STANDARD 621

Obstruction Marking and Lighting Standard

Norme 621 – Norme relative au balisage et à l’éclairage des obstacles

Of the General Operating and Flight Rules Standards

OPR:

Transport Canada
Airspace Standards and Procedures
AIS and Airspace Standards
AARTA

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CHAPTER 1
INTRODUCTION

621.01

1.1 Definitions

In this Standard:

**appurtenance** - means that part of any vertical mast, pole or other appendage added to a building, structure or object that protrudes above the top of the building, structure or object; *(accessoire)*

**aviation colours** - for lighting, the colours as defined in the ICAO Annex 14

**beam spread** - means the angle between the two directions in the vertical or horizontal plane in which the intensity is equal to 50 percent of the minimum specified peak beam effective intensity; *(angle d’ouverture du faisceau)*

**catenary** - means the curved span of overhead wires hung freely between two supporting structures, normally with regard to exceptionally long elevated spans over canyons, rivers and deep valleys; *(caténaire)*

**effective intensity** - means the effective intensity of a flashing light is equal to the intensity of a steady-burning (fixed) light of the same color which produces the same visual range under identical conditions of observation; *(intensité efficace)*.

**fixed light** - see steady burning light; *(feu fixe; feu permanent)*

**lighting** - means any light displayed on an obstruction as a means of indicating the presence of the obstruction to pilots; *(éclairage)*

**lighting terms** - refer Figure 1-1 *(unités photométriques)*

- (a) **Lumen** - International System unit of luminous flux equal to the amount of light given out through a solid angle of 1 steradian by a point source of 1 candela intensity radiating uniformly in all directions. The unit expresses the quantity of light output per second. *(lumen)*
- (b) **Candela** - International System unit of luminous intensity of light emitted from a light source; equal to \(\frac{1}{60}\) of the luminous intensity per square centimetre of a blackbody radiating at the temperature of solidification of platinum (2,046°K). A luminous intensity of one candela is one lumen per steradian (solid angle). The unit expresses the intensity of light within an incremental segment of the beam. *(candela)*
- (c) **Lux** - International System unit of illumination, equal to one lumen per square meter (lm/m²). The unit expresses the amount of light falling on surface area. *(lux)*

**markers** - means an object displayed on an obstruction during daytime as a means of indicating the presence of relatively invisible obstructions such as power lines; *(balise)*

**marking** - means a symbol, group of symbols, or markers that are displayed on the surface of an obstruction and intended to reduce hazards to aircraft by indicating the presence of the obstruction by day; *(balisage)*

**meteorological visibility** - means the greatest distance, expressed in statute miles, that selected objects (visibility markers) or lights of moderate intensity at night (25 candela) can be seen and identified under specific conditions of observation; *(visibilité météorologique)*

**painting** - means a marking applied to the surface of an obstruction and intended to identify the presence of the obstruction by day; *(marque de peinture)*

**steady burning light** - means a light having constant luminous intensity when observed from a fixed point; *(feu permanent; feu fixe)*
**vertical aiming angle** - means the angle formed between the horizontal and a line through the centre of the vertical beam spread; *(calage en site)*

### 1.2 Notification Responsibilities

(1) A person planning to erect an obstruction, namely a building, structure or object, including a moored balloon or kite, either permanently or temporarily, shall contact the appropriate regional Transport Canada Civil Aviation office, as specified in Appendix A, at least 90 days prior to erection and provide the following information on the planned obstruction, using the *Air Navigation Obstruction Clearance Form* as shown in Appendix C:

*Information Note: Any person planning to erect an obstruction, should also provide information to NavCanada, using the 'Land Use Proposal Submission Form'. which is available from the appropriate Transport Canada regional office. (See Appendix A)*

(2) If it appears that a planned construction might create an obstruction to air navigation in the vicinity of a Department of National Defence (DND) aerodrome, the person having responsibility or control over the construction shall advise the appropriate DND authorities.
CHAPTER 2
GENERAL

621.01

2.1 Purpose of Marking and Lighting Requirements.

Information Note: The application of the marking and lighting requirements specified in this Standard and the approval of equivalent requirements is to ensure that an obstruction to air navigation remains visible at a range sufficient to permit a pilot in VMC conditions to take appropriate action in order to avoid the obstruction, by not less than 300m vertically within a horizontal radius of 600m from the obstruction. In other words, the purpose of obstruction marking and lighting standards is to provide an effective means of indicating the presence of objects likely to present a hazard to aviation safety. Equivalent lighting and marking requirements can be approved depending on terrain features, weather patterns, geographic location, and in the case of wind turbines, depending on the number of structures and overall layout of design, in accordance with the criteria and procedures outlined in sections 2.2 and 2.3. below.

2.2 Shielding

(1) The principle of shielding shall be applied in a way that a dominant permanent building, structure or object which is marked or lighted, or both, obviates the need for marking or lighting other buildings, structures or objects in the immediate surrounding area, which might otherwise be treated as individual obstructions.

(2) More specifically, the principle of shielding shall be applied if the marking or lighting, or both, of a dominant permanent building, structure or object is assessed by the Transport Canada regional office as providing sufficient warning to aircraft that, in avoiding the dominant obstruction, they will also avoid the unmarked or unlighted obstructions in the immediate surrounding area without risk of collision.

(3) Where two similar objects of equal height are situated adjacent to each other, as shown Figure 2-2, one of two objects may be considered as shielded, provided the separations listed in Table 2-1 are not exceeded.

![Figure 2-2](image)

Table 2-1: Separation between Shielded Objects

<table>
<thead>
<tr>
<th>Height of Objects AGL (meters)</th>
<th>Maximum Separation (meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 to 75</td>
<td>15</td>
</tr>
<tr>
<td>76 to 122</td>
<td>23</td>
</tr>
<tr>
<td>123 to 198</td>
<td>30</td>
</tr>
<tr>
<td>199 to 290</td>
<td>45</td>
</tr>
<tr>
<td>291 and higher</td>
<td>60</td>
</tr>
</tbody>
</table>

(4) A narrow obstruction may be considered as shielded when it is situated with respect to a large obstruction so that an aircraft, whose flight path would avoid the large obstruction would, as a result, also avoid the narrow one. Refer Figure 2-3.

(5) Adjacent Cable Span.

(a) A cable span across a recognized VFR route does not require marking or lighting where it is shielded by a larger object such as a bridge or a higher cable span.

(b) A cable span segment may be considered as shielded when it is situated within 600m of the marked cable span of the dominant obstruction so that it remains below a sloping down surface at a gradient of 5% projected from the marked cable span. Refer to Figure 2-1.

(c) If the second cable span is above the gradient, this span may not be considered as shielded and shall be marked or lighted, or both, in accordance with this Standard.

(6) Complex Objects
(a) Where it is not possible to apply a uniform standard to a cluster of objects such as industrial plants, oil refineries, thermal generating stations, and similar structures, they shall be assessed by the Transport Canada regional office on an individual basis to determine whether or not to treat them as hazards to aviation safety or as an extended obstruction, taking into account the objects' location and height.

(b) When treated as an extended obstruction, sufficient marking or lighting, or both, shall be provided to ensure that the extent of the cluster is defined and visual warning is provided from any angle of aircraft approach.

2.3 Lighting Equipment

(1) Certificate of Conformance.

*Information Note:* As a basis of ensuring procurement of equipment meets the requirements of this Standard, the person having responsibility or control over the obstruction should obtain a Certificate of Conformance through 3rd Party testing.

(2) Combined Light Units.

*Information Note:* The requirements specified in this Standard are written with respect to the performance of obstruction lighting, without consideration of how they are actually designed. Manufacturers may supply light sources contained within a single luminaire. For example, a combined CL-864 red flashing beacon with a CL-865 white flashing light, as may be used for a dual medium intensity, Configuration “E” installation.

2.4 Environmental Evaluation.

*Information Note:* The person having responsibility or control over an obstruction may be required to file an environmental evaluation with the appropriate authority having jurisdiction when seeking authorization for the use of the high intensity flashing white lighting system on structures located in residential neighbourhoods, as defined by the applicable zoning law.
3.1 **Scope.** Except as otherwise provided for in this Standard, Chapter 3 governs marking requirements for obstructions to air navigation in order to be make them conspicuous to pilots during daylight.

3.2 **Paint Standards.** Where alternate sections of aviation orange and white, referred herein as "orange" and "white" paint markings, are required under this Standard to be displayed on a building, structure or object, the colours of paint markings shall be in accordance with United States Federal Standard **FED-STD-595B**, for colours identified as:

(a) orange, number 12197; and
(b) white, number 17875.

3.3 **Surfaces Not Requiring Paint**

(1) Except as otherwise provided for in Chapter 3, ladders, decks, and walkways of steel towers and similar structures are not required to be painted, if a painted surface presents a potential hazard to maintenance personnel.

(2) Subject to subsection (3), paint may be omitted from precision or critical surfaces, if it would have an adverse effect on the transmission or radiation characteristics of a signal.

(3) Where markings are omitted under subsection (1) or (2), the overall marking effect of the structure shall not be reduced to the point of compromising the visibility criteria of section 2.1.

3.4 **Use of Plastic Wrapping.** In the case of poles, where the use of paint is impractical, a wrapping of plastic or other weather resistant material, in the required colours and dimensions, may be applied instead of painting provided that the colour of the wrapping corresponds as close as possible to that required for painted marking.

3.5 **Paint Patterns.**

*Information Note:* The following patterns of painting are dependent upon the size and shape of the structure.

(1) **Solid Pattern.** A structure shall be coloured solid orange, if the structure has both horizontal and vertical dimensions not exceeding 3.2m.

(2) **Checkerboard Pattern.**

(a) Subject to paragraph (c), alternating rectangles of aviation orange and white shall be displayed on the following types of structure

(i) storage tanks for water, gas, and grain, and similar tanks,
(ii) buildings.

(iii) structures that both:

(A) appear broad from a side view, that are 3.2m or more across horizontally, and

(B) have a horizontal dimension that is equal to or greater than the vertical dimension.

(b) **Characteristics** [refer Figure 3-1] Checkerboard patterns shall have the following characteristics:

(i) for structures having horizontal and vertical dimensions both greater than 3.2m, the sides of the checkerboard pattern shall measure not less than 1.5m nor more than 6m,

(ii) for structures having a horizontal or vertical dimensions both less than 4.5m, the sides of the checkerboard pattern may be less than 1.5m, but not less than 1m,

(iii) the rectangles of the pattern shall be as nearly square as possible, and

(iv) corners shall be coloured orange.
(c) **Exceptions** The following exceptions apply to the marking requirements set out in this subsection:

(i) storage tanks not suitable for a checkerboard pattern shall be coloured with alternating bands of aviation orange and white or a limited checkerboard pattern applied to the upper one-third of the structure, and

(ii) the skeletal framework of certain water, gas, and grain storage tanks may be excluded, as a result of a risk evaluation, from the checkerboard pattern, where the main structure of the storage tank is large enough that its checkerboard pattern adequately suits the purpose of day marking.

(3) **Colour Bands**

(a) **Application** Subject to subsection (4), alternate bands of orange and white shall be displayed on the following types of structure:

(i) communications towers and supporting structures of overhead transmission lines,
(ii) poles,
(iii) chimneys,
(iv) skeletal framework of storage tanks and similar structures,
(v) wind turbine towers and rotor blades, including the nacelle or generator housing,
(vi) cables, conduits, and materials attached to the face of a tower, whether at time of construction or when later added to the structure, and
(vii) structures that appear narrow from a side view, that are 3.2 m or more across horizontally, and the horizontal dimension is less than the vertical dimension.

(b) **Characteristics** [Refer Figure 3-4] Bands applied to structures of any height in excess of 3.2m shall be:

(i) approximately equal in width and to a tolerance of ±10 percent,
(ii) not more than 30m wide,
(iii) coloured orange for the top and bottom bands,
(iv) odd number of bands on the structure, and
(v) in accordance with Table 3-1, except that for each additional 60m or fraction thereof, one (1) additional orange and one (1) additional white band shall be added.

<table>
<thead>
<tr>
<th>Structure height (AGL)</th>
<th>Greater than (meters)</th>
<th>Not exceeding (meters)</th>
<th>Number of Bands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>3.2</td>
<td>solid</td>
</tr>
<tr>
<td></td>
<td>3.2</td>
<td>210</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>210</td>
<td>270</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>270</td>
<td>330</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>330</td>
<td>390</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>390</td>
<td>450</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>450</td>
<td>510</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>510</td>
<td>570</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>570</td>
<td>630</td>
<td>21</td>
</tr>
</tbody>
</table>

(4) **Structures With a Cover or Roof.** If a structure referred to in subsection (3) has a cover or roof whose profile in the line of sight of approaching aircraft is less than 1.5m, the highest orange band shall be continued to cover the entire top of the structure. It is acceptable to have the roof made of a solid orange provided that the structure below has a checkerboard pattern.

(5) **Skeletal Structures Atop Buildings.** Where a flagpole, skeletal structure, or similar object is erected on top of a building:

(a) the combined height of the object and the building shall determine whether marking is required; however, only the height of this object determines the width of the colour bands; and
(b) if the building is required to have a checkerboard pattern of marking, the object and its height shall be considered separately for banding determination.

(6) Appurtenances. If a tower or similar skeletal structure is required to have banded marking and it also has an appurtenance of more than 12m, then the combined height of the appurtenance plus that of the main structure shall determine the width of the banding.

(7) Partial Marking. If marking is required for only a portion of a structure because of shielding by other objects or terrain:

(a) the width of the bands shall be determined by the overall height of the structure;
(b) a minimum of three bands shall be displayed on the upper portion of the structure; and
(c) in the case of cylindrical storage tanks shown in Figure 3-2, the checkerboard marking may applied to the top ½ to 2/3 of the tank.

(8) Teardrop Pattern. Spherical water storage tanks with a single circular standpipe support may be marked in a teardrop-striped pattern having the following characteristics:

(a) alternate stripes of aviation orange and white are displayed on the tank, as shown in Figure 3-2;
(b) the stripes extend from the top centre of the tank to its supporting standpipe; and
(c) the width of the stripes are nearly as equal as possible and the width at the greatest girth of the tank is not be less than 1.5m nor more than 6m.

(9) Community Names. If it is desirable to paint the name of the community on the side of a tank, the marking pattern may be broken for a height of not more than 1.0m to serve this purpose.

3.6 Flag Markers.

(1) Application. One or several flags may be used as markers instead of paint to indicate the presence of certain structures or objects when it is technically impractical to use spherical markers or painting.

Information Note: Some examples of structure or objects where flags may be used are temporary construction equipment, cranes, derricks, oil and other drilling rigs.

(2) Characteristics. Flags used as markers under subsection (1) shall have the following characteristics:

(a) Minimum Size - each side of a flag shall be at least 0.6m in length;
(b) Colour Patterns - they shall be coloured as follows:
  (i) if solid, the colour shall be orange,
  (ii) if orange and white colours are used, two triangular sections, one aviation orange and the other white, are arranged to form a rectangle, or
  (iii) a checkerboard pattern of aviation orange and white squares of 0.3m to a side, shall be used if the flags are 0.9m or larger;
(c) Shape - they shall be rectangular in shape and have stiffeners to keep it from drooping in calm wind; and
(d) Manner of Display - they shall be displayed as follows:
  (i) around, on top, or along the highest edge of the obstruction,
  (ii) when used to mark extensive or closely grouped obstructions, the flags are displayed approximately 15m apart, and
  (iii) the flag stakes are of such strength and height that they are able to support the flags above all surrounding ground, structures, or objects of natural growth, as the case may be.

3.7 Omission of Marking with Use of Lighting. A high or medium intensity white flashing lighting system may be used in place of marking if the following conditions are met:

(a) the lighting system is operated 24 hours a day; and
(b) in the case of a medium intensity lighting system, the system:
  (i) is operated 24 hours per day, and
(ii) the structure on which it is used is 150m AGL or less.
621.04

4.1 **Scope.** Except as otherwise provided for in this Standard, Chapter 4 governs lighting requirements for obstructions to air navigation in order to be make them conspicuous to pilots during nighttime. It also governs the marking requirements of catenary wires and catenary support structures, and moored balloons and kites, for daytime.

*Information Note:* Lighting is used to warn pilots of a potential collision during nighttime operations. If the lighting is of sufficient intensity, it may also serve to give warning during daytime operations and may be approved, by way of a risk evaluation, in lieu of other means of day marking. Criteria for lighting structures, as a result of a risk evaluation, can vary depending on terrain features, weather patterns, geographic location.

4.2 **Lighting Systems**

(1) **Configurations.** Obstruction lighting shall be displayed on a building, structure or object in one of six configurations, as shown in Figure 4-1 and listed in Table 4-2.

*Information note:* The following is a listing of light units required under this Standard. Chapter 12 provides detailed characteristics of these light units. Appendix B contains the governing electrotechnical requirements and quality assurance testing.

<table>
<thead>
<tr>
<th>Table 4-1: Light Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
</tr>
<tr>
<td>CL-810</td>
</tr>
<tr>
<td>CL-864</td>
</tr>
<tr>
<td>CL-865</td>
</tr>
<tr>
<td>CL-866, Catenary</td>
</tr>
<tr>
<td>CL-885, Catenary</td>
</tr>
<tr>
<td>CL-856</td>
</tr>
<tr>
<td>CL-857, Catenary</td>
</tr>
</tbody>
</table>

*Note 1:* In certain cases, some of these lights are supplied as a combined unit (e.g. CL-864/CL-865)  
*Note 2:* fpm = flashes per minute

<table>
<thead>
<tr>
<th>Table 4-2: Lighting Configurations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration</td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>D</td>
</tr>
<tr>
<td>E</td>
</tr>
<tr>
<td>F</td>
</tr>
</tbody>
</table>

(2) **Red Lighting Systems.** A red obstruction lighting system shall consist of CL-810 low intensity steady burning aviation red lights and CL-864 medium intensity red flashing aviation beacons.

(3) **CL-865 Medium Intensity White Flashing Lighting Systems.**

(a) A medium intensity white flashing lighting system shall consist of CL-865 medium intensity flashing white lights used during day/twilight with automatically selected reduced intensity for night time operation.  
(b) When the system is used on a building, structure or object 500 feet (150m) AGL or less in height, the marking requirements may be omitted.
(4) High Intensity White Flashing Lighting Systems.

(a) A high intensity white flashing lighting system shall consist of CL-856 and CL-857 high intensity flashing white lights used during daytime with automatically selected reduced intensities for twilight and night time operations.
(b) When the system is in use, the markings and the other lights required to be displayed on the building, structure or object may be omitted.

(5) Dual Lighting Installation

(a) A dual lighting system shall consist of red lights for night time use and high or medium intensity flashing white lights for daytime and twilight use.
(b) When a dual lighting system incorporates medium flashing intensity lights on a building, structure or object 150m or less in height, or high intensity flashing white lights on a building, structure or object of any height, the marking and the other lighting requirements may be omitted.

Information Note: When a building, structure or object is located in an urban area where there are numerous other white lights (e.g., streetlights, etc.), red obstruction lights with painting or a medium intensity dual system is recommended.

4.3 Floodlighting

(1) A chimney, church steeple or similar obstruction not exceeding 150m in height, may be floodlighted by three or more fixed search light projectors installed at equidistant points around the base of the obstruction.

(2) Where floodlighting is used for an obstruction referred to in subsection (1), the top 1/3 of the structure shall be provided with at least 30 lux of illumination as directed from the object horizontally to an approaching pilot, assuming diffuse reflection from the object.

4.4 Obstruction Lights During Construction

(1) As the height of a building, structure or object under construction progressively exceeds each level at which permanent obstruction lights would be required, two or more temporary medium intensity white flashing lights shall be installed at that level.

(2) Temporary lighting required under subsection (1) shall be operated 24 hours a day until all permanent lights required under this Standard are in operation.

(3) If practical, permanent obstruction lighting required under this Standard shall be installed and operated at each level as construction progresses.

(4) The lights shall be positioned to ensure that a pilot has an unobstructed view from any angle of approach of at least one light at each level.

4.5 Temporary Construction Equipment Lighting.
Information note: Since there is such a variance in construction cranes, derricks, oil and other drilling rigs, each case should be assessed individually. However, in principle, lights should be installed according to the standards given herein, as they would apply to permanent structures.

4.6 Groups of Obstructions

(1) When individual buildings, structures or objects within a group of obstructions are not the same height and are spaced more than 45m apart, the prominent building, structure or object within the group shall be lighted in accordance with the standards for individual obstructions of a corresponding height.

(2) If an outer building or structure is shorter than the prominent one, it shall be lighted in accordance with the requirements for individual obstructions of a corresponding height.

(3) Light units required under this section shall be placed to ensure that the light is visible to a pilot approaching from any direction.

(4) In addition to the requirement set out in subsection (3), at least one flashing beacon shall be installed at the top of a prominent centre obstruction or on a special tower located near the centre of the group.

(5) If there is no prominent centre obstruction, a risk evaluation shall be performed to assess the location of the applicable beacons.

4.7 Monitoring of Obstruction Lights

(1) An obstruction lighting system required under this Division shall be monitored by visual or automatic means.

(2) On a system without automatic monitoring, the obstruction lighting shall be visually inspected in all operating intensities at least once every 24 hours.

(3) If the lighting system of a building, structure or object is not readily accessible for visual observation, a properly maintained automatic monitor shall be used.

(4) The monitor referred to in subsection (3) shall be designed to register the malfunction of any light on the obstruction regardless of its position or colour.

(5) When using a remote monitoring device, the communication status of the device and operational status of the lighting system shall be confirmed at least once every 24 hours.

(6) The monitor display shall be located in an area occupied by responsible personnel where the status of the lighting can be noted at least once every 24 hours.

(7) The owner or operator of the obstruction lighting system shall advise the nearest regional NavCanada facility, as soon as possible, of any obstruction lighting failures so that an appropriate NOTAM action can be initiated.

4.8 Glare from Flashing Obstruction Lights

(1) Where obstruction lighting is likely to distract operators of aircraft, railway trains, surface vessels, and other vehicles, or if the lighting will be in a congested residential area, a suitable shield shall be installed on the appropriate lights to minimize the glare effects of the light.

(2) The application of such shielding shall not diminish the required performance of the light as specified in Chapter 13 of this Standard for obstruction identification to pilots.

(3) Shielding applied to the exterior of the light unit shall be suitable for environmental conditions such as snow, ice and frost cover, so that the light output is not degraded from that required by this Standard.
(4) In the proximity of navigable waterways or along coastal regions, the installation of obstruction lighting system shall be coordinated with marine authorities by the owner or operator of the obstruction in order to avoid interference with marine navigation.

4.9 Placement Factors

(1) The height of a building, structure or object above ground (AGL) shall be used to determine the number of light levels required to be installed as part of a lighting system.

(2) The height of light levels required to be installed under this Division may be adjusted slightly, but not to exceed 3m, when necessary to accommodate guy wires and personnel who replace or repair light fixtures.

(3) Except for catenary support structures, the following factors shall be considered when determining the placement of obstruction lights on a building, structure or object:

(a) for a red obstruction lighting system or a medium intensity white flashing lighting system, the overall height of the structure including all appurtenances such as rods, antennas, obstruction lights and similar objects, shall determine the number of light levels;
(b) for a high intensity white flashing lighting system,
   (i) the overall height of the main structure excluding all appurtenances shall be used to determine the number of light levels, and
   (ii) if required, a CL-865 medium intensity flashing light shall be displayed on the highest portion of any antenna or other appurtenance supported by the main structure; and
(c) for a dual obstruction lighting system, the determination of the number of light levels shall be in conformity with the pertinent requirements for white and red lighting systems.

(4) The elevation of the tops of adjacent buildings or structures in congested areas shall be used as the equivalent of ground level to determine the proper number of light levels required.

(5) If an adjacent building, structure or object shields any light, horizontal placement of the lights shall be adjusted or additional lights shall be mounted on that object to retain or contribute to the definition of the obstruction.

4.10 Ice Protectors

(1) Where icing is likely to occur, metal grates or similar protective means shall be installed directly over each light unit required under this Standard to be installed on a building structure or object to prevent falling ice or accumulations from damaging the light units.

(2) The protective means shall be of a design and manner of placement such that the required photometric output of the fixtures is not affected.
5.1 **Scope.** Chapter 5 governs obstruction lighting that uses a Configuration “A” lighting system.

5.2 **System Requirements**

(1) **General**

(a) A Configuration “A” red obstruction lighting system shall consist of one or several, as required under Chapter 5, CL-864 red flashing beacons or CL-810 steady burning red lights, or a combination thereof.

(b) When red lighting alone is used for night protection, no exemption to markings required under this Standard is allowed.

**Information Note:** The CL-810 comes in two forms; a single unit [one lamp and one globe] and a double unit [two lamps and two globes].

(2) **Double Obstruction Light Units** - Subject to subsection (3), when used as a top light or in areas or locations where the failure of a single unit could cause an obstruction to be totally unlighted, double unit CL-810 lights shall be installed at each end of a row of single unit obstruction lights, and more specifically as follows:

(a) **Top Level** on a structure, building or object 45m AGL or less, one or more double unit lights operating simultaneously shall be installed at the highest point;

(b) **Intermediate levels,**

(i) double unit lights shall be installed when a malfunction of a single unit light could create an unsafe condition and in remote areas where maintenance cannot be performed within a reasonable time, and

(ii) both lamps of the double unit shall operate simultaneously or a transfer relay shall be used to switch to the inactive lamp should the active lamp fail; and

(c) **Lowest Level** at the lowest level of a building, structure or object,

(i) light units may be installed at a higher elevation than standard if the surrounding terrain, trees or any adjacent buildings would obscure the lights, or

(ii) in certain exceptional instances, as determined by a risk evaluation, the lighting otherwise required under Chapter 5 may be omitted.

(3) **Single CL-810 Obstruction Light Units** Where more than one obstruction light is required either vertically or horizontally, or where maintenance can be accomplished within a reasonable period of time, single unit CL-810 lights may be used as follows:

(a) **Top Level** a top structures such as airport ILS buildings and long horizontal structures such as perimeter fences and building roof outlines; or

(b) **Intermediate Level** at intermediate levels on skeletal or solid structures when more than one level of lights is required to be installed and there are two or more single units per level.

(4) **Flashing Display.** When one or more levels of lights are comprised of CL-864 flashing beacons, the lights shall flash simultaneously.

(5) **Equivalent Method of Displaying Obstruction Lights.** Provided that approval is obtained following the result of a risk evaluation, lights may be placed on poles equal to the height of the building, structure or object required to be lighted, and may be installed on or adjacent to such building, structure or object.

5.3 **Radio and Television Towers and Similar Skeletal Structures.** The following requirements apply to radio and television towers, supporting structures for overhead transmission lines, and similar structures. Refer to Figures 5-1 and 5-2.

(1) On the topmost part of a structure:
(a) 45m AGL or less, two or more steady burning lights shall be installed; or
(b) exceeding 45m AGL, at least one red flashing beacon shall be installed.

(2) On the intermediate levels of a structure:

(a) the number of levels of lights shall be in accordance with Figure 5-1;
(b) the number of lights at each level shall be determined by the shape and height of the structure;
(c) the lights shall be installed so as to provide an unobstructed view of at least one light by a pilot from any angle of approach;
(d) where CL-810 steady burning red lights are installed on:
   (i) a structure 105m AGL or less, two or more steady burning red lights shall be installed on diagonally or diametrically opposite positions, and
   (ii) a triangular shaped structure 105m AGL or less:
      (A) two red light units, single or double, shall be installed, provided that at least one can be viewed unobstructed by a pilot from any angle of approach, or
      (B) where the requirement specified in clause (A) is impractical, three red light units shall be installed, one on each apex of the triangular cross-section, or
   (iii) a structure exceeding 105m AGL, a steady burning red light shall be installed on each outside corner at each level; and

(e) where a CL-864 flashing red beacon is used on a structure exceeding 105m AGL, the red flashing beacon shall be installed within the structure proper, except that if the structural members impair the viewing of the beacon, two flashing red beacons shall be installed on the outside of diagonally or diametrically opposite positions at each level.

(3) Appurtenances. Where a building, structure or object required to be lighted includes an appurtenance such as a rod, antenna, or similar extension, a topmost light shall be installed above the main part of the building, structure or object in accordance with the provisions of this subsection.

(a) Where the appurtenance is 12m or less in height and:
   (i) is incapable of supporting a red flashing beacon, the beacon may be placed at the base of the appurtenance, or
   (ii) if the mounting location does not allow unobstructed viewing of the beacon by a pilot from any angle of approach, additional beacons shall be added.

(b) Where the appurtenance exceeds 12m in height and:
   (i) is incapable of supporting a red flashing beacon, a supporting mast with one or more beacons shall be installed adjacent to the appurtenance, and
   (ii) The adjacent installation of (i) shall not exceed the height of the appurtenance and shall be within 12m of the tip of the appurtenance to allow the pilot an unobstructed view of at least one beacon, from any angle of approach.

5.4 Chimneys, Flare Stacks and Similar Solid Structures

(1) Lighting Levels and Location.

(a) CL-810 and CL-864 obstruction lights used on a chimney, flare stack or similar solid structure shall be installed in accordance with Figure 5-1.
(b) The topmost lights may be located up to 6m below the top of the structure to avoid the obscuring effect of emissions.

(2) Number of Light Units per Level. Subject to subsection (3), the number of lights to be installed at the top and at each level of a chimney, flare stack or similar solid structure depends on the diameter of the structure and shall be in accordance with Table 5-1.

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Number of Lights at top and per level</th>
</tr>
</thead>
<tbody>
<tr>
<td>6m or less</td>
<td>3</td>
</tr>
<tr>
<td>6m to 30m</td>
<td>4</td>
</tr>
<tr>
<td>30m to 60m</td>
<td>6</td>
</tr>
<tr>
<td>more than 60m</td>
<td>8</td>
</tr>
</tbody>
</table>
(3) **Hyperbolic Cooling Towers.** Where any cooling tower of a nuclear generating station:

(a) is 180m in height or less AGL, intermediate light levels may be omitted; or
(b) exceeds 180m AGL in height, a second level of light units shall be installed approximately at the midpoint of the structure and in a vertical line with the top level of lights.

### 5.5 Prominent Buildings and Similar Extensive Obstructions.

(1) Subject to subsection (4), individual obstructions having a similar height above ground and located not more than 45m apart within a group of obstructions may be considered as an extensive obstruction for lighting purposes, in which case the group shall display steady burning red lights to indicate the extent of the obstruction as specified in this section.

(2) On a structure 45m or less in both horizontal dimensions, a CL-810 light shall be displayed:

(a) on the highest point at each end of the major axis of the obstruction; or
(b) in the centre of the highest point.

(3) **Structures Exceeding 45m in any Horizontal Dimension.**

(a) On a structure exceeding 45m in any horizontal dimension, CL-810 lights shall be displayed on:

   (i) the highest point at each end of the obstruction, and
   (ii) the highest points for each 45m, or fraction thereof, for the overall length of the major axis.

(b) If the minor axis of a structure exceeding 45m in one of its horizontal dimension is 45m or less in length, the lights referred to in paragraph (a) may be installed as a row along the middle or along either side, as shown in Figure 5-3.

(c) If a structure exceeding 45m in any horizontal dimension is located near a landing area and two or more edges of the structure are of the same height, the edge nearest the landing area shall be lighted with CL-180 lights.

(4) **Structures Exceeding 45m AGL.**

(a) **Top Lights** CL-810 steady burning red lights shall be installed on the highest point at each end of a structure exceeding 45m AGL in height.

(b) **At intermediate levels** of the structure,

   (i) a CL-810 steady burning red light shall be displayed for each 45m or fraction thereof,
   (ii) the vertical position of the intermediate lights shall be equidistant between the top lights and the ground level as the shape and type of obstruction will permit, and
   (iii) one CL-810 steady burning red light shall be displayed at each outside corner on each level with the remaining lights evenly spaced between the corner lights.

(5) **Exceptions**

Flashing red CL-864 beacons may be used instead of steady burning lights if early or special warning to pilots is necessary, provided that, in the case of an extensive obstruction:

(a) they are displayed on the highest points of the obstruction, at intervals not exceeding 900m; and
(b) at least three beacons are displayed on one side of the obstruction to indicate a line of lights.

### 5.6 Bridges

(1) A bridge assessed through a risk evaluation as a likely hazard to aviation safety shall have CL-864 red flashing lighting, as shown in Figure 5-4.

(2) If the bridge referred to in subsection (1) is over navigable water, the obstruction lighting installer shall consult with the Coast Guard to avoid interference with signals to marine navigation.

### 5.7 Groups of Objects
(1) **Of Different Height**

(a) A group of objects of varying heights shall be lighted in accordance with the requirements specified in paragraph 5.5(a).

(b) In addition, at least one medium intensity flashing white light shall be installed at the top of a prominent center obstruction or on a special tower located near the centre of the group.

(2) **Of Similar Height** A group of objects of equal height shall be lighted in accordance with the requirements specified in section 5.5.

5.8 **Characteristics of Lights.** Lighting displayed on a bridge shall have the light characteristics specified in Chapter 13.
CHAPTER 6
MEDIUM INTENSITY WHITE FLASHING SYSTEM, CONFIGURATION "D"

621.06

6.1 Scope. Chapter 6 governs obstruction lighting that uses a Configuration “D” lighting system.

6.2 Application. CL-865 medium intensity white flashing light units:

(a) shall be used during daytime and twilight with automatically selected reduced intensity for nighttimes operation;
(b) where used on a building, structure or object 150m AGL or less in height, may result in day marking otherwise required under Division III being omitted on the building, structure or object; and
(c) where used on a building, structure or object greater than 150m AGL, shall not result in any day marking required under Division III being omitted on the building, structure or object.

Information Note: CL-865 medium intensity white flashing light units should not be used on:

(1) a building, structure or object 60m AGL or less in height;
(2) in populated urban areas due to their tendency to merge with background lighting in these areas at night and the cause of glare complaints; and
(3) on structures within 5 kilometres of an airport.

6.3 Characteristics

(1) Photometrics. The photometric output of a Configuration ‘D’ lighting system shall be in accordance with Table 13-2.

(2) Control. The lighting system shall be in accordance with Table 13-1 for day and twilight and night modes of operation.

6.4 Radio and Television Tower and Similar Skeletal Structures.

(1) Subject to subsection (4), on a radio or television tower, or similar skeletal structure, the number of light levels to be installed depends on the height of the structure, including antennas and similar appurtenances, and shall be determined in accordance with Figure 6-1.

Top Level.

(2) One or more light units shall be installed at the highest point of a skeletal structure to provide 360-degree coverage ensuring an unobstructed view.

Intermediate Levels.

(3) At an intermediate level of a skeletal structure, two CL-865 beacons shall be mounted outside, at diagonally or diametrically opposite positions of the intermediate level.

Lowest Level

(4) At the lowest level of light units of a skeletal structure:

(a) the light units may be installed at a higher elevation than that required under this section for the structure, if the surrounding terrain, trees, or any adjacent building would obscure the light units;
(b) in circumstances determined by a risk evaluation, the lights units may be omitted; and
(c) CL-865 light units shall not be installed at a height of less than 60m.

Appurtenances.
(5) An appurtenance shall be lighted in accordance with the requirements specified in section 5.2, except as far as the use of the CL-865 light in place of CL-864 light is concerned.

6.5 Chimneys, Flare Stacks, and Similar Solid Structures

Lighting Levels and Location.

(1) The number levels of light units required to be installed on a chimney, flare stacks or similar solid structure shall be determined in accordance with Figure 6-1.

Number of Light Units per Level.

(2) The number light units required to be installed on each level of a solid structure referred to in subsection (1), shall be determined in accordance with Table 5-1.

6.6 Hyperbolic Cooling Towers. A hyperbolic cooling tower shall be lighted in accordance with the requirements specified in section 5.4.

6.7 Prominent Buildings and Similar Extensive Obstructions

(1) Application is that of article 5.7, except with use of CL-865 medium intensity white flashing lights.
(2) Due to the glare factor, caution shall be used in the application of medium intensity white flashing lights.

6.8 Bridges. A bridge shall be lighted in accordance with the requirements specified in section 5.6.
CHAPTER 7
HIGH INTENSITY WHITE FLASHING SYSTEM, CONFIGURATIONS "B" and "C"

621.07

7.1 **Scope.** Chapter 7 governs obstruction lighting that uses a Configuration “B” and "C" lighting system.

7.2 **Application.**

When a high intensity white flashing lighting system is operated 24 hours a day, the marking requirements and the other applicable lighting requirements for an obstruction may be omitted.

*Information Note: This lighting system is not recommended on structures 150m AGL or less, unless a risk evaluation shows otherwise.*

7.3 **Characteristics**

1. **Photometrics.** The photometric output of a high intensity white flashing lighting system shall be in accordance with Table 13-2.

2. **Control.** The lighting system shall be controlled in accordance with Table 13-1 for day, twilight and night modes of operation.

7.4 **Installation**

1. **Vertical Aiming.** In order to avoid potential glare problems, the vertical aiming angle of a CL 856 light unit used in a high intensity white flashing system shall be as follows:

   a. **Location** the unit shall be adjusted to compensate for its height above ground, in accordance with Table 7-1; and

   b. **Terrain**
      - (i) where terrain, nearby residential areas, or other situations dictate, the light beam of a light unit may be further elevated above the horizontal,
      - (ii) the main beam of light unit located at the lowest level of a building, structure or object shall not strike the ground closer than 5km from the building, structure or object,
      - (iii) if additional adjustments are necessary, light units may be individually adjusted upward, in 1 degree increments, starting at the bottom of the building structure or object,
      - (iv) excessive elevation, however, may reduce conspicuousness by raising the beam above a collision course flight path,
      - (v) where the lighting system is installed on building, structure or object located near a highway, a waterway, or airport approach area, shielding or vertical or horizontal aiming adjustments, or both, shall be made as necessary to avoid causing glare, and
      - (vi) adjustment of light units shall not derogate from the conspicuousness requirement set out in section 2.1 of this Standard.

2. **Relocation or Omission of Light Units.** Where any light units are obstructed from view by a building, structure or object, including surrounding terrain and trees, the following actions may be taken:

   **Lowest Level**
(a) in the case of the lowest level of lights:
   (i) the light units may be installed at a higher elevation than that required under Chapter 7, and
   (ii) in circumstances determined by a risk evaluation, the lights units may be omitted; and

Two Adjacent Structures

(b) in the case of adjacent buildings or structures:
   (i) if two buildings or structures are situated within 150m of each other and their respective light units are
       installed at similar levels, the light units on the sides of the buildings or structures facing each other may be
       omitted provided that all lights on both structures flash simultaneously, except for adjacent catenary
       support structures,
   (ii) vertical placement of the lights to either or both structures’ intermediate levels shall be adjusted to
       place the lights on the same horizontal plane,
   (iii) where one building or structure is higher than the other, one or more complete levels of light units, as
       the case may be, shall be installed on that part of the higher building or structure that extends above the top
       of the lower structure, and
   (iv) if the structures are of such heights that their respective levels of lights cannot be placed in identical
       horizontal planes, the levels of light units shall be placed such that the centre of the horizontal beam
       patterns does not face toward the adjacent building or structure; and

Information Note: For example, based on subparagraph (iv) above, structures situated north and south of each
other will have the light units on both structures installed on a northwest/southeast and northeast/southwest
orientation.

Three or More Adjacent Structures.

(c) the treatment of a cluster of structures as an individual or a complex of structures shall be determined by way of
   a risk evaluation, taking into consideration the location, heights, and spacing with other structures.

7.5 Radio and TV Towers and Similar Skeletal Structures

Top Level.

(1) On a radio, TV tower or similar skeletal structure, one level of light units shall be installed within 3m of the
    highest point of the main structure.

Intermediate Levels.

(2) On a skeletal structure referred to in subsection (1):

   (a) the number of levels of light units to be installed depends on the height of the structure, excluding any
       appurtenances, and shall be determined in accordance with Figure 7-1; and
   (b) at least three lights shall be installed on each intermediate level and mounted to ensure that the effective
       intensity of the full horizontal beam coverage is not impaired by the structural members.

Appurtenances

(3) Where a skeletal structure has an appurtenance in excess of 12m in height above it:

   (a) a medium intensity white flashing light shall be installed in accordance with subsection 6.4(5); and
   (b) the light referred to in paragraph (a) shall operate 24 hours a day and flash simultaneously with the rest of the
       lighting system installed on the structure.

7.6 Chimneys, Flare Stacks and Similar Solid Structures

Lighting Levels and Location
(1) The number levels of light units required to be installed on a chimney, flare stacks or similar solid structure shall be determined in accordance with Figure 7-1.

Number of Light Units per Level

(2) The number light units required to be installed on each level of the high intensity white flashing lighting system of a structure referred to in subsection (1), shall be determined in accordance with Table 5-1.

Hyperbolic Cooling Towers

(3) Where any cooling tower of a nuclear generating station:

(a) is 180m in height or less AGL, intermediate light levels may be omitted; or
(b) exceeds 180m AGL in height, a second level of light units shall be installed approximately at the midpoint of the structure and in a vertical line with the top level of lights.

7.7 Prominent Buildings, Structures and Similar Extensive Objects.

(1) Subject to subsection (5), individual buildings, structures or objects having a similar height above ground and located not more than 60m apart within a group of obstructions may be considered as an extensive obstruction for lighting purposes, in which case the group shall display CL-856 white flashing light units to indicate the extent of the obstruction as specified in this section.

Information Note: Owing to the glare factor, caution shall be used in the application of high intensity white flashing lights.

(2) On a structure 60m or less in both horizontal dimensions, a CL-856 lights shall be displayed:

(a) on the highest point at each end of the major axis of the obstruction; or
(b) in the centre of the highest point.

(3) Structures Exceeding 60m in any Horizontal Dimension.

(a) On a structure exceeding 60m in any horizontal dimension, CL-856 light units shall be displayed on:
   (i) the highest point at each end of the obstruction, and
   (ii) the highest points for each 60m, or fraction thereof, for the overall length of the major axis.
(b) If the minor axis of a structure exceeding 60m in one of its horizontal dimension is 60m or less in length, the lights referred to in paragraph (a) may be installed as a row along the middle or along either side, as shown in Figure 5-3.

(4) Structures Exceeding 150m AGL.

(a) Top Lights A CL-856 white flashing light unit shall be installed on the highest point at each end of a structure exceeding 150m AGL in height.
(b) At intermediate levels of the structure,
   (i) a CL-856 white flashing unit shall be displayed for each 150m or fraction thereof,
   (ii) the vertical position of the intermediate lights shall be equidistant between the top lights and the ground level as the shape and type of obstruction will permit, and
   (iii) a CL-856 white flashing unit shall be displayed at each outside corner on each level with the remaining lights evenly spaced between the corner lights.
CHAPTER 8
DUAL RED/WHITE MEDIUM INTENSITY LIGHTING SYSTEM, CONFIGURATION "E"

621.08

8.1 Scope. Chapter 8 governs obstruction lighting that uses a Configuration “E” lighting system consisting of CL-810 steady burning red and CL-864 flashing red obstruction light units for nighttime operation and CL-865 medium intensity white flashing light units for daytime and twilight operation.

Information Note: This lighting system may be used in lieu of operating a CL-865 medium intensity white flashing system at night, in order to avoid glare complaints particularly in populated urban areas.

8.2 Application

(1) The light units of the system shall be installed as required by the relevant provisions of
(a) Chapter 4 for lighting in general;
(b) Chapter 5 for red lighting; and
(c) Chapter 6 for medium intensity lighting.

(2) The number of light levels needed shall be obtained from Figures 5-1 and 6-1 for the applicable components of the lighting system.

8.3 Operation. The lighting system shall be operated such that:

(a) both the red and white systems are not operated at the same time;
(b) there is no more than a 2-second delay when changing from one system to the other; and
(c) outage of one of two lamps in the uppermost CL-864 red flashing beacon or outage of any uppermost red light causes the white obstruction lighting system to operate in its specified “night” step intensity.

8.4 Control Device. The lighting system shall be controlled such that:

(a) a photocell device causes a changes of operation from red to white lighting with increase and decrease of the ambient light level;
(b) the system automatically changes from white to red and subsequently from red to white when the northern sky illuminance, as indicated in Table 13-1, goes through the transitions of twilight to night and night to twilight respectively; and
(c) where a malfunction requires the white lighting system to be operated during the night, the device causes operation at the lower intensity level.

8.5 Antenna or Similar Appurtenance Light. When a structure utilizing this dual lighting system is topped with an antenna or similar appurtenance exceeding 12m in height above the structure:

(a) a CL-865 medium intensity white flashing light and a CL-864 red flashing beacon shall be placed within 12m from the tip of the appurtenance;
(b) the CL-865 white light shall operate during daytime and twilight and the red light during nighttime; and
(c) the lights required in paragraphs (a) and (b) shall flash simultaneously with the rest of the lighting system.

8.6 Omission of Marking. When medium intensity white lights are operated on a structure 150m AGL or less during daytime and twilight, the markings required under this Standard may be omitted on the structure.
CHAPTER 9
DUAL RED/WHITE HIGH INTENSITY FLASHING SYSTEM, CONFIGURATION "F"

621.09

9.1 Scope. Obstruction lighting that uses a Configuration ‘F’ lighting system referred to in Table 4-2 of Chapter 4, shall meet the requirements set out in Chapter 9.

*Information Note:* This lighting system may be used in lieu of operating a white flashing lighting system at night. There may be populated urban areas where the use of high intensity lights at night may cause environmental complaints.

9.2 Light Units. CL 810 and CL 864 red light units shall be used for night time lighting and CL 856 high intensity white flashing light units shall be used for day time and twilight lighting.

9.3 Installation. The light units required under Chaptersection 9.2 shall be installed in accordance with the relevant provisions of Chapter 4 for lighting in general, of Chapter 5 for red lighting and Chapter 7 for high intensity white flashing lighting.

9.4 Operation A Configuration ‘F’ lighting system shall:

(a) be operated in accordance with the requirements of:
   (i) Chapter 4 for lighting in general.
   (ii) Chapter 5 for red lighting, and
   (iii) Chapter 7 for high intensity white flashing lighting;

(b) not have both red and white lighting systems operating at the same time; however, there shall be no more than a 2-second delay when changing from one colour of lighting system to the other; and

(c) where an outage of one of two lamps in the uppermost CL-864 red beacon or an outage of any uppermost red light units occurs, have the white lighting switched on and operating in its specified night mode of intensity.

9.5 Control Device. The light intensity of a Configuration ‘F’ lighting system shall be controlled by a photocell device set to operate in accordance with Table 13-1 for transition between day, twilight and night.

9.6 Antenna or Similar Appurtenance Light

(1) Where a Configuration ‘F’ lighting system is used on a building, structure or object that is topped with an antenna or similar appurtenance exceeding 12m in height above it, both a CL-864 medium red flashing and a CL-865 medium intensity white flashing light units shall be placed within 12m from the tip of the appurtenance.

(2) The white light unit referred to in subsection (1) shall operate during daytime and twilight, and the red light unit during night time.

9.7 Omission of Marking. When high intensity white flashing light units are operated during daytime and twilight, any day marking otherwise required under Chapter 3 to be displayed on the building, structure or object may be omitted.
CHAPTER 10
MARKING AND LIGHTING OF CATENARIES

621.10

10.1 Scope. Obstruction marking and lighting of a catenary wire and a catenary support structure shall meet the requirements of Chapter 10.

10.2 Marking of Catenary Support Structures. A support structure of a power line shall be painted in alternate bands of orange and white in accordance with section 3.4, and be clear of trees and brush insofar as practicable so as to meet the conspicuousness requirement of section 2.1.

10.3 Shore Markers. Where, according to a risk evaluation, the marking of a support structure would not clearly indicate the presence of a catenary, a shore marker shall be displayed as indicated in Figure 10-1, and shall:

(a) be painted aviation orange and white
(b) be either of:
   (i) a panel type, designed as 6m square panel with 5m diameter aviation orange dot, or
   (ii) a pole type.

10.4 Aerial Cable Markers. Spherical markers shall be displayed on a catenary, as indicated in Figure 10-1 and as specified below:

(1) Dimensions and spacing

Each marker shall have the following diameters and associated spacings on the catenary:

(a) 50cm diameter and 30m spacing;
(b) 75cm diameter and 45m spacing; or
(c) 150cm diameter and 90 to 120m spacing;

(2) Minimum Quantity

Where the length of the catenary span is less than twice the spacing, depending on the size of marker as that indicated in subsection (1), not less than two markers shall be used.

(3) Location

Markers shall be displayed:

(a) on the highest wire or by other means at the same height; or
(b) where there is more than one wire at the highest level, the markers may be installed alternately along each wire, as indicated in Figure 10-1, as long as the distance between adjacent markers meets the spacing standard.

Information Note: This method will allow the weight and wind loading factors to be distributed.

(4) Colour Pattern

Markers shall have the following colour patterns:

(a) on overhead wires, they shall be marked by alternating solid colour spheres of orange and white;
(b) an orange marker shall be placed at each end of the overhead wire and its spacing adjusted to accommodate the rest of the markers; and
(c) when less than four markers are needed, they shall all be orange.

10.5 Omission of Marking. Marking of a catenary wire or a support structure may be omitted, where:
(a) the height of the support structure is 150m AGL or less, and CL-866 lights are installed on the support structure and operated 24 hours a day; or
(b) CL-857 high intensity white flashing light units are installed on the support structure and operated 24 hours a day.

10.6 Lighting of Catenary Wires. Light units may be installed along a catenary wire, either separately or in combination with a day marker, provided that the light units are:

(a) used on transmission line catenary near airports, heliports, across rivers, canyons, lakes, and similar geographical features;
(b) visible by a pilot from any angle of approach;
(c) meet the requirements specified for the CL-810 light unit;
(d) used on the highest energized line;
(e) located within 6m of the day marker if the light unit is separate from the day marker; and
(f) spaced at the same interval as that required for the day markers on the same catenary.

10.7 Daytime Lighting of Catenary Support Structures. Where a support structure or a power line crossing is assessed as a result of a risk evaluation, as likely to be inadequately marked by the painting and markers specified in Chapter 10, the support structure shall be lighted in daytime by medium or high intensity white flashing light units as follows:

(a) Support Structures 150m AGL or less. One of the following lighting systems shall be used:
   (i) a CL-866 medium intensity white flashing white lighting system, or
   (ii) a CL-866/CL-885 dual medium intensity flashing lighting system.

(b) Support Structures exceeding 150m AGL. One of the following lighting systems shall be used for the catenary, where the obstruction exceeds 150m AGL:
   (i) a CL-857 high intensity white flashing lighting system, or
   (ii) a CL-857/CL-855 dual high intensity flashing lighting system.

(c) Levels of Light Units. The lighting system shall include light levels displayed as follows:
   (i) a system of three levels of sequentially flashing light units shall be installed on each supporting structure or adjacent terrain as follows:
      (A) at the top of the structure,
      (B) at the lowest point in the catenary, and
      (C) approximately midway between the other two light levels and at least at least 15m from the other two levels, except that the middle light level may be deleted when the distance between the top and the bottom light levels is less than 30m,
   (ii) the maximum vertical spacing tolerance allowed to accommodate structural limitations shall be 20 percent of the uniform spacing of the bottom and middle light units, and
   (iii) if the base of the supporting structure is higher than the lowest point in the catenary, such as a canyon crossing, the required light units shall be installed on the adjacent terrain at the level of the lowest point in the catenary.

(d) Light Coverage

The photometric coverage requirements for the light units are:
   (i) in the case of the top level of light units:
      (A) one or more lights shall be installed, subject to subparagraph (B), at the top of the structure to provide 360-degree coverage ensuring an unobstructed view to a pilot from any angle of approach,
      (B) if the installation presents a potential danger to maintenance personnel, or when necessary for lightning protection, the top level of light units may be mounted not more than 6m below the highest point of the structure, provided that due consideration is given to the overall obstacle avoidance distances referred to in section 2.1, and
   (ii) in the case of the middle and bottom levels of light units:
(A) the light units at the middle level and bottom level shall be installed so as to provide a minimum of 180-degree coverage centered perpendicular to the flyway,
(B) where a catenary crossing is situated near a bend in a river, canyon or similar geographical feature, or where it is not perpendicular to the flyway, the horizontal beam shall be directed to provide the most effective light coverage to warn pilots approaching the catenary wires from any angle of approach, and
(C) where a catenary involves three or more supporting structures, the inner structure or structures shall be equipped with enough light units per level to provide 360-degree coverage.

(e) **Flash Sequence**  The lighting system shall flash as follows:
   (i) each light unit shall have a flash frequency of 60 flashes per minute or 1 second per flash cycle (± 5 percent),
   (ii) the flash sequence of the levels of light units shall be middle, top, and then bottom,
   (iii) the interval between top and bottom flashes shall be about twice the interval between middle and top flashes, and
   (iv) the interval between the end of one sequence and the beginning of the next shall be about 10 times the interval between middle and top flashes.

(f) **Synchronization**  On the lighting system used for associated catenary support structures:
   (i) the corresponding light levels shall flash simultaneously, if practicable, and
   (ii) where three or more supporting structures are involved and the inner structure or structures are equipped with enough light units per level to provide 360-degree coverage, the light units for each level shall flash simultaneously.

(g) **Photocell Control**. Where a medium or high intensity lighting system is used for a catenary crossing, the light intensity of the system shall be automatically controlled by photocell devices whose day, twilight and night transition settings shall conform with the specifications set out in Table 13-1.

(h) **Photometric Characteristics**. The photometric characteristics of the lighting system shall be in accordance with the requirements set out in Chapter 13.
CHAPTER 11
MARKING AND LIGHTING OF MOORED BALLOONS AND KITES

621.11

11.1 Scope. Chapter 11 governs the marking and lighting of moored balloons and kites.

11.2 Application.

(1) A balloon that is 1.8m or more in diameter or exceeds 3 cubic meters of gas capacity, or a kite weighing more than 2.27 kg shall be marked and lighted in accordance with the requirements specified in Chapter 11.

11.3 Markers. Markers shall be attached, during daytime, to the mooring lines of a balloon or to the tether cable of a kite in accordance with this section.

(1) Location. Markers shall be displayed at not more than 15m intervals along the mooring lines of the balloon or the tether cable of the kite, beginning at 45m from the point of attachment on the ground.

(2) Characteristics Markers required under subsection (1) shall be:

(a) rectangular in shape, 0.15m wide and 3.0m in length; and
(b) of the following colour patterns:
   (i) solid orange, or
   (ii) of two triangular sections, one of aviation orange and the other aviation white, combined to form a triangle.

11.4 Lighting. At night, a moored balloon or a kite shall be equipped with the lighting devices specified in this section.

(1) Location

(a) Lights having the characteristics specified in subsection (2) shall be located on the top of the object in a fashion as to be viewable from all directions, except that where the dimensions of the object are in excess of 45m, additional lights of the same type shall be installed on the top, nose section, tail section, and on the mooring lines or tether cable approximately 5m below the balloon or kite, so as to define its shape and size; and
(b) additional lights shall be equally spaced along the mooring line or tether cable for each 107m, or fraction thereof, commencing at 90m AGL.

(2) Characteristics

(a) For operations from 90 m AGL to 150m AGL, red flashing or white flashing lights of 32.5 effective candelas shall be installed on the moored balloon and on its mooring lines, or on the tether cable of the kite.
(b) For operations above 150m AGL, white flashes of 500 effective candela shall be installed on the moored balloon and on its mooring line, or on the tether cable of a kite.

(3) Control. Lighting required on a moored balloon or on a kite shall be provided with a means of control such as, for instance a photocell, for day and nighttime operation in accordance with Table 13-1.
CHAPTER 12
WINDTURBINES AND WINDFARMS

621.12

12.1 Scope. A windturbine and a windturbine farm shall be marked and lighted in accordance with the requirements set out in Chapter 12.

Information Note 1: The application of these requirements can vary in accordance with the provisions of this Standard depending on terrain features, geographic location, overall layout of the structures, and angles of approach.

Information Note 2: The provision of lighting on windturbines and windfarms should be done in a fashion as to minimize the possibility of bird fatalities and interference with nighttime astronomical study.

12.2 Definitions

(a) Windturbine - A structure intended for the production of electrical power; comprising a support mast on which is installed a nacelle containing a generator unit and which in turn supports rotor blades that are caused to rotate by the wind. The total height of the obstruction is the height of the nacelle, above ground level (AGL), plus the length of one of the blades held in a vertical position.

(b) Windfarm - A grouping of 3 or more windturbines.

Information Note: The definition of windfarm is based on the premise that the installation of 3 windturbines is the first instance for which certain omission of lighting might be made. Since the exterior windturbines [on the perimeter] of a windfarm are to be lighted, should a grouping consist of only two windturbines, it would not be different from the lighting of two single windturbines.

(c) Windfarm Indicators - Light units installed with specified spacing on certain selected windturbines and serving to indicate the location of a windfarm to pilots.

12.3 Windturbines of Total Height Equal to or Less than 150m

(1) Marking Requirements A single windturbine and windturbines of a windfarm having a total height equal to or less than 150m shall be marked as follows:

(a) For a single windturbine:
   (i) each rotor blade shall be painted aviation white and marked, front and back, with aviation orange paint for the end third of each tip, as indicated in Figure 12-1.
   (ii) where the windturbine is of a vertical axis design, each rotor blade shall be painted aviation white with aviation orange for the top third of the blade.
   (iii) the support structure shall be painted aviation white with the exception that the bottom 20m or one third of the structure may be left unpainted.

(b) The windturbines of a windfarm:
   (i) Shall be painted white for those located on the perimeter of the windfarm.
   (ii) Windturbines located inside the perimeter of the windfarm and thus shielded by those located on the perimeter, do not require specified painting.

(2) Lighting Requirements A single windturbine and windturbines of a windfarm a total height equal to or less than 150m shall be lighted as illustrated in Figure 12-2 and as follows:

(a) For a single windturbine,
   (i) A windturbine shall be lighted with use of a CL-864 medium intensity red flashing beacon for nighttime hours.
   (ii) The additional provision of a CL-865 medium intensity white flashing beacon and operation during daytime and twilight hours, may be used in lieu of paint marking.
(iii) the lighting fixtures required under subparagraphs (i) and (ii) shall be mounted to ensure an unobstructed view by a pilot approaching from all angles of aircraft approach.

(b) For a windfarm;
(i) The group of windturbines composing a windfarm shall be indicated to pilots by installation of CL-864 medium intensity red flashing beacons on specified windturbines on the perimeter of the windfarm.
(ii) The "windfarm indicators" of subparagraph (i) shall be located so as to define the windfarm and spaced at a horizontal distance in the order of 900m for given directions of aircraft approach.
(iii) In addition to the windfarm indicators of subparagraph (ii) the dominant [highest in absolute height] windturbine within the windfarm shall also be required to be lighted. This requirement for lighting is dependent upon the degree of dominance deemed to produce a hazard to air navigation.
(iv) A tower or other structure within the windfarm, which in being lighted provides the same level of safety, may be used for installation of a windfarm indicator.
(v) Because of the variation in configuration of windfarms, the provision of lighting shall also be subject to a risk evaluation taking into account such factors as the general profile of the group, the location of the windfarm in relation to nearby aerodromes or recognized VFR flight routes, and the anticipated air traffic.
(vi) All indicator lighting provided for a windfarm shall flash simultaneously.

12.4 Windturbines of Total Height Exceeding 150m. The provision of marking and lighting for windturbines higher than 150m shall be determined through means of a risk assessment.

12.5 Continued Illumination.

(a) The lighting provided for a windturbine or windfarm shall be so designed such that it can draw power from the electrical grid for continued illumination even though the windturbine on which it is mounted ceases operation.

Information Note: The above standard is based upon the premise that the lighting of a non-operating windturbine can obtain power from the grid. However, it also recognizes that continued illumination will not be possible should the electrical grid itself fail.
13.1 **Scope.** Chapter 13 governs the overall technical characteristics of obstruction lighting equipment required under this Standard.

13.2 **Equipment Specification.** The specifications covering electrotechnical requirements of obstruction lighting equipment are contained in Appendix B.

13.3 **Photometrics.** The photometric output of obstruction light units required under this Standard shall be in accordance with Table 13-2. Table 13-1 provides an illustration of these photometric requirements.

13.4 **Photocell Control.** In order to have automatic control of obstruction lighting systems, these shall be provided with a photocell device with settings as shown in Table 13-1.

<table>
<thead>
<tr>
<th>Operational transition occurs from – to</th>
<th>at a north sky illuminance of</th>
</tr>
</thead>
<tbody>
<tr>
<td>day – twilight</td>
<td>600 to 350 lux</td>
</tr>
<tr>
<td>twilight – Night</td>
<td>350 to 20 lux</td>
</tr>
<tr>
<td>night – twilight</td>
<td>20 to 350 lux</td>
</tr>
<tr>
<td>twilight – Day</td>
<td>350 to 600 lux</td>
</tr>
</tbody>
</table>
Table 13-2. Obstruction Light Photometric Distribution

<table>
<thead>
<tr>
<th>Light Type</th>
<th>Colour</th>
<th>Signal type</th>
<th>day</th>
<th>twilight</th>
<th>night</th>
<th>Vert. beam spread (b)</th>
<th>- 10º (d)</th>
<th>- 1º (e)</th>
<th>± 0º (e)</th>
<th>+ 2.5º</th>
<th>+12.5º</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL810</td>
<td>red</td>
<td>fixed</td>
<td>N/A</td>
<td>32</td>
<td>32</td>
<td>10º</td>
<td>-----</td>
<td>-----</td>
<td></td>
<td>32 min</td>
<td>32 min</td>
</tr>
<tr>
<td>CL864</td>
<td>red</td>
<td>20-40 fpm</td>
<td>N/A</td>
<td>N/A</td>
<td>2k</td>
<td>3º min</td>
<td>-----</td>
<td>50% min</td>
<td>75% max</td>
<td>100% min</td>
<td>-----</td>
</tr>
<tr>
<td>CL865</td>
<td>white</td>
<td>40fpm</td>
<td>20k</td>
<td>20k</td>
<td>2k</td>
<td>3º min</td>
<td>3% max</td>
<td>50% min</td>
<td>75% max</td>
<td>100% min</td>
<td>-----</td>
</tr>
<tr>
<td>CL866</td>
<td>white</td>
<td>60fpm</td>
<td>20k</td>
<td>20k</td>
<td>2k</td>
<td>3º min</td>
<td>3% max</td>
<td>50% min</td>
<td>75% max</td>
<td>100% min</td>
<td>-----</td>
</tr>
<tr>
<td>CL885</td>
<td>red</td>
<td>60fpm</td>
<td>N/A</td>
<td>N/A</td>
<td>2k</td>
<td>3º min</td>
<td>-----</td>
<td>50% min</td>
<td>75% max</td>
<td>100% min</td>
<td>-----</td>
</tr>
<tr>
<td>CL856</td>
<td>white</td>
<td>40fpm</td>
<td>270k</td>
<td>20k</td>
<td>2k</td>
<td>3º min</td>
<td>3% max</td>
<td>50% min</td>
<td>75% max</td>
<td>100% min</td>
<td>-----</td>
</tr>
<tr>
<td>CL857</td>
<td>white</td>
<td>60fpm</td>
<td>140k</td>
<td>20k</td>
<td>2k</td>
<td>3º min</td>
<td>3% max</td>
<td>50% min</td>
<td>75% max</td>
<td>100% min</td>
<td>-----</td>
</tr>
</tbody>
</table>

(a) Effective intensity, as determined in accordance with the Appendix B
(b) Beam spread is defined as the angle between two directions in a plane for which the intensity is equal to 50% of the lower tolerance value of the intensity shown in columns 4, 5 and 6. The beam pattern is not necessarily symmetrical about the elevation angle at which the peak intensity occurs.
(c) Elevation (vertical) angles are referenced to the horizontal.
(d) Intensity at any specified horizontal radial as a percentage of the actual peak intensity at the same radial when operated at each of the intensities shown in columns 4, 5 and 6.
(e) Intensity at any specified horizontal radial as a factor of the lower tolerance value of the intensity shown in columns 4, 5 and 6.
(f) In the case of rotating type CL865 one third of the flash display shall be red in colour. e.g. WWRWWR
(g) For flashing lights a tolerance on the nominal of ±25%
621.14

14.1 Scope. Chapter 14 governs the maintenance of marking and lighting required under this Standard.

14.2 Marking. The surfaces of a building, structure or object required to be marked with paint, shall be repainted when the colour changes noticeably or when its effectiveness is reduced by scaling, oxidization, chipping or layers of contamination.

Information Note: In-Service Aviation Orange Colour Tolerance Charts are available from private suppliers for determining when repainting is required. The colour should be sampled on the upper half of the structure, since weathering is greater there.

14.3 Lighting

(1) Operating Voltage. To ensure proper candela output:

(a) for light units with incandescent lamps, the voltage provided to the lamp socket shall be within ±3 percent of the rated voltage of the lamp; or

(b) for light units with strobe [capacitor discharge] lamps, the input voltage to the power supply shall be within ±10 percent of rated voltage of the power supply.

(2) Lamp Replacement

(a) A lamp in a light unit shall be replaced immediately upon failure or after being operated for not more than 75 percent of its rated life.

(b) A flashtube in a light unit shall be replaced:
   (i) immediately upon failure, or
   (ii) when the peak effective intensity falls below specification limits, when the fixture begins skipping flashes or at the manufacturer’s recommended intervals, whichever occurs first.

(3) Fixture Lenses. Owing to the effects of harsh environments, a beacon lense shall be visually inspected for ultraviolet damage, cracks, crazing, dirt build up or similar forms of degradation, to ensure that the required certified light output has not been adversely affected.

14.4 Removal of Obscuring Effects. Regular inspection shall take place and remedial action undertaken to ensure that effects, such as the growth of vegetation, do not obscure the pilot's view of any portion of marking or lighting displayed pursuant to this Standard.
APPENDIX A

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Obstruction Lighting Specifications

1. Design Requirements

(a) General
This Appendix sets out the detailed technical design specifications applicable to obstruction marking and lighting standards.

(b) Classification of Obstruction Lights. Refer Standard 621.

(c) Definitions

(i) Beam Spread - The angle between the two directions in the vertical or horizontal plane in which the intensity is equal to 50 percent of the minimum specified peak beam effective intensity.

(ii) Vertical Aiming Angle - The angle formed between the horizontal and a line through the centre of the vertical beam spread.

(iii) Steady-Burning Light (Fixed Light) - A light having constant luminous intensity when observed from a fixed point.

(iv) Effective Intensity - The effective intensity of a flashing light is equal to the intensity of a steady-burning (fixed) light of the same colour which produces the same visual range under identical conditions of observation.

(d) Applicable Documents

(i) The following Military Standards and Specifications, as amended from time to time, apply to the specifications contained in this Appendix, to the extent stipulated below:

MIL-STD-810: Environmental Test Methods

MIL-C-7989: Covers, Light-Transmitting, for Aeronautical Lights, Specification for.

(e) Environmental Requirements - Obstruction lighting equipment is designed for continuous operation under the following conditions:

(i) Temperature: -55° C to +55° C.

(ii) Humidity: 95 % relative humidity.

(iii) Wind: Wind speeds up to 240 km/hr.

(iv) Wind-blown Rain: Exposure to wind-blown rain from any direction.

(v) Salt Fog: Exposure to salt-laden atmosphere.

(f) Light Unit - The light unit is compact, lightweight, and designed for easy servicing and lamp or flash tube replacement. Materials used within the light unit are selected for compatibility with their environment.

(g) Light Covers - Light-transmitting covers for light units conform to the requirements of MIL-C-7989.

(h) Light Colours - Red light systems shall emit aviation red defined in accordance with the International Commission on Illumination (CIE) chromaticity diagram with the "y" co-ordinate not exceeding 0.335. Xenon flashtube emission is acceptable for white obstruction lights.
(i) **Aiming for CL-856 and CL-857 (high intensity white flashing)** - CL-856 and CL-857 light units have a method for adjustment of the vertical aiming angle between 0 and +8 degrees. A spirit level or other device is provided as part of each light unit for setting the elevation angle of the light beam, and an indicator shows the elevation angle with an accuracy of ±1°.

(j) **Control Unit**
Control unit of a lighting system meets the following criteria:

(i) **White Obstruction Lighting Systems**

   (A) **Medium Intensity Lights** - The control unit sets the system’s flash rate, flash sequence, and light intensity. The power and control functions may be consolidated in a single box with the light unit or may be distributed into several units.

   (B) **High Intensity Lights** - The control unit sets the system’s flash rate, flash sequence, and light intensity. The system is designed for operation with light units located up to 800 m from the control unit. If the timing circuit fails, the light units continue to flash randomly or in accordance with Table 1. Failure of an intensity step change circuit will cause all light units to operate at the high intensity step. An override switch is mounted on the control unit to manually control light intensity during maintenance or in the event of a photometric control malfunction.

   (C) **Monitoring** - The control unit monitors the specified operating mode of the flash lamp in a system. The operating status of each light unit in the system is displayed at the control unit. The control unit has provisions to permit connection of a remote indicator, supplied by others or as an option, which indicates the system status.

(ii) **Red Obstruction Lights** - Control units for these light systems are optional. When provided, control units are capable of providing more than one or more of the following functions:

   (A) On/Off photometric control;

   (B) Lamp failure monitor/remote display.

(k) **Input Voltage** - The obstruction lighting equipment is designed to operate from the specified voltage ±10%.

(l) **Transient Protection** - The power input, control, and monitor interface circuitry is designed to withstand line to ground surges up to 5kv for 10 milliseconds (ms) duration.

(m) **Warning Labels** - All enclosures which contain voltages exceeding 150 volts have high voltage warning label(s) placed at a conspicuous location(s). Warning labels are in French and English.

(n) **Interlock Switches** - Interlock switches are incorporated in the control unit and power supplies so that opening the enclosure has the effect of (1) disconnecting incoming power and (2) discharging all high voltage capacitors to 50 volts within 30 seconds.

(o) **Component Ratings**

   (i) **Discharge Lighting Equipment** - All components on discharge lighting equipment, including the flashtube, are designed for ease of servicing and meet performance requirements for a minimum of one year without maintenance.

   (ii) **Incandescent Lighting Equipment** - All components in incandescent lighting equipment, except lamps, are designed to meet performance requirements for a minimum of 1 year without maintenance. Lamps have a minimum rated life of 2000 hours at rated voltage.

(p) **Performance Requirements**

   (i) **Photometric**
Lighting systems meet the following photometric requirements of Standard 621, Chapter 13:

(ii) **Formula** - The effective intensity for flashing lights are calculated in accordance with the following formula:

\[
I_e = \frac{\int_{t_1}^{t_2} I \, dt}{[0.2 + (t_2 - t_1)]}
\]

Where:
- \(I_e\) = Effective Intensity (Candelas)
- \(I\) = Instantaneous Intensity (Candelas)
- \(t_1, t_2\) = Integration limits (seconds).

The limits of integration are selected so that the value of \(I_e\) is maximized.

For discharge flashing lights, the equipment provides the specified light output at the specified temperature extremes as the input voltage simultaneously varies by ± 10% from nominal. The light intensity and beam distribution requirements for obstruction lighting equipment are specified below. All intensities listed are effective intensities (except steady-burning red obstruction lights) measured at the flash rate specified in Table 1.

**Table 1: Flash Characteristics for Obstruction Lights**

<table>
<thead>
<tr>
<th>Type</th>
<th>Intensity Step</th>
<th>Flash Rate (fpm)(^{(1)})</th>
<th>Flash Duration (^{(2)})</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL-856</td>
<td>Day &amp; Twilight</td>
<td>40</td>
<td>Less than 10 ms to night duration</td>
</tr>
<tr>
<td>CL-856</td>
<td>Night</td>
<td>40</td>
<td>Between 100 and 250 ms inclusive</td>
</tr>
<tr>
<td>CL-857</td>
<td>Day &amp; Twilight</td>
<td>60</td>
<td>Less than 10 ms to night duration</td>
</tr>
<tr>
<td>CL-857</td>
<td>Night</td>
<td>60</td>
<td>Between 100 and 250 ms inclusive</td>
</tr>
<tr>
<td>CL-810</td>
<td>Single</td>
<td>20 - 40</td>
<td>1/2 to 2/3 of flash period note (3)</td>
</tr>
<tr>
<td>CL-865</td>
<td>Day &amp; Twilight</td>
<td>40</td>
<td>Less than 10 ms to night duration</td>
</tr>
<tr>
<td>CL-865</td>
<td>Night</td>
<td>40</td>
<td>Between 100 and 250 ms inclusive</td>
</tr>
</tbody>
</table>

**Notes:**
1. Flash rates have a tolerance of ± 5%.
2. When the effective flash duration is achieved by a group of short flashes, the short flashes are emitted at not less than 30 per second.
3. The light intensity during the period is not less than 10% of the peak effective intensity. The off period is at least 1/3 of the flash period.

(iii) **System Flashing Requirements**

(A) **Simultaneous Flashing Systems** - All obstruction lights in systems composed of CL-856, and/or CL-864, and/or CL-865 light units flash simultaneously. The flash rate is in accordance with Table 1.

(B) **Sequenced Flashing Systems** - Systems composed of CL-857 (white flashing high intensity) light units have a sequenced flash characteristic. This system consists of three lighting levels on or near each supporting structure:
- one level is near the top;
- one level midway between the top and bottom; and
- one level at the bottom or lowest point of the catenary.

The flash sequence is middle, top and bottom. The interval between top and bottom flashes is about twice the interval between middle and top flashes. The interval between the end of one sequence and the beginning of the next is about 10 times the interval between middle and top flashes. The time for the completion of one cycle is one second (± 5%).
(iv) **Intensity Step Changing** - The intensity or mode change (on/off) for each of the obstruction lighting systems as stipulated in Standard 621 Chapters 13, Table 13-1.

2. **Quality Assurance Testing**

(a) **Qualification Tests** - Photometric and system operational tests are conducted after completion of all environmental tests. The same obstruction lighting units are used throughout the tests. The purpose of the following tests is to demonstrate compliance with these specifications. The tests may be run on the control unit, power supply, and a single light unit, with a simulated load replacing the other light units. Equipment tested are completed with optional equipment.

(b) **High Temperature Test** - The high temperature test is conducted in accordance with MIL-STD-810, Method 501.2, Procedure II. The equipment is subject to a constant temperature of at least +55° C for four hours after temperature stabilization. The equipment is then turned on for testing. The owner/operator of the obstruction lighting ensures that the manufacturer has demonstrated during the test that the equipment maintains the proper flash rate and (for discharge flashing light) the proper amount of energy is being delivered to flashing light) the proper amount of energy is being delivered to the lamp as the input voltage is varied by ± 10% from nominal and that a visual examination has been conducted after the equipment was removed from the test chamber. Failure of the equipment to operate properly or any deterioration in materials constitutes failure of the test.

(c) **Low Temperature Test** - The low temperature test is conducted in accordance with MIL-STD-810, Method 502.2 Procedure II. The equipment is placed in a chamber which maintains a temperature of -55° C or less. Equipment, with input power off, is then exposed to a 24-hour soaking period after which the equipment is turned on for 1 hour, and achieves proper flash rate and intensity within 30 seconds after being energized. The owner or operator of the building, structure or object on which the lighting equipment is used ensures that the manufacturer has demonstrated during one hour of operation as part of the test that the equipment maintains the proper flash rate and (for discharge flashing light) the proper amount of energy is being delivered to the lamp as the input voltage is varied by ±10% from nominal and that, at the conclusion of the test, a visual inspection has been conducted. Failure of the equipment to operate properly or any deterioration in materials constitutes failure of the test.

(d) **Rain Test** - The wind-blown rain test is conducted in accordance with MILSTD810, Method 506.2, Procedure I. The rain is at a rate of 130 mm/hour with an exposure time of 30 minutes per side. The equipment is operated throughout the test. Failure of the equipment to operate properly, or any deterioration in materials, or excessive accumulation of water in the equipment constitutes failure of the test.

(e) **Wind** - Evidence is provided, either by testing or by calculated mechanical force, to demonstrate that installed light units meet the wind requirements in paragraph 1(e)(iii).

(f) **Humidity Test** - The test is in accordance with MIL-STD-810, Method 509.2, Procedure I. The equipment is subjected to three complete cycles (71 hours) according to Table 507.2-I, except the maximum temperature at cycle 1 shall be +55° C. Failure of the equipment to operate properly or any deterioration in materials constitutes failure of the test.

(g) **Salt Fog Test** - The salt fog test is conducted in accordance with MIL-STD-810, Method 509.2, Procedure I. Failure of the equipment to operate properly or any evidence of damage, rust, or corrosion in materials constitutes failure of the test.

(h) **Photometric Test** - Light units are energized by system power supply and control unit, and tested for compliance with the photometric requirements set out above. For a discharge flashing light, the specified intensity is produced at high and low temperature extremes as the input voltage to the system power supply varies by ±10% from nominal. Red light intensity may be measured in white light and then calculated if the glassware manufacturer certifies the chromaticity and transmissivity values of the red filter material for the particular source. If more than one lamp type is to be used, the qualification testing is completed for each lamp type. For a discharge flashing system, if the power supply and optical head are separate components, the owner or operator of the building, structure or object on which the equipment is installed ensures that the manufacturer has demonstrated that the required photometrics are produced with the units separated by maximum and minimum recommended distances and connected by cable recommended by the manufacturer. Photometric test results are in the forms of:
(i) Vertical beam pattern: Distribution curve (vertical angle versus candelas).

(ii) Horizontal beam pattern: Polar plot (horizontal angle versus candelas).

(i) System Operational Test - System components are connected with the necessary wiring to electrically simulate an actual installation in which the top and bottom light units on a structure are separated by 600 m for a system composed of CL-856 or CL-865, and 150 m for system composed of CL-857, and the controller separated an additional 800 m. Simulated interconnecting cables with equivalent impedances may be used in lieu of full cable lengths. The system is energized and operated to demonstrate compliance with all specification operating requirements such as flash rate, flash sequence, photoelectric switching of intensity steps, operation of interlock devices and satisfactory operation under input voltage variations. If the power supply and optical head are separate components, it is demonstrated that with the maximum recommended separation between components, sufficient energy is delivered to the light unit to produce the specified photometrics. This test is modified to verify the specific requirements for single CL 810 and a system composed of CL 810 and CL 864 lights.

(j) Visual Examination - The obstruction lighting equipment is examined for compliance with the requirements on materials, finish and quality of workmanship.
APPENDIX C TO CAR 621.19 - ANNEXE C RAC 621.19

TO BE COMPLETED BY APPLICANT – À REMPLIR PAR LE REQUÉRANT

<table>
<thead>
<tr>
<th>Operator’s Name – Nom de l’opérateur</th>
<th>Address – Adresse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator’s Address – Adresse de l’opérateur</td>
<td></td>
</tr>
<tr>
<td>Operator’s Contact – Agent de liaison de l’opérateur</td>
<td></td>
</tr>
<tr>
<td>Contact’s Telephone No. – N° de téléphone de liaison</td>
<td>Contact’s FAX No. – N° de télécopieur de liaison</td>
</tr>
<tr>
<td>Applicant’s Name – Nom du requérant</td>
<td>Address – Adresse</td>
</tr>
<tr>
<td>City – Ville</td>
<td>Province/Territory – Province/Territoire</td>
</tr>
<tr>
<td>Applicant’s Telephone No. – N° de téléphone du requérant</td>
<td>Applicant’s FAX No. – N° de télécopieur du requérant</td>
</tr>
<tr>
<td>Applicant’s Email Address – Adresse électronique du requérant</td>
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<table>
<thead>
<tr>
<th>TOWERS / ANTENNAS</th>
<th>BUILDING OR OTHER STRUCTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
</tr>
<tr>
<td>C</td>
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<table>
<thead>
<tr>
<th>Geographic coordinates of structure – coordonnées géographiques de la structure</th>
</tr>
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<tbody>
<tr>
<td>N Latitude</td>
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<table>
<thead>
<tr>
<th>Height above ground</th>
<th>Hauteur au-dessus du sol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building height</td>
<td>Hauteur du bâtiment</td>
</tr>
<tr>
<td>Ground elevation above sea level</td>
<td>Hauteur du sol au-dessus du niveau de la mer</td>
</tr>
</tbody>
</table>

List any tall adjacent buildings and structures which may shield the proposed structure (Attach sketch). Faire une liste indiquant les structures et bâtiments avoisinants plus haut que le bâtiment projeté (Inclure un diagramme).

Yes | Oui  |  No | Non |  Add. to exist. struc. incl. total hght. = Ajout à un bâti. exis. incl. hauteur total  | Proposed Construction = Date de construction proposée |

<table>
<thead>
<tr>
<th>TYPE OF STRUCTURE (narrative description and function) – GENRE DE STRUCTURE (description narrative et fonction)</th>
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</thead>
<tbody>
<tr>
<td>e.g. 30 meter high antenna on roof of building</td>
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<table>
<thead>
<tr>
<th>Signature (of applicant) – Signature (du requérant)</th>
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<tbody>
<tr>
<td>Date (Y/A-M-D) = Date</td>
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TRANSPORT CANADA USE ONLY – À L’USAGE DE TRANSPORTS CANADA

AERONAUTICAL ASSESSMENT – ÉVALUATION AERONAUTIQUE

<table>
<thead>
<tr>
<th>Site acceptable – Emplacement acceptable</th>
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<tbody>
<tr>
<td>Oui</td>
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<tr>
<td>(if no, reason) (si non, pourquoi)</td>
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<table>
<thead>
<tr>
<th>Lighting as per CAR 621.19 required – Balisage lumineux tel que demandé au CAR 621.19</th>
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<tbody>
<tr>
<td>Oui</td>
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<td>eu</td>
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<tr>
<th>Marking as per CAR 621.19 required – Balisage peint tel que demandé au CAR 621.19</th>
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<tr>
<td>Oui</td>
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<td>eu</td>
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<tr>
<th>Temporary lighting required – Nécessité d’un balisage lumineux temporaire</th>
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<tbody>
<tr>
<td>Oui</td>
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<td>eu</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Advise Transport Canada in writing 90 days before construction</th>
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<tbody>
<tr>
<td>Avertir Transports Canada par écrit 90 jours avant la construction</td>
</tr>
<tr>
<td>when construction starts</td>
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<tr>
<td>and on completion</td>
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<tr>
<td>Valid to</td>
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<table>
<thead>
<tr>
<th>Civil Aviation Inspector (as required) – Inspecteur Aviation Civile (si nécessaire)</th>
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<tbody>
<tr>
<td>Comments – Commentaires</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Signature</th>
<th>Date</th>
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</thead>
</table>

Regional Manager Aerodrome Safety  
Gestionnaire Régional Sécurité des aérodromes

<table>
<thead>
<tr>
<th>Signature (du requérant)</th>
<th>Date (Y/A-M-D)</th>
</tr>
</thead>
</table>

26-0427 (0005-01)