Document Revisions

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**IALA Recommendation**

**On**

**The Marking of Man-Made Offshore Structures**

**Edition 2 (draft)**

**April 2013**

***AISM***Association Internationale de Signalisation Maritime ***IALA***

International Association of Marine Aids to Navigation and Lighthouse Authorities

Revisions to the IALA Document are to be noted in the table prior to the issue of a revised document.

|  |  |  |
| --- | --- | --- |
| **Date** | **Page / Section Revised** | **Requirement for Revision** |
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Recommendation on

The Marking of Man-Made Offshore Structures

**(Recommendation O-139)**

**THE COUNCIL:**

**RECALLING** the function of IALA with respect to Safety of Navigation, the efficiency of maritime transport and the protection of the environment;

**RECOGNISING** that there is an increase in new and emerging uses of ocean and coastal waters, subsoil and seabed, an increase of seaborne trade, increasing demands of energy resources, increasing recreational use and increasing pollution threats from both ocean uses and an expansion of coastal populations.

**RECOGNISING ALSO** the number and types of man-made structures being built in the maritime environment are increasing.

**RECOGNISING ALSO** the need to provide consistency in marking different types of offshore structures which may be a danger to navigation,

**RECOGNISING ALSO** that it is a matter for a National Authority to decide on whether a man-made structure needs to be marked, depending on the risk involved and the level of traffic.

**RECOGNISING ALSO** that IMO Resolution A.672(16), dated 6th December 1989, established Guidelines and Standards for the Removal of Offshore Installations and Structures on the Continental Shelf and in the Exclusive Economic Zone, which incorporate requirements for such installations and structures, whilst being removed, to be marked in accordance with IALA Recommendations.

**RECOGNISING FURTHER** that marking is to improve the safety to navigation and protect the structures themselves,

**ADOPTS** the recommendation on the Marking of Man-Made Offshore Structures as set out in the following Sections.

**NOTING** that the content of recommendations for marking as outlined in IALA Recommendations:

O-114 “The Marking of Offshore Structures” Edition 1 May 1998

O-116 “The Marking of Aquaculture Farms” Edition 2 June 2007

O-117 “The Marking of Offshore Wind Farms” Edition 2 December 2004

O-131 “The Marking of Offshore Wave and Tidal Energy Devices” Edition 1 June 2005

Have been fully incorporated into O-139 which now supersedes the above withdrawn documents.

**RECOMMENDS** that Members ensure that the marking of man-made structures conforms to the standards and practices specified in the following Sections of this recommendation.

\* \* \*

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Recommendation O-139

The Marking of Man-made Offshore Structures

# INTRODUCTION

There has been an increasing development in man-made structures at sea, in coastal or near coastal waters, which may affect shipping. These structures can be isolated or in groups, small or large, and close to or far from navigation zones.

IALA is monitoring the developments of these structures and will continue to create and update documentation as required to ensure clear and unambiguous marking of waterways for safe navigation, protection of the environment and protection of the structures themselves. Authorities facing problems in this field are invited to bring them to the attention of IALA to obtain advice on current practice.

The following sections of this Document detail the updated IALA Recommendations for the marking of each offshore structure type identified in Appendix 1, along with an inventory and examples of Man-Made Offshore Structures.

The marking of offshore structures should be implemented using these recommendations as a minimum requirement. Note, National Authorities may require more stringent marking.

In section 3, attention is drawn to the need to re-examine as part of a periodic review basis to update these Recommendations, with respect to advances in technology.

## Scope

These recommendations are for the guidance and information of stakeholders such as National Administrations, Lighthouse Authorities, Aviation Authorities and other competent Authorities, Aids to Navigation providers, and the Contractors and Developers involved in each type of the structures mentioned in the following sections.

## Field of Application

These Recommendations apply to all structures fixed in position temporarily or permanently which extend above or below the surface of the sea and which are obstructions to navigation, e.g. structures used for drilling or exploring for oil and/or minerals, oil production platforms, oil well protective jackets, renewable offshore energy installations or ocean data platforms. Structures specifically established as AtoN are excluded from these recommendations.

## Information

Authorities must ensure that all stakeholders are informed of installed AtoN and markings in accordance with these Recommendations. These are published in nautical documents and by promulgation of Maritime Safety Information (MSI).

## Definitions and Acronyms

* AIS – Automatic Identification System
* AIS AtoN – AIS as an Aid to Navigation
* AtoN – Aid(s) to Navigation
* CALM – Catenary Anchor Leg Mooring
* cd – Candela
* FPSO – Floating Production Storage Offloader
* HAT – Highest Astronomical Tide
* I – Intermediate Structure [OWF]
* MBS – IALA Maritime Buoyage System
* MER – Minimum Effective Range
* MFP – Minimum Facility Platform
* MHWS – Mean High Water Springs
* MSI – Maritime Safety Information (e.g. NAVTEX, Notices to Mariners)
* OREI – Offshore Renewable Energy Installation
* OWF – Offshore Wind Farm(s)
* Promulgation – the act of formally proclaiming or declaring a new [statutory](http://en.wikipedia.org/wiki/Statute) or [administrative law](http://en.wikipedia.org/wiki/Administrative_law) after its [enactment](http://en.wikipedia.org/wiki/Enactment).
* SOLAS – Safety of Life At Sea [convention].
* SPM – Single Point Mooring
* SPS – Significant Peripheral Structure [OWF]
* Subsidiary Light
* WTG - Wind Turbine Generator

Lantern Range/Intensity

* 10 Nautical Mile nominal range = 1400 cd
* 5 Nautical Mile nominal range = 75 cd
* 2 Nautical Mile nominal range = 5 cd

# marking of offshore STRUCTURES

Man Made Offshore structures present very different characteristics. Therefore, these structures have been grouped as follows:

* Section 2.1: Offshore Structures in General
* Section 2.2: Aquaculture Farms
* Section 2.3: Offshore Wind Farms
* Section 2.4: Wave and Tidal Energy Devices

It is important to consider that the marking of offshore structures is essential during the different phases of their existence, i.e. construction, operation and decommissioning, when the structure may remain as a hazard to navigation.

The table below lists the marking recommendations and considerations for offshore structures

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| \* = RECOMMENDED  + = TO BE CONSIDERED | Light (white)1 | Light (yellow)2 | Sub Light (Red)3 | Fog Signal | Radar Beacon | AIS | Buoys |
| Offshore Oil or Gas Platform – Temporary or Fixed (2.1) | \* |  | \* | + | + | + | + |
| Floating Production Storage Offloader (FPSO) (2.1) | \* |  |  | + | + | + |  |
| Floating Petrochem Offloading Points/ Single Point Mooring (SPM) | \* |  |  | + | + | + |  |
| Aquaculture (2.2) |  | \* |  |  | + | + | \* |
| Meteorological Mast (2.3) | \* |  |  | + | + | + | + |
| Minimum Facility Platform (MFP) (2.3) | \* |  | + | + | + | + | + |
| Offshore Docks/Loading Islands | \* |  | \* | + | + | + | + |
| Underwater Pipes, Underwater Manifolds | + |  |  |  |  |  | + |
| Tidal/Wave Generator (2.4) | \* |  | \* | + | + | + | + |
| Tidal/Wave Generator Field (2.4) | \* |  | \* | + | + | + | \* |
| Offshore Wind Farm (2.3) |  | \* |  | + | + | + | + |
| Isolated WTG (2.3) | \* |  |  | + | + | + | + |
| OWF Transformer/Sub-Station (2.3) | \* |  | + | + | + | + |  |

1 – Minimum intensity 1400cd Mo(U) W 15s

2 – Minimum intensity 75cd

3 – Minimum intensity 15cd

## MARKING OF OFFSHORE STRUCTURES/ PLATFORMS

### General

Consultation between the stakeholders such as Developers, National Administrations, Authorities, Competent Authorities and Contractors should take place at an early stage. In general, development of all structures mentioned in this Section should not prejudice the safe use of Traffic Separation Schemes, Inshore Traffic Zones, recognised sea lanes and safe access to anchorages, harbours and places of refuge. On a case-by-case basis, National Authorities may consider establishing, Recommendation to Avoid, Exclusion or Safety Zones, to prohibit or restrict vessels from entering areas of Offshore Structures in general. Such information must be identified on the navigation chart, as appropriate.

The IALA Recommendations of 1965, with later amendments in 1968, did not fully meet the requirements of the United Kingdom, Ireland and Norway. This was due mainly to the exposed position of structures and to the environmental conditions in the North Sea. These countries therefore agreed to enforce more stringent regulations.

These more stringent regulations have been in general use since 1977, and have met the operational requirements of certain authorities responsible for marking of structures, and those of shipping. These, and the Norwegian regulations, can be requested from those authorities.

In this respect the Authorities mentioned have further agreed to inform neighbouring countries and IALA about the establishment of any additional marking equipment installed.

### Marking

The Offshore Structures mentioned in this section should be marked as a single unit, a block or field as follows:

1. Any structure shall be marked at night by one or more white lights so constructed and fixed as to ensure that at least one light is visible upon approaching the structure from any direction.
2. The lights shall be placed not less than 6 metres and not more than 30 metres above Mean High Water Springs (MHWS) with a minimum effective intensity of 1400 candelas (approximately 10 Nautical Miles). The lights shall be synchronized with a flashing character according to Mo (U) W ≤15s. The vertical divergence of the projected beam shall be such that the light will be visible from the immediate vicinity of the structure to the maximum luminous range of the light.
3. **Such marine lanterns are referred to as Subsidiary Lights.**
4. Each structure shall, where practicable, display identification panels with black letters or numbers 1 m high on a yellow background visible in all directions. These panels shall be easily visible in daylight as well as at night, either by the use of illumination or retro-reflecting material.
5. Each structure may carry one or more sound signals so constructed and fixed as to be audible upon approaching the structure from any direction.
6. The fog signals should be placed not less than 6 metres and not more than 30 metres above MHWS with a range of at least 2 Nautical Miles. The character shall correspond to Mo (U) 30s.
7. The minimum duration of the short blast shall be 0.75 seconds. The fog signals shall be operated when the meteorological visibility is 2 Nautical Miles or less. A Visibility Detector will typically be used.
8. Where there is a requirement to identify a particular structure, a radar beacon may be fitted. The range and code shall be determined by the Authority. Any Racon on a temporary uncharted structure shall be coded Mo (D).
9. Where a number of structures are situated so that the safety of navigation in the area may be secured without each of the structures being individually equipped with lights and sound signals, in accordance with these recommendations, or where the Authority considers that local conditions permit a relaxation of the requirements for the intensity of the light, the Authority shall determine what marking shall be applied.
10. Wherever deemed necessary by the Authority, buoys or beacons shall be placed to mark the perimeter of a group of structures, or to mark channels through a group of structures, or to mark any fixed structure while being erected or dismantled. The characteristics of such marks shall be determined by the Authority in accordance with the IALA Maritime Buoyage System (MBS).
11. Where underwater obstructions, such as submerged wells or pipelines, exist in depths of water so as to be a hazard to surface borne vessels, they should be adequately marked in accordance with the IALA MBS.
12. The air navigation Authorities may require additional marking of structure.

### Considerations During Construction/ Decommissioning

During the construction/ decommissioning of Offshore Structures, working areas should be established and marked in accordance with the IALA MBS. National Authorities should also consider the use of floating AtoN or guard ships in areas of high traffic density.

MSI must be promulgated in advance of and during any offshore structure/ platform construction/ decommissioning.

When decommissioning such devices, the Authority should ensure that the operator/ contractor is obliged to remove all obstructions, so that the sea bed is returned to its original depth and topography. In the event that any residue or obstruction remains that, in the opinion of the Authority, constitutes a danger to navigation, then that shall be marked according to the Authority’s requirements.

### Additional marking

Authorities may, in special cases, require additional marking, for example:

* Lantern
* Racon
* Buoys in accordance with the IALA MBS
* AIS AtoN

## MARKING OF OFFSHORE AQUACULTURE FARMS

2.2.1 General

Aquaculture farms should be marked in accordance with this Recommendation and IALA MBS.

The use of electronic AtoN, such as Racons or AIS AtoN may also be considered.

The farm, or group of farms, should be marked depending on their size, extent and location. In some cases it may be sufficient to mark only part of the perimeter, or the centre.

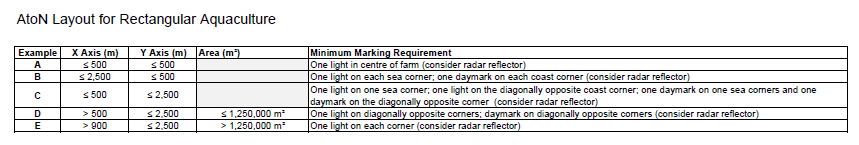
The Authority should bear in mind that the marking recommendations herein may be adjusted in consideration of traffic density, proximity to ports, proximity to dangers, tidal considerations and other factors.

* Aquaculture farms are normally marked by Special Marks;
* If there is a requirement for vessel traffic between aquaculture farms, then such channels are normally marked by Lateral Marks;
* If the prevailing situation warrants, Cardinal Marking alone may be used to direct vessel traffic away from the aquaculture farm(s);
* To improve the effectiveness of the lighting, and taking into account background lighting, synchronisation is recommended.
* The Authority should be satisfied that the selected lighting has a suitable Minimum Effective Range and sufficient autonomy with the ability to over-winter – especially in higher latitudes.
* To improve the radar target and radar visibility, radar reflectors and radar reflective material should be considered.

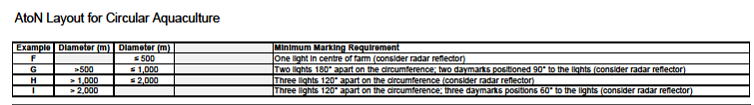
2.2.2 Marking Examples

Examples can be found in the following table which illustrates the minimum recommended marking arrangement with Special Marks.

* Rectangular Aquaculture Farms should be marked according to the length of their sides.



* Circular Aquaculture Farms should be marked according to their diameter.



**PRINCIPLES FOR MARKING OF AREA FOR AQUACULTURE**

 **Special Mark LIT (Fl Y 3s 5NM) synchronized**

 **Special Mark UNLIT**

** **

**Area borders**

**Safety borders**

**T**

**B**

**shore**

**sea**

**500 m**

**2500 m**

**A**

**500 m**

**500 m**

**E**

**shore**

**sea**

**900 m**

**2500 m**

**D**

**shore**

**sea**

**500 m**

**2500 m**

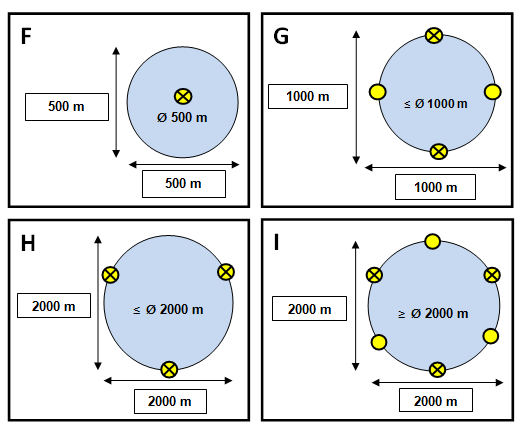
**C**

**shore**

**sea**

**500 m**

**2500 m**



**F**

**1000 m**

**1000 m**

**I**

**4000 m**

**4000 m**

**G**

**2000 m**

**2000 m**

**H**

**4000 m**

**4000 m**

**NOTE:** The number and range of AtoN is dependent of the current traffic situation in the area.

* 1. **MARKING OF OFFSHORE WIND FARMS**

### General

When mentioning Offshore Wind Farms, the following are included: Meteorological Mast, Wind Turbine Generator and Offshore Transformer/Sub-Station.

Consultation between the stakeholders such as Developers, National Administrations, Competent Authorities, AtoN providers and Wind Farm contractors/ developers should take place at an early stage.

Development of OWF should not prejudice the safe use of Traffic Separation Schemes, Inshore Traffic Zones, recognised sea lanes and safe access to anchorages, harbours and places of refuge. On a case-by-case basis, Authorities may consider establishing Exclusion or Safety Zones to prohibit or restrict vessels from entering OWF. Such information should be shown on the navigation chart, as appropriate.

In order to avoid confusion from a high-density of AtoN (and other general lighting), full consideration should be given to the use of synchronised lights, different light characters and varied light ranges.

Some IALA members have carried out trials on OWF to identify whether interference to radar, radio navigation and radio communications is experienced. Trials indicate that OWF structures may affect shipborne and shore based radar systems. This interference returned radar responses strong enough to produce significant interference in some cases. Bearing discrimination was also reduced by the magnitude of the response. It has been determined that passage close to an OWF boundary, or within the OWF itself, could affect the vessel’s ability to fully comply with the International Regulations for the Prevention of Collisions at Sea. Administrations/ developers should keep this information in mind when designing OWF, and they may wish to carry out individual trials to verify the impact of the OWF on navigation.

There has been some evidence that scouring at the bases of WTG, in areas of strong tides or currents, has resulted in significant deposits of material in other locations. Some Authorities have insisted on fitting depth monitoring devices to wind generators to measure scour. This may need to be considered when approving OWF proposals/locations.

### Marking of Isolated WTG, Meteorological Masts and other Individual Structures

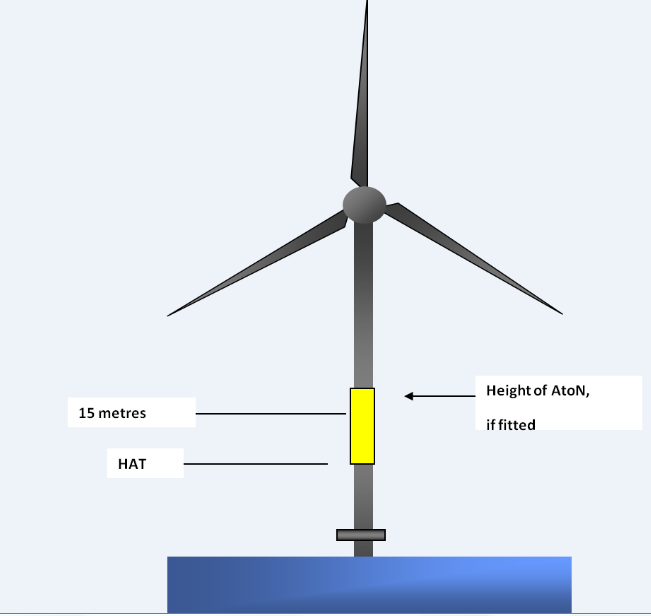
The tower of every structure should be painted yellow all around from the level of Highest Astronomical Tide (HAT) to 15 metres or the height of the AtoN, if fitted, whichever is greater.

Alternative marking may include horizontal yellow bands of not less than 2 metres in height and separation.

Consideration may be given to the use of additional retro reflective material.

Due to the increased danger posed by an isolated structure, it should be lit with a white light flashing Mo (U) W 15s, and with a MER of 10 Nautical Miles (approximately 1400 candelas).

The AtoN on the structure of a WTG should be mounted below the lowest point of the arc of the rotor blades. They should be exhibited at a height of at least 6 metres above the level of the HAT. AtoN on WTG should comply with IALA Recommendations and have an availability of not less than 99.0% (IALA Category 2).



1. Sample marking of an individual wind turbine

### Marking of Groups of Structures (Offshore Wind Farms)

A Significant Peripheral Structure (SPS) is the ‘corner’ or other significant point on the periphery of the OWF. Each individual SPS should be fitted with lights visible from all directions in the horizontal plane. These lights should be synchronized to display an IALA Special Mark characteristic, flashing yellow, with a MER of 5 Nautical Miles.

As a minimum, lights on individual SPS should exhibit synchronised flashing characteristics, however Authority should consider the synchronisation of all SPS. In the case of a large or extended OWF, the distance between SPS should not normally exceed 3 Nautical Miles.

Selected Intermediate structures on the periphery of an OWF, other than the SPS, should be marked with flashing yellow lights which are visible to the mariner from all directions in the horizontal plane. The flash character of these lights should be distinctly different from those displayed on the SPS, with a MER of 2 Nautical Miles. The lateral distance between such lit structures or the nearest SPS should not exceed 2 Nautical Miles.

#### Aids to Navigation for Marking OWF

In addition to the use of lights for marking the SPS and selected Intermediate peripheral structures of an OWF, further consideration should be given to the use of:

* L**i**ghting all peripheral structures
* Lighting all structures within the OWF
* Racons
* AIS AtoN

Consideration may also be given to the provision of fog signals where appropriate, taking into account the prevailing visibility, topography and vessel traffic conditions. The typical range of such a fog signal should not be less than two 2 Nautical Miles.

SPS - lights visible from all directions in the horizontal plane. These lights should be synchronized to display an IALA Special Mark characteristic, flashing yellow, with a range of not less than 5 Nautical Miles

**SPS**

Intermediate structures on the periphery of an OWF other than the SPSs - marked with flashing yellow lights which are visible to the mariner from all directions in the horizontal plane with a flash character distinctly different from those displayed on the SPSs and with a range of not less than 2 Nautical Miles

< 2 nm

**SPS**

**SPS**

**SPS**

**SPS**

**SPS**

< 3 nm

1. Sample marking of an OWF

### Considerations during Construction

During the construction/ decommissioning of Offshore Structures, working areas should be established and marked in accordance with the IALA MBS. National Authorities should also consider the use of floating AtoN or guard ships in areas of high traffic density.

MSI must be promulgated in advance of and during any offshore structure/ platform construction/ decommissioning.

When decommissioning such devices, the Authority should ensure that the operator/ contractor is obliged to remove all obstructions, so that the sea bed is returned to its original depth and topography. In the event that any residue or obstruction remains that, in the opinion of the Authority, constitutes a danger to navigation, then that shall be marked according to the Authority’s requirements.

Power cables between WTG, between WTG and the Offshore Sub Station, and between the Offshore Sub Station and the shore should be sufficiently trenched to avoid exposure from scouring / sand migration or trawling activities.

### Additional Considerations

Depending on the marking, lighting and lateral separation of the peripheral structures, the additional marking of the individual structures within an OWF may be considered as follows:

* Lighting of each structure
* Individual structures unlighted with retro-reflective areas
* Individual structures illuminated with down-lights on ladders and access platforms
* Use of flashing yellow lights with a MER of 2 Nautical Miles
* Identifying numbers on each individual structure, whether lit or unlit

An Offshore Transformer/Sub-Station or a Meteorological Mast, if considered to be a composite part of the OWF, should be included as part of the overall OWF marking. If not considered to be within the OWF block it should be marked as an offshore structure, i.e. flashing Mo (U) W ≤15 s.

As far as practicable, Aeronautical obstruction warning lights fitted to the tops of WTG should not be visible below the horizontal plane of these lights. The air navigation Authorities should be consulted regarding the specification of such lights.

## MARKING OF OFFSHORE WAVE AND TIDAL ENERGY DEVICES

### General

Wave and Tidal Energy Devices include: Tidal Generator, Tidal Generator field, Wave Generator, Wave Generator field, as defined in Appendix 1.

In general, any risk assessment of offshore wave and tidal extraction devices will likely determine that, when compared to gas and oil structures, there is a lower risk of either pollution or loss of life should a vessel foul such an installation. Consequently, the marking requirements can be mitigated. It should be borne in mind that many wave and tidal devices are low freeboard floating structures that are moored to the seabed. They may be moored in deep or shallow water and some may be located on the seabed or just below the surface. Surface piercing and subsurface elements may extend laterally beyond the surface elements. This could include shared moorings and mid-water connections between units which may also carry electricity, control signals, hydraulics or pneumatics associated with the units. It should also be noted that many tidal concepts have fast-moving sub-surface elements such as whirling blades, and these should be taken into account when identifying the marking requirements.

Consultation between the stakeholders such as Developers, National Administrations, Competent Authorities, AtoN providers and wave and tidal generator contractors/ developers should take place at an early stage.

Development of wave and tidal generators farm should not prejudice the safe use of Traffic Separation Schemes, Inshore Traffic Zones, recognised sea lanes and safe access to anchorages, harbours and places of refuge. On a case-by-case basis, Authorities may consider establishing Exclusion or Safety Zones to prohibit or restrict vessels from entering these areas. Such information should be shown on the navigation chart, as appropriate.

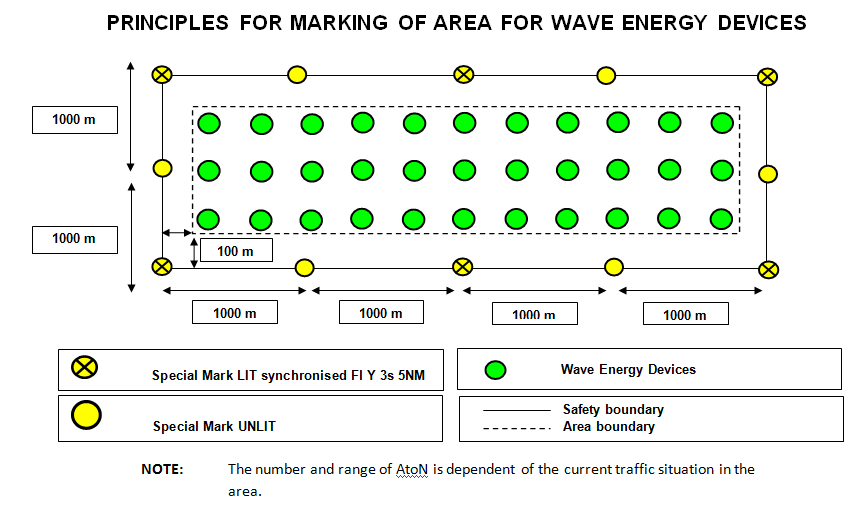
In order to avoid confusion from a high-density of AtoN (and other general lighting), full consideration should be given to the use of synchronised lights, different light characters and varied light ranges.

There has been some evidence that sea-bed scouring at the bases of offshore renewable energy installations in areas of strong tides or currents has resulted in significant deposits of material in other locations. Some Authorities have insisted on fitting depth monitoring devices to such installations to measure scour. This may need to be considered when approving wave and tidal energy extraction proposals/locations.

### Marking

Wave and Tidal energy extraction devices should be marked as a single unit or as a block or field as follows:

1. When structures are fixed to the seabed and extend above the surface, they should be marked in accordance with the recommendations contained in Section 2.3, Marking of OWF.



1. Areas containing surface or sub-surface EED (wave and/or tidal) should be marked by appropriate navigation buoys in accordance with the IALA MBS. In addition, radar reflectors, retro reflecting material, racons and/or AIS transponders should be fitted as the level of traffic and degree of risk requires.
2. The boundaries of the wave and tidal energy extraction field should be marked by lighted navigational buoys, so as to be visible to the Mariner from all relevant directions in the horizontal plane, by day and by night. Taking the results of a risk assessment into account, lights should have a MER of at least 5 Nautical Miles.
3. Taking into account environmental considerations, individual wave and tidal energy devices within a field which extend above the surface should be painted yellow above the waterline. Depending on the boundary marking, individual devices within the field need not be marked. However, if marked, they should have flashing yellow lights so as to be visible to the mariner from all relevant directions in the horizontal plane. The flash character of such lights should be sufficiently different from those displayed on the boundary lights with a MER of not less than 2 Nautical Miles.
4. Consideration should be given to the provision of AIS AtoN on selected peripheral wave and/or tidal energy devices.
5. A single wave and/or tidal energy extraction structure, standing alone, that extends above the surface should be painted black, with red horizontal bands, and should be marked as an Isolated Danger as described in the IALA MBS.
6. In the case of a single wave and/or tidal energy device which is not visible above the surface but is considered to be a hazard to surface navigation, it should be marked by an IALA special mark yellow buoy with flashing yellow light with a MER of not less than 5 Nautical Miles; in accordance with the IALA MBS. It should also be noted that many tidal concepts have fast-moving sub-surface elements such as whirling blades.
7. The Aids to Navigation described herein should comply with IALA Recommendations and have an appropriate availability, normally not less than 99.0% (IALA Category 2).
8. The relevant Hydrographic Office should be informed of the establishment of an energy extraction device or field, to permit appropriate charting of same.
9. Notices to Mariners should be issued to publicise the establishment of a wave and/or tidal energy device or field. The Notice to Mariners should include the marking, location and extent of such devices/fields.

### Considerations During Construction / Decommissioning

During the construction/ decommissioning of Offshore Structures, working areas should be established and marked in accordance with the IALA MBS. National Authorities should also consider the use of floating AtoN or guard ships in areas of high traffic density.

MSI must be promulgated in advance of and during any offshore structure/ platform construction/ decommissioning.

When decommissioning such devices, the Authority should ensure that the operator/ contractor is obliged to remove all obstructions, so that the sea bed is returned to its original depth and topography. In the event that any residue or obstruction remains that, in the opinion of the Authority, constitutes a danger to navigation, then that shall be marked according to the Authority’s requirements.

During construction, power cables between wave and tidal generators, between such generators and the transformer station, and between the transformer station and the shore should be sufficiently trenched to avoid exposure from scouring / sand migration or trawling activities.

### Contingency Plans

1. Operators of wave and/or tidal energy extraction devices or fields should develop contingency plans and emergency response plans which address the possibility of individual devices breaking loose and becoming floating hazards. AIS AtoN should be considered.
2. Developers and/or operators should have a reliable maintenance and casualty response regime in place to ensure the required availability targets are met. This will include having the necessary AtoN spares on hand, with provision made at the design stage, where necessary, to ensure safe access.

### Additional Considerations

Depending on the marking, lighting and lateral separation of the safety boundary, the additional marking of the individual structures within an energy extraction field, visible above the surface of the sea, may be considered as follows:

## Lighting of each structure.

## Individual structures unlighted with retro-reflective areas.

## Individual structures illuminated with down-lights on ladders and access platforms.

## Use of flashing yellow lights with a mer of 2 nautical miles.

## Identifying numbers on each individual structure, either lit or unlit.

An electrical Offshore Transformer/Sub-Station or other structure, if considered to be a composite part of the energy extraction field, should be included as part of the overall marking. If not considered to be within the boundaries of the field, it should be marked as a single stand alone device as described in Section 2.4.2 (paragraph 7 refers)

**3 FUTURE REQUIREMENTS**

IALA is aware that there is an increasing number of energy devices and structures already in place with many more planned which may affect shipping.

It is therefore recommended that Authorities should continuously monitor these Recommendations to ensure that any navigational problems caused by offshore structures are solved in a satisfactory manner.

Authorities facing problems in this field are invited to bring them to the attention of IALA to obtain advice based on current practice.

IALA foresees the need to re-examine these Recommendations from time to time, and if necessary to update them.

# 4 glossary

**National Authority**: the competent National Authority for determining the marking of offshore structures – hereafter referred to as the Authority.

**Effective intensity** – the effective intensity of rhythmic lights shall be calculated in accordance with the IALA Recommendations for the calculation of the effective intensity of a rhythmic light, November 1980, using the Schmidt-Clausen method of calculation, where this is applicable for the apparatus concerned.

**Energy Extraction Device (EED)** - a wave or tidal generator.

**Highest Astronomical Tide (HAT)** - is the highest level that can be expected to occur under average meteorological conditions and under any combination of astronomical conditions. HAT is not an extreme level, as certain meteorological conditions can cause a higher. The level under these circumstances is known as a 'storm surge'. HAT is determined by inspecting predicted sea levels over a number of years.

**Mean High Water Springs (MHWS)**. The height of mean high water springs is the average throughout the year (when the average maximum declination of the moon is 23.5°) of two successive high waters during those periods of 24 hours when the range of the tide is at its greatest.

**Nautical Mile** – 1852m.

**Significant Peripheral Structure (SPS)** – the ‘corner’ wind generator on a rectangular OWF or other significant point on the periphery of an OWF.

**Transformer Station (hub)** – a special structure within or outside the wave and/or tidal energy extraction field and/or OWF to which the individual generators are connected via a power cable. Power is transferred ashore from the transformer station by submarine cable. A ‘hub’ may be a separate fixed or floating platform, a unit very similar to the generators but carrying additional power conversion equipment.

**Usual Range** – the usual range of the fog signal shall be calculated in accordance with IALA Recommendation E-109, on the calculation of the range of a sound signal, dated May 1998.

1. INVENTORY OF OFFSHORE STRUCTURES

# oFFSHORE STRUCTURES: definitions

This Appendix states definitions and gives examples of current offshore structures.

## Aquaculture Farms

Aquaculture is the cultivation of fresh-water and marine species, including molluscs, crustaceans and aquatic plants. Unlike fishing, aquaculture, also known as aquafarming, implies the cultivation of aquatic populations under controlled conditions.

Particular kinds of aquaculture include algaculture (the production of kelp/seaweed and other algae); fish farming; shrimp farming, shellfish farming, and the growing of cultured pearls.

The worldwide practice of aquaculture runs the gamut from low-technology extensive methods to highly intensive systems.

Aquaculture farms take on a variety of forms including huge tanks, freshwater ponds, and shallow- or deep-water marine environments. This document will relate to farms in marine environments.

## Articulated Loading Platform (ALP) (Oil & Gas Permanent Installations)



1. A diagram of an Articulated Platform

An ALP is a metal lattice tower, buoyant at one end and attached at the other by a universal joint to a concrete filled base on the sea bed. The platform may be fitted with a helicopter platform, emergency accommodation and hawser/hose retrieval.

## (CALM) (Oil & Gas Permanent Installations - Loading / Discharge Buoys)



1. A Catenary Anchor Leg Mooring buoy

CALM systems, are named so for the characteristic curve of the anchor legs that hold the buoy in position. These buoys are also often referred to as a single buoy mooring, monobuoy or loading buoy.

CALM buoys can be designed to berth any size tanker up to and including Ultra Large Crude Carriers (ULCCs).

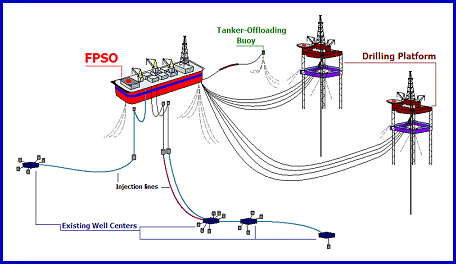
The main applications of a CALM system are:

# Short term mooring: for import and export of fluids between onshore or offshore facilities and a tanker;

# Permanent mooring: for production and storage systems;

# Semi-permanent mooring: permanent mooring with easy disconnect capability to evacuate the facility in case of severe weather conditions.

## Floating Production Storage Offloader (FPSOs) (Loading / Discharge Buoys)



1. Floating Production Storage Offloader

These are vessels which are usually self powered and make their own way from the builder yard to the oil fields where they are permanently anchored, and act as floating tanks.

They may be purpose built or can be ships (VLCC, for example) that have passed their active trading life and were refitted into a FPSO.

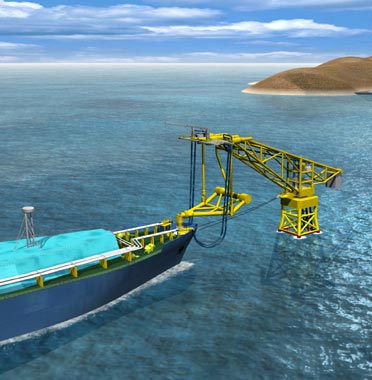
## Flotel (Oil & Gas Temporary Structures)



1. An example of a Flotel

This type of structure is a platform, that is used as an R&R (rest and recuperation) location for workers; it is not an active rig.

## LNG Offloading Points



1. An LNG Offloading Point

These Offloading Points, which are used for loading / unloading LNG, are linked or fixed to the seabed and include many types of transference structures.

## Meteorological Masts



1. Meteorological Masts

Any individual surface structure, usually consisting of an embedded mast or tower with meteorological measuring instruments.

## Minimum Facility Platform (MFP)



1. An example of a Minimum Facility Platform

These surface facilities have completed a variety of modules including power generation, compression, drilling and accommodation. They are designed for simultaneous drilling and production and have undertaken the construction of many jackets and subsea structures.

## Offshore docks / Loading Islands



1. Offshore docks / Loading Islands

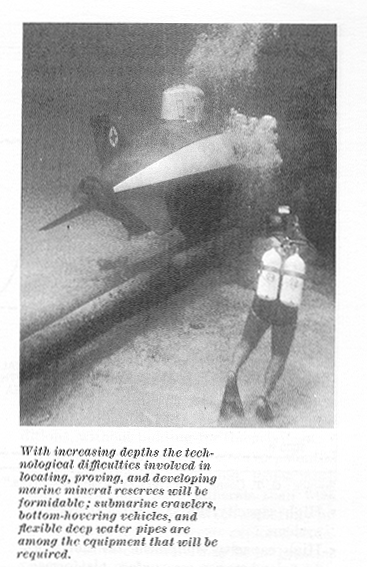
Floating structures of various types and sizes, moored to the seabed and used for berthing and loading / unloading cargo.

## Pipes

Underwater or subsea pipes are worldwide used. They are usually made of steel, have a concrete coating, and depending on the conditions, can be placed by barges with divers assistance.



1. Typical underwater piping



1. Underwater pipe maintenance

## Production Platform / Drilling Rigs



1. An example of a Production Platform

Production Platforms or Drilling Rigs are large structures used to house workers and machinery needed to drill and/or extract oil and natural gas through wells in the ocean bed. The platform may be attached to the ocean floor, consist of an artificial island, or be floating.

Many platforms also have remote wellheads attached by umbilical connections, these may be single wells or a manifold centre for multiple wells.

## Seaplane berth



1. An example of a Seaplane berth

A Seaplane is a fixed-wing aircraft designed to take off and land on water. A seaplane berth is a structure that has berthing facilities for these kind of planes, which are generally used for connecting islands to the mainland.

## Seawater Intakes / Sewage Outfalls



1. A Seawater Intake / Sewage Outfall

A seawater supply system can be found in many projects, and it includes Seawater Intakes and a discharge system. An outlet to a drainage network or a wastewater treatment is the Sewage Outfall.

## Single Point Mooring (SPM) (Loading / Discharge Buoys)



1. A Single Point Mooring buoy

Loading Buoys are anchored offshore and serve as a mooring point for tankers to (off)load gas or fluid products. They are the link between the geostatic subsea manifold connections and the tanker.

The main purpose of the buoy is to transfer fluids between onshore or offshore facilities and the moored tanker.

These Buoys are generally referred to as Single Point Mooring systems or ‘SPMs’. They are also often referred to as Single Buoy Moorings or ‘SBMs’.

## Tension Leg Platform (TLP) (Oil & Gas Permanent Installations)



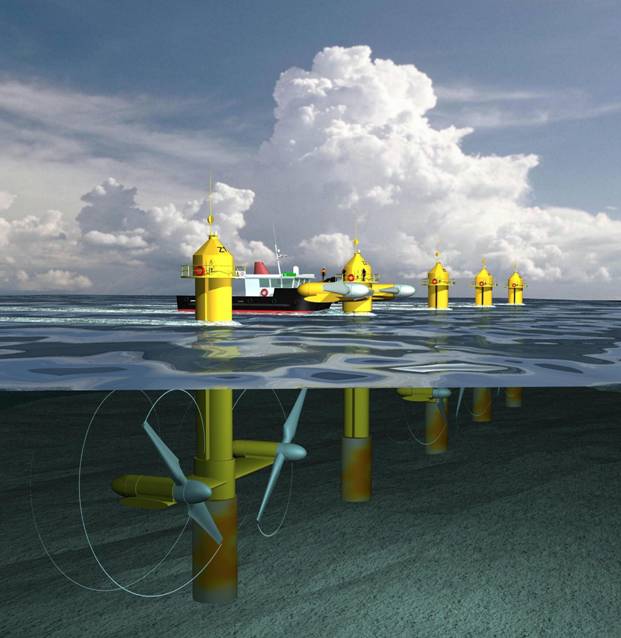
1. A diagram of a Tension Leg Platform

A Tension Leg Platform (TLP) is a buoyant platform held in place by a mooring system. The TLP’s are similar to conventional fixed platforms except that the platform is maintained on location through the use of moorings held in tension by the buoyancy of the hull.

The topside facilities (processing facilities, pipelines, and surface trees) of the TLP and most of the daily operations are the same as for a conventional platform.

## 

## Tidal Generator



1. Tidal Generators

Any individual surface or sub-surface structure incorporating a generator, fixed or moored to the seabed and connected to an electrical terminal via cable(s).

## Tidal Generator Field



1. A Tidal Generator Field

A group of individual tidal generators, which are located in one block and are considered to be a unit, fixed or moored to the seabed and/or each other and connected to an electrical terminal via cable(s).

## Underwater manifolds / obstructions



1. An example of an underwater obstruction

This group of structures comprises manifolds and various types of man-made obstructions placed on the seabed.

## Water Injection Platforms or booster station (WIPs)



1. A Water Injection Platform

Water injection platforms usually comprise a fixed steel platform, linked to the a wellhead platform. The integrated topside has water injection facilities, water treatment facilities and power generation. This platform can also lodge a drilling rig.

## Wave Generator

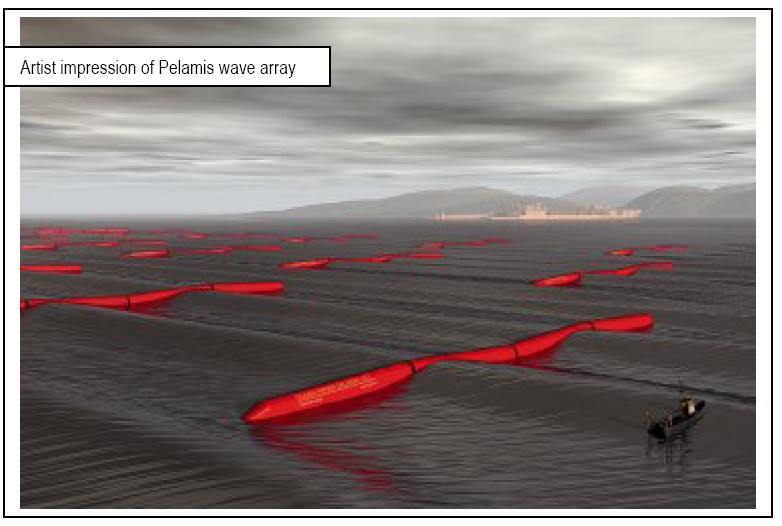


Production models will be coloured yellow, in accordance with the Recommendation.

1. A Wave Generator

Any individual surface or sub-surface structure incorporating a generator, moored to the seabed and connected to an electrical terminal.

## Wave Generator Field



Production models will be coloured yellow, in accordance with the Recommendation.

1. A Wave Generator Field

A group of individual wave generators, which are located in one block and are considered to be a unit, moored to the seabed and/or each other and connected to electrical hub.

## Wind Generator



1. A Wind Generator

Any individual surface structure, usually consisting of an embedded mast or tower with rotating blades and incorporating a generator.

## Offshore Wind Farm



1. An Offshore Wind Farm

A group of individual wind generators, which are located in one block and are considered to be a unit.