

**AVIATION ACT, 1962 (ACT NO 74 OF 1962)
THIRTEENTH AMENDMENT OF THE CIVIL AVIATION
REGULATIONS (CAR's), 1997**

The Minister of Transport has under section 22(1) of the Aviation Act, 1962 (Act No 74 of 1962) made the regulations in the Schedule hereto.

**Obstacle limitations and marking outside aerodrome or heliport
CAR Part 139.01.33**

(1) All objects, whether temporary or permanent, which project above the horizontal surface within a specified radius of 8 kilometres as measured from the aerodrome reference point should be marked as specified in Document SA-CATS-AH.

(2) Any other object which projects the horizontal surface beyond these radii or above the conical surface and which constitutes a potential hazard to aircraft shall be marked as specified in Document SA-CATS-AH.

(3) Buildings or other objects which will constitute an obstruction or potential hazard to aircraft moving in the navigable air space in the vicinity of an aerodrome, or navigation aid, or which will adversely affect the performance of the radio navigation or instrument landing systems, shall not be erected or allowed to come into existence without the prior approval of the Commissioner for Civil Aviation.

(4) No buildings or objects higher than 45 metres above the mean level of the landing area, or, in the case of a water aerodrome or heliport, the normal level of the water, shall without the approval of the Commissioner be erected within a distance of 8 kilometre measured from the nearest point on the boundary of an aerodrome or heliport.

(5) No building, structure or object which projects above a slope of 1 in 20 and which is within 3 000 metres measured from the nearest point on the boundary of an aerodrome or heliport shall, without the prior approval of the Commissioner be erected or be allowed to come into existence.

(6) No building, structure or other object which will project above the approach, transitional or horizontal surfaces of an aerodrome or heliport shall, without the prior approval of the Commissioner, be erected or allowed to come into existence.

(7) In cases where special circumstances do not permit the requirements of these Regulations to be met, the Commissioner may in public interest grant exemption from compliance with any or all the provisions of this Chapter in terms of Part 11 of the Regulations."

Part 91.01.10 of the CAR of 1997 - endangering safety:

"No person shall, through any act or omission endanger the safety of an aircraft or person therein, or cause or permit an aircraft to endanger the safety of any person or property".

Part 185.00.1(1) (f) makes non-compliance with the above-mentioned Regulation an offence.

**EXCERPT OF SA-CATS AH 139.01.33:
OBSTACLE LIMITATIONS AND MARKINGS OUTSIDE AERODROME OR
HELIPORT**

Marking of Obstacles

1. Applicability

If a difference between a standard prescribed in ICAO Annex 14 and the SA-CATS-AH exists, the SA-CATS-AH standard shall prevail.

2. Structures to be marked

Any structure exceeding 45m above ground level, or structures where the top of the structure exceeds 150m above the MEAN ground level, like on top of a hill, the mean ground level considered to be the lowest point in a 3 Kilometre radius around such structure. Structures lower than 45m, which are considered as a danger or a potential danger to aviation, shall be marked as such when specified.

Overhead wires, cables, etc., crossing a river, valley or major roads shall be marked and in addition, their supporting towers marked and lighted if an aeronautical study indicates that it could constitute a hazard to aircraft.

NOTE: -

Wind turbine generator (Windfarms) support structures are dealt with separately.

4 MARKERS

Markers are used to highlight structures when it is impractical to make them conspicuous by painting. Markers may also be used in addition to orange (or red) and white paint [detailed in Section 3] when additional conspicuousness is necessary for aviation safety. They should be displayed in conspicuous positions on or adjacent to the structures so as to retain the general definition of the structure.

They should be recognizable in clear air from a distance of at least 1 000m and in all directions from which aircraft are likely to approach. Markers should be distinctively shaped, i.e., spherical or cylindrical, so they are not mistaken for items that are used to convey other information.

They should be replaced when faded or otherwise deteriorated.

4.1 Spherical Markers.

Spherical markers are used to identify overhead wires [such as power lines]. Markers may be of another shape, i.e., cylindrical, provided the projected area of such markers will not be less than that presented by a spherical marker. The Commissioner may require that additional lighting systems be added to enhance visibility.

4.2 Size and Colour.

The diameter of the markers used on extensive catenary wires across canyons, lakes, rivers, etc., shall be not less than 60 cm.

Smaller 30cm spheres are permitted on less extensive power lines or on power lines below 15m above the ground and within 500m of an aerodrome runway end. Each marker should be a solid colour such as orange or white.

4.3 Installations.

4.3.1 Spacing.

Markers should be spaced equally along the wire at intervals of approximately 30 m where the marker diameter is 60 cm progressively increasing to 35 m where the marker diameter is 80 cm and further progressively increasing to a maximum of 40 m where the marker diameter is at least 130 cm.

Where multiple wires, cables, etc. are involved, a marker should be located not lower than the level of the highest wire at the point marked.

They should be displayed on the highest wire or by another means at the same height as the highest wire. Where there is more than one wire at the highest point, the markers may be installed alternately along each wire if the distance between adjacent markers meets the spacing standard. This method allows the weight and wind loading factors to be distributed.

Where 30cm spheres are used, intervals between markers should be 10m to 15m.

4.3.2 Pattern.

An alternating colour scheme provides the most conspicuousness against all backgrounds. Overhead wires shall be marked by alternating solid coloured markers of international orange and white. An orange sphere is placed at each end of a line and the spacing is adjusted not to exceed the maximum spacing for the applicable size of spheres used to accommodate the rest of the markers. When less than four markers are used, they should all be international orange.

8. Standards of lighting

The characteristics of lights shall comply with Annex 14 chapter 6 table 6-3

Red aeronautical obstacle lights on top of structures that require marking shall be dual units for redundancy purposes unless the system is monitored and failed units can be replaced within one working day.

9. Lighting Systems

a. Red, steady burning Low intensity type A lights of at least 10 candela intensity shall be used when required on structures not exceeding 45m AGL.

b. Red steady (or flashing) low intensity type B lights of at least 32 candela intensity shall be used on structures exceeding 45m but not exceeding 150m AGL.

Intermediate lights shall consist of at least 3 single units spaced at 120 degree intervals, depending on the diameter of the structure, and may be low intensity type A lights of at least 10 candela.

When flashing lights are used, the flashes shall be synchronized.

c. Structures exceeding 150m AGL shall comply with the standards of Annex 14 chapter 6 unless specified differently.

d. Temporary Construction Equipment Lighting.

Construction cranes in urban areas should be painted in a conspicuous colour that is in a sharp contrast to the background. In addition, the jib should be illuminated with red flashing low intensity type B lights clearly defining the outline and extremities of the jib as well as the highest point of the crane. Spacing between lights should not exceed 45m.

11. ALTERNATE METHOD OF DISPLAYING OBSTRUCTION LIGHTS

When recommended in a CAA aeronautical study, lights may be placed on poles equal to the height of the obstruction and installed on or adjacent to the structure instead of installing lights on the obstruction.

14. Wind turbine generators (Windfarms)

a. Introduction

A wind turbine generator is a special type of aviation obstruction due to the fact that at least the top third of the generator is continuously variable and offers a peculiar problem in as much marking by night is concerned.

When wind turbine generators are grouped in numbers of three or more they will be referred to as "Windfarms"

b. Windfarm Placement

Due to the potential of wind turbine generators to interfere on radio navigation equipment, no Windfarm should be built closer than 35 Km from an aerodrome. In addition much care should be taken to consider visual flight rules routes, proximity of known recreational flight activity such as hang gliders, en route navigational facilities etc.

c. Windfarm Configurations

Windfarms come primarily in three predominant configurations, although actual installations may contain one or any combination of the three configurations. These three configurations are linear, cluster, and grid.

- a. Linear configurations are those where the turbines are placed in a line-like arrangement along a ridgeline, the face of a mountain, on a hill or along the borders of a field. The line may be ragged in shape or be periodically broken and may vary from just a few turbines to over several kilometres of wind turbines.
- b. Cluster configurations are those where the turbines are placed in circle-like groups on top of a hill or within a large field. A cluster is typically characterized by having a pronounced perimeter with various turbines placed inside the circle at various, erratic distances throughout the centre of the circle.
- c. Grid configurations are those where the turbines are arranged in a geographical shape such as a square or a rectangle, with each turbine

placed a consistent distance apart in rows, giving the appearance of a square-like pattern.

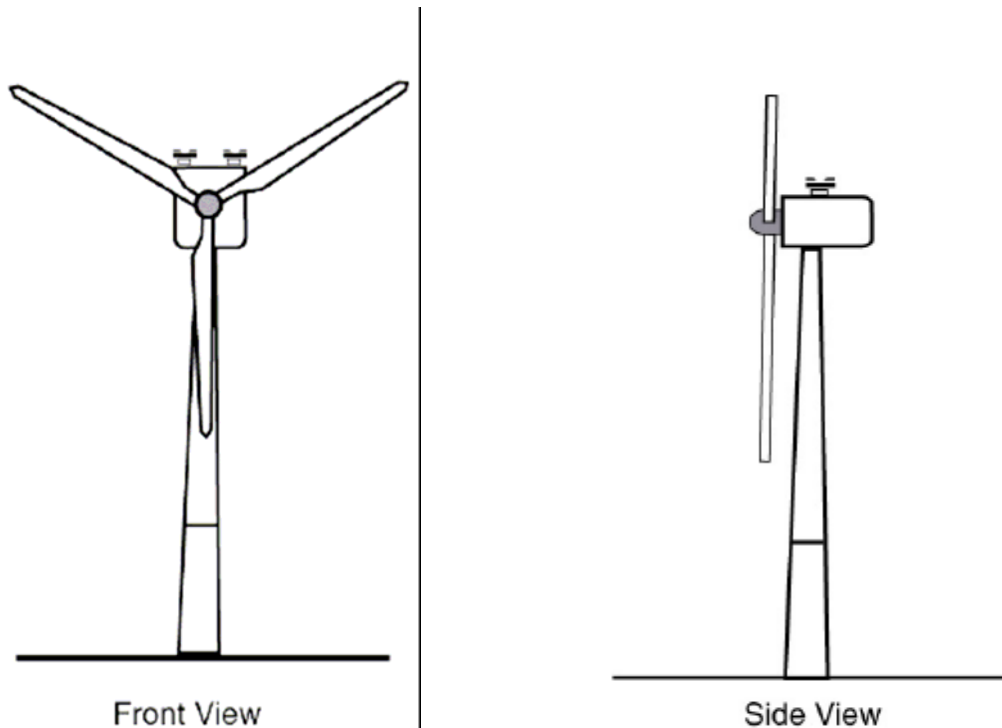
d. Windfarm Markings

Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness. The colours grey, blue and darker shades of white should be avoided altogether. If such colours have been used, the wind turbines shall be supplemented with daytime lighting, as required.

e. Windfarm Lighting

i) Individual wind turbine structures

Individual wind turbine structures shall be lighted by mounting two medium intensity type B lights on top of the generator housing and should flash simultaneously. Lighting fixtures are to be mounted at a horizontal separation to ensure an unobstructed view of at least one fixture by an aircraft approaching from any angle of azimuth. No intermediate level lights are required on these structures.



Lighting of individual wind turbines

ii) Windfarm (3 or more units) Lighting

In determining the required lighting of a Windfarm, it is important to identify the layout of the Windfarm first. This will allow the proper approach to be taken when

identifying which turbines need to be lit. Any special consideration to the site's location in proximity to aerodromes or known corridors, as well as any special terrain considerations, must be identified and addressed at this time.

Details are as follows:

- a. Not all wind turbine units within an installation or Windfarm need to be lit. Definition of the periphery of the installation is essential. Lighting of interior wind turbines is of lesser importance unless they project above the peripheral units. This can be the case when higher ridges or plateaus are present within the Windfarm area.
- b. Obstruction lights within a group of wind turbines should have unlighted separations or gaps of no more than 800m if the integrity of the group appearance is to be maintained. This is especially critical if the arrangement of objects is essentially linear, as is the case with most wind turbine groups.
- c. Any array of flashing or pulsed obstruction lighting, intended to warn of a group of wind turbines forming an entity (i.e., a line, string, or series of units), shall be synchronized to flash simultaneously. If an installation consists of a number of widespread, but obviously separated areas or entities more than 1500m from each other, it is not necessary that all such areas flash synchronously.
- d. Night time wind turbine obstruction lighting should consist of medium intensity type B aviation red flashing lights. Minimum intensities of 2000 candela for nighttime red flashing or strobe lights are required.

Note: Steady-burning obstruction lights shall not be used.

- e. White medium intensity type A strobe lights may be used in lieu of the preferred medium intensity type B strobe lights, but must be used alone without any red lights, and must be positioned in the same manner as the red flashing lights.
- f. Since the hub of the wind turbine unit is frequently as large as the nacelle (body) itself, a top-mounted obstruction light should be raised well above the surface of the nacelle so that it may be easily seen from directly in front of the turbine. Placement of the light fixtures on the turbine nacelle should be accomplished to ensure that they are visible from 360 degrees, with particular attention being made to ensure that the hub of the turbine rotor in no way blocks the light from an aircraft approaching the windward side of the turbine at the same elevation as the turbine hub.
- g. When possible, antennas or towers of heights over 45m that are within the turbine farm area should be incorporated into the lighting plan for the site,

as they offer tall, unobstructed platforms on which lighting fixtures can be mounted and should be included in the synchronization and spacing calculations.

- h. Each turbine should only require one fixture if the site is monitored, and that a failed light fixture can be replaced within the next working day. Failure to replace a failed fixture, which is essential to maintaining the 800m-separation requirement, will result in an unsafe gap in the lighting configuration. If the facility does not possess the capability to replace fixtures within the next working day, each turbine shall be fitted with two separate fixtures.

A well-balanced lighting plan has all the light fixtures within the Windfarm flash at the same time, thus delineating the farm as one large obstruction and navigation between the turbines should be discouraged. The synchronisation function can be accomplished through various means, either by radio frequency devices, hard-wired control cables, or independently mounted global positioning system synchroniser units. The site developer can decide the selection of the units, as long as the end result is that all lights flash perceivably at the same time. If the developer fails to synchronise the fixtures, the developer will be required to add additional fixtures at closer spacing. **The very basis of the lighting standards for Windfarms is centred on the synchronous flashing of the perimeter lighting.**

F. Turbine Lighting Assignment

The following guidelines should be followed to determine which turbines, need to be equipped with lighting fixtures. Again, the placement of the lights is contingent upon which type of configuration is being used.

- i. Linear: A light should be placed on each turbine positioned at each end of the line or string of turbines. From those end turbines, lights should then be positioned such that the next lit turbine is no more than 800m, from the last lit turbine. This pattern should continue until the end of the string is reached. If the last segment is significantly short, it may be practical to move the lit turbines back one or two turbines towards the starting point to present a nice, well-balanced string of lights. A high concentration of lights, in close proximity, should be avoided.
- ii. Cluster: A starting point should be selected along the outer perimeter of the cluster. This turbine should be lit, and then, continuing along the outer perimeter of the farm, a light should be placed on the next turbine with the maximum gap between the lit turbines being no more than 800m. This pattern should continue around the perimeter of the cluster, and end at the starting point. If it appears that the lights are crowded at the ending point, the lit turbines may be moved back by one turbine to present a balanced

lighting presentation. If it is determined that the distance across the cluster is of a distance greater than 1500m, or the terrain may vary within the cluster (+30m from the perimeter elevations), it may be appropriate to place a few lit turbines at strategic locations throughout the centre of the cluster. This will prevent pilots from believing they may be able to climb over the outer perimeter and descend down into the centre of the cluster. Discretion should be used when placing these lights to maintain a well-balanced, safe lighting configuration.

- iii. Grid: Initially, each of the defined corners of the grid layout should be selected for lighting, and then, using the same concept of the cluster configuration, lights should be placed on turbines along the outer limits of the farm so that the maximum spacing between lit turbines is no more than 800m. If it appears as though the end of the lighting strings may be crowded, it may be necessary to move the lights back one or two turbines to create an even lighting configuration. If the grid is more than 1500m wide across the centre of the group of turbines, it may be appropriate to position one or two lights within the centre of the configuration to again provide warning to pilots attempting to climb over the outer limits of the grid, and descending into the centre of the grid. Elevation should also be considered.
- iv. Special Instances: On occasion, if one or two turbines may be positioned at locations that do not lend themselves to the linear, cluster, or grid layouts, the following guidelines should be followed. If the turbine protrudes from the general limits of the Windfarm, the turbine should automatically receive a lighting fixture. If another turbine is collocated with the first turbine, it does not require any lighting as long as it is within 150m from the lit turbine and not positioned on the outboard side of the lit turbine. If these requirements cannot be met, both turbines, in this case, would need to be illuminated.