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

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

Sicherheitsanforderungen an Batterien und Batterieanlagen -- Teil 2: Stationäre Batterien

Règles de sécurité pour les batteries et les installations de batteries -- Partie 2: Batteries stationnaires

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English version

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

Règles de sécurité pour les batteries et les installations de batteries
Partie 2: Batteries stationnaires

Sicherheitsanforderungen an Batterien und Batterieanlagen
Teil 2: Stationäre Batterien

This European Standard was approved by CENELEC on 2000-08-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CENELEC

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

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Ref. No. EN 50272-2:2001 E

Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 21X, Secondary cells and batteries.

The text of the draft was submitted to the formal vote and was approved by CENELEC on 2000-08-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2001-12-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2003-04-01

Annexes designated "informative" are given for information only.
In this standard, annexes A and B are informative.

Introductory note

1. For the preparation of EN 50272-2 the following European country's national standards have been taken into consideration:

Germany:	DIN VDE 0510 Part 2 Batteries and battery installations
United Kingdom:	BS 6133 for lead-acid batteries BS 6132 for NiCd batteries
Sweden:	SS 408 01 10 relating parts for rechargeable batteries, erection and ventilation
Switzerland:	SEV 1000-1 and SEV 1000-2 relating parts of instructions for installations in buildings
Italy:	Doc. D.P.R. 547, art. 302 and 303 , Safety in battery installations CEI 21-6 Part 3
Netherlands:	NEN 1010 relating parts of safety regulations for low voltage installations
Austria	ÖVE-C10 Part 2 , Batteries and battery installations
France	NF C15-100 , article 554 Batteries d'accumulateurs Article EC10, Règlement de securité contre l'incendie relatif aux établissemments recevant du public

Only those paragraphs have been considered where common agreement was found or specific need was recognised.

2. 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.

3. For the electrical safety (protection against electric shock) under clause 5 this document refers to HD 384.4.41 (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.

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

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1 Scope

This European Standard applies to stationary secondary batteries and battery installations with a maximum voltage of DC 1500 V (nominal) and describes the principal measures for protections against hazards generated from:

- electricity,
- gas emission,
- electrolyte.

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

It covers lead-acid and NiCd batteries.

2 Main applications

Examples for the main applications are:

- Telecommunications,
- Power Station Operation,
- Central Emergency Lighting and Alarm Systems,
- Uninterruptible Power Supplies,
- Stationary Engine Starting,
- Photovoltaic Systems.

3 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 166	Eye protection
EN 345	Safety footwear for professional use
EN 50091-1-2	Uninterruptible power systems (UPS) General and safety requirements for UPS used in restricted access locations
EN 50178	Electronic equipment for use in power installations
EN 60079-10	Electrical apparatus for explosive gas atmospheres Part 10: Classification of hazardous areas (IEC 60079-10)
EN 60529	Degrees of protection provided by enclosures (IP code) (IEC 60529)
EN 60623	Vented nickel-cadmium prismatic rechargeable single cells (IEC 60623)
EN 60896-1	Stationary lead-acid batteries - General requirements and methods of test Part 1: Vented types (IEC 60896-1)
EN 60896-2	Stationary lead-acid batteries - General requirements and methods of test Part 2: Valve-regulated types (IEC 60896-2)
EN 60900	Hand tools for live working up to 1 kV a.c. and 1,5 kV d.c. (IEC 60900, mod.)
EN 60950	Safety of information technology equipment (IEC 60950, mod.)
EN 60990	Methods of measurement of touch-current and protective conductor current (IEC 60990)

EN 61140	Protection against electric shock - Common aspects for installation and equipment (IEC 61140)
EN 61660-1	Short-circuit currents in d.c. auxiliary installations in power plants and substations -- Part 1: Calculation of short-circuit currents (IEC 61660-1)
EN 61660-2	Short-circuit currents in d.c. auxiliary installations in power plants and substations -- Part 2: Calculation of effects (IEC 61660-2)
HD 193	Voltage bands for electrical installations of buildings (IEC 60449)
HD 366	Classification of electrical and electronic equipment with regard to protection against electric shock (IEC 60536)
HD 384.4.41	Electrical installations of buildings Part 4: Protection for safety -- Chapter 41: Protection against electric shock (IEC 60364-4-41, mod.)
HD 384.4.43	Electrical installation of building Part 4: Protection for safety -- Chapter 43: Protection against overcurrent (IEC 60364-4-43)
HD 384.5.53	Electrical installation of buildings Part 5: Selection and erection of electrical equipment (IEC 60364-5-53)
HD 384.5.54	Electrical installations of buildings Part 5: Selection and erection of electrical equipment Chapter 54: Earthing arrangements and protective conductors (IEC 60364-5-54, mod.)
HD 384.7.706	Electrical installation of buildings Part 7: Requirements for special installations or locations Section 706: Restrictive conductive locations (IEC 60364-7-706)
HD 625.1	Insulation co-ordination for equipment in low-voltage systems Part 1: Principles, requirements and tests (IEC 60664-1)
IEC 60050-486	International Electrotechnical Vocabulary, Chapter 486: Secondary cells and batteries
IEC/TR 60755	General requirements for residual current operated protective devices
IEC 61201	Extra-low voltage (ELV) - Limit values
IEC 61340-4-1	Electrostatics - Part 4: Standard test methods for specific applications - Section 1: Electrostatic behaviour of floor coverings and installed floors
ISO 3864	Safety colours and safety signs

EC Directive 91/157/EEC	Batteries and accumulators containing certain dangerous substances
EC Directive 93/86/EEC	Adaptation to technical progress of Directive 91/157/EEC

4 General definitions

4.1 (secondary) cell; (rechargeable) cell; single cell

An assembly of electrodes and electrolyte which constitutes the basic unit of a secondary battery. (see IEC 60050-486-01-02)

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

4.2 vented (secondary) cell

A secondary cell having a cover provided with an opening through which gaseous products may escape. (see IEC 60050-486-01-18)

4.3 valve regulated (secondary) cell

A 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. (see IEC 60050-486-01-20)

4.4 gastight sealed (secondary) cell

A 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. (see IEC 60050-486-01-21)

4.5 secondary battery

Two or more secondary cells connected together and used as a source of electrical energy. (see IEC 60050-486-01-03)

4.6 lead-acid battery

A secondary battery in which the electrodes are made mainly from lead and the electrolyte is a sulphuric acid solution (H_2SO_4). (see IEC 60050-486-01-04)

4.7 nickel-cadmium battery

An alkaline secondary battery in which the positive material is made mainly from nickel and the negative material is made mainly from cadmium (see IEC 60050-486-01-07). The electrolyte is an alkaline solution (potassium hydroxide, KOH).

4.8 stationary battery

A 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 DC power supply (fixed installation).

4.9 monobloc battery

A secondary battery in which the plate packs are fitted in a multi-compartment container. (see IEC 60050-486-01-17)

4.10 electrolyte

A liquid or solid phase containing mobile ions which render the phase ionically conductive. (see IEC 60050-486-02-19)

4.11 gassing; gas emission

The formation of gas produced by electrolysis of the electrolyte. (see IEC 60050-486-03-24)

4.12 charge; charging (of a battery)

An operation during which a battery receives from an external circuit electrical energy which is converted into chemical energy. (see IEC 60050-486-01-11)

4.13 float charge

An operation during which the battery is permanently connected to a source of constant voltage sufficient to maintain the battery in fully charged condition and to recharge the battery in a specified time. (see IEC 60050-486-04-10, floating battery)

4.14 float (charge) voltage

The constant voltage needed to keep the cell or battery charged.

4.15 float charge current

The current resulting from the float charge.

4.16 boost charge

A partial charge generally at high-rate for a short period. (see IEC 60050-486-04-04)

4.17 boost charge voltage

The constant voltage -at higher voltage level- needed to recharge a battery in a specified time and / or to restore full capacity after a longer period of float charging or insufficient recharge.

4.18 boost charge current

The current arising from the boost charge voltage.

4.19 discharge; discharging (of a battery)

An operation during which a battery delivers current to an external circuit by the conversion of chemical energy into electrical energy. (see IEC 60050-486-01-12)

4.20 overcharge; overcharging (of a cell or battery)

Continued charging after the full charge of a cell or battery. (see IEC 60050-486-03-35)

5 Protection against electric shock

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

These measures are described in detail in HD 384.4.41 and EN 61140. The following clauses describe the typical measures to be taken for battery installations and the resulting amendments.

The appropriate equipment standards (EN 50178, HD 366/IEC 60536, EN 60990) apply to batteries and direct current distribution circuits located inside equipment.

5.1 Protection against direct contact

In battery installations, protection shall be ensured against direct contact with live parts in accordance with HD 384.4.41, subclause 412.1 to 412.4 inclusive.

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 locked accommodation with restricted access. Doors to battery rooms and cabinets are regarded as obstacles and shall be marked with the warning labels according to 12.1.

Batteries with nominal voltages up to or equal DC 60 V do not require protection against direct contact, as long the whole installation corresponds to the conditions for SELV (safety extra low voltage) and PELV (protective extra low voltage) (see 5.3.1).

Short circuit protection may be required (see clause 7.1).

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

5.2 Protection against indirect contact

In battery installations, protection against indirect contact shall be applied in accordance with HD 384.4.41, clause 413.

The following measures can 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 HD 193, HD 384.4.41 and IEC 61201).

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 overcurrent protection devices (see HD 384.4.41, clause 413). For dimensioning the cross-sectional areas of protective conductors, see HD 384.5.54.

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 HD 384.4.41, subclause 413.2. Other simultaneously accessible conductive parts, i.e. metal ducts, shall be out of reach. For requirements on creepage distances and clearances, see HD 625.1, using a value of 4000 V for the high-voltage impulse test.

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

a) fuses;
b) overcurrent protective devices;
c) Residual current or differential protective devices (RCD’s), suitable for DC current;

NOTE Residual current protective devices (RCD’s) in accordance with IEC 60755 shall be of type B suitable for DC fault current.

d) insulation monitoring devices (e.g. in IT-systems);
e) fault-voltage operated protective devices (see HD 384.4.41, subclause 413.1.4.4).

5.2.1 Protection by automatic disconnection of supply

5.2.1.1 TN-System

In a TN-system (see HD 384.4.41, subclause 413.1.3) the positive or negative terminal (see Figure 1 and Figure 2) or the central point (in special cases also an 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 HD 384.4.41, subclause 413.1.3.3 applies.

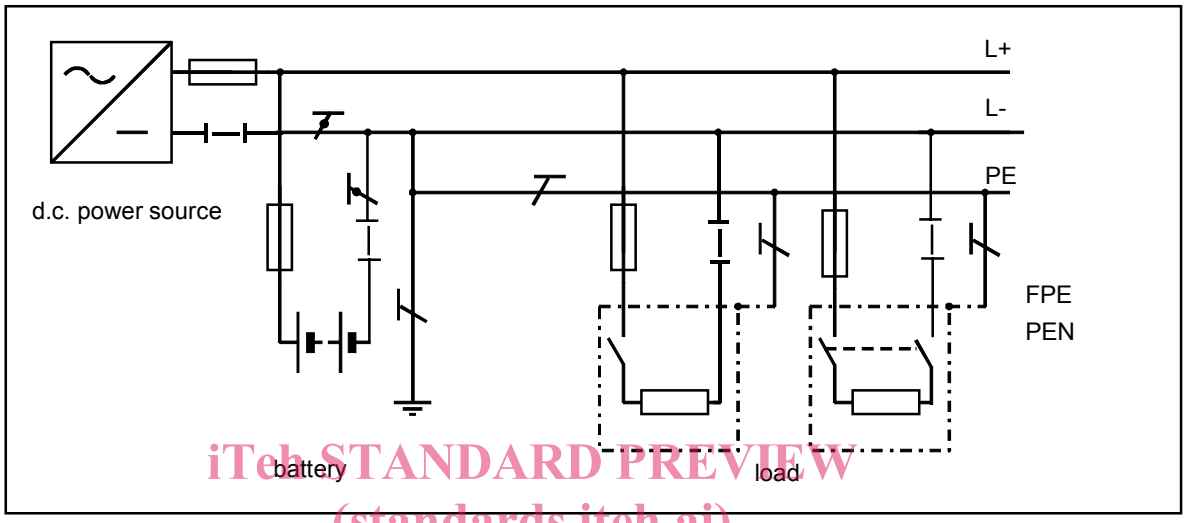

Figure1 - TN system with separate protective conductor (PE) in the entire system (TN-S network)

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

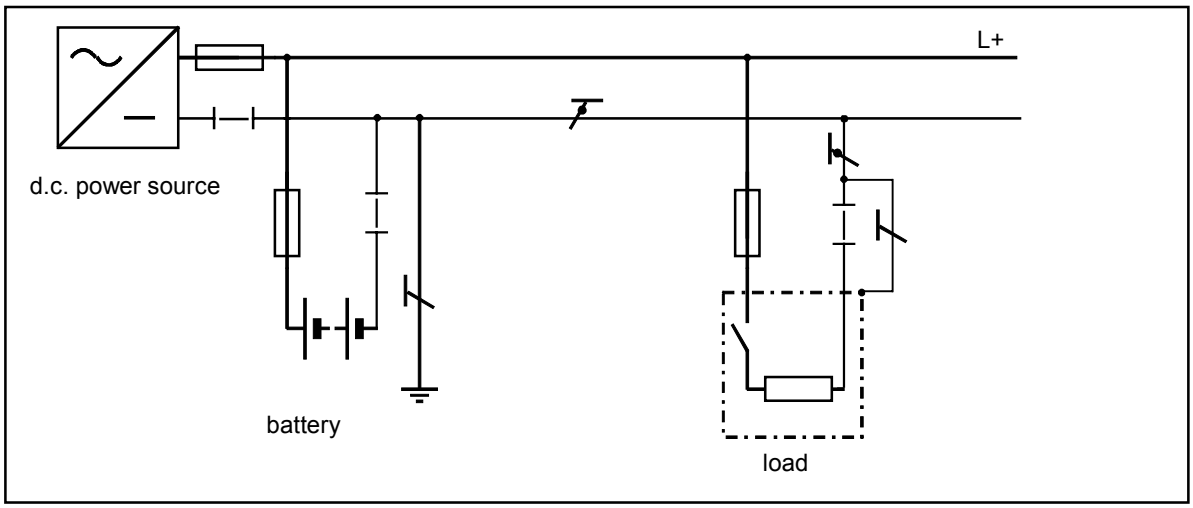

Figure 2 - TN system with functional earthing and protective (FPE, PEN) combined with an external line conductor (TN-C) system)

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.

[1] For definitions see HD 384.5.54.
[2] Introduced with reference to HD 384.5.54.
[3] For definitions see EN 60950.