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colour inside

Electrical installations for lighting and beaconing of aerodromes –Safety secondary circuits in series circuits – General safety requirements

Installations électriques pour l'éclairage et le balisage des aérodromes – Circuits secondaires de sécurité dans des circuits série – Exigences générales de sécurité

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICAL INSTALLATIONS FOR LIGHTING AND BEACONING OF AERODROMES – SAFETY SECONDARY CIRCUITS IN SERIES CIRCUITS – GENERAL SAFETY REQUIREMENTS

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International Standard IEC 62870 has been prepared by IEC technical committee 97: Electrical installations for lighting and beaconing of aerodromes.

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

FDIS	Report on voting
97/167/FDIS	97/169/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 website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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INTRODUCTION

With a few exceptions, aeronautical ground lighting is designed for series circuit technology operating with a constant current and a maximum input voltage of 5 000 V a.c. rms, including tolerances. The input voltage to the series circuit is constantly adjusted by the constant current regulator to maintain the series circuit current irrespective of the variations in the load. The properties and characteristics of the constant current regulators are provided in IEC 61822. Due to the structure of the series circuit, i.e. a series connection of all loads, the usual protective devices for personnel protection of an IT, TT or TN network cannot be applied.

Aeronautical ground lighting is defined as any light provided as an aid to air navigation and as such is subject to specific requirements with respect to its resilience, availability, and serviceability levels. Therefore, insulation faults in the series circuit are often tolerated, and do not lead to the automatic disconnection of the electrical supply to the series circuit.

In view of the above IEC 61821 states that no work of any kind is normally permitted on live series circuits without first conducting a suitable and sufficient Risk Assessment and using appropriate protective equipment according to IEC 61821.

The electrical characteristics of the constant current series circuits are often confused with those of IT, TT or TN networks, i.e. constant input voltage, equipment connected in parallel, and a load-dependent current. In practice, it is not always easy to assign rated voltages correctly to individual components of the series circuit or to determine possible touch voltages. In a constant current series circuits, the rated voltage of the equipment in the series circuit and the maximum touch voltage frequently exceed the normal mains input voltage.

In a series circuit installation the series circuit input voltage is divided in proportion to the internal resistances of the various loads. The rated voltage, i.e. the voltage between the input lines of the equipment, is defined by the series circuit current that flows through the equipment and its input impedance. Since input impedance depends on the equipment design and the series circuit current is constant, the input voltage remains the same for each item of equipment. As a result of the provision of current control in the series circuit the series circuit input voltage is load-dependent and corresponds to the sum of all partial voltages in the series circuit.

This is different to determining the maximum possible touch voltage to earth in a series circuit. Since one or more earth faults, of varying resistance to earth, maybe present, the touch voltage to earth may assume any value up to the maximum series circuit input voltage depending on the location of the earth fault and the equipment installed in the series circuit. Therefore when determining the dielectric strength against earth potential it is usual to take the maximum series circuit input voltage. Such peculiarities of the series circuit have been taken into account in the requirements for lamp systems in this standard.

Since there are only a few effective safety features available for personnel protection in series circuit technology the protective measure “Safety extra low voltage (SELV)” and “Protective extra low voltage (PELV)” is applied in this standard for the supply of lamp systems. This measure is common practice and can resort to the application of well-known and accepted methodology. The introduction of SELV/PELV in this type of application has been made possible by the introduction of new illuminant technology that has lower power requirements and hence requires a lower voltage supply.

NOTE This standard is based on SELV specification according to IEC 60364-4-41 and IEC 61558-1.

ELECTRICAL INSTALLATIONS FOR LIGHTING AND BEACONING OF AERODROMES – SAFETY SECONDARY CIRCUITS IN SERIES CIRCUITS – GENERAL SAFETY REQUIREMENTS

1 Scope

This International Standard specifies protective provisions for the operation of lamp systems powered by series circuits in aeronautical ground lighting.

The protective provisions described here refer only to secondary supply systems for loads that are electrically separated from the series circuit.

This standard specifies the level of SELV, and alternatively PELV, under consideration of additional personnel protection during work on live secondary circuits by electrically skilled persons. This standard also covers the special operational features of aeronautical ground lighting and addresses the level of training and the requirements for maintenance procedures detailed in IEC 61821.

The requirements and tests are intended to set a specification framework for system designers, users, and maintenance personnel to ensure a safe and economic use of electrical systems in installations for the beaconing of aerodromes.

This standard complements existing IEC Airfield-Ground- Lighting (AGL) standards and can be used as a design specification.

2 Normative references

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

IEC 60364-4-41, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60417, *Graphical symbols for use on equipment* (available from: http://www.graphical-symbols.info/equipment)

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments*

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

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61558-2-4, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers*

IEC 61558-2-6, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-6: Particular requirements and tests for safety isolating transformers and power supply units incorporating safety isolating transformers*

IEC 61821, *Electrical installations for lighting and beaconing of aerodromes – Maintenance of aeronautical ground lighting constant current series circuits*

IEC 61822, *Electrical installations for lighting and beaconing of aerodromes – Constant current regulators*

IEC 61823, *Electrical installations for lighting and beaconing of aerodromes – AGL series transformers*

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

CISPR 22, *Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement*

3 Terms and definitions

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

3.1
assembly
self-contained, closed functional unit forming a lamp system together with other assemblies

3.2
electrical equipment
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

3.3
basic protection
protection against electric shock under fault-free conditions

3.4
basic insulation
insulation of hazardous live parts providing basic protection

Note 1 to entry: The term “basic insulation” does not include insulation used exclusively for functional purposes.

3.5
electrically skilled person
person with relevant education and experience to enable him or her to perceive risks and to avoid hazards which electricity can create

[SOURCE: IEC 60050-195:1998,195-04-01]

3.6
SELV/PELV power supply
single physical unit or an assembly of physical units performing as the power supply according to SELV/PELV definitions

3.7
extra-low voltage
ELV
voltage not exceeding the relevant voltage limit specified in 3.9

3.8
lighting system
the SELV/PELV power supply unit and all connected components supplied from the SELV/PELV

3.9
safety extra-low voltage
SELV
voltage values of which does not exceed values in 4.7.2 , between conductors, or between any conductor and reference earth, in an electric circuit which has galvanic separation from the supplying electric power system by such means as a separate-winding transformer

3.10
SELV system
electrical system in which the voltage cannot exceed the value of extra-low voltage:

– under normal conditions, and
– under single-fault conditions, including earth faults in other electric circuits

Note 1 to entry: SELV is the abbreviation for safety extra low voltage.

[SOURCE: IEC 60050-826:2004, 826-12-31]

3.11
SELV-circuit
ELV circuit with protective separation from other circuits, and which has neither provisions for earthing of the circuit nor of the exposed conductive parts

Note 1 to entry: SELV circuit does not include the housing of the light fixture.

[SOURCE: IEC 61558-1:2005, 3.7.17, modified – addition of a note to entry]

3.12
electrically protective separation
protective separation
separation of one electric circuit from another by means of:

– double insulation or
– basic insulation and electrically protective screening or
– reinforced insulation

3.13
protective extra low voltage circuit
PELV-circuit
ELV circuit with protective separation from other circuits and which, for functional reasons, may be earthed and/or the exposed conductive parts of which may be earthed

Note 1 to entry: PELV-circuits are used where the circuits are earthed and SELV is not required.

[SOURCE: IEC 61558-1:2005, 3.7.18]

3.14
power supply unit
all components for the supply and transfer of energy used to operate a lighting unit in a series circuit

3.15
electric shock
physiological effect resulting from an electric current passing through a human or animal body

[SOURCE: IEC 60050-195:1998, 195-01-04]

3.16
hazardous live part
live part which, under certain conditions, can give a harmful electric shock

[SOURCE: IEC 60050-195:1998, 195-06-05]

3.17
effective touch voltage
touch voltage
voltage between conductive parts when touched simultaneously by a person or an animal

Note 1 to entry: The value of the effective touch voltage may be appreciably influenced by the impedance of the person or the animal in electric contact with these conductive parts.

[SOURCE: IEC 60050-195:1998, 195-05-11]

3.18
single fault condition
condition in which there is a fault of a single protection (but not a reinforced protection) or of a single component or a device

[SOURCE: IEC 60050-903:2013, 903-01-15]

3.19
light fixture(US)
light fitting (UK)
luminaire
electrical device used to create artificial light by use of an electric lamp above ground or inside the pavement

Note 1 to entry: The luminaire is an apparatus which distributes, filters or transforms the light transmitted from one or more lamps and which includes all the parts necessary for supporting, aiming, fixing and protecting the lamps, but not the lamps themselves and, where necessary, circuit auxiliaries together with the means for connecting them to supply.

4 Requirements for the SELV/PELV supply

4.1 General

Lamp systems for use in aeronautical ground lighting shall be designed for use in a series circuit. The maximum power ratings of the series circuit supply are given by the constant current regulators according to IEC 61822.

If the lamp systems are designed for other current ranges, such information shall be provided by the manufacturer.

The design of the safety secondary circuit shall support safe working conditions for electrically skilled persons.

The maintenance practices shall follow IEC 61821. When considering life work on the secondary circuit the risk assessment should take into account the nature of the work (fault finding, testing, and repair), the nature of the hazards present, and the provision of SELV/PELV designs.

The recommendation is to implement a PELV design because it is considered the more practical solution over complete live time of the installation but with the same safety level as a SELV design. If this requirement could not be fulfilled then it has to be considered that you need to enforce maintenance effort to achieve a suitable insulation level to implement the SELV design.

4.2 SELV/PELV-safety demarcation line in an AGL series circuit

Figure 1 and Figure 2 below show the extent of the safety secondary system. The safety secondary system (50 V a.c. or 120 V d.c. level) is all circuitry below the dashed safety demarcation line.

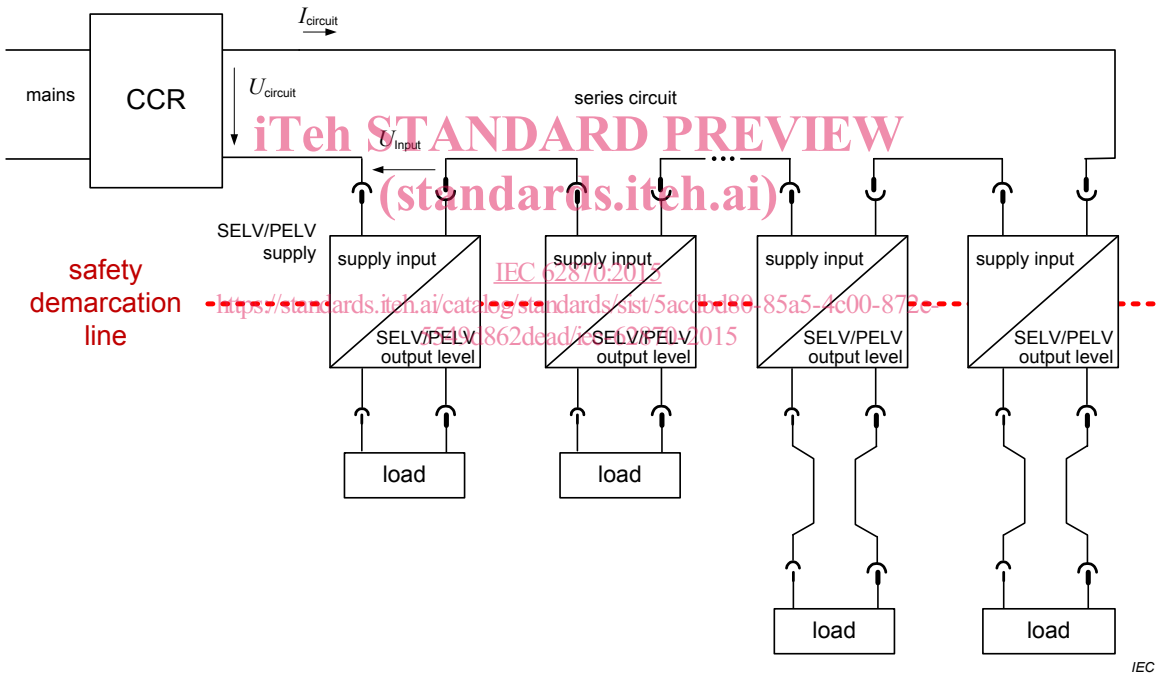

Figure 1 – Safety demarcation line in a SELV system