5.3.26.1 Aircraft stand manoeuvring guidance lights shall be provided to facilitate the positioning of an aircraft on an aircraft stand on a paved apron intended for use in poor visibility conditions, unless adequate guidance is provided by other means.

Location

5.3.26.2 Aircraft stand manoeuvring guidance lights shall be collocated with the aircraft stand markings.

Characteristics

5.3.26.3 Aircraft stand manoeuvring guidance lights, other than those indicating a stop position, shall be fixed yellow lights, visible throughout the segments within which they are intended to provide guidance.

5.3.26.4 The lights used to delineate lead-in, turning and lead-out lines shall be spaced at intervals of not more than 7.5 m on curves and 15 m on straight sections.

5.3.26.5 The lights indicating a stop position shall be fixed unidirectional lights showing red.

5.3.26.6 The intensity of the lights shall be adequate for the condition of visibility and ambient light in which the use of the aircraft stand is intended.

5.3.26.7 The lighting circuit shall be designed so that the lights may be switched on to indicate that an aircraft stand is to be used and switched off to indicate that it is not to be used.

### 5.3.27 ROAD-HOLDING POSITION LIGHT

Application

5.3.27.1 A road-holding position light shall be provided at each road-holding position serving a

runway when it is intended that the runway will be used in runway visual range conditions less than a value of 350 m.

5.3.27.2 A road-holding position light shall be provided at each road-holding position serving a runway when it is intended that the runway will be used in runway visual range conditions of values between 350 m and 550 m.

Location

5.3.27.3 A road-holding position light shall be located adjacent to the holding position marking 1.5 m (± 0.5 m) from one edge of the road, i.e. left or right as appropriate to the local traffic regulations.

Note.— See 9.9 for the mass and height limitations and frangibility requirements of navigation aids located on runway strips.

Characteristics

5.3.27.4 The road-holding position light shall comprise:

a) a controllable red (stop)/green (go) traffic light; or

b) a flashing-red light.

Note.— It is intended that the lights specified in sub-paragraph a) be controlled by the air traffic services.

5.3.27.5 The road-holding position light beam shall be unidirectional and aligned so as to be visible to the driver of a vehicle approaching the holding position.

5.3.27.6 The intensity of the light beam shall be adequate for the conditions of visibility and ambient light in which the use of the holding position is intended, but shall not dazzle the driver.

Note.— The commonly used traffic lights are likely to meet the requirements in 5.3.28.5 and

5.3.28.6.

5.3.27.7 The flash frequency of the flashing-red light shall be between 30 and 60 flashes per minute.

### 5.3.28 NO-ENTRY BAR

Note.— Runway incursions may take place in all visibility or weather conditions. The use of no-entry bars can form part of effective runway incursion prevention measures.

Application

5.3.28.1 A no-entry bar shall be provided across a taxiway which is intended to be used as an exit only taxiway to assist in preventing inadvertent access of traffic to that taxiway.

Location

5.3.28.2 A no-entry bar shall be located across the taxiway at the end of an exit only taxiway where it is desired to prevent traffic from entering the taxiway in the wrong direction.

5.3.28.3 A no-entry bar shall be collocated with a no-entry sign and/or a no-entry marking.

Characteristics

5.3.28.4 A no-entry bar shall consist of unidirectional lights spaced at uniform intervals of no more than 3 m showing red in the intended direction(s) of approach to the runway.

Note.— Where necessary to enhance conspicuity, extra lights are installed uniformly.

5.3.28.5 A pair of elevated lights shall be added to each end of the no-entry bar where the in-pavement no entry bar lights might be obscured from a pilot's view, for example, by rain, or where a pilot may be required to stop the aircraft in a position so close to the lights that they are blocked

from view by the structure of the aircraft.

5.3.28.6 The intensity in red light and beam spreads of no-entry bar lights shall be in accordance with the specifications in Appendix 2, Figures A2-12 through A2-16, as appropriate.

5.3.28.7 Where no-entry bars are specified as components of an advanced surface movement guidance and control system and where, from an operational point of view, higher intensities are required to maintain ground movements at a certain speed in very low visibilities or in bright daytime conditions, the intensity in red light and beam spreads of no-entry bar lights shall be in accordance with the specifications of Appendix 2, Figure A2-17, A2-18 or A2-19.

Note.— High-intensity no-entry bars are typically used only in case of an absolute necessity and following a specific study.

5.3.28.8 Where a wide beam fixture is required, the intensity in red light and beam spreads of no-entry bar lights shall be in accordance with the specifications of Appendix 2, Figure A2-17 or A2-19.

5.3.28.9 Taxiway centre line lights installed beyond the no-entry bar, looking in the direction of the runway, shall not be visible when viewed from the taxiway.

### 5.3.29 RUNWAY STATUS LIGHTS

Introductory Note.— Runway status lights (RWSL) is a type of autonomous runway incursion warning system (ARIWS). The two basic visual components of RWSL are runway entrance lights (RELs) and take-off hold lights (THLs). Either component may be installed by itself, but the two components are designed to be complementary to each other.

Location

5.3.29.1 Where provided, RELs shall be offset 0.6 m from the taxiway centre line on the

opposite side to the taxiway centre line lights and begin 0.6 m before the runway-holding position extending to the edge of the runway. An additional single light shall be placed on the runway 0.6 m from the runway centre line and aligned with the last two taxiway RELs.

Note.— Where two or more runway-holding positions are provided, the runway-holding position referred is that closest to the runway.

5.3.29.2 RELs shall consist of at least five light units and shall be spaced at a minimum of 3.8 m and a maximum of 15.2 m longitudinally, depending upon the taxiway length involved, except for a single light installed near the runway centre line.

5.3.29.3 Where provided, THLs shall be offset 1.8 m on each side of the runway centre line lights and extend, in pairs, starting at a point 115 m from the beginning of the runway and, thereafter, every 30 m for at least 450 m.

Note.— Additional THLs may be similarly provided at the starting point of the take-off roll.

Characteristics

5.3.29.4 Where provided, RELs shall consist of a single line of fixed in pavement lights showing red in the direction of aircraft approaching the runway.

5.3.29.5 RELs shall illuminate as an array at each taxiway/runway intersection where they are installed less than two seconds after the system determines a warning is needed.

5.3.29.6 Intensity and beam spread of RELs shall be in accordance with the specifications of Appendix 2, Figures A2-12 and A2-14.

Note.— Consideration for reduced beam width may be required for some REL lights at acute angled runway/taxiway intersections to ensure the RELs are not visible to aircraft on the runway.

5.3.29.7 Where provided, THLs shall consist of two rows of fixed in pavement lights showing

red facing the aircraft taking off.

5.3.29.8 THLs shall illuminate as an array on the runway less than two seconds after the system determines a warning is needed.

5.3.29.9 Intensity and beam spread of THLs shall be in accordance with the specifications of Appendix 2, Figure A2-25.

5.3.29.10 RELs and THLs shall be automated to the extent that the only control over each system will be to disable one or both systems.

## 5.4 SIGNS

### 5.4.1 General

Note.— Signs shall be either fixed message signs or variable message signs. Guidance on signs is contained in the Aerodrome Design Manual (Doc 9157), Part 4.

Application

5.4.1.1 Signs shall be provided to convey a mandatory instruction, information on a specific location or destination on a movement area or to provide other information to meet the requirements of 9.8.1.

Note.— See 5.2.17 for specifications on information marking.

5.4.1.2 A variable message sign shall be provided where:

a) the instruction or information displayed on the sign is relevant only during a certain period of time; and/or

b) there is a need for variable predetermined information to be displayed on the sign to meet the requirements of 9.8.1.

Characteristics

5.4.1.3 Signs shall be frangible. Those located near a runway or taxiway shall be sufficiently low to preserve clearance for propellers and the engine pods of jet aircraft. The installed height of the sign shall not exceed the dimension shown in the appropriate column of Table 5-5.

**Table 5-5. Location distances for taxiing guidance signs including runway exit signs**

| Sight height (mm) | | | | Perpendicular distance from defined taxiway pavement edge to near side of sign | Perpendicular distance from defined runway pavement edge to near side of sign |
|---|---|---|---|---|---|
| Code number | Legend | Face (min) | Installed (max.) | | |
| 1 or 2 | 200 | 300 | 700 | 5-11 m | 3-10 m |
| 1 or 2 | 300 | 450 | 900 | 5-11 m | 3-10 m |
| 3 or 4 | 300 | 450 | 900 | 11-21 m | 8-15 m |
| 3 or 4 | 400 | 600 | 1 100 | 11-21 m | 8-15 m |

5.4.1.4 Signs shall be rectangular, as shown in Figures 5-30 and 5-31 with the longer side horizontal.

5.4.1.5 The only signs on the movement area utilizing red shall be mandatory instruction signs.

5.4.1.6 The inscriptions on a sign shall be in accordance with the provisions of Appendix 4.

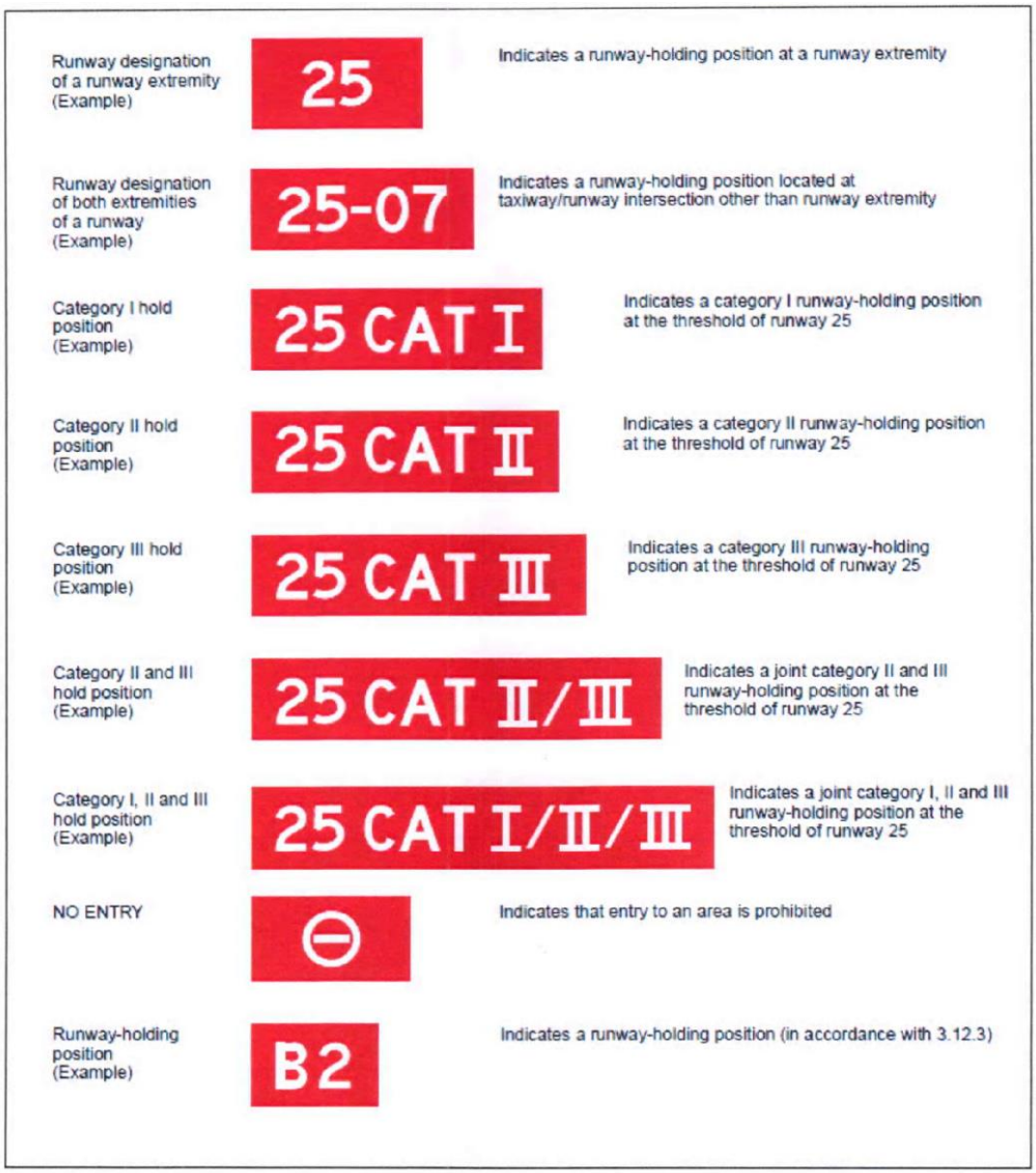



**Figure 5-28. Mandatory instruction signs**

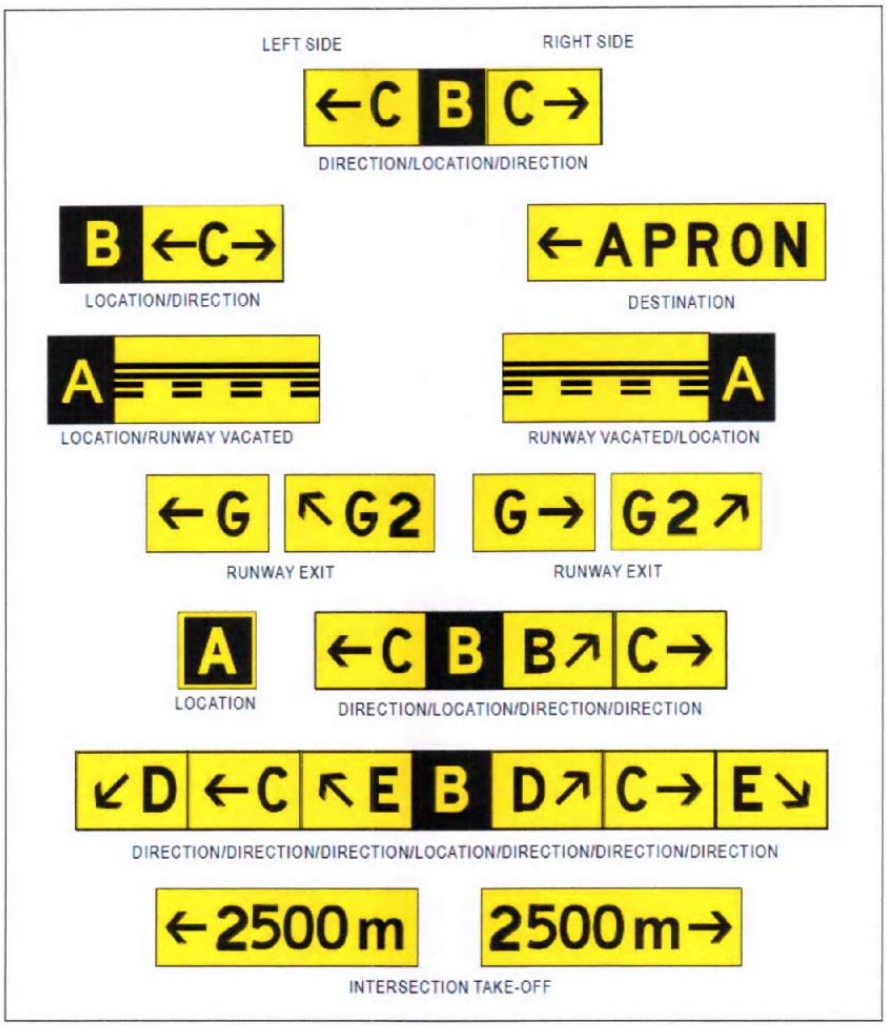



**Figure 5-29. Information signs**

5.4.1.7 Signs shall be illuminated in accordance with the provisions of Appendix 4 when intended for use:

a) in runway visual range conditions less than a value of 800 m; or

b) at night in association with instrument runways; or

c) at night in association with non-instrument runways where the code number is 3 or 4.

5.4.1.8 Signs shall be retroreflective and/or illuminated in accordance with the provisions of Appendix 4 when intended for use at night in association with non-instrument runways where the code number is 1 or 2.

5.4.1.9 A variable message sign shall show a blank face when not in use.

5.4.1.10 In case of failure, a variable message sign shall not provide information that could lead to unsafe action from a pilot or a vehicle driver.

5.4.1.11 The time interval to change from one message to another on a variable message sign shall be as short as practicable and should not exceed 5 seconds.

### 5.4.2 MANDATORY INSTRUCTION SIGNS

Note.— See Figure 5-28 for pictorial representation of mandatory instruction signs and Figure 5-30 for examples of locating signs at taxiway/runway intersections.

Application

5.4.2.1 A mandatory instruction sign shall be provided to identify a location beyond which an aircraft taxiing or vehicle shall not proceed unless authorized by the aerodrome control tower.

5.4.2.2 Mandatory instruction signs shall include runway designation signs, category I, II or III holding position signs, runway-holding position signs, road-holding position signs and NO ENTRY signs.

Note.— See 5.4.7 for specifications on road-holding position signs.

5.4.2.3 A pattern "A" runway-holding position marking shall be supplemented at a taxiway/runway intersection or a runway/runway intersection with a runway designation sign.

5.4.2.4 A pattern "B" runway-holding position marking shall be supplemented with a category I, II or III holding position sign.

5.4.2.5 A pattern "A" runway-holding position marking at a runway-holding position

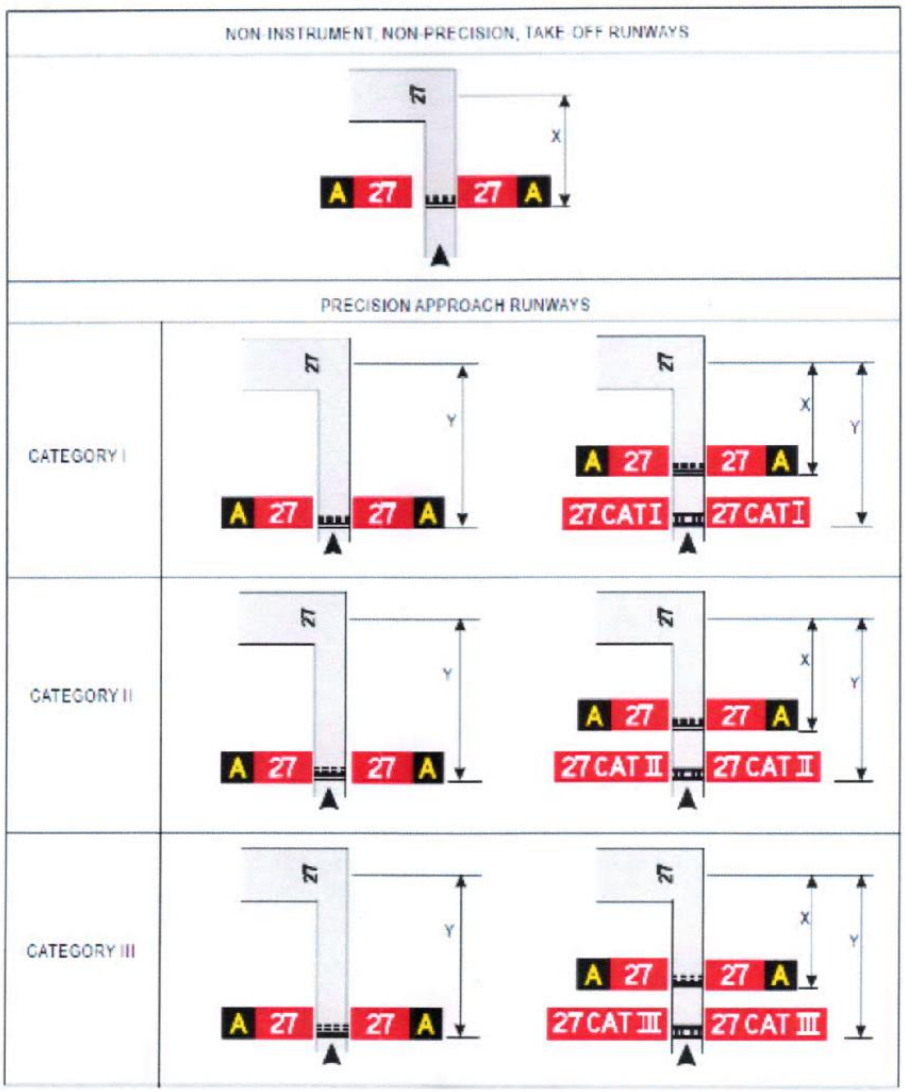
established in accordance with 3.12.3 shall be supplemented with a runway-holding position sign.

Note.— See 5.2.10 for specifications on runway-holding position marking.

5.4.2.6 A runway designation sign at a taxiway/runway intersection shall be supplemented with a location sign in the outboard (farthest from the taxiway) position, as appropriate.

Note.— See 5.4.3 for characteristics of location signs.

5.4.2.7 A NO ENTRY sign shall be provided when entry into an area is prohibited.



Note.— Distance X is established in accordance with Table 3-2. Distance Y is established at the edge of the ILS/MLS critical/sensitive area.

**Figure 5-30. Examples of sign positions at taxiway/runway intersections**

Location

5.4.2.8 A runway designation sign at a taxiway/runway intersection or a runway/runway intersection shall be located on each side of the runway-holding position marking facing the direction of approach to the runway.

5.4.2.9 A category I, II or III holding position sign shall be located on each side of the runway-holding position marking facing the direction of the approach to the critical area.

5.4.2.10 A NO ENTRY sign shall be located at the beginning of the area to which entrance is prohibited on each side of the taxiway as viewed by the pilot.

5.4.2.11 A runway-holding position sign shall be located on each side of the runway-holding position established in accordance with 3.12.3, facing the approach to the obstacle limitation surface or ILS/MLS critical/sensitive area, as appropriate.

Characteristics

5.4.2.12 A mandatory instruction sign shall consist of an inscription in white on a red background.

5.4.2.13 Where, owing to environmental or other factors, the conspicuity of the inscription on a mandatory instruction sign needs to be enhanced, the outside edge of the white inscription shall be supplemented by a black outline measuring 10 mm in width for runway code numbers 1 and 2, and 20 mm in width for runway code numbers 3 and 4.

5.4.2.14 The inscription on a runway designation sign shall consist of the runway designations of the intersecting runway properly oriented with respect to the viewing position of the sign, except

that a runway designation sign installed in the vicinity of a runway extremity may show the runway designation of the concerned runway extremity only.

5.4.2.15 The inscription on a category I, II, III, joint II/III or joint I/II/III holding position sign shall consist of the runway designator followed by CAT I, CAT II, CAT III, CAT II/III or CAT I/II/III, as appropriate.

5.4.2.16 The inscription on a NO ENTRY sign shall be in accordance with Figure 5-28.

5.4.2.17 The inscription on a runway-holding position sign at a runway-holding position established in accordance with 3.12.3 shall consist of the taxiway designation and a number.

5.4.2.18 Where installed, the inscriptions/symbol of Figure 5-28 shall be used.

### 5.4.3 INFORMATION SIGNS

Note.— See Figure 5-29 for pictorial representations of information signs.

Application

5.4.3.1 An information sign shall be provided where there is an operational need to identify by a sign, a specific location, or routing (direction or destination) information.

5.4.3.2 Information signs shall include: direction signs, location signs, destination signs, runway exit signs, runway vacated signs and intersection take-off signs.

5.4.3.3 A runway exit sign shall be provided where there is an operational need to identify a runway exit.

5.4.3.4 A runway vacated sign shall be provided where the exit taxiway is not provided with taxiway centre line lights and there is a need to indicate to a pilot leaving a runway the perimeter of the ILS/MLS critical/sensitive area or the lower edge of the inner transitional surface, whichever

is farther from the runway centre line.

Note.— See 5.3.17 for specifications on colour coding taxiway centre line lights.

5.4.3.5 An intersection take-off sign shall be provided when there is an operational need to indicate the remaining take-off run available (TORA) for intersection take-offs.

5.4.3.6 Where necessary, a destination sign shall be provided to indicate the direction to a specific destination on the aerodrome, such as cargo area, general aviation, etc.

5.4.3.7 A combined location and direction sign shall be provided when it is intended to indicate routing information prior to a taxiway intersection.

5.4.3.8 A direction sign shall be provided when there is an operational need to identify the designation and direction of taxiways at an intersection.

5.4.3.9 A location sign shall be provided at an intermediate holding position.

5.4.3.10 A location sign shall be provided in conjunction with a runway designation sign except at a runway/runway intersection.

5.4.3.11 A location sign shall be provided in conjunction with a direction sign, except that it may be omitted where an aeronautical study indicates that it is not needed.

5.4.3.12 Where necessary, a location sign shall be provided to identify taxiways exiting an apron or taxiways beyond an intersection.

5.4.3.13 Where a taxiway ends at an intersection such as a ''T'' and it is necessary to identify this, a barricade, direction sign and/or other appropriate visual aid shall be used.

Location

5.4.3.14 Except as specified in 5.4.3.16 and 5.4.3.24 information signs shall, wherever practicable, be located on the left-hand side of the taxiway in accordance with Table 5-5.

5.4.3.15 At a taxiway intersection, information signs shall be located prior to the intersection and in line with the intermediate holding position marking. Where there is no intermediate holding position marking, the signs shall be installed at least 60 m from the centre line of the intersecting taxiway where the code number is 3 or 4, and at least 40 m where the code number is 1 or 2.

Note.— A location sign installed beyond a taxiway intersection may be installed on either side of a taxiway.

5.4.3.16 A runway exit sign shall be located on the same side of the runway as the exit is located (i.e. left or right) and positioned in accordance with Table 5-5.

5.4.3.17 A runway exit sign shall be located prior to the runway exit point in line with a position at least 60 m prior to the point of tangency where the code number is 3 or 4, and at least 30 m where the code number is 1 or 2.

5.4.3.18 A runway vacated sign shall be located at least on one side of the taxiway. The distance between the sign and the centre line of a runway shall be not less than the greater of the following:

a) the distance between the centre line of the runway and the perimeter of the ILS/MLS critical/sensitive area; or

b) the distance between the centre line of the runway and the lower edge of the inner transitional surface.

5.4.3.19 Where provided in conjunction with a runway vacated sign, the taxiway location sign shall be positioned outboard of the runway vacated sign.

5.4.3.20 An intersection take-off sign shall be located at the left-hand side of the entry taxiway. The distance between the sign and the centre line of the runway shall be not less than 60 m where

the code number is 3 or 4, and not less than 45 m where the code number is 1 or 2.

5.4.3.21 A taxiway location sign installed in conjunction with a runway designation sign shall be positioned outboard of the runway designation sign.

5.4.3.22 A destination sign shall not normally be collocated with a location or direction sign.

5.4.3.23 An information sign other than a location sign shall not be collocated with a mandatory instruction sign.

5.4.3.24 A direction sign, barricade and/or other appropriate visual aid used to identify a ''T'' intersection shall be located on the opposite side of the intersection facing the taxiway.

Characteristics

5.4.3.25 An information sign other than a location sign shall consist of an inscription in black on a yellow background.

5.4.3.26 A location sign shall consist of an inscription in yellow on a black background and where it is a stand-alone sign shall have a yellow border.

5.4.3.27 The inscription on a runway exit sign shall consist of the designator of the exit taxiway and an arrow indicating the direction to follow.

5.4.3.28 The inscription on a runway vacated sign shall depict the pattern A runway-holding position marking as shown in Figure 5-29.

5.4.3.29 The inscription on an intersection take-off sign shall consist of a numerical message indicating the remaining take-off run available in metres plus an arrow, appropriately located and oriented, indicating the direction of the take-off as shown in Figure 5-29.

5.4.3.30 The inscription on a destination sign shall comprise an alpha, alphanumerical or

numerical message identifying the destination plus an arrow indicating the direction to proceed as shown in Figure 5-29.

5.4.3.31 The inscription on a direction sign shall comprise an alpha or alphanumerical message identifying the taxiway(s) plus an arrow or arrows appropriately oriented as shown in Figure 5-29.

5.4.3.32 The inscription on a location sign shall comprise the designation of the location taxiway, runway or other pavement the aircraft is on or is entering and shall not contain arrows.

5.4.3.33 Where it is necessary to identify each of a series of intermediate holding positions on the same taxiway, the location sign shall consist of the taxiway designation and a number.

5.4.3.34 Where a location sign and direction signs are used in combination:

a) all direction signs related to left turns shall be placed on the left side of the location sign, and all direction signs related to right turns shall be placed on the right side of the location sign, except that where the junction consists of one intersecting taxiway, the location sign may alternatively be placed on the left-hand side;

b) the direction signs shall be placed such that the direction of the arrows departs increasingly from the vertical with increasing deviation of the corresponding taxiway;

c) an appropriate direction sign shall be placed next to the location sign where the direction of the location taxiway changes significantly beyond the intersection; and

d) adjacent direction signs shall be delineated by a vertical black line as shown in Figure 5-29.

5.4.3.35 A taxiway shall be identified by a designator that is used only once on an aerodrome and comprise a single letter, two letters, or a combination of a letter or letters followed by a number.

5.4.3.36 When designating taxiways, the use of words such as “inner” and “outer” shall be avoided wherever possible.

5.4.3.37 When designating taxiways, the letters I, O and X shall not be used to avoid confusion

with the numerals 1 and 0, and the closed marking.

5.4.3.38 The use of numbers alone on the manoeuvring area shall be reserved for the designation of runways.

5.4.3.39 Apron stand designators shall not be the same as taxiway designators.

### 5.4.4 VOR AERODROME CHECKPOINT SIGN

Application

5.4.4.1 When a VOR aerodrome checkpoint is established, it shall be indicated by a VOR aerodrome checkpoint marking and sign.

Note.— See 5.2.12 for VOR aerodrome checkpoint marking.

Location

5.4.4.2 A VOR aerodrome checkpoint sign shall be located as near as possible to the checkpoint and so that the inscriptions are visible from the cockpit of an aircraft properly positioned on the VOR aerodrome checkpoint marking.

Characteristics

5.4.4.3 A VOR aerodrome checkpoint sign shall consist of an inscription in black on a yellow background.

5.4.4.4 The inscriptions on a VOR checkpoint sign shall be in accordance with one of the alternatives shown in Figure 5-31 in which:

VOR is an abbreviation identifying this as a VOR checkpoint;

116.3 is an example of the radio frequency of the VOR concerned;

147° is an example of the VOR bearing, to the nearest degree, which should be indicated

at the VOR checkpoint; and

4.3 NM is an example of the distance in nautical miles to a DME collocated with the VOR concerned.

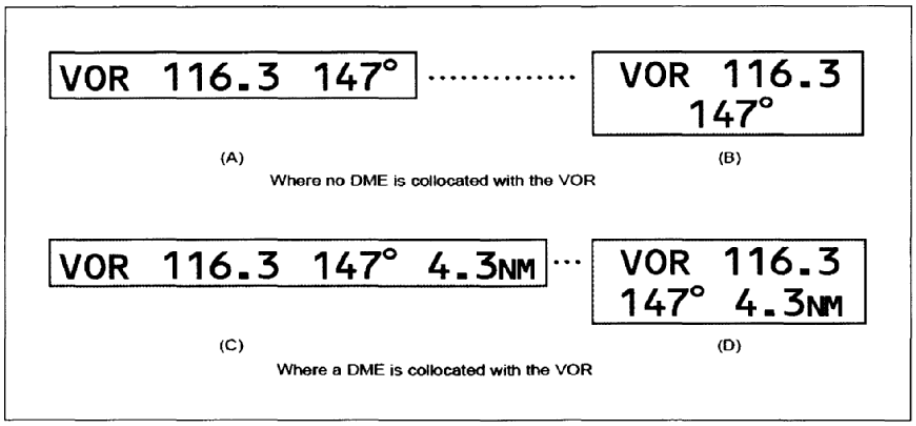



**Figure 5-31. VOR aerodrome checkpoint sign**

Note.— Tolerances for the bearing value shown on the sign are given in Annex 10, Volume I, Attachment E. It will be noted that a checkpoint can only be used operationally when periodic checks show it to be consistently within ±2 degrees of the stated bearing.

### 5.4.5 AERODROME IDENTIFICATION SIGN

Application

5.4.5.1 An aerodrome identification sign shall be provided at an aerodrome where there is insufficient alternative means of visual identification.

Location

5.4.5.2 The aerodrome identification sign shall be placed on the aerodrome so as to be legible, in so far as is practicable, at all angles above the horizontal.

Characteristics

5.4.5.3 The aerodrome identification sign shall consist of the name of the aerodrome.

5.4.5.4 The colour selected for the sign shall give adequate conspicuity when viewed against its background.

5.4.5.5 The characters shall have a height of not less than 3 m.

### 5.4.6 AIRCRAFT STAND IDENTIFICATION SIGNS

Application

5.4.6.1 An aircraft stand identification marking shall be supplemented with an aircraft stand identification sign where feasible.

Location

5.4.6.2 An aircraft stand identification sign shall be located so as to be clearly visible from the cockpit of an aircraft prior to entering the aircraft stand.

Characteristics

5.4.6.3 An aircraft stand identification sign shall consist of an inscription in black on a yellow background.

### 5.4.7 ROAD-HOLDING POSITION SIGN

5.4.7.1 A road-holding position sign shall be provided at all road entrances to a runway.

Location

5.4.7.2 The road-holding position sign shall be located 1.5 m from one edge of the road (left or right as appropriate to the local traffic regulations) at the holding position.

Characteristics

5.4.7.3 A road-holding position sign shall consist of an inscription in white on a red background.

5.4.7.4 The inscription on a road-holding position sign shall be in the national language, be in conformity with the local traffic regulations and include the following:

a) a requirement to stop; and

b) where appropriate:

1) a requirement to obtain ATC clearance; and

2) location designator.

Note.— Examples of road-holding position signs are contained in the Aerodrome Design Manual (Doc 9157), Part 4.

5.4.7.5 A road-holding position sign intended for night use shall be retroreflective or illuminated.

## 5.5 MARKERS

### 5.5.1 General

Markers shall be frangible. Those located near a runway or taxiway shall be sufficiently low to preserve clearance for propellers and for the engine pods of jet aircraft.

Note 1.— Anchors or chains, to prevent markers which have broken from their mounting from blowing away, are sometimes used.

Note 2.— Guidance on frangibility of markers is given in the Aerodrome Design Manual (Doc 9157), Part 6.

### 5.5.2 Unpaved runway edge markers

Application

5.5.2.1 Markers shall be provided when the extent of an unpaved runway is not clearly indicated by the appearance of its surface compared with that of the surrounding ground.

Location

5.5.2.2 Where runway lights are provided, the markers shall be incorporated in the light fixtures. Where there are no lights, markers of flat rectangular or conical shape shall be placed so as to delimit the runway clearly.

Characteristics

5.5.2.3 The flat rectangular markers shall have a minimum size of 1 m by 3 m and shall be placed with their long dimension parallel to the runway centre line. The conical markers shall have a height not exceeding 50 cm.

### 5.5.3 Stopway edge markers

Application

5.5.3.1 Stopway edge markers shall be provided when the extent of a stopway is not clearly indicated by its appearance compared with that of the surrounding ground.

Characteristics

5.5.3.2 The stopway edge markers shall be sufficiently different from any runway edge markers used to ensure that the two types of markers cannot be confused.

Note.— Markers consisting of small vertical boards camouflaged on the reverse side, as viewed

from the runway, have proved operationally acceptable.

### 5.5.4 Taxiway edge markers

Application

5.5.4.1 Taxiway edge markers shall be provided on a taxiway where the code number is 1 or 2 and taxiway centre line or edge lights or taxiway centre line markers are not provided.

Location

5.5.4.2 Taxiway edge markers shall be installed at least at the same locations as would the taxiway edge lights had they been used.

Characteristics

5.5.4.2 A taxiway edge marker shall be retroreflective blue.

5.5.4.3 The marked surface as viewed by the pilot shall be a rectangle and shall have a minimum viewing area of 150 $cm^2$.

5.5.4.4 Taxiway edge markers shall be frangible. Their height shall be sufficiently low to preserve clearance for propellers and for the engine pods of jet aircraft.

### 5.5.5 Taxiway centre line markers

Application

5.5.5.1 Taxiway centre line markers shall be provided on a taxiway where the code number is 1 or 2 and taxiway centre line or edge lights or taxiway edge markers are not provided.

5.5.5.2 Taxiway centre line markers shall be provided on a taxiway where the code number is

3 or 4 and taxiway centre line lights are not provided if there is a need to improve the guidance provided by the taxiway centre line marking.

Location

5.5.5.3 Taxiway centre line markers shall be installed at least at the same location as would taxiway centre line lights had they been used.

Note.— See 5.3.17.12 for the spacing of taxiway centre line lights.

5.5.5.4 Taxiway centre line markers shall normally be located on the taxiway centre line marking except that they may be offset by not more than 30 cm where it is not practicable to locate them on the marking.

Characteristics

5.5.5.5 A taxiway centre line marker shall be retroreflective green.

5.5.5.6 The marked surface as viewed by the pilot shall be a rectangle and shall have a minimum viewing area of 20 $cm^2$.

5.5.5.7 Taxiway centre line markers shall be so designed and fitted as to withstand being run over by the wheels of an aircraft without damage either to the aircraft or to the markers themselves.

**5.5.6 Unpaved taxiway edge markers**

Application

5.5.6.1 Where the extent of an unpaved taxiway is not clearly indicated by its appearance compared with that of the surrounding ground, markers shall be provided.

Location

5.5.6.2 Where taxiway lights are provided, the markers shall be incorporated in the light fixtures. Where there are no lights, markers of conical shape shall be placed so as to delimit the taxiway clearly.

### 5.5.7 Boundary markers

Application

5.5.7.1 Boundary markers shall be provided at an aerodrome where the landing area has no runway.

Location

5.5.7.2 Boundary markers shall be spaced along the boundary of the landing area at intervals of not more than 200 m, if the type shown in Figure 5-32 is used, or approximately 90 m, if the conical type is used with a marker at any corner.

Characteristics

5.5.7.3 Once determined necessary by the Authority, boundary markers shall be of a form similar to that shown in Figure 5-32, or in the form of a cone not less than 50 cm high and not less than 75 cm in diameter at the base. The markers shall be coloured to contrast with the background against which they will be seen. A single colour, orange or red, or two contrasting colours, orange and white or alternatively red and white, shall be used, except where such colours merge with the background.

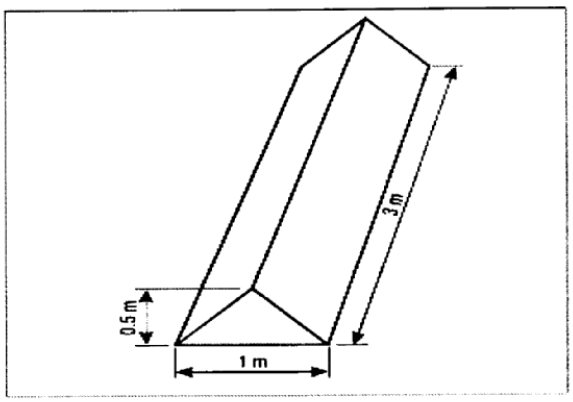



**Figure 5-32. Boundary markers**

# CHAPTER 6 – VISUAL AIDS FOR DENOTING OBSTACLES

## 6.1 OBJECTS TO BE MARKED AND/OR LIGHTED

Note - The marking and/or lighting of obstacles is intended to reduce hazards to aircraft by indicating the presence of the obstacles. It does not necessarily reduce operating limitations which may be imposed by an obstacle. An autonomous aircraft detection system may be installed on or near an obstacle (or group of obstacles such as wind farms), designed to operate the lighting only when the system detects an aircraft approaching the obstacle, in order to reduce light exposure to local residents. Guidance on the design and installation of an autonomous aircraft detection system is available in the Aerodrome Design Manual (Doc 9157), Part 4. The availability of such guidance is not intended to imply that such a system has to be provided.

### 6.1.1 Objects within the lateral boundaries of the obstacle limitation surfaces

6.1.1.1 Vehicles and other mobile objects, excluding aircraft, on the movement area of an aerodrome are obstacles and shall be marked and, if the vehicles and aerodrome are used at night or in conditions of low visibility, lighted, except that aircraft servicing equipment and vehicles used only on aprons may be exempt.

6.1.1.2 Elevated aeronautical ground lights within the movement area shall be marked so as to be conspicuous by day. Obstacle lights shall not be installed on elevated ground lights or signs in the movement area.

6.1.1.3 All obstacles within the distance specified in Table 3-2, column 11 or 12, from the centre line of a taxiway, an apron taxiway or aircraft stand taxilane shall be marked and, if the taxiway, apron taxiway or aircraft stand taxilane is used at night, lighted.

6.1.1.4 A fixed obstacle that extends above a take-off climb surface within 3 000 m of the inner edge of the take-off climb surface shall be marked and, if the runway is used at night, lighted, except that:

(a) such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle;

(b) the marking may be omitted when the obstacle is lighted by medium-intensity obstacle lights, Type A, by day and its height above the level of the surrounding ground does not exceed 150 m;

(c) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day; and

(d) the lighting may be omitted where the obstacle is a lighthouse and an aeronautical study indicates the lighthouse light to be sufficient.

6.1.1.5 A fixed object, other than an obstacle, adjacent to a take-off climb surface shall be marked and, if the runway is used at night, lighted, if such marking and lighting is considered necessary to ensure its avoidance, except that the marking may be omitted when:

(a) the object is lighted by medium-intensity obstacle lights, Type A, by day and its height above the level of the surrounding ground does not exceed 150 m; or

(b) the object is lighted by high-intensity obstacle lights by day.

6.1.1.6 A fixed obstacle that extends above an approach surface within 3 000 m of the inner edge or above a transitional surface shall be marked and, if the runway is used at night, lighted, except that:

(a) such marking and lighting may be omitted when the obstacle is shielded by another fixed obstacle;

(b) the marking may be omitted when the obstacle is lighted by medium-intensity obstacle lights, Type A, by day and its height above the level of the surrounding ground does not exceed 150 m;

(c) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day; and

(d) the lighting may be omitted where the obstacle is a lighthouse and an aeronautical study indicates the lighthouse light to be sufficient.

6.1.1.7 A fixed obstacle that extends above a horizontal surface shall be marked and, if the

aerodrome is used at night, lighted, except that:

(a) such marking and lighting may be omitted when:

1) the obstacle is shielded by another fixed obstacle; or

2) for a circuit extensively obstructed by immovable objects or terrain, procedures have been established to ensure safe vertical clearance below prescribed flight paths; or

3) an aeronautical study shows the obstacle not to be of operational significance;

(b) the marking may be omitted when the obstacle is lighted by medium-intensity obstacle lights, Type A, by day and its height above the level of the surrounding ground does not exceed 150 m;

(c) the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day; and

(d) the lighting may be omitted where the obstacle is a lighthouse and an aeronautical study indicates the lighthouse light to be sufficient.

6.1.1.8 A fixed object that extends above an obstacle protection surface shall be marked and, if the runway is used at night, lighted.

Note.— See 5.3.5 for information on the obstacle protection surface.

6.1.1.9 Other objects inside the obstacle limitation surfaces shall be marked and/or lighted if an aeronautical study indicates that the object could constitute a hazard to aircraft (this includes objects adjacent to visual routes e.g. waterway or highway).

Note.— See note accompanying 4.4.2.

6.1.1.10 Overhead wires, cables, etc., crossing a river, waterway, valley or highway shall be marked and their supporting towers marked and lighted if an aeronautical study indicates that the wires or cables could constitute a hazard to aircraft.

### 6.1.2 Objects outside the lateral boundaries of the obstacle limitation surfaces

6.1.2.1 Obstacles in accordance with 4.3.2 shall be marked and lighted, except that the marking may be omitted when the obstacle is lighted by high-intensity obstacle lights by day.

6.1.2.2 Other objects outside the obstacle limitation surfaces shall be marked and/or lighted if an aeronautical study indicates that the object could constitute a hazard to aircraft (this includes objects adjacent to visual routes e.g. waterway, highway).

6.1.2.3 Overhead wires, cables, etc., crossing a river, waterway, valley or highway shall be marked and their supporting towers marked and lighted if an aeronautical study indicates that the wires or cables could constitute a hazard to aircraft.

## 6.2 MARKING AND/OR LIGHTING OF OBJECTS

### 6.2.1 General

6.2.1.1 The presence of objects which must be lighted, as specified in 6.1, shall be indicated by low-, medium- or high- intensity obstacle lights, or a combination of such lights.

6.2.1.2 Low-intensity obstacle lights, Types A B, C, D and E, medium-intensity obstacle lights, Types A, B and C, high-intensity obstacle lights Type A and B, shall be in accordance with the specifications in Table 6-1 and Appendix 1.

6.2.1.3 The number and arrangement of low-, medium- or high-intensity obstacle lights at each level to be marked shall be such that the object is indicated from every angle in azimuth. Where a light is shielded in any direction by another part of the object, or by an adjacent object, additional lights shall be provided on that adjacent object or the part of the object that is shielding the light, in such a way as to retain the general definition of the object to be lighted. If the shielded light does not contribute to the definition of the object to be lighted, it may be omitted.

### 6.2.2 Mobile objects

**Marking**

6.2.2.1 All mobile objects to be marked shall be coloured or display flags.

**Marking by colour**

6.2.2.2 When mobile objects are marked by colour, a single conspicuous colour, preferably red or yellowish green for emergency vehicles and yellow for service vehicles, shall be used.

**Marking by flags**

6.2.2.3 Flags used to mark mobile objects shall be displayed around, on top of, or around the highest edge of the object. Flags shall not increase the hazard presented by the object they mark.

6.2.2.4 Flags used to mark mobile objects shall not be less than 0.9 m on each side and shall consist of a chequered pattern, each square having sides of not less than 0.3 m. The colours of the pattern shall contrast each with the other and with the background against which they will be seen. Orange and white or alternatively red and white shall be used, except where such colours merge with the background.

**Table 6-1. Characteristics of obstacle lights**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Light Type | Colour | Signal type/ (flash rate) | Peak intensity (cd) at given Background Luminance (b) | | | Light Distribution Table |
| | | | Day (Above 500 cd/m²) | Twilight (50-500 cd/m²) | Night (Below 50 cd/m²) | |
| Low-intensity, Type A (fixed obstacle) | Red | Fixed | N/A | N/A | 10 | Table 6-2 |
| Low-intensity, Type B (fixed obstacle) | Red | Fixed | N/A | N/A | 32 | Table 6-2 |
| Low-intensity, Type C (mobile obstacle) | Yellow/Blue (a) | Flashing (60-90 fpm) | N/A | 40 | 40 | Table 6-2 |
| Low-intensity, Type D (follow-me vehicle) | Yellow | Flashing (60–90 fpm) | N/A | 200 | 200 | Table 6-2 |
| Low-intensity, Type E | Red | Flashing (c) | N/A | N/A | 32 | Table 6-2 (Type B) |
| Medium-intensity, Type A | White | Flashing (20–60 fpm) | 20 000 | 20 000 | 2 000 | Table 6-3 |
| Medium-intensity, Type B | Red | Flashing (20–60 fpm) | N/A | N/A | 2 000 | Table 6-3 |
| Medium-intensity, Type C | Red | Fixed | N/A | N/A | 2 000 | Table 6-3 |
| High-intensity, Type A | White | Flashing (40–60 fpm) | 200 000 | 20 000 | 2 000 | Table 6-3 |
| High-intensity, Type B | White | Flashing (40–60 fpm) | 100 000 | 20 000 | 2 000 | Table 6-3 |

(a) See 6.2.2.6

(b) For flashing lights, effective intensity as determined in accordance with the Aerodrome Design Manual (Doc 9157), Part 4.

(c) For wind turbine application, to flash at the same rate as the lighting on the nacelle.

**Table 6-2. Light distribution for low-intensity obstacle lights**

| | Minimum intensity (a) | Maximum intensity (a) | Vertical beam spread (f) | |
|---|---|---|---|---|
| | | | Minimum beam spread | Intensity |
| Type A | 10 cd (b) | N/A | 10° | 5 cd |
| Type B | 32 cd (b) | N/A | 10° | 16 cd |
| Type C | 40 cd (b) | 400 cd | 12° (d) | 20 cd |
| Type D | 200 cd (c) | 400 cd | N/A (e) | N/A |

Note.— This table does not include recommended horizontal beam spreads. 6.2.1.3 requires 360° coverage around an obstacle. Therefore, the number of lights needed to meet this requirement will depend on the horizontal beam spreads of each light as well as the shape of the obstacle. Thus, with narrower beam spreads, more lights will be required.

(a) 360° horizontal. For flashing lights, the intensity is read into effective intensity, as determined in accordance with the Aerodrome Design Manual (Doc 9157), Part 4.

(b) Between 2 and 10° vertical. Elevation vertical angles are referenced to the horizontal when the light is levelled.

(c) Between 2 and 20° vertical. Elevation vertical angles are referenced to the horizontal when the light is levelled.

(d) Peak intensity should be located at approximately 2.5° vertical.

(e) Peak intensity should be located at approximately 17° vertical.

(f) Beam spread is defined as the angle between the horizontal plane and the directions for which the intensity exceeds that mentioned in the "intensity" column.

**Table 6-3. Light distribution for medium- and high-intensity obstacle lights according to benchmark intensities of Table 6-1**

| Benchmark intensity | Minimum requirements | | | | | Recommendations | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Vertical elevation angle (b) | | | Vertical beam spread (c) | | Vertical elevation angle (b) | | | Vertical beam spread (c) | |
| | 0° | | -1° | | | 0° | -1° | -10° | | |
| | Minimum average intensity (a) | Minimum intensity (a) | Minimum intensity (a) | Minimum beam spread | Intensity (a) | Maximum intensity (a) | Maximum intensity (a) | Maximum intensity (a) | Maximum beam spread | Intensity (a) |
| 200 000 | 200 000 | 150 000 | 75 000 | 3° | 75 000 | 250 000 | 112 500 | 7 500 | 7° | 75 000 |
| 100 000 | 100 000 | 75 000 | 37 500 | 3° | 37 500 | 125 000 | 56 250 | 3 750 | 7° | 37 500 |
| 20 000 | 20 000 | 15 000 | 7 500 | 3° | 7 500 | 25 000 | 11 250 | 750 | N/A | N/A |
| 2 000 | 2 000 | 1 500 | 750 | 3° | 750 | 2 500 | 1 125 | 75 | N/A | N/A |

Note.— This table does not include recommended horizontal beam spreads. 6.2.1.3 requires 360° coverage around an obstacle. Therefore, the number of lights needed to meet this requirement will depend on the horizontal beam spreads of each light as well as the shape of the obstacle. Thus, with narrower beam spreads, more lights will be required.

(a) 360° horizontal. All intensities are expressed in Candela. For flashing lights, the intensity is read into effective intensity, as determined in accordance with the Aerodrome Design Manual (Doc 9157), Part 4.

b) Elevation vertical angles are referenced to the horizontal when the light unit is levelled.

(c) Beam spread is defined as the angle between the horizontal plane and the directions for which the intensity exceeds that mentioned in the "intensity" column.

Note.— An extended beam spread may be necessary under specific configuration and justified by an aeronautical study.

**Lighting**

6.2.2.5 Low-intensity obstacle lights, Type C, shall be displayed on vehicles and other mobile objects excluding aircraft.

Note.— See Annex 2 for lights to be displayed by aircraft.

6.2.2.6 Low-intensity obstacle lights, Type C, displayed on vehicles associated with emergency or security shall be flashing-blue and those displayed on other vehicles shall be flashing-yellow.

6.2.2.7 Low-intensity obstacle lights, Type D, shall be displayed on follow-me vehicles.

6.2.2.8 Low-intensity obstacle lights on objects with limited mobility such as aerobridges shall be fixed-red, and as a minimum be in accordance with the specifications for low-intensity obstacle lights, Type A, in Table 6-1. The intensity of the lights shall be sufficient to ensure conspicuity considering the intensity of the adjacent lights and the general levels of illumination against which they would normally be viewed.

### 6.2.3 Fixed objects

Note.— The fixed objects of wind turbines are addressed separately in 6.2.4 and the fixed objects of overhead wires, cables, etc., and supporting towers are addressed separately in 6.2.5.

**Marking**

6.2.3.1 All fixed objects to be marked shall, whenever practicable, be coloured, but if this is not practicable, markers or flags shall be displayed on or above them, except that objects that are sufficiently conspicuous by their shape, size or colour need not be otherwise marked.

**Marking by colour**

6.2.3.2 An object shall be coloured to show a chequered pattern if it has essentially unbroken surfaces and its projection on any vertical plane equals or exceeds 4.5 m in both dimensions. The

pattern shall consist of rectangles of not less than 1.5 m and not more than 3 m on a side, the corners being of the darker colour. The colours of the pattern shall contrast each with the other and with the background against which they will be seen. Orange and white or alternatively red and white shall be used, except where such colours merge with the background. (See Figure 6-1.)

6.2.3.3 An object shall be coloured to show alternating contrasting bands if:

(a) it has essentially unbroken surfaces and has one dimension, horizontal or vertical, greater than 1.5 m, and the other dimension, horizontal or vertical, less than 4.5 m; or

(b) it is of skeletal type with either a vertical or a horizontal dimension greater than 1.5 m.

The bands shall be perpendicular to the longest dimension and have a width approximately 1/7 of the longest dimension or 30 m, whichever is less. The colours of the bands shall contrast with the background against which they will be seen. Orange and white should be used, except where such colours are not conspicuous when viewed against the background. The bands on the extremities of the object shall be of the darker colour. (See Figures 6-1 and 6-2.)

Note.— Table 6-4 shows a formula for determining band widths and for having an odd number of bands, thus permitting both the top and bottom bands to be of the darker colour.

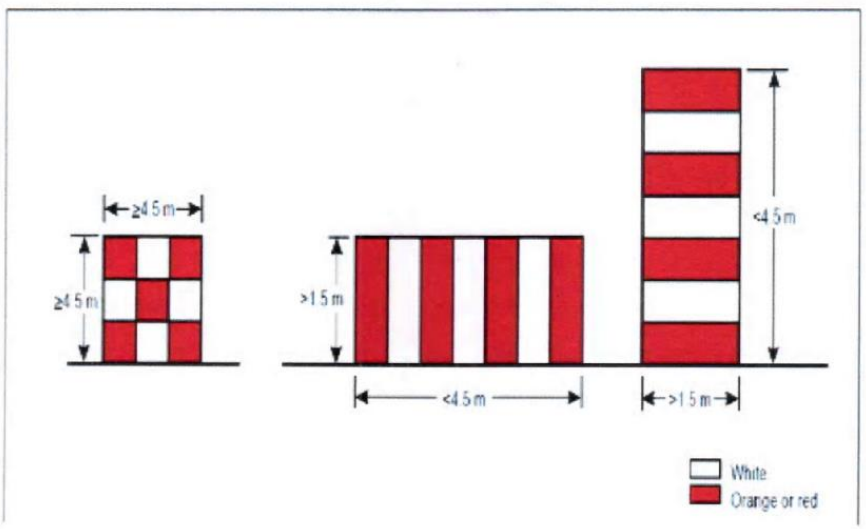



**Figure 6-1. Basic marking patterns**

**Table 6-4. Marking band widths**

| Longest dimension | | | | | |
|---|---|---|---|---|---|
| Greater than | Not exceeding | Band width | | | |
| 1.5 m | 210 m | 1/7 | of | longest | dimension |
| 210 m | 270 m | 1/9 | " | " | " |
| 270 m | 330 m | 1/11 | " | " | " |
| 330 m | 390 m | 1/13 | " | " | " |
| 390 m | 450 m | 1/15 | " | " | " |
| 450 m | 510 m | 1/17 | " | " | " |
| 510 m | 570 m | 1/19 | " | " | " |
| 570 m | 630 m | 1/21 | " | " | " |

6.2.3.4 An object shall be coloured in a single conspicuous colour if its projection on any vertical plane has both dimensions less than 1.5 m. Orange or red shall be used, except where such colours merge with the background.

Note.— Against some backgrounds it may be found necessary to use a different colour from orange or red to obtain sufficient contrast.

**Marking by flags**

6.2.3.5 Flags used to mark fixed objects shall be displayed around, on top of, or around the highest edge of, the object. When flags are used to mark extensive objects or groups of closely spaced objects, they shall be displayed at least every 15 m. Flags shall not increase the hazard presented by the object they mark.

6.2.3.6 Flags used to mark fixed objects shall not be less than 0.6 m on each side.

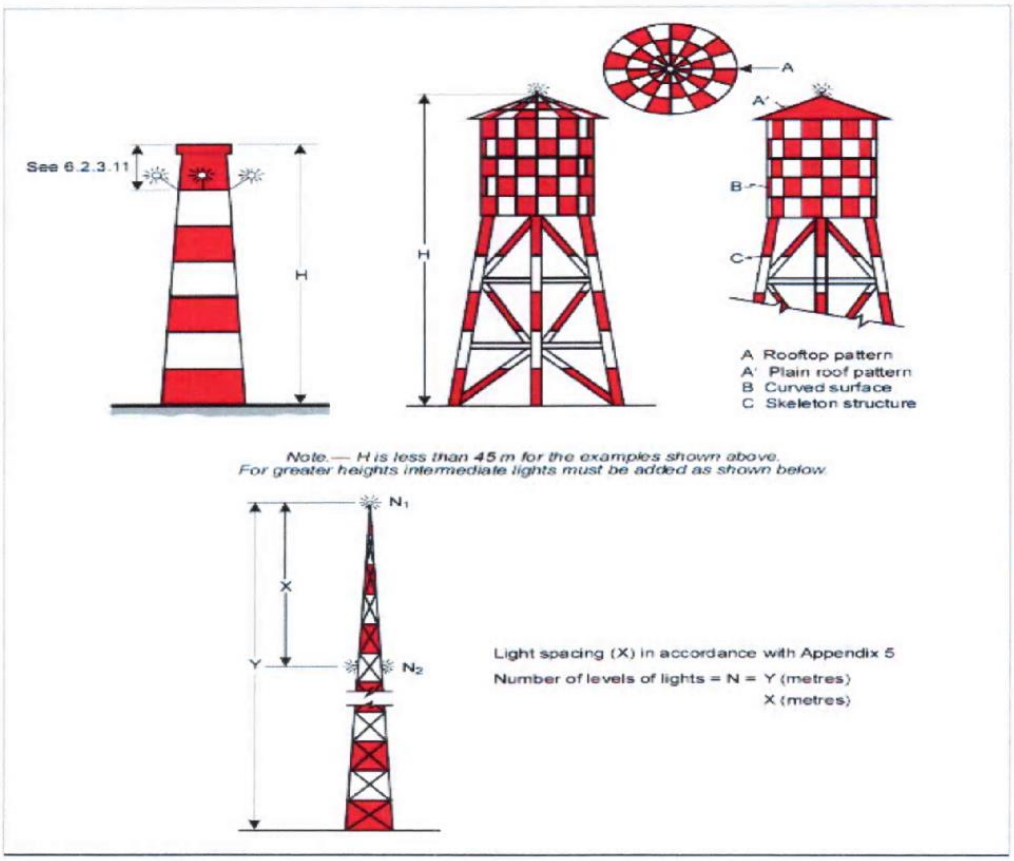



**Figure 6-2. Examples of marking and lighting of tall structures**

6.2.3.7 Flags used to mark fixed objects shall be orange in colour or a combination of two triangular sections, one orange and the other white, or one red and the other white, except that where such colours merge with the background, other conspicuous colours shall be used.

Marking by markers

6.2.3.8 Markers displayed on or adjacent to objects shall be located in conspicuous positions so as to retain the general definition of the object and shall be recognizable in clear weather from a distance of at least 1 000 m for an object to be viewed from the air and 300 m for an object to be viewed from the ground in all directions in which an aircraft is likely to approach the object. The shape of markers shall be distinctive to the extent necessary to ensure that they are not mistaken for markers employed to convey other information, and they shall be such that the hazard presented

by the object they mark is not increased.

6.2.3.9 A marker shall be of one colour. When installed, white and red, or white and orange markers shall be displayed alternately. The colour selected shall contrast with the background against which it will be seen.

**Lighting**

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

Note.— Recommendations on how a combination of low-, medium- and/or high-intensity lights on obstacles should be displayed are given in Appendix 5.

6.2.3.11 In the case of a chimney or other structure of like function, the top lights shall be placed sufficiently below the top so as to minimize contamination by smoke, etc. (See Figure 6-2).

6.2.3.12 In the case of a tower or antenna structure indicated by high-intensity obstacle lights by day with an appurtenance, such as a rod or an antenna, greater than 12 m where it is not practicable to locate a high-intensity obstacle light on the top of the appurtenance, such a light shall be located at the highest practicable point and, if practicable, a medium-intensity obstacle light, Type A, mounted on the top.

6.2.3.13 In the case of an extensive object or of a group of closely spaced objects to be lighted that are:

(a) penetrating a horizontal obstacle limitation surface (OLS) or located outside an OLS, the top lights shall be so arranged as to at least indicate the points or edges of the object highest in relation to the obstacle limitation surface or above the ground, and so as to indicate the general definition and the extent of the objects; and

(b) penetrating a sloping OLS, the top lights shall be so arranged as to at least indicate the points or edges of the object highest in relation to the OLS, and so as to indicate the

general definition and the extent of the objects. If two or more edges are of the same height, the edge nearest the landing area shall be marked.

6.2.3.14 When the obstacle limitation surface concerned is sloping and the highest point above the OLS is not the highest point of the object, additional obstacle lights shall be placed on the highest point of the object.

6.2.3.15 Where lights are applied to display the general definition of an extensive object or a group of closely spaced objects, and

(a) low-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 45 m; and

(b) medium-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 900 m.

6.2.3.16 High-intensity obstacle lights, Type A, and medium-intensity obstacle lights, Types A and B, located on an object shall flash simultaneously.

6.2.3.17 The installation setting angles for high-intensity obstacle lights, Type A, shall be in accordance with Table 6-5.

Note.— High-intensity obstacle lights are intended for day use as well as night use. Care is needed to ensure that these lights do not create disconcerting dazzle. Guidance on the design, location and operation of high-intensity obstacle lights is given in the Aerodrome Design Manual (Doc 9157), Part 4.

6.2.3.18 Where, in the opinion of the Operator of a Certified Aerodrome, the use of high-intensity obstacle lights, Type A, or medium-intensity obstacle lights, Type A, at night may dazzle pilots in the vicinity of an aerodrome (within approximately 10 000 m radius) or cause significant environmental concerns, a dual obstacle lighting system shall be provided. This system shall be composed of high-intensity obstacle lights, Type A, or medium-intensity obstacle lights, Type A, as appropriate, for daytime and twilight use and medium-intensity obstacle lights, Type B or C,

for night-time use.

**Lighting of objects with a height less than 45 m above ground level**

6.2.3.19 Low-intensity obstacle lights, Type A or B, shall be used where the object is a less extensive one and its height above the surrounding ground is less than 45 m.

6.2.3.20 Where the use of low-intensity obstacle lights, Type A or B, would be inadequate or an early special warning is required, then medium- or high-intensity obstacle lights shall be used.

6.2.3.21 Low-intensity obstacle lights, Type B, shall be used either alone or in combination with medium-intensity obstacle lights, Type B, in accordance with 6.2.3.22.

6.2.3.22 Medium-intensity obstacle lights, Type A, B or C, shall be used where the object is an extensive one. Medium-intensity obstacle lights, Types A and C, shall be used alone, whereas medium-intensity obstacle lights, Type B, shall be used either alone or in combination with low-intensity obstacle lights, Type B.

Note.— A group of buildings is regarded as an extensive object.

**Lighting of objects with a height 45 m to a height less than 150 m above ground level**

6.2.3.23 Medium-intensity obstacle lights, Type A, B or C, shall be used. Medium-intensity obstacle lights, Types A and C, shall be used alone, whereas medium-intensity obstacle lights, Type B, shall be used either alone or in combination with low-intensity obstacle lights, Type B.

6.2.3.24 Where an object is indicated by medium-intensity obstacle lights, Type A, and the top of the object is more than 105 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 105 m.

6.2.3.25 Where an object is indicated by medium-intensity obstacle lights, Type B, and the top of the object is more than 45 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights shall be provided at intermediate levels. These additional intermediate lights shall be alternately low-intensity obstacle lights, Type B, and medium-intensity obstacle lights, Type B, and shall be spaced as equally as practicable between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.

6.2.3.26 Where an object is indicated by medium-intensity obstacle lights, Type C, and the top of the object is more than 45 m above the level of the surrounding ground or the elevation of tops of nearby buildings (when the object to be marked is surrounded by buildings), additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.

6.2.3.27 Where high-intensity obstacle lights, Type A, are used, they shall be spaced at uniform intervals not exceeding 105 m between the ground level and the top light(s) specified in 6.2.3.10, except that where an object to be marked is surrounded by buildings, the elevation of the tops of the buildings may be used as the equivalent of the ground level when determining the number of light levels.

**Lighting of objects with a height 150 m or more above ground level**

6.2.3.28 High-intensity obstacle lights, Type A, shall be used to indicate the presence of an object if its height above the level of the surrounding ground exceeds 150 m and an aeronautical study indicates such lights to be essential for the recognition of the object by day.

6.2.3.29 Where high-intensity obstacle lights, Type A, are used, they shall be spaced at uniform intervals not exceeding 105 m between the ground level and the top light(s) specified in 6.2.3.10, except that where an object to be marked is surrounded by buildings, the elevation of the tops of

the buildings may be used as the equivalent of the ground level when determining the number of light levels.

6.2.3.30 Where, in the opinion of the Operator of a Certified Aerodrome, the use of high-intensity obstacle lights, Type A, at night may dazzle pilots in the vicinity of an aerodrome (within approximately 10 000 m radius) or cause significant environmental concerns, medium-intensity obstacle lights, Type C, shall be used alone, whereas medium- intensity obstacle lights, Type B, shall be used either alone or in combination with low-intensity obstacle lights, Type B.

6.2.3.31 Where an object is indicated by medium-intensity obstacle lights, Type A, additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 105 m.

6.2.3.32 Where an object is indicated by medium-intensity obstacle lights, Type B, additional lights shall be provided at intermediate levels. These additional intermediate lights shall be alternately low-intensity obstacle lights, Type B, and medium-intensity obstacle lights, Type B, and shall be spaced as equally as practicable between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.

6.2.3.33 Where an object is indicated by medium-intensity obstacle lights, Type C, additional lights shall be provided at intermediate levels. These additional intermediate lights shall be spaced as equally as practicable, between the top lights and ground level or the level of tops of nearby buildings, as appropriate, with the spacing not exceeding 52 m.

### 6.2.4 Wind turbines

6.2.4.1 A wind turbine shall be marked and/or lighted if it is determined to be an obstacle.

Note 1.— Additional lighting or markings may be provided where in the opinion of the Authority such lighting or markings are deemed necessary.

Note 2.— See 4.3.1 and 4.3.2

**Markings**

6.2.4.2 The rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines shall be painted white, unless otherwise indicated by an aeronautical study.

**Lighting**

6.2.4.3 When lighting is deemed necessary, in the case of a wind farm, i.e. a group of two or more wind turbines, the wind farm shall be regarded as an extensive object and the lights should be installed:

(a) to identify the perimeter of the wind farm;

(b) respecting the maximum spacing, in accordance with 6.2.3.15, between the lights along the perimeter, unless a dedicated assessment shows that a greater spacing can be used;

(c) so that, where flashing lights are used, they flash simultaneously throughout the wind farm;

(d) so that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located; and

(e) at locations prescribed in a), b) and d), respecting the following criteria:

i) for wind turbines of less than 150 m in overall height (hub height plus vertical blade height), medium-intensity lighting on the nacelle shall be provided;

ii) for wind turbines from 150 m to 315 m in overall height, in addition to the medium-intensity light installed on the nacelle, a second light serving as an alternate shall be provided in case of failure of the operating light. The lights shall be installed to assure that the output of either light is not blocked by the other; and

iii) in addition, for wind turbines from 150 m to 315 m in overall height, an intermediate level at half the nacelle height of at least three low-intensity Type E lights, as specified in 6.2.1.3, shall be provided. If an aeronautical study shows that low-intensity Type E lights are not suitable, low-intensity Type A or B lights may be

used.

Note.— The above 6.2.4.3 e) does not address wind turbines of more than 315 m of overall height. For such wind turbines, additional marking and lighting may be required as determined by an aeronautical study.

6.2.4.4 The obstacle lights shall be installed on the nacelle in such a manner as to provide an unobstructed view for aircraft approaching from any direction.

6.2.4.5 Where lighting is deemed necessary for a single wind turbine or short line of wind turbines, the installation shall be in accordance with 6.2.4.3 e) or as determined by an aeronautical study.

### 6.2.5 Overhead wires, cables, etc., and supporting towers

**Marking**

6.2.5.1 The wires, cables, etc., to be marked shall be equipped with markers; the supporting tower shall be coloured.

**Marking by colours**

6.2.5.2 The supporting towers of overhead wires, cables, etc., that require marking shall be marked in accordance with 6.2.3.1 to 6.2.3.4, except that the marking of the supporting towers may be omitted when they are lighted by high-intensity obstacle lights by day.

**Marking by markers**

6.2.5.3 Markers displayed on or adjacent to objects shall be located in conspicuous positions so as to retain the general definition of the object and shall be recognizable in clear weather from a distance of at least 1 000 m for an object to be viewed from the air and 300 m for an object to be viewed from the ground in all directions in which an aircraft is likely to approach the object. The

shape of markers shall be distinctive to the extent necessary to ensure that they are not mistaken for markers employed to convey other information, and they shall be such that the hazard presented by the object they mark is not increased.

6.2.5.4 A marker displayed on an overhead wire, cable, etc., shall be spherical and have a diameter of not less than 60 cm.

6.2.5.5 The spacing between two consecutive markers or between a marker and a supporting tower shall be appropriate to the diameter of the marker, but in no case shall the spacing exceed:

(a) 30 m where the marker diameter is 60 cm progressively increasing with the diameter of the marker to

(b) 35 m where the marker diameter is 80 cm and further progressively increasing to a maximum of

(c) 40 m where the marker diameter is of at least 130 cm.

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

6.2.5.6 A marker shall be of one colour. When installed, white and red, or white and orange markers shall be displayed alternately. The colour selected shall contrast with the background against which it will be seen.

6.2.5.7 When it has been determined that an overhead wire, cable, etc., needs to be marked but it is not practicable to install markers on the wire, cable, etc., then high-intensity obstacle lights, Type B, shall be provided on their supporting towers.

**Lighting**

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

(a) an aeronautical study indicates such lights to be essential for the recognition of the

presence of wires, cables, etc.; or

(b) it has not been found practicable to install markers on the wires, cables, etc.

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

— at the top of the tower;

—at the lowest level of the catenary of the wires or cables; and

—at approximately midway between these two levels.

Note.— In some cases, this may require locating the lights off the tower.

6.2.5.10 High-intensity obstacle lights, Type B, indicating the presence of a tower supporting overhead wires, cables, etc., shall flash sequentially; first the middle light, second the top light and last, the bottom light. The intervals between flashes of the lights shall approximate the following ratios:

| Flash interval between | Ratio of cycle time |
|---|---|
| middle and top light | 1/13 |
| top and bottom light | 2/13 |
| bottom and middle light | 10/13 |

Note.— High-intensity obstacle lights are intended for day use as well as night use. Care is needed to ensure that these lights do not create disconcerting dazzle. Guidance on the design, operation and the location of high-intensity obstacle lights is given in the Aerodrome Design Manual (Doc 9157), Part 4.

6.2.5.11 Where, in the opinion of the Operator of a Certified Aerodrome, the use of high-intensity obstacle lights, Type B, at night may dazzle pilots in the vicinity of an aerodrome (within approximately 10 000 m radius) or cause significant environmental concerns, a dual obstacle lighting system should be provided. This system should be composed of high-intensity obstacle lights, Type B, for daytime and twilight use and medium-intensity obstacle lights, Type B, for

night- time use. Where medium-intensity lights are used they should be installed at the same level as the high-intensity obstacle light Type B.

6.2.5.12 The installation setting angles for high-intensity obstacle lights, Type B, shall be in accordance with Table 6-5.

**Table 6-5.Installation setting angles for high-intensity obstacle lights**

| Height of light unit above terrain (AGL) (m) | | Angle of the peak of the beam above the horizontal |
|---|---|---|
| Greater than | Not exceeding | |
| 151 | | 0° |
| 122 | 151 | 1° |
| 92 | 122 | 2° |
| | 92 | 3° |

# CHAPTER 7 – VISUAL AIDS FOR DENOTING RESTRICTED USE AREAS

## 7.1 CLOSED RUNWAYS AND TAXIWAYS, OR PARTS THEREOF

### Application

7.1.1 A closed marking shall be displayed on a runway or taxiway or portion thereof which is permanently closed to the use of all aircraft.

7.1.2 A closed marking shall be displayed on a temporarily closed runway or taxiway or portion thereof, except that such marking may be omitted when the closing is of short duration and adequate warning by air traffic services is provided.

### Location

7.1.3 On a runway a closed marking shall be placed at each end of the runway, or portion thereof, declared closed, and additional markings shall be so placed that the maximum interval between markings does not exceed 300 m. On a taxiway a closed marking shall be placed at least at each end of the taxiway or portion thereof closed.

### Characteristics

7.1.4 The closed marking shall be of the form and proportions as detailed in Figure 7-1, Illustration a), when displayed on a runway, and shall be of the form and proportions as detailed in Figure 7-1, Illustration b), when displayed on a taxiway. The marking shall be white when displayed on a runway and shall be yellow when displayed on a taxiway.

Note 1.— When an area is temporarily closed, frangible barriers or markings utilizing materials other than paint or other suitable means may be used to identify the closed area.

Note 2.— Procedures pertaining to the planning, coordination, monitoring and safety management of works in progress on the movement area are specified in the PANS-Aerodromes (Doc 9981).

7.1.5 When a runway or taxiway or portion thereof is permanently closed, all normal runway and taxiway markings shall be obliterated.

7.1.6 Lighting on a closed runway or taxiway or portion thereof shall not be operated, except as required for maintenance purposes.

7.1.7 In addition to closed markings, when the runway or taxiway or portion thereof closed is intercepted by a usable runway or taxiway which is used at night, unserviceability lights shall be placed across the entrance to the closed area at intervals not exceeding 3 m (see 7.4.4).

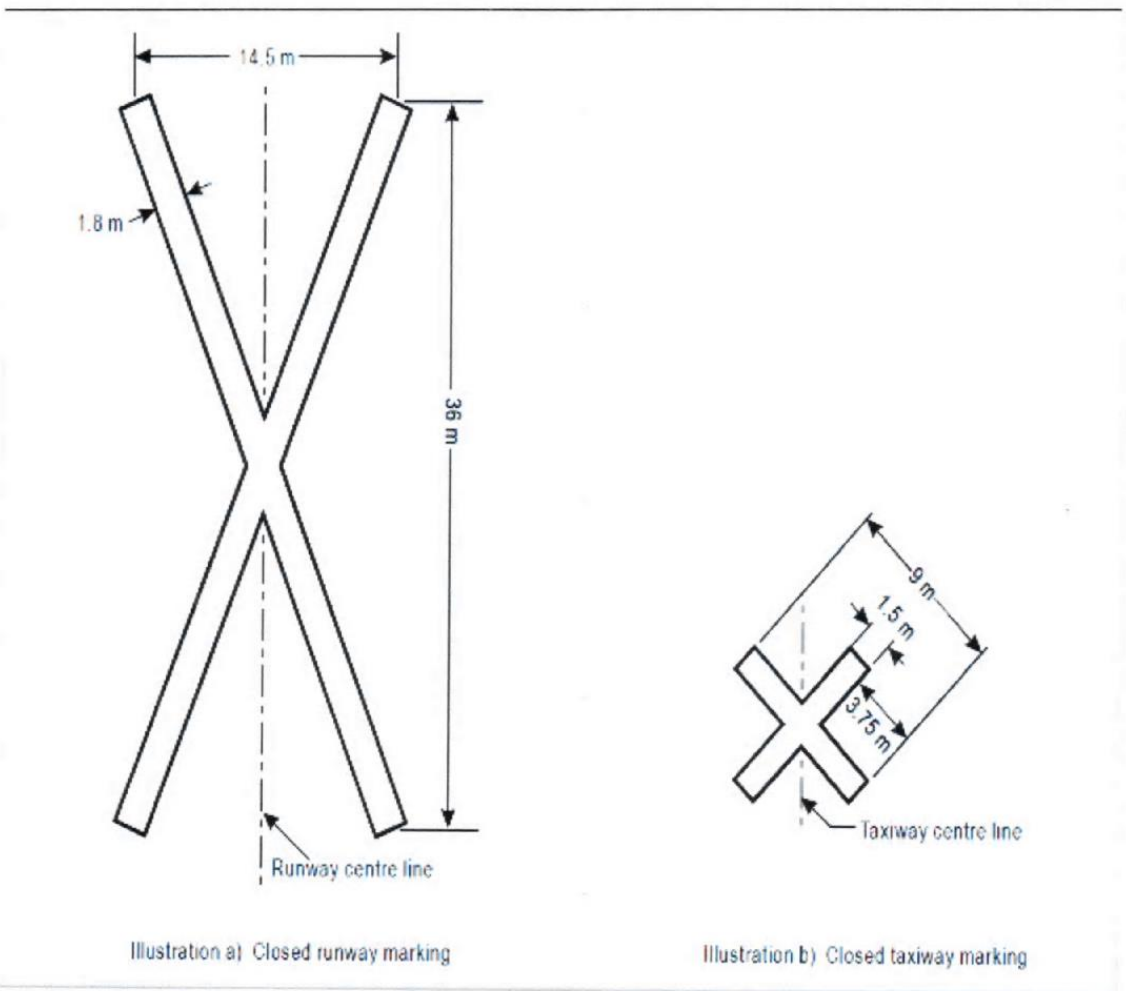



**Figure 7-1. Closed runway and taxiway markings**

## 7.2 NON-LOAD-BEARING SURFACES

### Application

7.2.1 Shoulders for taxiways, runway turn pads, holding bays and aprons and other non-load-bearing surfaces which cannot readily be distinguished from load-bearing surfaces and which, if used by aircraft, might result in damage to the aircraft shall have the boundary between such areas and the load-bearing surface marked by a taxi side stripe marking.

Note.— The marking of runway sides is specified in 5.2.7.

### Location

7.2.2 A taxi side stripe marking shall be placed along the edge of the load-bearing pavement, with the outer edge of the marking approximately on the edge of the load-bearing pavement.

### Characteristics

7.2.3 A taxi side stripe marking shall consist of a pair of solid lines, each 15 cm wide and spaced 15 cm apart and the same colour as the taxiway centre line marking.

Note.— Guidance on providing additional transverse stripes at an intersection or a small area on the apron is given in the Aerodrome Design Manual (Doc 9157), Part 4.

## 7.3 Pre-threshold Area

### Application

7.3.1 When the surface before a threshold is paved and exceeds 60 m in length and is not suitable for normal use by aircraft, the entire length before the threshold shall be marked with a chevron marking.

**Location**

7.3.2 A chevron marking shall point in the direction of the runway and be placed as shown in Figure 7-2.

**Characteristics**

7.3.3 A chevron marking shall be of conspicuous colour and contrast with the colour used for the runway markings; it shall be yellow. It shall have an overall width of at least 0.9 m.

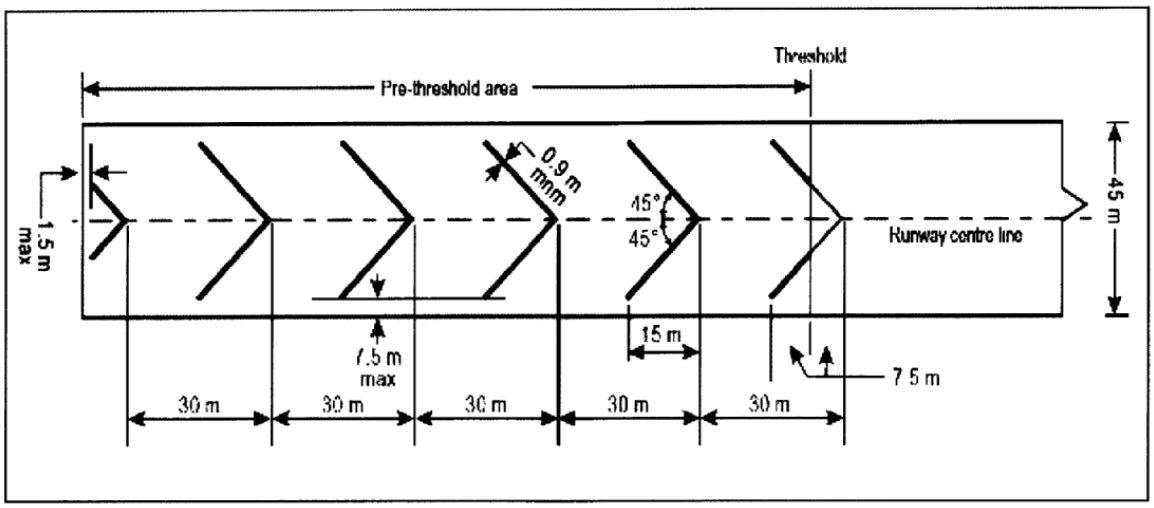



**Figure 7-2. Pre-threshold marking**

**7.4 Unserviceable Areas**

**Application**

7.4.1 Unserviceability markers shall be displayed wherever any portion of a taxiway, apron or holding bay is unfit for the movement of aircraft but it is still possible for aircraft to bypass the area safely. On a movement area used at night, unserviceability lights shall be used.

Note 1.— Unserviceability markers and lights are used for such purposes as warning pilots of a hole in a taxiway or apron pavement or outlining a portion of pavement, such as on an apron, that is under repair. They are not suitable for use when a portion of a runway becomes unserviceable,

nor on a taxiway when a major portion of the width becomes unserviceable. In such instances, the runway or taxiway is normally closed.

Note 2.— Procedures pertaining to the planning, coordination, monitoring and safety management of works in progress on the movement area are specified in the PANS-Aerodromes (Doc 9981).

**Location**

7.4.2 Unserviceability markers and lights shall be placed at intervals sufficiently close so as to delineate the unserviceable area.

Note.— Guidance on the location of unserviceability lights is given in Attachment A, Section 13.

**Characteristics of unserviceability markers**

7.4.3 Unserviceability markers shall consist of conspicuous upstanding devices such as flags, cones or marker boards.

**Characteristics of unserviceability lights**

7.4.4 An unserviceability light shall consist of a red fixed light. The light shall have an intensity sufficient to ensure conspicuity considering the intensity of the adjacent lights and the general level of illumination against which it would normally be viewed. In no case shall the intensity be less than 10 cd of red light.

**Characteristics of unserviceability cones**

7.4.5 An unserviceability cone shall be at least 0.5 m in height and red, orange or yellow or any one of these colours in combination with white.

**Characteristics of unserviceability flags**

7.4.6 An unserviceability flag should be at least 0.5 m square and red, orange or yellow or any one of these colours in combination with white.

**Characteristics of unserviceability marker boards**

7.4.7 An unserviceability marker board shall be at least 0.5 m in height and 0.9 m in length, with alternate red and white or orange and white vertical stripes.

# CHAPTER 8 – ELECTRICAL SYSTEMS

## 8.1 ELECTRICAL POWER SUPPLY SYSTEMS FOR AIR NAVIGATION FACILITIES

Note - The safety of operations at aerodromes depends on the quality of the supplied power. The total electrical power supply system may include connections to one or more external sources of electric power supply, one or more local generating facilities and to a distribution network including transformers and switchgear. Many other aerodrome facilities supplied from the same system need to be taken into account while planning the electrical power system at aerodromes.

8.1.1 Adequate primary power supply shall be available at aerodromes for the safe functioning of air navigation facilities.

8.1.2 The design and provision of electrical power systems for aerodrome visual and radio navigation aids shall be such that an equipment failure will not leave the pilot with inadequate visual and non-visual guidance or misleading information.

Note.— The design and installation of the electrical systems need to take into consideration factors that can lead to malfunction, such as electromagnetic disturbances, line losses, power quality, etc. Additional guidance is given in the Aerodrome Design Manual (Doc 9157), Part 5.

8.1.3 Electric power supply connections to those facilities for which secondary power is required shall be so arranged that the facilities are automatically connected to the secondary power supply on failure of the primary source of power.

8.1.4 The time interval between failure of the primary source of power and the complete restoration of the services required by 8.1.10 shall be as short as practicable, except that for visual aids associated with non-precision, precision approach or take-off runways the requirements of Table 8-1 for maximum switch-over times should apply.

Note.— A definition of switch-over time is given in Chapter 1.

8.1.5 The provision of a definition of switch-over time shall not require the replacement of an existing secondary power supply before 1 January 2010. However, for a secondary power supply installed after 4 November 1999, the electric power supply connections to those facilities for which secondary power is required shall be so arranged that the facilities are capable of meeting the requirements of Table 8-1 for maximum switch-over times as defined in Chapter 1.

**Visual aids**

**Application**

8.1.6 For a precision approach runway, a secondary power supply capable of meeting the requirements of Table 8-1 for the appropriate category of precision approach runway shall be provided. Electric power supply connections to those facilities for which secondary power is required shall be so arranged that the facilities are automatically connected to the secondary power supply on failure of the primary source of power.

8.1.7 For a runway meant for take-off in runway visual range conditions less than a value of 800 m, a secondary power supply capable of meeting the relevant requirements of Table 8-1 shall be provided.

8.1.8 At an aerodrome where the primary runway is a non-precision approach runway, a secondary power supply capable of meeting the requirements of Table 8-1 shall be provided except that a secondary power supply for visual aids need not be provided for more than one non-precision approach runway.

8.1.9 At an aerodrome where the primary runway is a non-instrument runway, a secondary power supply capable of meeting the requirements of 8.1.4 shall be provided, except that a secondary power supply for visual aids need not be provided when an emergency lighting system in accordance with the specification of 5.3.2 is provided and capable of being deployed in 15 minutes.

8.1.10 The following aerodrome facilities shall be provided with a secondary power supply capable of supplying power when there is a failure of the primary power supply:

(a) the signalling lamp and the minimum lighting necessary to enable air traffic services personnel to carry out their duties;

Note.— The requirement for minimum lighting may be met by other than electrical means.

(b) all obstacle lights which are essential to ensure the safe operation of aircraft;

(c) approach, runway and taxiway lighting as specified in 8.1.6 to 8.1.9;

(d) meteorological equipment;

(e) essential security lighting, if provided in accordance with 9.11;

(f) essential equipment and facilities for the aerodrome responding emergency agencies;

(g) floodlighting on a designated isolated aircraft parking position if provided in accordance with 5.3.24.1; and

(h) illumination of apron areas over which passengers may walk.

Note.— Specifications for secondary power supply for radio navigation aids and ground elements of communications systems are given in Annex 10, Volume I, Chapter 2.

8.1.11 Requirements for a secondary power supply shall be met by either of the following:

— independent public power, which is a source of power supplying the aerodrome service from a substation other than the normal substation through a transmission line following a route different from the normal power supply route and such that the possibility of a simultaneous failure of the normal and independent public power supplies is extremely remote; or

— standby power unit(s), which are engine generators, batteries, etc., from which electric power can be obtained.

Note.— Guidance on electrical systems is included in the Aerodrome Design Manual (Doc 9157), Part 5.

**Table 8-1. Secondary power supply requirements**

(see 8.1.4)

| Runway | Lighting aids requiring power | Maximum switch-over time. |
|---|---|---|
| Non-instrument | Visual approach slope indicators[a] | See 8.1.4 and 8.1.9 |
| | Runway edge[b] | |
| | Runway threshold[b] | |
| | Runway end[b] | |
| | Obstacle[a] | |
| Non-precision approach | Approach lighting system | 15 seconds |
| | Visual approach slope indicators[a,d] | |
| | Runway edge[d] | |
| | Runway threshold[d] | |
| | Runway end | |
| | Obstacle[a] | |
| Precision approach Cat I | Approach lighting system | 15 seconds |
| | Runway edge[d] | |
| | Visual approach slope indicators[a,d] | |
| | Runway threshold | |
| | Runway end | |
| | Essential taxiway[a] | |
| | Obstacles[a] | |
| Precision approach Cat II/III | Inner 300 m of the approach lighting system | 1 second |
| | Other parts of the approach lighting system | 15 seconds |
| | Obstacle[a] | 15 seconds |
| | Runway edge | 15 seconds |
| | Runway threshold | 1 second |
| | Runway end | 1 second |
| | Runway centre line | 1 second |
| | Runway touchdown zone | 1 second |
| | All stop bars | 1 second |

| | | |
|---|---|---|
| Runway meant for take-off in runway visual range conditions less than a value of 800 m | Essential taxiways | 15 seconds |
| | Runway edge | 15 seconds |
| | Runway end | 1 second |
| | Runway centre line | 1 second |
| | All stop bars | 1second |
| | Essential taxiway[a] | 15 seconds |
| | Obstacle | 15 seconds |

a. Supplied with secondary power when their operation is essential to the safety of flight operation.
b. See Chapter 5, 5.3.2, regarding the use of emergency lighting.
c. One second where no runway centre line lights are provided.
d. One second where approaches are over hazardous or precipitous terrain.

## 8.2 SYSTEM DESIGN

8.2.1 For a runway meant for use in runway visual range conditions less than a value of 550 m, the electrical systems for the power supply, lighting and control of the lighting systems included in Table 8-1 shall be so designed that an equipment failure will not leave the pilot with inadequate visual guidance or misleading information.

Note.— Guidance on means of providing this protection is given in the Aerodrome Design Manual (Doc 9157), Part 5.

8.2.2 Where the secondary power supply of an aerodrome is provided by the use of duplicate feeders, such supplies shall be physically and electrically separate so as to ensure the required level of availability and independence.

8.2.3 Where a runway forming part of a standard taxi-route is provided with runway lighting and taxiway lighting, the lighting systems shall be interlocked to preclude the possibility of simultaneous operation of both forms of lighting.

## 8.3 MONITORING

Note.— Guidance on this subject is given in the Aerodrome Design Manual (Doc 9157), Part 5.

8.3.1 A system of monitoring shall be employed to indicate the operational status of the lighting systems.

8.3.2 Where lighting systems are used for aircraft control purposes, such systems shall be monitored automatically so as to provide an indication of any fault which may affect the control functions. This information shall be automatically relayed to the air traffic services unit.

8.3.3 Where a change in the operational status of lights has occurred, an indication shall be provided within two seconds for a stop bar at a runway-holding position and within five seconds for all other types of visual aids.

8.3.4 For a runway meant for use in runway visual range conditions less than a value of 550 m, the lighting systems detailed in Table 8-1 shall be monitored automatically so as to provide an indication when the serviceability level of any element falls below the minimum serviceability level specified in 10.5.7 to 10.5.11, as appropriate. This information should be automatically relayed to the maintenance crew.

8.3.5 For a runway meant for use in runway visual range conditions less than a value of 550 m, the lighting systems detailed in Table 8-1 shall be monitored automatically to provide an indication when the serviceability level of any element falls below the minimum level specified by the Authority below which operations should not continue. This information should be automatically relayed to the air traffic services unit and displayed in a prominent position.

Note.— Guidance on air traffic control interface and visual aids monitoring is included in the Aerodrome Design Manual (Doc 9157), Part 5.

# CHAPTER 9 – AERODROME OPERATIONAL SERVICES, EQUIPMENT AND INSTALLATIONS

## 9.1 AERODROME EMERGENCY PLANNING

### General

Note - Aerodrome emergency planning is the process of preparing an aerodrome to cope with an emergency occurring at the aerodrome or in its vicinity. The objective of aerodrome emergency planning is to minimize the effects of an emergency, particularly in respect of saving lives and maintaining aircraft operations. The aerodrome emergency plan sets forth the procedures for coordinating the response of different aerodrome agencies (or services) and of those agencies in the surrounding community that could be of assistance in responding to the emergency. Guidance material to assist the Operator of a Certified Aerodrome in establishing aerodrome emergency planning is given in the Airport Services Manual (Doc 9137), Part 7.

9.1.1 An aerodrome emergency plan shall be established at an aerodrome, commensurate with the aircraft operations and other activities conducted at the aerodrome.

9.1.2 The aerodrome emergency plan shall provide for the coordination of the actions to be taken in an emergency occurring at an aerodrome or in its vicinity.

Note 1.— Examples of emergencies are: aircraft emergencies, sabotage including bomb threats, unlawfully seized aircraft, dangerous goods occurrences, building fires, natural disaster and public health emergencies.

Note 2.— Examples of public health emergencies are increased risk of travellers or cargo spreading a serious communicable disease internationally through air transport and severe outbreak of a communicable disease potentially affecting a large proportion of aerodrome staff.

9.1.3 The plan shall coordinate the response or participation of all existing agencies which,

in the opinion of the Operator of a Certified Aerodrome, could be of assistance in responding to an emergency.

Note 1.— Examples of agencies are:

— on the aerodrome: air traffic control units, rescue and firefighting services, aerodrome administration, medical and ambulance services, aircraft operators, security services, and police;

— off the aerodrome: fire departments, police, health authorities (including medical, ambulance, hospital and public health services), military, and harbour patrol or coast guard.

Note 2.— Public health services include planning to minimize adverse effects to the community from health-related events and deal with population health issues rather than provision of health services to individuals.

9.1.4 The plan shall provide for cooperation and coordination with the rescue coordination centre, as necessary.

9.1.5 The aerodrome emergency plan document should include at least the following:

(a) types of emergencies planned for;

(b) agencies involved in the plan;

(c) responsibility and role of each agency, the emergency operations centre and the command post, for each type of emergency;

(d) information on names and telephone numbers of offices or people to be contacted in the case of a particular emergency; and

(e) a grid map of the aerodrome and its immediate vicinity.

9.1.6 The plan shall observe human factors principles to ensure optimum response by all existing agencies participating in emergency operations.

Note 1.— Guidance material on human factors principles can be found in the Human Factors

Training Manual (Doc 9683).

Note 2.— General principles and procedures on the training of aerodrome personnel, including training programmes and competence checks, are specified in the PANS-Aerodromes (Doc 9981).

**Emergency operations centre and command post**

9.1.7 A fixed emergency operations centre and a mobile command post shall be available for use during an emergency.

9.1.8 The emergency operations centre shall be a part of the aerodrome facilities and shall be responsible for the overall coordination and general direction of the response to an emergency.

9.1.9 The command post shall be a facility capable of being moved rapidly to the site of an emergency, when required, and shall undertake the local coordination of those agencies responding to the emergency.

9.1.10 A person shall be assigned to assume control of the emergency operations centre and, when appropriate, another person the command post.

**Communication system**

9.1.11 Adequate communication systems linking the command post and the emergency operations centre with each other and with the participating agencies shall be provided in accordance with the plan and consistent with the particular requirements of the aerodrome.

**Aerodrome emergency exercise**

9.1.12 The plan shall contain procedures for periodic testing of the adequacy of the plan and for reviewing the results in order to improve its effectiveness.

Note.— The plan includes all participating agencies and associated equipment.

9.1.13 The plan shall be tested by conducting:

(a) a full-scale aerodrome emergency exercise at intervals not exceeding two years and partial emergency exercises in the intervening year to ensure that any deficiencies found during the full-scale aerodrome emergency exercise have been corrected; or

(b) a series of modular tests commencing in the first year and concluding in a full-scale aerodrome emergency exercise at intervals not exceeding three years;

and reviewed thereafter, or after an actual emergency, so as to correct any deficiency found during such exercises or actual emergency.

Note 1.— The purpose of a full-scale exercise is to ensure the adequacy of the plan to cope with different types of emergencies. The purpose of a partial exercise is to ensure the adequacy of the response to individual participating agencies and components of the plan, such as the communications system. The purpose of modular tests is to enable concentrated effort on specific components of established emergency plans.

Note 2.— Guidance material on airport emergency planning is available in the Airport Services Manual (Doc 9137), Part 7.

**Emergencies in difficult environments**

9.1.14 The plan shall include the ready availability of, and coordination with, appropriate specialist rescue services to be able to respond to emergencies where an aerodrome is located close to water and/or swampy areas and where a significant portion of approach or departure operations takes place over these areas.

9.1.15 At those aerodromes located close to water and/or swampy areas, or difficult terrain, the aerodrome emergency plan shall include the establishment, testing and assessment at regular intervals of a predetermined response for the specialist rescue services.

9.1.16 An assessment of the approach and departure areas within 1 000 m of the runway threshold shall be carried out to determine the options available for intervention.

Note.— Guidance material on assessing approach and departure areas within 1 000 m of runway thresholds can be found in Chapter 13 of the Airport Services Manual (Doc 9137), Part 1.

## 9.2 RESCUE AND FIREFIGHTING

### General

Introductory Note.— The principal objective of a rescue and firefighting service is to save lives in the event of an aircraft accident or incident occurring at, or in the immediate vicinity of, an aerodrome. The rescue and firefighting service is provided to create and maintain survivable conditions, to provide egress routes for occupants and to initiate the rescue of those occupants unable to make their escape without direct aid. The rescue may require the use of equipment and personnel other than those assessed primarily for rescue and firefighting purposes.

The most important factors bearing on effective rescue in a survivable aircraft accident are: the training received, the effectiveness of the equipment and the speed with which personnel and equipment designated for rescue and firefighting purposes can be put into use.

Requirements to combat building and fuel farm fires, or to deal with foaming of runways, are not taken into account.

### Application

9.2.1 Rescue and firefighting equipment and services shall be provided at an aerodrome when serving commercial air transport operations.

Note.— Public or private organizations, suitably located and equipped, may be designated to provide the rescue and firefighting service. It is intended that the fire station housing these organizations be normally located on the aerodrome, although an off-aerodrome location is not precluded provided the response time can be met.

9.2.2 Where an aerodrome is located close to water/swampy areas, or difficult terrain, and

where a significant portion of approach or departure operations takes place over these areas, specialist rescue services and firefighting equipment appropriate to the hazard and risk shall be available.

Note 1.— Special firefighting equipment need not be provided for water areas; this does not prevent the provision of such equipment if it would be of practical use, such as when the areas concerned include reefs or islands.

Note 2.— The objective is to plan and deploy the necessary life-saving flotation equipment as expeditiously as possible in a number commensurate with the largest aeroplane normally using the aerodrome.

Note 3.— Additional guidance is available in Chapter 13 of the Airport Services Manual (Doc 9137), Part 1.

**Level of protection to be provided**

9.2.3 The level of protection provided at an aerodrome for rescue and firefighting shall be appropriate to the aerodrome category determined using the principles in 9.2.5 and 9.2.6, except that, where the number of movements of the aeroplanes in the highest category normally using the aerodrome is less than 700 in the busiest consecutive three months, the level of protection provided shall be not less than one category below the determined category.

Note.— Either a take-off or a landing constitutes a movement.

9.2.4 The level of protection provided at an aerodrome for rescue and firefighting shall be equal to the aerodrome category determined using the principles in 9.2.5 and 9.2.6.

9.2.5 The aerodrome category shall be determined from Table 9-1 and shall be based on the longest aeroplanes normally using the aerodrome and their fuselage width.

Note.— To categorize the aeroplanes using the aerodrome, first evaluate their overall length and second, their fuselage width.

9.2.6 If, after selecting the category appropriate to the longest aeroplane's overall length, that aeroplane's fuselage width is greater than the maximum width in Table 9-1, column 3, for that category, then the category for that aeroplane shall actually be one category higher.

Note 1.— See guidance in the Airport Services Manual (Doc 9137), Part 1, for categorizing aerodromes, including those for all-cargo aircraft operations, for rescue and firefighting purposes.

Note 2.— Principles and procedures on training, including training programmes and competence checks, are specified in the PANS-Aerodromes (Doc 9981). Further guidance on the training of personnel, rescue equipment for difficult environments, and other facilities and services for rescue and firefighting is given in Attachment A, Section 17, and in the Airport Services Manual (Doc 9137), Part 1.

9.2.7 During anticipated periods of reduced activity, the level of protection available shall be no less than that needed for the highest category of aeroplane planned to use the aerodrome during that time irrespective of the number of movements.

**Table 9-1. Aerodrome category for rescue and firefighting**

| Aerodrome Category (1) | Aeroplane overall length (2) | Maximum Fuselage width (3) |
|---|---|---|
| 1 | 0 m up to but not including 9 m | 2 m |
| 2 | 9 m up to but not including 12 m | 2 m |
| 3 | 12 m up to but not including 18 m | 3 m |
| 4 | 18 m up to but not including 24 m | 4 m |
| 5 | 24 m up to but not including 28 m | 4 m |
| 6 | 28 m up to but not including 39 m | 5 m |
| 7 | 39 m up to but not including 49 m | 5 m |
| 8 | 49 m up to but not including 61 m | 7 m |
| 9 | 61 m up to but not including 76 m | 7 m |
| 10 | 76 m up to but not including 90 m | 8 m |

**Extinguishing agents**

9.2.8 Both principal and complementary agents shall normally be provided at an aerodrome.

Note.— Descriptions of the agents may be found in the Airport Services Manual (Doc 9137), Part 1.

9.2.9 The principal extinguishing agent shall be:

(a) a foam meeting the minimum performance level A; or

(b) a foam meeting the minimum performance level B; or

(c) a foam meeting the minimum performance level C; or

(d) a combination of these agents;

except that the principal extinguishing agent for aerodromes in categories 1 to 3 shall preferably meet a performance level B or C foam.

Note.— Information on the required physical properties and fire extinguishing performance

criteria needed for a foam to achieve an acceptable performance level A, B or C rating is given in the Airport Services Manual (Doc 9137), Part 1.

9.2.10 The complementary extinguishing agent shall be a dry chemical powder suitable for extinguishing hydrocarbon fires.

Note 1.— When selecting dry chemical powders for use with foam, care must be exercised to ensure compatibility.

Note 2.— Alternate complementary agents having equivalent firefighting capability may be utilized. Additional information on extinguishing agents is given in the Airport Services Manual (Doc 9137), Part 1.

9.2.11 The amounts of water for foam production and the complementary agents to be provided on the rescue and firefighting vehicles shall be in accordance with the aerodrome category determined under 9.2.3, 9.2.4, 9.2.5, 9.2.6 and Table 9-2, except that for aerodrome categories 1 and 2 up to 100 per cent of the water may be substituted with complementary agent. For the purpose of agent substitution, 1 kg of complementary agent shall be taken as equivalent to 1.0 L of water for production of a foam meeting performance level A.

Note 1.— The amounts of water specified for foam production are predicated on an application rate of 8.2 L/min/$m^2$ for a foam meeting performance level A, 5.5 L/min/$m^2$ for a foam meeting performance level B and 3.75 L/min/$m^2$ for a foam meeting performance level C.

Note 2.— When any other complementary agent is used, the substitution ratios need to be checked.

9.2.12 At aerodromes where operations by aeroplanes larger than the average size in a given category are planned, the quantities of water shall be recalculated and the amount of water for foam production and the discharge rates for foam solution shall be increased accordingly.

Note.— Guidance on the determination of quantities of water and discharge rates based on the

largest overall length of aeroplane in a given category is available in Chapter 2 of the Airport Services Manual (Doc 9137), Part 1.

**Table 9-2. Minimum usable amounts of extinguishing agents**

| Aerodrome category (1) | Foam meeting performance level A Water (L) (2) | Foam meeting performance level A Discharge rate foam solution/ minute (L) (3) | Foam meeting performance level B Water (L) (4) | Foam meeting performance level B Discharge rate foam solution/ minute (L) (5) | Foam meeting performance level C Water (L) (6) | Foam meeting performance level C Discharge rate foam solution/ minute (L) (7) | Complementary agents Dry chemical powders (kg) (8) | Complementary agents Discharge Rate (kg/second) (9) |
|---|---|---|---|---|---|---|---|---|
| 1 | 350 | 350 | 230 | 230 | 160 | 160 | 45 | 2.25 |
| 2 | 1 000 | 800 | 670 | 550 | 460 | 360 | 90 | 2.25 |
| 3 | 1 800 | 1 300 | 1 200 | 900 | 820 | 630 | 135 | 2.25 |
| 4 | 3 600 | 2 600 | 2 400 | 1 800 | 1 700 | 1 100 | 135 | 2.25 |
| 5 | 8 100 | 4 500 | 5 400 | 3 000 | 3 900 | 2 200 | 180 | 2.25 |
| 6 | 11 800 | 6 000 | 7 900 | 4 000 | 5 800 | 2 900 | 225 | 2.25 |
| 7 | 18 200 | 7 900 | 12 100 | 5 300 | 8 800 | 3 800 | 225 | 2.25 |
| 8 | 27 300 | 10 800 | 18 200 | 7 200 | 12 800 | 5 100 | 450 | 4.5 |
| 9 | 36 400 | 13 500 | 24 300 | 9 000 | 17 100 | 6 300 | 450 | 4.5 |
| 10 | 48 200 | 16 600 | 32 300 | 11 200 | 22 800 | 7 900 | 450 | 4.5 |

Note.— The quantities of water shown in columns 2, 4 and 6 are based on the average overall length of aeroplanes in a given category.

9.2.13 The quantity of foam concentrates separately provided on vehicles for foam production shall be in proportion to the quantity of water provided and the foam concentrate selected.

9.2.14 The amount of foam concentrate provided on a vehicle shall be sufficient to produce at least two loads of foam solution.

9.2.15 Supplementary water supplies, for the expeditious replenishment of rescue and firefighting vehicles at the scene of an aircraft accident, shall be provided.

9.2.16 When a combination of different performance level foams are provided at an aerodrome, the total amount of water to be provided for foam production shall be calculated for each foam type and the distribution of these quantities shall be documented for each vehicle and applied to the overall rescue and firefighting requirement.

9.2.17 The discharge rate of the foam solution shall not be less than the rates shown in Table

9-2.

9.2.18 The complementary agents shall comply with the appropriate specifications of the International Organization for Standardization (ISO).*

9.2.19 The discharge rate of complementary agents shall be no less than the values shown in Table 9-2.

9.2.20 Dry chemical powders shall only be substituted with an agent that has equivalent or better firefighting capabilities for all types of fires where complementary agent is expected to be used.

Note.— Guidance on the use of complementary agents can be found in the Airport Services Manual (Doc 9137), Part 1.

9.2.21 A reserve supply of foam concentrate, equivalent to 200 per cent of the quantities identified in Table 9-2, shall be maintained on the aerodrome for vehicle replenishment purposes.

Note.— Foam concentrate carried on fire vehicles in excess of the quantity identified in Table 9-2 can contribute to the reserve.

9.2.22 A reserve supply of complementary agent, equivalent to 100 per cent of the quantity identified in Table 9-2, shall be maintained on the aerodrome for vehicle replenishment purposes. Sufficient propellant gas shall be included to utilize this reserve complementary agent.

9.2.23 Category 1 and 2 aerodromes that have replaced up to 100 per cent of the water with complementary agent shall hold a reserve supply of complementary agent of 200 per cent.

9.2.24 Where a major delay in the replenishment of the supplies is anticipated, the amount of reserve supply in 9.2.21, 9.2.22 and 9.2.23 shall be increased as determined by a risk assessment.
Note.— See the Airport Services Manual (Doc 9137), Part 1 for guidance on the conduct of a risk

analysis to determine the quantities of reserve extinguishing agents.

**Rescue equipment**

9.2.25 Rescue equipment commensurate with the level of aircraft operations shall be provided on the rescue and firefighting vehicle(s).

Note.— Guidance on the rescue equipment to be provided at an aerodrome is given in the Airport Services Manual (Doc 9137), Part 1.

**Response time**

9.2.26 The operational objective of the rescue and firefighting service shall be to achieve a response time not exceeding three minutes to any point of each operational runway, in optimum visibility and surface conditions.

9.2.27 The operational objective of the rescue and firefighting service shall be to achieve a response time not exceeding three minutes to any other part of the movement area, in optimum visibility and surface conditions.

Note 1.— Response time is considered to be the time between the initial call to the rescue and firefighting service, and the time when the first responding vehicle(s) is (are) in position to apply foam at a rate of at least 50 per cent of the discharge rate specified in Table 9-2.

Note 2.— Optimum visibility and surface conditions are defined as daytime, good visibility, no precipitation with normal response route free of surface contamination, e.g. water.

9.2.28 To meet the operational objective as nearly as possible in less than optimum conditions of visibility, especially during low visibility operations, suitable guidance, equipment and/or procedures for rescue and firefighting services shall be provided.

Note.— Additional guidance is available in the Airport Services Manual (Doc 9137), Part 1.

9.2.29 Any vehicles, other than the first responding vehicle(s), required to deliver the amounts of extinguishing agents specified in Table 9-2 shall ensure continuous agent application and shall arrive no more than four minutes from the initial call.

9.2.30 Any vehicles, other than the first responding vehicles(s), required to deliver the amounts of extinguishing agents specified in Table 9-2 shall ensure continuous agent application and should arrive no more than three minutes from the initial call.

9.2.31 A system of preventive maintenance of rescue and firefighting vehicles shall be employed to ensure effectiveness of the equipment and compliance with the specified response time throughout the life of the vehicle.

Emergency access roads

9.2.32 Emergency access roads shall be provided on an aerodrome where terrain conditions permit their construction, so as to facilitate achieving minimum response times. Particular attention shall be given to the provision of ready access to approach areas up to 1 000 m from the threshold, or at least within the aerodrome boundary. Where a fence is provided, the need for convenient access to outside areas shall be taken into account.

Note.— Aerodrome service roads may serve as emergency access roads when they are suitably located and constructed.

9.2.33 Emergency access roads shall be capable of supporting the heaviest vehicles which will use them, and be usable in all weather conditions. Roads within 90 m of a runway should be surfaced to prevent surface erosion and the transfer of debris to the runway. Sufficient vertical clearance shall be provided from overhead obstructions for the largest vehicles.

9.2.34 When the surface of the road is indistinguishable from the surrounding area, edge markers shall be placed at intervals of about 10 m.

**Fire stations**

9.2.35 All rescue and firefighting vehicles shall normally be housed in a fire station. Satellite fire stations shall be provided whenever the response time cannot be achieved from a single fire station.

9.2.36 The fire station shall be located so that the access for rescue and firefighting vehicles into the runway area is direct and clear, requiring a minimum number of turns.

**Communication and alerting systems**

9.2.37 A discrete communication system shall be provided linking a fire station with the control tower, any other fire station on the aerodrome and the rescue and firefighting vehicles.

9.2.38 An alerting system for rescue and firefighting personnel, capable of being operated from that station, shall be provided at a fire station, any other fire station on the aerodrome and the aerodrome control tower.

**Number of rescue and firefighting vehicles**

9.2.39 The minimum number of rescue and firefighting vehicles provided at an aerodrome shall be in accordance with the following tabulation:

| Aerodrome category | Rescue and firefighting vehicles |
|---|---|
| 1 | 1 |
| 2 | 1 |
| 3 | 1 |
| 4 | 1 |
| 5 | 1 |
| 6 | 2 |
| 7 | 2 |
| 8 | 3 |
| 9 | 3 |
| 10 | 3 |

Note.— Guidance on minimum characteristics of rescue and firefighting vehicles is given in the Airport Services Manual (Doc 9137), Part 1.

**Personnel**

9.2.40 All rescue and firefighting personnel shall be properly trained to perform their duties in an efficient manner and shall participate in live fire drills commensurate with the types of aircraft and type of rescue and firefighting equipment in use at the aerodrome, including pressure-fed fuel fires.

Note 1.— Guidance to assist the Operator of a Certified Aerodrome in providing proper training is given in Attachment A, Section 17, and the Airport Services Manual (Doc 9137), Part 1.

Note 2.— Fires associated with fuel discharged under very high pressure from a ruptured fuel tank are known as "pressure-fed fuel fires".

9.2.41 The rescue and firefighting personnel training programme shall include training in human performance, including team coordination.

Note.— Guidance material to design training programmes on human performance and team coordination can be found in the Human Factors Training Manual (Doc 9683).

9.2.42 During flight operations, sufficient trained and competent personnel shall be designated to be readily available to ride the rescue and firefighting vehicles and to operate the equipment at maximum capacity. These personnel shall be deployed in a way that ensures that minimum response times can be achieved and that continuous agent application at the appropriate rate can be fully maintained. Consideration shall also be given for personnel to use hand lines, ladders and other rescue and firefighting equipment normally associated with aircraft rescue and firefighting operations.

9.2.43 In determining the minimum number of rescue and firefighting personnel required, a task resource analysis shall be completed and the level of staffing documented in the Aerodrome Manual.

Note.— Guidance on the use of a task resource analysis can be found in the Airport Services Manual (Doc 9137), Part 1.

9.2.44 All responding rescue and firefighting personnel shall be provided with protective clothing and respiratory equipment to enable them to perform their duties in an effective manner.

**9.3 DISABLED AIRCRAFT REMOVAL**

Note.— Guidance on removal of a disabled aircraft, including recovery equipment, is given in the Airport Services Manual (Doc 9137), Part 5. See also Annex 13 — Aircraft Accident and Incident Investigation concerning protection of evidence, custody and removal of aircraft.

9.3.1 A plan for the removal of an aircraft disabled on, or adjacent to, the movement area shall be established for an aerodrome, and a coordinator designated to implement the plan, when necessary.

9.3.2 The disabled aircraft removal plan shall be based on the characteristics of the aircraft that may normally be expected to operate at the aerodrome, and include among other things:

a) a list of equipment and personnel on, or in the vicinity of, the aerodrome which would be available for such purpose; and

b) arrangements for the rapid receipt of aircraft recovery equipment kits available from other aerodromes.

**9.4 WILDLIFE STRIKE HAZARD REDUCTION**

Note.— The presence of wildlife (birds and other animals) on, or in the vicinity of an aerodrome poses a serious threat to aircraft operational safety.

9.4.1 The wildlife strike hazard on, or in the vicinity of, an aerodrome shall be assessed through:

(a) the establishment of an aerodrome procedure for recording and reporting wildlife strikes to aircraft;

(b) the collection of information from aircraft operators, aerodrome personnel and other sources on the presence of wildlife on or around the aerodrome constituting a potential hazard to aircraft operations; and

(c) an ongoing evaluation of the wildlife hazard by competent personnel.

(d) Participation of the Operator of the Certified Aerodrome in the national wildlife committee.

Note.— See Annex 15, Chapter 5.

9.4.2 Wildlife strike reports shall be collected and forwarded to ICAO for inclusion in the ICAO Bird Strike Information System (IBIS) database.

Note.— The IBIS is designed to collect and disseminate information on wildlife strikes to aircraft. Information on the system is included in the Manual on the ICAO Bird Strike Information System (IBIS) (Doc 9332) (forthcoming).

9.4.3 Action shall be taken to decrease the risk to aircraft operations by adopting measures to minimize the likelihood of collisions between wildlife and aircraft.

Note.— Procedures on the management of wildlife hazards on and in the vicinity of an aerodrome, including the establishment of a wildlife hazard management programme (WHMP), wildlife risk assessment, land-use management and personnel training, are specified in the PANS-Aerodromes (Doc 9981), Part II, Chapters 1 and 6. Further guidance is given in the Airport Services Manual (Doc 9137), Part 3.

9.4.4 The Operator of a Certified Aerodrome shall take action to eliminate or to prevent the establishment of garbage disposal dumps or any other source which may attract wildlife to the aerodrome, or its vicinity, unless an appropriate wildlife assessment indicates that they are unlikely to create conditions conducive to a wildlife hazard problem. Where the elimination of existing sites is not possible, the Operator of a Certified Aerodrome shall ensure that any risk to aircraft posed by these sites is assessed and reduced to as low as reasonably practicable.

9.4.5 Developers and local authorities shall give due consideration to aviation safety concerns related to land developments in the vicinity of the aerodrome that may attract wildlife.

### 9.5 APRON MANAGEMENT SERVICE

9.5.1 When warranted by the volume of traffic and operating conditions, an appropriate apron management service shall be provided on an apron by an aerodrome ATS unit, by another aerodrome operating authority, or by a cooperative combination of these, in order to:

(a) regulate movement with the objective of preventing collisions between aircraft, and between aircraft and obstacles;

(b) regulate entry of aircraft into, and coordinate exit of aircraft from, the apron with the aerodrome control tower; and

(c) ensure safe and expeditious movement of vehicles and appropriate regulation of other activities.

9.5.2 When the aerodrome control tower does not participate in the apron management service, procedures shall be established to facilitate the orderly transition of aircraft between the apron management unit and the aerodrome control tower.

Note.— Procedures on apron safety are specified in the PANS-Aerodromes (Doc 9981). Guidance on an apron management service is given in the Airport Services Manual (Doc 9137), Part 8, and in the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).

9.5.3 An apron management service shall be provided with radiotelephony communications facilities.

9.5.4 Where low visibility procedures are in effect, persons and vehicles operating on an apron shall be restricted to the essential minimum.

Note.— Guidance on related special procedures is given in the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).

9.5.5 An emergency vehicle responding to an emergency shall be given priority over all other surface movement traffic.

9.5.6 A vehicle operating on an apron shall:

(a) give way to an emergency vehicle; an aircraft taxiing, about to taxi, or being pushed or towed; and

(b) give way to other vehicles in accordance with local regulations.

9.5.7 An aircraft stand shall be visually monitored to ensure that the recommended clearance distances are provided to an aircraft using the stand.

Note.— Procedures on the training of operational personnel, and on apron safety and operations, are specified in the PANS-Aerodromes (Doc 9981), Part II, Chapters 1 and 7.

## 9.6 GROUND SERVICING OF AIRCRAFT

9.6.1 Fire extinguishing equipment suitable for at least initial intervention in the event of a fuel fire and personnel trained in its use shall be readily available during the ground servicing of an aircraft, and there shall be a means of quickly summoning the rescue and firefighting service in the event of a fire or major fuel spill.

9.6.2 When aircraft refuelling operations take place while passengers are embarking, on board or disembarking, ground equipment shall be positioned so as to allow:

(a) the use of a sufficient number of exits for expeditious evacuation; and

(b) a ready escape route from each of the exits to be used in an emergency.

## 9.7 AERODROME VEHICLE OPERATIONS

Note 1.— Procedures on the establishment of an airside driver permit scheme and vehicle/equipment safety requirements, including detailed personnel training, are specified in the PANS-Aerodromes (Doc 9981), Part II, Chapter 9.

Note 2.— Guidance on aerodrome vehicle operations is contained in Attachment A, Section 18, and on traffic rules and regulations for vehicles in the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).

Note 3.— It is intended that roads located on the movement area be restricted to the exclusive use of aerodrome personnel and other authorized persons, and that access to the public buildings by an unauthorized person will not require use of such roads.

9.7.1 A vehicle shall be operated:

(a) on a manoeuvring area only as authorized by the aerodrome control tower; and

(b) on an apron only as authorized by the appropriate designated authority.

9.7.2 The driver of a vehicle on the movement area shall comply with all mandatory instructions conveyed by markings and signs unless otherwise authorized by:

(a) the aerodrome control tower when on the manoeuvring area; or

(b) the appropriate designated authority when on the apron.

9.7.3 The driver of a vehicle on the movement area shall comply with all mandatory instructions conveyed by lights.

9.7.4 The driver of a vehicle on the movement area shall be appropriately trained for the tasks to be performed and shall comply with the instructions issued by:

(a) the aerodrome control tower, when on the manoeuvring area; and

(b) the appropriate designated authority, when on the apron.

9.7.5 The driver of a radio-equipped vehicle shall establish satisfactory two-way radio communication with the aerodrome control tower before entering the manoeuvring area and with the appropriate designated authority before entering the apron. The driver shall maintain a continuous listening watch on the assigned frequency when on the movement area.

## 9.8 SURFACE MOVEMENT GUIDANCE AND CONTROL SYSTEMS

### Application

9.8.1 A surface movement guidance and control system (SMGCS) shall be provided at an aerodrome.

Note.— Guidance on surface movement guidance and control systems is contained in the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476).

### Characteristics

9.8.2 The design of a SMGCS shall take into account:

(a) the density of air traffic;

(b) the visibility conditions under which operations are intended;

(c) the need for pilot orientation;

(d) the complexity of the aerodrome layout; and

(e) movements of vehicles.

9.8.3 The visual aid components of a SMGCS, i.e. markings, lights and signs, shall be designed to conform with the relevant specifications in 5.2, 5.3 and 5.4, respectively.

9.8.4 A SMGCS shall be designed to assist in the prevention of inadvertent incursions of aircraft and vehicles onto an active runway.

9.8.5 The system shall be designed to assist in the prevention of collisions between aircraft, and between aircraft and vehicles or objects, on any part of the movement area.

Note.— Guidance on control of stop bars through induction loops and on a visual taxiing guidance and control system is contained in the Aerodrome Design Manual (Doc 9157), Part 4.

9.8.6 Where an SMGCS is provided by selective switching of stop bars and taxiway centre line lights, the following requirements shall be met:

(a) taxiway routes which are indicated by illuminated taxiway centre line lights shall be capable of being terminated by an illuminated stop bar;

(b) the control circuits shall be so arranged that when a stop bar located ahead of an aircraft is illuminated, the appropriate section of taxiway centre line lights beyond it is suppressed; and

(c) the taxiway centre line lights are activated ahead of an aircraft when the stop bar is suppressed.

Note 1.— See Sections 5.3.17 and 5.3.20 for specifications on taxiway centre line lights and stop bars, respectively.

Note 2.— Guidance on installation of stop bars and taxiway centre line lights in SMGCSs is given in the Aerodrome Design Manual (Doc 9157), Part 4.

9.8.7 Surface movement radar for the manoeuvring area shall be provided at an aerodrome intended for use in runway visual range conditions less than a value of 350 m.

9.8.8 Surface movement radar for the manoeuvring area shall be provided at an aerodrome other than that in 9.8.7 when traffic density and operating conditions are such that regularity of traffic flow cannot be maintained by alternative procedures and facilities.

Note.— Guidance on the use of surface movement radar is given in the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476) and in the Air Traffic Services Planning Manual (Doc 9426).

**9.9 SITING OF EQUIPMENT AND INSTALLATIONS ON OPERATIONAL AREAS**

Note 1.— Requirements for obstacle limitation surfaces are specified in 4.2.

Note 2.— The design of light fixtures and their supporting structures, light units of visual approach slope indicators, signs, and markers, is specified in 5.3.1, 5.3.5, 5.4.1 and 5.5.1, respectively. Guidance on the frangible design of visual and non-visual aids for navigation is given in the Aerodrome Design Manual (Doc 9157), Part 6.

9.9.1 Unless its function requires it to be there for air navigation or for aircraft safety purposes, no equipment or installation shall be:

(a) on a runway strip, a runway end safety area, a taxiway strip or within the distances specified in Table 3-2, column 11, if it would endanger an aircraft; or

(b) on a clearway if it would endanger an aircraft in the air.

9.9.2 Any equipment or installation required for air navigation or for aircraft safety purposes which must be located:

(a) on that portion of a runway strip within:

1) 75 m of the runway centre line where the code number is 3 or 4; or

2) 45 m of the runway centre line where the code number is 1 or 2; or

(b) on a runway end safety area, a taxiway strip or within the distances specified in Table 3-2; or

(c) on a clearway and which would endanger an aircraft in the air; shall be frangible and mounted as low as possible.

9.9.3 Any equipment or installation required for air navigation or for aircraft safety purposes which must be located on the non-graded portion of a runway strip shall be regarded as an obstacle and shall be frangible and mounted as low as possible.

Note.— Guidance on the siting of navigation aids is contained in the Aerodrome Design Manual (Doc 9157), Part 6.

9.9.4 Unless its function requires it to be there for air navigation or for aircraft safety purposes, no equipment or installation shall be located within 240 m from the end of the strip and within:

(a) 60 m of the extended centre line where the code number is 3 or 4; or

(b) 45 m of the extended centre line where the code number is 1 or 2; of a precision approach runway category I, II or III.

9.9.5 Any equipment or installation required for air navigation or for aircraft safety purposes which must be located on or near a strip of a precision approach runway category I, II or III and which:

(a) is situated within 240 m from the end of the strip and within:

1) 60 m of the extended runway centre line where the code number is 3 or 4; or

2) 45 m of the extended runway centre line where the code number is 1 or 2; or

(b) penetrates the inner approach surface, the inner transitional surface or the balked landing surface; shall be frangible and mounted as low as possible.

9.9.6 Any equipment or installation required for air navigation or for aircraft safety purposes which is an obstacle of operational significance in accordance with 4.2.4, 4.2.11, 4.2.20 or 4.2.27

shall be frangible and mounted as low as possible.

## 9.10 FENCING

### Application

9.10.1 A fence or other suitable barrier shall be provided on an aerodrome to prevent the entrance to the movement area of animals large enough to be a hazard to aircraft.

9.10.2 A fence or other suitable barrier shall be provided on an aerodrome to deter the inadvertent or premeditated access of an unauthorized person onto a non-public area of the aerodrome.

Note 1.— This is intended to include the barring of sewers, ducts, tunnels, etc., where necessary to prevent access.

Note 2.— Special measures may be required to prevent the access of an unauthorized person to runways or taxiways which overpass public roads.

9.10.3 Suitable means of protection shall be provided to deter the inadvertent or premeditated access of unauthorized persons into ground installations and facilities essential for the safety of civil aviation located off the aerodrome.

### Location

9.10.4 The fence or barrier shall be located so as to separate the movement area and other facilities or zones on the aerodrome vital to the safe operation of aircraft from areas open to public access.

9.10.5 When greater security is thought necessary, a cleared area shall be provided on both sides of the fence or barrier to facilitate the work of patrols and to make trespassing more difficult. Consideration shall be given to the provision of a perimeter road inside the aerodrome fencing for

the use of both maintenance personnel and security patrols.

## 9.11 SECURITY LIGHTING

At an aerodrome where it is deemed desirable for security reasons, a fence or other barrier provided for the protection of international civil aviation and its facilities shall be illuminated at a minimum essential level. Consideration shall be given to locating lights so that the ground area on both sides of the fence or barrier, particularly at access points, is illuminated.

## 9.12 AUTONOMOUS RUNWAY INCURSION WARNING SYSTEM

Note 1.— The inclusion of detailed specifications for an autonomous runway incursion warning system (ARIWS) in this section is not intended to imply that an ARIWS has to be provided at an aerodrome.

Note 2.— The implementation of an ARIWS is a complex issue deserving careful consideration by aerodrome operators, air traffic services and the Authority, and in coordination with the aircraft operators.

Note 3.— Attachment A, Section 20, provides a description of an ARIWS and information on its use.

### Characteristics

9.12.1 Where an ARIWS is installed at an aerodrome:

(a) it shall provide autonomous detection of a potential incursion or of the occupancy of an active runway and a direct warning to a flight crew or vehicle operator;

(b) it shall function and be controlled independently of any other visual system on the aerodrome;

(c) its visual aid components, i.e. lights, shall be designed to conform with the relevant specifications in 5.3; and

(d) failure of part or all of it shall not interfere with normal aerodrome operations. To this

end, provision shall be made to allow the ATC unit to partially or entirely shut down the system.

Note 1.— An ARIWS may be installed in conjunction with enhanced taxiway centre line markings, stop bars or runway guard lights.

Note 2.— It is intended that the system(s) be operational under all weather conditions, including low visibility.

Note 3.— An ARIWS may share common sensory components of an SMGCS or A-SMGCS, however, it operates independently of either system.

9.12.2 Where an ARIWS is installed at an aerodrome, information on its characteristics and status shall be provided to the appropriate aeronautical information services for promulgation in the AIP with the description of the aerodrome surface movement guidance and control system and markings as specified in Annex 15.

Note.— Detailed specifications concerning the AIP are contained in PANS-AIM (Doc 10066).

# CHAPTER 10 – AERODROME MAINTENANCE

## 10.1 GENERAL

10.1.1 A maintenance programme, including preventive maintenance where appropriate, shall be established at an aerodrome to maintain facilities in a condition which does not impair the safety, regularity or efficiency of air navigation.

Note 1.— Preventive maintenance is programmed maintenance work done in order to prevent a failure or degradation of facilities.

Note 2.— "Facilities" are intended to include such items as pavements, visual aids, fencing, drainage systems, electrical systems and buildings.

10.1.2 The design and application of the maintenance programme shall observe human factors principles.

Note 1.— Guidance material on human factors principles can be found in the Human Factors Training Manual (Doc 9683) and in the Airport Services Manual (Doc 9137), Part 8.

Note 2.— General principles and procedures on the training of aerodrome personnel, including training programmes and competence checks, are specified in the PANS-Aerodromes (Doc 9981).

## 10.2 PAVEMENTS

10.2.1 The surfaces of all movement areas including pavements (runways, taxiways and aprons) and adjacent areas fshall be inspected and their conditions monitored regularly as part of an aerodrome preventive and corrective maintenance programme with the objective of avoiding and eliminating any foreign object debris (FOD) that might cause damage to aircraft or impair the operation of aircraft systems.

Note 1.— See 2.9.3 for inspections of movement areas.

Note 2.— Procedures on carrying out daily inspections of the movement area and control of FOD are given in the PANS-Aerodromes (Doc 9981), the Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476) and the Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (Doc 9830).

Note 3.— Additional guidance on sweeping/cleaning of surfaces is contained in the Airport Services Manual (Doc 9137), Part 9.

Note 4.— Guidance on precautions to be taken in regard to the surface of shoulders is given in Attachment A, Section 8, and the Aerodrome Design Manual (Doc 9157), Part 2.

Note 5.— Where the pavement is used by large aircraft or aircraft with tire pressures in the upper categories referred to in 2.6.6 c), particular attention should be given to the integrity of light fittings in the pavement and pavement joints.

10.2.2 The surface of a runway shall be maintained in a condition such as to prevent formation of harmful irregularities.

Note.— See Attachment A, Section 5.

10.2.3 A paved runway shall be maintained in a condition so as to provide surface friction characteristics at or above the minimum friction level specified by the Authority in Table 3.1.

Note.— Assessment, Measurement and Reporting of Runway Surface Conditions (Cir 355) contains further information on this subject.

10.2.4 Runway surface friction characteristics for maintenance purposes shall be periodically measured with a continuous friction measuring device using self-wetting features and documented. The frequency of these measurements shall be sufficient to determine the trend of the surface

friction characteristics of the runway.

Note 1.— Guidance on evaluating the runway surface friction characteristics is provided in Assessment, Measurement and Reporting of Runway Surface Conditions (Cir 355).

Note 2.— The objective of 10.2.3 to 10.2.8 is to ensure that the surface friction characteristics for the entire runway remain at or above a minimum friction level specified by the Authority.

10.2.5 When runway surface friction measurements are made for maintenance purposes using a self-wetting continuous friction measuring device, the performance of the device shall meet the standard set or agreed by the Authority.

10.2.6 Personnel measuring runway surface friction required in 10.2.5 shall be trained to fulfil their duties.

10.2.7 Corrective maintenance action shall be taken to prevent the runway surface friction characteristics for either the entire runway or a portion thereof from falling below a minimum friction level specified by the Authority.

Note.— A portion of runway in the order of 100 m long may be considered significant for maintenance or reporting action.

10.2.8 The runway surface shall be visually assessed, as necessary, under natural or simulated rain conditions for ponding or poor drainage and where required, corrective maintenance action taken.

10.2.9 When a taxiway is used by turbine-engined aeroplanes, the surface of the taxiway shoulders shall be maintained so as to be free of any loose stones or other objects that could be ingested by the aeroplane's engines.

Note.— Guidance on this subject is given in the Aerodrome Design Manual (Doc 9157), Part 2.

## 10.3 REMOVAL OF CONTAMINANTS

10.3.1 Standing water, mud, dust, sand, oil, rubber deposits and other contaminants shall be removed from the surface of runways in use as rapidly and completely as possible to minimize accumulation.

10.3.2 Taxiways shall be kept clear of sand, oil, mud, etc., to the extent necessary to enable aircraft to be taxied to and from an operational runway.

10.3.3 Aprons shall be kept clear of sand, oil, mud, etc., to the extent necessary to enable aircraft to manoeuvre safely or, where appropriate, to be towed or pushed.

10.3.4 Whenever the clearance of sand, oil, mud, etc., from the various parts of the movement area cannot be carried out simultaneously, the order of priority after the runway(s) in use shall be set in consultation with the affected parties such as rescue and firefighting service.

10.3.5 Chemicals which may have harmful effects on aircraft or pavements, or chemicals which may have toxic effects on the aerodrome environment, shall not be used.

## 10.4 RUNWAY PAVEMENT OVERLAYS

Note.— The following specifications are intended for runway pavement overlay projects when the runway is to be returned temporarily to an operational status before resurfacing is complete. This may necessitate a temporary ramp between the new and old runway surfaces. Guidance on overlaying pavements and assessing their operational status is given in the Aerodrome Design Manual (Doc 9157), Part 3.

10.4.1 The longitudinal slope of the temporary ramp, measured with reference to the existing runway surface or previous overlay course, shall be:

a) 0.5 to 1.0 per cent for overlays up to and including 5 cm in thickness; and

b) not more than 0.5 per cent for overlays more than 5 cm in thickness.

10.4.2 Overlaying should proceed from one end of the runway toward the other end so that based on runway utilization most aircraft operations will experience a down ramp.

10.4.3 The entire width of the runway shall be overlaid during each work session.

10.4.4 Before a runway being overlaid is returned to a temporary operational status, a runway centre line marking conforming to the specifications in Section 5.2.3 shall be provided. Additionally, the location of any temporary threshold shall be identified by a 3.6 m wide transverse stripe.

10.4.5 The overlay shall be constructed and maintained above the minimum friction level specified in 10.2.3.

## 10.5 VISUAL AIDS

Note 1.— These specifications are intended to define the maintenance performance level objectives. They are not intended to define whether the lighting system is operationally out of service.

Note 2.— Enhanced vision systems (EVS) technology relies on the infra-red heat signature provided by incandescent lighting. Annex 15 protocols provide an appropriate means of notifying aerodrome users of EVS when lighting systems are converted to LED.

10.5.1 A light shall be deemed to be unserviceable when the main beam average intensity is less than 50 per cent of the value specified in the appropriate figure in Appendix 2. For light units where the designed main beam average intensity is above the value shown in Appendix 2, the 50 per cent value shall be related to that design value.

10.5.2 A system of preventive maintenance of visual aids shall be employed to ensure lighting and marking system reliability.

Note.— Guidance on preventive maintenance of visual aids is given in the Airport Services Manual (Doc 9137), Part 9.

10.5.3 The system of preventive maintenance employed for a precision approach runway category II or III shall include at least the following checks:

(a) visual inspection and in-field measurement of the intensity, beam spread and orientation of lights included in the approach and runway lighting systems;

(b) control and measurement of the electrical characteristics of each circuitry included in the approach and runway lighting systems; and

(c) control of the correct functioning of light intensity settings used by air traffic control.

10.5.4 In-field measurement of intensity, beam spread and orientation of lights included in approach and runway lighting systems for a precision approach runway category II or III shall be undertaken by measuring all lights, as far as practicable, to ensure conformance with the applicable specification of Appendix 2.

10.5.5 Measurement of intensity, beam spread and orientation of lights included in approach and runway lighting systems for a precision approach runway category II or III shall be undertaken using a mobile measuring unit of sufficient accuracy to analyse the characteristics of the individual lights.

10.5.6 The frequency of measurement of lights for a precision approach runway category II or III shall be based on traffic density, the local pollution level, the reliability of the installed lighting equipment and the continuous assessment of the results of the in-field measurements but, in any event, shall not be less than twice a year for in-pavement lights and not less than once a year for other lights.

10.5.7 The system of preventive maintenance employed for a precision approach runway category II or III shall have as its objective that, during any period of category II or III operations, all approach and runway lights are serviceable and that, in any event, at least:

(a) 95 per cent of the lights are serviceable in each of the following particular significant elements:

1) precision approach category II and III lighting system, the inner 450 m;

2) runway centre line lights;

3) runway threshold lights; and

4) runway edge lights;

(b) 90 per cent of the lights are serviceable in the touchdown zone lights;

(c) 85 per cent of the lights are serviceable in the approach lighting system beyond 450 m; and

(d) 75 per cent of the lights are serviceable in the runway end lights.

In order to provide continuity of guidance, the allowable percentage of unserviceable lights shall not be permitted in such a way as to alter the basic pattern of the lighting system. Additionally, an unserviceable light shall not be permitted adjacent to another unserviceable light, except in a barrette or a crossbar where two adjacent unserviceable lights may be permitted.

Note.— With respect to barrettes, crossbars and runway edge lights, lights are considered to be adjacent if located consecutively and:
— laterally: in the same barrette or crossbar; or
— longitudinally: in the same row of edge lights or barrettes.

10.5.8 The system of preventive maintenance employed for a stop bar provided at a runway-holding position used in conjunction with a runway intended for operations in runway visual range conditions less than a value of 350 m shall have the following objectives:

(a) no more than two lights will remain unserviceable; and

(b) two adjacent lights will not remain unserviceable unless the light spacing is significantly less than that specified.

10.5.9 The system of preventive maintenance employed for a taxiway intended for use in runway visual range conditions less than a value of 350 m shall have as its objective that no two adjacent taxiway centre line lights be unserviceable.

10.5.10 The system of preventive maintenance employed for a precision approach runway category I shall have as its objective that, during any period of category I operations, all approach and runway lights are serviceable and that, in any event, at least 85 per cent of the lights are serviceable in each of the following:

(a) precision approach category I lighting system;

(b) runway threshold lights;

(c) runway edge lights; and

(d) runway end lights.

In order to provide continuity of guidance an unserviceable light shall not be permitted adjacent to another unserviceable light unless the light spacing is significantly less than that specified.

Note.— In barrettes and crossbars, guidance is not lost by having two adjacent unserviceable lights.

10.5.11 The system of preventive maintenance employed for a runway meant for take-off in runway visual range conditions less than a value of 550 m shall have as its objective that, during any period of operations, all runway lights are serviceable and that in any event:

(a) at least 95 per cent of the lights are serviceable in the runway centre line lights (where provided) and in the runway edge lights; and

(b) at least 75 per cent of the lights are serviceable in the runway end lights.

In order to provide continuity of guidance, an unserviceable light shall not be permitted adjacent to another unserviceable light.

10.5.12 The system of preventive maintenance employed for a runway meant for take-off in runway visual range conditions of a value of 550 m or greater shall have as its objective that, during any period of operations, all runway lights are serviceable and that, in any event, at least 85 per cent of the lights are serviceable in the runway edge lights and runway end lights. In order to provide continuity of guidance, an unserviceable light shall not be permitted adjacent to another

unserviceable light.

10.5.13 During low visibility procedures the aerodrome operator shall restrict construction or maintenance activities in the proximity of aerodrome electrical systems.

# CHAPTER 11 – AERODROME CERTIFICATION REQUIREMENTS

## INTRODUCTION

This chapter provides the requirements covering the process for the certification of Category A Aerodromes. This Chapter is divided into six sections:

- Section 1 — General
- Section 2 — Aerodrome Certification
- Section 3 — Aerodrome Manual
- Section 4 — Obligations of the Aerodrome Operator
- Section 5 — Exemptions.
- Section 6 — Renewal of Aerodrome Certification.

## SECTION 1

## GENERAL

The following Requirements are adopted from the Manual on Certification of Aerodromes (Doc 9774), and Procedures for Air Navigation Services-Aerodrome and Ground Aids (Doc 9981 PANS-AGA) issued by the International Civil Aviation Organization (ICAO), and were developed and promulgated in accordance with the with Sub-section 11 of the Civil Aviation (Aerodrome and Ground Aids) Regulations 2024, with which operators of certified aerodromes, and applicants for Aerodrome Certificates are required to comply.

## SECTION 2

## AERODROME CERTIFICATION

### 11.2.1 REQUIREMENT FOR AN AERODROME CERTIFICATE

The operator of a Category A Aerodrome under Civil Aviation (Aerodromes and Ground Aids)

Regulations 2024 is required to be in possession of an Aerodrome Certificate in order to legally operate in Guyana.

### 11.2.2 APPLICATION FOR AN AERODROME CERTIFICATE

An application for an Aerodrome Certificate shall be submitted to the Authority in the form prescribed by the Authority (Appendix 6). The application shall include:

(a) three copies of the Aerodrome Manual for the aerodrome (One electronic and two printed).

(b) a plan for the aerodrome;

(c) proof of approval for construction/establishment of the aerodrome; and

(d) particulars of any non-compliance or deviations from the appropriate aerodrome design, operation or equipment requirement.

### 11.2.3 GRANT OF AN AERODROME CERTIFICATE

11.2.3.1 Subject to the provisions in Civil Aviation (Aerodromes and Ground Aids) Regulations 2024 and requirements 11.2.3.2 and 11.2.3.3, the Authority may approve the application and the Aerodrome Manual submitted under these requirements and grant an Aerodrome Certificate to the applicant.

11.2.3.2 Before granting an Aerodrome Certificate, the Authority must be satisfied that:

(a) the applicant and his/her staff have the necessary competence and experience to operate and maintain the aerodrome properly;

(b) the Aerodrome Manual prepared for the applicant's aerodrome and submitted with the application contains all the relevant information;

(c) the aerodrome facilities, services and equipment are in accordance with Chapters 1 to 10 of these Requirements;

(d) the aerodrome operating procedures make satisfactory provision for the safety of aircraft; and

(e) an acceptable safety management system is in place at the aerodrome.

11.2.3.3 The Authority may refuse to grant an Aerodrome Certificate to an applicant. In such cases, the Authority must notify the applicant, in writing, of its reasons no later than twenty-one (21) days after making that decision.

### 11.2.4 ENDORSEMENT OF CONDITIONS ON AN AERODROME CERTIFICATE

After successful completion of the processing of the application and the inspection of the aerodrome, the Authority, when granting the Aerodrome Certificate, will endorse the conditions for the type of use of the aerodrome and other details as shown in Appendix 9.

### 11.2.5 DURATION OF AN AERODROME CERTIFICATE

An Aerodrome Certificate shall remain in force until it is suspended or cancelled or, alternatively, an Aerodrome Certificate shall be valid for three (3) years or until it is suspended or cancelled, whichever is earlier.

### 11.2.6 SURRENDER OF AN AERODROME CERTIFICATE

11.2.6.1 An Aerodrome Certificate holder must give the Authority not less than ninety (90) days' written notice of the date on which the certificate is to be surrendered in order that suitable promulgation action can be taken.

11.2.6.2 The Authority will cancel the certificate on the date specified in the notice.

### 11.2.7 TRANSFER OF AN AERODROME CERTIFICATE

11.2.7.1 The Authority may give its consent to and issue an instrument of transfer of an Aerodrome Certificate to a transferee when:

(a) the current holder of the Aerodrome Certificate notifies the Authority, in writing, at least ninety (90) days before ceasing to operate the aerodrome, that the current holder will

cease to operate the aerodrome as of the date specified in the notice;

(b) the current holder of the Aerodrome Certificate notifies the Authority, in writing, of the name of the transferee;

(c) the transferee applies to the Authority, in writing, within sixty (60) days before the current holder of the Aerodrome Certificate ceases to operate the aerodrome for the Aerodrome Certificate to be transferred to the transferee; and

(d) the requirements set out 11.2.3.2 are met in respect of the transferee.

If the Authority does not consent to the transfer of an Aerodrome Certificate, it shall notify the transferee, in writing, of its reasons no later than thirty (30) days after making that decision.

### 11.2.8 INTERIM AERODROME CERTIFICATE

11.2.8.1 The Authority may issue an interim Aerodrome Certificate to the applicant referred to 11.2.2 or the proposed transferee of an Aerodrome Certificate referred to in 11.2.7.1 authorizing the applicant or transferee to operate an aerodrome if the Authority is satisfied that:

(a) an Aerodrome Certificate in respect of the aerodrome will be issued to the applicant or transferred to the transferee as soon as the application procedure for the grant or transfer of an Aerodrome Certificate has been completed; and

(b) the grant of the interim certificate is in the public interest and is not detrimental to aviation safety.

11.2.8.2 An interim Aerodrome Certificate issued pursuant to 11.2.8.1 shall expire on:

(a) the date on which the Aerodrome Certificate is issued or transferred; or

(b) the expiry date specified in the interim Aerodrome Certificate;

whichever is earlier.

11.2.8.3 These requirements apply to an interim Aerodrome Certificate in the same manner as they apply to an Aerodrome Certificate.

### 11.2.9 AMENDMENT OF AN AERODROME CERTIFICATE

The Authority may, provided that the requirements of 11.2.3.2, 11.3.5, and 11.3.6 have been met, amend an Aerodrome Certificate when:

a) there is a change in the ownership or management of the aerodrome;

b) there is a change in the use or operation of the aerodrome;

c) there is a change in the boundaries of the aerodrome; or

d) the holder of the Aerodrome Certificate requests an amendment.

### 11.2.10 PROVISIONAL AERODROME CERTIFICATE

11.2.10.1 The Authority may grant the holder of an Aerodrome Certificate a Provisional Aerodrome Certificate once, for whatever reason, the renewal of the certificate is not practical at the time of the expiration of his/her Aerodrome Certificate.

11.2.10.2 The Provisional Aerodrome Certificate shall be non-renewable and have a validity of up to six (6) months, starting from the date of issuance.

11.2.10.3 Once the Provisional Aerodrome Certificate expires, the aerodrome shall:

(a) Undergo the full certification process, described in 12.2; or

(b) Loose their certificate, if they are unable to undergo the full certification process.

## SECTION 3

## AERODROME MANUAL

### 11.3.1 PREPARATION OF THE AERODROME MANUAL

11.3.1.1 The operator of a certified aerodrome shall have a manual, to be known as the Aerodrome Manual, for the aerodrome.

11.3.1.2 The Aerodrome Manual shall:

(a) be printed and in digital format,

(b) and signed by the Operator of a Certified Aerodrome;

(c) be in a format that is easy to revise (three ring binder);

(d) have a system for recording the currency of pages and amendments thereto, including a page for logging revisions; and

(e) be organized in a manner that will facilitate the preparation, review and approval process.

### 11.3.2 LOCATION OF THE AERODROME MANUAL

11.3.2.1 The Operator of a Certified Aerodrome must provide the Authority with a complete and current copy of the Aerodrome Manual.

11.3.2.2 The Operator of a Certified Aerodrome must keep at least one complete and current copy of the Aerodrome Manual at the aerodrome and one copy at the operator's principal place of business if other than the aerodrome.

11.3.2.3 The Operator of a Certified Aerodrome must make the copy referred to in 11.3.2.2 available for inspection by authorized Authority personnel.

11.3.2.4 The aerodrome operator shall furnish the applicable portions of the approved Aerodrome Manual to the aerodrome personnel responsible for their implementation. The method of enabling all aerodrome operating staff to have access to the relevant parts of the manual shall be defined by the Operator of the Certified aerodrome and the evidence to demonstrate this kept.

### 11.3.3 INFORMATION TO BE INCLUDED IN THE AERODROME MANUAL

11.3.3.1 The operator of a certified aerodrome must include the following particulars in an Aerodrome Manual, to the extent that they are applicable to the aerodrome, under the following parts:

Part 1. General information set out in Appendix 6 Part 1on the purpose and scope of the

Aerodrome Manual; the legal requirement for an Aerodrome Certificate and an Aerodrome Manual as prescribed in the Civil Aviation (Aerodromes and Ground Aids) Regulations 2024; conditions for use of the aerodrome; the aeronautical information services available and the procedures for their promulgation; the system for recording aircraft movements and the obligations of the Operator of a Certified Aerodrome as specified in Chapter 11 Section 4 of these requirements.

Part 2. Particulars of the aerodrome site as set out in Appendix 6 Part 2 of these requirements.

Part 3. Particulars of the aerodrome required to be reported to the aeronautical information service as set out in Appendix 6 Part 3 of these requirements.

Part 4. The aerodrome operating procedures and safety measures as set out in Appendix 6 Part 4 of the schedule of these requirements. This may include references to air traffic procedures such as those relevant to low- visibility operations. Air traffic management procedures are normally published in the air traffic services manual with a cross-reference to the Aerodrome Manual.

Part 5. Details of the aerodrome administration and the safety management system as set out in Appendix 6 Part 5 of these requirements.

11.3.3.2 If, under 11.5.1.2, the Authority exempts the Operator of a Certified Aerodrome from complying with any requirement set out in 11.2.3.2, the Aerodrome Manual must show the identifying number given to that exemption by the Authority and the date the exemption came into effect and any conditions or procedures subject to which the exemption was granted.

11.3.3.3 If a particular is not included in the Aerodrome Manual because it is not applicable to the aerodrome, the Operator of a Certified Aerodrome must state in the manual the reason for non-applicability of the particular.

### 11.3.4 AMENDMENT OF THE AERODROME MANUAL

11.3.4.1 The operator of a certified aerodrome shall alter or amend the Aerodrome Manual, whenever necessary, in order to maintain the accuracy of the information in the manual.

11.3.4.2 To maintain the accuracy of the Aerodrome Manual, the Authority may issue a written directive to an Operator of a Certified Aerodrome requiring the operator to alter or amend the manual in accordance with that directive.

11.3.4.3 The operator of a certified aerodrome shall:

(a) Clearly define the process for amending/updating the Aerodrome Manual, which shall include a record of all amendments, effective dates and amendment approvals.

(b) Clearly define the roles and responsibilities for maintaining the accuracy of the information in the manual.

### 11.3.5 NOTIFICATION OF CHANGES TO THE AERODROME MANUAL

An Operator of a Certified Aerodrome must notify the Authority, as soon as practicable, of any changes that the operator wishes to make to the Aerodrome Manual.

### 11.3.6 AUTHORITY APPROVAL OF THE AERODROME MANUAL

The Authority shall approve the Aerodrome Manual and any amendments thereto, provided these meet the preceding requirements of this section.

## SECTION 4

## OBLIGATIONS OF THE AERODROME OPERATOR

### 11.4.1 COMPLIANCE WITH REQUIREMENTS

The Operator of a Certified Aerodrome shall comply with the requirements specified in 11.1.2 and with any conditions endorsed in the certificate pursuant to 11.2.4 and 11.5.1.2.

### 11.4.2 COMPETENCE OF OPERATIONAL AND MAINTENANCE PERSONNEL

11.4.2.1 The Operator of a Certified Aerodrome shall employ an adequate number of qualified and skilled personnel to perform all critical activities for aerodrome operation and maintenance.

11.4.2.2 If the Authority or any other competent authority of the government requires competency certification for the personnel referred to in 11.4.2.1, the Operator of a Certified Aerodrome shall employ only those persons possessing such certificates.

11.4.2.3 The Operator of a Certified Aerodrome shall implement a programme to upgrade the competency of the personnel referred to in 11.4.2.1.

### 11.4.3 AERODROME OPERATION AND MAINTENANCE

11.4.3.1 Subject to any directives that the Authority may issue, the Operator of a Certified Aerodrome shall operate and maintain the aerodrome in accordance with the procedures set out in the Aerodrome Manual.

11.4.3.2 To ensure the safety of aircraft, the Authority may give written directives to the Operator of a Certified Aerodrome to alter the procedures set out in the Aerodrome Manual.

11.4.3.3 The Operator of a Certified Aerodrome should ensure proper and efficient maintenance of the aerodrome facilities.

11.4.3.4 Where air traffic services are provided at an aerodrome, the Aerodrome Certificate holder shall coordinate with the ATS provider in order to be satisfied that appropriate air traffic services are available to ensure the safety of aircraft in the airspace associated with the aerodrome. The coordination shall cover other areas related to safety such as aeronautical information service, air traffic services, designated meteorological authorities, and security.

### 11.4.4 AERODROME OPERATOR'S SAFETY MANAGEMENT SYSTEM

11.4.4.1 The Operator of a Certified Aerodrome shall establish a safety management system for the aerodrome describing the structure of the organization and the duties, powers and responsibilities of the officials in the organizational structure, with a view to ensuring that operations are carried out in a demonstrably controlled way and are improved where necessary.

11.4.4.2 The Operator of a Certified Aerodrome shall oblige all users of the aerodrome, including fixed-base operators, ground-handling agencies and other organizations that perform activities independently at the aerodrome in relation to flight or aircraft handling, to comply with the requirements laid down by the Operator of a Certified Aerodrome with regard to safety at the aerodrome. The Operator of a Certified Aerodrome shall monitor such compliance.

11.4.4.3 The Operator of a Certified Aerodrome shall require all users of the aerodrome, including fixed-base operators, ground- handling agencies and other organizations referred to in 11.4.4.2, to cooperate in the programme to promote safety at, and the safe use of, the aerodrome by immediately informing it of any accidents, incidents, defects and faults which have a bearing on safety.

### 11.4.5 AERODROME OPERATOR'S INTERNAL SAFETY AUDITS AND SAFETY REPORTING

11.4.5.1 The Operator of a Certified Aerodrome shall arrange for an audit of the safety management system, including an inspection of the aerodrome facilities and equipment. The audit shall cover the Operator of a Certified Aerodrome's own functions. The Operator of a Certified Aerodrome shall also arrange for an external audit and inspection programme for evaluating other users, including fixed-base operators, ground handling agencies and other organizations working at the aerodrome as referred to in 11.4.4.2.

11.4.5.2 The audits referred to in 11.4.5.1 shall be carried out every twelve (12) months, or less, as agreed with the Authority.

11.4.5.3 The Operator of a Certified Aerodrome shall ensure that the audit reports, including the

report on the aerodrome facilities, services and equipment, are prepared by suitably qualified safety experts.

11.4.5.4 The Operator of a Certified Aerodrome shall retain a copy of the report(s) referred to in 11.4.5.3 for a period to be agreed with the Authority. The Authority may request a copy of the report(s) for its review and reference.

11.4.5.5 The report(s) referred to in 11.4.5.3 must be prepared and signed by the persons who carried out the audits and inspections.

### 11.4.6 ACCESS TO THE AERODROME

11.4.6.1 Personnel so authorized by the Authority may inspect and carry out tests on the aerodrome facilities, services and equipment, inspect the Operator of a Certified Aerodrome's documents and records and verify the Operator of a Certified Aerodrome's safety management system before the Aerodrome Certificate is granted or renewed and, subsequently, at any other time, for the purpose of ensuring safety at the aerodrome.

11.4.6.2 An Operator of a Certified Aerodrome shall, at the request of the person referred to in 11.4.6.1, allow access to any part of the aerodrome or any aerodrome facility, including equipment, records, documents and operator personnel, for the purpose referred to in 11.4.6.1.

11.4.6.3 The Operator of a Certified Aerodrome shall cooperate in conducting the activities referred to in 11.4.6.1.

### 11.4.7 NOTIFYING AND REPORTING

11.4.7.1 An Operator of a Certified Aerodrome shall adhere to the requirement to notify and report to the Authority, air traffic control and pilots within the time limits specified under 11.4.7.2 – 11.4.7.6 below.

11.4.7.2 Notification of inaccuracies in aeronautical information service (AIS) publications. An

Operator of a Certified Aerodrome shall review all Aeronautical Information Publications (AIPs), AIP Supplements, AIP Amendments, Notices to Airmen (NOTAMs), Pre-flight Information Bulletins and Aeronautical Information Circulars issued by AIS on receipt thereof and immediately after such reviews shall notify AIS of any inaccurate information contained therein that pertains to the aerodrome.

11.4.7.3 Notification of changes to the aerodrome facilities, equipment and level of service planned in advance. An Operator of a Certified Aerodrome shall notify AIS and the Authority, in writing, at least fourteen (14) days before effecting any change to the aerodrome facility or equipment or the level of service at the aerodrome that has been planned in advance and which is likely to affect the accuracy of the information contained in any AIS publication referred to in 11.4.7.2.

11.4.7.4 Issues requiring immediate notification. Subject to the requirements 11.4.7.5, an Operator of a Certified Aerodrome shall give AIS and shall arrange for air traffic control and the flight operations unit to receive immediate notice detailing any of the following circumstances of which the operator has knowledge:

(a) obstacles, obstructions and hazards:

1) any projections by an object through an obstacle limitation surface relating to the aerodrome; and

2) the existence of any obstruction or hazardous condition affecting aviation safety at or near the aerodrome;

(b) level of service:

reduction in the level of service at the aerodrome as set out in any of the AIS publications referred to in 11.4.7.2;

(c) movement area:

closure of any part of the movement area of the aerodrome; and

(d) any other condition that could affect aviation safety at the aerodrome and against which precautions are warranted.

11.4.7.5 Immediate notification to pilots. When it is not feasible for an Operator of a Certified

Aerodrome to arrange for the air traffic control and the flight operations unit to receive notice of a circumstance referred to in 11.4.7.4, the operator must give immediate notice direct to the pilots who may be affected by that circumstance.

11.4.7.6 Aerodrome accident/incident reporting and investigation

An aerodrome operator shall notify the Authority of any accident, serious incident, fatal or serious injury occurring at his aerodrome – in accordance with aerodrome operator's standard operating procedures or as soon as practicable – and provide a detailed occurrence report thereafter.

### 11.4.8 SPECIAL INSPECTIONS

An Operator of a Certified Aerodrome shall inspect an aerodrome, as circumstances require, to ensure aviation safety: as soon as practicable after any aircraft accident or incident; during any period of construction or repair of the aerodrome facilities or equipment that is critical to the safety of aircraft operation; and at any other time when there are conditions at the aerodrome that could affect aviation safety.

(a) as soon as practicable after any aircraft accident or incident; within the meaning of these terms as defined in the Civil Aviation (Aviation Accidents and Serious Incidents Investigation) Regulations 2024;

(b) during any period of construction or repair of the aerodrome facilities or equipment that is critical to the safety of aircraft operation; and

(c) at any other time when there are conditions at the aerodrome that could affect aviation safety.

### 11.4.9 REMOVAL OF OBSTRUCTIONS FROM THE AERODROME SURFACE

An Operator of a Certified Aerodrome shall remove from the aerodrome surface any vehicle or other obstruction that is likely to be hazardous to aircraft operations.

### 11.4.10 WARNING NOTICES

When low flying aircraft, at or near an aerodrome, or taxiing aircraft are likely to be hazardous to people or vehicular traffic, the Operator of a Certified Aerodrome shall:

(a) post hazard warning notices on any public way that is adjacent to the manoeuvring area; or

(b) if such a public way is not controlled by the Operator of a Certified Aerodrome, inform the authority responsible for posting the notices on the public way that there is a hazard.

**SECTION 5**

**EXEMPTIONS**

11.5.1.1 When an Operator of a Certified Aerodrome is not able to comply with any requirement, the aerodrome operator shall apply in writing for exemptions from the relevant requirements. Applicants shall provide justifications for the exemption, including any aeronautical study/ risk analysis conducted and their associated results, and where appropriate, an indication of when compliance with the current requirements can be expected.

11.5.1.2 The Authority may exempt, in writing, an Operator of a Certified Aerodrome from complying with specific provisions of these requirements or any other applicable regulations/requirements.

11.5.1.3 Before the Authority decides to exempt the Operator of a Certified Aerodrome, the Authority shall take into account all safety-related aspects.

11.5.1.4 An exemption is subject to the Operator of a Certified Aerodrome complying with the conditions and procedures specified by the Authority in the Aerodrome Certificate as being necessary in the interest of safety.

11.5.1.5 When an aerodrome does not meet the requirement in 11.1.2, the Authority may determine, after assessing the aeronautical study/risk analysis which was carried out by the applicant, the conditions and procedures that are necessary to ensure a level of safety equivalent

to that established by the relevant requirement.

11.5.1.5 Deviation from a requirement and the conditions and procedures referred to in 11.2.4 shall be set out in an endorsement on the Aerodrome Certificate.

## SECTION 6

## RENEWAL OF AERODROME CERTIFICATION

### 11.6.1 REQUIREMENT FOR THE RENEWAL OF AN AERODROME CERTIFICATE

The holder of an Aerodrome Certificate, under Civil Aviation (Aerodromes and Ground Aids) Regulations 2024, is required to renew said certificate every three years.

### 11.6.2 APPLICATION FOR THE RENEWAL OF AN AERODROME CERTIFICATE

An application for the renewal of an Aerodrome Certificate shall be submitted to the Authority, no less than 60 days prior to the expiration of the certificate in the form prescribed by the Authority (Appendix 6). The application shall include:

(a) A signed application form;

(b) A letter directed to the Director General indicating the Operator's desire to renew the Aerodrome Certificate;

(c) two copies of the Aerodrome Manuals for the aerodrome (One electronic and one printed), if content has changed since the last certification/ renewal of certificate; and

(d) any other document the Director General may deem necessary.

### 11.6.3 PROVISIONAL AERODROME CERTIFICATE

11.6.3.1 Pursuant to the Civil Aviation (Aerodromes and Ground Aids) Regulations 2024, the Director General may grant the holder of an Aerodrome Certificate a Provisional Aerodrome Certificate, if:

(a) the holder of the certificate is unable to submit to a safety inspections and audit

procedures required for a renewal of the certificate: or

(b) safety inspections and audit procedures at the aerodrome reveal that the aerodrome is not entirely in compliance with the Act.

11.6.3.2 The Provisional Aerodrome Certificate shall be non-renewable and have a validity of up to six (6) months, starting from the date of issuance.

11.6.3.3 Upon the expiration of the Provisional Aerodrome Certificate, the Aerodrome Certificate shall undergo the full certification process, described in 12.2. However, if the holder of the Aerodrome Certificate is unable to undergo the full certification process, the Director General may recall the Aerodrome Certificate.

# CHAPTER 12 – AERODROME CERTIFICATION PROCEDURES

## 12.1 INTRODUCTION

12.1.1 The procedures in this chapter refer to the requirements in Chapter 11.

## 12.2 THE CERTIFICATION PROCESS

The aerodrome certification process will comprise:

a) dealing with the expression of interest by anintending applicant for the aerodrome certificate;

b) assessing the formal application,

c) evaluation of the aerodrome manual;

d) conducting inspection of the aerodrome facilities and equipment; issuing or refusing an aerodrome certificate; and

e) promulgating the certified status of an aerodromeand the required details in the AIP.

## 12.3 DEALING WITH THE EXPRESSION OF INTEREST

12.3.1 Prior to the commencement of the formal application process, the applicant may express an interest in having an aerodrome certified under Section 11 of the Civil Aviation (Aerodromes and Ground Aids) Regulations 2024. This expression of interest shall include an assessment, by the Applicant and/or the relevant authorities, to ensure that the operation of an aerodrome at the location specified in the application will not endanger the safety of aircraft operations. If the result of this assessment is negative, then there is no need to proceed any further, and the applicant will be advised accordingly by invoking 11.2.3.3 at this initial stage.

12.3.2 The assessment will take into consideration the proximity of the aerodrome to other aerodromes and landing sites, including military aerodromes; obstacles and terrain; any excessive operational restriction requirements; any existing restrictions and controlled airspace; and any existing instrument procedures.

12.3.3 The processing of the expression of interest shall also include referrals to those competent State entities for their clearance with the necessary documentation, e.g. an environmental impact study carried out by the applicant, approval from the Central Housing and Planning Authority, etc.

12.3.4 If the results of the above assessment be positive, the Authority shall advise the applicant in writing to:

(a) submit a formal application for an aerodrome certificate in accordance with the requirements of 11.2.2. The Authority shall provide the applicant with the prescribed application form, a copy ofthe aerodrome certification requirements, and any other relevant circular or publication that the Authority may have issued; and

(b) obtain copies of other State entities other than the Authority.

12.3.5 In the letter to the applicant, the contact person in the Authority will be indicated.

## 12.4 ASSESSMENT OF A FORMAL APPLICATION FOR AN AERODROME CERTIFICATE

12.4.1 Requirement 11.2.3.2 specifies the responsibilities of the Authority before it can grant an aerodrome certificate. It specifies the requirements for aerodrome certification and the need for operational safety considerations. The Authority must be satisfied that the applicant for an Aerodrome Certificate has the necessary competence and experience to comply with the relevant regulatory provisions, orders and directives of the Authority.

12.4.2 Applicants are required to use the prescribed certification application form in Appendix 7.

12.4.3 The assessment by the Authority of the formal application shall include the following:

(a) an assessment, if that was not carried out during the time of dealing with the expression of interest. This assessment shall also include an aeronautical study pursuant to 11.5.1.5 if there is a deviation from a requirement;

(b) an assessment of the aerodrome manual submitted by the applicant to determine whether:

(1) the manual complies with the requirements in Section 4, (see Appendix 6). All verifications that can be completed or initiated in the office should be carried out, including the aerodrome data to be published by the aeronautical information service, and the adequacy of the aerodrome operating procedures; and

(2) the management system, including the safety management system, indicates that the applicant will be able to operate and maintain the aerodrome properly; and

(3) a site visit as detailed in 12.4.4.

12.4.4 A site visit shall be undertaken for the purpose of assessing the aerodrome facilities, services and equipment to verify and ensure that they comply with the specified standards and practices. This shall include:

(a) on-site verification of aerodrome data; and

(b) the checking of aerodrome facilities and equipment, which shall include:

1) dimensions and surface conditions of: runway(s);

- runway shoulders;
- runway strip(s);
- runway end safety areas;
- stopway(s) and clearways;
- taxiway(s);
- taxiway shoulders;
- taxiway strips; and
- aprons;

2) the presence of obstacles in obstacle limitation surfaces at and in the vicinity of the aerodrome;

3) the following aeronautical ground lights, including their flight check records:

- runway and taxiway lighting;

- approach lights;
- PAPI/APAPI
- apron floodlighting;
- obstacle lighting;
- pilot-activated lighting, if applicable; and
- visual docking guidance systems;

(4) standby power;

(5) wind direction indicator(s);

(6) illumination of the wind direction indicator(s);

(7) aerodrome markings and markers;

(8) signs in the movement areas;

(9) tie-down points for aircraft;

(10) ground earthing points;

(11) rescue and fire-fighting equipment and installations;

(12) aerodrome maintenance equipment, particularly for the airside facilities maintenance including runway surface friction measurement;

(13) runway sweepers and snow removal equipment;

(14) disabled aircraft removal equipment;

(15) wildlife management procedures and equipment;

(16) two-way radios installed in vehicles for use by the Operator of a Certified Aerodrome in the movement area;

(17) the presence of lights that may endanger the safety of aircraft; and

(18) fueling facilities.

## 12.5 THE GRANT OR REFUSAL OF A CERTIFICATE

12.5.1 Pursuant to 11.2.3 the Authority is required to notify its decision to issue or refuse to issue a certificate. Subsection 11.2.4 allows the Authority to endorse conditions, in the interest of safety, on an aerodrome certificate being issued.

12.5.2 Based on the results of the assessment of the formal application for a certificate, the

Authority shall notify the applicant whether the application was successful or unsuccessful. If the application was unsuccessful, the applicant will be advised of the additional steps thatneed to be taken by the applicant prior to certification. For example, the aerodrome manual may need to be amended to incorporate any changes to the aerodrome facilities and equipment that may be required in order to comply with requirements of Chapters 1 to 10.

12.5.3 If the application was successful, the aerodrome certificate, incorporating conditions pursuant 11.2.4 or 11.5.1.5, as applicable, shall be grantedto the applicant after an identifying number has been allocated.

12.5.4 If after being advised of the additional steps that must be taken to rectify the shortcomings referred to in 12.5.2, the Operator of a Certified Aerodrome is still not able to satisfy the requirements, the Authority may refuse to grant a certificate. The refusal may be based on one or more of the following determinations, for which details shall be given:

(a) the inspection of aerodrome facilities and equipment revealed that they do not make satisfactory provision for the safety of aircraft operations;

(b) the assessment of the aerodrome operating procedures revealed that they do not make satisfactory provision for the safety of aircraft operations; and

(c) the assessment of the aerodrome manual revealed that it does not contain the particulars set out in 11.3.1.

In the letter of refusal, the applicant's attention shall be drawn to the review process, as is provided for Section 73 of the Civil Aviation Act 2018.

**Costs**

12.6.6 Guyana requires the applicant to bear all costs associated with the certification of the aerodrome.

## 12.6 PROMULGATION IN THE AIP OF THE CERTIFIED STATUS AND DETAILS OF THE AERODROME

Upon satisfactory completion of the certification process, information about the aerodrome shall be provided to the aeronautical information service (AIS) for publication, within fourteen (14) days.

## 12.7 TRANSFER OF AN AERODROMECERTIFICATE

12.7.1 Transfer of an aerodrome certificate may be required in accordance with Civil Aviation (Aerodromes and Ground Aids) Regulation 2024 when the ownership and the operation of the aerodrome are transferred from one operator to another.

12.7.2 The reasons for a transfer may include the sale or transfer of the responsibility to operate the aerodrome from a government department to a government-constituted aerodrome entity, such as an airport authority or a provincial or municipal administration, or as a result of privatization or corporatization. The ownership and the operational responsibility may also change from one privateentity to another.

12.7.3 Requirement 11.2.7.1 specifies, inter alia, the requirement for the Authority's consent for the transfer of an aerodrome certificate and for the powers to transfer a certificate to be vested in the Authority. Consent to transfer will be given by the Authority only if it is satisfied that the proposed transferee will be able to operate and maintain the aerodrome properly and that no significant variation will occur in the day-to-day operations of the aerodrome. This implies that the aerodrome facilities, services and equipment should remain substantially unaltered; key aerodrome operational and maintenance personnel should remain in position or be replaced with staff of equivalent qualifications, experience or skill level; the safety management system should remain effective and, finally, the aerodrome manual procedures should remain substantially unaltered.

12.7.4 Consent to the proposed transfer may be refusedif the Authority is not satisfied that the proposed transferee will be able to operate and maintain the aerodrome properly orif significant changes to the operational aspects of the aerodrome will result or will be made by the transferee (e.g. reduction in runway, taxiway or apron facilities; changes inthe conditions of the existing

certificate unacceptable to the Authority; inadequacy or inappropriateness of the new staffing arrangements or significant revisions to the aerodrome manual).

12.7.5 If the Authority decides to deny consent, it will advise the transferee, in writing, within the period specifiedin 11.2.7.2 stating the reasons for denial.

## 12.8 SURRENDER OF AN AERODROME CERTIFICATE

12.8.1 Requirement 11.2.6.1 and 11.2.6.2 provide for the cancellation of an aerodrome certificate if an Operator of a Certified Aerodrome voluntarily gives notice in writing to the Authority.

12.8.2 Upon receipt of the notice, the Authority will:

(a) verify the credentials of the operator requesting cancellation as the certificate holder;

(b) verify that the notification received from theOperator of a Certified Aerodrome meets the requirements of 11.2.6.1 and 11.2.6.2; and

(c) check that the information provided by the Operator of a Certified Aerodrome includes the following:

(1) if the aerodrome is to remain open, an appropriate NOTAM has been promulgated to advise the change of status; and

(2) if the aerodrome is to be closed to all traffic, sufficient safety measures have been taken by the Operator of a Certified Aerodrome, such as the removal of windsocks and markings, the provision of appropriate closed markings, unserviceabilitymarkers and such other visual aids as necessary.

12.8.3 If the application for cancellation of the certificate is found to be in order, a competent official of the Authority will issue a letter cancelling the certificateeffective from the date specified in the notice given by the certificate holder.

12.8.4 If the aerodrome is to remain open for use as an uncertified aerodrome, the Authority will ensure that the safety requirements at such aerodromes are met.

12.8.5 The aeronautical information service shall be advised to take appropriate action regarding the uncertified status of the aerodrome or the closure of the aerodrome, as the case may be, in accordance with Sub-section 9.2.3 a) of the Guyana Civil Aviation Authority Requirements for Aeronautical Information Services, 2024.

## 12.9 RENEWAL OF AN AERODROME CERTIFICATE

The renewal of an aerodrome certification process will comprise:

(a) Request for the renewal of the aerodrome certificate;

(b) Review of the operations manuals and procedures;

(c) Inspection of the aerodrome facilities and services for the renewal of the certificate; and

(d) Renewal of the aerodrome certificate.

# APPENDIX 1. COLOURS FOR AERONAUTICAL GROUND LIGHTS, MARKINGS, SIGNS AND PANELS

## 1. GENERAL

Introductory Note.— The following specifications define the chromaticity limits of colours to be used for aeronautical ground lights, markings, signs and panels. The specifications are in accord with the 1983 specifications of the International Commission on Illumination (CIE), except for the colour orange in Figure A1-2. It is not possible to establish specifications for colours such that there is no possibility of confusion. For reasonably certain recognition, it is important that the eye illumination be well above the threshold of perception, that the colour not be greatly modified by selective atmospheric attenuations and that the observer's colour vision be adequate. There is also a risk of confusion of colour at an extremely high level of eye illumination such as may be obtained from a high-intensity source at very close range. Experience indicates that satisfactory recognition can be achieved if due attention is given to these factors.

The chromaticities are expressed in terms of the standard observer and coordinate system adopted by the International Commission on Illumination (CIE) at its Eighth Session at Cambridge, England, in 1931.*

The chromaticities for solid state lighting (e.g. LED) are based upon the boundaries given in the standard S 004/E-2001 of the International Commission on Illumination (CIE), except for the blue boundary of white.

## 2. COLOURS FOR AERONAUTICAL GROUND LIGHTS

### 2.1 Chromaticities for lights having filament-type light sources

2.1.1 The chromaticities of aeronautical ground lights with filament-type light sources shall be within the following boundaries:
CIE Equations (see Figure A1-1a):

a) Red

| | |
|---|---|
| Purple boundary | $y = 0.980 - x$ |
| Yellow boundary | $y = 0.335$, except for visual approach slope indicator systems |
| Yellow boundary | $y = 0.320$, for visual approach slope indicator systems |

Note.— See 5.3.5.15 and 5.3.5.31.

b) Yellow

| | |
|---|---|
| Red boundary | $y = 0.382$ |
| White boundary | $y = 0.790 - 0.667x$ |
| Green boundary | $y = x - 0.120$ |

* See CIE Publication No. 15, Colorimetry (1971).

c) Green

| | |
|---|---|
| Yellow boundary | $x = 0.360 - 0.080y$ |
| White boundary | $x = 0.650y$ |
| Blue boundary | $y = 0.390 - 0.171x$ |

d) Blue

| | |
|---|---|
| Green boundary | $y = 0.805x + 0.065$ |
| White boundary | $y = 0.400 - x$ |
| Purple boundary | $x = 0.600y + 0.133$ |

e) White

| | |
|---|---|
| Yellow boundary | $x = 0.500$ |
| Blue boundary | $x = 0.285$ |
| Green boundary | $y = 0.440$ and $y = 0.150 + 0.640x$ |
| Purple boundary | $y = 0.050 + 0.750x$ and $y = 0.382$ |

f) Variable white

| | |
|---|---|
| Yellow boundary | $x = 0.255 + 0.750y$ and $y = 0.790 – 0.667x$ |
| Blue boundary | $x = 0.285$ |
| Green boundary | $y = 0.440$ and $y = 0.150 + 0.640x$ |
| Purple boundary | $y = 0.050 + 0.750x$ and $y = 0.382$ |

Note.— Guidance on chromaticity changes resulting from the effect of temperature on filtering elements is given in the Aerodrome Design Manual (Doc 9157), Part 4.

2.1.2 Where dimming is not required, or where observers with defective colour vision must be able to determine the colour of the light, green signals shall be within the following boundaries:

| | |
|---|---|
| Yellow boundary | $y = 0.726 – 0.726x$ |
| White boundary | $x = 0.650y$ |
| Blue boundary | $y = 0.390 – 0.171x$ |

Note.— Where the colour signal is to be seen from long range, it has been the practice to use colours within the boundaries of 2.1.2.

2.1.3 Where increased certainty of recognition from white is more important than maximum visual range, green signals shall be within the following boundaries:

| | |
|---|---|
| Yellow boundary | $y = 0.726 – 0.726x$ |
| White boundary | $x = 0.625y – 0.041$ |
| Blue boundary | $y = 0.390 – 0.171x$ |

## 2.2 DISCRIMINATION BETWEEN LIGHTS HAVING FILAMENT-TYPE SOURCES

2.2.1 If there is a requirement to discriminate yellow and white from each other, they shall be displayed in close proximity of time or space as, for example, by being flashed successively from the same beacon.

2.2.2 If there is a requirement to discriminate yellow from green and/or white, as for example on exit taxiway centre line lights, the y coordinates of the yellow light shall not exceed a value of

0.40.

Note.— The limits of white have been based on the assumption that they will be used in situations in which the characteristics (colour temperature) of the light source will be substantially constant.

2.2.3 The colour variable white is intended to be used only for lights that are to be varied in intensity, e.g. to avoid dazzling. If this colour is to be discriminated from yellow, the lights shall be so designed and operated that:

a) the x coordinate of the yellow is at least 0.050 greater than the x coordinate of the white; and

b) the disposition of the lights will be such that the yellow lights are displayed simultaneously and in close proximity to the white lights.

## 2.3 Chromaticities for lights having a solid state light source

2.3.1 The chromaticities of aeronautical ground lights with solid state light sources, e.g. LEDs, shall be within the following boundaries:

CIE Equations (see Figure A1-1b):

a) Red

| | |
|---|---|
| Purple boundary | $y = 0.980 - x$ |
| Yellow boundary | $y = 0.335$, except for visual approach slope indicator systems |
| Yellow boundary | $y = 0.320$, for visual approach slope indicator systems |

Note.— See 5.3.5.15 and 5.3.5.31.

b) Yellow

| | |
|---|---|
| Red boundary | $y = 0.387$ |
| White boundary | $y = 0.980 - x$ |
| Green boundary | $y = 0.727x + 0.054$ |

c) Green (also refer to 2.3.2 and 2.3.3)

| | |
|---|---|
| Yellow boundary | $x = 0.310$ |
| White boundary | $x = 0.625y - 0.041$ |
| Blue boundary | $y = 0.400$ |

d) Blue

| | |
|---|---|
| Green boundary | $y = 1.141x - 0.037$ |
| White boundary | $y = 0.400 - y$ |
| Purple boundary | $x = 0.134 + 0.590y$ |

e) White

| | |
|---|---|
| Yellow boundary | $x = 0.440$ |
| Blue boundary | $x = 0.320$ |
| Green boundary | $y = 0.150 + 0.643x$ |
| Purple boundary | $y = 0.050 + 0.757x$ |

f) Variable white

The boundaries of variable white for solid state light sources are those of e) White above.

2.3.2 Where observers with defective colour vision must be able to determine the colour of the light, green signals shall be within the following boundaries:

| | |
|---|---|
| Yellow boundary | $y = 0.726 - 0.726x$ |
| White boundary | $x = 0.625y - 0.041$ |
| Blue boundary | $y = 0.400$ |

2.3.3 In order to avoid a large variation of shades of green, if colours within the boundaries below are selected, colours within the boundaries of 2.3.2 shall not be used.

| | |
|---|---|
| Yellow boundary | $x = 0.310$ |
| White boundary | $x = 0.625y - 0.041$ |
| Blue boundary | $y = 0.726 - 0.726x$ |

**2.4 Colour measurement for filament-type and solid state-type light sources**

2.4.1 The colour of aeronautical ground lights shall be verified as being within the boundaries specified in Figure A1-1a or A1-1b, as appropriate, by measurement at five points within the area limited by the innermost isocandela curve (isocandela diagrams in Appendix 2 refer), with operation at rated current or voltage. In the case of elliptical or circular isocandela curves, the colour measurements shall be taken at the centre and at the horizontal and vertical limits. In the case of rectangular isocandela curves, the colour measurements shall be taken at the centre and the limits of the diagonals (corners). In addition, the colour of the light shall be checked at the outermost isocandela curve to ensure that there is no colour shift that might cause signal confusion to the pilot.

Note 1.— For the outermost isocandela curve, a measurement of colour coordinates should be made and recorded for review and judgement of acceptability by the Authority.

Note 2.— Certain light units may have application so that they may be viewed and used by pilots from directions beyond that of the outermost isocandela curve (e.g. stop bar lights at significantly wide runway-holding positions).

2.4.2 In the case of visual approach slope indicator systems and other light units having a colour transition sector, the colour shall be measured at points in accordance with 2.4.1, except that the colour areas shall be treated separately and no point shall be within 0.5 degrees of the transition sector.

## 3. COLOURS FOR MARKINGS, SIGNS AND PANELS

Note 1.— The specifications of surface colours given below apply only to freshly coloured surfaces. Colours used for markings, signs and panels usually change with time and therefore require renewal.

Note 2.— Guidance on surface colours is contained in the CIE document entitled Recommendations for Surface Colours for Visual Signalling — Publication No. 39-2 (TC-106) 1983.

Note 3.— The specifications recommended in 3.4 for transilluminated panels are interim in nature and are based on the CIE specifications for transilluminated signs. It is intended that these specifications will be reviewed and updated as and when CIE develops specifications for transilluminated panels.

3.1 The chromaticities and luminance factors of ordinary colours, colours of retroreflective materials and colours of transilluminated (internally illuminated) signs and panels shall be determined under the following standard conditions:

(a) angle of illumination: 45°;

(b) direction of view: perpendicular to surface; and

(c) illuminant: CIE standard illuminant D65.

3.2 The chromaticity and luminance factors of ordinary colours for markings and externally illuminated signs and panels shall be within the following boundaries when determined under standard conditions.

CIE Equations (see Figure A1-2):

| | |
|---|---|
| a) Red | |
| Purple boundary | $y = 0.345 - 0.051x$ |
| White boundary | $y = 0.910 - x$ |
| Orange boundary | $y = 0.314 + 0.047x$ |
| Luminance factor | $ß = 0.07$ (mnm) |
| | |
| b) Orange | |
| Red boundary | $y = 0.285 + 0.100x$ |
| White boundary | $y = 0.940 - x$ |
| Yellow boundary | $y = 0.250 + 0.220x$ |
| Luminance factor | $ß = 0.20$ (mnm) |

c) Yellow

| | |
|---|---|
| Orange boundary | $y = 0.108 + 0.707x$ |
| White boundary | $y = 0.910 - x$ |
| Green boundary | $y = 1.35x - 0.093$ |
| Luminance factor | ß = 0.45 (mnm) |

d) White

| | |
|---|---|
| Purple boundary | $y = 0.010 + x$ |
| Blue boundary | $y = 0.610 - x$ |
| Green boundary | $y = 0.030 + x$ |
| Yellow boundary | $y = 0.710 - x$ |
| Luminance factor | ß = 0.75 (mnm) |

e) Black

| | |
|---|---|
| Purple boundary | $y = x - 0.030$ |
| Blue boundary | $y = 0.570 - x$ |
| Green boundary | $y = 0.050 + x$ |
| Yellow boundary | $y = 0.740 - x$ |
| Luminance factor | ß = 0.03 (max) |

f) Yellowish green

| | |
|---|---|
| Green boundary | $y = 1.317x + 0.4$ |
| White boundary | $y = 0.910 - x$ |
| Yellow boundary | $y = 0.867x + 0.4$ |

g) Green

| | | | |
|---|---|---|---|
| Yellow boundary | $x = 0.313$ | | |
| White boundary | $y = 0.243 + 0.670x$ | | |
| Blue boundary | $y = 0.493 - 0.524x$ | Luminance factor | $\beta = 0.10$ (mnm) |

Note.— The small separation between surface red and surface orange is not sufficient to ensure

the distinction of these colours when seen separately.

3.3 The chromaticity and luminance factors of colours of retroreflective materials for markings, signs and panels shall be within the following boundaries when determined under standard conditions.

CIE Equations (see Figure A1-3):

| | |
|---|---|
| a) Red | |
| Purple boundary | $y = 0.345 - 0.051x$ |
| White boundary | $y = 0.910 - x$ |
| Orange boundary | $y = 0.314 + 0.047x$ |
| Luminance factor | ß = 0.03 (mnm) |
| b) Orange | |
| Red boundary | $y = 0.265 + 0.205x$ |
| White boundary | $y = 0.910 - x$ |
| Yellow boundary | $y = 0.207 + 0.390x$ |
| Luminance factor | ß = 0.14 (mnm) |
| c) Yellow | |
| Orange boundary | $y = 0.160 + 0.540x$ |
| White boundary | $y = 0.910 - x$ |
| Green boundary | $y = 1.35x - 0.093$ |
| Luminance factor | ß = 0.16 (mnm) |
| d) White | |
| Purple boundary | $y = x$ |
| Blue boundary | $y = 0.610 - x$ |
| Green boundary | $y = 0.040 + x$ |
| Yellow boundary | $y = 0.710 - x$ |
| Luminance factor | ß = 0.27 (mnm) |
| e) Blue | |
| Green boundary | $y = 0.118 + 0.675x$ |

| | |
|---|---|
| White boundary | y = 0.370 – x |
| Purple boundary | y = 1.65x – 0.187 |
| Luminance factor | ß = 0.01 (mnm) |

f) Green

| | | |
|---|---|---|
| Yellow boundary | y = 0.711 – 1.22x | |
| White boundary | y = 0.243 + 0.670x | |
| Blue boundary | y = 0.405 – 0.243x Luminance factor | ß = 0.03 (mnm) |

3.4 The chromaticity and luminance factors of colours for luminescent or transilluminated (internally illuminated) signs and panels shall be within the following boundaries when determined under standard conditions.

CIE Equations (see Figure A1-4):

a) Red

| | |
|---|---|
| Purple boundary | y = 0.345 – 0.051x |
| White boundary | y = 0.910 – x |
| Orange boundary | y = 0.314 + 0.047x |
| Luminance factor | ß = 0.07 (mnm) |
| (day condition) | |
| Relative luminance | 5% (mnm) |
| to white (night condition) | 20% (max) |

b) Yellow

| | |
|---|---|
| Orange boundary | y = 0.108 + 0.707x |
| White boundary | y = 0.910 – x |
| Green boundary | y = 1.35x – 0.093 |
| Luminance factor | ß = 0.45 (mnm) |
| (day condition) | |
| Relative luminance | 30% (mnm) |

| | |
|---|---|
| to white (night condition) | 80% (max) |
| c) White | |
| Purple boundary | y = 0.010 + x |
| Blue boundary | y = 0.610 – x |
| Green boundary | y = 0.030 + x |
| Yellow boundary | y = 0.710 – x |
| Luminance factor (day condition) | ß = 0.75 (mnm) |
| Relative luminance to white (night condition) | 100% |
| d) Black | |
| Purple boundary | y = x – 0.030 |
| Blue boundary | y = 0.570 – x |
| Green boundary | y = 0.050 + x |
| Yellow boundary | y = 0.740 – x |
| Luminance factor (day condition) | ß = 0.03 (max) |
| Relative luminance to white (night condition) | 0% (mnm)<br>2% (max) |

| | |
|---|---|
| e) Green | |
| Yellow boundary : | x = 0.313 |
| White boundary: | y = 0.243 + 0.670x |
| Blue boundary: | y = 0.493 – 0.524x |
| Luminance factor: | β = 0.10 minimum (day Conditions) |
| Relative luminance: | 5% (minimum) |
| to white (night | 30% (maximum) conditions) |

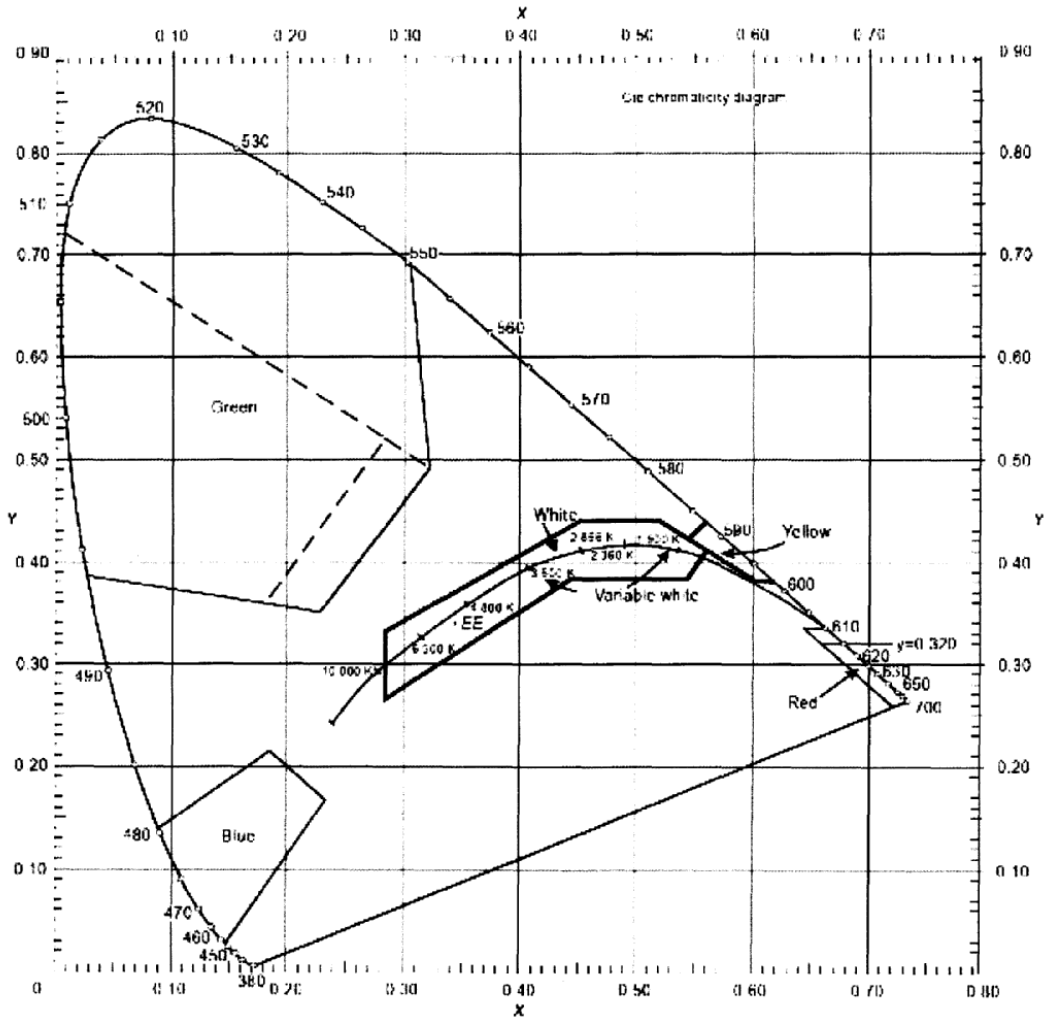



**Figure A1-1a. Colours for aeronautical ground lights (filament-type lamps)**

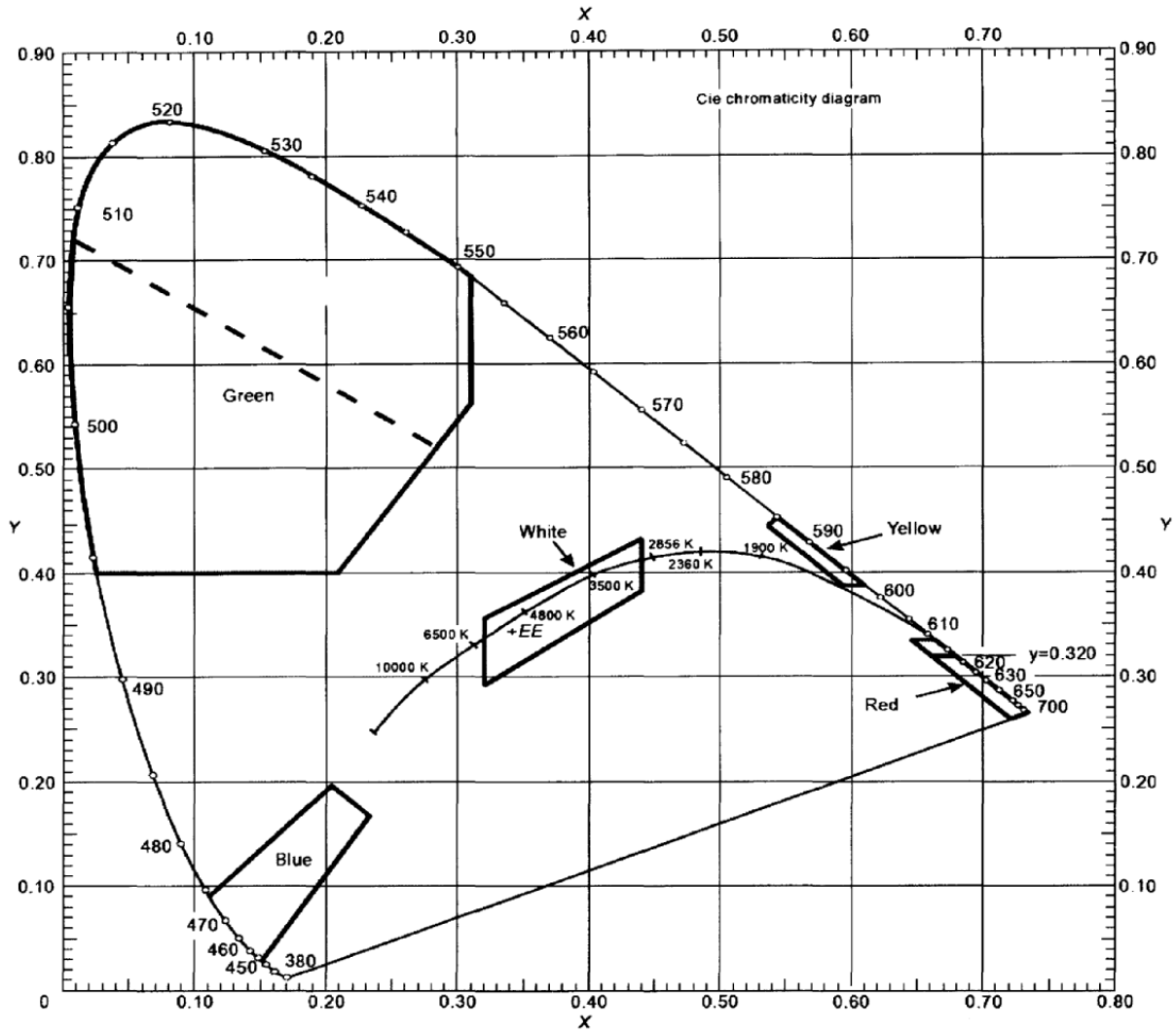



**Figure A1-1b. Colours for aeronautical ground lights (solid state lighting)**

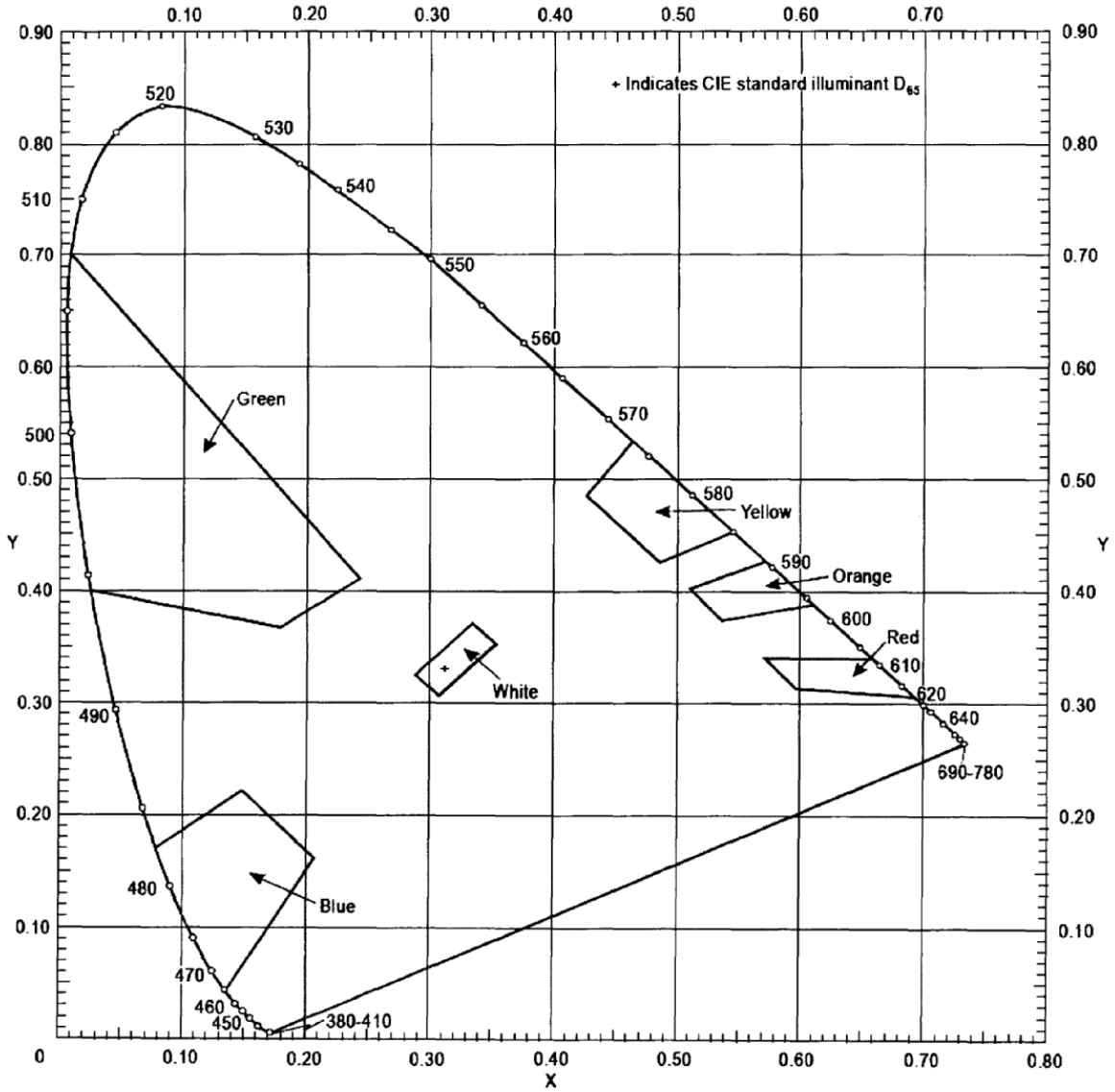



**Figure A1-2. Ordinary colours for markings and externally illuminated signs and panels**

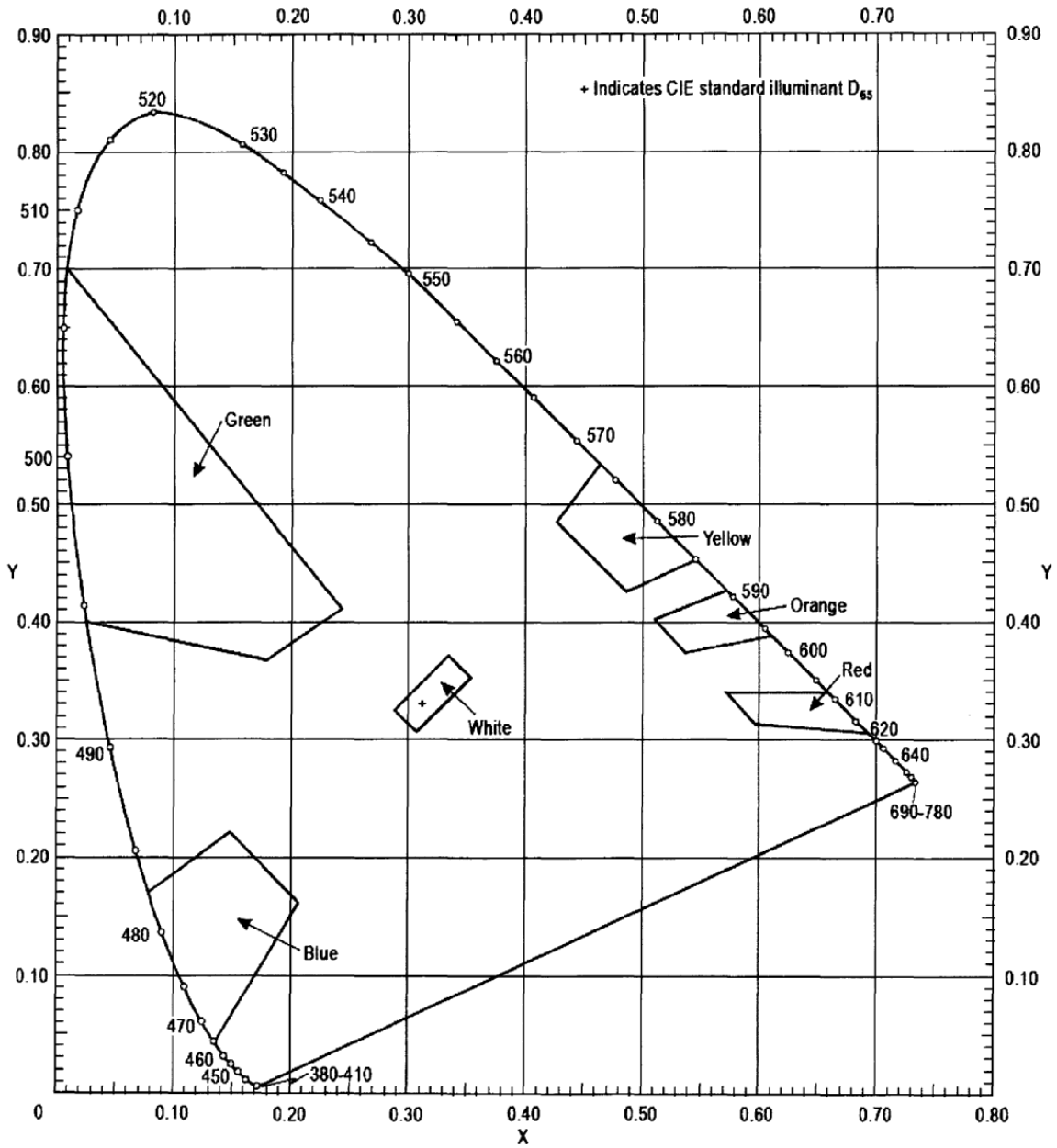



**Figure A1-3. Colours of retroreflective materials for markings, signs and panels**

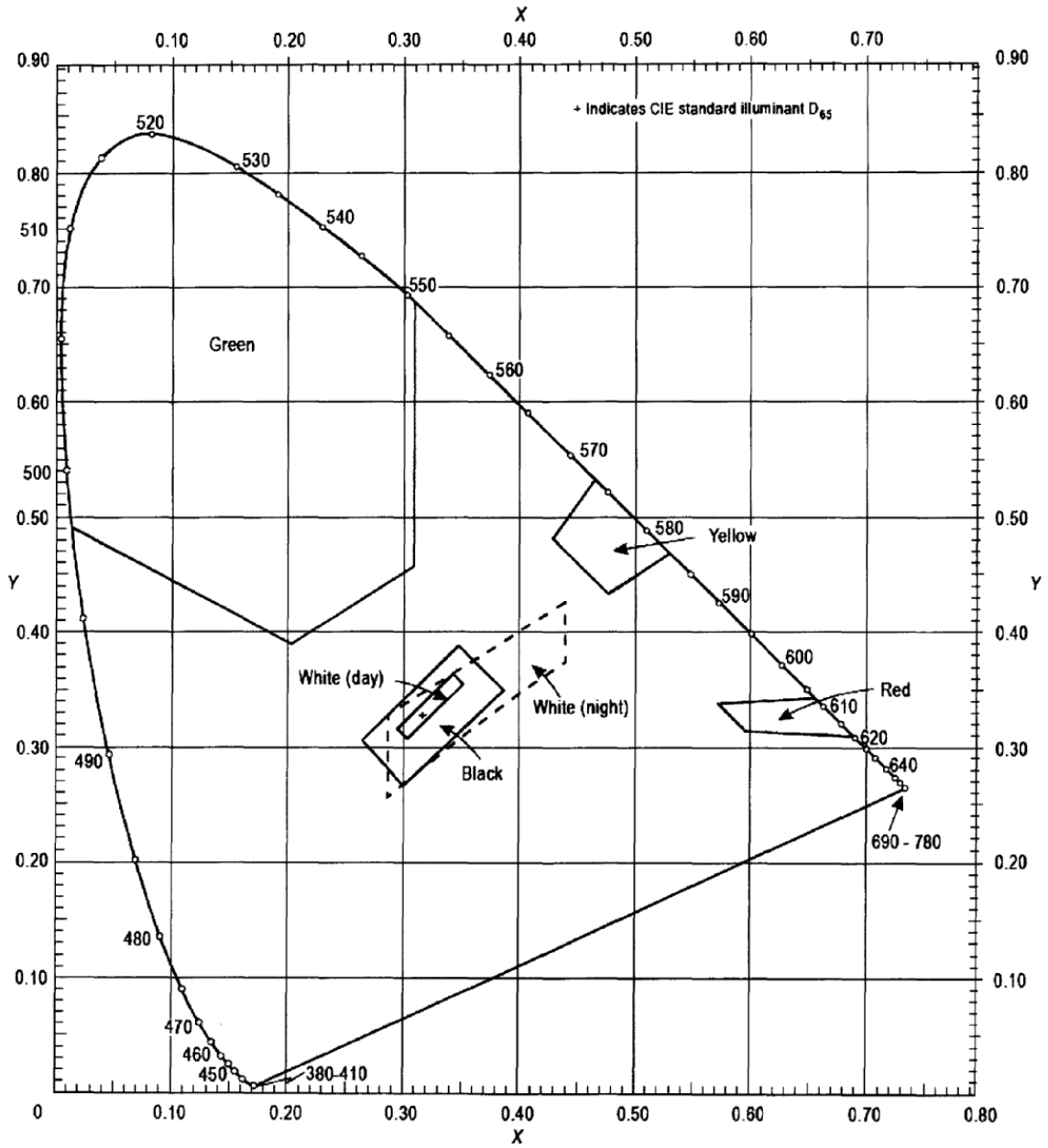
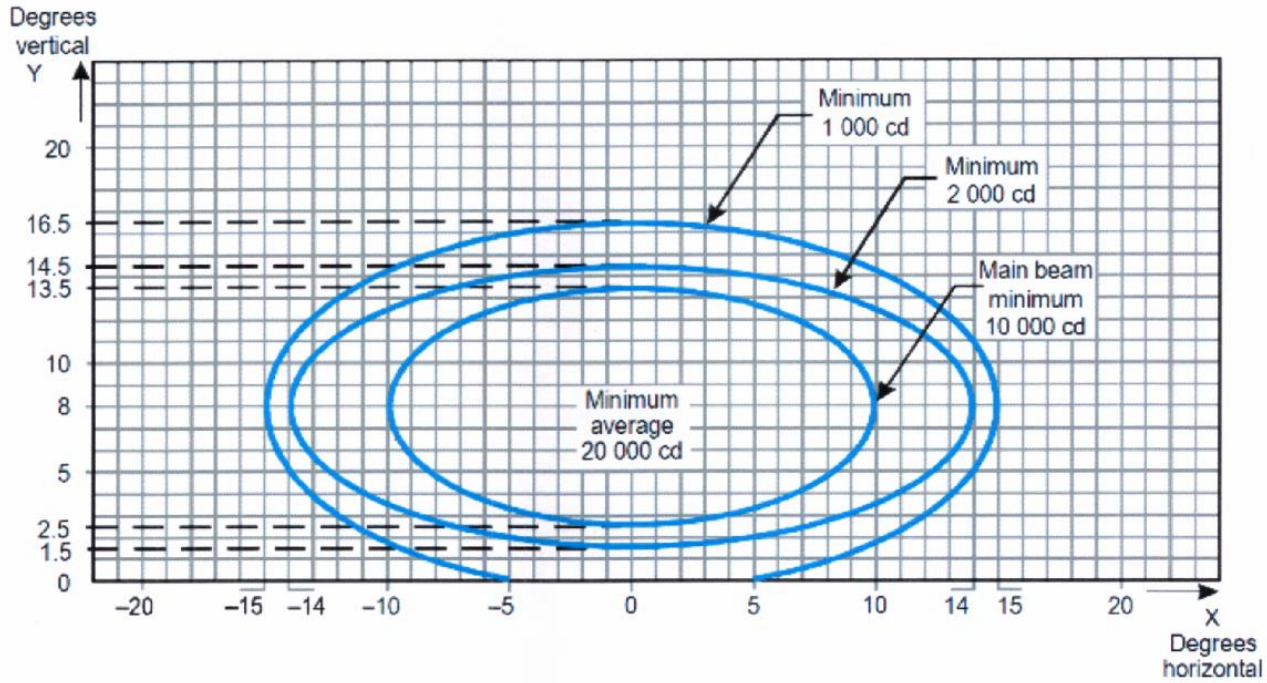



**Figure A1-4. Colours of luminescent or transilluminated (internally illuminated) signs and panels**

## APPENDIX 2. AERONAUTICAL GROUND LIGHT CHARACTERISTICS




Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 10 | 14 | 15 |
| b | 5.5 | 6.5 | 8.5 |

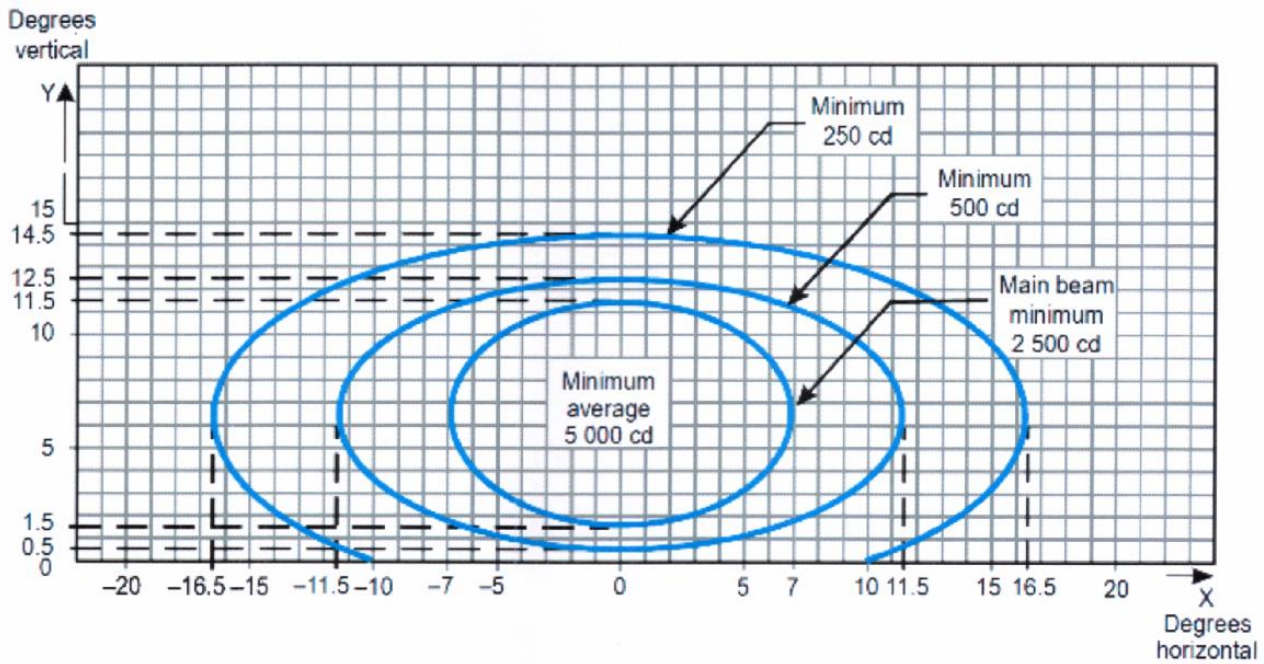
2. Vertical setting angles of the lights shall be such that the following vertical coverage of the main beam will be met:

| distance from threshold | vertical main beam coverage |
|---|---|
| threshold to 315 m | 0° — 11° |
| 316 m to 475 m | 0.5° — 11.5° |
| 476 m to 640 m | 1.5° — 12.5° |
| 641 m and beyond | 2.5° — 13.5° (as illustrated above) |

3. Lights in crossbars beyond 22.5 m from the centre line shall be toed-in 2 degrees. All other lights shall be aligned parallel to the centre line of the runway.

4. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-1. Isocandela diagram for approach centre line light and crossbars (white light)**




Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 7.0 | 11.5 | 16.5 |
| b | 5.0 | 6.0 | 8.0 |

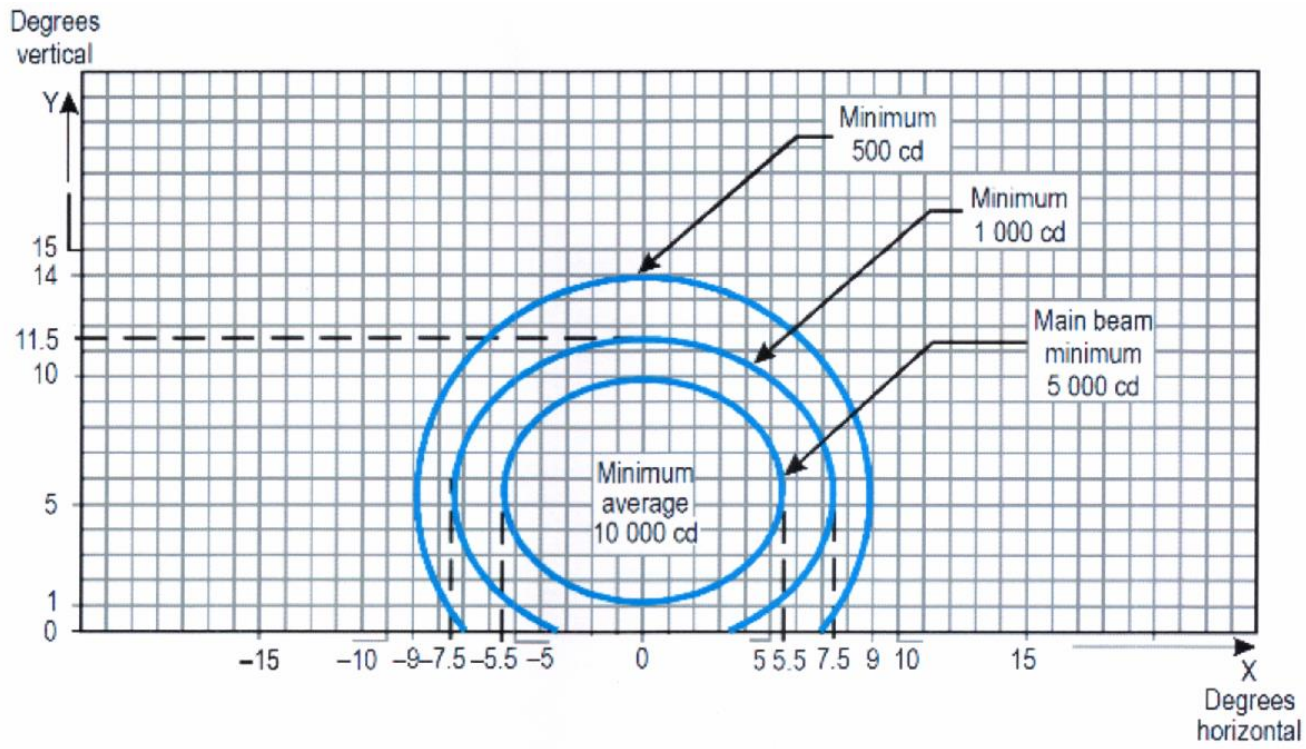
2. Toe-in 2 degrees

3. Vertical setting angles of the lights shall be such that the following vertical coverage of the main beam will be met:

| distance from threshold | vertical main beam coverage |
|---|---|
| threshold to 115 m | 0.5° — 10.5° |
| 116 m to 215 m | 1° — 11° |
| 216 m and beyond | 1.5° — 11.5° (as illustrated above) |

4. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-2. Isocandela diagram for approach side row light (red light)**



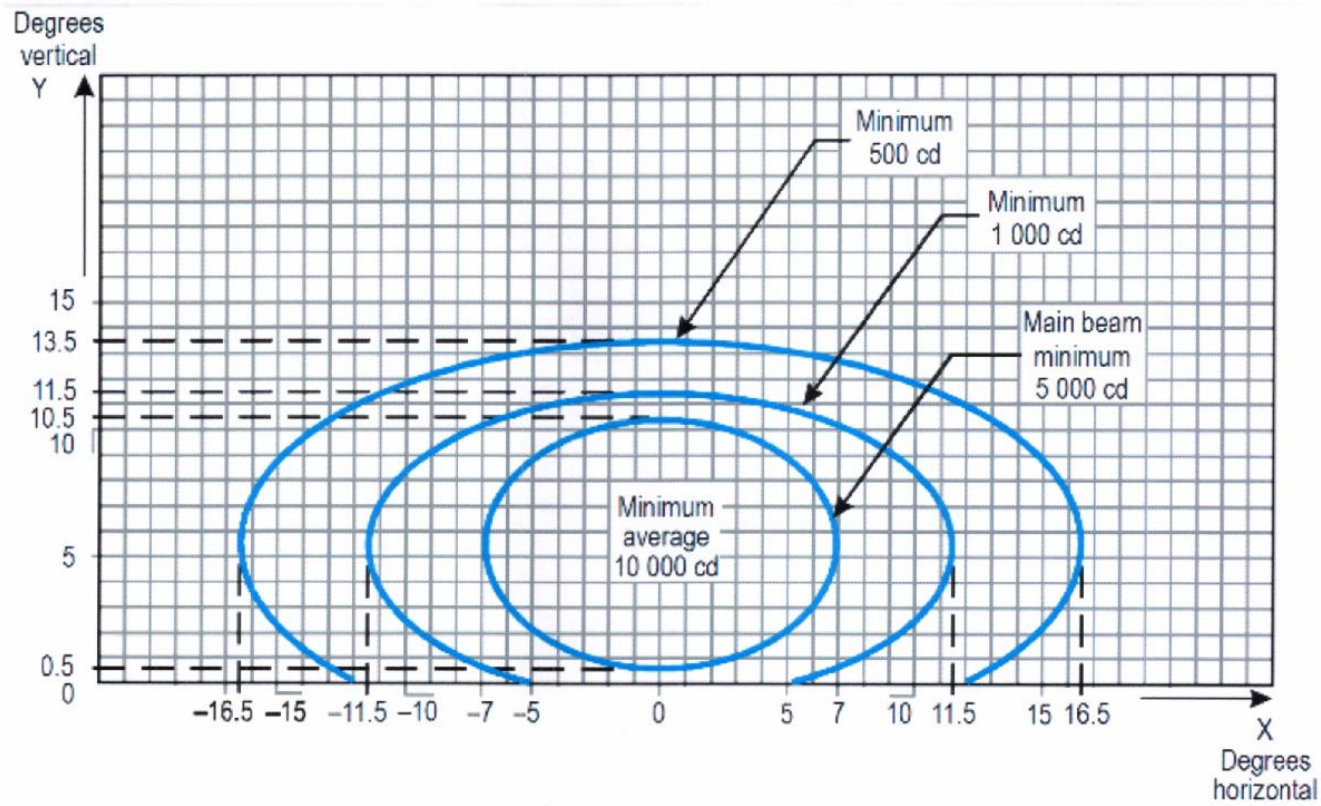

Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 5.5 | 7.5 | 9.0 |
| b | 4.5 | 6.0 | 8.5 |

2. Toe-in 3.5 degrees
3. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-3. Isocandela diagram for threshold light (green light)**




Notes:

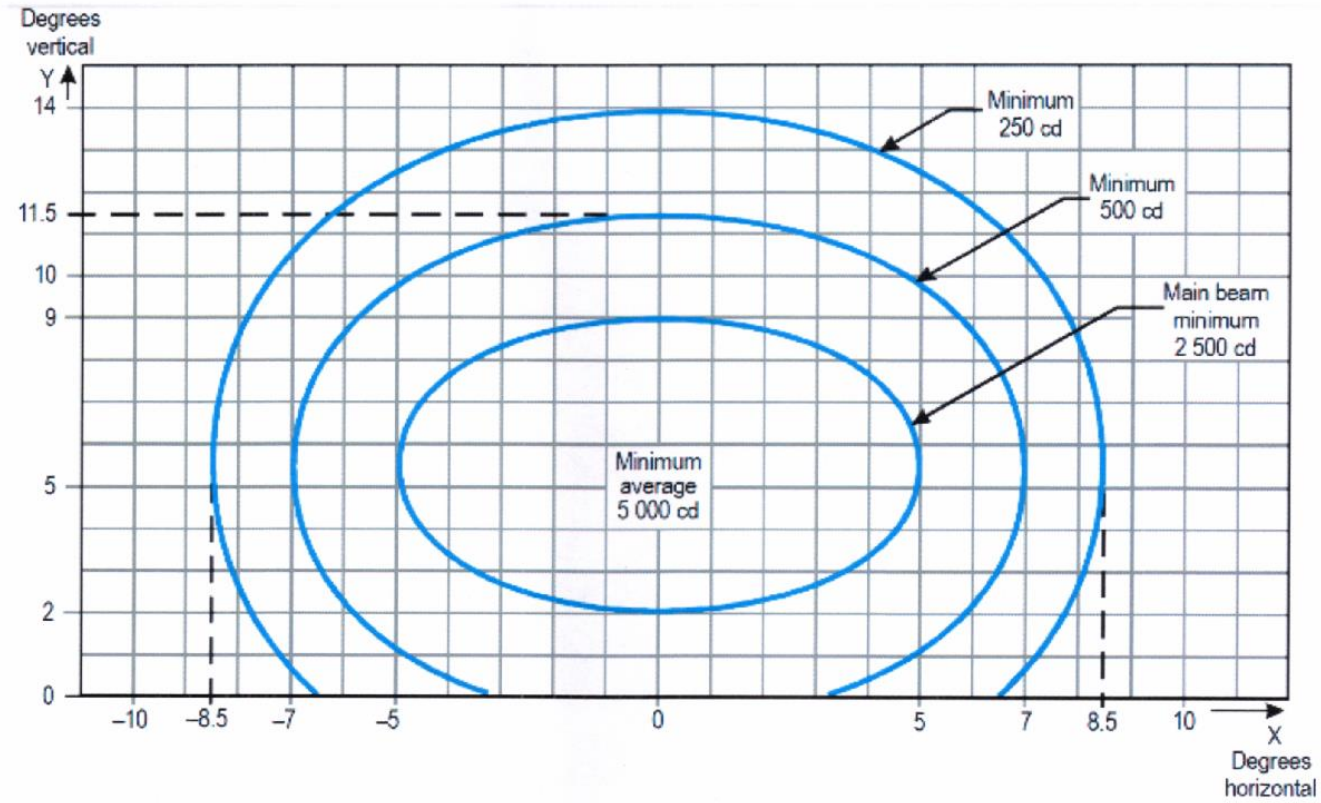
1. Curves calculated on formula. $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 7.0 | 11.5 | 16.5 |
| b | 5.0 | 6.0 | 8.0 |

2. Toe-in 2 degrees

3. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-4. Isocandela diagram for threshold wing bar light (green light)**




Note

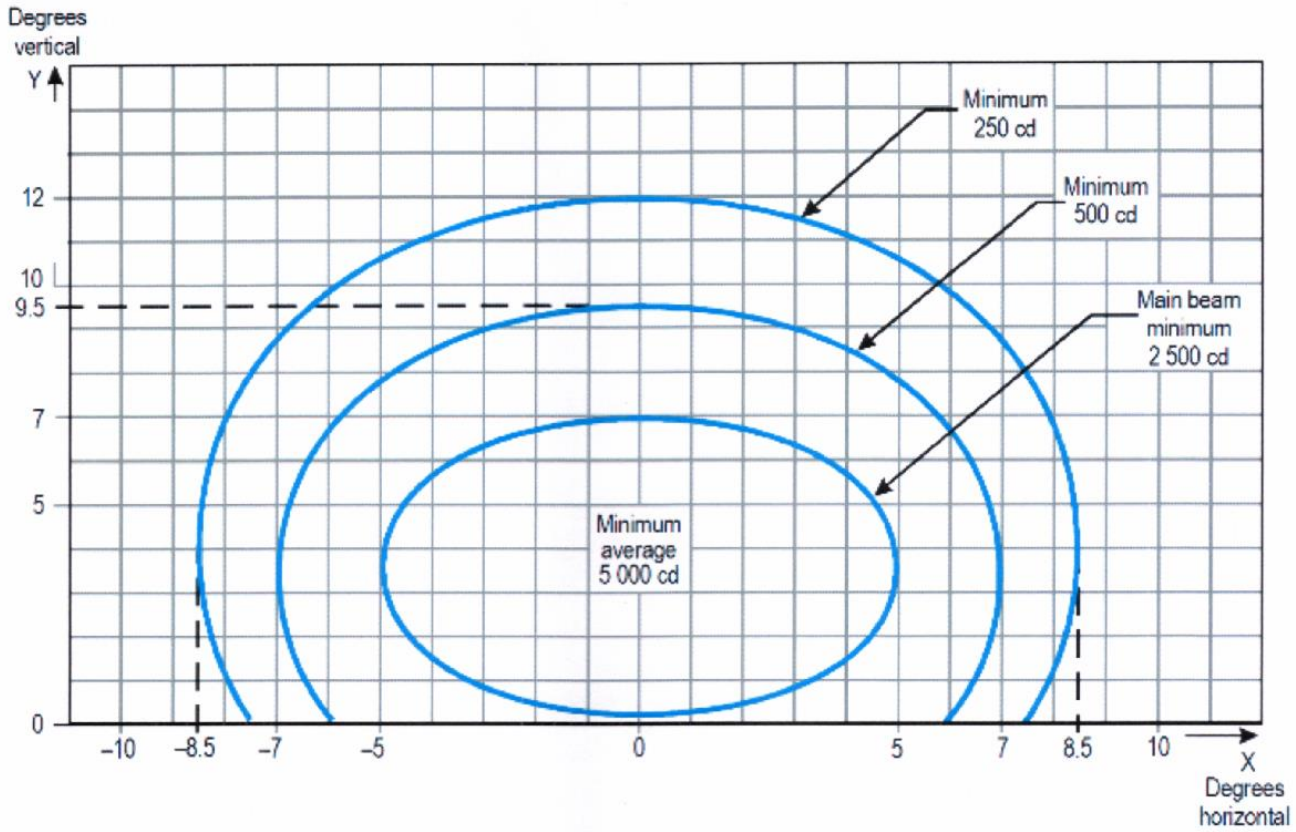
1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 5.0 | 7.0 | 8.5 |
| b | 3.5 | 6.0 | 8.5 |

2. Toe-in 4 degrees

3. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-5. Isocandela diagram for touchdown zone light (white light)**




Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

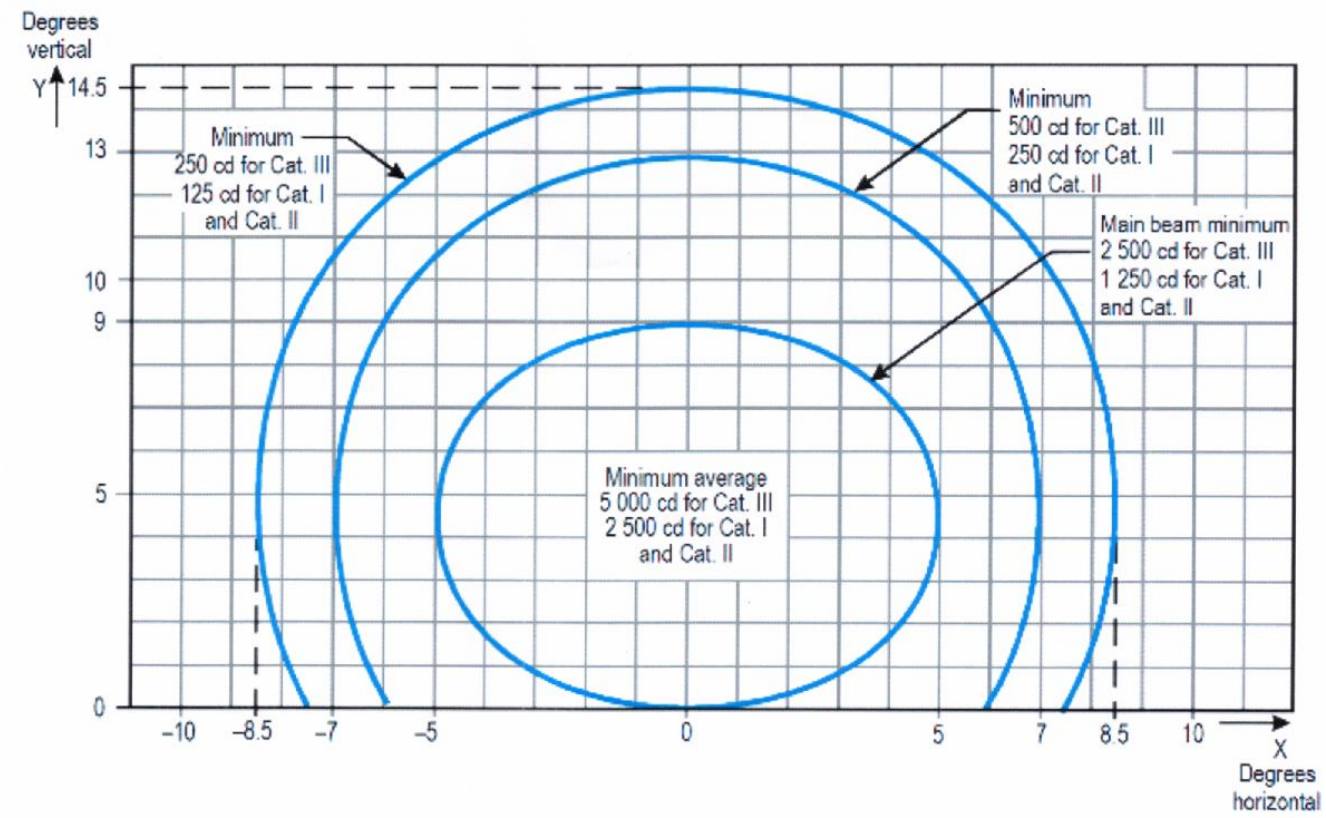
| | | | |
|---|---|---|---|
| a | 5.0 | 7.0 | 8.5 |
| b | 3.5 | 6.0 | 8.5 |

2. For red light, multiply values by 0.15.

3. For yellow light, multiply values by 0.40.

4. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-6. Isocandela diagram for runway centre line light with 30 m longitudinal spacing (white light) and rapid exit taxiway indicator light (yellow light)**



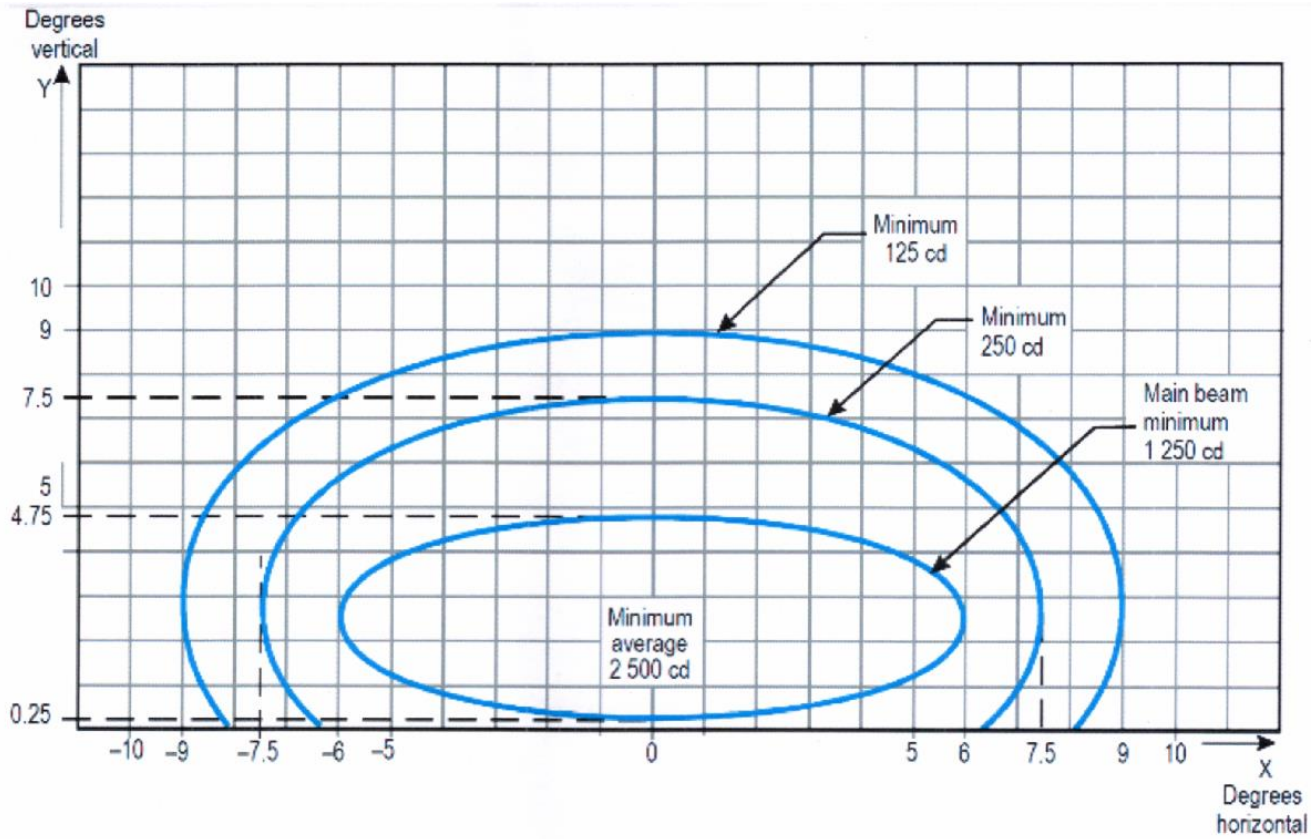

Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 5.0 | 7.0 | 8.5 |
| b | 4.5 | 8.5 | 10 |

2. For red light, multiply values by 0.15.
3. For yellow light, multiply values by 0.40.
4. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-7. Isocandela diagram for runway centre line light with 15 m longitudinal spacing (white light) and rapid exit taxiway indicator light (yellow light)**



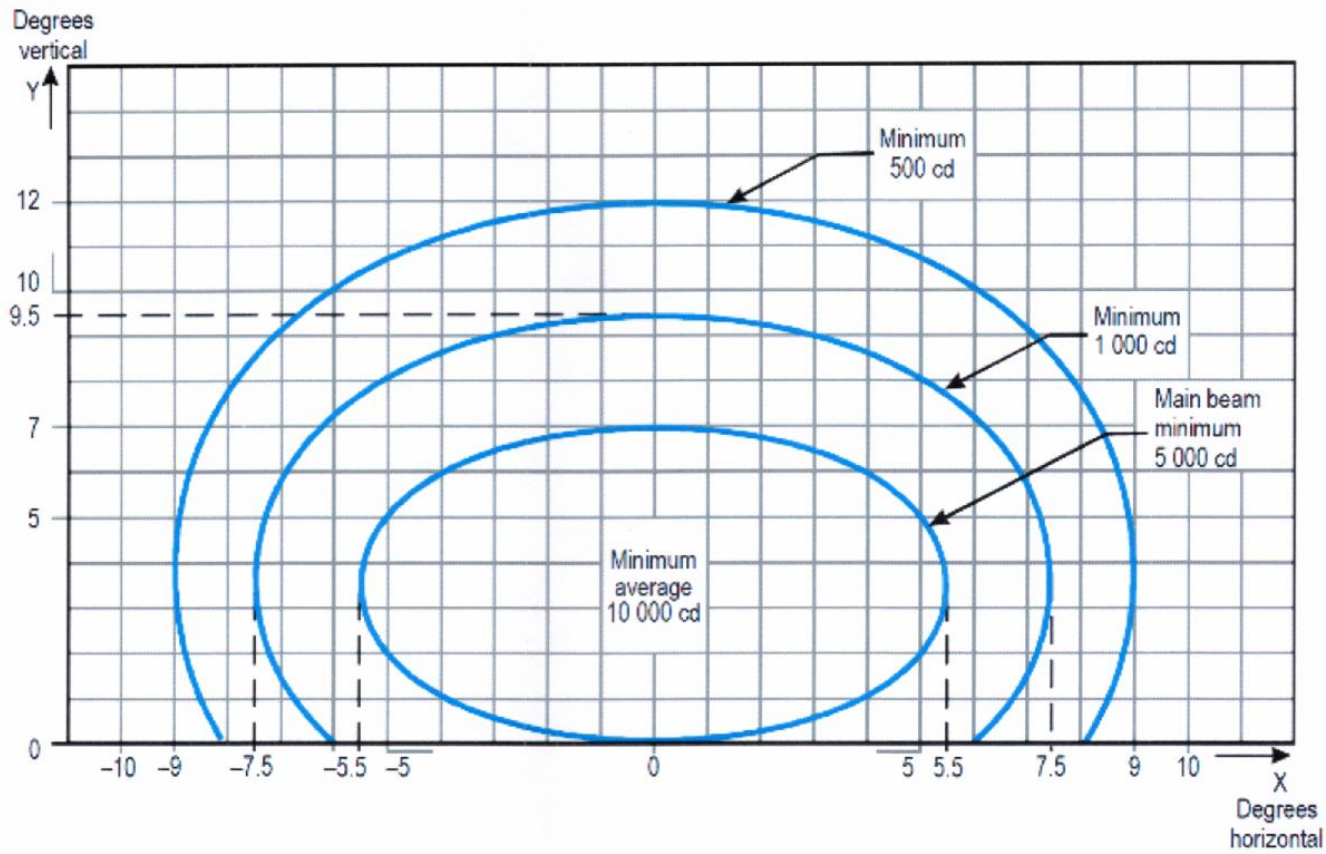

Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 6.0 | 7.5 | 9.0 |
| b | 2.25 | 5.0 | 6.5 |

2. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-8. Isocandela diagram for runway end light (red light)**



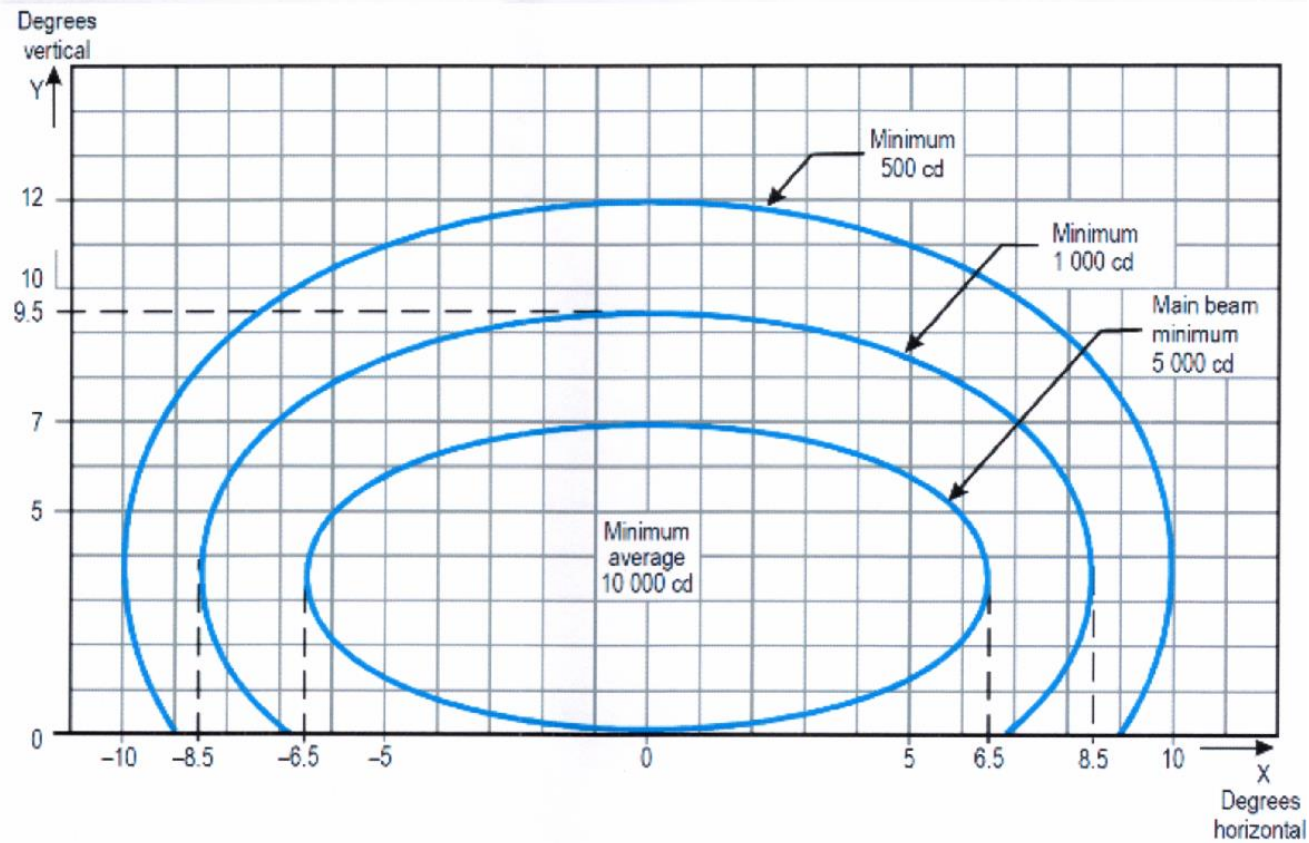

Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 5.5 | 7.5 | 9.0 |
| b | 3.5 | 6.0 | 8.5 |

2. Toe-in 3.5 degrees
3. For red light, multiply values by 0.15.
4. For yellow light, multiply values by 0.40.
5. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-9. Isocandela diagram for runway edge light where width of runway is 45 m (white light)**




Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 6.5 | 8.5 | 10.0 |
| b | 3.5 | 6.0 | 8.5 |

2. Toe-in 4.5 degrees
3. For red light, multiply values by 0.15.
4. For yellow light, multiply values by 0.40.
5. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-10. Isocandela diagram for runway edge light where width of runway is 60 m (white light)**

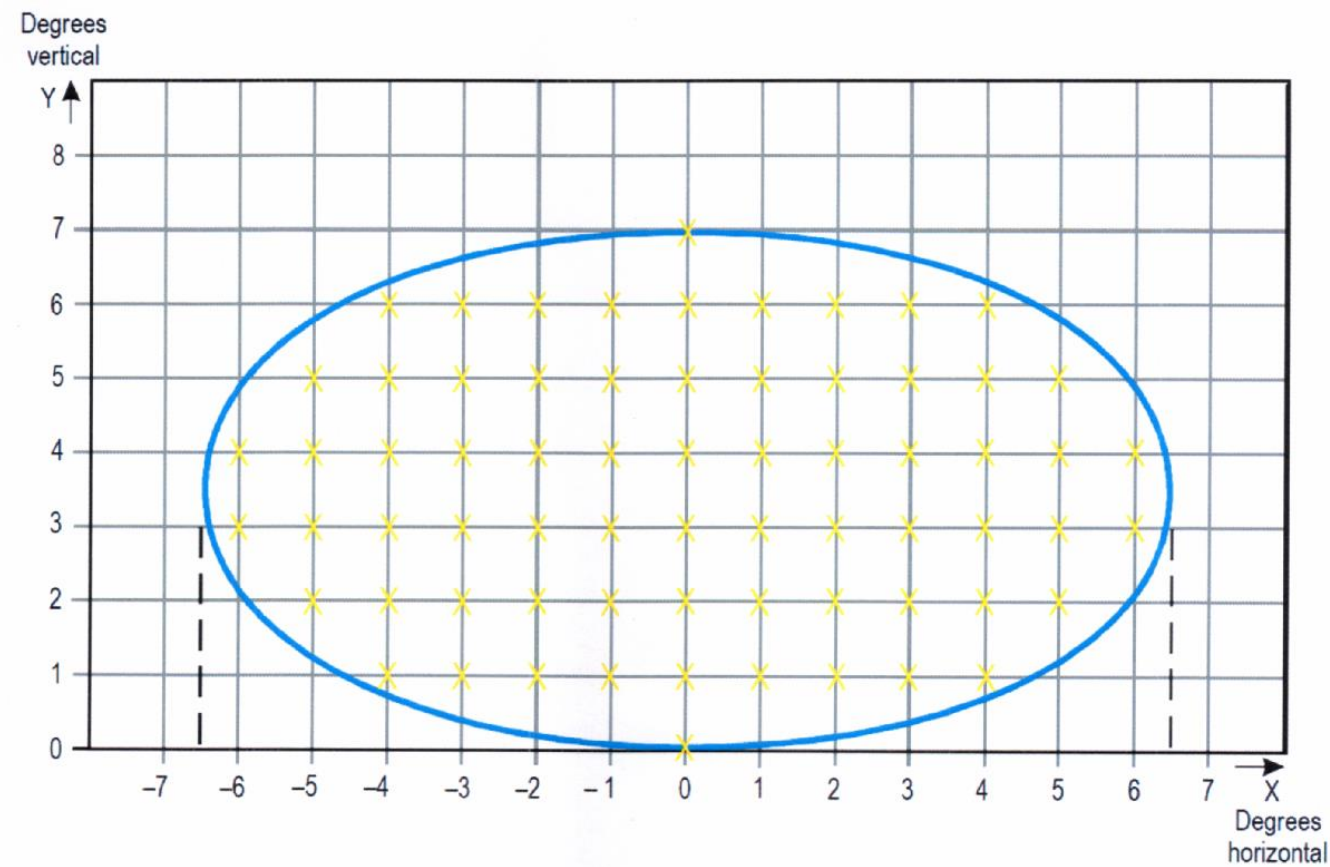



**Figure A2-11. Grid points to be used for the calculation of average intensity of approach and runway lights**

Collective notes to Figures A2-1 to A2-11 and A2-26

1. The ellipses in each figure are symmetrical about the common vertical and horizontal axes.

2. Figures A2-1 to A2-10, as well as Figure A2-25, show the minimum allowable light intensities. The average intensity of the main beam is calculated by establishing grid points as shown in Figure A2-11 and using the intensity value measures at all grid points located within and on the perimeter of the ellipse representing the main beam. The average value is the arithmetic average of light intensities measured at all considered grid points.

3. No deviations are acceptable in the main beam pattern when the lighting fixture is properly aimed.

4. Average intensity ratio. The ratio between the average intensity within the ellipse defining the main beam of a typical new light and the average light intensity of the main beam of a new runway edge light shall be as follows:

| | | |
|---|---|---|
| Figure A2-1 | Approach centre line and crossbars | 1.5 to 2.0 (white light) |
| Figure A2-2 | Approach side row | 0.5 to 1.0 (red light) |
| Figure A2-3 | Threshold | 1.0 to 1.5 (green light) |
| Figure A2-4 | Threshold wing bar | 1.0 to 1.5 (green light) |
| Figure A2-5 | Touchdown zone | 0.5 to 1.0 (white light) |
| Figure A2-6 | Runway centre line (longitudinal spacing 30 m) | 0.5 to 1.0 (white light) |
| Figure A2-7 | Runway centre line (longitudinal spacing 15 m) | 0.5 to 1.0 for CAT III (white light)<br>0.25 to 0.5 for CAT I, II (white light) |
| Figure A2-8 | Runway end | 0.25 to 0.5 (red light) |
| Figure A2-9 | Runway edge (45 m runway width) | 1.0 (white light) |
| Figure A2-10 | Runway edge (60 m runway width) | 1.0 (white light) |

5. The beam coverages in the figures provide the necessary guidance for approaches down to an RVR of the order of 150 m and take-offs down to an RVR of the order of 100 m.

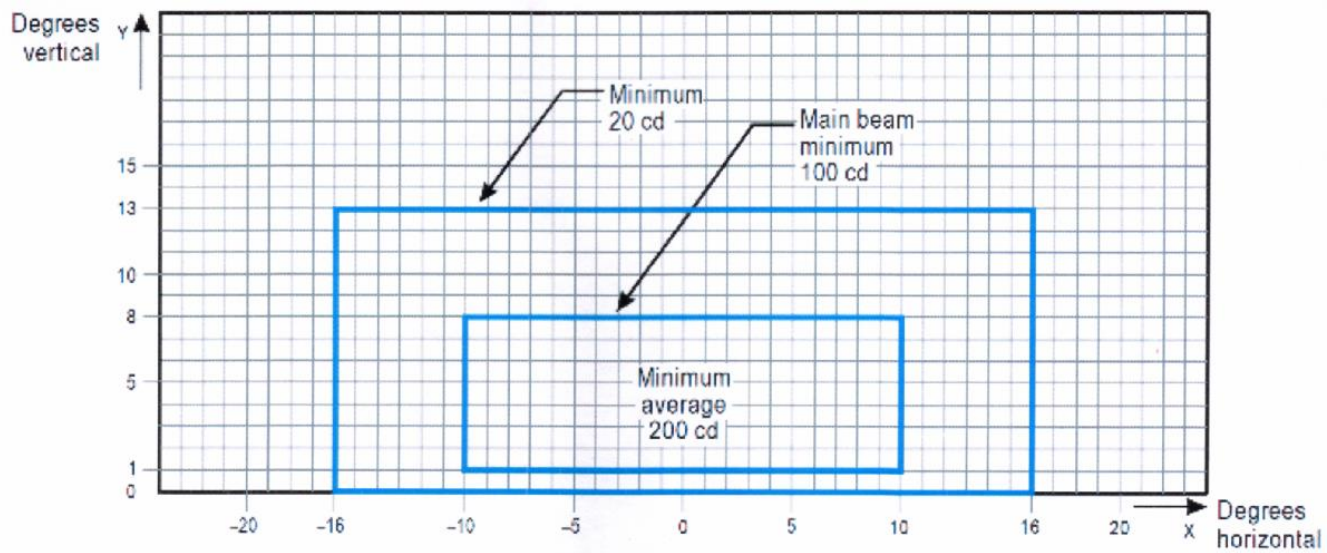
6. Horizontal angles are measured with respect to the vertical plane through the runway centre line. For lights other than centre line lights, the direction towards the runway centre line is

considered positive. Vertical angles are measured with respect to the horizontal plane.

7. Where, for approach centre line lights and crossbars and for approach side row lights, inset lights are used in lieu of elevated lights, e.g. on a runway with a displaced threshold, the intensity requirements can be met by installing two or three fittings (lower intensity) at each position.

8. The importance of adequate maintenance cannot be overemphasized. The average intensity should never fall to a value less than 50 per cent of the value shown in the figures, and it should be the aim of airport authorities to maintain a level of light output close to the specified minimum average intensity.

9. The light unit shall be installed so that the main beam is aligned within one-half degree of the specified requirement.



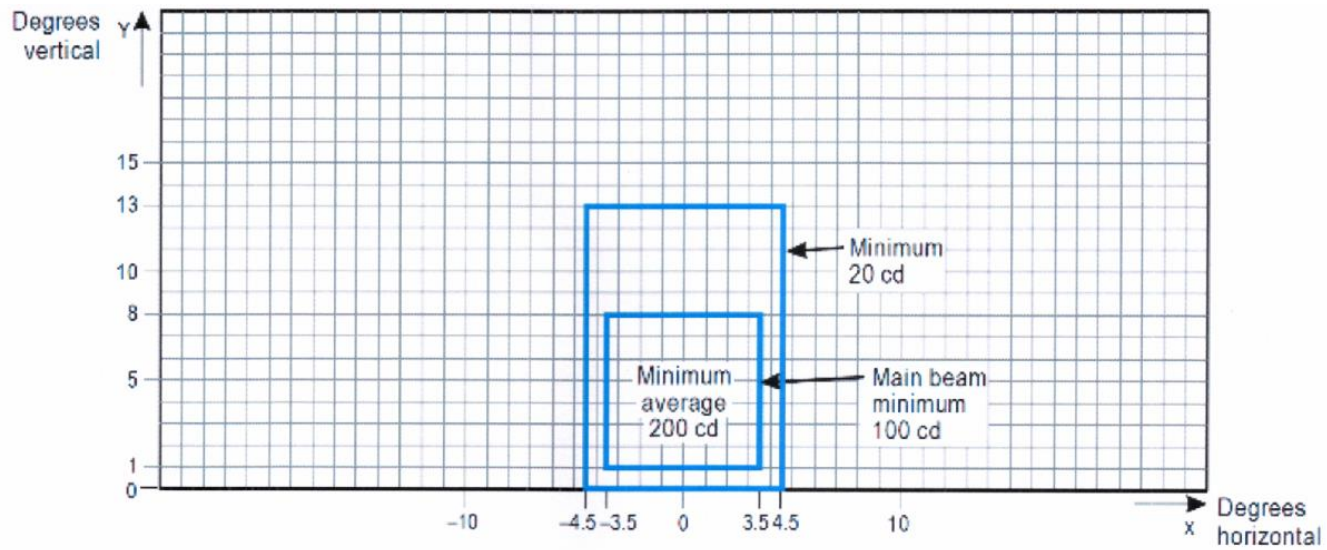

Notes:

1. These beam coverages allow for displacement of the cockpit from the centre line up to distances of the order of 12 m and are intended for use before and after curves.

2. See collective notes for Figures A2-12 to A2-21.

3. Increased intensities for enhanced rapid exit taxiway centre line lights as recommended in 5.3.16.9 are four times the respective intensities in the figure (i.e. 800 cd for minimum average main beam).

**Figure A2-12. Isocandela diagram for taxiway centre line (15 m spacing), RELs, no-entry bar and stop bar lights in straight sections intended for use in runway visual range conditions of less than a value of 350 m where large offsets can occur and for low-intensity runway guard lights, Configuration B**

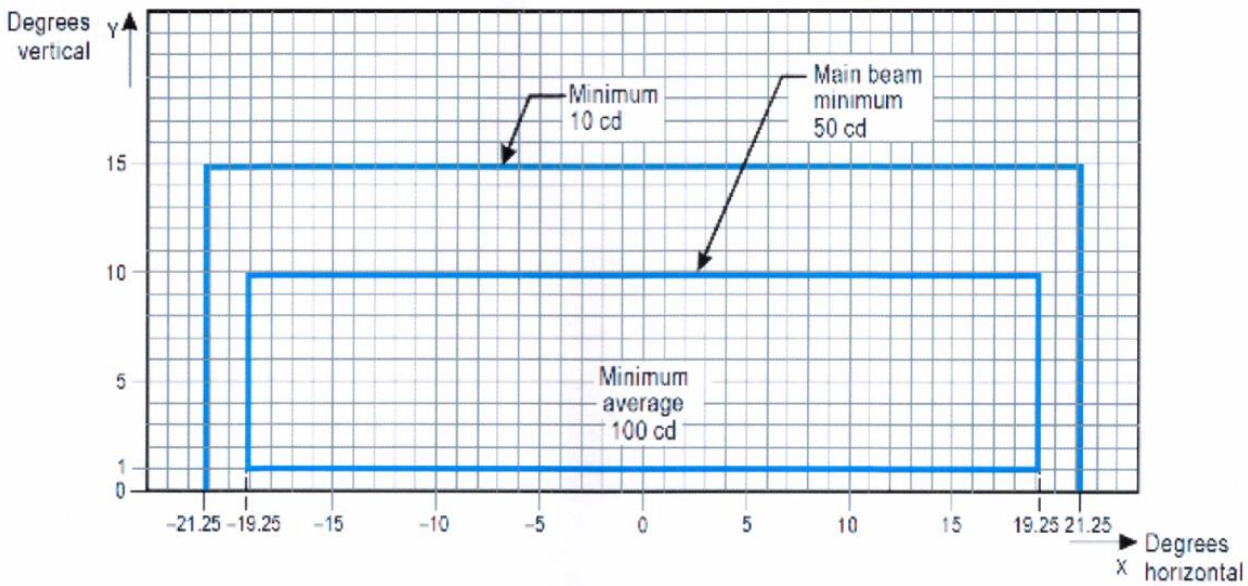



Notes:

1. These beam coverages are generally satisfactory and cater for a normal displacement of the cockpit from the centre line of approximately 3 m.

2. See collective notes for Figures A2-12 to A2-21.

**Figure A2-13. Isocandela diagram for taxiway centre line (15 m spacing), no-entry bar and stop bar lights in straight sections intended for use in runway visual range conditions of less than a value of 350 m**



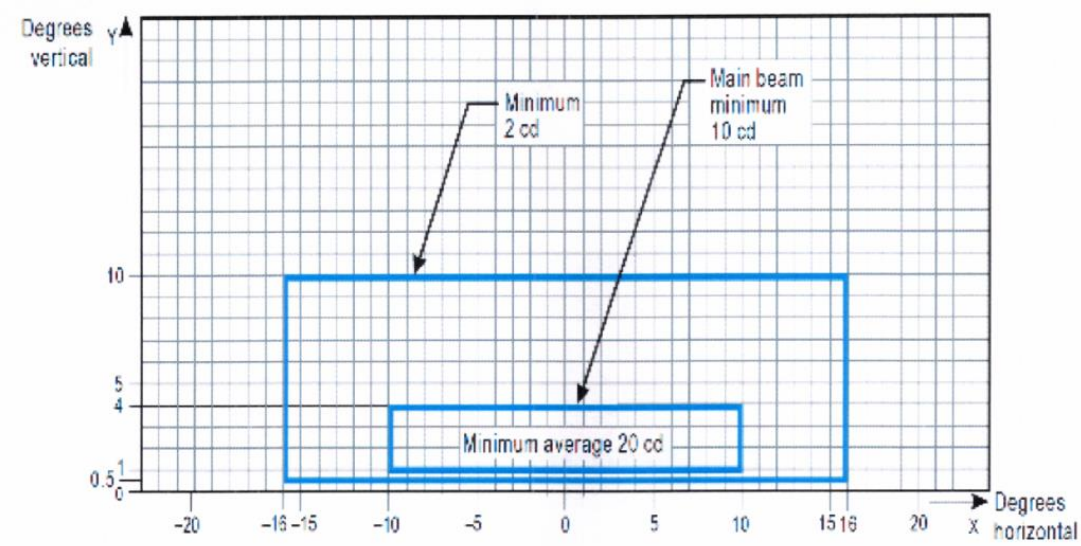

Notes:

1. Lights on curves to be toed-in 15.75 degrees with respect to the tangent of the curve. This does not apply to runway entrance lights (RELs)

2. Increased intensities for RELs shall be twice the specified intensities, i.e., minimum 20 cd, main beam minimum 100 cd and minimum average 200 cd.

3. See collective notes for Figures A2-12 to A2-21.

**Figure A2-14. Isocandela diagram for taxiway centre line (7.5 m spacing), RELs, no-entry bar and stop bar lights in curved sections intended for use in runway visual range conditions of less than a value of 350 m**



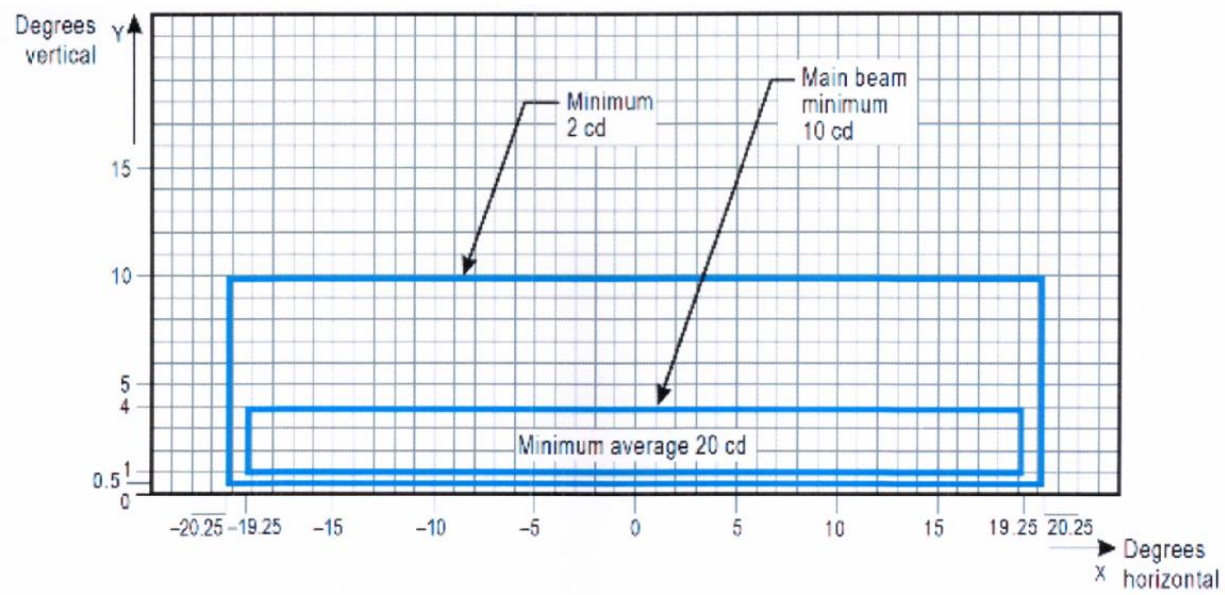

Notes:

1. At locations where high background luminance is usual and where deterioration of light output resulting from dust, and local contamination is a significant factor, the cd- values should be multiplied by 2.5.

2. Where omnidirectional lights are used they shall comply with the vertical beam requirements in this figure.

3. See collective notes for Figures A2-12 to A2-21.

**Figure A2-15. Isocandela diagram for taxiway centre line (30 m, 60 m spacing), no-entry bar and stop bar lights in straight sections intended for use inrunway visual range conditions of 350 m or greater**




Notes:

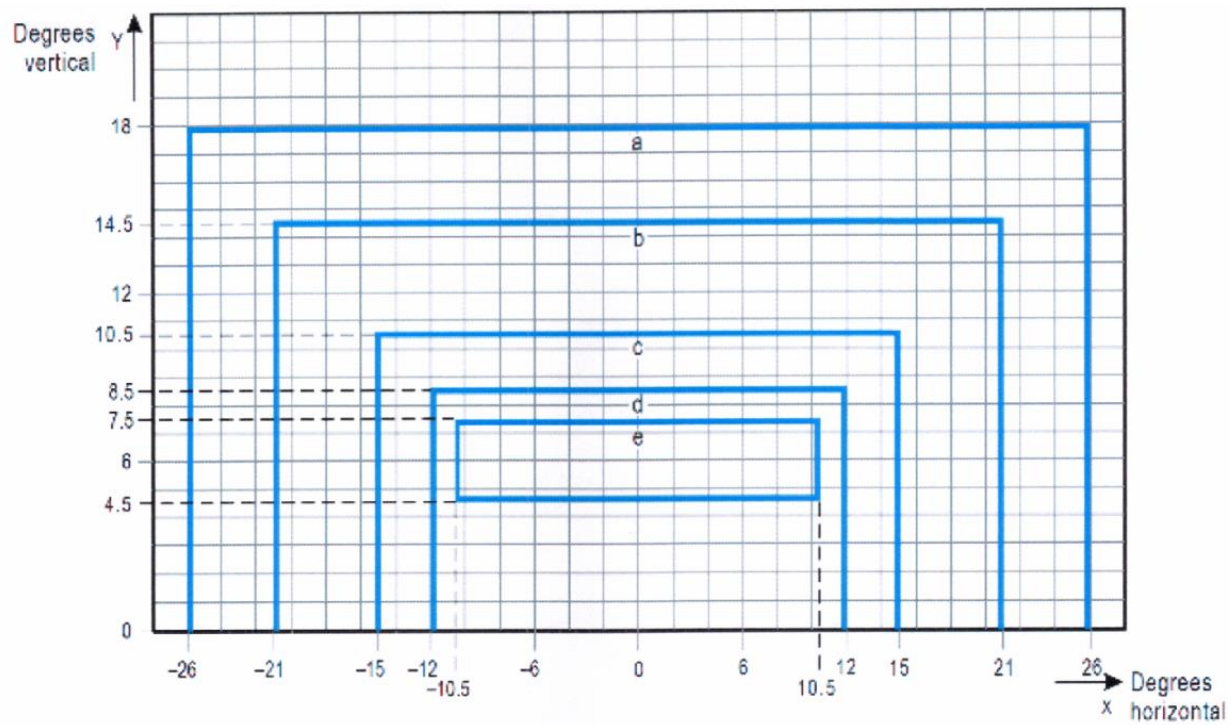
1. Lights on curves to be toed-in 15.75 degrees with respect to the tangent of the curve.

2. At locations where high background luminance is usual and where deterioration of light output resulting from dust, and local contamination is a significant factor, the cd- values should be multiplied by 2.5.

3. These beam coverages allow for displacement of the cockpit from the centre line up to distances of the order of 12 m as could occur at the end of curves.

4. See collective notes for Figures A2-12 to A2-21.

**Figure A2-16. Isocandela diagram for taxiway centre line (7.5 m, 15 m, 30 m spacing), no-entry bar and stop bar lights in curved sections intended for use in runway visual range conditions of 350 m or greater**



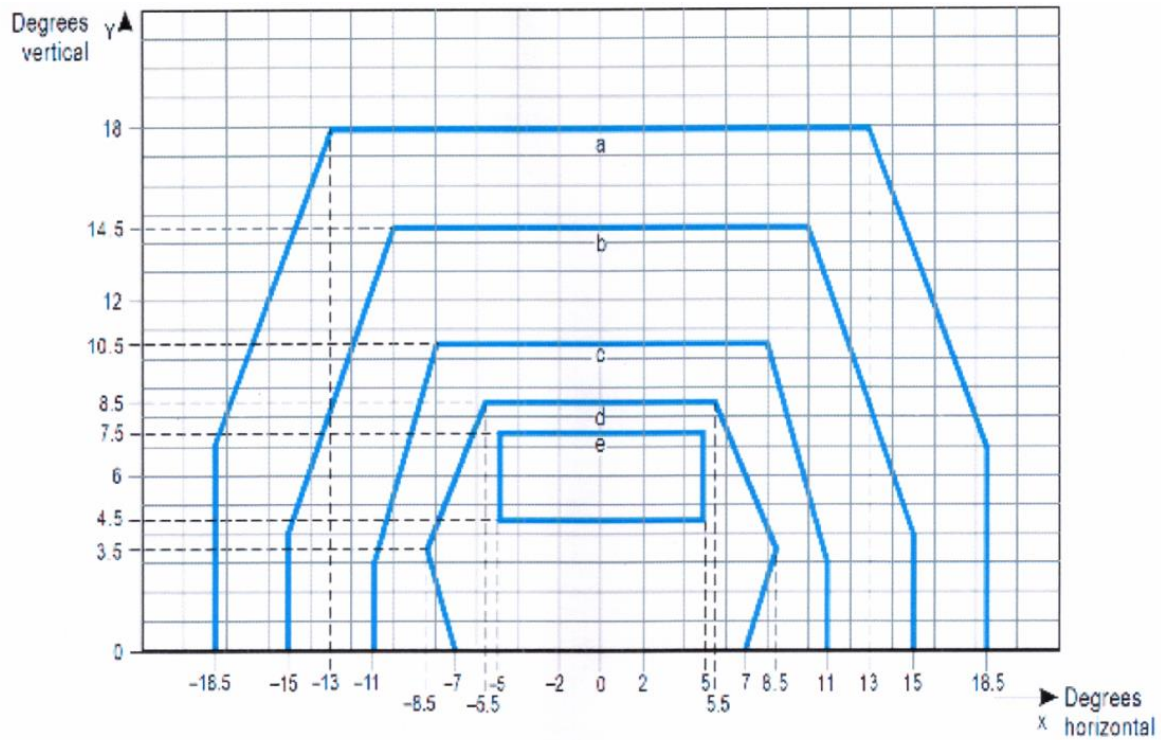

| Curve | a | b | c | d | e |
|---|---|---|---|---|---|
| Intensity (cd) | 8 | 20 | 100 | 450 | 1 800 |

Notes:

1. These beam coverages allow for displacement of the cockpit from the centre line up to distances of the order of 12 m and are intended for use before and after curves.

2. See collective notes for Figures A2-12 to A2-21.

**Figure A2-17. Isocandela diagram for high-intensity taxiway centre line (15 m spacing), no-entry bar and stop bar lights in straight sections intended for use in an advanced surface movement guidance and control system where higher light intensities are required and where large offsets can occur**



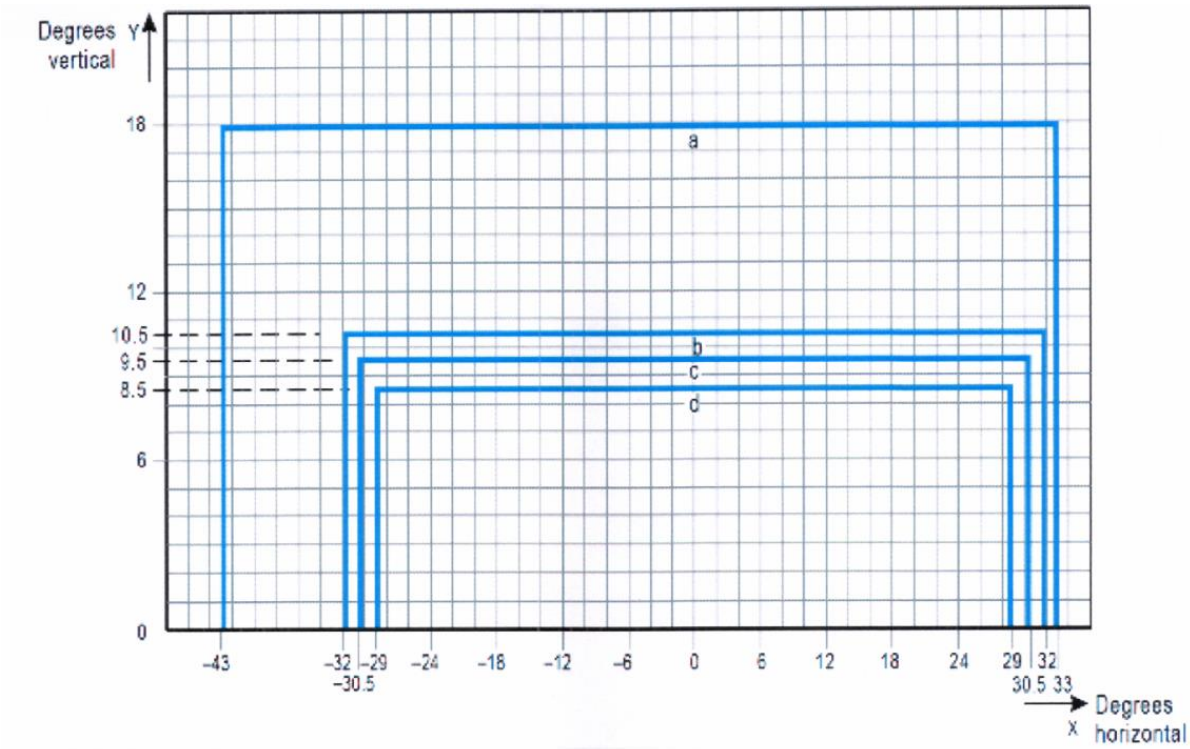

| Curve | a | b | c | d | e |
|---|---|---|---|---|---|
| Intensity (cd) | 8 | 20 | 100 | 450 | 1 800 |

Notes:

1. These beam coverages are generally satisfactory and cater for a normal displacement of the cockpit corresponding to the outer main gear wheel on the taxiway edge.

2. See collective notes for Figures A2-12 to A2-21.

**Figure A2-18. Isocandela diagram for high-intensity taxiway centre line (15 m spacing), no-entry bar and stop bar lights in straight sections intended for use in an advanced surface movement guidance and control system where higher light intensities are required**



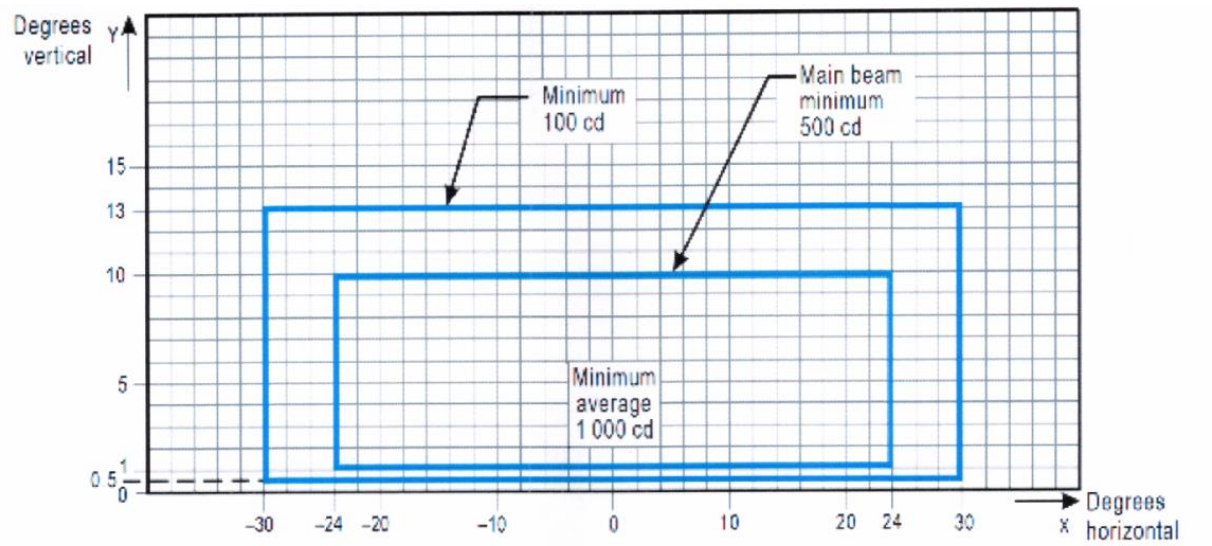

| Curve | a | b | c | d |
|---|---|---|---|---|
| Intensity (cd) | 8 | 100 | 200 | 400 |

Notes:

1. Lights on curves to be toed-in 17 degrees with respect to the tangent of the curve.

2. See collective notes for Figures A2-12 to A2-21.

**Figure A2-19. Isocandela diagram for high-intensity taxiway centre line (7.5 m spacing), no-entry bar and stop bar lights in curved sections intended for use in an advanced surface movement guidance and control system where higher light intensities are required**




Notes:

1. Although the lights flash in normal operation, the light intensity is specified as if the lights were fixed for incandescent lamps.

2. See collective notes for Figures A2-12 to A2-21.

**Figure A2-20. Isocandela diagram for high-intensity runway guard lights, Configuration B**

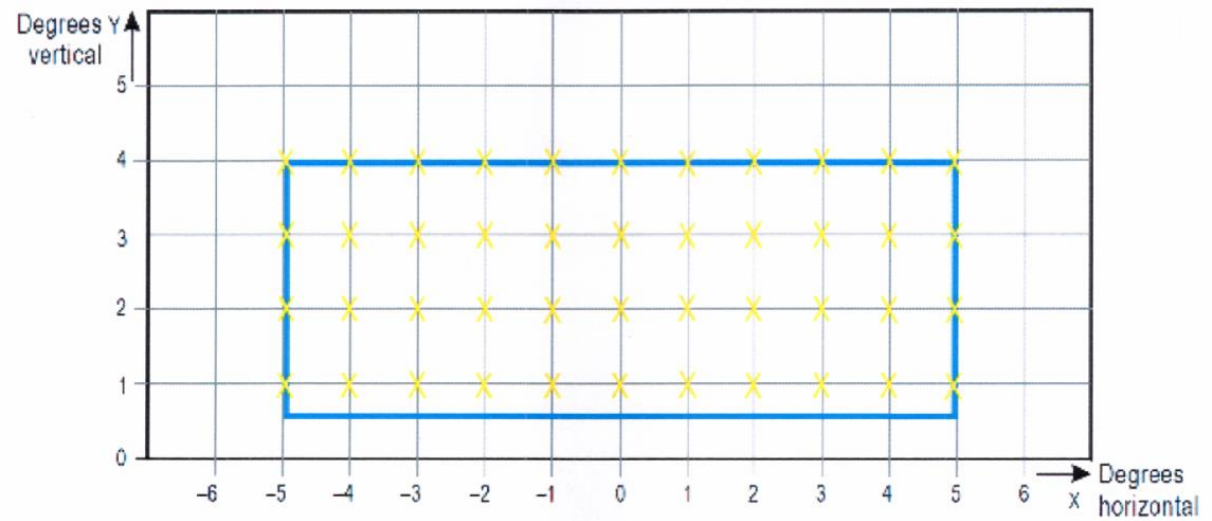



**Figure A2-21. Grid points to be used for calculation of average intensity of taxiway centre line and stop bar lights**

Collective notes to Figures A2-12 to A2-21

1. The intensities specified in Figures A2-12 to A2-20 are in green and yellow light for taxiway centre line lights, yellow light for runway guard lights and red light for stop bar lights.

2. Figures A2-12 to A2-20 show the minimum allowable light intensities. The average intensity of the main beam is calculated by establishing grid points as shown in Figure A2-21 and using the intensity values measured at all grid points located within and on the perimeter of the rectangle representing the main beam. The average value is the arithmetic average of the light intensities measured at all considered grid points.

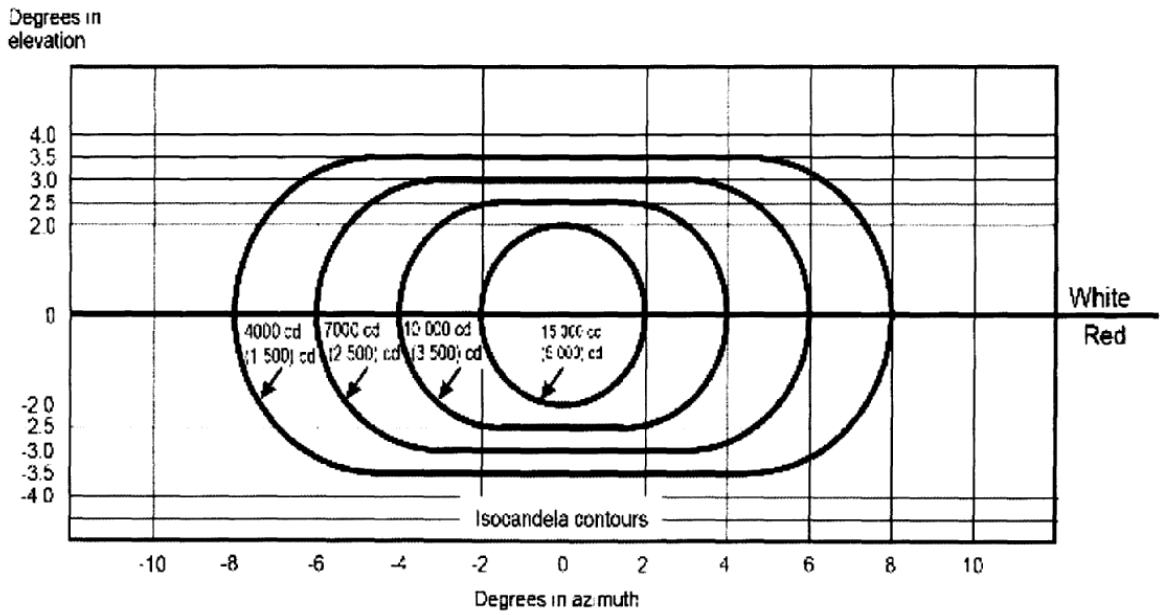
3. No deviations are acceptable in the main beam or in the innermost beam, as applicable, when the lighting fixture is properly aimed.

4. Horizontal angles are measured with respect to the vertical plane through the taxiway centre line except on curves where they are measured with respect to the tangent to the curve.

5. Vertical angles are measured from the longitudinal slope of the taxiway surface.

6. The importance of adequate maintenance cannot be overemphasized. The intensity, either average where applicable or as specified on the corresponding isocandela curves, should never fall to a value less than 50 per cent of the value shown in the figures, and it should be the aim of airport authorities to maintain a level of light output close to the specified minimum average intensity.

7. The light unit shall be installed so that the main beam or the innermost beam, as applicable, is aligned within one- half degree of the specified requirement.



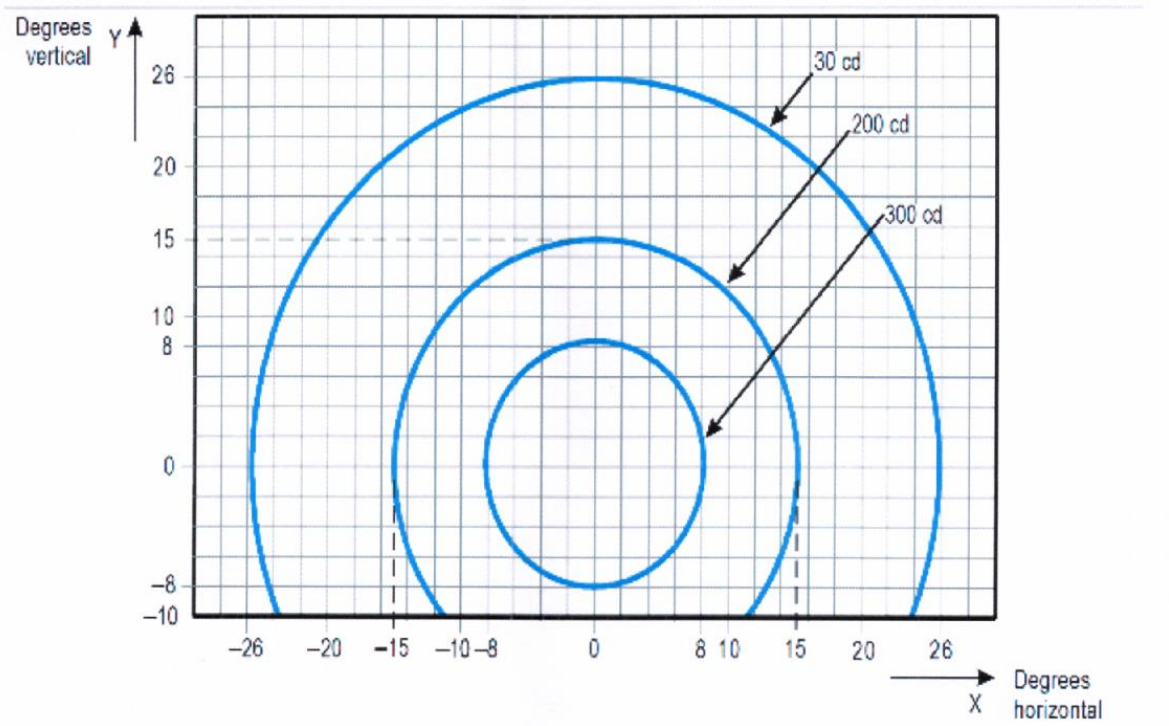

Notes:

1. These curves are for minimum intensities in red light.

2. The intensity value in the white sector of the beam is no less than 2 and may be as high as 6.5 times the corresponding intensity in the red sector.

3. The intensity values shown in brackets are for APAPI.

**Figure A2-22. Light intensity distribution of PAPI and APAPI**

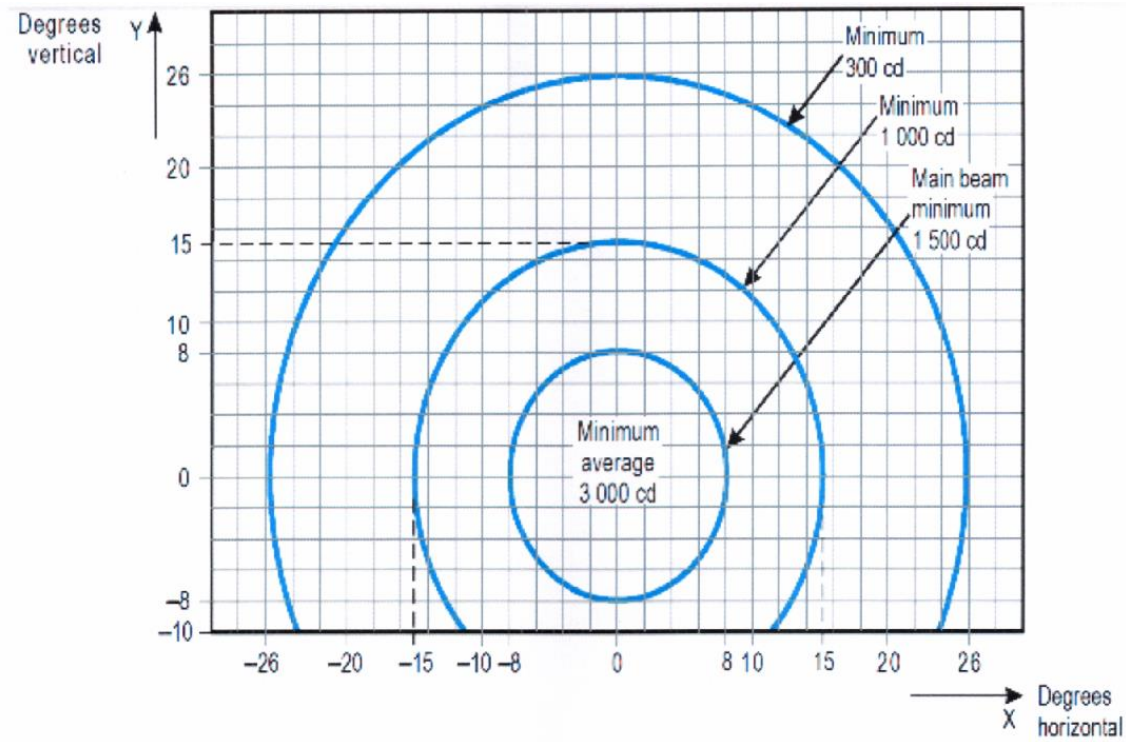



Notes:

1. Although the lights flash in normal operation, the light intensity is specified as if the lights were fixed for incandescent lamps.

2. The intensities specified are in yellow light.

**Figure A2-23. Isocandela diagram for each light in low-intensity runway guard lights, Configuration A**

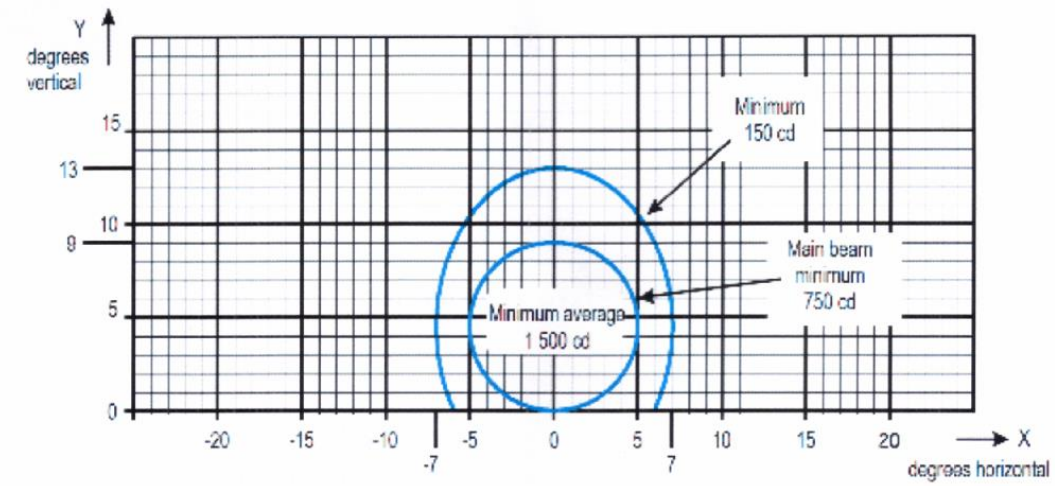



Notes:

1. Although the lights flash in normal operation, the light intensity is specified as if the lights were fixed for incandescent lamps.

2. The intensities specified are in yellow light.

**Figure A2-24. Isocandela diagram for each light in high-intensity runway guard lights, Configuration A**




Notes:

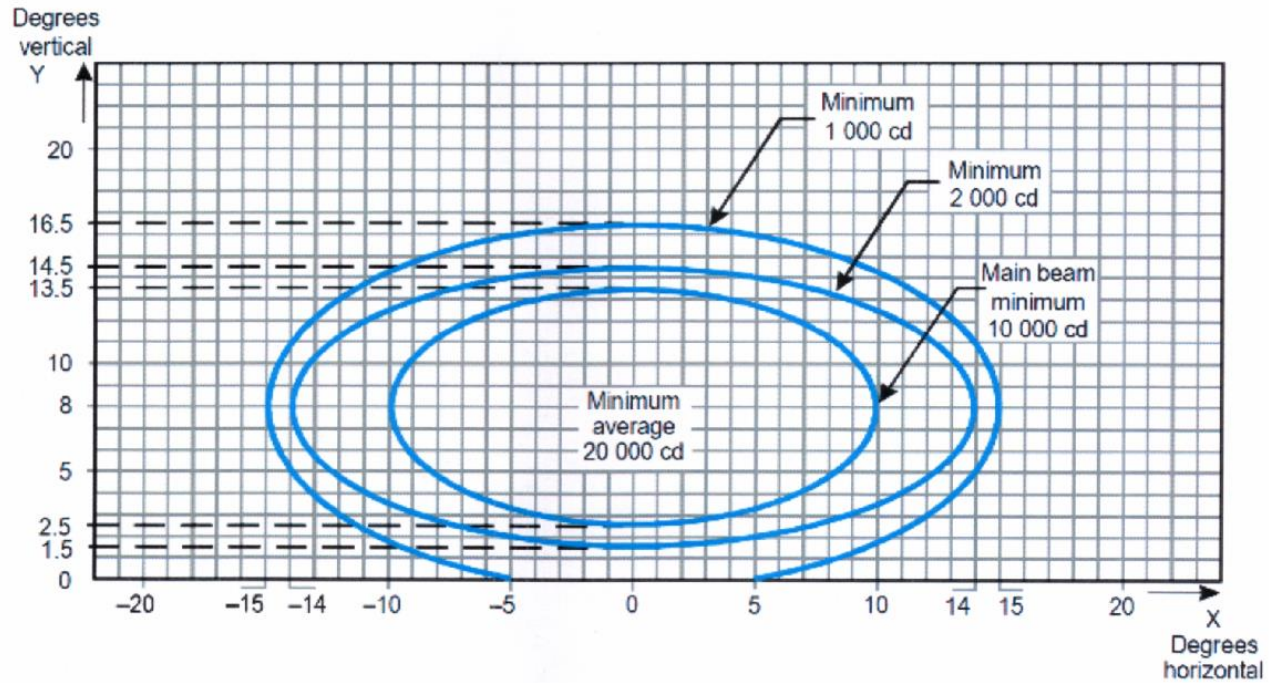
1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | |
|---|---|---|
| a | 5.0 | 7.0 |
| b | 4.5 | 8.5 |

2. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-25. Isocandela diagram for take-off and hold lights (THL) (red light)**

## APPENDIX 2. AERONAUTICAL GROUND LIGHT CHARACTERISTICS




Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 10 | 14 | 15 |
| b | 5.5 | 6.5 | 8.5 |

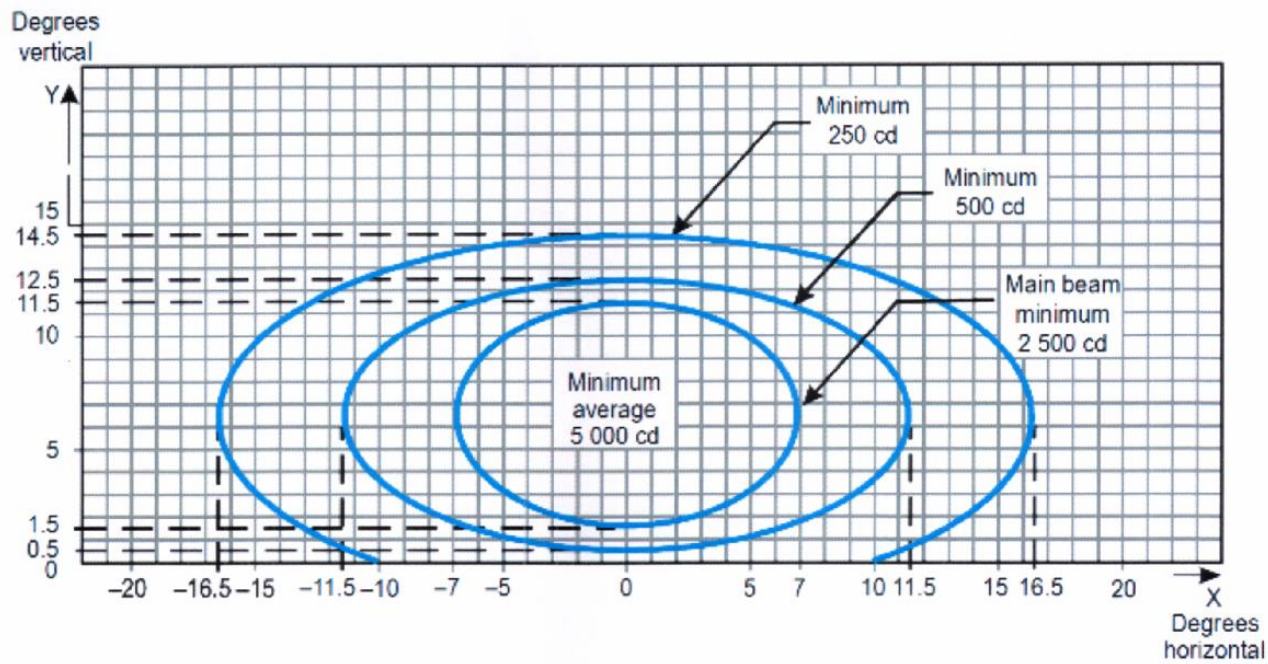
2. Vertical setting angles of the lights shall be such that the following vertical coverage of the main beam will be met:

| distance from threshold | vertical main beam coverage |
|---|---|
| threshold to 315 m | 0° — 11° |
| 316 m to 475 m | 0.5° — 11.5° |
| 476 m to 640 m | 1.5° — 12.5° |
| 641 m and beyond | 2.5° — 13.5° (as illustrated above) |

3. Lights in crossbars beyond 22.5 m from the centre line shall be toed-in 2 degrees. All other lights shall be aligned parallel to the centre line of the runway.

4. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-1. Isocandela diagram for approach centre line light and crossbars (white light)**




Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 7.0 | 11.5 | 16.5 |
| b | 5.0 | 6.0 | 8.0 |

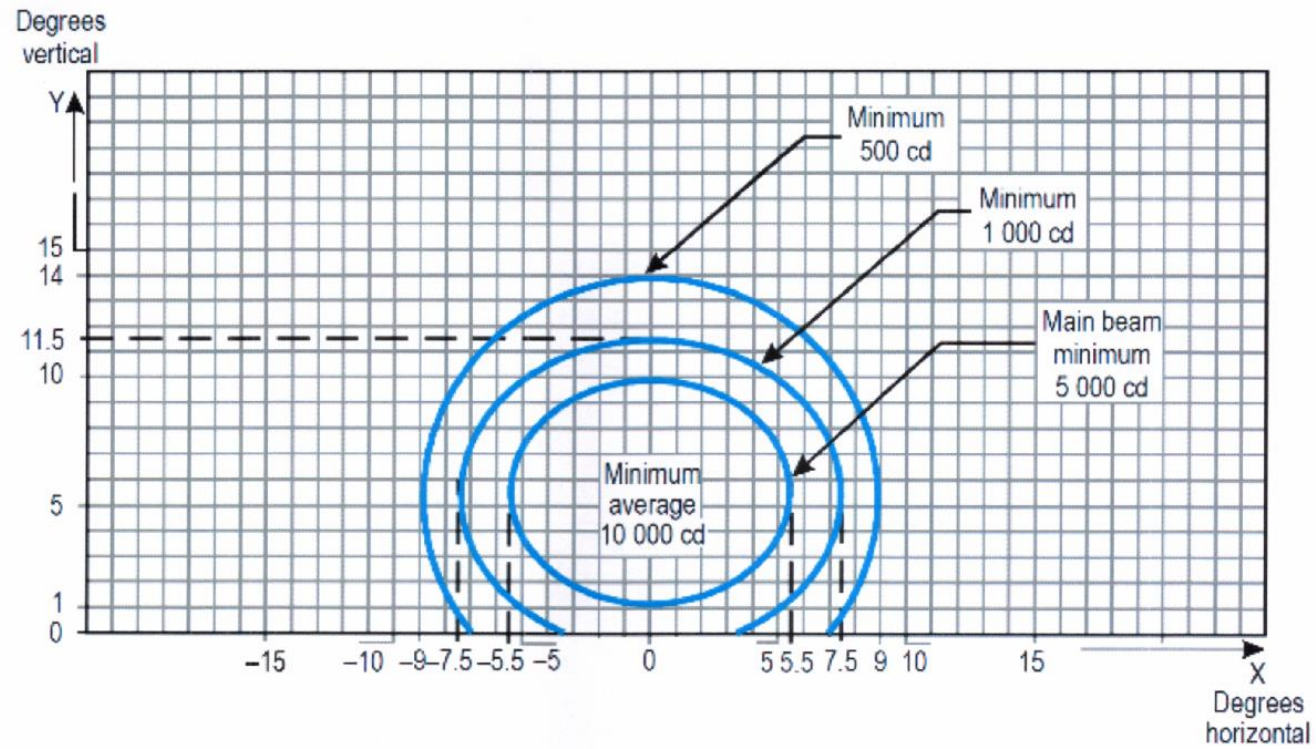
2. Toe-in 2 degrees

3. Vertical setting angles of the lights shall be such that the following vertical coverage of the main beam will be met:

| distance from threshold | vertical main beam coverage |
|---|---|
| threshold to 115 m | 0.5° — 10.5° |
| 116 m to 215 m | 1° — 11° |
| 216 m and beyond | 1.5° — 11.5° (as illustrated above) |

4. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-2. Isocandela diagram for approach side row light (red light)**




Notes:

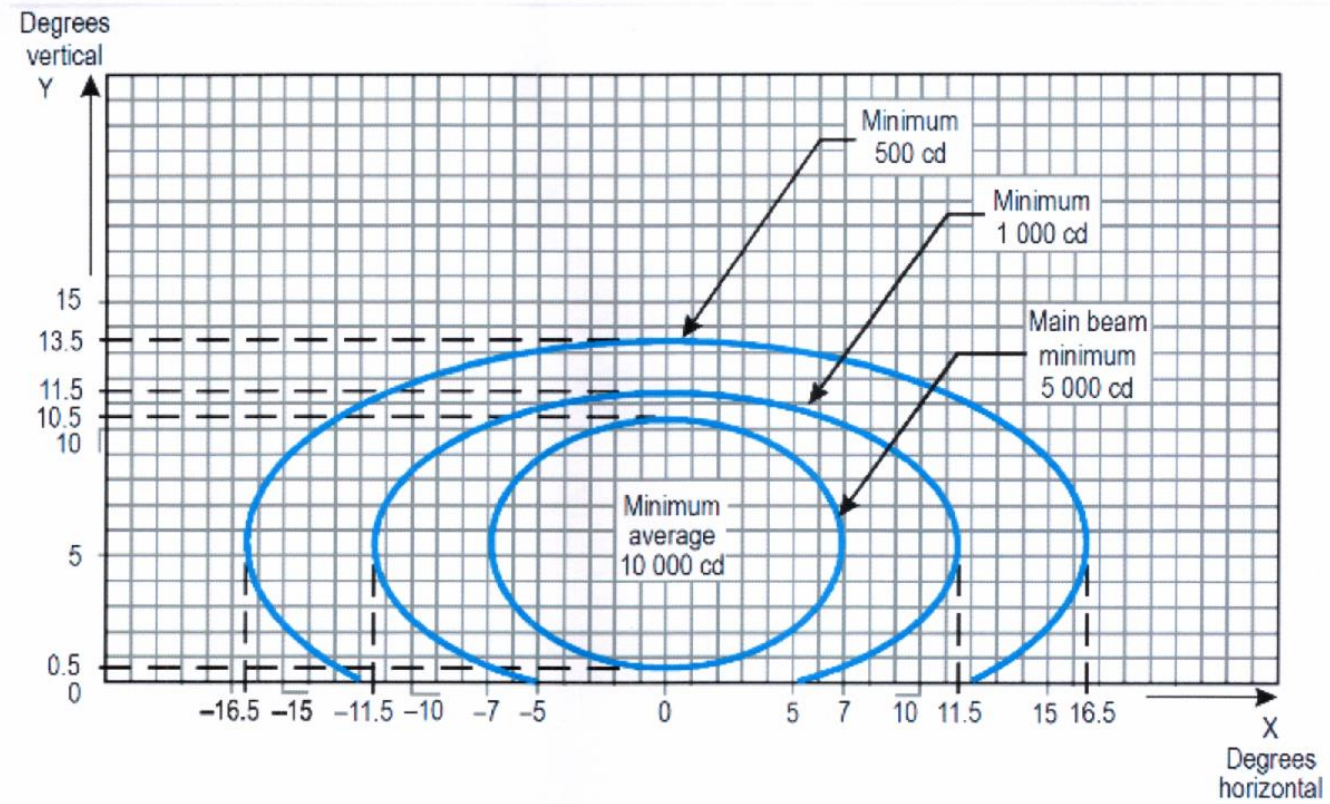
1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 5.5 | 7.5 | 9.0 |
| b | 4.5 | 6.0 | 8.5 |

2. Toe-in 3.5 degrees

3. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-3. Isocandela diagram for threshold light (green light)**




Notes:

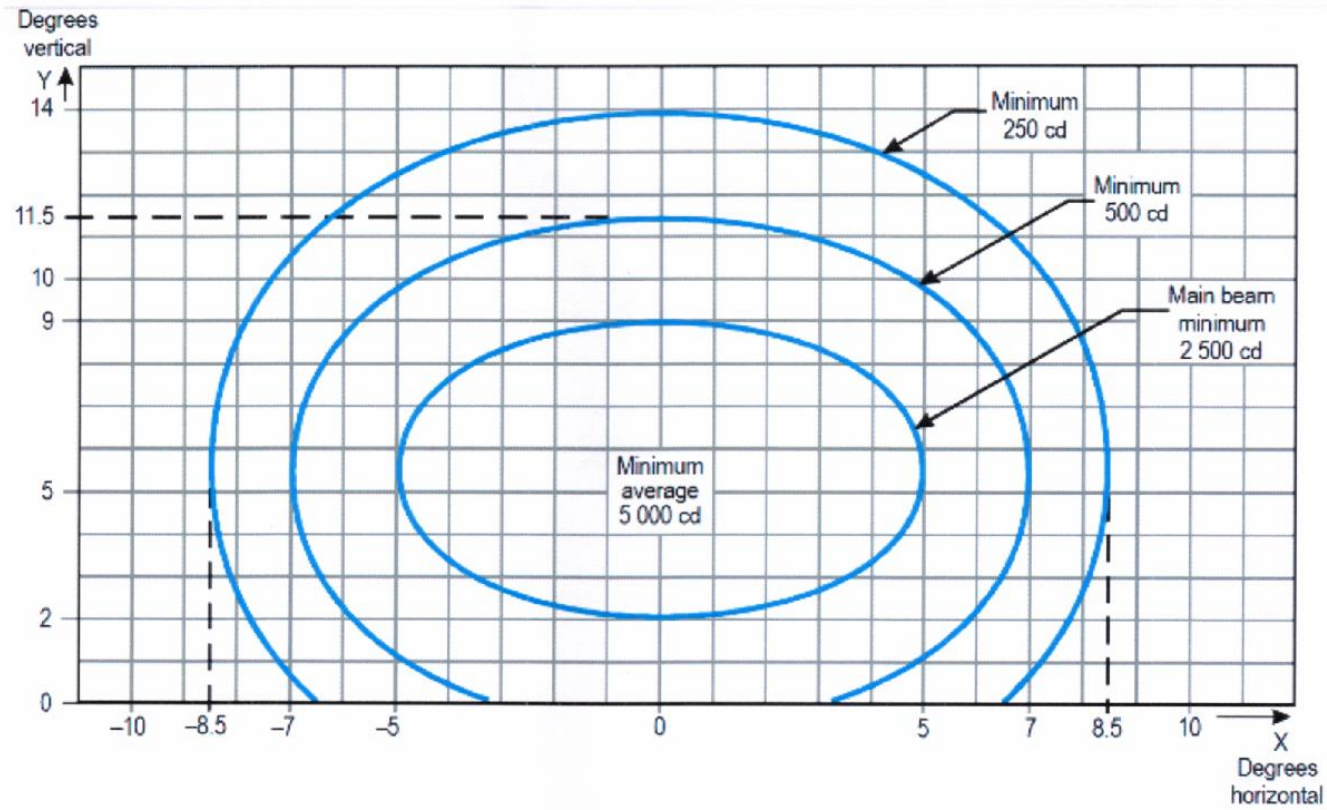
1. Curves calculated on formula. $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 7.0 | 11.5 | 16.5 |
| b | 5.0 | 6.0 | 8.0 |

2. Toe-in 2 degrees

3. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-4. Isocandela diagram for threshold wing bar light (green light)**




Notes:

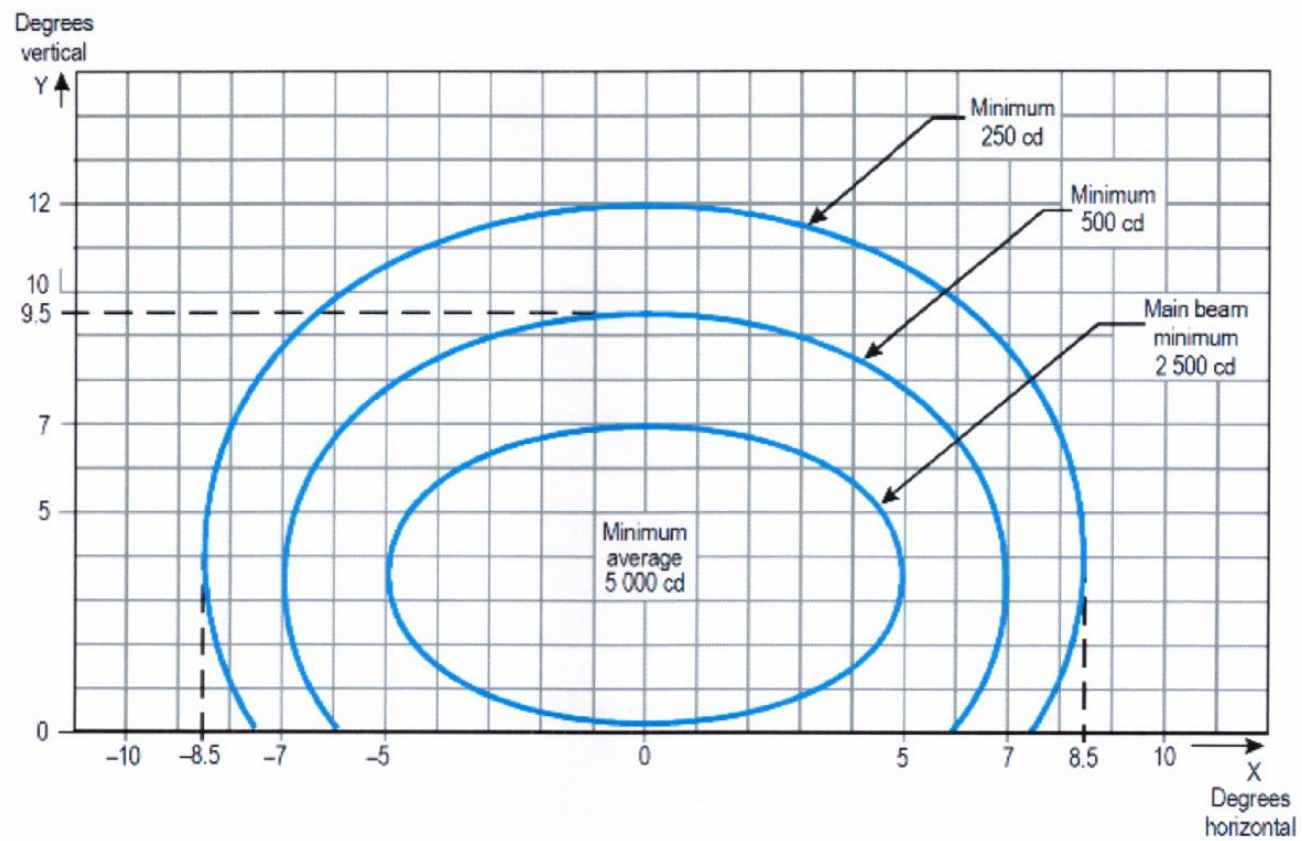
1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 5.0 | 7.0 | 8.5 |
| b | 3.5 | 6.0 | 8.5 |

2. Toe-in 4 degrees

3. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-5. Isocandela diagram for touchdown zone light (white light)**



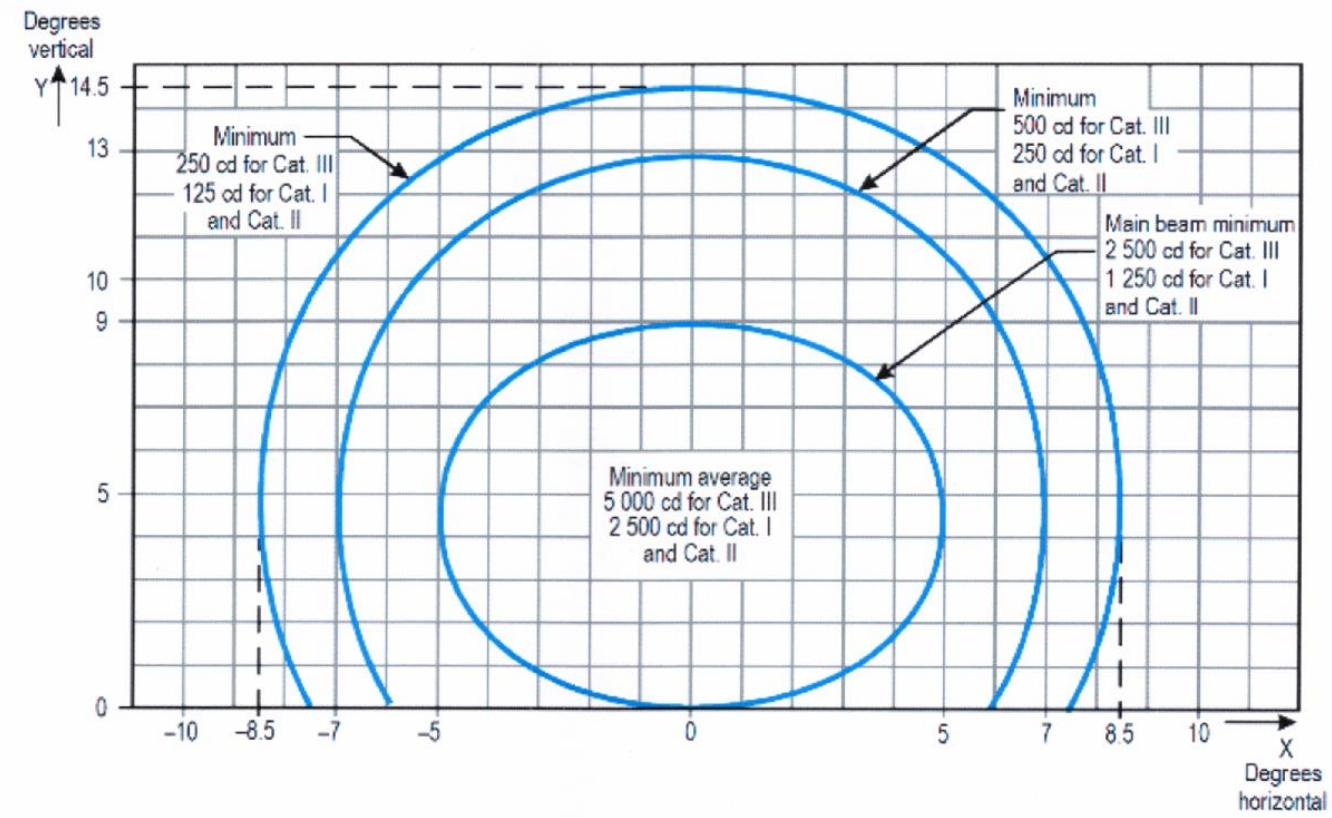

Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 5.0 | 7.0 | 8.5 |
| b | 3.5 | 6.0 | 8.5 |

2. For red light, multiply values by 0.15.
3. For yellow light, multiply values by 0.40.
4. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-6. Isocandela diagram for runway centre line light with 30 m longitudinal spacing (white light) and rapid exit taxiway indicator light (yellow light)**



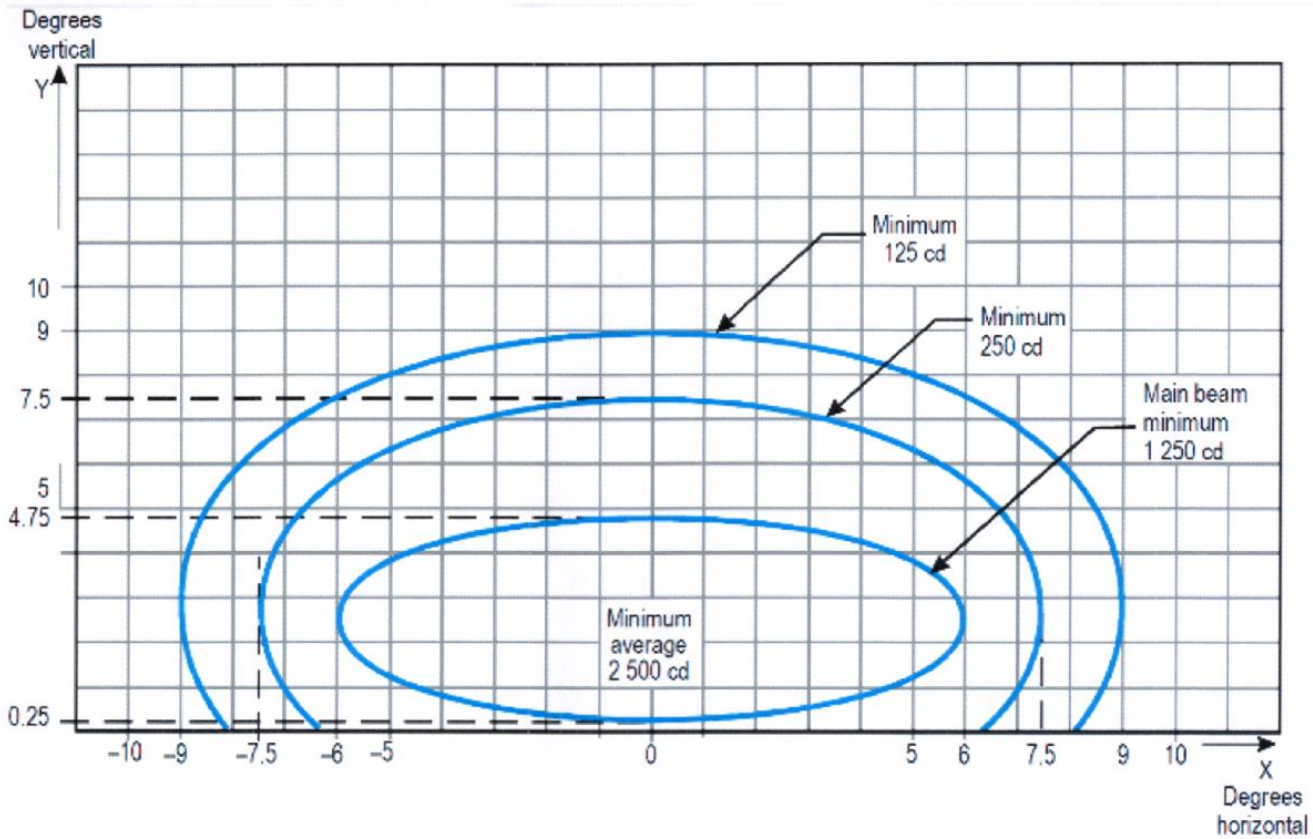

Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 5.0 | 7.0 | 8.5 |
| b | 4.5 | 8.5 | 10 |

2. For red light, multiply values by 0.15.
3. For yellow light, multiply values by 0.40.
4. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-7. Isocandela diagram for runway centre line light with 15 m longitudinal spacing (white light) and rapid exit taxiway indicator light (yellow light)**



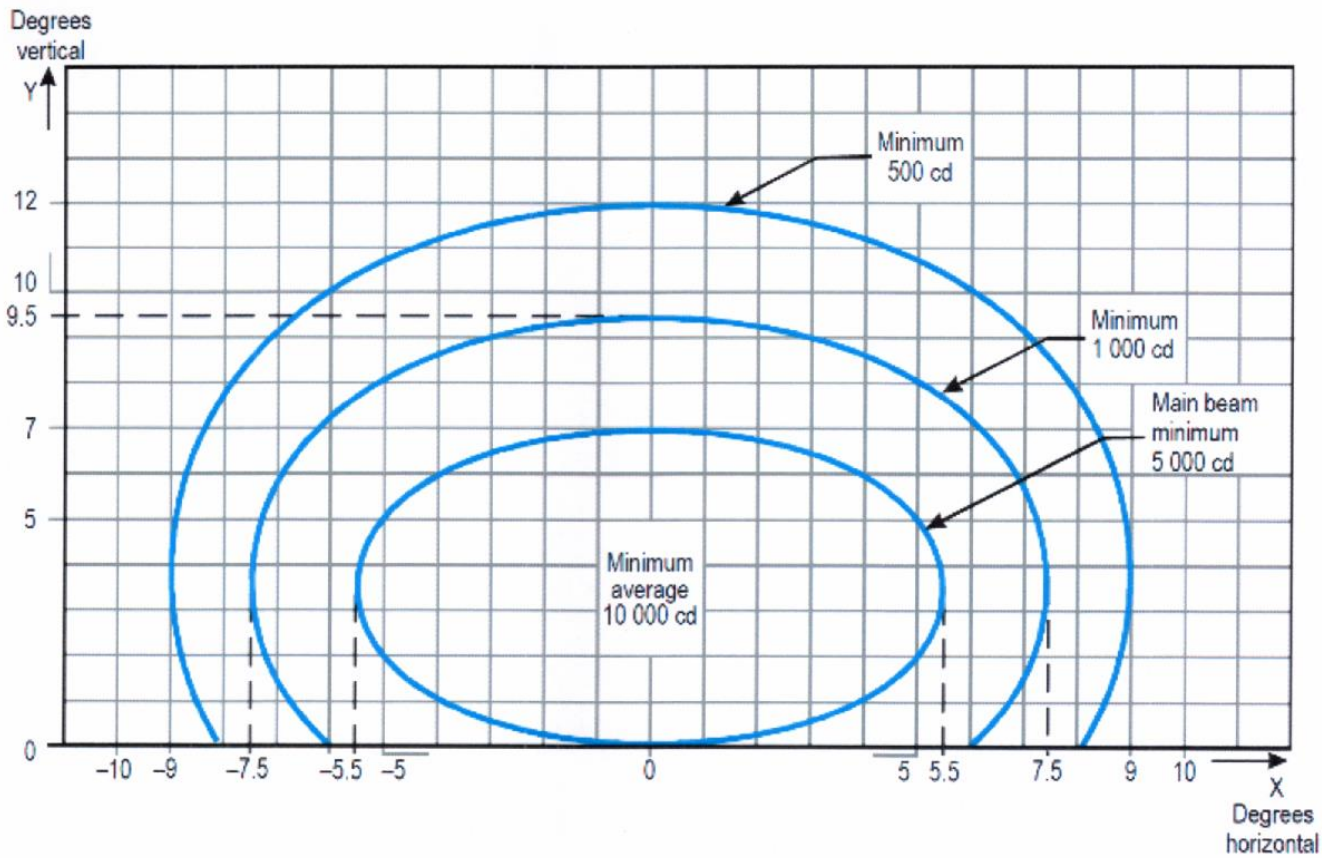

Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 6.0 | 7.5 | 9.0 |
| b | 2.25 | 5.0 | 6.5 |

2. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-8. Isocandela diagram for runway end light (red light)**



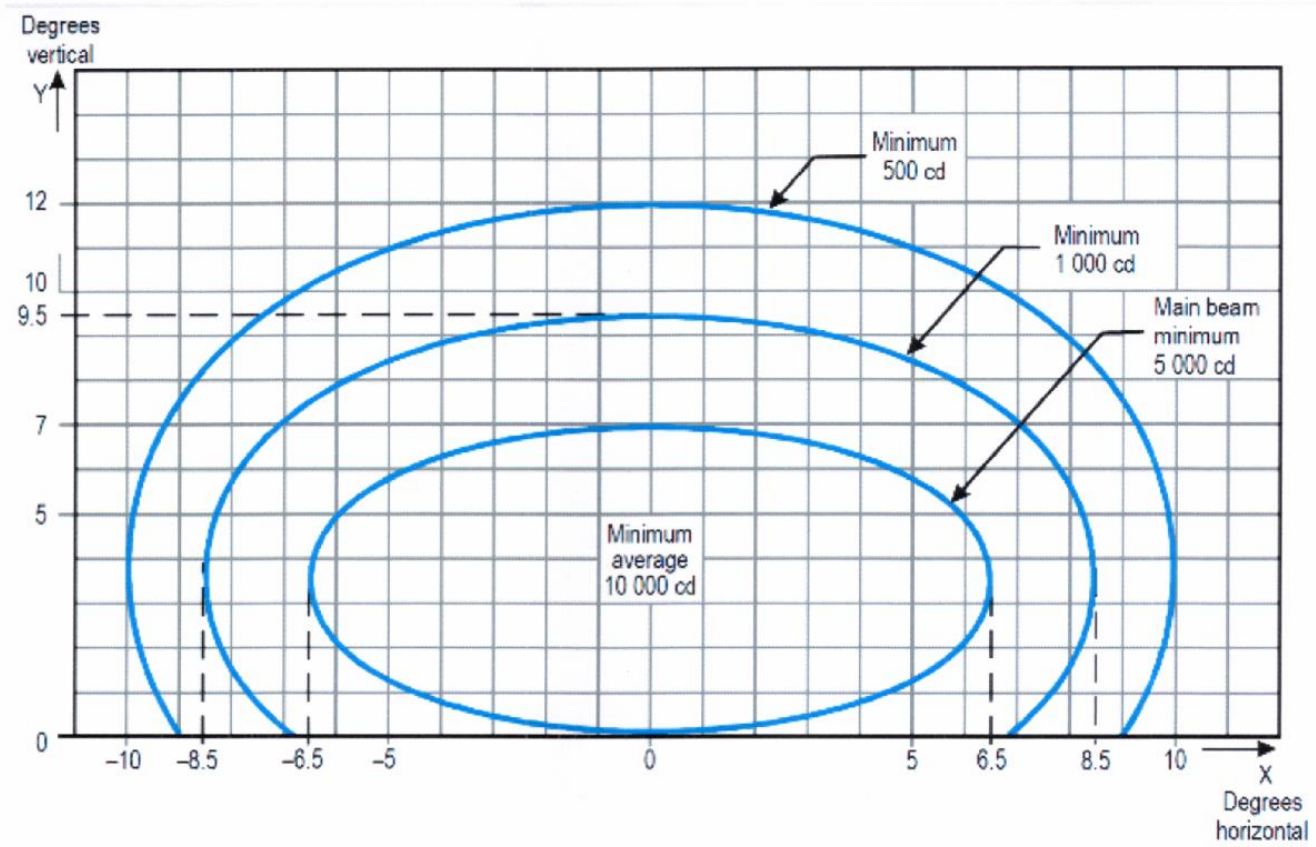

Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 5.5 | 7.5 | 9.0 |
| b | 3.5 | 6.0 | 8.5 |

2. Toe-in 3.5 degrees
3. For red light, multiply values by 0.15.
4. For yellow light, multiply values by 0.40.
5. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-9. Isocandela diagram for runway edge light where width of runway is 45 m (white light)**




Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | | |
|---|---|---|---|
| a | 6.5 | 8.5 | 10.0 |
| b | 3.5 | 6.0 | 8.5 |

2. Toe-in 4.5 degrees
3. For red light, multiply values by 0.15.
4. For yellow light, multiply values by 0.40.
5. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-10. Isocandela diagram for runway edge light where width of runway is 60 m (white light)**

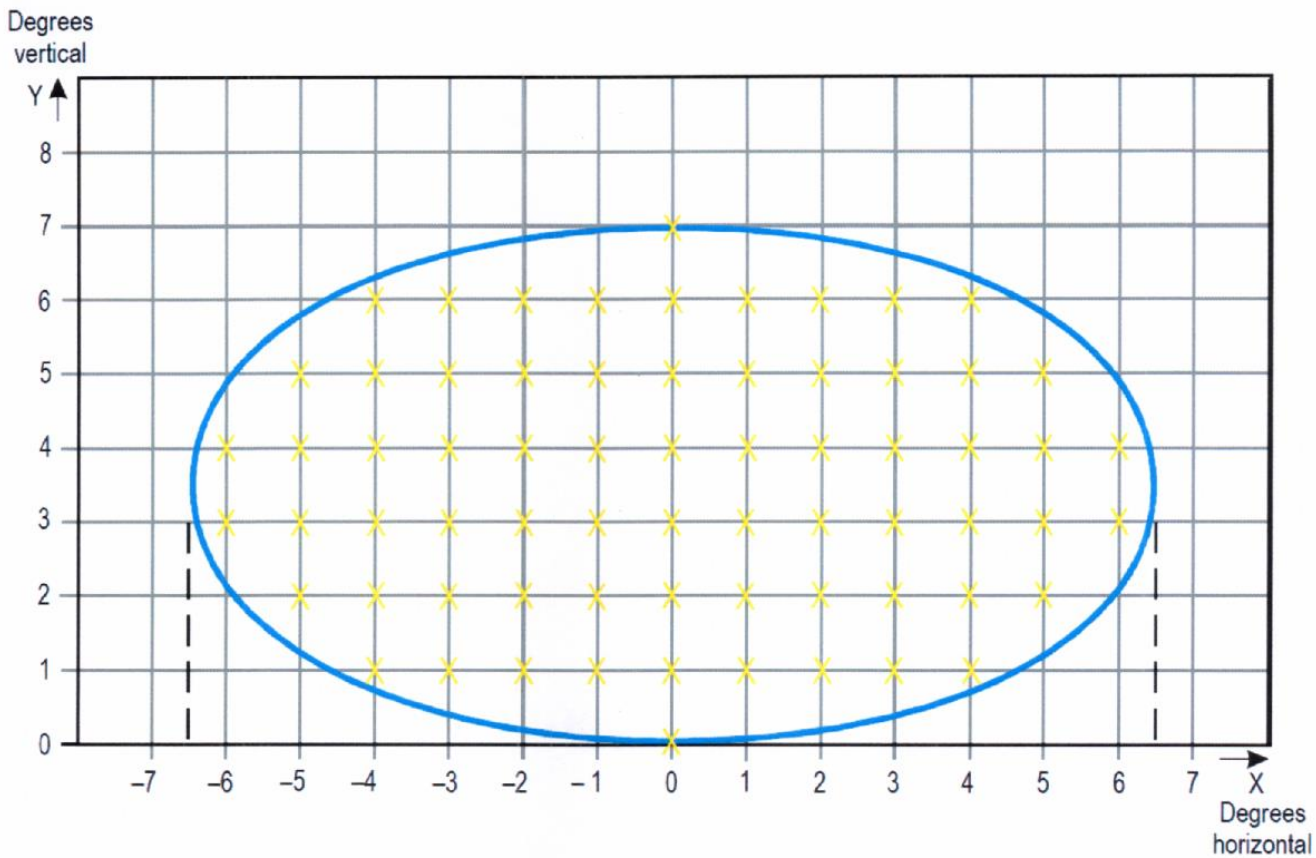



***Figure A2-11. Grid points to be used for the calculation of average intensity of approach and runway lights.***

*Collective notes to Figures A2-1 to A2-11 and A2-26*

1. The ellipses in each figure are symmetrical about the common vertical and horizontal axes.

2. Figures A2-1 to A2-10, as well as Figure A2-25, show the minimum allowable light intensities. The average intensity of the main beam is calculated by establishing grid points as shown in Figure A2-11 and using the intensity value measures at all grid points located within and on the perimeter of the ellipse representing the main beam. The average value is the arithmetic average of light intensities measured at all considered grid points.

3. No deviations are acceptable in the main beam pattern when the lighting fixture is properly aimed.

4. Average intensity ratio. The ratio between the average intensity within the ellipse defining the main beam of a typical new light and the average light intensity of the main beam of a new runway edge light shall be as follows:

| | | |
|---|---|---|
| Figure A2-1 | Approach centre line and crossbars | 1.5 to 2.0 (white light) |
| Figure A2-2 | Approach side row | 0.5 to 1.0 (red light) |
| Figure A2-3 | Threshold | 1.0 to 1.5 (green light) |
| Figure A2-4 | Threshold wing bar | 1.0 to 1.5 (green light) |
| Figure A2-5 | Touchdown zone | 0.5 to 1.0 (white light) |
| Figure A2-6 | Runway centre line (longitudinal spacing 30 m) | 0.5 to 1.0 (white light) |
| Figure A2-7 | Runway centre line (longitudinal spacing 15 m) | 0.5 to 1.0 for CAT III (white light)<br>0.25 to 0.5 for CAT I, II (white light) |
| Figure A2-8 | Runway end | 0.25 to 0.5 (red light) |
| Figure A2-9 | Runway edge (45 m runway width) | 1.0 (white light) |
| Figure A2-10 | Runway edge (60 m runway width) | 1.0 (white light) |

5. The beam coverages in the figures provide the necessary guidance for approaches down to an RVR of the order of 150 m and take-offs down to an RVR of the order of 100 m.

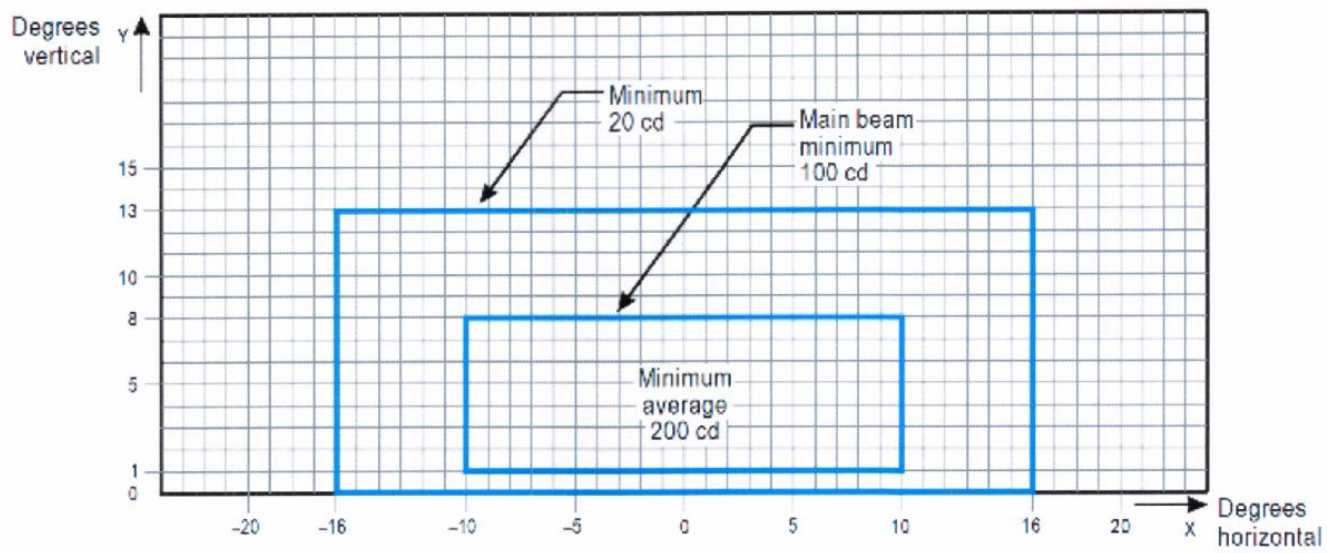
6. Horizontal angles are measured with respect to the vertical plane through the runway centre line. For lights other than centre line lights, the direction towards the runway centre line is

considered positive. Vertical angles are measured with respect to the horizontal plane.

7. Where, for approach centre line lights and crossbars and for approach side row lights, inset lights are used in lieu of elevated lights, e.g. on a runway with a displaced threshold, the intensity requirements can be met by installing two or three fittings (lower intensity) at each position.

8. The importance of adequate maintenance cannot be overemphasized. The average intensity should never fall to a value less than 50 per cent of the value shown in the figures, and it should be the aim of airport authorities to maintain a level of light output close to the specified minimum average intensity.

9. The light unit shall be installed so that the main beam is aligned within one-half degree of the specified requirement.



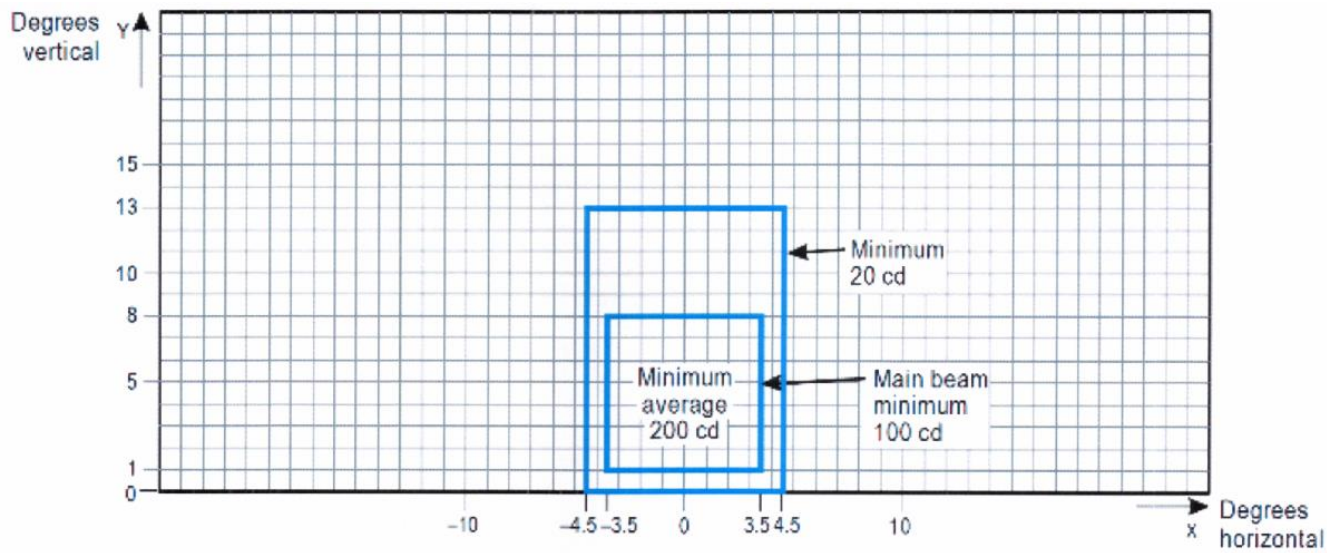

Notes:

1. These beam coverages allow for displacement of the cockpit from the centre line up to distances of the order of 12 m and are intended for use before and after curves.

2. See collective notes for Figures A2-12 to A2-21.

3. Increased intensities for enhanced rapid exit taxiway centre line lights as recommended in 5.3.16.9 are four times the respective intensities in the figure (i.e. 800 cd for minimum average main beam).

**Figure A2-12. Isocandela diagram for taxiway centre line (15 m spacing), RELs, no-entry bar and stop bar lights in straight sections intended for use in runway visual range conditions of less than a value of 350 m where large offsets can occur and for low-intensity runway guard lights, Configuration B**

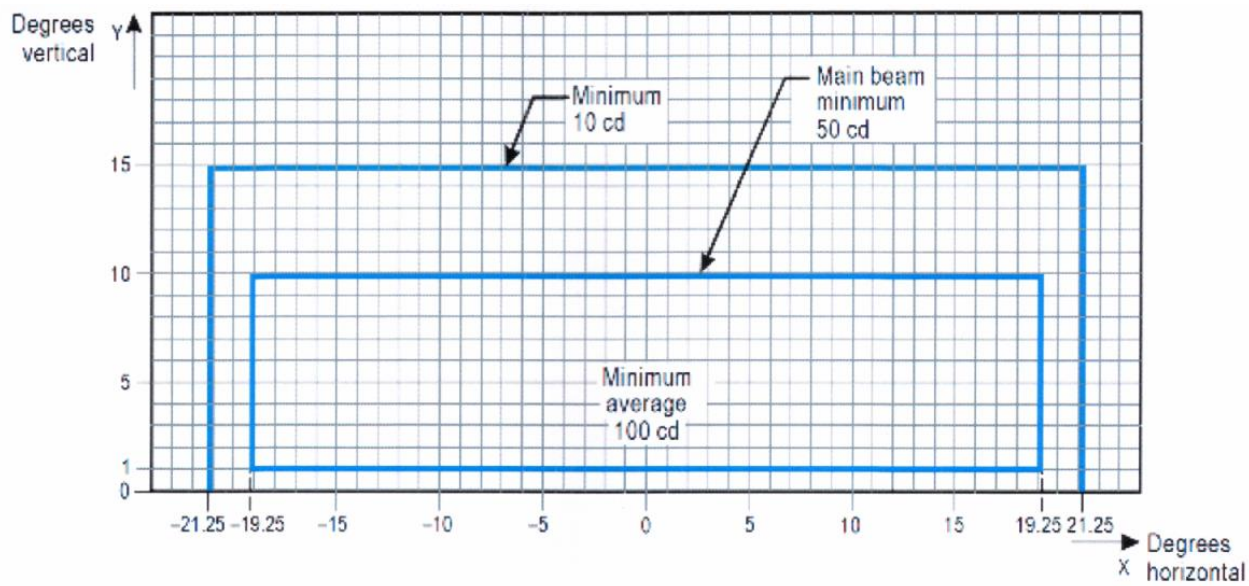



Notes:

1. These beam coverages are generally satisfactory and cater for a normal displacement of the cockpit from the centre line of approximately 3 m.

2. See collective notes for Figures A2-12 to A2-21.

***Figure A2-13. Isocandela diagram for taxiway centre line (15 m spacing), no-entry bar and stop bar lights in straight sections intended for use in runway visual range conditions of less than a value of 350 m***



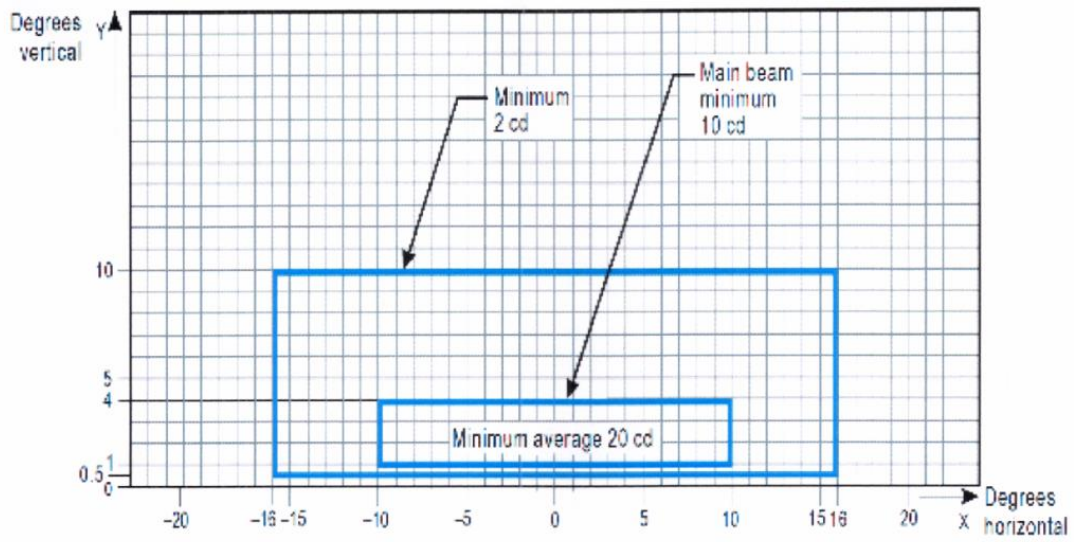

Notes:

1. Lights on curves to be toed-in 15.75 degrees with respect to the tangent of the curve. This does not apply to runway entrance lights (RELs)

2. Increased intensities for RELs shall be twice the specified intensities, i.e., minimum 20 cd, main beam minimum 100 cd and minimum average 200 cd.

3. See collective notes for Figures A2-12 to A2-21.

***Figure A2-14. Isocandela diagram for taxiway centre line (7.5 m spacing), RELs, no-entry bar and stop bar lights in curved sections intended for use in runway visual range conditions of less than a value of 350 m***



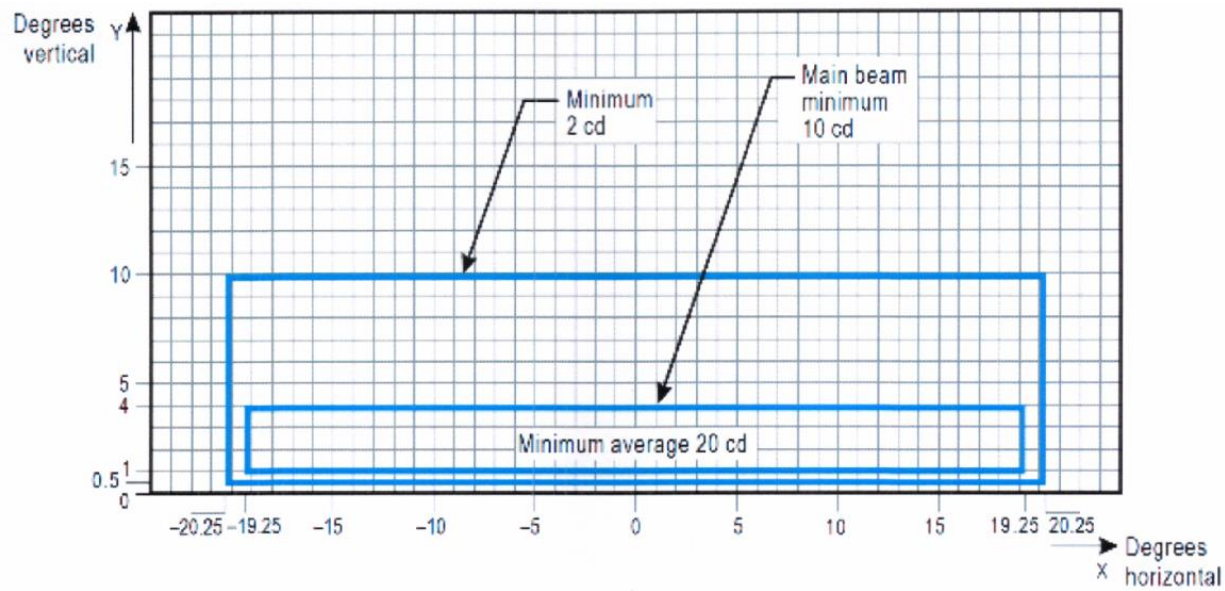

Notes:

1. At locations where high background luminance is usual and where deterioration of light output resulting from dust, and local contamination is a significant factor, the cd- values should be multiplied by 2.5.

2. Where omnidirectional lights are used they shall comply with the vertical beam requirements in this figure.

3. See collective notes for Figures A2-12 to A2-21.

**Figure A2-15. Isocandela diagram for taxiway centre line (30 m, 60 m spacing), no-entry bar and stop bar lights in straight sections intended for use inrunway visual range conditions of 350 m or greater**




Notes:

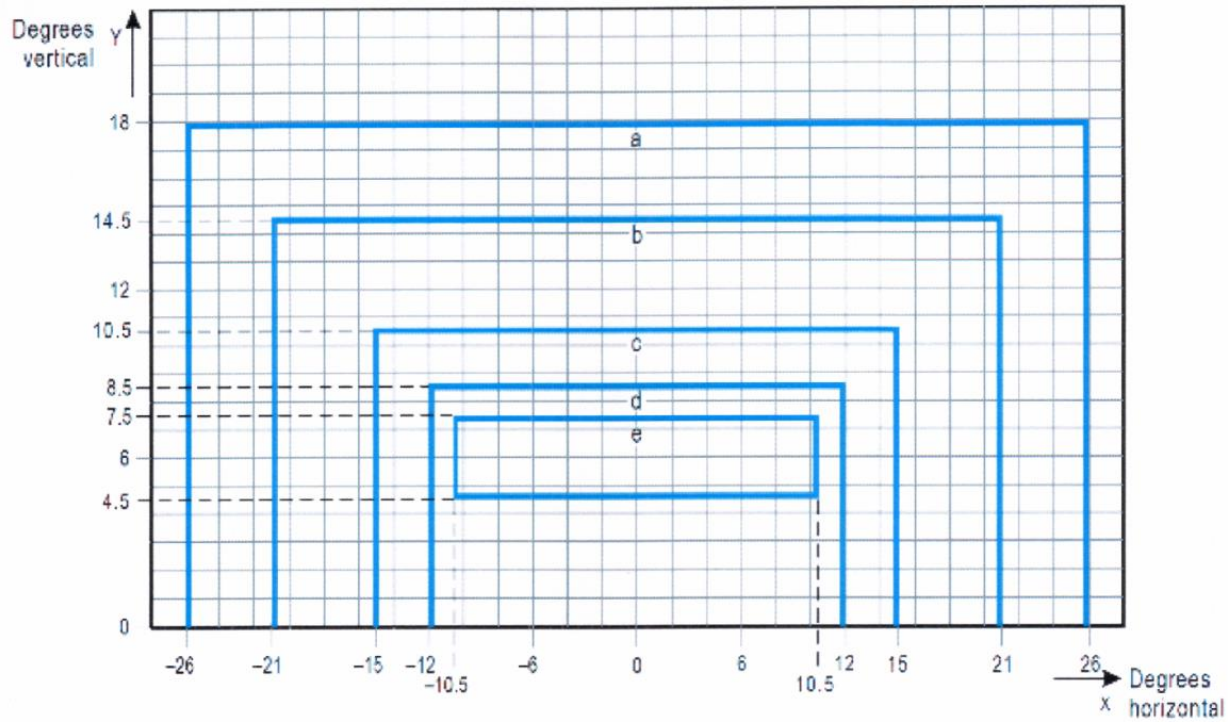
1. Lights on curves to be toed-in 15.75 degrees with respect to the tangent of the curve.

2. At locations where high background luminance is usual and where deterioration of light output resulting from dust, and local contamination is a significant factor, the cd- values should be multiplied by 2.5.

3. These beam coverages allow for displacement of the cockpit from the centre line up to distances of the order of 12 m as could occur at the end of curves.

4. See collective notes for Figures A2-12 to A2-21.

**Figure A2-16. Isocandela diagram for taxiway centre line (7.5 m, 15 m, 30 m spacing), no-entry bar and stop bar lights in curved sections intended for use in runway visual range conditions of 350 m or greater.**



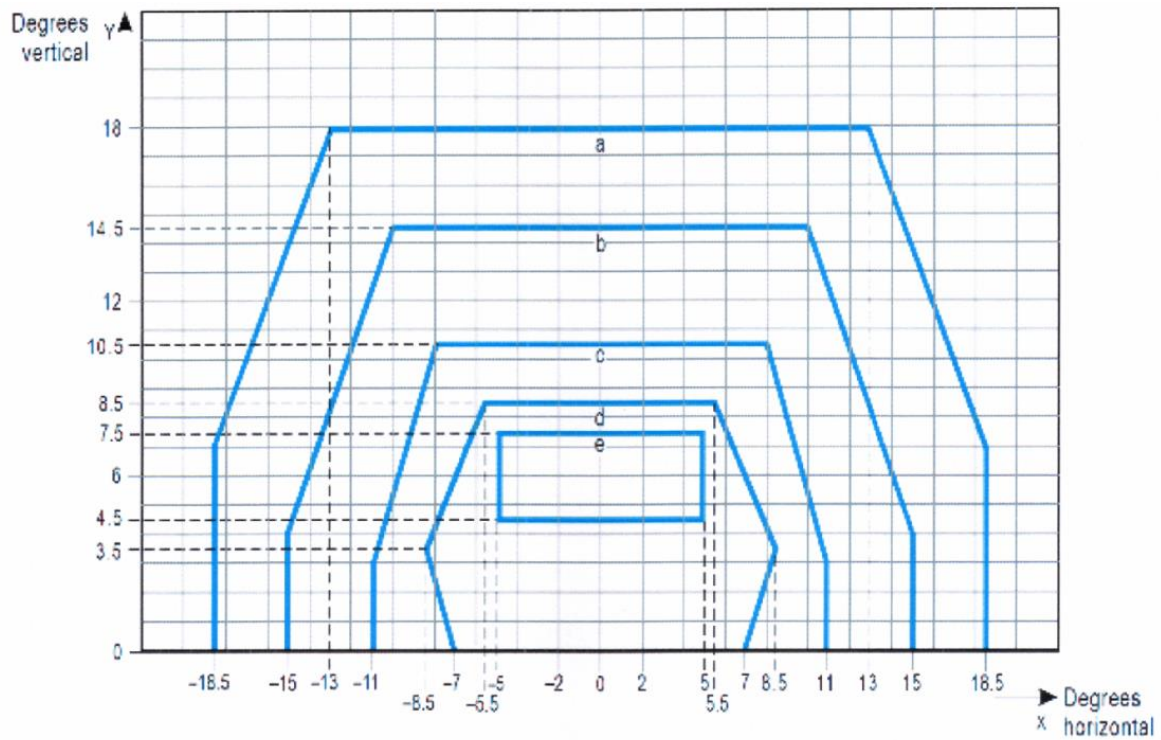

| Curve | a | b | c | d | e |
|---|---|---|---|---|---|
| Intensity (cd) | 8 | 20 | 100 | 450 | 1 800 |

Notes:

1. These beam coverages allow for displacement of the cockpit from the centre line up to distances of the order of 12 m and are intended for use before and after curves.

2. See collective notes for Figures A2-12 to A2-21.

**Figure A2-17. Isocandela diagram for high-intensity taxiway centre line (15 m spacing), no-entry bar and stop bar lights in straight sections intended for use in an advanced surface movement guidance and control system where higher light intensities are required and where large offsets can occur.**



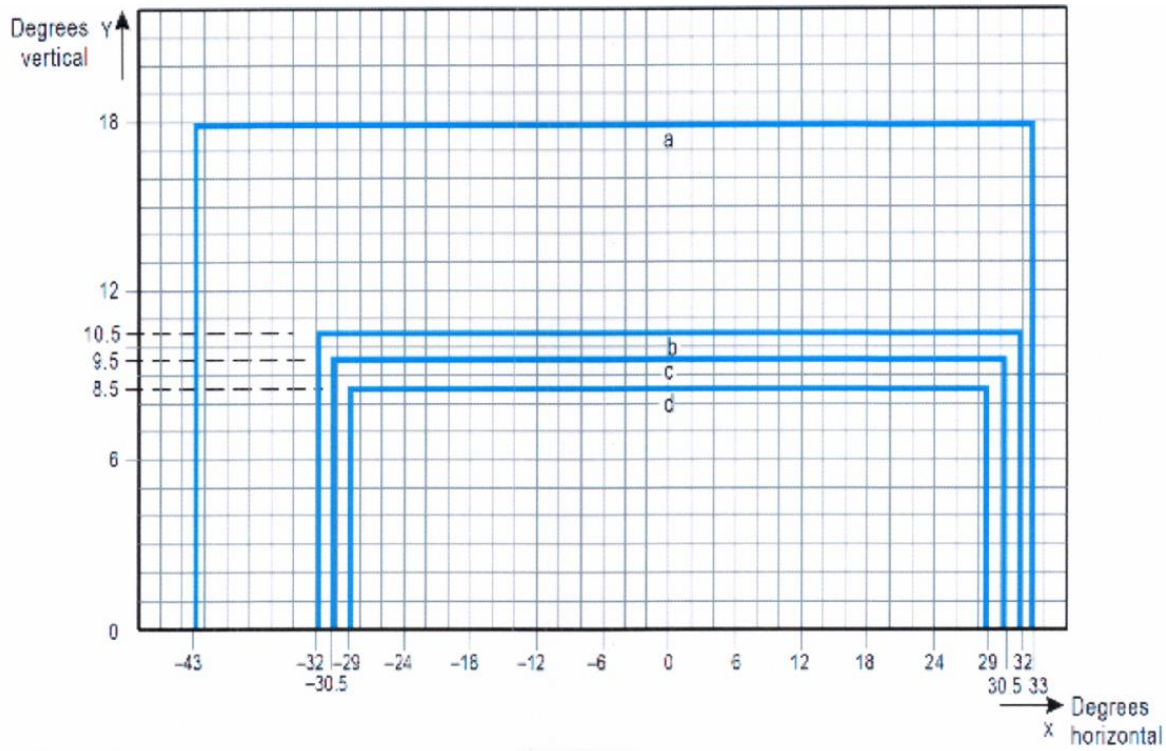

| Curve | a | b | c | d | e |
|---|---|---|---|---|---|
| Intensity (cd) | 8 | 20 | 100 | 450 | 1 800 |

Notes:

1. These beam coverages are generally satisfactory and cater for a normal displacement of the cockpit corresponding to the outer main gear wheel on the taxiway edge.

2. See collective notes for Figures A2-12 to A2-21.

**Figure A2-18. Isocandela diagram for high-intensity taxiway centre line (15 m spacing), no-entry bar and stop bar lights in straight sections intended for use in an advanced surface movement guidance and control system where higher light intensities are required.**

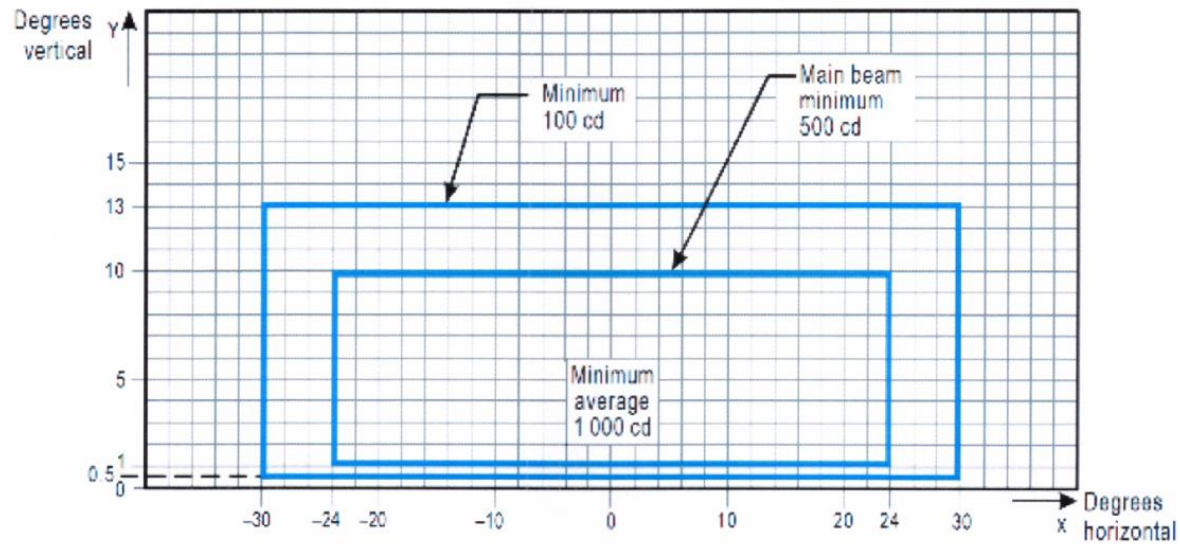



| Curve | a | b | c | d |
|---|---|---|---|---|
| Intensity (cd) | 8 | 100 | 200 | 400 |

Notes:

1. Lights on curves to be toed-in 17 degrees with respect to the tangent of the curve.
2. See collective notes for Figures A2-12 to A2-21.

**Figure A2-19. Isocandela diagram for high-intensity taxiway centre line (7.5 m spacing), no-entry bar and stop bar lights in curved sections intended for use in an advanced surface movement guidance and control system where higher light intensities are required**




Notes:

1. Although the lights flash in normal operation, the light intensity is specified as if the lights were fixed for incandescent lamps.

2. See collective notes for Figures A2-12 to A2-21.

***Figure A2-20. Isocandela diagram for high-intensity runway guard lights, Configuration B***

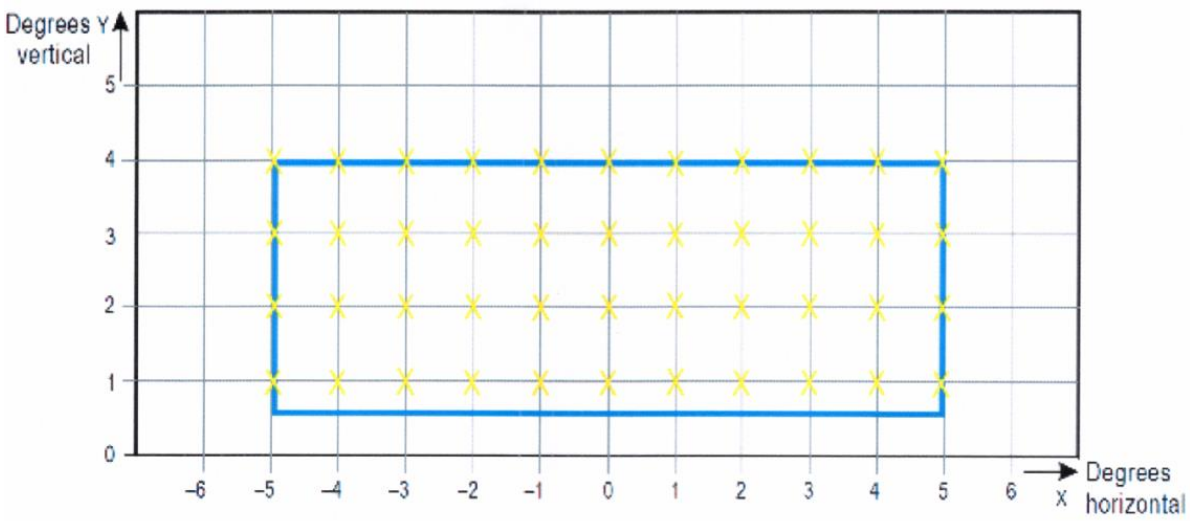



***Figure A2-21. Grid points to be used for calculation of average intensity of taxiway centre line and stop bar lights***

*Collective notes to Figures A2-12 to A2-21*

1. The intensities specified in Figures A2-12 to A2-20 are in green and yellow light for taxiway centre line lights, yellow light for runway guard lights and red light for stop bar lights.

2. Figures A2-12 to A2-20 show the minimum allowable light intensities. The average intensity of the main beam is calculated by establishing grid points as shown in Figure A2-21 and using the intensity values measured at all grid points located within and on the perimeter of the rectangle representing the main beam. The average value is the arithmetic average of the light intensities measured at all considered grid points.

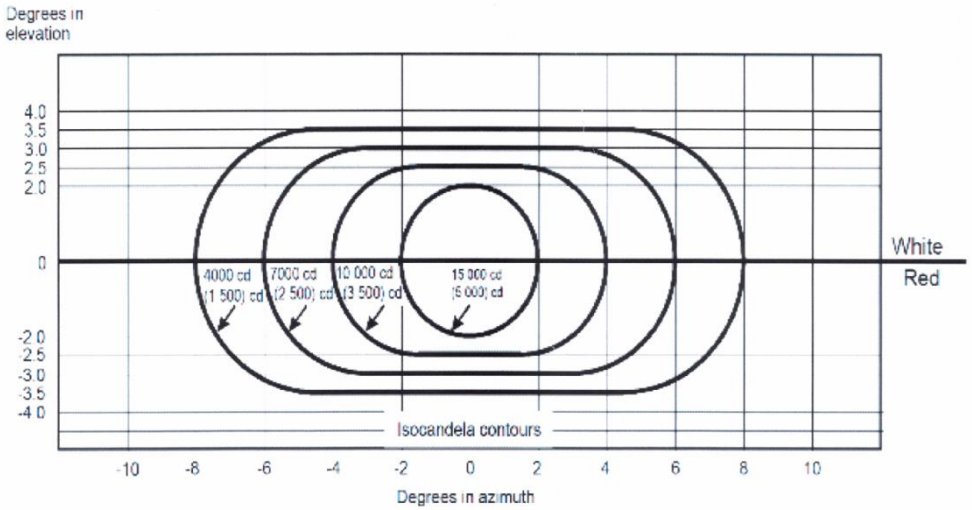
3. No deviations are acceptable in the main beam or in the innermost beam, as applicable, when the lighting fixture is properly aimed.

4. Horizontal angles are measured with respect to the vertical plane through the taxiway centre line except on curves where they are measured with respect to the tangent to the curve.

5. Vertical angles are measured from the longitudinal slope of the taxiway surface.

6. The importance of adequate maintenance cannot be overemphasized. The intensity, either average where applicable or as specified on the corresponding isocandela curves, should never fall to a value less than 50 per cent of the value shown in the figures, and it should be the aim of airport authorities to maintain a level of light output close to the specified minimum average intensity.

7. The light unit shall be installed so that the main beam or the innermost beam, as applicable, is aligned within one- half degree of the specified requirement.



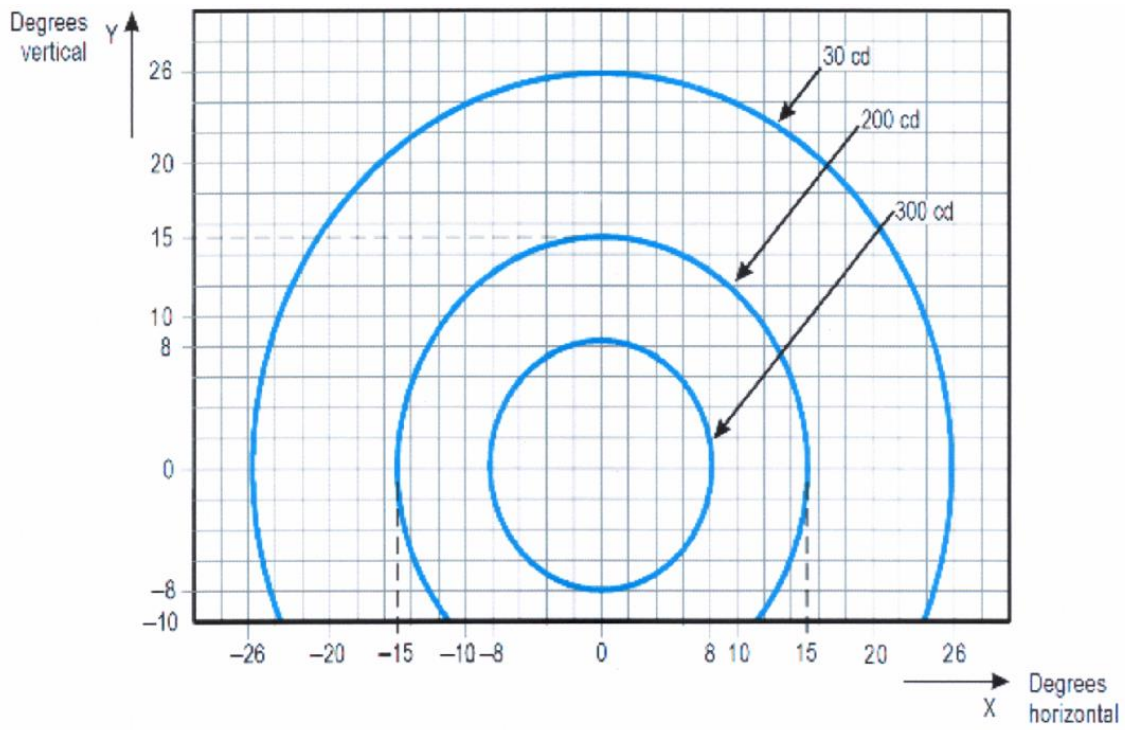

Notes:

1. These curves are for minimum intensities in red light.

2. The intensity value in the white sector of the beam is no less than 2 and may be as high as 6.5 times the corresponding intensity in the red sector.

3. The intensity values shown in brackets are for APAPI.

**Figure A2-22. Light intensity distribution of PAPI and APAPI**

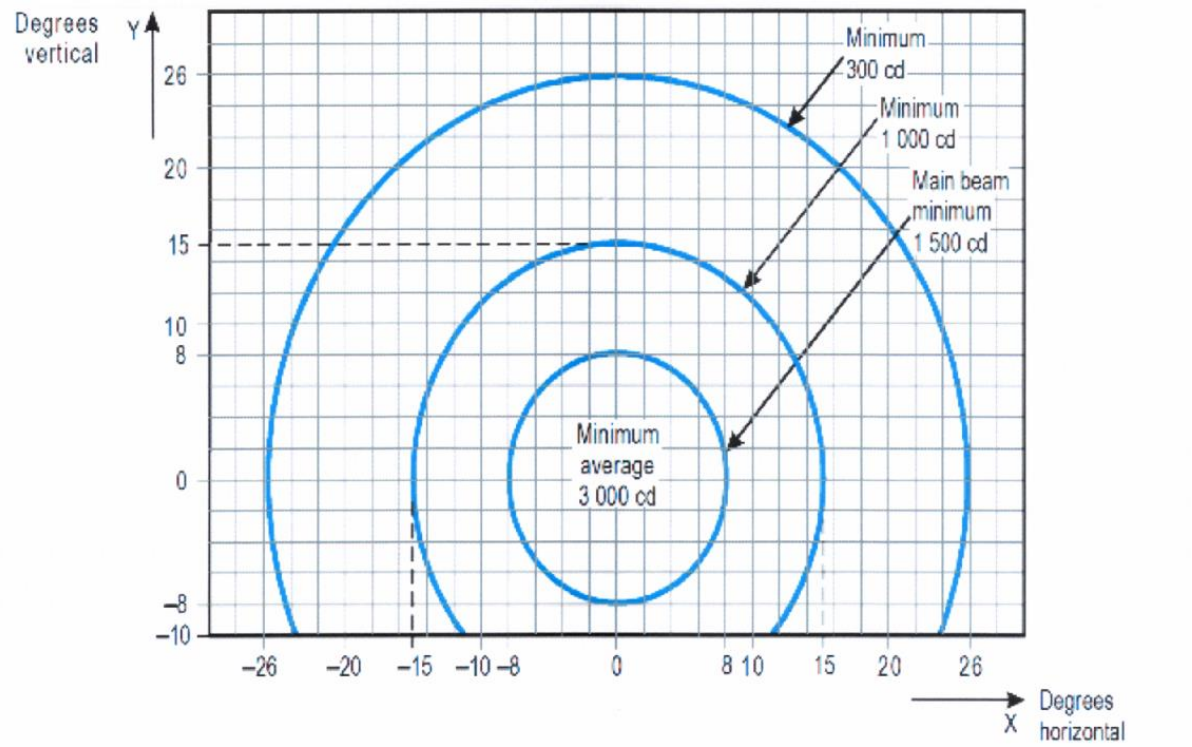



Notes:

1. Although the lights flash in normal operation, the light intensity is specified as if the lights were fixed for incandescent lamps.

2. The intensities specified are in yellow light.

**Figure A2-23. Isocandela diagram for each light in low-intensity runway guard lights, Configuration A**

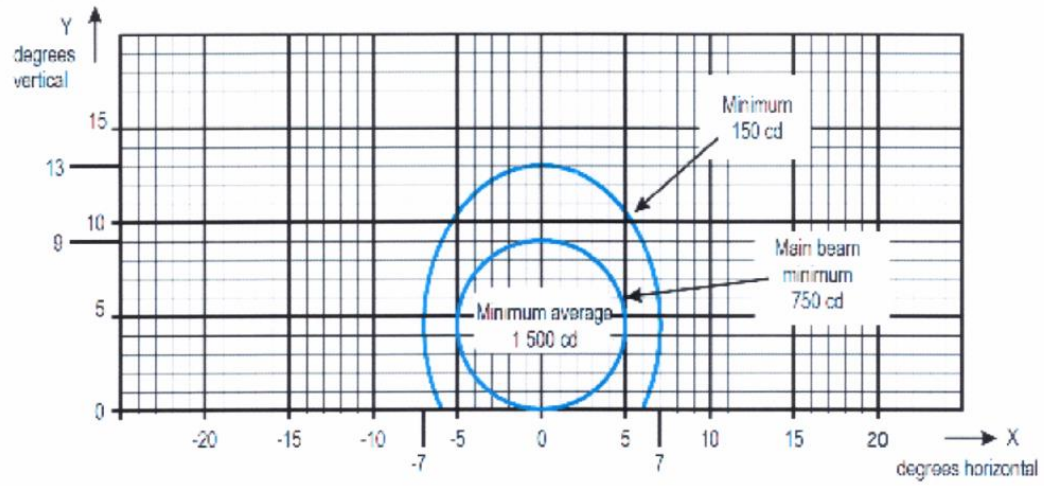



Notes:

1. Although the lights flash in normal operation, the light intensity is specified as if the lights were fixed for incandescent lamps.

2. The intensities specified are in yellow light.

***Figure A2-24. Isocandela diagram for each light in high-intensity runway guard lights, Configuration A***




Notes:

1. Curves calculated on formula $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

| | | |
|---|---|---|
| a | 5.0 | 7.0 |
| b | 4.5 | 8.5 |

2. See collective notes for Figures A2-1 to A2-11 and A2-26.

**Figure A2-25. Isocandela diagram for take-off and hold lights (THL) (red light)**

## APPENDIX 3. MANDATORY INSTRUCTION MARKINGS AND INFORMATION MARKINGS

Note 1.— See Chapter 5, Sections 5.2.16 and 5.2.17, for specifications on the application, location and characteristics of mandatory instruction markings and information markings.

Note 2.— This appendix details the form and proportions of the letters, numbers and symbols of mandatory instruction markings and information markings on a grid.

Note 3.— The mandatory instruction markings and information markings on pavements are formed as if shadowed (i.e., stretched) from the characters of an equivalent elevated sign by a factor of 2.5 as shown in Figure A3-1. The shadowing, however, only affects the vertical dimension. Therefore, the spacing of characters for pavement marking is obtained by first determining the equivalent elevated sign character height and then proportioning from the spacing values given in Table A4-1. For example, in the case of the runway designator "10" which is to have a height of 4 000 mm (Hps), the equivalent elevated sign character height is 4 000/2.5=1 600 mm (Hes). Table A4-1(b) indicates numeral to numeral code 1 and from Table A4-1(c) this code has a dimension of 96 mm, for a character height of 400 mm. The pavement marking spacing for "10" is then (1 600/400)*96=384 mm.

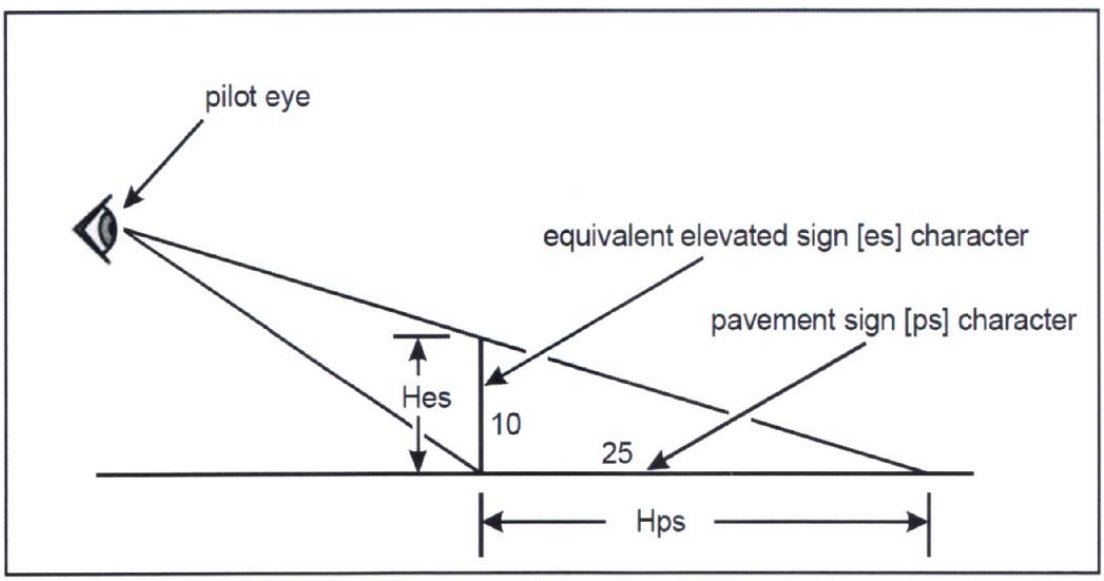
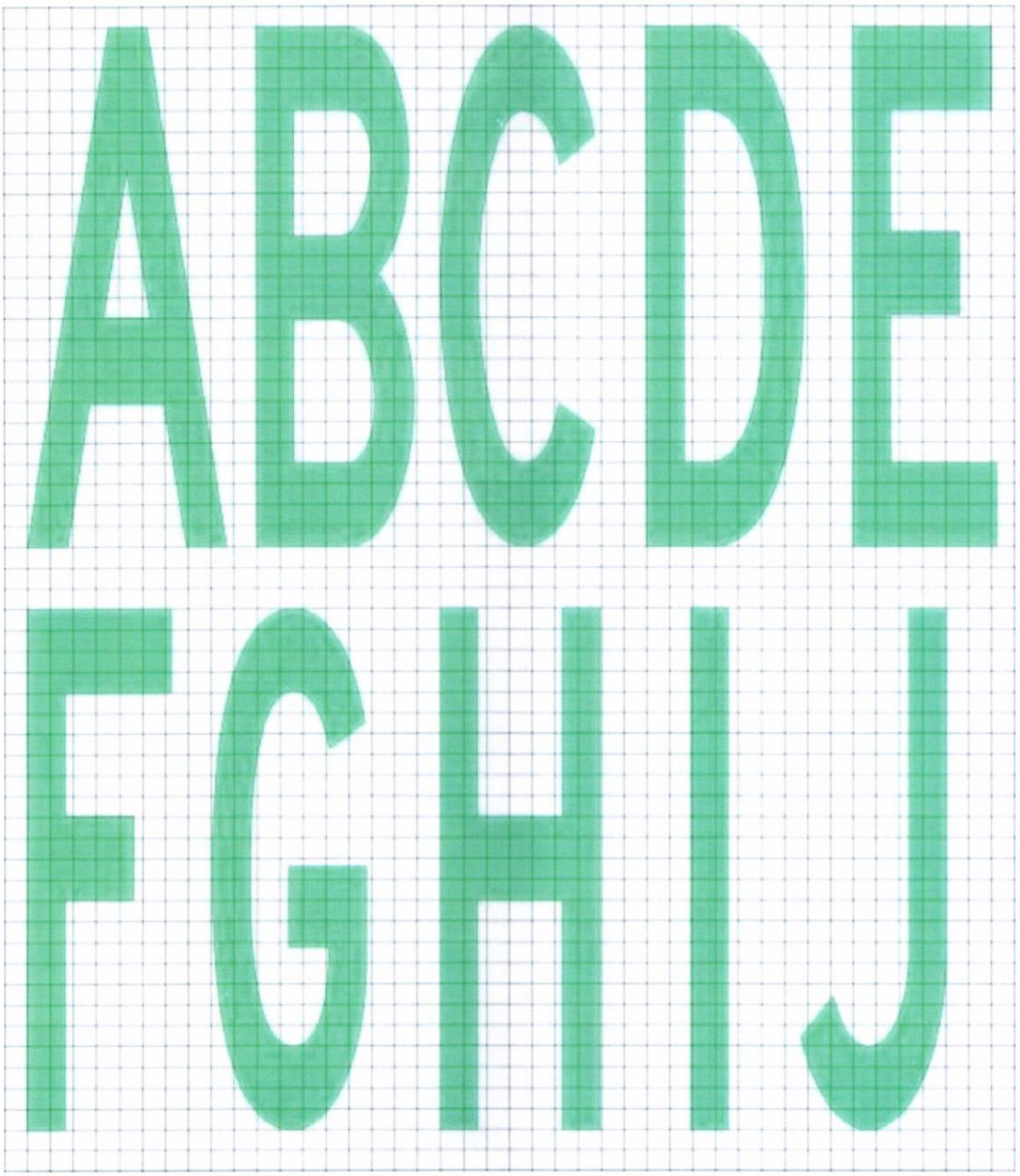
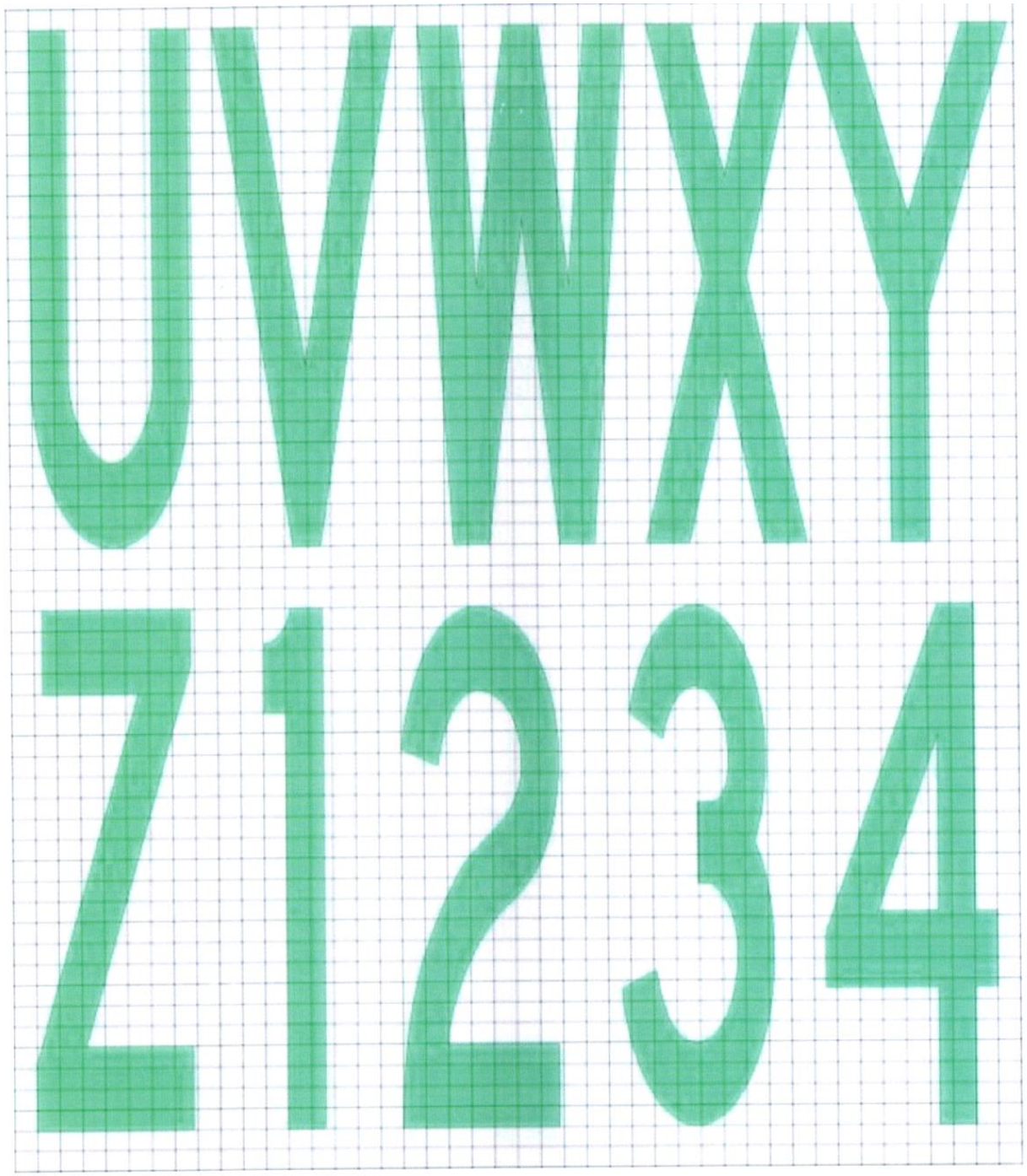



**Figure A3-1**


ABCDE
FGHIJ


KLMNO
PQRST


UVWXY
Z1234


56789
0

## APPENDIX 4. REQUIREMENTS CONCERNING DESIGN OF TAXIING GUIDANCE SIGNS

Note.— See Chapter 5, Section 5.4, for specifications on the application, location and characteristics of signs.

1. Inscription heights shall conform to the following tabulation.

| Runway code number | Minimum character height | | |
|---|---|---|---|
| | Mandatory instruction sign | Information sign | |
| | | Runway exit and runway vacated signs | Other signs |
| 1 or 2 | 300 mm | 300 mm | 200 mm |
| 3 or 4 | 400 mm | 400 mm | 300 mm |

Note.— Where a taxiway location sign is installed in conjunction with a runway designation sign (see 5.4.3.22), the character size shall be that specified for mandatory instruction signs.

2. Arrow dimensions shall be as follows:

| Legend height | Stroke |
|---|---|
| 200 mm | 32 mm |
| 300 mm | 48 mm |
| 400 mm | 64 mm |

3. Stroke width for single letter shall be as follows:

| Legend height | Stroke |
|---|---|
| 200 mm | 32 mm |
| 300 mm | 48 mm |
| 400 mm | 64 mm |

4. Sign luminance shall be as follows:

a) Where operations are conducted in runway visual range conditions less than a value of 800 m, average sign luminance shall be at least:

| | |
|---|---|
| Red | 30 cd/m$^2$ |
| Yellow | 150 cd/m$^2$ |
| White | 300 cd/m$^2$ |

b) Where operations are conducted in accordance with 5.4.1.7 b) and c) and 5.4.1.8, average sign luminance shall be at least:

| | |
|---|---|
| Red | 10 cd/m$^2$ |
| Yellow | 50 cd/m$^2$ |
| White | 100 cd/m$^2$ |

Note.— In runway visual range conditions less than a value of 400 m, there will be some degradation in the performance of signs.

5. The luminance ratio between red and white elements of a mandatory sign shall be between 1:5 and 1:10.

6. The average luminance of the sign is calculated by establishing grid points as shown in Figure A4-1 and using the luminance values measured at all grid points located within the rectangle representing the sign.

7. The average value is the arithmetic average of the luminance values measured at all considered grid points.

Note.— Guidance on measuring the average luminance of a sign is contained in the Aerodrome Design Manual (Doc 9157), Part 4.

8. The ratio between luminance values of adjacent grid points shall not exceed 1.5:1. For

areas on the sign face where the grid spacing is 7.5 cm, the ratio between luminance values of adjacent grid points shall not exceed 1.25:1. The ratio between the maximum and minimum luminance value over the whole sign face shall not exceed 5:1.

9. The forms of characters, i.e. letters, numbers, arrows and symbols, shall conform to those shown in Figure A4-2. The width of characters and the space between individual characters shall be determined as indicated in Table A4-1.

10. The face height of signs shall be as follows:

| Legend height | Face height (min) |
|---|---|
| 200 mm | 300 mm |
| 300 mm | 450 mm |
| 400 mm | 600 mm |

11. The face width of signs shall be determined using Figure A4-4 except that, where a mandatory instruction sign is provided on one side of a taxiway only, the face width shall not be less than:

a) 1.94 m where the code number is 3 or 4; and

b) 1.46 m where the code number is 1 or 2.

Note.— Additional guidance on determining the face width of a sign is contained in the Aerodrome Design Manual (Doc 9157), Part 4.

12. Borders

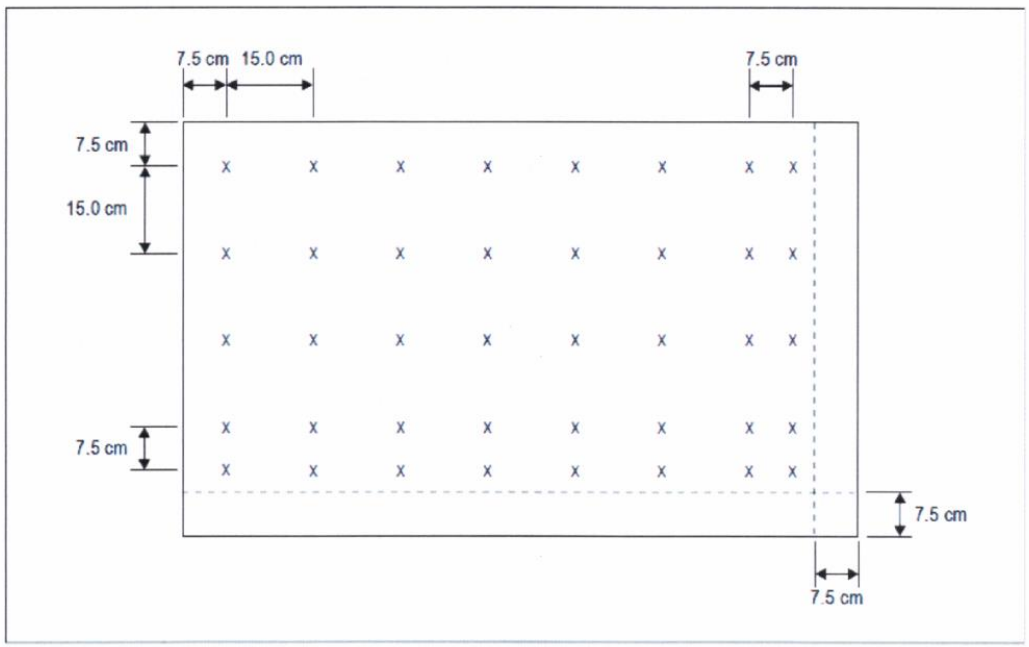
a) The black vertical delineator between adjacent direction signs should have a width of approximately 0.7 of the stroke width.

b) The yellow border on a stand-alone location sign should be approximately 0.5 stroke width.

13. The colours of signs shall be in accordance with the appropriate specifications in

Appendix 1.

**Figure A4-1. Grid points for calculating average luminance of a sign**




Note 1.— The average luminance of a sign is calculated by establishing grid points on a sign face showing typical inscriptions and a background of the appropriate colour (red for mandatory instruction signs and yellow for direction and destination signs) as follows:

a) Starting at the top left corner of the sign face, establish a reference grid point at 7.5 cm from the left edge and the top of the sign face.

b) Create a grid of 15 cm spacing horizontally and vertically from the reference grid point. Grid points within 7.5 cm of the edge of the sign face shall be excluded.

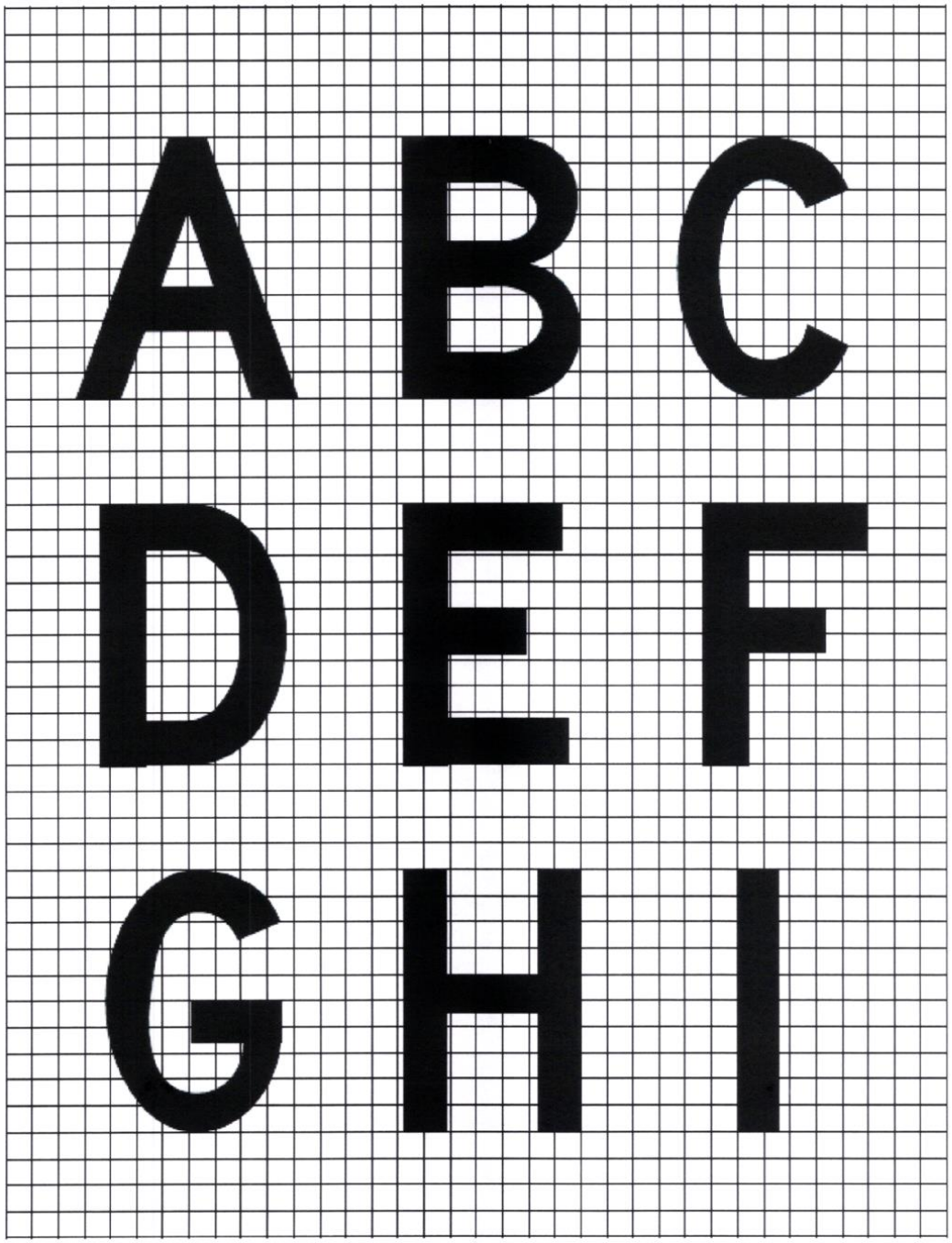
c) Where the last point in a row/column of grid points is located between 22.5 cm and 15 cm from the edge of the sign face (but not inclusive), an additional point shall be added 7.5 cm from this point.

d) Where a grid point falls on the boundary of a character and the background, the grid point shall be slightly shifted to be completely outside the character.

Note 2.— Additional grid points may be required to ensure that each character includes at least five evenly spaced grid points.

Note 3.— Where one unit includes two types of signs, a separate grid shall be established for each type.

**Figure A4-2. Forms of characters**


A B C
D E F
G H I

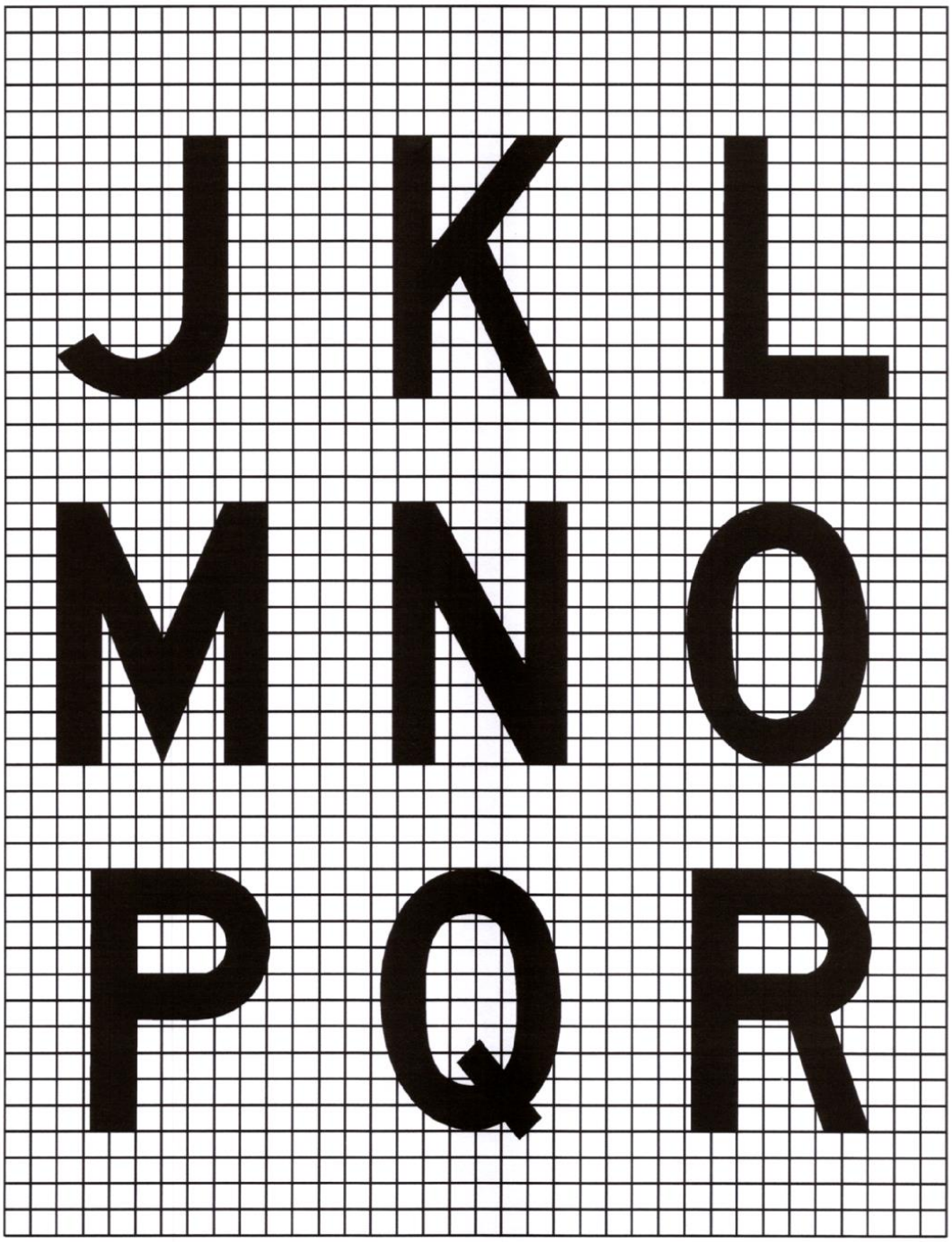



**Figure A4-2.** (cont.)

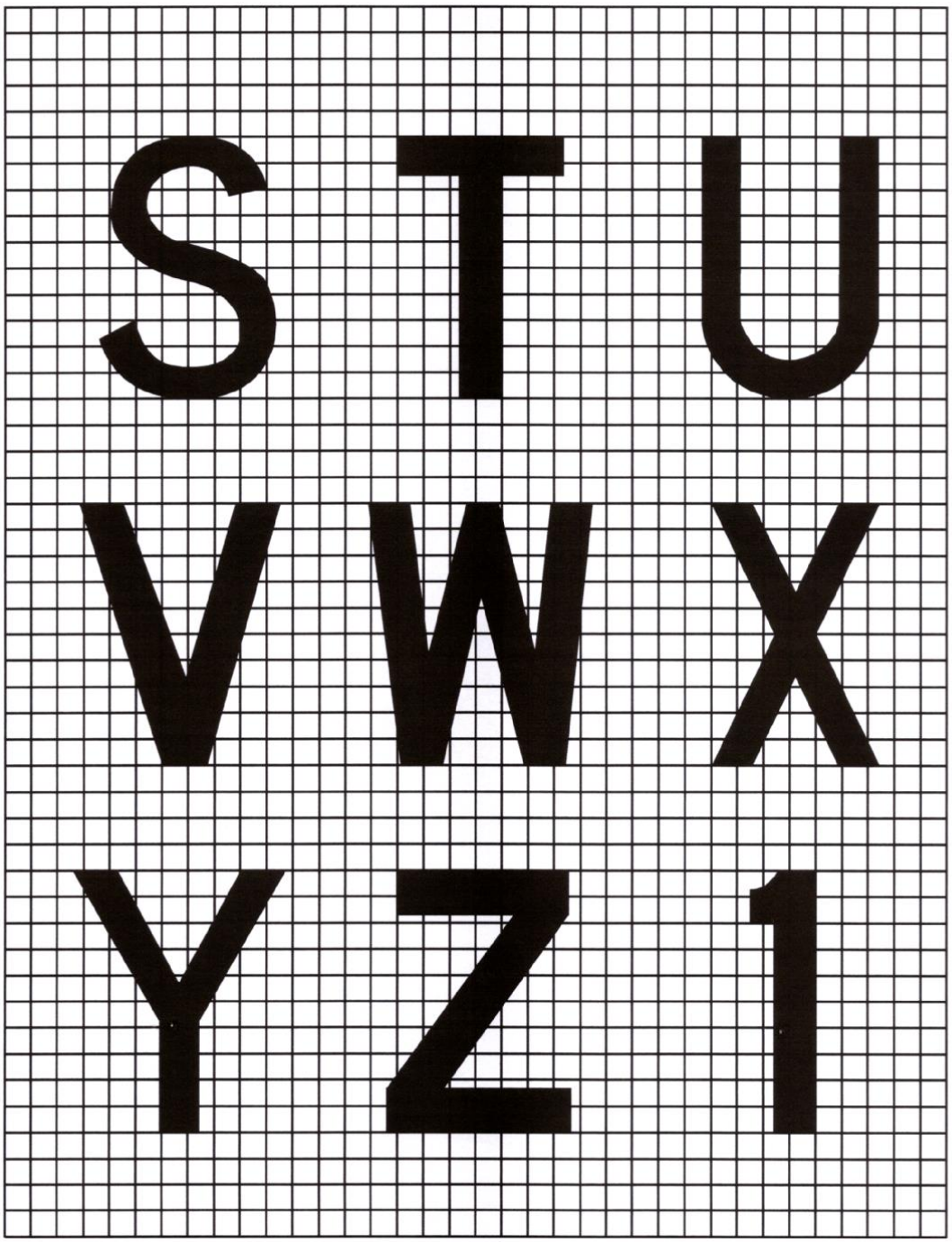



**Figure A4-2. (cont.)**

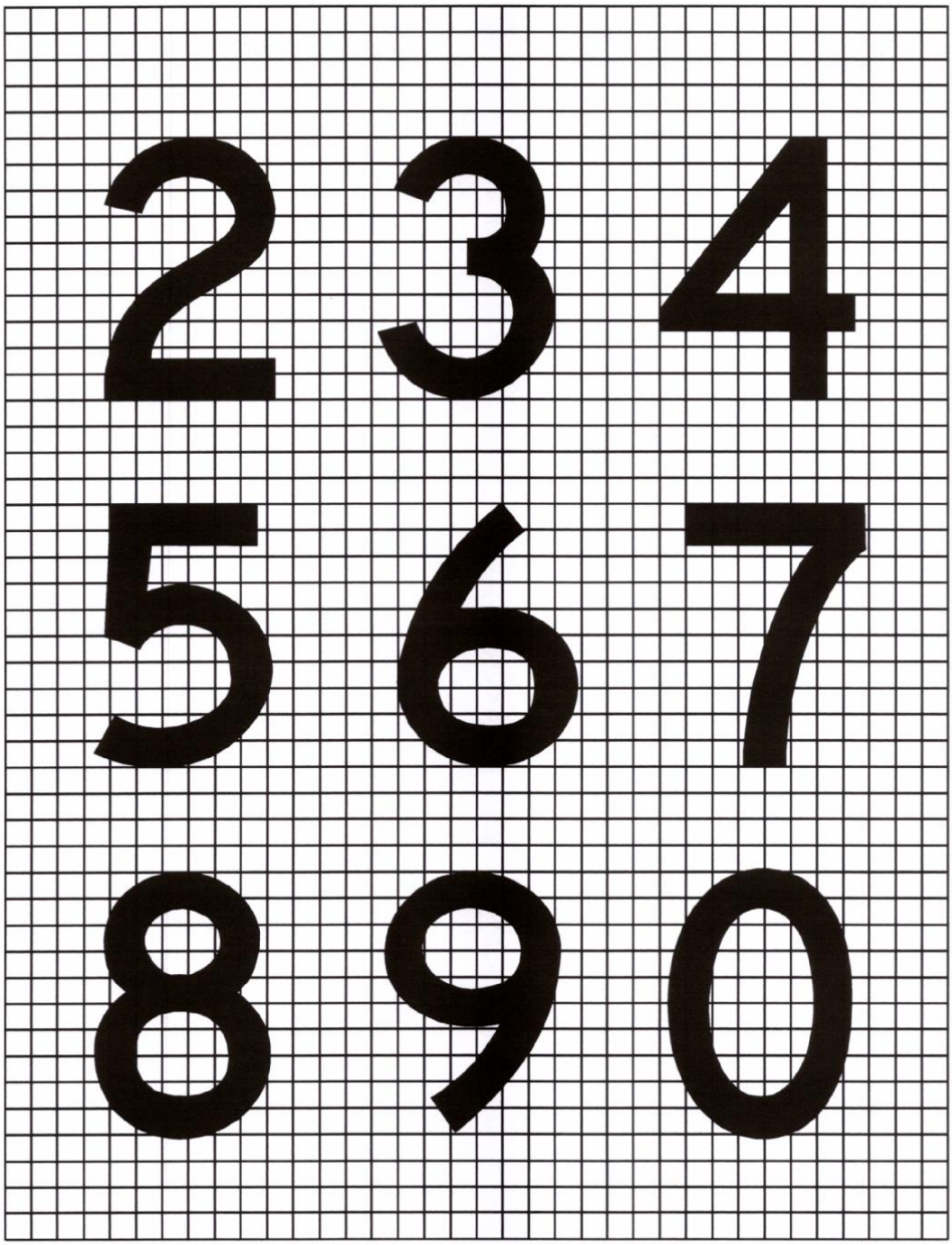



**Figure A4-2.** (cont.)

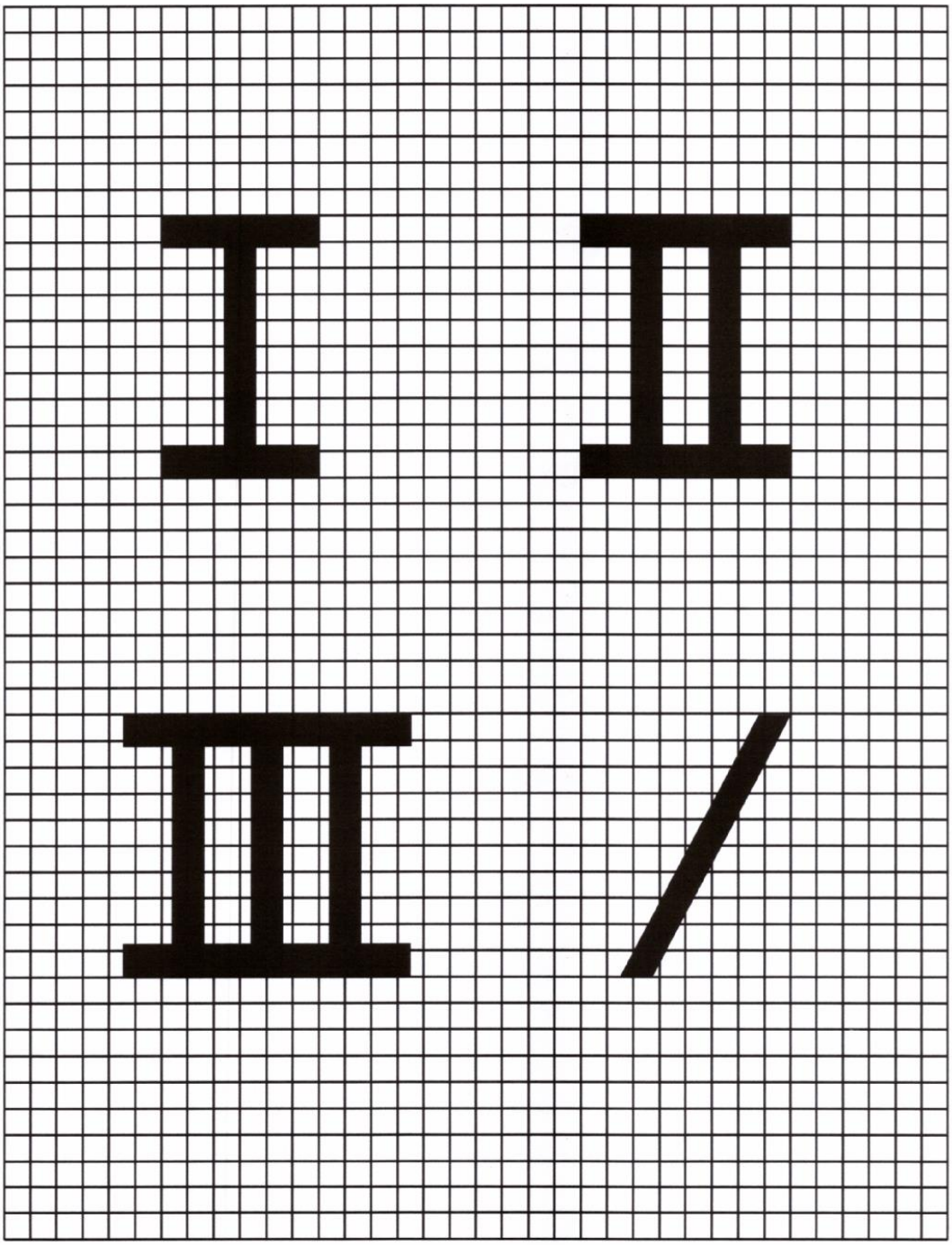
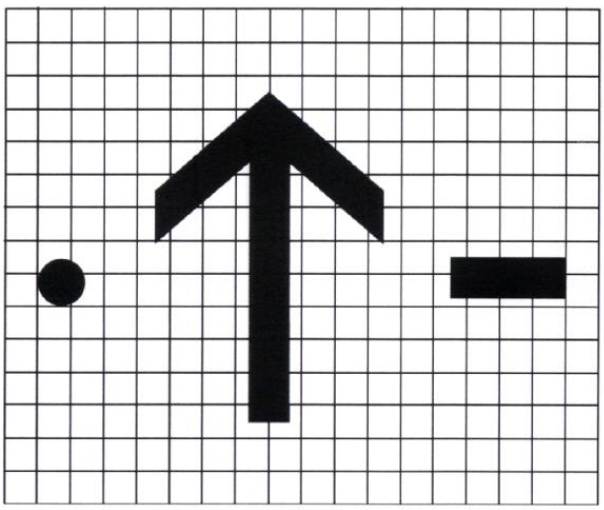


**Figure A4-2. (cont.)**

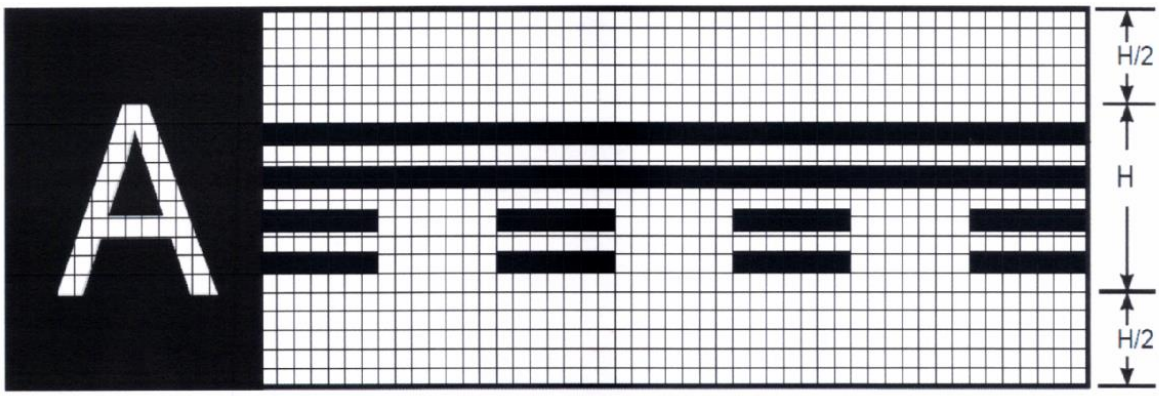


Note 1.—The arrow stroke width, diameter of the dot, and both width and length of the dash shall be proportioned to the character stroke widths.

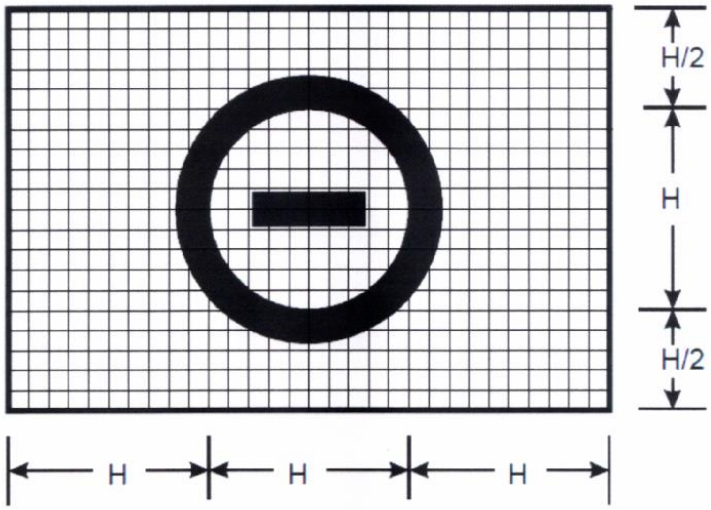
Note 2.— The dimensions of the arrow shall remain constant for a particular sign size, regardless of orientation.

Arrow, dot and dash

**Figure A4-2.**

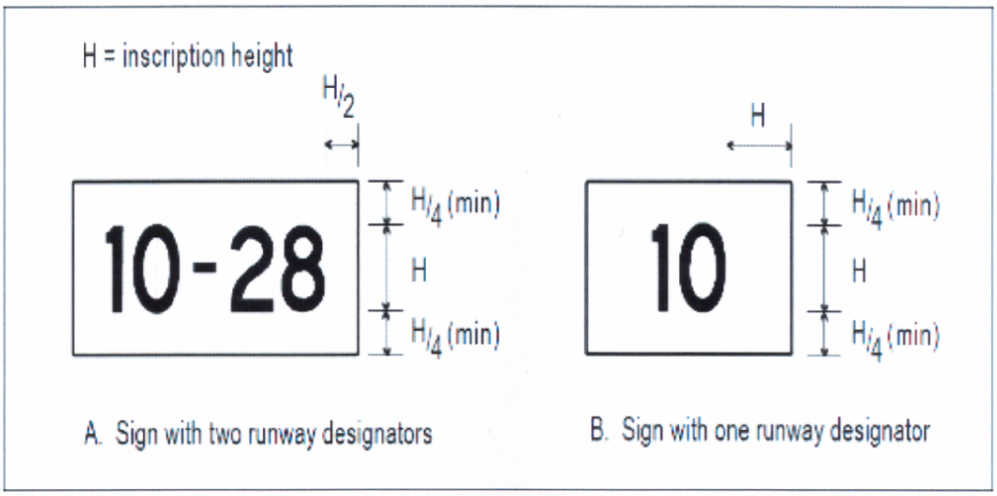



**Runway vacated sign (with typical location sign)**




**NO ENTRY sign**

**Figure A4-3. Runway vacated and NO ENTRY signs**




Explanatory Note to Figure A4-4: "H" stands for the inscription height.

**Figure A4-4. Sign dimensions**

| | | | |
|---|---|---|---|
| 4 | 2 | 2 | 4 |
| 5 | 1 | 2 | 2 |
| 6 | 1 | 2 | 2 |
| 7 | 2 | 2 | 4 |
| 8 | 1 | 2 | 2 |
| 9 | 1 | 2 | 2 |
| 0 | 1 | 2 | 2 |

c) Space between characters

| Code No. | Character height (mm) 200 | 300 | 400 |
|---|---|---|---|
| | Space (mm) | | |
| 1 | 48 | 71 | 96 |
| 2 | 38 | 57 | 76 |
| 3 | 25 | 38 | 50 |
| 4 | 13 | 19 | 26 |
| 5 | 137 | 205 | 274 |
| 6 | 137 | 205 | 274 |
| 7 | 137 | 205 | 274 |
| 8 | 137 | 205 | 274 |
| 9 | 137 | 205 | 274 |
| 0 | 143 | 214 | 286 |

INSTRUCTIONS

1. To determine the proper SPACE between letters or numerals, obtain the code number from table a) or b) and enter table c) for that code number to the desired letter or numeral height.
2. The space between words or groups of characters forming an abbreviation or symbol should be equal to 0.5 to 0.75 of the height of the characters used except that where an arrow is located with a single character such as 'A □', the space may be reduced to not less than one quarter of the height of the character in order to provide a good visual balance.
3. Where the numeral follows a letter or vice versa use Code 1.
4. Where a hyphen, dot, or diagonal stroke follows a character or vice versa use Code 1.
5. For the intersection take-off sign, the height of the lower case "m" is
0.75 of the height of the preceding "0" (zero) and spaced from the preceding "0" at code 1 for the character height of the numerals.