BS EN 62870:2015

BSI Standards Publication

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

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National foreword

This British Standard is the UK implementation of EN 62870:2015. It is identical to IEC 62870:2015.

The UK participation in its preparation was entrusted to Technical Committee EPL/97, Aeronautical ground lighting.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

Electrical installations for lighting and beaconing of aerodromes - Safety secondary circuits in series circuits - General safety requirements (IEC 62870:2015)

Installations électriques pour l'éclairage et le balisage des aérodromes - Circuits secondaires de sécurité dans des circuits série - Exigences générales de sécurité (IEC 62870:2015)

Elektrische Anlagen für Beleuchtung und Befeuerung von Flugplätzen - Sicherheitssekundärkreise in Serienstromkreisen - Allgemeine Sicherheitsfestlegungen (IEC 62870:2015)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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European foreword

The text of document 97/167/FDIS, future edition 1 of IEC 62870, prepared by IEC/TC 97 "Electrical installations for lighting and beaconing of aerodromes" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62870:2015.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2016-07-21
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2018-10-21

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The text of the International Standard IEC 62870:2015 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60364-1	NOTE	Harmonized as HD 60364-1.
IEC 61558-1:2005	NOTE	Harmonized as EN 61558-1:2005 (not modified).

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60364-4-41	-	Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock	HD 60364-4-41	-
IEC 60417	-	Graphical symbols for use on equipment	-	-
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	EN 60529	-
IEC 61000-6-2	-	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments	EN 61000-6-2	-
IEC 61000-6-4	-	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments	EN 61000-6-4	-
IEC 61140	-	Protection against electric shock - Common aspects for installation and equipment	EN 61140	-
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	EN 61558-2-4	-
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	EN 61558-2-6	-

Publication	Year	Title	EN/HD	Year
IEC 61821	-	Electrical installations for lighting and beaconing of aerodromes - Maintenance of aeronautical ground lighting constant current series circuits	EN 61821	-
IEC 61822	-	Electrical installations for lighting and beaconing of aerodromes - Constant current regulators	EN 61822	-
IEC 61823	-	Electrical installations for lighting and beaconing of aerodromes - AGL series transformers	EN 61823	-
CISPR 11	-	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement	EN 55011	-
CISPR 22	-	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	EN 55022	-

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

FOREWORD

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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

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

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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.

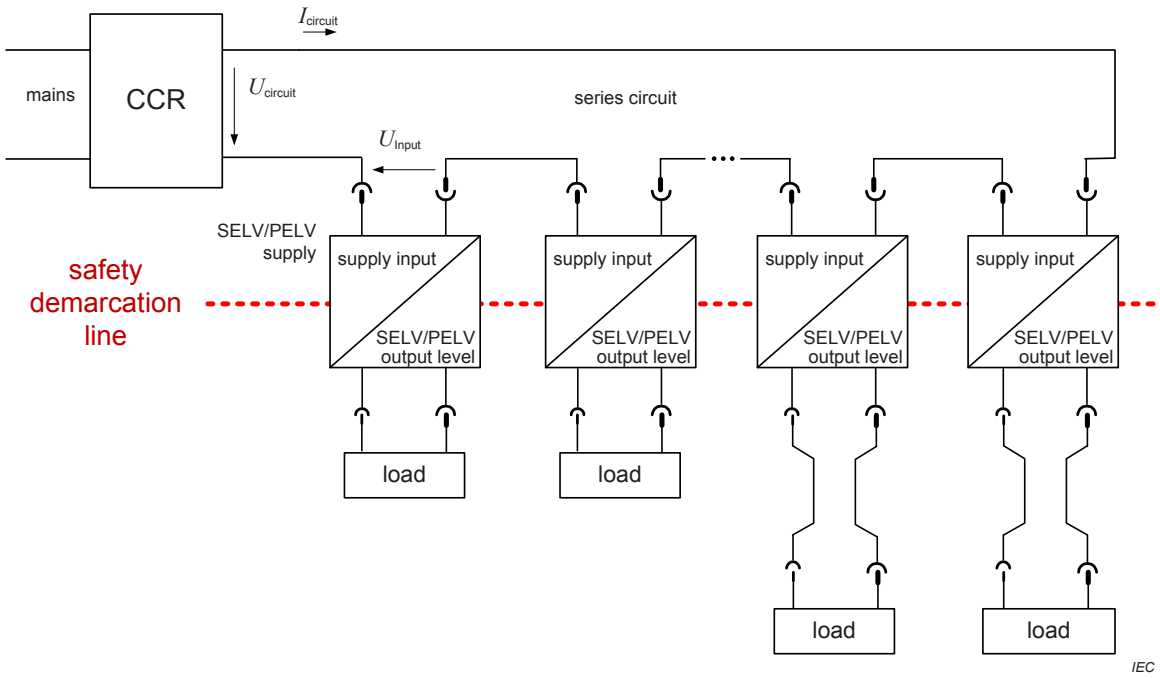
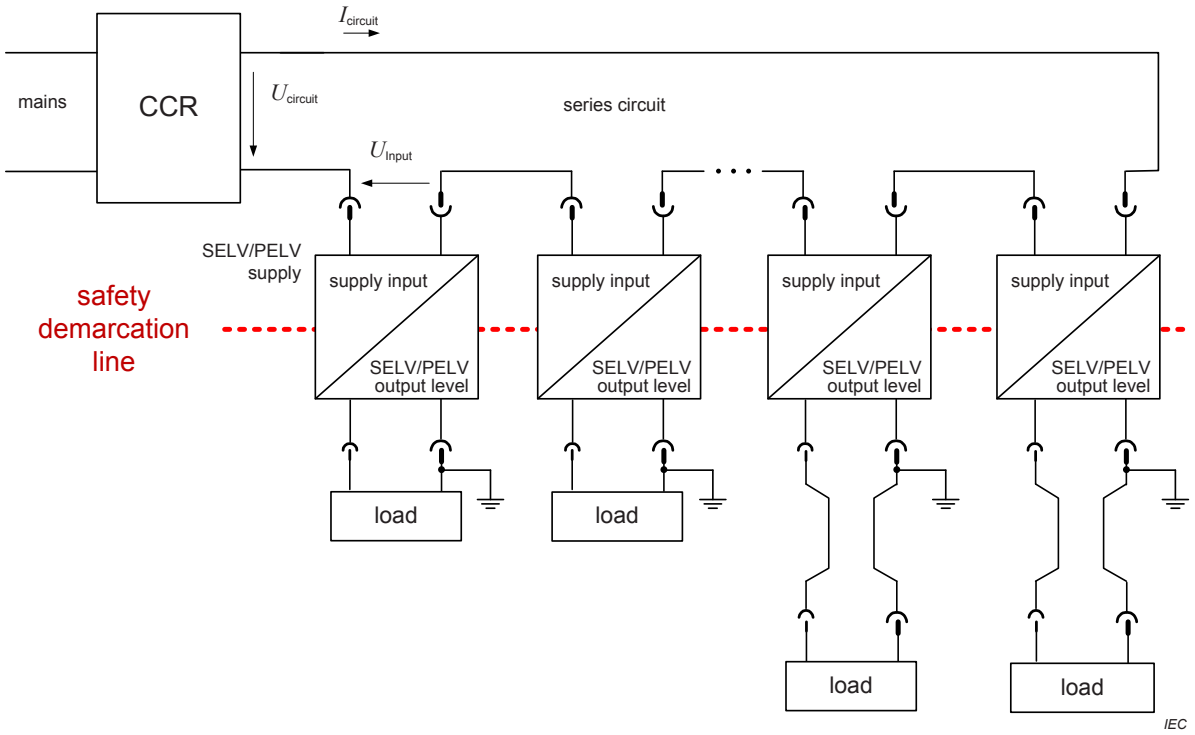


Figure 1 – Safety demarcation line in a SELV system



NOTE The given earthing in this figure is an example. The earthing connection can be performed anywhere in the secondary circuit.

Figure 2 – Safety demarcation line in a PELV system

The PELV-system can be used where local regulations require an earth (bonding of a live conductor) to be provided.

Important notice: It is strongly recommended that SELV and PELV systems are not mixed on a single circuit.

4.3 Environmental conditions

Lamp systems shall be designed for continuous outdoor operation without any derating factor, under the following environmental conditions:

- temperature range from –40 °C to +55 °C;
- relative humidity from 10 % to 100 %.

4.4 Degree of protection provided by enclosures

The degree of protection against contact with conducting parts or the ingress of solid objects and liquids shall be indicated by the IP coding according to IEC 60529.

Where the supply is intended to be installed outdoors the following IP-grade shall apply:

- underground IP 67,
- above ground IP 54.

4.5 Electromagnetic compatibility (EMC)

4.5.1 Limits of electromagnetic emission

The SELV/PELV supply shall comply with the requirements given in the EMC generic standard IEC 61000-6-4. The limits of electromagnetic emission shall comply with CISPR 11, class B.

4.5.2 Limits of immunity

The SELV/PELV supply shall comply with the requirements given in the generic standard for industrial environments IEC 61000-6-2. The immunity limits and methods of measurement of CISPR 22 shall be complied with.

4.6 Marking

4.6.1 Marking of the SELV/PELV power supply

Each SELV/PELV supply of it shall be permanently marked. The marking shall contain the following information:

- unambiguous type designation of the manufacturer;
- name of the manufacturer of the assembly;
- nominal input current;
- nominal output current;
- maximum output power (W and VA);
- marking of the assembly as class III (SELV) with symbol original 5180 of IEC 60417 (Roman III within a rhombus).

The SELV/PELV marking shall be available to maintenance personnel and easily readable in the normal installation position (see 4.7.4).

4.6.2 Marking at the installation locations

The location of a light fixture fed by a SELV/PELV power supply shall be marked as SELV/PELV. The marking shall be clearly readable to allow maintenance people to confirm SELV / PELV condition before starting any work on the installation. If the SELV/PELV supply will be replaced by a non-SELV/PELV supply the marking shall be removed or permanently covered.

4.7 Protection against electric shock

4.7.1 Basic requirements

Hazardous live parts shall not be accessible and accessible conductive parts shall not be hazardous live

- neither in normal use without fault, nor
- under single fault conditions.

4.7.2 Protective measure to be applied

The protective mechanisms of the SELV/PELV supply shall not be lost if a single fault occurs.

For this purpose

- limitation of voltage at the output of the SELV/PELV supply and
- protective-separation of the SELV/PELV supply from all circuits other than SELV and PELV and
- simple-separation of the SELV/PELV supply from other SELV/PELV supply

  shall be provided.

For a SELV supply, operational earthing of active parts nor the intentional connection of parts to a protective conductor or to an earth conductor according to IEC 61140 is not permitted. Where the safety secondary system is explicitly defined as a PELV supply, the PELV circuits and/or exposed conductive parts of equipment supplied by the PELV circuit may be earthed.

In locations where protective screening is used for the purpose of protective separation the protective screen shall be separated from each adjacent circuit by basic insulation intended for the highest voltage present.

The maximum SELV/PELV shall not exceed the following values:

- 50 V a.c. for a.c. voltages in the 15 Hz to 100 Hz range,
- 120 V d.c. for direct voltages with a maximum harmonic content of 10 % of the direct voltage effective value.

SELV/PELV and non-SELV/PELV circuits shall not be carried in the same cable.

4.7.3 Protective separation from the primary series circuit

The power supply unit of the lamp systems with the SELV/PELV supply shall provide a galvanic, safe separation from the primary side of the series circuit.

The input voltage of one single SELV /PELV supply is defined as the voltage between the two poles of that SELV/PELV supply and shall not exceed 1 000 V a.c. rms.

Protective separation between the input and the output of the supply shall be achieved according to IEC 61140 by means of:

- basic insulation and supplementary insulation, each rated for the highest voltage present, i.e. double insulation, or
- reinforced insulation rated for the highest voltage present, or
- protective screening with the protective screen being separated from each adjacent circuit by basic insulation rated for the adjacent circuit voltage, or
- a combination of these provisions.

If the conductors of the separated circuit are contained together with the conductors of other circuits in a multi-conductor cable or in another grouping of conductors, they shall be insulated, individually or collectively, for the highest voltage present, so that double insulation is achieved.

If any component is connected between the separated circuits, that component shall comply with the requirements for protective impedance devices according to IEC 61140.

4.7.4 Assemblies in the SELV/PELV supply

If assemblies in the SELV/PELV supply are connected to the power supply by means of an external interface they shall be designed as Class III equipment according to IEC 61140.

When a SELV supply is chosen there shall be no provision for the connection of live parts to earth.

The enclosure of an assembly may be provided with an earth terminal if it is necessary for an earth to be provide for reasons other than personnel protection.

An earth connection may be necessary to integrate an enclosure into a lightning protection system.

4.7.5 Load of the SELV/PELV supply

Equipment marked as Class III shall only be used in SELV or PELV systems.

4.8 Interfaces

4.8.1 Supply unit

The electrical supply to the lamp system is usually provided by the series circuit. All subsystems having a direct galvanic connection to the primary series circuit shall comply with IEC 61823 (AGL series transformers).

If the electrical supply of a series circuit, or another voltage supply, is intended to have a nominal voltage less than 1 000 V a.c., the dielectric strength can be determined according to IEC 61558-2-4.

4.8.2 Connectors

The live side of the circuit shall be equipped with the socket.

Plug and socket-outlets in SELV and PELV systems shall comply to IEC 60364-4-41 with the following requirements:

- plugs shall not be able to enter socket-outlets of other non AGL voltage systems;
- socket outlets shall not admit plugs of other non AGL voltage systems.

5 Testing

5.1 Type tests

The tests shall assure that the SELV/PELV supply complies with the applicable IEC standards referenced in 4.1 to 4.8.2.

All applicable type tests of dielectric strength shall be carried out on applicable parts of the SELV/PELV supply having a galvanic connection to the series circuit on one side according to IEC 61823.

The applicable tests for safety isolating transformers according to IEC 61558-2-6 shall be carried out.

The tests have been passed if all requirements have been fulfilled.

The tests shall be documented with all results clearly tabulated including a clear description of the structural condition of units after the completion of each test.

If a SELV/PELV supply is modified in any way that this has an effect on the safety or basic function of the SELV/PELV supply the type test shall be repeated.

5.2 Routine tests

After production the manufacturer shall submit each assembly to a visual inspection, a non-destructive dielectric test according to the applicable parts of IEC 61558-2-6, and a functional test. The functional test shall contain the basic functions and compliance with the maximum permitted output voltage for supply unit.

The manufacturer shall document the type and scope of tests in the test instructions.

Annex A
(informative)

System design selection

To select the right system design, the airport should consider the different characteristics of the installation (see Table A.1 below).

Table A.1 – Comparison of characteristics of PELV and SELV

	PELV	SELV
Work safety level	Same as SELV	Same as PELV
Can be combined with any local earthing requirements	Yes	No; Earthing is not allowed
Installation cost	Normal	Lower, due to the not required earthing
Functional availability	Lower, first insulation fault could cause the lamp malfunction	Higher, first insulation fault will not influence the function
Maintenance effort	Lower, requires the same maintenance as with secondary earth bonded systems	Higher, the insulation level shall be tested and each single fault shall be repaired

Bibliography

IEC 60050-195:1998, *International Electrotechnical Vocabulary – Part 195: Earthing and protection against electric shock*

IEC 60050-826:2004, *International Electrotechnical Vocabulary – Part 826: Electrical installations*

IEC 60050-903:2013, *International Electrotechnical Vocabulary – Part 903: Risk assessment*

IEC 60364-1, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

IEC TS 61201, *Use of conventional touch voltage limits – Application guide*

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