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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Safety requirements for secondary batteries and battery installations –
Part 2: Stationary batteries

Exigences de sécurité pour les batteries d'accumulateurs et les installations de batteries –
Partie 2: Batteries stationnaires

IEC 62485-2:2010

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SAFETY REQUIREMENTS FOR SECONDARY BATTERIES AND BATTERY INSTALLATIONS –

Part 2: Stationary batteries

FOREWORD

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International Standard IEC 62485-2 has been prepared by IEC technical committee 21: Secondary cells and batteries.

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

FDIS	Report on voting
21/711/FDIS	21/718/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.

A list of all parts of the IEC 62485 series can be found, under the general title *Safety requirements for secondary batteries and battery installations*, on the IEC website.

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- withdrawn,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.

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INTRODUCTION

The described safety requirements comprise the protective measures to protect from hazards generated by the electricity, the electrolyte, and the explosive gases when using secondary batteries. In addition measures are described to maintain the functional safety of batteries and battery installations.

For the electrical safety (protection against electric shock) under Clause 4, this standard refers to IEC 60364-4-41. The pilot function of this standard is fully observed by indication of cross-reference numbers of the relevant clauses, but interpretation is given where adoption to direct current (DC) circuits is required.

This safety standard comes into force with the date of publication and applies to all new batteries and battery installations. Previous installations are intended to conform to the existing national standards at the time of installation. In case of redesign of old installations this standard applies.

Valve-regulated lead-acid batteries used in stationary battery installations are intended to fulfil safety requirements in accordance to IEC 60896-21 and IEC 60896-22.

SAFETY REQUIREMENTS FOR SECONDARY BATTERIES AND BATTERY INSTALLATIONS –

Part 2: Stationary batteries

1 Scope

This part of the IEC 62485 applies to stationary secondary batteries and battery installations with a maximum voltage of DC 1 500 V (nominal) and describes the principal measures for protections against hazards generated from:

– electricity,
– gas emission,
– electrolyte.

This International Standard provides requirements on safety aspects associated with the erection, use, inspection, maintenance and disposal.

It covers lead-acid and NiCd / NiMH batteries.

Examples for the main applications are:

– telecommunications,
– power station operation,
– central emergency lighting and alarm systems,
– uninterruptible power supplies,
– stationary engine starting,
– photovoltaic systems.

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

IEC 60364-4-43, *Low-voltage electrical installations – Part 4-43: Protection for safety – Protection against overcurrent*

IEC 60364-5-53, *Electrical installations of buildings – Part 5-53: Selection and erection of electrical equipment – Isolation, switching and control*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60622:2002, *Secondary cells and batteries containing alkaline or other non-acid electrolytes –Sealed nickel cadmium prismatic rechargeable single cells*

IEC 60623:2001, *Secondary cells and batteries containing alkaline or other non-acid electrolytes –Vented nickel-cadmium prismatic rechargeable single cells*

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC/TR 60755, *General requirements for residual current operated protective devices*

IEC 60896-11:2002, *Stationary lead-acid batteries – Part 11: Vented types – General requirements and methods of tests*

IEC 60896-21:2004, *Stationary lead-acid batteries – Part 21: Valve regulated types – Methods of test*

IEC 60896-22:2004, *Stationary lead-acid batteries – Part 22: Valve regulated types – Requirements*

IEC 60900, *Live working – Hand tools for use up to 1 000 V a.c. and 1 500 V d.c.*

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

IEC 61340-4-1, *Electrostatics – Part 4-1: Standard test methods for specific applications – Electrical resistance of floor coverings and installed floors*

IEC 61660-1, *Short-circuit currents in d.c. auxiliary installations in power plants and substations – Part 1: Calculation of short-circuit currents*

IEC 61660-2, *Short-circuit currents in d.c. auxiliary installations in power plants and substations – Part 2: Calculation of effects*

IEC 62259:2003, *Secondary cells and batteries containing alkaline and other non-acid electrolytes – Nickel cadmium prismatic secondary single cells with partial gas recombination*

ISO 3864 (all parts), *Graphical symbols – Safety colours and safety signs*

3 Terms and definitions

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

3.1
(secondary) cell
(rechargeable) cell
single cell
assembly of electrodes and electrolyte which constitutes the basic unit of a secondary battery

NOTE This assembly is contained in an individual case and closed by a cover.

3.2
vented (secondary) cell
secondary cell having a cover provided with an opening through which gaseous products may escape

3.3
valve regulated (secondary) cell
secondary cell which is closed under normal conditions but has an arrangement which allows the escape of gas if the internal pressure exceeds a predetermined value. The cell cannot normally receive addition to the electrolyte

3.4
gastight sealed (secondary) cell
secondary cell which remains closed and does not release either gas or liquid when operated within the limits of charge and temperature specified by the manufacturer. The cell may be equipped with a safety device to prevent dangerously high internal pressure. The cell does not require addition to the electrolyte and is designed to operate during its life in its original sealed state

3.5
secondary battery
two or more secondary cells connected together and used as a source of electrical energy

3.6
lead dioxide-lead (acid) battery
secondary battery with an aqueous electrolyte based on dilute sulphuric acid, a positive electrode of lead dioxide and a negative electrode of lead

3.7
nickel oxide-cadmium battery
secondary battery with an alkaline electrolyte, a positive electrode containing nickel oxide and a negative electrode of cadmium

3.8
stationary battery
secondary battery which is designed for service in a fixed location and is not habitually moved from place to place during the operating life. It is permanently connected to the d.c power supply (fixed installation)

3.9
monobloc battery
battery with multiple separate but electrically connected cell compartments each of which is designed to house an assembly of electrodes, electrolyte, terminals and interconnections and possible separator

NOTE The cells in a monobloc battery can be connected in series or parallel.

3.10
electrolyte
liquid or solid substance containing mobile ions which render it ionically conductive

NOTE The electrolyte may be liquid, solid or a gel.

3.11
gassing
gas emission
evolution of gas resulting from the electrolysis of water in the electrolyte of a cell

3.12
charge
charging (of a battery)
operation during which a secondary cell or battery is supplied with electrical energy from an external circuit which results in chemical changes within a cell and thus storage of energy as chemical energy occurs

3.13
battery on float charge
secondary battery whose terminals are permanently connected to a source of constant voltage sufficient to maintain the battery approximately fully charged, and which is intended to supply power to an electrical circuit, if the normal supply is temporarily interrupted

3.14
float (charge) voltage
constant voltage needed to keep the cell or battery fully charged

3.15
float charge current
current resulting from the float charge

3.16
boost charge
accelerated charge applied at greater than normal values of electrical current or of voltages (for a particular design) during a short time interval

3.17
boost charge voltage
constant voltage -at higher voltage level- used in the boost charge

3.18
boost charge current
current arising from the boost charge voltage

3.19
discharge
discharging (of a battery)
operation during which a battery delivers, to an external circuit and under specified conditions, electrical energy produced in the cells

3.20
overcharge
overcharging (of a cell or battery)
continued charging after the full charge of a secondary cell or battery

NOTE Overcharge is also the act of charging beyond a certain limit specified by the manufacturer.

3.21
nickel-metal hydride battery
a secondary battery with an electrolyte of aqueous potassium hydroxide, a positive electrode containing nickels as nickel hydroxide and a negative electrode of hydrogen in the form of a metal hydride

3.22
nominal voltage
suitable approximate value of the voltage used to designate or indentify a cell, a battery or an electrochemical system

4 Protection against electric shock

4.1 General

Measures shall be taken in stationary battery installations for protection against either direct contact or indirect contact or against both direct and indirect contact.

These measures are described in detail in IEC 60364-4-41 and IEC 61140. The following subclauses describe the typical measures to be taken for battery installations and the resulting amendments.

The appropriate equipment standard IEC 61140 applies to batteries and direct current distribution circuits located inside equipment.

4.2 Protection against direct contact

In battery installations, protection against direct contact with live parts shall be ensured in accordance with IEC 60364-4-41.

The following protective measures apply:

– ”protection by insulation of live parts”;
– ”protection by barriers or enclosures”;
– ”protection by obstacles”;
– ”protection by placing out of reach”.

Protection by obstacles or by placing out of reach is expressly permitted in battery installations. It requires however that batteries with nominal voltages from >DC 60 V to DC 120 V between terminals and/or with nominal voltages from >DC 60 V to DC 120 V with respect to earth shall be located in accommodation with restricted access, and batteries with a nominal voltage above DC 120 V shall be located in accommodation with restricted access achieved by locks or other equivalent means. Doors to battery rooms and cabinets are regarded as obstacles and shall be marked with the warning labels according to 11.1.

Protection against direct contact is not required for batteries with nominal voltages up to or equal DC 60 V as long the whole installation corresponds to the conditions for SELV (safety extra low voltage) and PELV (protective extra-low voltage) (see 4.4.2).

NOTE The nominal voltage of a lead dioxide - lead cell (lead acid) is 2,0 V, that of a nickel oxide – cadmium or nickel oxide - metal hydride cell is 1,2 V. When these cells are boost charged, their voltage may reach 2,7 V in lead acid or 1,6 V in nickel oxide based systems.

Short circuit protection may be required, see 6.2.

If protection by barriers or enclosures is applied, degrees of protection IEC 60529 IP 2X or IPXXB shall at least be used.

4.3 Protection against indirect contact

In battery installations, protection against indirect contact shall be applied in accordance with IEC 60364-4-41.

One or more of the following measures shall be selected:

– ”protection by automatic disconnection of supply”;
– ”protection by use of class II equipment or by equivalent insulation”;
– ”protection by non-conducting locations” (used in specific applications only);
– ”protection by earth-free local equipotential bonding” (used in specific applications only);
– ”protection by electrical separation”.

A nominal touch voltage of DC 120 V shall not be exceeded (see IEC 60449, IEC 60364-4-41 and IEC/TS 61201). Beyond this voltage other suitable protection schemas shall be implemented.

Certain of these methods of protection require a protective conductor. Protective conductors or conductors with a protective function shall not be disconnected by a switching device. No switching device is permitted in a protective conductor. They shall not contain over-current protection devices (see IEC 60364-4-41). For dimensioning the cross-sectional areas of protective conductors, see IEC 60364-5-54.

Battery stands or battery cabinets made from metal shall either be connected to the protective conductor or insulated from the battery and the place of installation. This insulation shall correspond to the conditions for protection by insulation according to IEC 60364-4-41. Other simultaneously accessible conductive parts, i.e. metal ducts, shall be out of reach. For requirements on creepage distances and clearances (see IEC 60664-1), using a value of 4 000 V for the high-voltage impulse test.

The following protective devices shall be used with direct current, as applicable to the type of power system:

a) fuses;

b) over-current protective devices;

c) residual current or differential protective devices (RCD's), suitable for DC current.

The residual current protective devices in accordance with IEC/TR 60755 shall be of type B suitable for DC fault current.

e) insulation monitoring devices (e.g. in IT-systems);

f) fault-voltage operated protective devices (see IEC 60364-4-41).

4.3.1 Protection by automatic disconnection of supply

4.3.1.1 TN-system

In a TN-system (see IEC 60364-4-41) the positive or negative terminal (see Figure 1 and Figure 2) or the central point (in special cases also a non-central point) of the battery installation shall be connected to earth.

The exposed conductive parts of the equipment shall be connected to the protective conductor (PE)[1], the PEN-conductor (PEN)[2], or the earthing functional and protective conductor (FPE)[3], which is connected to the point on the battery having earth potential. Additional earthing of the protective conductor may be required in order to ensure that its potential deviates as little as possible from earth potential.

For fixed mounted electrical equipment, the disconnecting time shall be within 5 s after a fault occurs.

NOTE For portable equipment and socket-outlet circuits IEC 60364-4-41, applies.

PE conductor:	conductor provided for purposes of safety, for examples protection against electrical shock
PEN conductor	conductor combining the functions of both protective earthing conductor and neutral conductor

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1 For definitions see IEC 60364-5-54.

2 Introduced with reference to IEC 60364-5-54.

3 For definitions see IEC 60950-1.

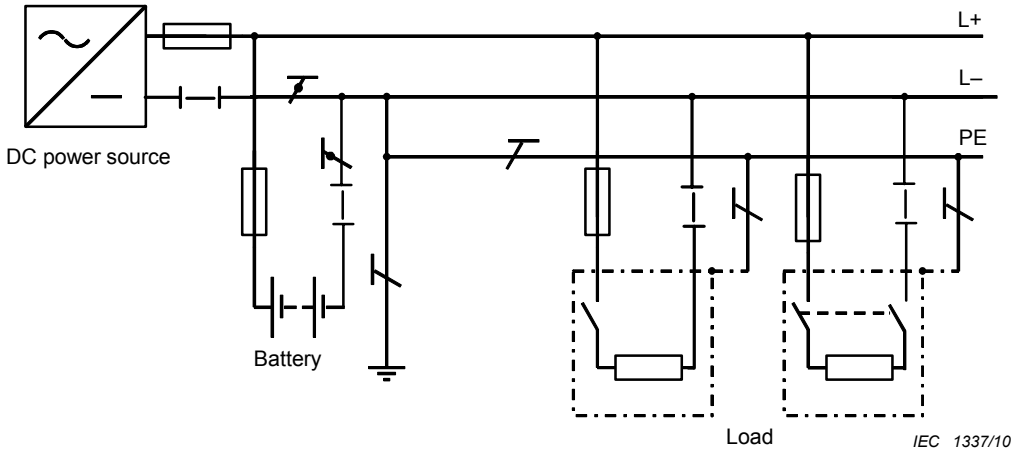

Figure 1 – TN system with separate protective conductor (PE) in the entire system (TN-S network)

In the TN-S system, the protective conductor (PE) shall be free of load current.

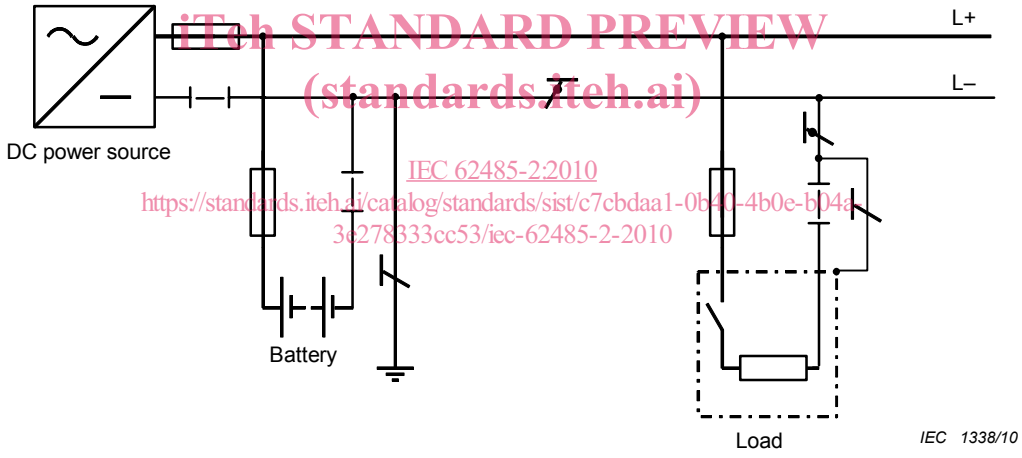

Figure 2 – TN system with functional earthing and protective (FPE, PEN) combined with an external line conductor (TN-C system)

In the TN-C system for DC-installations, the protective conductor and the earthed line conductor carrying the load current are combined. The cross-sectional area of the PEN or FPE conductor shall be at least 10 mm^2 Cu.

4.3.1.2 TT-System

In a TT-System (see Figure 3) the positive or negative terminal or another point on the battery installation shall be connected to earth (system earth electrode).

The exposed conductive parts of the electrical installation shall be earthed individually, in groups or collectively to a common earth electrode which is separate from the system earth electrode.

All exposed conductive parts collectively protected by the same protective device, shall be connected together with protective conductors to an earth electrode common to all those parts. Simultaneously accessible conductive parts shall be connected to the same earth electrode (IEC 60364-4-41).