light, and its full attribution. Compilers should note that where this occurs on paper charts, the position of the light shown on the chart normally corresponds with the rear leading light.
- The leading line must be encoded using the method described in clause X.X.

18.1.6 Lighthouses (see S-4 – B-457.3)

If it is required to encode a lighthouse, it must be done using a **Landmark** feature (see clause X.X), with attributes **category of landmark** = *17* (tower) and **function** = *33* (light support) for towers, or using a **Building** feature (see clause X.X), with the attribute **function** = *33*, for any other shapes.

If it is required to encode the attributes **elevation**, **height** and **vertical length** for a lighthouse, this must be done as described in clause X.X.

If the lighthouse is permanently extinguished/unlit, this must be indicated by population of the attribute **status** = *4* (not in use) for the **Landmark**/**Building**, and the light feature must be removed. Where a lighthouse is illuminated by floodlights, the additional value of **status** = *12* (illuminated) must also be populated. For lights that are temporarily extinguished, see clause X.X.

18.1.7 Various special types of lights

Type	S-4	category of light	Remarks
Subsidiary light	B-471.8	*10*	Encoded as a separate light from the main light feature
Aero light	B-476.1	*5*	
Air obstruction light	B-476.2		Encode using feature **Light Air Obstruction**
Fog detector light	B-477		Encode using feature **Light Fog Detector**
Bearing light		*18*	
Flood light	B-478.2	*8*	Only to encode flood lights that are visible from seaward. The illuminated structure should be encoded using appropriate feature classes, with attribute **status** = *12* (illuminated)
Synchronised lights	B-478.3		**status** =*15.* Synchronised lights may be associated using the collection feature **Association**
Strip light	B-478.5	*9*	
Spot light		*11*	Only to encode spot lights that are visible from seaward. The illuminated feature should be encoded using appropriate feature classes, with attribute **status** = *12* (illuminated)
Emergency light		*17*	Must be encoded as a separate feature to the main light feature
Horizontally disposed lights	B-471.8	*19*	The number of lights must be encoded using attribute **multiplicity of lights**
Vertically disposed lights	B-471.8	*20*	The number of lights must be encoded using attribute **multiplicity of lights**

18.1.8 Light structures

Light features located in the water must have a structure feature, generally a beacon (e.g. **Beacon Lateral**, **Beacon Special Purpose/General**) or other fixed structure (e.g. **Offshore Platform**), or a buoy structure (e.g. **Buoy Lateral**, **Buoy Special Purpose/General**) for floating aids to navigation. When a light is located in the water with no indication on the source of the structure feature, regardless of the height of the light, a **Pile** or **Beacon Special Purpose/General** feature should be encoded as the structure feature. This will ensure that a symbol will be shown on ECDIS systems when the light features are not displayed during daytime navigation.

18.2 Light all around

IHO Definition: **LIGHT**. A light is a luminous or lighted aid to navigation. (IHO Dictionary – S-32).

An all around light is a light that is visible over the whole horizon of interest to marine navigation and having no change in the characteristics of the light.

S-101 Geo Feature: Light all around (LIGHTS)

Primitives: Point

Real World	*Paper Chart Symbol*	*ECDIS Symbol*

S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Category of light	(CATLIT)	4 : leading light 5 : aero light 8 : flood light 9 : strip light 10 : subsidiary light 11 : spotlight 12 : front 13 : rear 14 : lower 15 : upper 17 : emergency 18 : bearing light 19 : horizontally disposed 20 : vertically disposed	EN	0,*
Colour	(COLOUR)	1 : white 3 : red 4 : green 5 : blue 6 : yellow 9 : amber 10 : violet 11 : orange	EN	1,*
Exhibition condition of light	(EXCLIT)	1 : light shown without change of character 2 : daytime light 3 : fog light 4 : night light	EN	0,1
Feature name			C	0,*
Display name			(S) BO	0,1
Language		ISO 639-3	(S) TE	0,1
Name	*(OBJNAM)* *(NOBJNM)*		(S) TE	1,1
Fixed date range			C	0,1
Date end	(DATEND)	ISO 8601:1988	(S) DA	0,1
Date start	(DATSTA)	ISO 8601:1988	(S) DA	0,1
Height	(HEIGHT)		RE	0,1
Light visibility	(LITVIS)	1 : high intensity 2 : low intensity	EN	0,1
Major light			BO	0,1

Marks navigational – system of	(MARSYS)	1 : IALA A 2 : IALA B 9 : no system 10 : other system 11 : CEVNI	EN	0,1
Multiplicity of lights	(MLTYLT)		IN	0,1
Periodic date range			C	0,*
Date end	*(PEREND)*	ISO 8601:1988	(S) DA	1,1
Date start	*(PERSTA)*	ISO 8601:1988	(S) DA	1,1
Rhythm of light			C	1,1
Light characteristic	(LITCHR)	1 : fixed 2 : flashing 3 : long-flashing 4 : quick-flashing 5 : very quick-flashing 6 : ultra quick-flashing 7 : isophased 8 : occulting 9 : interrupted quick-flashing 10 : interrupted very quick flashing 11 : interrupted ultra quick flashing 12 : morse 13 : fixed and flash 14 : flash and long-flash 15 : occulting and flash 16 : fixed and long-flash 17 : occulting alternating 18 : long-flash alternating 19 : flash alternating 25 : quick-flash plus long-flash 26 : very quick-flash plus long flash 27 : ultra quick-flash plus long flash 28 : alternating 29 : fixed and alternating flashing	(S) EN	1,1
Signal group	(SIGGRP)		(S) TE	0,* (ordered)
Signal period	(SIGPER)		(S) RE	0,1
Signal sequence	*(SIGSEQ)*		(S) C	0,* (ordered)
Signal duration			(S) RE	1,1
Signal status		1 : lit 2 : eclipsed	(S) EN	1,1
Status	(STATUS)	1 : permanent 2 : occasional 4 : not in use 5 : periodic/intermittent 6 : reserved 7 : temporary 8 : private 11 : extinguished 14 : public 15 : synchronized 16 : watched 17 : un-watched	EN	0,*

Value of nominal range	(VALNMR)		RE	0,1
Vertical datum	(VERDAT)	3 : Mean sea level 16 : Mean high water 17 : Mean high water springs 18 : High water 19 : Approximate mean sea level 20 : High water springs 21 : Mean higher high water 24 : Local datum 25 : International great lakes datum 1985 26 : Mean water level 28 : Higher high water large tide 29 : Nearly highest high water 30 : Highest astronomical tide (HAT)	EN	0,1
Information			C	0,*
Language		ISO 639-3	(S) TE	0,1
Text	*(INFORM)* *(NINFOM)*		(S) TE	1,1
Scale minimum	(SCAMIN)	See clause X.X	IN	0,1
Textual description			C	0,*
File reference	*(TXTDSC)* *(NTXTDS)*		(S) TE	1,1
Language		ISO 639-3	(S) TE	0,1
Flare angle			IN	0,1
Association	**Acronym**	**Role**	**Multiplicity**	
Structure/equipment		Supported by	0,1	
Structure/equipment		Supports	0,1	

INT 1 Reference: P 1-65

18.2.1 All around lights (see S-4 – B-470)

If it is required to encode an all around light (excluding fog detector and air obstruction lights), it must be done using the feature **Light All Around**. This feature must be an equipment feature of a structure feature (see clause X.X), which may be another light feature at the same position (if it exists and there is no structure feature available), using a **Structure/equipment** feature association.

The IALA Maritime Buoyage System rules do not apply for most landfall lights and will apply to minor lights, but not to leading lights, some sector lights or major floating lights. In general, sector lights follow IALA convention when used for marking a channel.

Further guidance for encoding various types and characteristics of lights can be found in clauses X.X to X.X.

Remarks:

- All sector lights, whether single sectored, multi-sectored or having sectors that are deliberately obscured or completely or partially obscured by obstructions, must be encoded, where required, using the feature **Light Sectored** (see clause X.X).
- Fog detector and air obstruction lights must be encoded, where required, using the features **Light Fog Detector** and **Light Air Obstruction** (see clauses X.X and X.X).
- If it is required to encode details of the lighting technology (e.g. neon), it must be done using the complex attribute **information**.
- If it is required to encode the purpose of a marine spotlight, it must be done using **information**.
- The attribute **vertical datum** applies only to **height**; this value must only be encoded if it is different to the

value encoded in the VDAT subfield of the "Coordinate Reference System Header field" [CRSH] field, or different to the value of **vertical datum** encoded on meta feature **Vertical Datum of Data**.

- The indication that a light is a "major" light through the population of the Boolean attribute **major light** with a *True* value determines the way the light is displayed in ECDIS, and is not based on any legal or formal classification of the importance of lights. Generally, a major light may be considered to be a light intended for use at sea, usually with a range of 15 miles or more, and in outer approaches to harbours. However the determination of what is a major light may be based on a number of additional factors, including the number and characteristics of navigational (and non-navigational) lights in the geographical area, and specific navigational requirements for the area. Indication in a dataset that a light is a major light should be based only on the requirements for ECDIS display, at the discretion of the Producing Authority.
- Names of major lights are very important. If a light has a name which is unrelated to any other encoded feature, the name must be populated using the complex attribute **feature name** on at least the largest scale maximum display scale ENC data. If the name of a light is obviously that of the named feature on which the light stands, e.g. Saint Catherine's Point, the name of the light need not be repeated for the light.

18.2.1.1 Types and functions of lights (see S-4 – B-471.1)

If it is required to encode types and functions of lights, this must be done using the attribute **category of light** (see clause X.X).

Distinction: Beacon, cardinal; beacon, isolated danger; beacon, lateral; beacon, safe water; beacon, special purpose/general; buoy, cardinal; buoy, installation; buoy, isolated danger; buoy, lateral; buoy, safe water; buoy, special purpose/general; light air obstruction; light float; light fog detector; light sectored; light vessel.

18.3 Light sectored

IHO Definition: **LIGHT**. A light is a luminous or lighted aid to navigation. (IHO Dictionary – S-32).

A sectored light is a light having one or more sectors, which have different characteristics across, and sometimes within, each sector.

S-101 Geo Feature: Light sectored (LIGHTS)

Primitives: Point

Real World	*Paper Chart Symbol*	*ECDIS Symbol*

S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Feature name			C	0,*
Display name			(S) BO	0,1
Language		ISO 639-3	(S) TE	0,1
Name	*(OBJNAM)* *(NOBJNM)*		(S) TE	1,1
Fixed date range			C	0,1
Date end	(DATEND)	ISO 8601:1988	(S) DA	0,1
Date start	(DATSTA)	ISO 8601:1988	(S) DA	0,1
Height	(HEIGHT)		RE	0,1
Light sector			C	1,*
Colour	(COLOUR)	1 : white 3 : red 4 : green 5 : blue 6 : yellow 9 : amber 10 : violet 11 : orange	(S) EN	1,*
Exhibition condition of light	(EXCLIT)	1 : light shown without change of character 2 : daytime light 3 : fog light 4 : night light	(S) EN	0,1
Directional			(S) BO	0,1
Directional character			(S) C	0,1
Moiré effect			BO	0,1
Orientation			(S) C	1,1
Orientation uncertainty			(S) RE	0,1
Orientation value	*(ORIENT)*		(S) RE	1,1
Light visibility	(LITVIS)	1 : high intensity 2 : low intensity 3 : faint 4 : intensified 5 : unintensified 6 : visibility deliberately restricted	(S) EN	0,*

		8 : partially obscured 9 : visible in line of range		
Rhythm of light			(S) C	1,1
Light characteristic	(LITCHR)	1 : fixed 2 : flashing 3 : long-flashing 4 : quick-flashing 5 : very quick-flashing 6 : ultra quick-flashing 7 : isophased 8 : occulting 9 : interrupted quick-flashing 10 : interrupted very quick flashing 11 : interrupted ultra quick flashing 12 : morse 13 : fixed and flash 14 : flash and long-flash 15 : occulting and flash 16 : fixed and long-flash 17 : occulting alternating 18 : long-flash alternating 19 : flash alternating 25 : quick-flash plus long-flash 26 : very quick-flash plus long flash 27 : ultra quick-flash plus long flash 28 : alternating 29 : fixed and alternating flashing	(S) EN	1,1
Signal group	(SIGGRP)		(S) TE	0,* (ordered)
Signal period	(SIGPER)		(S) RE	0,1
Signal sequence	*(SIGSEQ)*		(S) C	0,* (ordered)
Signal duration			(S) RE	1,1
Signal status		1 : lit 2 : eclipsed	(S) EN	1,1
Sector limit			(S) C	0,1
Sector limit one	(SECTR1)		(S) RE	1,1
Sector limit two	(SECTR2)		(S) RE	1,1
Value of nominal range	(VALNMR)		(S) RE	0,1
Information			(S) C	0,*
Language		ISO 639-3	(S) TE	0,1
Text	*(INFORM)* *(NINFOM)*		(S) TE	1,1
Sector extension			IN	0,1
Marks navigational – system of	(MARSYS)	1 : IALA A 2 : IALA B 9 : no system 10 : other system 11 : CEVNI	EN	0,1
Periodic date range			C	0,*
Date end	*(PEREND)*	ISO 8601:1988	(S) DA	1,1

Date start	*(PERSTA)*	ISO 8601:1988	(S) DA	1,1
Status	(STATUS)	1 : permanent 2 : occasional 4 : not in use 5 : periodic/intermittent 6 : reserved 7 : temporary 8 : private 11 : extinguished 14 : public 15 : synchronized 16 : watched 17 : un-watched	EN	0,*
Vertical datum	(VERDAT)	3 : Mean sea level 16 : Mean high water 17 : Mean high water springs 18 : High water 19 : Approximate mean sea level 20 : High water springs 21 : Mean higher high water 24 : Local datum 25 : International great lakes datum 1985 26 : Mean water level 28 : Higher high water large tide 29 : Nearly highest high water 30 : Highest astronomical tide (HAT)	EN	0,1
Information			C	0,*
Language		ISO 639-3	(S) TE	0,1
Text	*(INFORM)* *(NINFOM)*		(S) TE	1,1
Scale minimum	(SCAMIN)	See clause X.X	IN	0,1
Textual description			C	0,*
File reference	*(TXTDSC)* *(NTXTDS)*		(S) TE	1,1
Language		ISO 639-3	(S) TE	0,1
Association	**Acronym**	**Role**	**Multiplicity**	
Structure/equipment		Supported by	0,1	
Structure/equipment		Supports	0,1	

INT 1 Reference: P 1-65

18.3.1 Sectored lights (see S-4 – B-475)

If it is required to encode a light that consists of one or more sectors, it must be done using the feature **Light Sectored**. This feature must be an equipment feature of a structure feature (see clause X.X), which may be another light feature at the same position (if it exists and there is no structure feature available), using a **Structure/equipment** feature association.

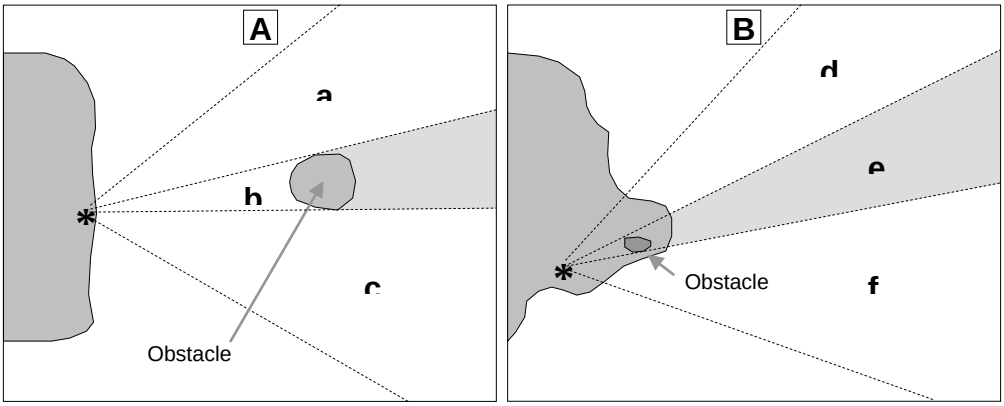
The IALA Maritime Buoyage System rules do not apply for most landfall lights and will apply to minor lights, but not to leading lights, some sector lights or major floating lights. In general, sector lights follow IALA convention when used for marking a channel.

Further guidance for encoding various types and characteristics of lights can be found in clauses X.X to X.X.

Remarks:

- The complex attribute **light sector** is used to populate each sector for the light, except for sectors in which there is no light exhibited.
- The characteristics of a sectored light may differ from sector to sector, particularly for some complex directional lights (see clause X.X.X.X). The complex sub-attribute **rhythm of light** must therefore be populated for each light sector.
- If a sector of sectored light is intended to have a directional function, this must be encoded using the **light sector** complex sub-attributes **directional** (*True*) and **directional character**. If the light is intensified in this sector, **light sector** sub-attribute **light visibility** = *4* (intensified) must be populated. The complex sub-attribute **sector limit** is optional for directional light sectors.
- If a sector of a sectored light is not directional (sub-attribute **directional** not populated), the complex sub-attribute **sector limit** is mandatory, and the complex sub-attribute **directional character** must not be populated for the light sector.
- The fairway defined by the succession of navigable areas in the white sectors of a series of **Light Sectored** features may be encoded using the feature **Fairway** (see clause X.X).
- If there is additional information required to be encoded that is relevant to all sectors of the light, this must be done using the complex attribute **information** for the **Light Sectored** feature. If the additional information is relevant to individual sectors of the light only (e.g. for complex (oscillating) light sectors (see clause X.X.X.X below)), this must be encoded using the complex sub-attribute **information** for the complex attribute **light sector**.
- If it is required to encode details of the lighting technology (e.g. neon), it must be done using the complex attribute **information**.
- The attribute **vertical datum** applies only to **height**; this value must only be encoded if it is different to the value encoded in the VDAT subfield of the "Coordinate Reference System Header field" [CRSH] field, or different to the value of **vertical datum** encoded on meta feature **Vertical Datum of Data**.
- Names of major lights are very important. If a light has a name which is unrelated to any other encoded feature, the name must be populated using the complex attribute **feature name** on at least the largest scale maximum display scale ENC data. If the name of a light is obviously that of the named feature on which the light stands, e.g. Saint Catherine's Point, the name of the light need not be repeated for the light.

18.3.1.1 Lights obscured by obstructions (see S-4 – B-475.3)



If an encoded light is obscured in a part of the navigable area of a sector (see Figure A above) beyond an offshore obstruction, it must be encoded using **Light Sectored**, with each of the sectors (a) – (c) encoded using the complex attribute **light sector**. The partially obscured sector of (b) must have **light sector** with sub-attributes **light visibility** = *8* (partially obscured) and sub-attribute **value of nominal range** set to the distance from the light to the obstruction. The sectors in which the light is visible from seaward ((a) and (c)) must be encoded as separate iterations of **light sector**.

If there is no navigable water between the light and the obstacle (see (e) in Figure B above), the masked sector must not have an iteration of **light sector** encoded, unless a faint light is visible in the navigable part of the sector, which should be encoded using **light sector**, with sub-attribute **light visibility** = *3* (faint). The sectors in which the light is visible from seaward ((d) and (f)) must be encoded as separate iterations of **light sector**.

18.3.1.2 Directional lights (see S-4 – B-475.7)

Directional (or direction) lights of several types are in use but all have in common a very narrow sector

intended to mark a direction to be followed. The narrow sector may be flanked by:

- Unlit sectors or unintensified light.
- Sectors of different colour or character. Some direction lights are so precise that a complete colour change at a sector boundary occurs over an angle of less than 1 minute (0·02°). This corresponds to a lateral distance of just 1 metre at a viewing distance of 3.5 km. In addition the intensity may be maintained right to the edge of the beam, and does not reduce the further the observer is away from the axis.

A moiré effect mark (or variable arrow mark) is a short-range (normally up to 2 km) type of directional "light". Sodium lighting gives a yellow background to a screen (up to 3 m square) on which a vertical black line will be seen by an observer on the centreline, or variable arrow marks when course alteration is needed. The system can be used by day and night. It can also be used as a stop line (seen abeam) for vessels berthing along quays.

If it is required to encode a light sector having a directional function, it must be done using the feature **Light Sectored**.

Remarks:

- The indication that a particular light sector has a directional function is encoded by populating the complex attribute **light sector**, Boolean sub-attribute **directional** as *True*. This indicates that the sub-complex attribute **directional character** is mandatory for the sector.
- The mandatory complex sub-attribute **orientation** must only be encoded to indicate the orientation, measured from seaward, of the leading line of the directional light sector when there is no **Recommended Track** or **Navigation Line** feature associated with the directional light. Where the directional sector has an associated **Recommended Track** and/or **Navigation Line**, **orientation** (**orientation value**) for the light sector must be populated with an empty (null) value.
- For a sector indicated as directional, the **light sector** complex sub-attribute **sector limit** is optional.
- For moiré effect lights, the Boolean sub-attribute **moiré effect** must be set to *True*.
- If it is required to encode the recommended track and/or navigation line associated with a directional light, it must be done using the methods described in clause X.X.

18.3.1.3 Oscillating light sectors

Evolving technology in the development of navigational lights has resulted in the installation of complex directional navigation lights with multiple sectors, colours and characteristics, some with oscillating sectors, in many areas where navigation is restricted. These lights may have up to 7 sectors, with the central sector being a very narrow, sometimes intensified, fixed white sector performing the directional function of the light. In the IALA A System, the sectors flanking this directional light may be alternating and oscillate increasingly from white to green (to starboard) and red (to port) with increasing deviation from the track defined by the directional light. These lights will normally be flanked by narrow sectors of fixed green (to starboard) and red (to port). Additionally, there may be outer sectors that are occulting green (to starboard) and red (to port) which oscillate with increasing period of eclipse to isophased or flashing with increasing deviation from the track defined by the directional light. For the IALA B System the colours are reversed. In some cases these complex lights may not conform to IALA. Each of the outer sectors may be very narrow.

If is required to encode an oscillating light sector, it should be done using a **Light Sectored** feature, with iterations of the complex attribute **light sector** as follows:

For light sectors in the IALA A system that are alternating and oscillate increasingly from white to green (to starboard) and red (to port) with increasing deviation from the track defined by the directional light:

light sector: **light characteristic** = *28* (Alternating); **colour** = *1,3* (White, Red); **sector limit**; **information** (**text**) = *White phase decreases as bearing to light increases*

light sector: **light characteristic** = *28* (Alternating); **colour** = *1,4* (White, Green); **sector limit**; **information** (**text**) = *White phase increases as bearing to light increases*

For lights in the IALA B system that are alternating and oscillate increasingly from white to red (to starboard) and green (to port) with increasing deviation from the track defined by the directional light; transpose the colours red and green in the above encoding.

For lights in the IALA A system that are occulting green (to starboard) and red (to port) which oscillate with increasing period of eclipse to isophased or flashing with increasing deviation from the track defined by the directional light:

light sector: **light characteristic** = *8* (Occulting); **colour** = *3* (Red); **sector limit**; **information** (**text**) = *Light*

phase decreases as bearing to light increases

light sector: **light characteristic** = *8* (Occulting); **colour** = *4* (Green); **sector limit**; **information** (**text**) = *Light phase increases as bearing to light increases*

For lights in the IALA B system that are occulting red (to starboard) and green (to port) which oscillate with increasing period of eclipse to isophased or flashing with increasing deviation from the track defined by the directional light; transpose the colours red and green in the above encoding.

Oscillating lights which are not IALA should be encoded similar to the above. For instance, where a light contains white sectors that are occulting and oscillate with increasing period of eclipse to isophased or flashing with increasing deviation from the track defined by the directional light:

For the sector to port of the track defined by the directional light:

light sector: **light characteristic** = *8* (Occulting); **colour** = *1* (White); **sector limit**; **information** (**text**) = *Light phase decreases as bearing to light increases*

For the sector to starboard of the track defined by the directional light:

light sector: **light characteristic** = *8* (Occulting); **colour** = *1* (White); **sector limit**; **information** (**text**) = *Light phase increases as bearing to light increases*

All other light sectors must be encoded using additional iterations of **light sector**, with sub-attributes (including **light characteristic**) populated in accordance with the characteristics of the sector.

Distinction: Beacon, cardinal; beacon, isolated danger; beacon, lateral; beacon, safe water; beacon, special purpose/general; buoy, cardinal; buoy, installation; buoy, isolated danger; buoy, lateral; buoy, safe water; buoy, special purpose/general; light air obstruction; light all around; light float; light fog detector; light vessel.

18.4 Light fog detector

IHO Definition: **FOG DETECTOR LIGHT**. A light is a luminous or lighted aid to navigation. (IHO Dictionary – S-32).

A fog detector light is a light used to automatically determine conditions of visibility which warrant the turning on or off of a sound signal. (IHO Dictionary – S-32).

S-101 Geo Feature: Light fog detector (LIGHTS)

Primitives: Point

Real World	*Paper Chart Symbol*	*ECDIS Symbol*

S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Colour	(COLOUR)	1 : white 3 : red 4 : green 5 : blue 6 : yellow 9 : amber 10 : violet 11 : orange	EN	0,*
Feature name			C	0,*
Display name			(S) BO	0,1
Language		ISO 639-3	(S) TE	0,1
Name	*(OBJNAM)* *(NOBJNM)*		(S) TE	1,1
Fixed date range			C	0,1
Date end	(DATEND)	ISO 8601:1988	(S) DA	0,1
Date start	(DATSTA)	ISO 8601:1988	(S) DA	0,1
Height	(HEIGHT)		RE	0,1
Periodic date range			C	0,*
Date end	*(PEREND)*	ISO 8601:1988	(S) DA	1,1
Date start	*(PERSTA)*	ISO 8601:1988	(S) DA	1,1
Rhythm of light			C	0,1
Light characteristic	(LITCHR)	1 : fixed 2 : flashing 3 : long-flashing 4 : quick-flashing 5 : very quick-flashing 6 : ultra quick-flashing 7 : isophased 8 : occulting 9 : interrupted quick-flashing 10 : interrupted very quick flashing 11 : interrupted ultra quick flashing 12 : morse 13 : fixed and flash 14 : flash and long-flash	(S) EN	1,1

		15 : occulting and flash 16 : fixed and long-flash 17 : occulting alternating 18 : long-flash alternating 19 : flash alternating 25 : quick-flash plus long-flash 26 : very quick-flash plus long flash 27 : ultra quick-flash plus long flash 28 : alternating 29 : fixed and alternating flashing		
Signal group	(SIGGRP)		(S) TE	0,* (ordered)
Signal period	(SIGPER)		(S) RE	0,1
Signal sequence	*(SIGSEQ)*		(S) C	0,* (ordered)
Signal duration			(S) RE	1,1
Signal status		1 : lit 2 : eclipsed	(S) EN	1,1
Status	(STATUS)	1 : permanent 2 : occasional 4 : not in use 5 : periodic/intermittent 6 : reserved 7 : temporary 8 : private 11 : extinguished 14 : public 15 : synchronized 16 : watched 17 : un-watched	EN	0,*
Vertical datum	(VERDAT)	3 : Mean sea level 16 : Mean high water 17 : Mean high water springs 18 : High water 19 : Approximate mean sea level 20 : High water springs 21 : Mean higher high water 24 : Local datum 25 : International great lakes datum 1985 26 : Mean water level 28 : Higher high water large tide 29 : Nearly highest high water 30 : Highest astronomical tide (HAT)	EN	0,1
Information			C	0,*
Language		ISO 639-3	(S) TE	0,1
Text	*(INFORM)* *(NINFOM)*		(S) TE	1,1
Scale minimum	(SCAMIN)	See clause X.X	IN	0,1
Textual description			C	0,*
File reference	*(TXTDSC)* *(NTXTDS)*		(S) TE	1,1

Language		ISO 639-3	(S) TE	0,1
Flare angle			IN	0,1
Association	**Acronym**	**Role**	**Multiplicity**	
Structure/equipment		Supported by	0,1	

INT 1 Reference: P 1-65

18.4.1 Fog detector lights (see S-4 – B-470)

If it is required to encode a light used to automatically determine conditions of visibility which warrant the turning on or off of a sound signal, it must be done using the feature **Light Fog Detector**. This feature must be an equipment feature of a structure feature (see clause X.X), if it exists, using a **Structure/equipment** feature association.

Further guidance for encoding various types and characteristics of lights can be found in clauses X.X to X.X.

Remarks:

- If it is required to encode details of the lighting technology (e.g. neon), it must be done using the complex attribute **information**.
- The attribute **vertical datum** applies only to **height**; this value must only be encoded if it is different to the value encoded in the VDAT subfield of the “Coordinate Reference System Header field” [CRSH] field, or different to the value of **vertical datum** encoded on meta feature **Vertical Datum of Data**.

Distinction: Beacon, cardinal; beacon, isolated danger; beacon, lateral; beacon, safe water; beacon, special purpose/general; buoy, cardinal; buoy, installation; buoy, isolated danger; buoy, lateral; buoy, safe water; buoy, special purpose/general; light air obstruction; light all around; light float; light sectored; light vessel.

18.5 Light air obstruction

IHO Definition: **AIR OBSTRUCTION LIGHT**. A light is a luminous or lighted aid to navigation. (IHO Dictionary – S-32).

An air obstruction light is a light marking an obstacle which constitutes a danger to air navigation. (IHO Dictionary – S-32).

S-101 Geo Feature: Light air obstruction (LIGHTS)

Primitives: Point

Real World	*Paper Chart Symbol*	*ECDIS Symbol*

S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Colour	(COLOUR)	1 : white 3 : red 4 : green 5 : blue 6 : yellow 9 : amber 10 : violet 11 : orange	EN	0,*
Exhibition condition of light	(EXCLIT)	1 : light shown without change of character 2 : daytime light 3 : fog light 4 : night light	EN	0,1
Feature name			C	0,*
Display name			(S) BO	0,1
Language		ISO 639-3	(S) TE	0,1
Name	*(OBJNAM)* *(NOBJNM)*		(S) TE	1,1
Fixed date range			C	0,1
Date end	(DATEND)	ISO 8601:1988	(S) DA	0,1
Date start	(DATSTA)	ISO 8601:1988	(S) DA	0,1
Height	(HEIGHT)		RE	0,1
Light visibility	(LITVIS)	1 : high intensity 2 : low intensity 3 : faint 4 : intensified 5 : unintensified 6 : visibility deliberately restricted 7 : obscured 8 : partially obscured 9 : visible in line of range	EN	0,*
Multiplicity of lights	(MLTYLT)		IN	0,1
Periodic date range			C	0,*
Date end	*(PEREND)*	ISO 8601:1988	(S) DA	1,1
Date start	*(PERSTA)*	ISO 8601:1988	(S) DA	1,1

Rhythm of light			C	0,1
Light characteristic	(LITCHR)	1 : fixed 2 : flashing 3 : long-flashing 4 : quick-flashing 5 : very quick-flashing 6 : ultra quick-flashing 7 : isophased 8 : occulting 9 : interrupted quick-flashing 10 : interrupted very quick flashing 11 : interrupted ultra quick flashing 12 : morse 13 : fixed and flash 14 : flash and long-flash 15 : occulting and flash 16 : fixed and long-flash 17 : occulting alternating 18 : long-flash alternating 19 : flash alternating 25 : quick-flash plus long-flash 26 : very quick-flash plus long flash 27 : ultra quick-flash plus long flash 28 : alternating 29 : fixed and alternating flashing	(S) EN	1,1
Signal group	(SIGGRP)		(S) TE	0,* (ordered)
Signal period	(SIGPER)		(S) RE	0,1
Signal sequence	*(SIGSEQ)*		(S) C	0,* (ordered)
Signal duration			(S) RE	1,1
Signal status		1 : lit 2 : eclipsed	(S) EN	1,1
Status	(STATUS)	1 : permanent 2 : occasional 4 : not in use 5 : periodic/intermittent 6 : reserved 7 : temporary 8 : private 11 : extinguished 14 : public 15 : synchronized 16 : watched 17 : un-watched	EN	0,*
Value of nominal range	(VALNMR)		RE	0,1
Vertical datum	(VERDAT)	3 : Mean sea level 16 : Mean high water 17 : Mean high water springs 18 : High water 19 : Approximate mean sea level 20 : High water springs 21 : Mean higher high water 24 : Local datum 25 : International great lakes datum 1985	EN	0,1

		26 : Mean water level 28 : Higher high water large tide 29 : Nearly highest high water 30 : Highest astronomical tide (HAT)		
Information			C	0,*
Language		ISO 639-3	(S) TE	0,1
Text	*(INFORM)* *(NINFOM)*		(S) TE	1,1
Scale minimum	(SCAMIN)	See clause X.X	IN	0,1
Textual description			C	0,*
File reference	*(TXTDSC)* *(NTXTDS)*		(S) TE	1,1
Language		ISO 639-3	(S) TE	0,1
Flare angle			IN	0,1
Association	**Acronym**	**Role**	**Multiplicity**	
Structure/equipment		Supported by	0,1	

INT 1 Reference: P 1-65

18.5.1 Air obstruction lights (see S-4 – B-470)

If it is required to encode a light marking an obstacle which constitutes a danger to air navigation, which may also be used as a marine navigational aid, it must be done using the feature **Light Air Obstruction**. This feature must be an equipment feature of a structure feature (see clause X.X), if it exists, using a **Structure/equipment** feature association.

Further guidance for encoding various types and characteristics of lights can be found in clauses X.X to X.X.

Remarks:

- If it is required to encode details of the lighting technology (e.g. neon), it must be done using the complex attribute **information**.
- The attribute **vertical datum** applies only to **height**; this value must only be encoded if it is different to the value encoded in the VDAT subfield of the “Coordinate Reference System Header field” [CRSH] field, or different to the value of **vertical datum** encoded on meta feature **Vertical Datum of Data**.

Distinction: Beacon, cardinal; beacon, isolated danger; beacon, lateral; beacon, safe water; beacon, special purpose/general; buoy, cardinal; buoy, installation; buoy, isolated danger; buoy, lateral; buoy, safe water; buoy, special purpose/general; light all around; light float; light fog detector; light sectored; light vessel.