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## 1. PURPOSE:

This advisory circular (AC) provides information on procedures for inspection of Secondary power supply and outage to ensure an essential back-up power capability to Aerodrome electrical systems that support important airport services in case of failure of the main power supply. This AC provides basic guidance for and lines of responsibility for the day-to-day provision of secondary power for the Aerodrome.

## 2. REFERENCES:

- 2.1 ICAO Annex 14 – Volume 1, 7<sup>th</sup> edition, July 2016
- 2.2 ICAO doc 9157 – Part 5 (Electrical Systems)
- 23 Manual of Aerodromes Standards, 4<sup>th</sup> edition, December 2016


## 3. REQUIREMENTS FOR INSPECTION OF SECONDARY POWER SUPPLY AND OUTAGE:

Regulation 57 Fourth Schedule Part four subparts 6 (d) requires particulars of the procedures for the inspection and maintenance of aerodrome electrical systems including:

- a. Arrangements for carrying out inspection during and outside the normal hours of aerodrome operation, and the checklist for such inspections;
- b. arrangements for recording the result of inspections and for taking follow-up action to correct deficiencies;
- c. arrangements for carrying out routine maintenance and emergency maintenance;
- d. arrangements for secondary power supplies and, if applicable, the particulars of any other method (solar power, mobile lighting) for dealing with partial or total system failure; and
- e. Personnel responsible for the inspection and maintenance of the lighting, and the telephone numbers for contacting those persons during and after working hours.

## 4. PROCEDURES FOR INSPECTION OF SECONDARY POWER SUPPLIES:

To ensure continuity of and safety of services it is important to have procedures for inspection of secondary power and electrical outage. Essentially, the inspection procedures

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referred in this AC are part and parcel of the aerodrome's electric systems maintenance program. It should also form part of the aerodromes self inspection program.

4.1 An aerodrome serving an International traffic shall have two levels of power supply back-up

- a) The first level shall consist of standby generators capable of supplying all the important airport areas.
- b) The second level of the back – up (which will be put into operation in case the first back –up facility fails) consists of a number of standby generators positioned strategically and dedicated mainly for: -
  - (i) Airfield Lighting
  - (ii) Air Traffic Control Communication Equipment
  - (iii) Passenger Terminals

4.2 Airfield Emergency Generator

To ensure constant source of power for airfield lighting, the Airport maintains (describe what you own - e.g. a diesel generator) as a secondary power source to main power for Runways/Taxiways/NAVAIDS. At least two independent circuits should be maintained and supplied by a secondary power supply.

4.3 Air Traffic Control Communication Equipment

4.4 Passenger Terminals


4.5 Ensure that there are adequate procedures and qualified personal to conduct inspections.

4.6 Ensure that there are procedures for inspection of facilities (generators etc)

4.7 Ensure that both first and second level back – ups operate automatically in case of power supply disruption to the dedicated areas.

4.8 The inspection procedure must ensure that the connection of secondary power supply to air navigation services and facilities is automatically connected to the secondary power supply upon failure of the primary power source.

4.9 Ensure that the following aerodrome facilities are provided with secondary power supply with the capacity of supplying power in case of the failure of the primary power supply -

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- (a) The signaling lamp and the minimum lighting necessary to enable air traffic services personnel to carry out their duties;
- (b) All obstacle lights which, in the opinion of the Authority are essential to ensure the safe operation of aircraft;
- (c) Approach, runway and taxiway lighting;
- (d) Meteorological equipment;
- (e) Essential security lighting, if provided;
- (f) Essential equipment and facilities for the aerodrome emergency services;
- (g) Floodlighting on a designated isolated aircraft parking position if provided; and
- (h) Illumination of apron areas over which passengers are expected to walk.

- 4.10 Ensure that the maximum switch-over time between failure of the primary source of power and the secondary source of power for the services required in 4.9 meets the specification indicated in Table 1 below.
- 4.11 Ensure that there are adequate facilities, and equipment for rapid dissemination of information.
- 4.12 Ensure that inspection schedules correspond with the Maintenance schedules for all standby generators as per the Manufacturer's Manual and shall ensure that the machines are maintained accordingly.
- 4.13 Ensure that details of the inspection procedures to be followed during routine matters and unusual circumstances such as construction and emergencies that may arise.
- 4.14 Ensure that the procedure contains details of Facilities, Equipment and Personnel performing the inspection tasks at the aerodrome.

**Table 1 Stipulated automatic switchover time**

Runway Type	Lighting Aids Requiring Power	Maximum switch Over time
Non-instrument	Visual approach slope indicators a Runway edge b Runway threshold b Runway end b	15 seconds 15 seconds 15 seconds 15 seconds



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Non-precision approach	Approach lighting system Visual approach slope indicators a,d Runway edge d Runway threshold d Runway end Obstacle a	15 seconds 15 seconds 15 seconds 15 seconds 15 seconds 15 seconds
Precision approach category I	Approach lighting system Visual approach slope indicators a,d Runway edge d Runway threshold d Runway end Essential taxiways a Obstacle a	15 seconds 15 seconds 15 seconds 15 seconds 15 seconds 15 seconds
Precision approach category II	Inner 300 m of the approach lighting system Other parts of the approach lighting system Obstacle a Runway edge Runway threshold Runway end Runway centre line Runway touchdown zone All stop bars Essential taxiway	1 second 15 seconds 15 seconds 1 second 1 second 1 second 1 second 1 second 15 seconds
Runway meant for take-off in runway visual	Runway edge Runway end Runway centre line	15 seconds c 1 second 1 second

<b>Runway Type</b>	<b>Lighting Aids Requiring Power</b>	<b>Maximum switch Over time</b>
range conditions less than a value of 800 m	All stop bars Essential taxiway a Obstacle a	1 second 15 seconds 15 seconds

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**Note:**

- a. Supplied with secondary power when their operation is essential to the safety of flight operation.
- c. One second where no runway centre line lights are provided.
- d. One second where approaches are over hazardous or precipitous terrain.

**Lighting Interference due to outages**

- 4.15 Ensure that outage does not hinder continuity of visual guidance to users. The allowable percentage of inoperable lights must be in such a way that does not alter the basic pattern of the lighting system.
- 4.16 Ensure that, an unserviceable light shall not be adjacent to another unserviceable light. For the purposes of this advisory circular, lights shall be considered adjacent if located either laterally or longitudinally in a lighting system.
- 4.17 For purposes of this A/C, the operating limits for lighting systems before a system is considered inoperable are as follows:

Runway Edge Lights

85% Operable for Visual, Nonprecision or CAT I Runways  
95% Operable for CAT II Runways (if applicable)


Runway End/Threshold Lights

75% Operable (No more than two lights inoperable at any runway end)

Taxiway Edge Lights

85% Operable

- 4.18 Ensure that the above operating limits can be maintained.
- 4.19 If the operating limits cannot be maintained, the aerodrome operator shall determine whether the outage may not provide an accurate reference to aerodrome users, and initiate a NOTAM.
- 4.20 Information concerning the outage shall also be disseminated locally.
- 4.21 If the inspection reveals that an entire lighting system is inoperable or out of service, an aerodrome condition report shall be issued in accordance with procedure given Manual of Aerodromes Standards

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4.22 Ensure that there is a reporting system in place to assure prompt correction of conditions.

### **5.0 Personnel and Instructions**

5.1 Ensure that qualified personnel are assigned for every inspection task:

5.2 Specify the role and function/title/telephone number of personnel responsible for carrying out inspections.

5.3 The procedure shall identify the inspection and the personnel and when and how the inspection is to be carried out during and outside normal working hours.

5.4 Describe procedures, checklists, forms used for each inspection. Detailed inspection checklist should be commensurate with the competence, training and skills required for the task to be performed.

5.5 Ensure that the reporting format link in the procedures links with maintenance processes and programs for effective follow-up

### **6.0 Inspection Schedule**

6.1 Ensure that the procedure for inspection clearly defines

WHAT is to be inspected?

HOW is it to be inspected & WHEN it is to be inspected (Daily, Weekly, Monthly, Bi-annually or Yearly etc


6.2 Ensure that adequate arrangements are made for special additional inspections to conduct:

- i. Following Metrological condition
- ii. Following a major accident
- iii. Following Electrical and Civil Maintenance work

6.3 The procedure shall be documented in sufficient details in the Aerodrome Manual specifying who, what, how and when a particular inspection regarding secondary power supply is to be carried out.

## **7. Specific Inspection Procedures for Generators Installed Before 1990**

### **7.1 General**

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Engine-generator sets, especially those installed before 1990, may provide limited power in the event of a power outage. They consist of an engine, a generator, control panels, and possibly a fuel storage tank. The engine drives the generator to create electrical power.

Emergency and standby generators are the stationary units hard wired into the electrical distribution system to ensure continuity of the aerodrome air navigation services through a transfer switch. The Automatic Transfer Switches (ATS) are the most common type of transfer switches used for these applications. An ATS can provide a signal for the generator to start and transfer the load from the main supply to the generator.

Improper or poorly maintained generator sets, especially old ones, are more prone to failure and are more likely to fail to provide power to the aerodrome facilities to ensure safe operation of aircraft. The most common engine failures can be attributed to the starting, cooling, lubrication or fuel delivery systems. Failure of the electric generator is often attributed to excessive moisture in the generator windings. These types of failures can be minimized or prevented, by implementing regularly scheduled, comprehensive, generator maintenance and testing programs.

## 7.2 Inspection Overview

The components of a good maintenance program consists of: competent visual inspection of the generator, surrounding area and fluid levels; changing the lubrication, coolant and fuel on a regular basis; and testing the starting system, including the batteries. The routine maintenance of such old generators will ensure working at optimum performance levels.

Extreme temperatures, the presence of deleterious water, or excessive exposure to debris, such as dust or sand, may require more frequent inspections for long serving generators.

Keeping a maintenance log is also important. A record of all maintenance, inspections, fluid levels, and test results will enable more accurate planning of future maintenance.

## 7.3 Procedures for inspection

The procedure for inspection for preventive maintenance is divided into three programmes as shown below:



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Daily Procedures	Repairs (as necessary)	Pass/fail
Visual inspection and condition monitoring of unit – leaks, wear, damage, loose connections/components, vibrations, noise, corrosion	Correct	
Check engine oils level	Adjust	
Check engine coolant levels	Adjust	
Check fuel delivery system – Leaks, pressure	Tighten connections	
Check air inlets/outlets for debris	Clean	
Check battery and its charger – verify operation	Adjust	
Test run the generator for 5 minutes to verify operating parameters (i.e. frequency, voltage, power factor)	Correct	
Return engine to standby setup for operation	When required	

Monthly Procedures	Repairs (as necessary)	Pass/Fail
Check engine coolant thermal protection level	Correct	
Check gearbox oil level (if equipped)	Adjust	
Check battery electrolyte level and specific gravity (where appropriate)	Adjust	
Check battery posts, cables, and charger – connections, corrosion, proper operation	Correct	
Check wiring – connections, corrosion,	Correct	

damage		
Check engine drive belts, fan coupling device – tension, wear, weather cracking, damage	Correct	

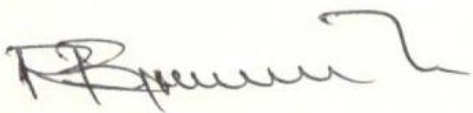


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Automatic start and transfer to a load bank (or site load). Exercise for at least 30 minutes at a min. capacity of 30% of the nameplate rating. Check for leaks, connections, components, abnormal operating conditions	Correct	
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Annual Procedures	Repairs (as necessary)	Pass/Fail
Engine oil and filters	Change and replace	
Gearbox Oil (if applicable)	Change	
Drive belts, fan coupling device for tension, wear, weather cracking, damage	Replace	
Clean and re-cap spark plugs	Replace	
Engine air filters	Replace	
Automatic start and transfer to a load bank (or site load). Exercise it for at least 1 hour at 100% of the nameplate capacity. Check for leaks, connections, components, abnormal operating conditions	Correct	

The above inspection procedures shall be implemented while taking into account the manufacturer's or service provider's recommendations in regard to the servicing and maintaining a particular generator set.



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