



AIRCRAFT WARNING LIGHTS

DESIGN AND OPERATIONS GUIDELINES

- ICAO GUIDELINES ANNEX 14 - Vol. I
- EASA GUIDELINES CS-ADR-DSN-CHAPTER Q

*“In the case of an object to be lighted, **one or more low, medium or high intensity obstacle lights** shall be located as close as practicable to the top of the object.”*

ICAO, Annex 14, Vol.1, Ch.6, Paragraph 6.2.3.10



WORKSHOP

Founded in 1988, **COMBUSTION AND ENERGY SRL is an Italian Company** specialized in design and manufacture of **electrical equipment for hazardous area**. The company has a sound experience in process and detailed engineering, project management and plant start up, in compliance with the main international Oil & Gas standard ATEX, IECEx, INMETRO (Brazil), TrCu (Russia) and PESO (India).

In the early 2000s, C&E started developing a line of Aircraft Warning Lights, launched under the LUXSOLAR brand.

Aircraft Warning Lights Devices (AWL) are systems that improve a safe air navigation allowing aircrafts to easily identify elevated structures such as skyscrapers, towers, chimneys, wind generators, offshore platforms, etc. **Since 2005 LUXSOLAR provides a wide range of customized LED Lighting systems** for several different applications such as heliports, helidecks, airfield and marine environment, that comply with International regulations.

Innovation and Research made LUXSOLAR one of the most important manufacturers of LED lighting systems for signalling in the market, and this is one of the reasons why for the **new bridge San Giorgio in Genova (Italy)**, The Renzo Piano Building Workshop RPBW has selected LUXSOLAR Aircraft Warning Lights, both for the technical features and the attractive design (unique of its kind), while on the astonishing **“Bosco Verticale”** in Milano, LUXSOLAR AWL are adding flashes of red and white to the dominant green colour of the building, forming the Italian flag colours.

In 2019 LUXSOLAR celebrated 10 years of continuous operation of the first LED AWL installed on the bridges designed by Santiago Calatrava in Reggio Emilia (Italy), and we expect the beacons to reach new performance goals in the years ahead.

A significant part of C&E Group activity is the concern for the environment; our mission is to create more and more sustainable products thanks to continuous innovation, offering customers high quality and high reliable products.



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BUILDINGS

Tall structures and buildings either temporary or permanent, which have the potential to endanger aviation in navigable airspace or has the potential to interfere with the operation of navigation, should be lighted.

BASIC RULES

- The number of light levels recommended depends on the height of the structure;
- The number and arrangement of light units at each level should be placed so the lighting is visible from every angle in azimuth;
- Lights are applied to display the general definition of an object or a group of buildings;
- Width and length of buildings determine the number of lights installed at the top and at each light level.

LIGHTS SPECIFICATIONS

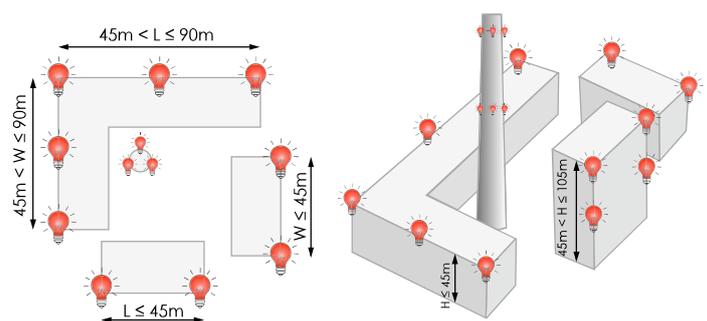
Low intensity lights should be used for structure with $H \leq 45$ m during night time, if those are considered inadequate, than medium - high intensity lights should be used.

Medium intensity lights type A,B or C should be used to lit extensive object (group of buildings or tree) or structure with $45 \text{ m} < H \leq 150$ m.

Note: Medium intensity lights, type A and C should be used alone, whereas medium intensity lights, Type B should be used either alone or in combination with LIOL-B.

High intensity type A, should be used to indicate the presence of an object if its $H > 150$ m and an aeronautical study indicates such lights to be essential for the recognition of the object by day.

LENGTH / WIDTH	N° OF LIGHT PER LEVEL
$W \ \& \ L \leq 45 \text{ m}$	4 AWL, one at each corner
$45 < W \ \& \ L \leq 90 \text{ m}$	3 AWL equispaced along L or W
$W \ \& \ L > 90 \text{ m}$	AWL should be spaced at intervals $< 45 \text{ m}$





TELECOMMUNICATION & RADIO TOWERS

Telecommunications & Radio Towers are, typically, tall structures designed to support antennas for telecommunications and broadcasting, including television. They are among the tallest man-made structures.

BASIC RULES

- The number of light levels recommended depends on the height of the structure;
- The number and arrangement of light units at each level should be placed so the lighting is visible from every angle in azimuth;
- Lights are applied to display the general definition of the structure;
- Width and length of buildings determine the number of lights installed at the top and at each light level.

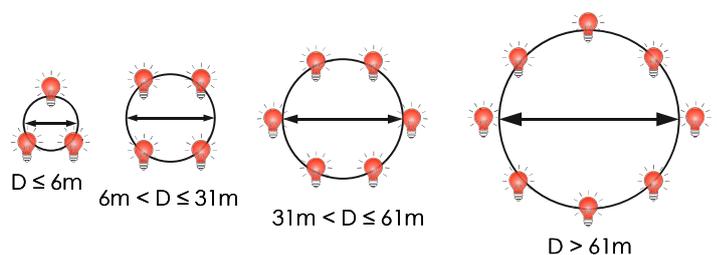
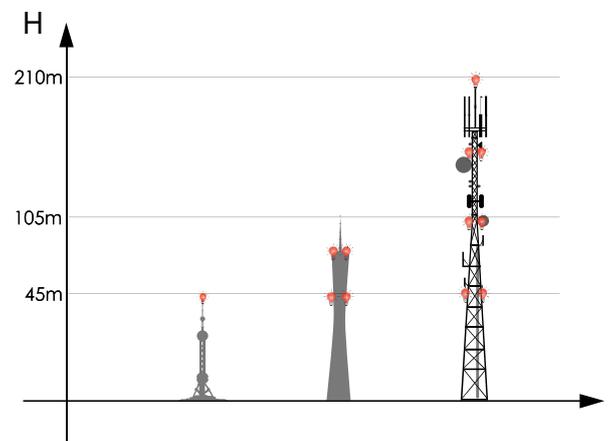
LIGHTS SPECIFICATIONS

Low intensity lights should be used for structure with $H \leq 45$ m during night time, if those are considered inadequate, than medium - high intensity lights should be used.

Medium intensity lights type A,B or C should be used to lit extensive object (group of buildings or tree) or structure with $45 \text{ m} < H \leq 150 \text{ m}$

Note: Medium intensity lights, type A and C should be used alone, whereas medium intensity lights, Type B should be used either alone or in combination with LIOL-B.

High intensity type A, should be used to indicate the presence of an object if its $H > 150$ m and an aeronautical study indicates such lights to be essential for the recognition of the object by day



PLAN SHAPE	N° OF LIGHT PER LEVEL
	Square base $W < 45\text{m}$: • 4 AWL; • Lights to be installed in each corner
	Depends on the diameter of the structure regarding the level lights' height



POWER TRANSMISSION LINES

An overhead power line is a structure used in electric power transmission and distribution to transmit electrical energy along large distances. It consists of one or more conductors (commonly multiples of three) suspended by towers or poles.

BASIC RULES

- The number of light levels recommended depends on the height of the structure;
- The number and arrangement of light units at each level should be placed so the lighting is visible from every angle in azimuth;
- Lights are applied to display the general definition of an object or a group of buildings;
- Width and length of buildings determine the number of lights installed at the top and at each light level.

LIGHTS SPECIFICATIONS

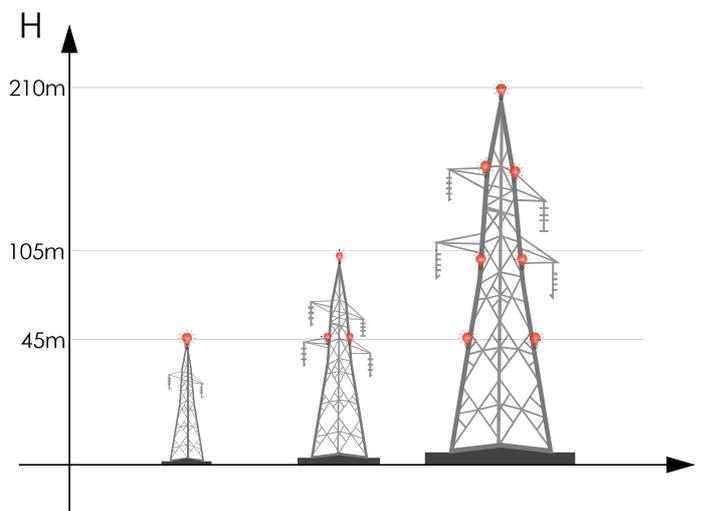
High-intensity obstacle lights, Type B, should be used to indicate the presence of a tower supporting overhead wires, cables, etc., where:

- an aeronautical study indicates such lights to be essential for the recognition of the presence of wires, cables, etc.; or
- it has not been found practicable to install markers on the wires, cables, etc.

Where high-intensity obstacle lights, Type B, are used, they shall be located at three levels:

- at the top of the tower;
- at the lowest level of the catenary of the wires or cables; and
- at approximately midway between these two levels.

High-intensity obstacle lights, Type B, indicating the presence of a tower supporting overhead wires, cables, etc., should flash sequentially; first the middle light, second the top light and last, the bottom light.



PLAN SHAPE	N° OF LIGHT PER LEVEL
	Lights should define the general shape of the object; 1 or more lights should be mounted outside at diagonally opposite positions;



CRANES

A crane is a type of tall machine, generally equipped with a hoist rope, wire ropes or chains, and sheaves that can be used both to lift and lower materials and to move them horizontally.

BASIC RULES

- The number of light levels recommended depends on the height of the structure;
- The number and arrangement of light units at each level should be placed so the lighting is visible from every angle in azimuth;
- Lights are applied to display the general definition of an object or a group of buildings;
- Width and length of buildings determine the number of lights installed at the top and at each light level.

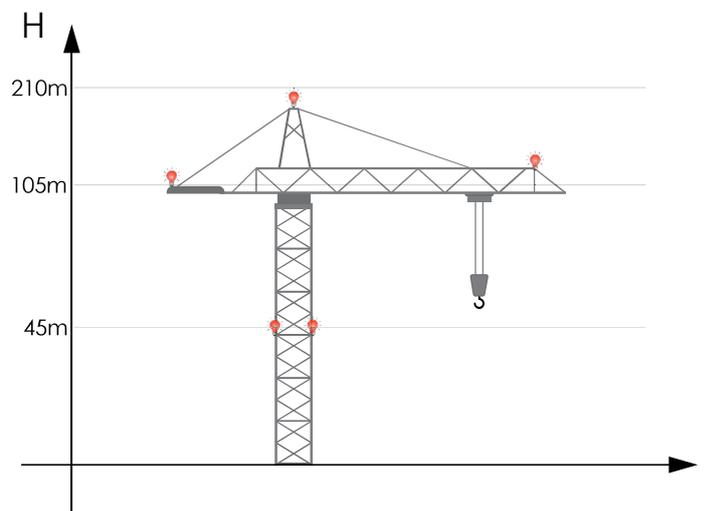
LIGHTS SPECIFICATIONS

Low intensity lights should be used for structure with $H \leq 45$ m during night time, if those are considered inadequate, than medium - high intensity lights should be used.

Medium intensity lights type A,B or C should be used to lit extensive object (group of buildings or tree) or structure with $45 \text{ m} < H \leq 150 \text{ m}$.

Note: Medium intensity lights, type A and C should be used alone, whereas medium intensity lights, Type B should be used either alone or in combination with LIOL-B.

High intensity type A, should be used to indicate the presence of an object if its $H > 150$ m and an aeronautical study indicates such lights to be essential for the recognition of the object by day.



PLAN SHAPE	N° OF LIGHT PER LEVEL
	Lights should define the general shape of the object; 1 or more lights should be mounted outside at diagonally opposite positions;
	1-3 AWL should be placed at top level and if required at jib and counter-jib



CHIMNEYS STACK

A chimney is a typical cylindrical and vertical structure that provides ventilation for hot flue gases or smoke from a boiler, stove, furnace or fireplace to the outside atmosphere.

BASIC RULES

- The number of light levels recommended depends on the height of the structure;
- The number and arrangement of light units at each level should be placed so the lighting is visible from every angle in azimuth;
- Lights are applied to display the general definition of an object or a group of buildings;
- The top lights should be placed sufficiently below the top so as to minimize contamination by smoke, etc
- The diameter of the structure determine the number of lights installed at the top and at each light level.

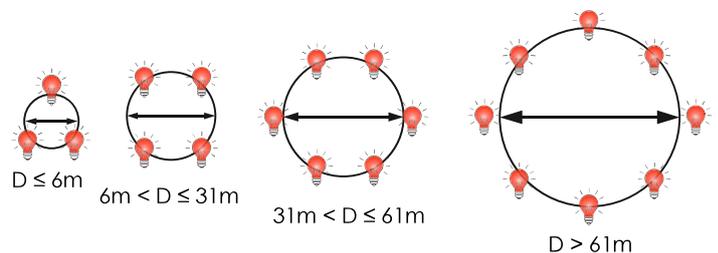
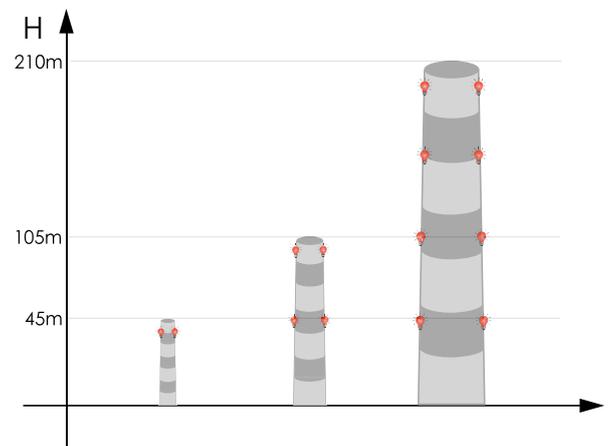
LIGHTS SPECIFICATIONS

Low intensity lights should be used for structure with $H \leq 45$ m during night time, if those are considered inadequate, than medium - high intensity lights should be used.

Medium intensity lights type A,B or C should be used to lit extensive object (group of buildings or tree) or structure with $45 \text{ m} < H \leq 150 \text{ m}$.

N intensity lights, type A and C should be used alone, whereas medium intensity lights, Type B should be used either alone or in combination with LIOL-B.

High intensity type A, should be used to indicate the presence of an object if its $H > 150 \text{ m}$ and an aeronautical study indicates such lights to be essential for the recognition of the object by day.



PLAN SHAPE	N° OF LIGHT PER LEVEL
	Depends on the diameter of the structure



COOLING TOWERS

A cooling tower is a heat rejection device which rejects waste heat to the atmosphere through the cooling of a water stream to a lower temperature.

BASIC RULES

- The number of light levels recommended depends on the height of the structure;
- The number and arrangement of light units at each level should be placed so the lighting is visible from every angle in azimuth;
- Lights are applied to display the general definition of an object or a group of buildings;
- The top lights should be placed sufficiently below the top so as to minimize contamination by smoke, etc
- The diameter of the structure determine the number of lights installed at the top and at each light level.

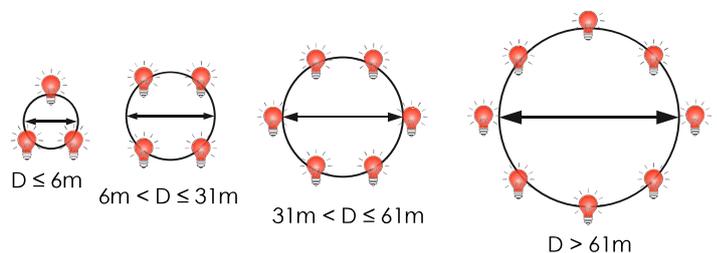
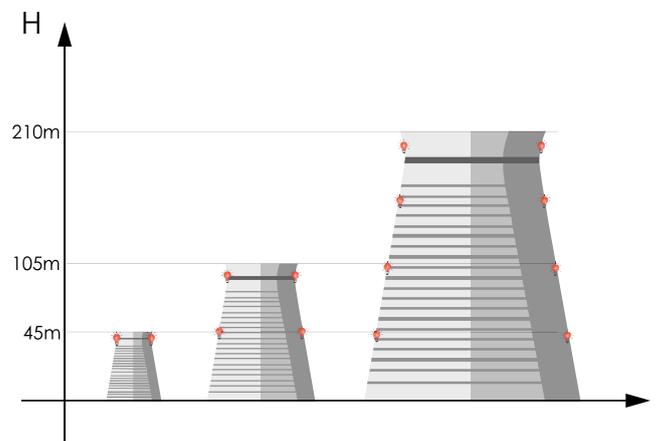
LIGHTS SPECIFICATIONS

Low intensity lights should be used for structure with $H \leq 45$ m during night time, if those are considered inadequate, than medium - high intensity lights should be used.

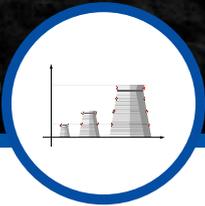
Medium intensity lights type A,B or C should be used to lit extensive object (group of buildings or tree) or structure with $45 \text{ m} < H \leq 150$ m.

Note: Medium intensity lights, type A and C should be used alone, whereas medium intensity lights, Type B should be used either alone or in combination with LIOL-B.

High intensity type A, should be used to indicate the presence of an object if its $H > 150$ m and an aeronautical study indicates such lights to be essential for the recognition of the object by day.



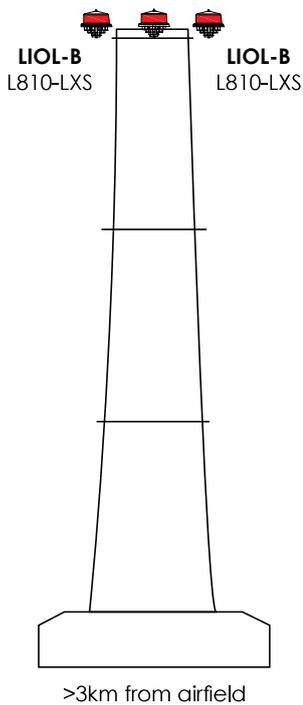
PLAN SHAPE	N° OF LIGHT PER LEVEL
	Depends on the diameter of the structure



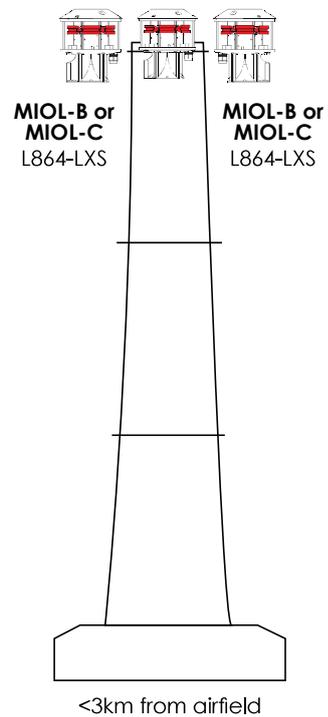
CONFIGURATION

ELEVATED STRUCTURES <45m

LOW INTENSITY
Red steady burning (Night)



MEDIUM INTENSITY
Red flashing or steady burning (Night)

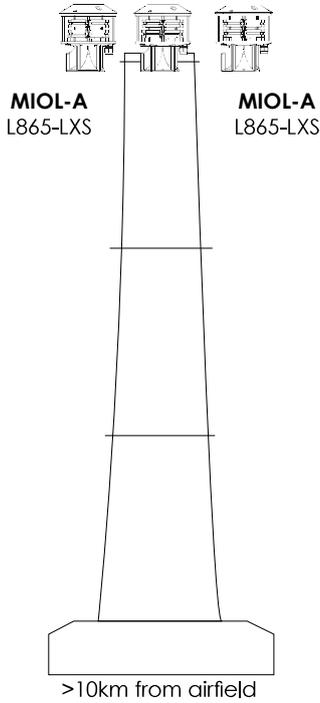


NOT MARKED

ELEVATED STRUCTURES FROM 45m TO 105m

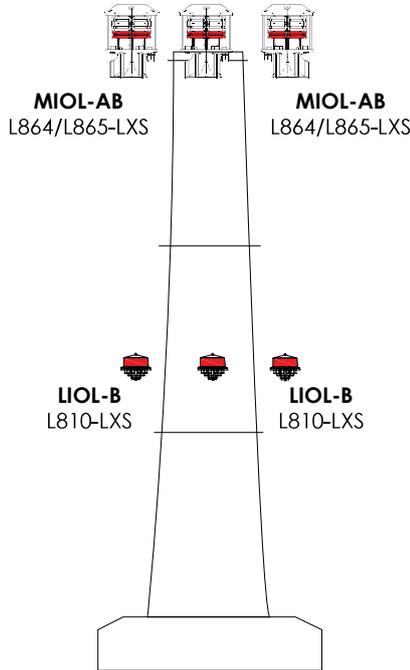
MEDIUM INTENSITY

White flashing
(Day and Night)



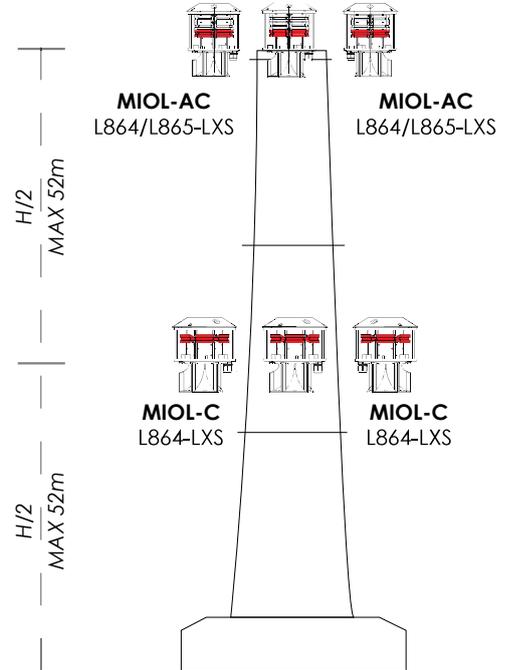
DUAL MEDIUM INTENSITY

White flashing (Day)
Red flashing (Night)



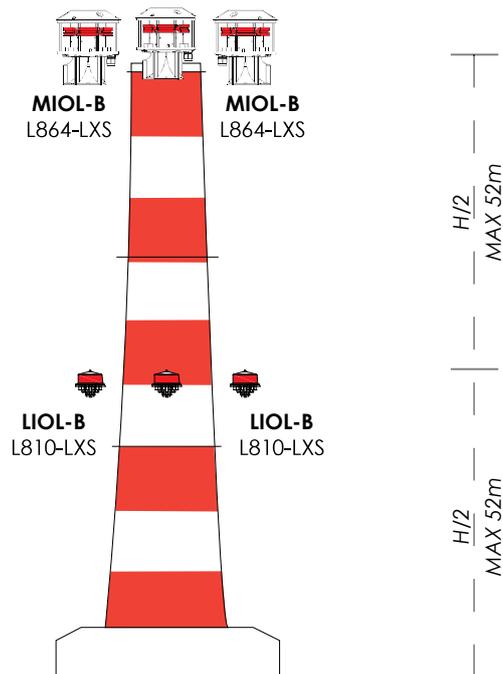
DUAL MEDIUM INTENSITY

White flashing (Day)
Red steady burning (Night)

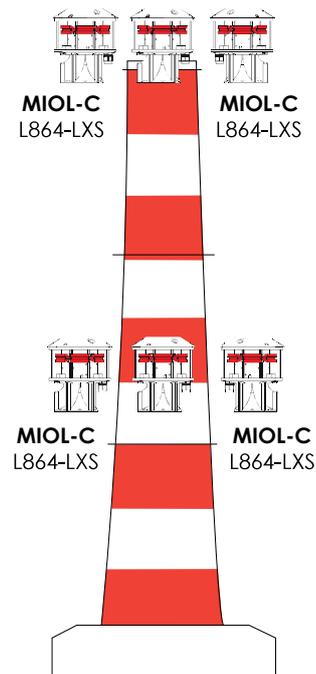


NOT MARKED

MEDIUM INTENSITY
Red flashing (Night)
Red steady burning (Night)



MEDIUM INTENSITY
Red steady burning (Night)

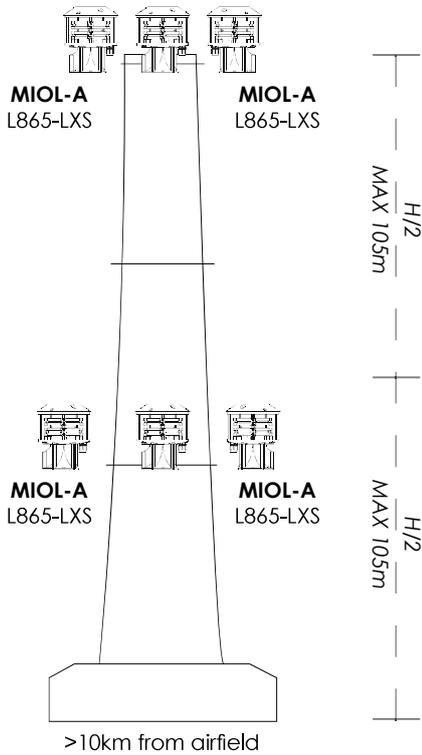


MARKED

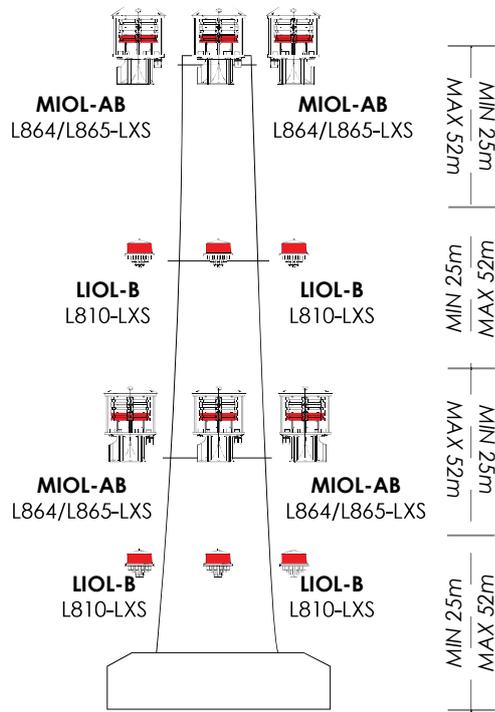
ELEVATED STRUCTURES FROM 105m TO 150m

NOT MARKED

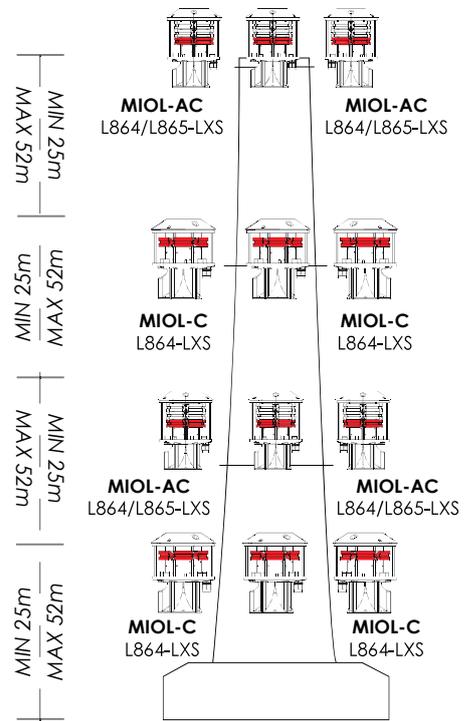
MEDIUM INTENSITY
White flashing
(Day and Night)



DUAL MEDIUM INTENSITY
White flashing (Day)
Red steady burning (Night)

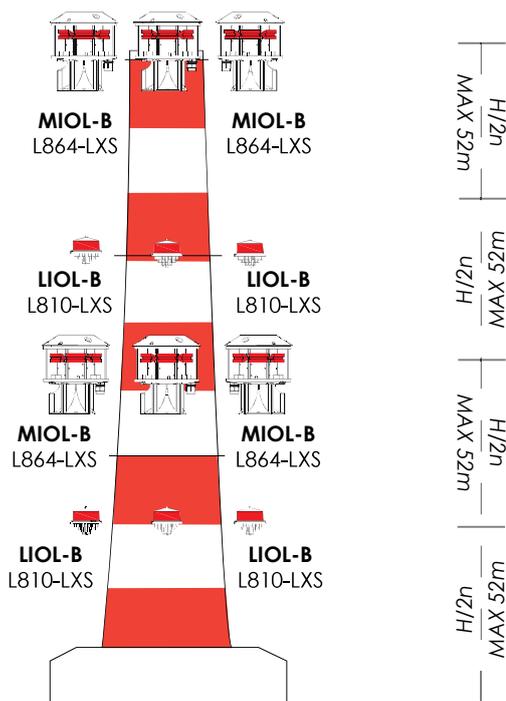


DUAL MEDIUM INTENSITY
White flashing (Day)
Red steady burning (Night)

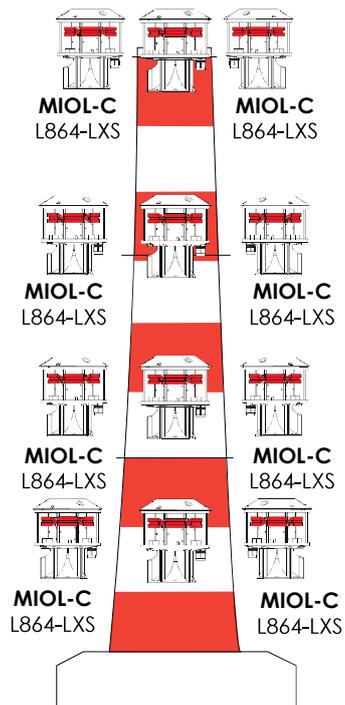


MARKED

MEDIUM INTENSITY
Red flashing (Night)
Red steady burning (night)

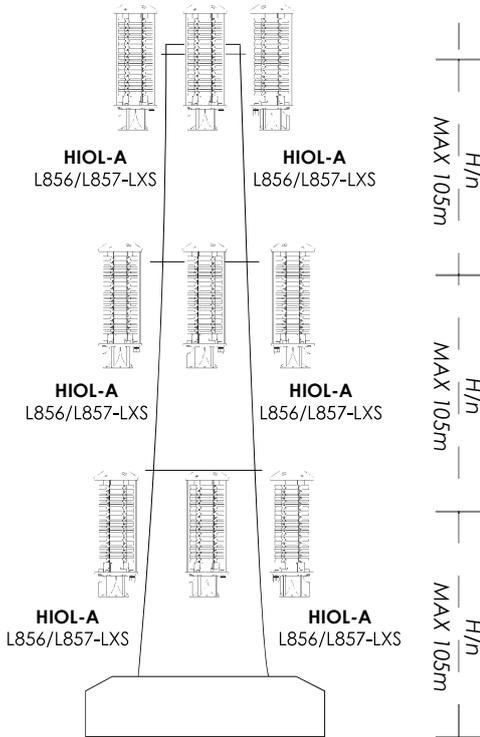


MEDIUM INTENSITY
Red steady burning (Night)



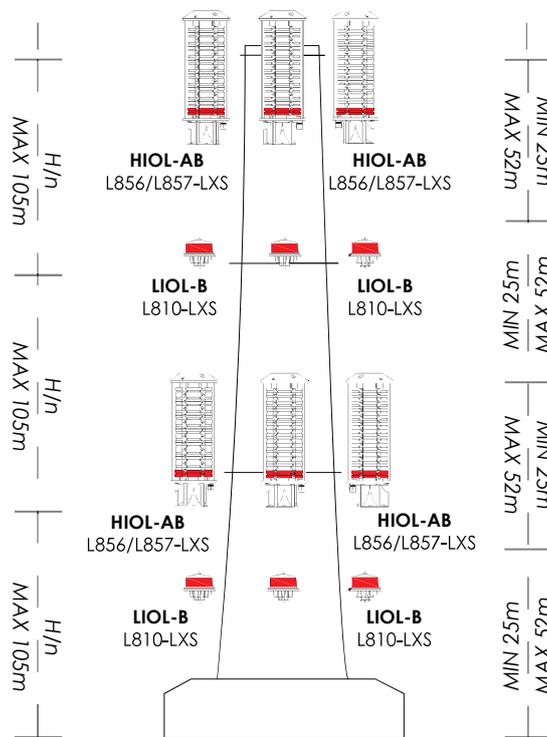
ELEVATED STRUCTURES >150m

HIGH INTENSITY White flashing (Day and Night)

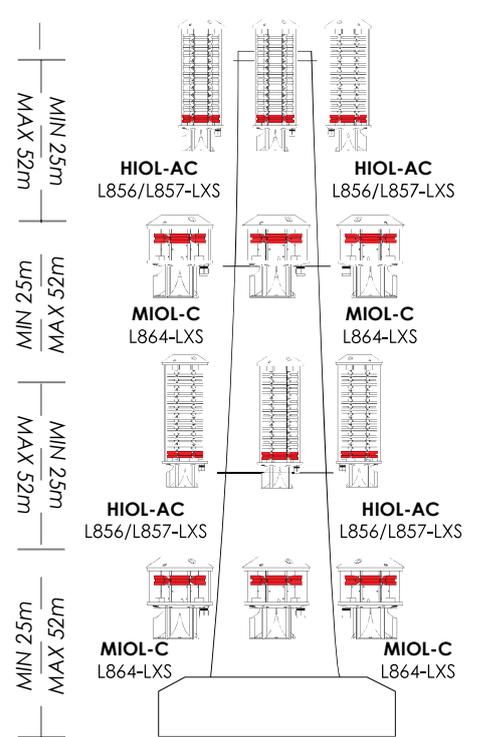


>10km from airfield

DUAL HIGH INTENSITY White flashing (Day) Red flashing (Night) Red steady burning (Night)

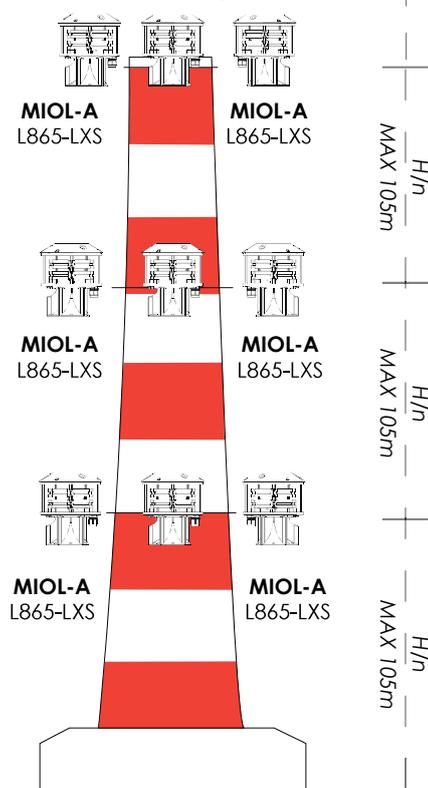


DUAL HIGH INTENSITY White flashing (Day) Red steady burning (Night)



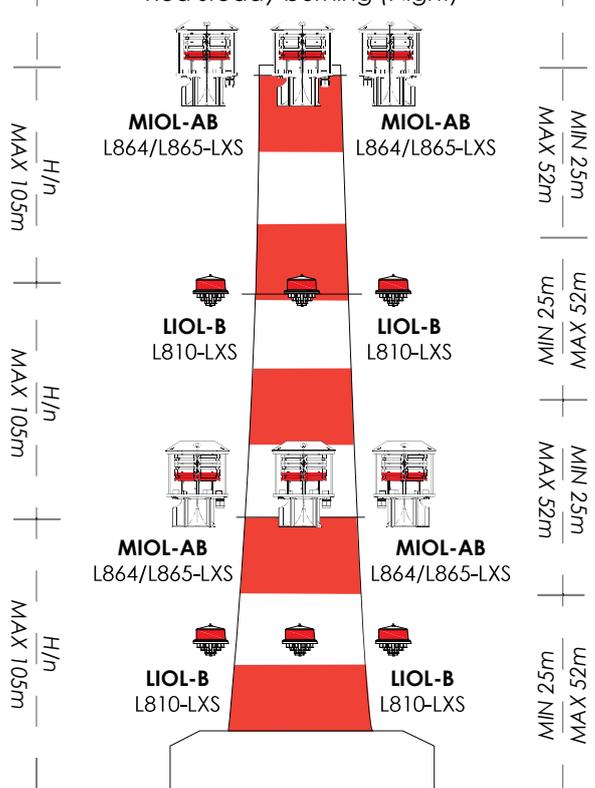
NOT MARKED

MEDIUM INTENSITY White flashing (Day and Night)

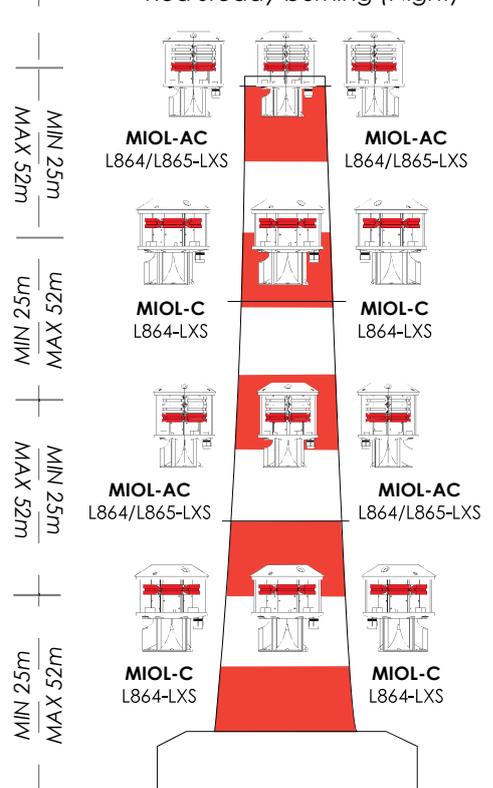


>10km from airfield

DUAL MEDIUM INTENSITY White flashing (Day) Red flashing (Night) Red steady burning (Night)



DUAL MEDIUM INTENSITY White flashing (Day) Red steady burning (Night)



MARKED



WIND TURBINES

A wind turbine is a device that converts the wind's kinetic energy into electrical power. Wind turbines are manufactured in a wide range of vertical and horizontal axis types. A wind turbine shall be marked and/or lighted if it is determined to be an obstacle.

BASIC RULES

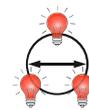
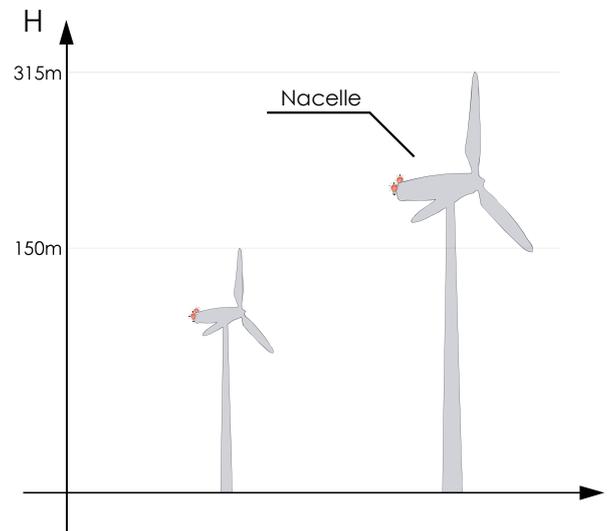
- The number of light levels recommended depends on the height of the structure;
- The obstacle lights should be installed on the nacelle to provide an unobstructed view for aircraft approaching from any direction;
- Lights are applied to identify the perimeter of the wind farm;
- The diameter of the structure determine the number of lights installed at mast level.

LIGHTS SPECIFICATIONS

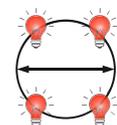
When lighting is deemed necessary, medium-intensity and low-intensity obstacle lights should be used.

In the case of a wind farm, i.e. a group of two or more wind turbines, it should be regarded as an extensive object and the lights should be installed:

1. to identify the perimeter of the wind farm;
2. respecting the maximum spacing of 900 m, between the lights along the perimeter, unless a dedicated assessment shows that a greater spacing can be used;
3. so that, where flashing lights are used, they flash simultaneously; and
4. so that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located.



$D \leq 6m$



$D > 6m$

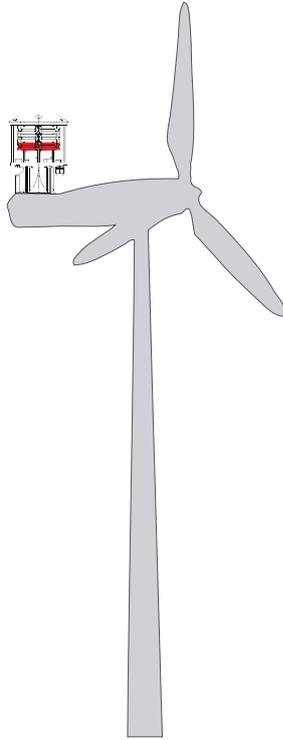
PLAN SHAPE	N° OF LIGHT PER LEVEL
	Depends on the diameter of the mast

ELEVATED STRUCTURES ≤ 150m

DUAL MEDIUM INTENSITY

White flashing (Day)
Red flashing (Night)

MIOL-AB
L864/L865-LXS

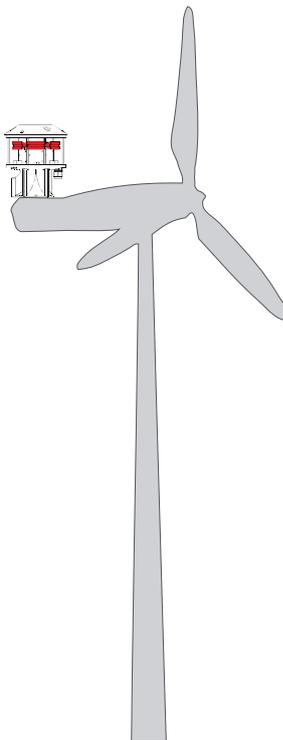


DAY AND NIGHT

MEDIUM INTENSITY

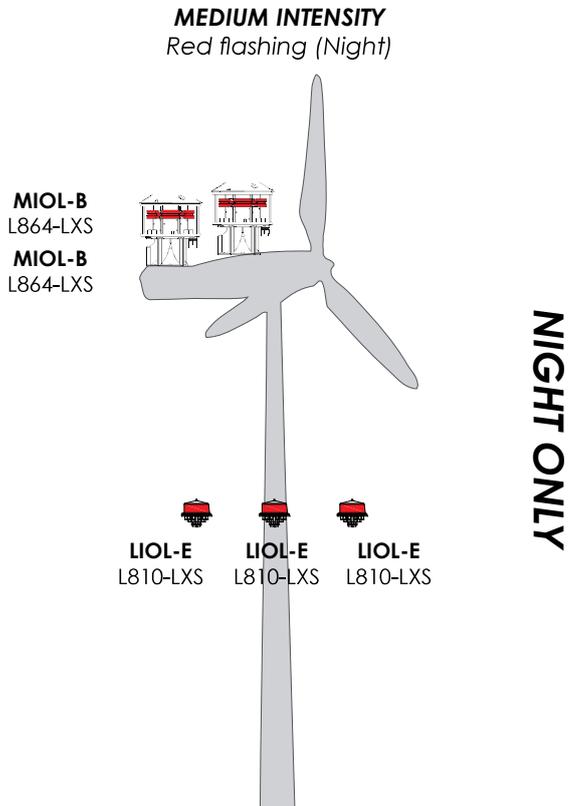
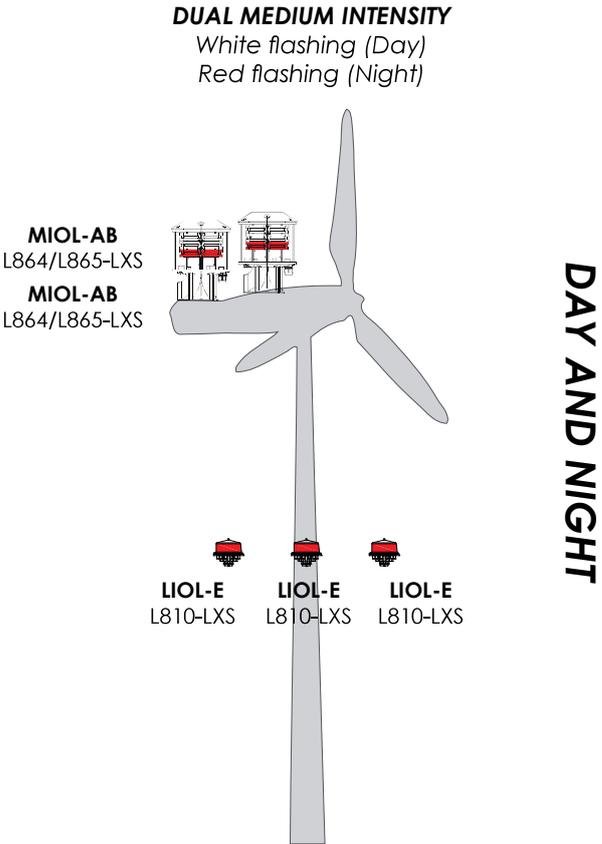
Red flashing (Night)

MIOL-B
L864-LXS



NIGHT ONLY

ELEVATED STRUCTURES FROM 150m TO 315m







PRODUCTS



AWL LIOL L810-LXS

- Red LEDs, steady burning or flashing mode
- Visibility: 10cd or 32cd
- Compact and lightweight
- Ready for LUXSOLAR Monitoring System



AWL LIOL L810-LXS c/w BOX

- Compact box to control up to 08 SINGLE L810-LXS, 04 TWIN L810-LXS, 04 SINGLE+IR L810-LXS
- Easy to install and ready-to-use system
- Ready for LUXSOLAR Monitoring System



AWL MIOL ALL-IN-ONE L864-LXS

- RED LEDs, steady burning or flashing mode
- Visibility: 2.000cd
- TWIN LED circuit and photocell integrated as standard features
- Ready for LUXSOLAR Monitoring System



AWL MIOL L864-LXS

- RED LEDs, steady burning or flashing
- Visibility: 2.000cd
- TWIN version available in one light fixture
- To be controlled by dedicated LUXSOLAR control panel





AWL MIOL L865-LXS

- WHITE LEDs, flashing
- Visibility: 20.000cd day mode, 2.000cd night mode
- TWIN version available in one light fixture
- To be controlled by dedicated LUXSOLAR control panel



AWL DUAL MIOL L864/L865-LXS

- WHITE LEDs flashing day-mode, RED LEDs flashing or steady burning night-mode
- Double colour and double working mode in the same light fixture
- Visibility: 20.000cd day mode, 2.000cd night mode
- To be controlled by dedicated LUXSOLAR control panel



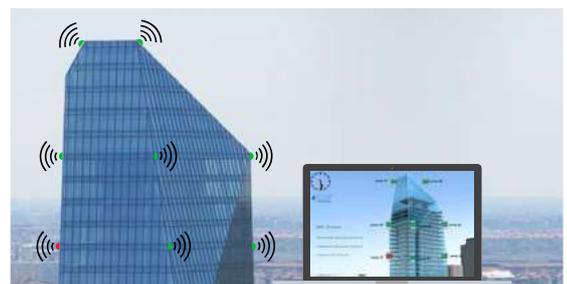
AWL HIOL L856/L857-LXS

- WHITE or WHITE/RED LEDs, flashing mode day-time and flashing or steady mode night-time
- Visibility: 200.000cd or 100.000cd
- Ultra bright LEDs
- Improved design for optimum heat dissipation



LUXSOLAR CLOUD MONITORING

- 24/7 status control of AWL system
- E-mail alert for fault or conditions change
- Customer dedicated Web Dashboard
- Cost-effective solution



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- EASA GUIDELINES CS-ADR-DSN-CHAPTER Q

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