# Advisory Circular

**CAA-AC-AGA503**

**October 2022**

## PROCEDURES FOR INSPECTION OF SECONDARY POWER SUPPLY AND OUTAGES

### 1.0 PURPOSE

This Advisory circular has been developed to provide guidance 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.

### 2.0 REFERENCES

2.1 The Civil Aviation (Aerodromes) Regulations, 2022

2.2 ICAO Annex 14 – Volume I

2.3 ICAO doc 9157 – Airport Design Manual, Part 5 (Electrical Systems)

### 3.0 REGULATORY REQUIREMENTS

The Civil Aviation (Aerodromes) Regulation requires the Aerodrome Manual to include particulars of the procedures for the inspection and maintenance of aeronautical lighting, signs, markers and aerodrome electrical systems including arrangements for secondary power supplies and, if applicable, the particulars for any other method for dealing with partial or total system failure.

### 4.0 GLOSSARY OF TERMS

**Aerodrome** is a defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.

**Apron** is a defined area, on an aerodrome, intended to accommodate aircraft for purposes of loading or unloading of passengers, mail or cargo, fuelling, parking or maintenance;

**Movement Area** refers to the runways, taxiways, and other areas of an airport which are used for taxiing or hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and aircraft parking areas.

**Switch-over time (light).** The time required for the actual intensity of a light measured in a given direction to fall from 50 percent and recover to 50 per cent during a power supply changeover, when the light is being operated at intensities of 25 per cent or above.

**Taxiway** is a defined path on a land aerodrome established for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another, including -

(a) **aircraft stand taxi lane** which is a portion of an apron designated as a taxiway and intended to provide access to aircraft stands only;

(b) **apron taxiway** which is a portion of a taxiway system located on an apron and intended to provide a through taxi route across the apron;

(c) **rapid exit taxiway** which is a taxiway connected to a runway at an acute angle and designed to allow landing aircrafts to turn off at higher speeds than are achieved on other exit taxiways thereby minimizing runway occupancy times;

## 5.0 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 referred in this advisory circular are part of the aerodrome's electric systems maintenance program. It should also form part of the aerodromes self-inspection program.

### 5.1 Levels of Power Supply Backup

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

### 5.2 Airfield Emergency Generators

To ensure constant source of power for airfield lighting, the airport will maintain a secondary power source to main power for Runways/Taxiways/NAVAIDS. At least two independent circuits will be maintained and supplied by a secondary power supply.

### 5.3 Backup System Requirements

For the backup system to operate effectively the following best practices will be followed**;**

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

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

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

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

5.3.5 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 -

(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 packing position if provided; and

(h) Illumination of apron areas over which passengers are expected to walk.

5.3.6 Ensure that the maximum switch-over time between failure of the primary source of power and the start of the secondary source of power for the services required in 5.3.5 meets the specification indicated in Table 1 below.

5.3.7 Ensure that there are adequate facilities, and equipment for rapid dissemination of information.

5.3.8 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.

5.3.9 Ensure availability of the details of the inspection procedures to be followed during routine matters and unusual circumstances such as construction and emergencies that may arise.

5.3.10 Ensure that the procedure contains details of facilities, equipment and personnel performing the inspection tasks at the aerodrome.

## 6 STIPULATED AUTOMATIC SWITCHOVER TIME

| **Runway Type** | **Lighting aids Requiring Power** | **Maximum Switch-over Time** |
|---|---|---|
| Non-instrument | Visual approach slope indicators [a] | 15 seconds |
| | Runway edge [b] | 15 seconds |
| | Runway threshold [b] | 15 seconds |
| | Runway end [b] | 15 seconds |
| Non-precision approach | Approach lighting system | 15 seconds |
| | Visual approach slope indicators [ad] | 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 |
| | Visual approach slope indicators [a,d] | 15 seconds |
| | Runway edge [d] | 15 seconds |
| | Runway threshold [d] | 15 seconds |
| | Runway end | 15 seconds |
| | Essential taxiways [a] | 15 seconds |
| | Obstacle [a] | 15 seconds |
| Precision approach category II | 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 Type | Lighting aids Requiring Power | Maximum Switch-over Time |
|---|---|---|
| | 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 centerline | 1 second |
| | All stop bars | 1 second |
| | Essential taxiway [a] | 15 seconds |
| | Obstacle [a] | 15 seconds |

***Note:***

*a. Supplied with secondary power when their operation is essential to the safety of flight operation.*

*c. One second where no runway centreline lights are provided.*

*d. One second where approaches are over hazardous or precipitous terrain.*

### 6.1 Lighting Interference due to Outages

6.1.1 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. To achieve this, ensure that, an unservicable 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.

6.1.2 For purposes of this AC, 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

Ensure that the above operating limits can be maintained.

6.1.3 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. Information concerning the outage shall also be disseminated locally.

6.1.4 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 in A/C number CAA-AC-AGA304 – *Procedures for Monitoring and Reporting of Conditions of Movement Areas*. Ensure that there is a reporting system in place to assure prompt correction of conditions.

**6.2 Personnel and Instructions.**

The following best practices in relation to personnel will be observed;

6.2.1 Ensure that qualified personnel are assigned for every inspection task.

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

6.2.3 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.

6.2.4 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.

6.2.5 Ensure that there is a proper reporting format in the procedures that links with maintenance processes and programs for effective follow-up

**6.3 Inspection Schedule**

6.3.1 Ensure that the procedure for inspection clearly defines;

a) WHAT is to be inspected.

b) HOW is it to be inspected.

c) WHEN it is to be inspected (Daily, Weekly, Monthly, Bi-annually or Yearly etc.

6.3.2 Ensure that adequate arrangements are made for special additional inspections to be conducted following:

a) meteorological condition

b) a major accident

c) electrical and civil maintenance work.

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 MANUFATURED BEFORE 1990

## 7.1 General.

Engine-generator sets, especially those manufactured 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 facilitaties to ensure safe operation of aicraft. 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:

7.3.1 Daily Procedures

| **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 | |

7.3.2 Monthly Procedures

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

| | | |
|---|---|---|
| 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 | |

7.3.3 Annual Procedures

| **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.


**Director Safety, Security and Economic**