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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrical installations for lighting and beaconing of aerodromes – Maintenance of aeronautical ground lighting constant current series circuits

Installations électriques pour l'éclairage et le balisage des aérodromes – Maintenance des circuits série à courant constant pour le balisage aéronautique au sol

IEC 61821:2011

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ELECTRICAL INSTALLATIONS FOR LIGHTING AND BEACONING OF AERODROMES – MAINTENANCE OF AERONAUTICAL GROUND LIGHTING CONSTANT CURRENT SERIES CIRCUITS

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International Standard IEC 61821 has been prepared by IEC technical committee 97: Electrical installations for lighting and beaconing of aerodromes.

This second edition cancels and replaces the first edition published in 2002. It is a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) addition of references to normative references;
b) addition of notes in Clauses 5, 6 and 7;
c) modification of pre-work procedures in item e) of 7.2.2.

The text of this standard is based on the following documents:

FDIS	Report on voting
97/153/FDIS	97/154/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

INTRODUCTION

This International Standard contains the management, safety and procedural requirements specific to the maintenance of an aeronautical ground lighting (AGL) constant current series circuit and has taken into consideration existing national standards, requirements and practices. The maintenance activities are required to ensure that the AGL constant current series circuit continues to meet the operational requirements and minimize the occurrence of operational failures.

To conform to this International Standard it should be demonstrated to the relevant bodies that the requirements have been satisfied and therefore that the clause objective(s) has (have) been met.

NOTE Examples of relevant bodies would include the following:

- certification and licensing authorities;
- safety regulators;
- notified bodies for international or European directives;
- national standards bodies.

ELECTRICAL INSTALLATIONS FOR LIGHTING AND BEACONING OF AERODROMES – MAINTENANCE OF AERONAUTICAL GROUND LIGHTING CONSTANT CURRENT SERIES CIRCUITS

1 Scope

This International Standard applies to the maintenance of AGL constant current series circuits.

This International Standard

- covers constant current series circuits for AGL installed at aerodromes and heliports;
- concentrates on providing the safety requirements for the maintenance of an AGL constant current series circuit. It is recognized that AGL constant current series circuits of different design characteristics and parameters are in existence;
- is mainly concerned with safety to persons by specifying the rules and fundamental principles for the maintenance of AGL constant current series circuits;
- is not intended to apply to AGL primary series circuits supplied directly from a mains constant voltage source;
- is not intended to be used for public street lighting, roadway lighting or any other installation requiring the use of constant current series circuits.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60903, *Live working – Gloves of insulating material*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
aerodrome authority
organization accountable for the operational safety and security of persons, aircraft operations and facilities at an aerodrome

NOTE Temporally the occupational safety for third party personal, contracted for AGL work on non-operational areas, can be delegated to the third party contractor if the evidence of professional skills, knowledge of the behavior rules and the separation to the airport operation area is given and documented.

3.2
AGL constant current series circuit
apparatus configured as an electrical circuit designed to produce and operate with a constant current, independent of specified load variations, in order to provide a specified light for aeronautical purposes

3.3
AGL operator
person responsible for the control of the AGL to permit the safe movement of aircraft

3.4
caution sign
non-metallic safety sign attached to equipment conveying a warning against interference with such equipment

3.5
constant current regulator
CCR
apparatus which produces a current output at a constant r.m.s. value independent of variations in the constant current series circuit load, input voltage and service conditions as specified

3.6
contractor
organization or person(s) given a written order to provide a service or undertake specified work

3.7
dead
free from any electrical connection to a source of potential difference and from electric charge; not having a potential different from that of the earth

3.8
earthed
connected to the general mass of earth in such a manner as to ensure at all times an immediate discharge of electrical energy without harm

3.9
electrical equipment
anything used, intended to be used or installed for use, to generate, provide, transmit, transform, rectify, convert, conduct, distributes, control, store, measure or use electrical energy

3.10
harm
physical injury or damage to the health of people either directly, or indirectly, as a result of damage to property or to the environment

[ISO/IEC Guide 51, 3.3, modified]

3.11
hazard
potential source of harm

NOTE The term includes hazards to persons arising within a short time scale (for example, fire and explosion) and also those that have a long-term effect on a person's health (for example, release of a toxic substance).

[ISO/IEC Guide 51, 3.5, modified]

3.12
hazardous event
occurrence, with possible hazardous consequences, arising as the result of a hazardous condition

3.13
hazard sign
non-metallic safety sign that conveys a warning against risk of harm

3.14
isolate
disconnect and separate electrical equipment from the normal source(s) of electrical energy in such a way that the disconnection and separation is secure

3.15
live
electrically connected to a source of electricity or which has acquired a charge by other means

3.16
maintenance
act of diagnosing and physically repairing, or preventing, equipment failures

3.17
personal protective equipment
equipment used to protect persons from harm in the working environment

NOTE Personal protective equipment includes such items as special tools, protective clothing, insulating screening, safety harnesses and safety signs.

3.18
prove dead
demonstrate with the use of test equipment that no electrical potential liable to cause harm is present

3.19
risk
combination of the probability of occurrence of harm and the severity of that harm

[ISO/IEC Guide 51, 3.2]

3.20
risk assessment
1. systematic quantitative assessment of the magnitude of the threat to safety induced by the accumulation of controlled and unresolved residual hazards;

2. integrated analysis of the risks inherent in a product, system or facility and their significance in an appropriate context

3.21
test equipment
equipment to undertake particular tests, that is suitable for the use for which it is provided, that is maintained in a condition suitable for that use, and that is properly used

3.22
test/testing (of electrical equipment)
1. providing a sequence of operations or the measuring of electrical characteristics of live electrical equipment (for example, diagnostic testing of faulty equipment);

2. applying voltages, currents or signals for the purposes of providing insulation, continuity or other characteristic of isolated electrical equipment (for example, before a permanent electrical installation is energised from the normal source(s) of electrical energy)

3.23
work/working (on electrical equipment)
installing, dismantling, assembling, maintaining, testing or repairing of electrical equipment

4 Competence of persons

4.1 Objective

The objective of the requirements of this clause is to ensure that persons who have responsibility for any activity, or are directly engaged in the maintenance of AGL constant current series circuits are competent to discharge those duties or perform those tasks.

NOTE It is recommended that the appropriate administration or aerodrome authority encourage the development of a formal and structured competency training programme(s). The training programme(s) should consist of multiple tiers that enhance progressively a person's skills and ensure a recognised level of competency for those persons who have satisfactorily completed the programme(s).

4.2 Requirements

In accordance with national legislation, all persons involved in any activity, including management and maintenance activities, shall have the appropriate and verifiable training, technical knowledge, experience and qualifications relevant to the specific duties they have to perform. In particular, where involved in work on constant current series circuits, they shall be knowledgeable of the specific risks and the safety procedures involved in the work. The training, experience and qualifications of all persons involved in any activity shall be justified taking into account all the relevant competence factors. The justification shall be recorded in appropriate documentation.

NOTE The following competence factors should be addressed when assessing and justifying the competence of persons carrying out their duties:

- engineering appropriate to the application area;
- engineering appropriate to the technology (for example, mechanical, electrical/electronic/software engineering);
- safety engineering appropriate to the technology;
- knowledge of the legal and safety regulatory framework;
- knowledge of the operational aspects related to the AGL system at the aerodrome;
- the consequences in the event of a failure of a constant current series circuit;
- the consequences of failure to adhere to safety procedures when working on constant current series circuits;
- the novelty of the design, design procedures or application;
- previous experience relevant to the specific duties to be performed and the technology being employed;
- relevance of qualifications to the specific duties performed.

5 Management of maintenance activities

NOTE Additional informative guidance material for management of maintenance activities is included in Annex A.

5.1 Objective

The objective of the requirements of this clause is to detail the roles and responsibilities of those personnel engaged in maintenance activities on or near AGL constant current series circuits and the procedures to ensure that safety are addressed.

5.2 Requirements

5.2.1 Organizational roles and responsibilities

The aerodrome authority shall appoint one or more named persons to manage, supervise or undertake specific maintenance tasks. Those persons shall be identified on any applicable record or other documentation associated with the task. All persons involved in work on the AGL shall be aware of

- their role and responsibilities;
- their duties and how to perform those duties;
- the procedures to be followed;

- contingency working arrangements.

The content of this clause is a minimum requirement.

NOTE IEC/TS 62143 contains details of requirements for the safety management of an AGL system at an aerodrome.

5.2.2 Use of contractors

The aerodrome authority retains full accountability under these requirements for all work undertaken on an AGL constant current series circuit by a contractor. This accountability shall include where the AGL constant current series circuit, or part of it, is to be under the control of a contractor. The aerodrome authority shall ensure that all other organisations, including the users and operators of the AGL and other applicable aerodrome facilities, are notified prior to the commencement of the work and the procedures used. Contractors and other non-aerodrome employees shall follow the safety rules and procedures provided by the aerodrome authority (see 5.2.4).

5.2.3 Maintenance policy

5.2.3.1 Concept

A maintenance policy shall be produced and implemented. The maintenance policy shall include the following aspects:

- the maintenance philosophy, that includes and takes account of
  - the maintenance objectives;
  - the operational requirements;
  - the maintenance resources;
- a maintenance schedule and procedures (see 5.2.4), which includes
  - planned, controlled, conditional and corrective maintenance programmes;
  - post-maintenance activities;
  - the modification or upgrading of equipment;
- reference to the maintenance procedures (see 5.2.4);
- reference to specific safety procedures (see 6.2.1);
- the management of records and documentation (see 7.2.6);
- the provision of spares, tools, test and safety equipment (see 6.2.4 and 6.2.5);
- inspections (see 7.2);
- provision for the review and amendment of the maintenance policy.

NOTE Maintenance activities can be described as

- planned, where prescribed tasks are carried out on a routine basis;
- controlled, where an analysis of the equipment is carried out in order to minimize the amount of planned maintenance required;
- conditional, where the maintenance requirements have changed during the life of the equipment;
- corrective, in order to restore equipment to the required operational state.

5.2.3.2 Operational aspects

The maintenance of AGL equipment shall consider the objectives of aerodrome operations and address the impact on such operations whilst maintenance activities are being carried out.

NOTE For example, the following should be considered:

- the withdrawal of operational facilities and the closing of movement areas to aircraft operations prior to works;

- the return of operational facilities and movement areas when operationally necessary even though the works may not be completed;
- the raising of a notice to airmen (NOTAM) where work will affect the availability of operational facilities;
- procedures for entering and being recalled from active operational areas;
- precautions to prevent the possibility of foreign object damage (FOD) to aircraft by maintenance (particularly vehicles) and excavating plant;
- procedures for communication with the AGL operator before, during and after works.

5.2.4 Maintenance procedures

5.2.4.1 Procedures manual

Maintenance procedures that instruct on the correct and safe method of maintenance shall be provided for each maintenance activity that is to be undertaken on the AGL. The maintenance procedures shall be contained in a suitable document (for example, an AGL operation and maintenance plan, see IEC/TS 62143) and shall be provided and used at all times. A copy of the maintenance procedures shall be made available to all AGL maintenance personnel and any contractors' representative(s). They shall read and understand the maintenance procedures and their implication to both themselves and others. Ignorance of the procedures shall not be accepted as an excuse for neglect of responsible action or failure to implement them. The aerodrome authority shall keep an appropriately controlled record of this action.

Any questions of safety shall be raised with the aerodrome authority who shall have the matter investigated and satisfactorily resolved before the applicable work commences.

In all appropriate work areas, there shall be access to the following items:

- a copy of the maintenance procedures;
- instructions and details of procedures designed to protect personnel;
- applicable safety equipment;
- all relevant and appropriate drawings of the equipment and its identification and location;
- all relevant service manuals;
- local safety and operational procedures.

5.2.4.2 Authorization procedures

The aerodrome authority shall determine which activities require authorization, who is able to give the authorization, how the authorization, including written permission, is to be obtained, and all other safety procedures associated with the activity. One method, a safe system of work involving the issuance of permits/sanctions, is illustrated in Annex A. The authorization procedures shall be outlined explicitly in a suitable document.

5.2.5 Admittance to AGL work areas

When entering an AGL indoor work area, all persons shall sign a logbook. The logbook shall be located in the work area.

NOTE 1 Such work areas may include sub-stations, switchrooms, plant and machinery rooms, AGL control centres, diesel generator rooms and electrical workshops.

NOTE 2 The logbook should contain the following information:

- time of entry;
- name and signature of all persons present;
- reason for visit;
- permit/sanction serial number (if applicable, see 5.2.4.2 and Annex A);
- brief detail of the work to be carried out;
- time of exit.

6 Safety requirements

NOTE Additional informative guidance material for management of maintenance activities which have impact on safety to personnel engaged in maintenance activities is included in Annex A.

6.1 Objective

The objective of the requirements of this clause is to detail the measures to ensure operational safety and safety to personnel engaged in maintenance activities on or near AGL constant current series circuits.

6.2 Requirements

6.2.1 Safety procedures

The aerodrome authority shall perform a risk assessment of all work to be performed on AGL constant current series circuits. A risk assessment shall include, *inter alia*, the determination of the required manning level to complete the work safely. Care shall be taken to ensure that maintenance equipment and other materials do not present a hazard to aircraft. The completed risk assessments shall be contained in a suitable document and retained by the aerodrome authority. They should be reviewed and updated periodically or whenever necessary, for example, due to a hazardous event.

Safety procedures shall be developed that take into account the completed risk assessment for the work and shall consider

- that work shall not be performed on live electrical conductors or equipment, except where special procedures shall be implemented to prevent harm (see 6.2.2);
- that, where required, authorization to perform work or testing on AGL electrical equipment shall be obtained prior to that work commencing and that the authorization shall remain valid for the duration of the work (see 5.2.4.2 and Annex A);
- that power shall always be assumed to be on and electrical equipment is live until the true condition is determined (see 7.2.2);
- that, unless determined otherwise by a risk assessment, at least two persons shall be assigned to carry out maintenance work on AGL electrical equipment;
- that maintenance procedures shall begin only after a visual inspection has been made and possible hazards have been identified, evaluated in a risk assessment and recorded (see 7.2.2);
- that a specific safety training for personnel is provided;
- that a safety protection device is intended to prevent hazards. The deliberate disconnection of such device shall only be authorized in accordance with specific safety procedures (see 6.2.3.2);
- the use of safety signs and instructions (see 6.2.3.3);
- the availability of earth terminals and other safety facilities (see 6.2.3.4);
- that some electrical equipment is exposed to weather and moisture and may develop electrical shock hazards through damage from lightning or insulation deterioration from exposure (see 6.2.3.5);
- that all tools and test equipment shall be appropriate for the task (see 6.2.4);
- the use of appropriate safety equipment (see 6.2.5);
- the periodic inspection and/or calibration of tools, test and safety equipment (see 6.2.4 and 6.2.5);
- that electrical equipment shall not be returned to operational service without verifying that it is functioning correctly and that all the maintenance activities have been satisfactorily completed (see 7.2.5).

6.2.2 Live working

No work of any kind shall be performed on live AGL constant current series circuits unless the aerodrome authority has undertaken a risk assessment and provided procedures that have been assessed by that authority as safe. In this case, all practical precautions to prevent harm shall be taken.

Fault finding or testing on live electrical equipment shall only be undertaken when it is unreasonable for the electrical equipment to be made dead. Any subsequent repair shall not be performed on live electrical equipment.

6.2.3 Safety checks

6.2.3.1 Securing the work area

Electrical equipment covers shall be replaced and doors closed whenever electrical equipment is left unattended. If electrical equipment door locks are provided they shall be left locked with keys made available for authorized use. Any electrical equipment in the vicinity of the work in progress that cannot be made dead shall be identified and appropriate precautions shall be taken to prevent any additional hazard.

6.2.3.2 Safety protection devices

Fault diagnosis may require defeating interlocks or the removal of covers to give access to live electrical equipment (see 6.2.2). On such occasions testing shall be limited to the use of appropriate test equipment and shall follow a formalized procedure. This procedure may include a written checklist, agreed routines or any other precautions deemed necessary to maintain safety. Where interlocks have been defeated or covers removed for test purposes, the interlocks shall be re-instated and covers replaced at the earliest opportunity. The safety protection devices shall be re-set, tested and verified as operating correctly before the electrical equipment is returned to operational service.

6.2.3.3 Safety signs

The working area shall be screened off by suitable barriers and indicated by appropriate signs. Caution signs shall be affixed to all switchgear controlling the electrical equipment which has been made dead and on which work is proceeding. Hazard signs shall also be attached on, or adjacent to, live electrical equipment and at the limits of the area in which work may be carried out. In all cases a safety or job tag shall be securely attached at the point of isolation giving the name of the person who carried out the isolation procedure, essential contact telephone number(s) and date and time of isolation. If any test equipment or electrical equipment under test cannot be placed within the screened area, it shall be separately screened. Any safety signs that are not in use shall be stored in the appropriate place. A sign or placard, giving details of emergency resuscitation in the event of electric shock and first aid, shall be displayed in AGL indoor work areas where persons may be at risk of electric shock.

6.2.3.4 Earthing facilities

Earth connections shall be installed and maintained in conformance with the installation instructions. Earth connections, including devices for providing the temporary connection of an earth, shall be tested and the measurement recorded on a regular basis.

NOTE This test should take into account seasonal variations in the soil and should be performed on a nine-month cycle.

6.2.3.5 Proving circuit is dead

Where necessary (see 6.2.2), appropriate measures shall be taken to assure that the circuit on which work is to be performed is dead. The circuit should be earthed during the time taken to do the work (see 7.2.2 e)).