Guidance Material for ILS requirements in RSA

General:-

- Controlled airspace required with appropriate procedures.
- Control Tower to have clear and unobstructed view of the complete runway complex.
- ATC to have status indicators of all equipment associated with precision approach. (Annex 10 Vol.1 chapter 2)
- Meteorological equipment required as per part 139 and part 172 including RVR and Ceilometer (Annex 3)
- Strip width of 150m from the runway centre line required. (Refer Annex 14 chapter 3)
- Clear area of at least 300m required beyond the runway threshold. The localizer antenna must hence be at least 300m from the threshold. This 300m area serves several purposes such as runway end safety area (RESA), radio altimeter operating area etc. (Refer Annex 14 chapter 3)
- Mains ring feed and standby power supply required with change over times as specified depending on category. (Refer Annex 14 Chapter 8).
- Obstacle limitation surfaces apply (Refer Annex 14 chapter 4) also see Power point presentation on Obstacle limitation surfaces. A Take –off climb surface of **1,6% shall apply (1:62,5)** unless a different slope already exists, providing that this slope shall be equal or below 2% (1:50) (Refer Annex 14 chapter 4. 2.26)
- Appropriate approach lighting system (Annex 14 Chapter 5) including centreline and touchdown zone lights. Approach and runway light systems shall be maintained to the levels of serviceability as specified in Annex 14 Chapter 9.4
- ILS equipment to the standards of Annex 10 Chapter 3 (Also attachment C)
- It is recommended that all new ILS installations be provided with (directional) DME (DME/N) instead of 75 MHz marker beacons. This has the advantage of supplying continuous distance information in a more secure environment than a marker beacon. Such DME shall indicate distance to touchdown.
- New ILS equipment shall also feature a “no-break” power supply with autonomy of at least 4 hours.
- Obstacle marking in accordance (***with SA CATS- AH 139.01.33 – new reference - will take precedence over Annex 14***) of Annex 14 chapter 6 shall apply unless specified differently.

Lighting (Ref Annex 14 Chapter 5.3)

C.- Precision approach runway category I
Where physically practicable, a precision approach category I lighting system as specified in 5.3.4.10 to 5.3.4.21 shall be provided to serve a precision approach runway category I.

D.- Precision approach runway categories II and III
A precision approach category II and III lighting system as specified in ***5.3.4.22*** to ***5.3.4.39*** shall be provided to serve a precision approach runway category II or III.

Simple approach lighting system

Location

5.3.4.2 A simple approach lighting system shall consist of a row of lights on the extended centre line of the runway extending, whenever possible, over a distance of not less than 420 m from the threshold with a row of lights forming a crossbar 18 m or 30 m in length at a distance of 300 m from the threshold.

5.3.4.3 The lights forming the crossbar shall be as nearly as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights. The lights of the crossbar shall be spaced so as to produce a linear effect, except that, when a crossbar of 30 m is used, gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m.

Note I.- *Spacings for the crossbar lights between 1 m and 4 m are in use. Gaps on each side of the centre line may improve directional guidance when approaches are made with a lateral error, and facilitate the movement of rescue and fire*
fighting vehicles.

Note 2.- *See Attachment A, Section II for guidance on installation tolerances.*

5.3.4.4 The lights forming the centre line shall be placed at longitudinal intervals of 60 m, except that, when it is desired to improve the guidance, an interval of 30 m may be used. The innermost light shall be located either 60 m or 30 m from the threshold, depending on the longitudinal interval selected for the centre line lights.

5.3.4.5 ***Recommendation***.- *If it is not physically possible to provide a centre line extending for a distance of 420 m from the threshold, it should be extended to 300 m so as to include the crossbar. If this is not possible, the centre line lights should be extended as far as practicable, and each centre*

line light should then consist of a barrette at least 3 m in length. 'Subject to the approach system having a crossbar at
300 m from the threshold, an additional crossbar may be provided at 150 m from the threshold.

5.3.4.6 The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that:

a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the
system; and
b) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities) shall be screened from an approaching aircraft.

Any ILS or MLS azimuth antenna protruding through the plane of the lights shall be treated as an obstacle and marked and lighted accordingly.

Characteristics

5.3.4.7 The lights of a simple approach lighting system shall be fixed lights and the colour of the lights shall be such as to ensure that the system is readily distinguishable from other aeronautical ground lights, and from extraneous lighting if present. Each centre line light shall consist of either:
a) a single source**;** or
b) a barrette at least 3 m in length.

Note I*.- When the barrette as in b) is composed of lights approximating to point sources, a spacing of 1.5 m between adjacent lights in the barrette has been found satisfactory.*

Note 2.- *It may be advisable to use barrettes 4 m in length if it is anticipated that the simple approach lighting system will be developed into a precision approach lighting system.*

Note 3.- *At locations where identification of the simple approach lighting system is difficult at night due to surrounding lights, sequence flashing lights installed in the outer portion of the system may resolve this problem.*

5.3.4.8 ***Recommendation.-*** *Where provided for a non-instrument runway, the lights should show at all angles in azimuth necessary to a pilot on base leg and final approach. The intensity of the lights should be adequate for all conditions*
of visibility and ambient light for which the system has been provided.

5.3.4.9 ***Recommendation.-*** *Where provided for a non-precision approach runway, the lights should show at all angles in azimuth necessary to the pilot of an aircraft which on final approach does not deviate by an abnormal amount from the path defined by the non-visual aid. The lights should be*

designed to provide guidance during both day and night in the most adverse conditions of visibility and ambient light for which it is intended that the system should remain usable.

Precision approach category I lighting system

Location

5.3.4.10 A precision approach category I lighting system shall consist of a row of lights on the extended centre line of the runway extending, wherever possible, over a distance of 900 m from the runway threshold with a row of lights forming a crossbar 30 m in length at a distance of 300 m from the runway threshold.

Note.- *The installation of an approach lighting system of less than 900 m in length may result in operational limitations on the use of the runway. See Attachment A, Section II.*

5.3.4.11 The lights forming the crossbar shall be as nearly as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights. The lights of the crossbar shall be spaced so as to produce a linear effect,
except that gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m.

Note I.- *Spacing for the crossbar lights between 1 m and 4 m are in use. Gaps on each side of the centre line may improve directional guidance when approaches are made with a lateral error, and facilitate the movement of rescue and fire fighting vehicles.*

Note 2.- *See Attachment A, Section I1 for guidance on installation tolerances.*

5.3.4.12 The lights forming the centre line shall be placed at longitudinal intervals of 30 m with the innermost light located 30 m from the threshold.

5.3.4.13 The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that:
a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and
b) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities) shall be screened from an approaching aircraft.

Any ILS or MLS azimuth antenna protruding through the plane of the lights shall be treated as an obstacle and marked and lighted accordingly.

Characteristics

5.3.4.14 The centre line and crossbar lights of a precision approach category I lighting system shall be fixed lights showing variable white. Each centre line light position shall consist of either:

a) a single light source in the innermost 300 m of the centre line, two light sources in the central 300 m of the centre line and three light sources in the outer 300 m of
the centre line to provide distance information; or
b) a barrette.

5.3.4.15 Where the serviceability level of the approach lights specified as a maintenance objective in 9.4.29 can be demonstrated, each centre line light position may consist of either:
a) a single light source; or
b) a barrette.

5.3.4.16 The barrettes shall be at least 4 m in length. When barrettes are composed of lights approximating to point sources, the lights shall be uniformly spaced at intervals of not more than 1.5 m.

5.3.4.17 Recommendation.- *If the centre line consists of barrettes as described in* **5.3.4.14** *b) or* **5.3.4.15** *b), each barrette should be supplemented by a capacitor discharge light, except where such lighting is considered unnecessary taking into account the characteristics of the system and the nature of the meteorological conditions.*

5.3.4.18 Each capacitor discharge light as described in 5.3.4.17 shall be flashed twice a second in sequence, beginning with the outermost light and progressing toward the
threshold to the innermost light of the system. The design of the electrical circuit shall be such that these lights can be operated independently of the other lights of the approach lighting system.

5.3.4.19 If the centre line consists of lights as described in 5.3.4.14 a) or 5.3.4.15 a), additional crossbars of lights to the crossbar provided at 300 m from the threshold shall be provided at 150 m, 450 m, 600 m and 750 m from the threshold. The lights forming each crossbar shall be as nearly as practicable in a horizontal straight line at right angles to, and bisected by, the line of the centre line lights. The lights shall be spaced so as to produce a linear effect, except that gaps may be left on each side of the centre line. These gaps shall be kept to a minimum to meet local requirements and each shall not exceed 6 m.

Note*.- See Attachment A, Section 11 for detailed configuration.*

5.3.4.20 Where the additional crossbars described in 5.3.4.19 are incorporated in the system, the outer ends of the crossbars shall lie on two straight lines that either are parallel to the line of the centre line lights or converge to meet the runway centre line 300 m from threshold.

5.3.4.21 The lights shall be in accordance with the specifications of Appendix 2, Figure 2.1.

Note.- *The flight path envelopes used in the design of these lights are given in Attachment A, Figure A-4.*

Precision approach category II and III lighting system
Location

5.3.4.22 The approach lighting system shall consist of a row of lights on the extended centre line of the runway, extending, wherever possible, over a distance of 900 m from the runway threshold. In addition, the system shall have two side rows of lights, extending 270 m from the threshold, and two crossbars, one at 150 m and one at 300 m from the threshold, all as shown in Figure 5-10. Where the serviceability level of the approach lights specified as maintenance objectives in 9.4.26 can be demonstrated, the system may have two side rows of lights, extending 240 m
from the threshold, and two crossbars, one at 150 m and one at 300 m from the threshold, all as shown in Figure 5- 11.

Note.- *The length of 900 m is based on providing guidance for operations under category I, II and III conditions. Reduced lengths may support category II and III operations but may impose limitations on category I operations. See Attachment A,*
Section 1 I.

5.3.4.23 The lights forming the centre line shall be placed at longitudinal intervals of 30 m with the innermost lights located 30 m from the threshold.

5.3.4.24 The lights forming the side rows shall be placed on each side of the centre line, at a longitudinal spacing equal to that of the centre line lights and with the first light located 30 m from the threshold. Where the serviceability level of the
approach lights specified as maintenance objectives in 9.4.26 can be demonstrated, lights forming the side rows may be placed on each side of the centre line, at a longitudinal spacing of 60 m with the first light located 60 m from the threshold.
The lateral spacing (or gauge) between the innermost lights of the side rows shall be not less than 18 m nor more than 22.5 m, and preferably 18 m, but in any event shall be equal to that of the touchdown zone lights.

5.3.4.25 The crossbar provided at 150 m from the threshold shall fill in the gaps between the centre line and side row lights.

5.3.4.26 The crossbar provided at 300 m from the threshold shall extend on both sides of the centre line lights to a distance of 15 m from the centre line.

5.3.4.27 If the centre line beyond a distance of 300m from the threshold consists of lights as described in 5.3.4.31 b)
or 5.3.4.32 b), additional crossbars of lights shall be provided at 450 m, 600 m and 750 m from the threshold.

5.3.4.28 Where the additional crossbars described in ***5.3.4.27*** are incorporated in the system, the outer ends of these crossbars shall lie on two straight lines that either are parallel to the centre line or converge to meet the runway centre line 300 m from the threshold.

5.3.4.29 The system shall lie as nearly as practicable in the horizontal plane passing through the threshold, provided that:
a) no object other than an ILS or MLS azimuth antenna shall protrude through the plane of the approach lights within a distance of 60 m from the centre line of the system; and
b) no light other than a light located within the central part of a crossbar or a centre line barrette (not their extremities) shall be screened from an approaching aircraft.
Any ILS or MLS azimuth antenna protruding through the plane of the lights shall be treated as an obstacle and marked and lighted accordingly.

Characteristics

5.3.4.30 The centre line of a precision approach category II and III lighting system for the first 300 m from the threshold shall consist of barrettes showing variable white,
except that, where the threshold is displaced 300 m or more, the centre line may consist of single light sources showing variable white. Where the serviceability level of the approach lights specified as maintenance objectives in 9.4.26 can be
demonstrated, the centre line of a precision approach category II and III lighting system for the first 300 m from the threshold may consist of either:

a) barrettes, where the centre line beyond 300 m from the threshold consists of barrettes as described in 5.3.4.32 a); or

b) alternate single light sources and barrettes, where the centre line beyond 300 m from the threshold consists of single light sources as described in 5.3.4.32 b), with the
innermost single light source located 30 m and the innermost barrette located 60 m from the threshold; or
c) single light sources where the threshold is displaced 300 m or more;
all of which shall show variable white.

5.3.4.31 Beyond 300 m from the threshold each centre line light position shall consist of either:
a) a barrette as used on the inner 300 m; or

b) two light sources in the central 300 m of the centre line and three light sources in the outer 300 m of the centre line:
all of which shall show variable white.

5.3.4.32 Where the serviceability level of the approach lights specified as maintenance objectives in 9.4.26 can be demonstrated, beyond 300 m from the threshold each centre line light position may consist of either:
a) a barrette; or
b) a single light source;
all of which shall show variable white.

5.3.4.33 The barrettes shall be at least 4 m in length. When barrettes are composed of lights approximating to point sources, the lights shall be uniformly spaced at intervals of not more than 1.5 m.

5.3.4.34 Recommendation.- *If the centre line beyond 300 m from the threshold consists of barrettes as described in **5.3.4.31** a) or **5.3.4.32** a), each barrette beyond 300 m should be supplemented by a capacitor discharge light, except where*
such lighting is considered unnecessary taking into account the characteristics of the system and the nature of the meteorological conditions.

5.3.4.35 Each capacitor discharge light shall be flashed twice a second in sequence, beginning with the outermost light and progressing toward the threshold to the innermost light of the system. The design of the electrical circuit shall be such
that these lights can be operated independently of the other lights of the approach lighting system.

5.3.4.36 The side row shall consist of barrettes showing red. The length of a side row barrette and the spacing of its lights shall be equal to those of the touchdown zone light barrettes.

5.3.4.37 The lights forming the crossbars shall be fixed lights showing variable white. The lights shall be uniformly spaced at intervals of not more than 2.7 m.

5.3.4.38 The intensity of the red lights shall be compatible with the intensity of the white lights.

5.3.4.39 The lights shall be in accordance with the specifications of Appendix 2, Figures 2.1 and 2.2.

Note.- *The Flight path envelopes used in the design of these lights are given in Attachment A, Figure A-4.*

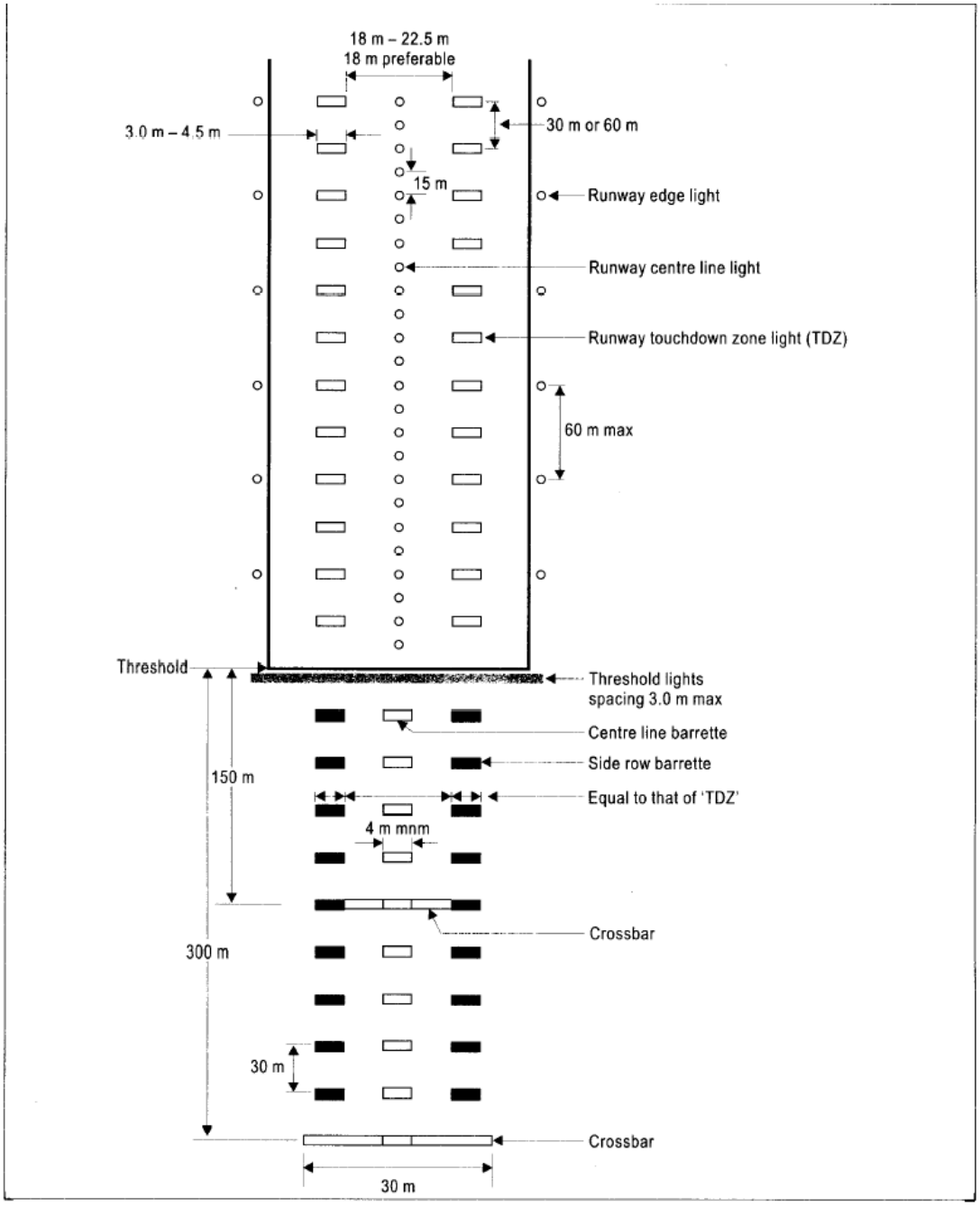

Figure 5-10. Inner 300 m approach and runway lighting for precision approach runways categories II and III

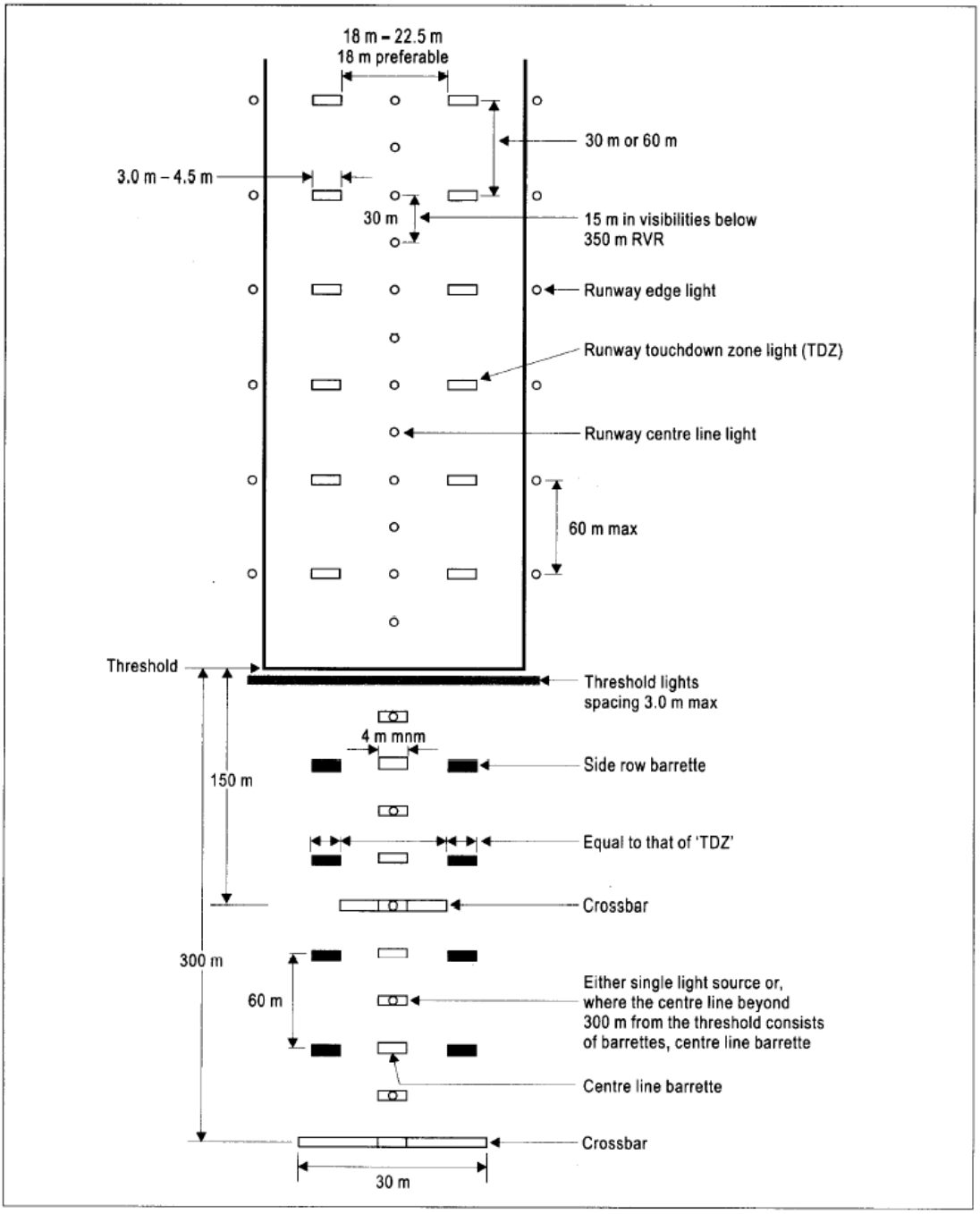

Figure 5-11. Inner 300 m approach and runway lighting for precision approach runways categories II and III where the serviceability levels of the lights specified as maintenance objectives in Section 9.4 can be demonstrated

Electrical system (Ref Annex 14 Chapter 8) Extracts

8.1 Secondary power supply

General

Application

8.1.1 Recommendation*.-A secondary power supply should be provided, capable of supplying the power requirements of at least the aerodrome facilities listed below:*

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, in the opinion of the appropriate authority, 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, provided in accordance with 8.5;

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

g) floodlighting on a designated isolated aircraft parking position if provided in accordance with 5.3.21.1.

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

Characteristics

8.1.2 Recommendation*.-Electric power supply connections to those facilities for which secondary power is required should be so arranged that the facilities are automatically connected to the secondary power supply on failure of the normal source of power*

8.1.3 Recommendation*.-The time interval between failure of the normal souse of power and the complete restoration of the services required by 8.1.1 should be as short as practicable and should not exceed two minutes, 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 I**.- In certain cases, less than thirty seconds has been found to be attainable.*

***Note 2**.- A definition of switch-over time is given in Chapter I.*

8.1.4 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.

***8.1.5 Recommendation**.-Requirements for a secondary power supply should 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 secondary power supply is given in the Aerodrome Design Manual, Part 5.*

Visual aids

Application

***8.1.6 Recommendation**.-At an aerodrome where the primary runway is a non-instrument runway, a secondary power supply capable of meeting the requirements of 8.1.3 should 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.*

Maintenance (Ref Annex 14 Chapter 9.4 – extracts)

9.4 Maintenance

General

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

***Note I**.- 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 and buildings.*

***9.4.2 Recommendation**. -The design and application of the maintenance programme should observe Human Factors principles.*

***Note**.-Guidance material on Human Factors principles can be found in Circular 216 (Human Factors Digest No. 1* - Fundamental Human Factors Concepts) and Circular 238 (Human Factors Digest No. 6 - Ergonomics).

Visual aids

***Note**.-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.*

9.4.20 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.

9.4.21 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, Part 9.*

***9.4.22 Recommendation**.-The system of preventive maintenance employed for a precision approach runway category II or III should 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.

***9.4.23 Recommendation**.-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 should be undertaken by measuring all lights, as far as practicable, to ensure conformance with the applicable specification of Appendix 2.*

***9.4.24 Recommendation**.-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 should be undertaken using a mobile measuring unit of sufficient accuracy to analyse the characteristics of the individual lights.*

***9.4.25 Recommendation**.-The frequency of measurement of lights for a precision approach runway category II or III should 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 should not be less than twice a year for in-pavement lights and not less than once a year for other lights.*

9.4.26 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 tf located consecutively and:

-laterally: in the same barrette or crossbar; or

-longitudinally: in the same row of edge lights or barrettes.

9.4.27 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.

9.4.28 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.

9.4.29 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.*

9.4.30 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.

9.4.31 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.

***9.4.32 Recommendation**.-During low visibility procedures the appropriate authority should restrict construction or maintenance activities in the proximity of aerodrome electrical systems.*

Table 8-1. Secondary power supply requirements
(see 8.1.3)

Runway	Lighting aids requiring power	Maximum switch-over time
Non-instrument	Visual approach slope indicators[a]	See
	Runway edge[b]	8.1.3 and
	Runway threshold[b]	8.1.6
	Runway end[b]	
	Obstacle[a]	
Non-precision approach	Approach lighting system	15 seconds
	Visual approach slope indicators[a, d]	15 seconds
	Runway edge[d]	15 seconds
	Runway threshold[d]	15 seconds
	Runway end	15 seconds
	Obstacle[a]	15 seconds
Precision approach category I	Approach lighting system	15 seconds
	Runway edge[d]	15 seconds
	Visual approach slope indicators[a, d]	15 seconds
	Runway threshold[d]	15 seconds
	Runway end	15 seconds
	Essential taxiway[a]	15 seconds
	Obstacle[a]	15 seconds
Precision approach category II/III	Approach lighting system	15 seconds
	Supplementary approach lighting barrettes	1 second
	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
	Essential taxiway	15 seconds
Runway meant for take-off in runway visual range conditions less than a value of 800 m.	Runway edge	15 seconds[c]
	Runway end	1 second
	Runway centre line	1 second
	All stop bars	1 second
	Essential taxiway[a]	15 seconds
	Obstacle[a]	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.

***Note**.-Guidance on means of achieving the specified secondary power supply switch-over times, etc., is given in the Aerodrome Design Manual, Part 5.*

***8.1.7 Recommendation**.-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-I should be provided except that a secondary power supply for visual aids need not be provided for more than one non-precision approach runway.*

8.1.8 For a precision approach runway, a secondary power supply capable of meeting the requirements of Table 8-l 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 normal source of power.

8.1.9 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-l shall be provided.

***Note**.-Guidance on electrical systems is included in the Aerodrome Design Manual, Part 5 - Electrical Systems.*

8.2 Electrical systems

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-l 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, Part 5 -Electrical Systems.*

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.

***Note**.-Guidance' on acceptable power source arrangements for the use of duplicate feeders for a secondary power supply is given in the Aerodrome Design Manual, Part 5 - Electrical Systems.*

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, Part 5.*

8.3.1 Recommendation*.-A system of monitoring visual aids should be employed to ensure lighting system reliability.*

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

8.3.3 Recommendation*.-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-l should be monitored so as to provide an immediate indication when the serviceability level of any element falls below the minimum serviceability level specified in 9.4.26 to 9.4.30, as appropriate. This information should be immediately relayed to the maintenance crew.*

8.3.4 Recommendation*.-For a runway meant for use in runway visual range conditions less than a value of 5.50 m, the lighting systems detailed in Table 8-1 should be monitored automatically to provide an immediate indication when the serviceability level of any element falls below the minimum level specified by the appropriate 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, Part 5 - Electrical Systems.*

8.7 Siting and construction of equipment and installations on operational areas

Note I*.- Requirements for obstacle limitation surfaces are specified in 4.2.*

Note 2*.- The design of light fixtures und their supporting structures, light units of visual approach slope indicators, signs, and markers, is specified in 5.3. I, 5.3.5, 5.4.1 and 5.5. I, respectively.*

Guidance on the frangible design of visual and non-visual aids for navigation is given in the Aerodrome Design Manual, Part 6 (in preparation).

8.7.1 Unless its function requires it to be there for air navigation 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 3-1, column 11, if it would endanger an aircraft; or
b) b) on a clearway if it would endanger an aircraft in the air.

8.7.2 Any equipment or installation required for air navigation purposes which must be located:

a) on that portion of a runway strip within:

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

1) 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-l; or

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

8.7.3 Existing non-visual aids need not meet the requirement of 8.7.2 until 1 January 2010.

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

Note*.-Guidance on the siting of navigation aids is contained in the Aerodrome Design Manual, Part 6 (in preparation}.*

8.7.5 Unless its function requires it to be there for air navigation 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) 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.

8.7.6 Any equipment or installation required for air navigation 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 on that portion of the strip within 77.5 m of the runway centre line where the code number is 4 and the code letter is F: or

b) 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

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

8.7.7 Existing non-visual aids need not meet the requirement of 8.7.6 b) until 1 January 2010.

***Note**.-See 5.3.1.4 for the protection date for existing elevated approach lights.*

***8.7.8 Recommendation**.-Any equipment or installation required for air navigation purposes which is an obstacle of operational significance in accordance with 4.2.4, 4.2. II, 4.2.20 or 4.2.27 should be frangible and mounted as low as possible.*