IEC 61820-3-2

Edition 1.0 2023-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electrical installations for lighting and beaconing of aerodromes – Part 3-2: Requirements for power supplies – Particular requirements for series circuits

Installations électriques pour l'éclairage et le balisage des aérodromes – Partie 3-2 : Exigences relatives aux alimentations électriques – Exigences particulières relatives aux circuits série

IEC 61820-3-2:2023-10(en-fr)

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.140.50, 93.120

ISBN 978-2-8322-7604-4

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTRICAL INSTALLATIONS FOR LIGHTING AND BEACONING OF AERODROMES –

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IEC 61820-3-2 has been prepared by IEC technical committee 97: Electrical installations for lighting and beaconing of aerodromes. It is an International Standard.

This first edition cancels and replaces IEC 61822 published in 2009. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC 61822:2009:

a) introduction of power electronic converter systems (PECS) to be used in the aeronautical ground lighting systems other than the 6,6 A aeronautical ground lighting systems;
b) introduction of classification for different device types;

c) introduction of IEC 62477-1:2022 and IEC 62477-2:2018 as the basis for safety related requirements.

The text of this International Standard is based on the following documents:

Draft	Report on voting
97/264/FDIS	97/265/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 61820 series, published under the general title *Electrical installations for lighting and beaconing of aerodromes*, can be found on the IEC website.

Future documents in this series will carry the new general title as cited above. Titles of existing documents in this series will be updated at the time of the next edition.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

INTRODUCTION

This document introduces an open specification for power electronic converter systems (PECS) to be used in aeronautical ground lighting (AGL) series circuit systems. The aim of this open specification is to enable various technologies to be used within AGL systems while ensuring the safe operation and function of the AGL system based on specific items in a series circuit topology.

This document also includes updated requirements for 6,6 A constant current regulators (CCR), previously defined in IEC 61822:2009.

The PECS defined in this document are power supplies for AGL circuits with a series circuit topology. It is possible that a PECS is not interoperable with AGL devices designed for the 6,6 A system. It is also possible that a PECS is not interoperable with AGL devices from other PECS-driven AGL systems. Special care should be taken to ensure the interoperability of the AGL components unless they are specifically designed to be operated together.

To clarify the distinction between different series circuit power supplies, a new classification system is introduced in Clause 4. A base class divides the power supplies into PECS and CCRs. In this document the term PECS refers to series circuit power supplies belonging to the class "General PECS for AGL systems" and the term CCR refers to series circuit power supplies belonging to the class "CCR for 6,6 A systems". The term PECS/CCR refers to both device classes. The class "CCR for 6,6 A AGL systems" corresponds to the traditional series circuit power supplies as defined by IEC 61822:2009.

In addition to the base class, classes for voltage ranges and construction mechanics are introduced. Where a part of this document only refers to one or more specific AGL systems, the systems in question will be clearly indicated.

Meanwhile this updated edition can be partially applicable to PECS dedicated to converting power from a mains supply to power suited for AGL other than series circuit topology. The maintenance work of IEC 61822:2009 into IEC 61820-3-2 started before the writing of the related subparts IEC 61820-3-1 and IEC 61820-3-3 had started. This updated version can therefore be partially applicable to PECS dedicated to converting power from a mains supply to power suited for AGL systems with other than series circuit topology.

ELECTRICAL INSTALLATIONS FOR LIGHTING AND BEACONING OF AERODROMES –

Part 3-2: Requirements for power supplies – Particular requirements for series circuits

1 Scope

This part of IEC 61820 specifies the requirements for power electronic converter systems (PECS) dedicated to powering aeronautical ground lighting (AGL) circuits with series circuit topology. An example of a traditional implementation is an AGL circuit with 6,6 A RMS nominal current, powered by a constant current regulator (CCR). In addition to revising the requirements for 6,6 A CCR setups, this document introduces requirements for general PECS for new AGL systems including systems specifically designed for LED based luminaires.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60038, *IEC standard voltages*

IEC 60076-11, *Power transformers – Part 11: Dry-type transformers*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 61000-6-5, *Electromagnetic compatibility (EMC) – Part 6-5: Generic standards – Immunity for equipment used in power station and substation environment*

IEC 61439-1, *Low-voltage switchgear and controlgear assemblies – Part 1: General rules*

IEC 61439-2, *Low-voltage switchgear and controlgear assemblies – Part 2: Power switchgear and controlgear assemblies*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61820-1:2019, *Electrical installations for aeronautical ground lighting at aerodromes – Part 1: Fundamental principles*

IEC 62477-1:2022, *Safety requirements for power electronic converter systems and equipment – Part 1: General*

IEC 62477-2:2018, *Safety requirements for power electronic converter systems and equipment – Part 2: Power electronic converters from 1 000 V AC or 1 500 V DC up to 36 kV AC or 54 kV DC*

CISPR 11, *Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement*

CISPR 32, *Electromagnetic compatibility of multimedia equipment – Emission requirements*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1
aeronautical ground lighting constant current series circuit
AGL constant current series circuit
apparatus configured as an electrical circuit designed to produce and operate with a constant current, independent of variations in the load, in order to provide a specified light output for aeronautical purposes

3.2
constant current regulator
CCR
apparatus which produces a current output at a constant root mean square (RMS) value independent of variations in the constant current series circuit load, input voltage and service conditions as specified

Note 1 to entry: Within this document, the term CCR is reserved for series circuit power supplies belonging to the class CCR for 6,6 A AGL systems.

Note 2 to entry: It is acknowledged that legacy systems still in use across the world also use alternative current ratings such as 8,33 A and 12 A but 6,6 A is the present standard. For the purposes of this document, 6,6 A systems will be referenced only.

3.3
open circuit
AGL constant current series circuit with an unplanned interruption at any location of the primary current line that produces a hazardous high voltage between the interrupted circuit sections

3.4
forced ventilation
cooling system in which the air is moved by external power

3.5
power electronic converter
PEC
device or part thereof for the purpose of electronic power conversion, including signalling, measurement, control circuitries and other parts, if essential for the power conversion function

[SOURCE: IEC 62477-1:2022, 3.55]

3.6
power electronic converter system
PECS
one or more power electronic converters intended to work together with other equipment

Note 1 to entry: Within this document, the term PECS is reserved for series circuit power supplies belonging to the class General PECS for AGL systems.

[SOURCE: IEC 62477-1:2022, 3.56, modified – "System consisting of" replaced with "one or more" in the definition and Note 1 to entry added.]

3.7
PECS/CCR
series circuit power supply belonging to either base class

3.8
main transformer
transformer used for transferring energy and providing galvanic isolation between the mains input of the PECS/CCR and the series circuit

3.9
local control
controlling functions affecting the output and thereby the AGL fixture brightness levels within the series circuit power by the PECS/CCR from within the immediate vicinity of the PECS/CCR (implemented on the PECS/CCR, or on a separate control device within the same substation in which the PECS/CCR is installed) in order to allow a direct supervision and intervention only by the operator acting on the device

3.10
remote control
control equipment which can alter the output state of the PECS/CCR and thereby the AGL lighting fixture brilliancy and which is located remotely from the substation where the PECS/CCR is installed, typically from the airfield control tower

Note 1 to entry: Remote control can be implemented by parallel wiring switched in response to airfield control tower changes or via serial communications using a fibre optic or copper wire cable between the tower and the remotely located equipment.

4 Classification

4.1 Base classes

The PECS or CCR shall be classified into one of the following base classes:

- General PECS for AGL systems
  - The general PECS for AGL systems may control the AGL fixture brightness via stabilized series circuit primary effective current. The AGL fixture brightness level may be independent of the effective current in the primary series circuit and controlled through a different information exchange mechanism.
- CCR for 6,6 A AGL systems
  - The 6,6 A system CCR shall control the brightness levels of the AGL fixtures via stabilized series circuit RMS current with precisely defined maximum current. The 6,6 A CCR category closely follows the definitions from IEC 61822:2009 and is capable of operating both halogen bulb and LED based AGL systems.

4.2 Voltage classes

The PECS/CCR shall be classified into one of the following categories based on the maximum available output voltage:

- Low-voltage PECS/CCRs
  - The rated system and output voltages of a low-voltage PECS/CCR shall not exceed 1 000 V AC.
- High-voltage PECS/CCRs
  - The rated system and output voltages of a high-voltage PECS/CCR may be over 1 000 V AC, but shall not exceed 5 000 V AC.

NOTE 1 Within this document, the term "high voltage" refers to voltages greater than 1 kV. In other contexts, this voltage range is often referred to as medium voltage.

NOTE 2 For safety electrical low-voltage and protective extra-low-voltage circuits, refer to the dedicated standard IEC 61820-3-4.

NOTE 3 The DC voltage definition of V2 in IEC 61820-1 is not applicable for series circuit systems.

4.3 Construction classes

The PECS/CCR shall be classified into one of the following categories based on the mechanical construction:

- Self-contained PECS/CCR

  A self-contained PECS/CCR is defined as a unit with all its components integral to one individual and purpose-built housing. The self-contained unit takes an input power supply and converts this to a series circuit primary current to power and control AGL fixtures. The complete process of power conversion takes place within the housing of the PECS/CCR with the input and output defined within this document. Self-contained PECS/CCRs are typically delivered to the end user in its final form.

- Switchgear assemblies

  A switchgear assembly is defined as a PECS or CCR consisting of an assembly of sub-parts or modular parts. The complete assembly takes an input power supply and converts this to a series circuit primary current to power and control AGL fixtures. These assemblies consist of parts or modules that perform a subtask of process of the power electronic conversion. The switchgear assembly can be used to separate low-voltage and high-voltage parts physically in different enclosures or rooms. Switchgear assembly parts or modules are typically connected and mounted by the end user to finalize the assembly.

The degree of interoperability of CCRs and PECS is defined by a reference to a specific primary AGL series circuit system. The 6,6 A AGL system is an example of such a system.

5 Requirements

5.1 General

The following requirements are grouped into five categories: environmental, functional, performance, design requirements and protection against electric shock.

5.2 Environmental requirements

5.2.1 General

The environmental condition classifications follow the definitions given in IEC 60721-3-3.

5.2.2 Environmental conditions

A PECS/CCR designed for continuous indoor operation without derating, shall follow the provisions for environmental conditions of either class E20 or class E21, as defined in IEC 61820-1:2019 and under one of the following temperature ranges:

- indoor temperature range: from +5 °C to +40 °C (class 3K3);
- normal temperature range: from +0 °C to +50 °C;
- extreme temperature range: from −40 °C to +55 °C (class 3K7 with 3Z11).

If the temperature range of the equipment is not explicitly specified, the PECS/CCR shall be designed for operation under the normal temperature range.

A PECS/CCR designed for outdoor use shall follow the provisions for environmental conditions of class E10, as defined in IEC 61820-1:2019.

A PECS/CCR following the climatic conditions of class 3K3 may be designed to operate in altitude conditions from sea-level to 1 000 m. The limited altitude conditions of 1 000 m shall be explicitly mentioned in the documentation.

A climate-controlled environment is recommended for PECS/CCR installations.

NOTE For PECS used externally, a specific temperature range can be defined if it is clearly mentioned in the product documentation.

5.2.3 Electromagnetic compatibility (EMC)

5.2.3.1 Limits for emission

The PECS/CCR shall comply with IEC 61000-6-4, the EMC generic emission standard for industrial environments. Radiated emission limits shall be in accordance with CISPR 11, class A.

5.2.3.2 Limits for immunity

The PECS/CCR shall comply with the EMC immunity requirements of IEC 61000-6-5 for substation, interface type 2.

5.2.3.3 Limits for harmonic current emissions on the PECS input

If specified in the data sheet, the emitted harmonic current should be stated in terms of IEC 61000-3-2 and IEC 61000-3-12. Where possible, a 3-phase mains input should be used to improve the harmonic content on the input current of the PECS/CCR.

5.3 Functional requirements

5.3.1 Input voltage

The rated input voltage to the PECS/CCR shall be in accordance with IEC 60038. The PECS/CCR shall tolerate input voltage frequency changes up to ±7,5 % from the nominal value.

The PECS/CCR shall be designed to withstand momentary increases of voltage up to 120 % and momentary decreases of voltage down to 80 % of the nominal input voltage without being de-energized or damaged by such voltages. The PECS/CCR shall withstand such voltage excursions for up to 50 ms within a 1 min period. The PECS/CCR shall automatically resume normal operation when the input voltage returns to 90 % to 110 % of the nominal value.

5.3.2 Power ratings

The PECS/CCR can be manufactured in the following output power ratings:

1 kVA; 2 kVA; 2,5 kVA; 3 kVA; 4 kVA; 5 kVA; 7,5 kVA; 10 kVA; 15 kVA; 20 kVA; 25 kVA; and 30 kVA.

Greater power ratings than those specified in this document can be used to meet existing circuit requirements. In this case, the PECS/CCR should meet the applicable performance, qualification and safety requirements contained in this document.

5.3.3 Brightness level control

The PECS/CCR shall be capable of controlling the AGL fixture brightness on at least three different illuminating levels. The steps shall correspond to the brightness levels required. If the 'step 0' exists, it shall correspond to no light output.

NOTE Five brightness levels are common, but additional brightness levels can be used.

5.3.4 Remote interface communication

5.3.4.1 General

The PECS/CCR shall be capable of being controlled from a remote location allowing integration into an airfield lighting control system. All pre-set brightness levels of the PECS/CCR shall be selectable through the remote control. Feedback shall be available regardless of whether the PECS/CCR is in local or remote-control mode.

5.3.4.2 Remote control and monitoring functions

The PECS/CCR shall provide at least the standard functions listed in Table 1. Additional control and monitoring functions can be provided.

Table 1 – Remote control and monitoring functions

Control	
Standard	Optional
On/Off selection	Non-illumination step (NVG – night vision goggles) or black heat selection
Brightness selection	Circuit selector switch
Monitoring	
Standard	Optional
On	Non-illumination step obtained
Local/remote	Circuit selector feedback
Brightness 1 obtained	Circuit selector fault
Brightness 2 obtained	Lamp fault warning
Brightness 3 obtained	Lamp fault alarm
Brightness 4 obtained	Earth fault warning
Brightness 5 obtained[a]	Earth fault alarm
Brightness out of range	Lamp fault detection level
Open circuit trip	Earth fault detection value
Over current trip	Input readings
	Output readings
	PECS/CCR status parameters
	PECS/CCR errors

[a] Three and five brightness levels are common, but additional brightness levels can be used.

5.3.4.3 Network interfaces

The PECS/CCR may be controlled and monitored through a network interface. It can also be possible to combine parallel and serial or network interfaces. It can be possible to control the PECS/CCR control through parallel wiring while monitoring is available through serial or a network interface.

The data availability on the network interfaces shall be no less than that specified under standard in Table 1. The interface may allow more elaborate interfacing for control and monitoring to improve integration into a higher system.

Execution of mandatory commands and provision of feedback by the PECS/CCR shall be within 1 s.