SLOVENSKI STANDARD
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Sekundarne litijeve baterije za LEV (lahka električna vozila) - 1. del: Splošne varnostne zahteve in preskusne metode

Secondary lithium batteries for LEV (Light Electric Vehicle) applications - Part 1: General safety requirements and test methods

Sekundärbatterien für LEV - Anwendungen (Light Electric Vehicle) - Teil 1: Allgemeine Sicherheitsanforderungen und Prüfverfahren

Batteries d'accumulateurs au lithium pour applications liées aux véhicules électriques légers (VEL) - Partie 1: Exigences générales de sécurité et méthodes d'essai

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Secondary lithium batteries for LEV (Light Electric Vehicle) applications - Part 1: General safety requirements and test methods

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This draft European Standard is submitted to CENELEC members for enquiry.
Deadline for CENELEC: 2014-10-03.

It has been drawn up by CLC/TC 21X.

If this draft becomes a European Standard, 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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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document [prEN 50604-1:2014] has been prepared by CLC/TC 21X "Secondary cells and batteries".

This document is currently submitted to the Enquiry.

59 ## Introduction

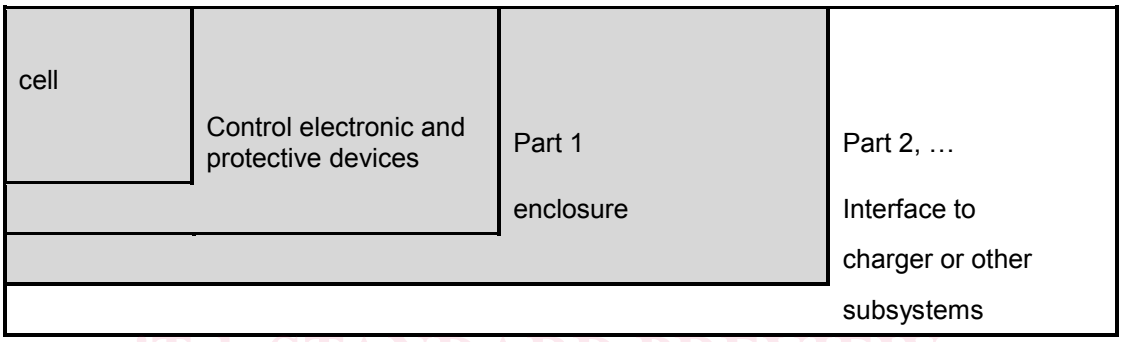
60 The goal of EN 50604 is to increase safety of battery packs (EPAC) which contain lithium battery techno-
61 logies in combination with their chargers for use in light electric vehicles.

62 Part 1 sets definitions, safety issues and test procedures.

63 Part 2 sets construction rules.

64 EN 50604 was designed to assess aspects on battery pack level. The battery pack and its charger can be
65 described as system comprising of following subsystems:

66



67 **Figure 1 – Battery packs system and subsystems**

68 The requirements to be met by subsystems are detailed in other parts of EN 50604.

1 General

1.1 Scope

This standard specifies test methods and requirements for secondary lithium batteries and its interface with an appropriate charging system for the safe use in EPACs.

This standard does not apply to performance and functional characteristics of batteries.

This standard refers to the UN Recommendations on the Transport of Dangerous Goods – Manual of Tests and Criteria: Section 38.3 which are performed independently from this testing program. Test reports issued by an ILAC, APLAC or similar accredited party are acceptable for the Battery complying with all aspects of Section 38.3 of Manual of Tests and Criteria of UN Recommendations on the Transport of Dangerous Goods for this test option.

This standard treats electric chargers only as far as it defines requirements for the interface between pack and charger which influence the safety of Li-battery-packs while being charged.

This standard does not cover batteries for electric vehicles covered by ISO 6469 and ISO 18246.

For cells: Relevant international standard IEC 62133, IEC 61960; IEC 62660.

This standard does not apply to:

– lithium cells;
– batteries other than lithium ion types;
– primary Batteries(including lithium types);
– lithium Battery Packs with a total weight exceeding 12 kg (UNT 38.3);
– batteries covered by ISO 12405 and ISO 18243.

1.2 General explanation

Test items were selected to simulate conditions likely to occur during the transport of batteries (either transported separately or when installed into the electric vehicle), during the handling (e. g. removal or replacement) or during the operation. They cover conditions of normal operation, rough handling and as well likely conditions of misuse or negligent handling. For electric vehicles operating under extreme conditions (e. g. off-road, extreme climate etc.) additional requirements may be necessary which are not covered by this standard.

Additional requirements might also apply to battery system after the integration into the vehicle resulting from national or regional regulations and are not dealt within this standard. Same applies to hazards from electric shock.

1.3 Subsystem requirements

Table 1 – subsystem requirements red in Part 2

Subsystem	Requirement
Protective devices	Corresponding IEC component standards [a], or – Other component standards ensuring corresponding safety levels [a] – Controlling of charging/discharging process avoiding overcharge/overdischarge, of internal shortcircuits, respecting temperature limits detection – The device may be integrated in charger or battery pack
Enclosure	Mechanical strength to withstand stress caused by normal use and rough handling – Sufficiently resistant to degradation caused by sunlight radiation – Reducing the possibility of ignition and spread of flame – Providing suitable insulation characteristics – The housing of the battery pack has to be constructed in a way that it cannot be opened without the use of tools and any opening from not authorized people should be easily detectible e. g. by a broken seal to be defined by the manufacturer.
Charger – Battery Pack	– IEC 61851 series, or – IEC 60335-1 and IEC 60335-2-29, or – Other product standards ensuring corresponding safety levels, and – IEC 60529 IP codes according to the designed use – Charger and battery pack form a functional unit – Charger and battery are constructed in a way that they can undoubtedly identify each other before any energy transfer. For the connection of the battery pack to the supply equipment no plug or socket shall be used with which a direct connection to any unintended power source e. g. a household AC-net can be realized (IEC/TR 683; IEC 60906-1; IEC 60320; IEC 60884; IEC 60309; EN 50075) – The terminals have to be protected against accidental short circuit
[a] Valid component certificate must be available.	

NOTE Test reports issued by an ILAC, APLAC or similar accredited party are acceptable.

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 60335-1:2006 (4.2 ed.), *Household and similar electrical appliances – Safety – Part 1: General requirements*

IEC 60335-2-29:2010 (4.2 ed.), *Household and similar electrical appliances – Safety – Part 2-29: Particular requirements for battery chargers*

IEC 60529:2001 (2.1 ed.), *Degrees of protection provided by enclosures (IP code)*

IEC 61851-1:2001 (1st ed.), *Electric vehicle conductive charging system – Part 1: General requirements*

IEC 61851-21:2001 (1st ed.), *Electric vehicle conductive charging system – Part 21: Electric vehicle requirements for conductive connection to an a.c./d.c. supply*

IEC 61851-22:2001 (1st ed.), *Electric vehicle conductive charging system – Part 22: AC electric vehicle charging station*

IEC 61960:2003 (1st ed.), *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications*

IEC 62133:2002 (1st ed.), *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications*

ISO 4892-2:2006 (2nd ed.), *Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps*

3 Terms and definitions

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

3.1 Batteries

3.1.1
active protective device
devices integral to the battery pack or the charger requiring active external controls, that are intended for protection from or mitigation of abusive, out-of range conditions experienced by the cell or battery. The active device cuts the connection to the charger or to a consumer (e. g. a motor) if the controls detect a situation under which the battery could be damaged or become dangerous

EXAMPLES MOSFET, integrated circuits, microcontroller.

3.1.2
ambient temperature
temperature of the medium in the immediate vicinity of the battery

3.1.3
battery assembly
connection of two or more batteries in series or parallel.

Note 1 to entry: Such assemblies are not covered by the manual.

Note 2 to entry: Such assemblies must contain protective devices and/or electronic circuits.

3.1.4
battery cell
cell
single encased electrochemical unit (one positive and one negative electrode), which exhibits a voltage difference across its two terminals

3.1.5
battery pack
battery
two or more cells that are electrically connected by permanent means. It may include housing, terminals, electronic circuits, sensors, markings and protective devices. If the cells are integrated in a frame of the LEV, this frame means the housing of the cells

3.1.6
cycle
one sequence of fully charging and fully discharging a rechargeable battery within the limits specified by the manufacturer

3.1.7
enclosure
cabinet, box or container providing protection for the parts building the battery

Note 1 to entry: Specific requirements applying to enclosures are detailed in 3.4 and 5.2.

3.1.8
first cycle
initial cycle following the completion of all manufacturing processes

3.1.9
fresh battery
battery after the completion of all manufacturing processes, ready for use

3.1.10
fully charged
rechargeable battery, which has been electrically charged to its rated electrical capacity, as specified by the manufacturer

3.1.11
fully discharged
rechargeable battery, which has been electrically discharged to its cut-off voltage as specified by the manufacturer

3.1.12
lithium ion battery
rechargeable electrochemical battery in which the positive and negative electrodes are both intercalation compounds (intercalated lithium exists in an ionic form in the lattice of the electrode material) constructed with no metallic lithium in either electrode. A lithium polymer battery that uses lithium ion chemistries, as described herein, is regulated as a lithium ion battery.

3.1.13
passive protective device
devices that do not require active external control for operation and which are either integral or external to the cell

EXAMPLES Over-current fuse links, circuit breaker, thermal releases.

Note 1 to entry: Protective devices, which were not tested according to the relevant component standard, are not considered as protective device.

Note 2 to entry: Semiconductor devices with no interface for external control can be permitted if they are subject to testing according to the relevant component standard, e.g. IEC 61643-321:2001 for avalanche breakdown diodes.

3.1.14
prismatic battery
battery whose ends are similar, equal and parallel rectilinear figures, and whose sides are parallelograms

3.1.15
protective device
either an active protective device or passive protective device

3.1.16
rated capacity
capacity, in ampere-hours, of a battery as measured by subjecting it to a load specified by IEC 61960, 7.2.1, temperature and voltage cut-off point as specified by the manufacturer

3.1.17
rechargeable or secondary battery
batteries or cells that can be repeatedly electrically charged and discharged

3.1.18
short circuit
direct low resistance connection between positive and negative terminals of a battery that provides a virtual zero resistance path for current flow

3.1.19
swapable batteries
lithium battery with a gross mass of not exceeding 12 kg intended to be easily removable by the end-user

3.1.20
built-in batteries
lithium battery fixed, installed and connected to the vehicle. Only meant to be removed by authorised persons

3.1.21
subsystem
major portion or module that comprises the overall system

3.1.22
type
particular electrochemical system and physical design of a battery

3.1.23
watt-hour rating
unit of energy, which is calculated by multiplying the discharge current with the time integral of the voltage curve of a battery.

Energy, in watt-hours of a battery as measured by subjecting it to a load specified by IEC 61960, 7.2.1, temperature and voltage cut-off point as specified by the manufacturer.

Note 1 to entry: See ISO/CD 18243.

3.2 Others

3.2.1
fault condition
equipment operated not in accordance with the manufacturer's specification and accompanying documents and markings. Conditions can occur as result of negligent use (foreseeable misuse), accident, failure of components or materials or other situations

3.2.2
normal condition
equipment operated in accordance with the manufacturer's specification and accompanying documents and markings

3.2.3
single fault
single failure of any protection means integral to the battery/charger design. When the application of a single fault condition is required by tests of this manual, the equipment, circuit diagrams, and component specifications are to be examined to determine those fault conditions that are likely to occur. Consideration shall be taken for any active protective devices and passive protective devices, which could be either electrical protection means or mechanical protection means

Note 1 to entry: Examples of single faults include but are not limited to:

a) short circuits and open circuits of semiconductor devices and capacitors;

b) faults causing continuous dissipation in resistors designed for intermittent dissipation;

c) internal faults in integrated circuits causing excessive dissipation;

d) any mechanical conducting part to bridge or open the circuits.

Note 2 to entry: Single faults can be the result of misuse of the battery or the partial or complete loss of function of components.

3.2.4
steady state condition
state reached when the temperature rise of the several parts of the battery does not vary by more than a gradient of 2 K per hour

Note 1 to entry: Steady state condition may be determined from the time-temperature rise plot when the straight lines between points at the beginning and end of two successive reasonable intervals each have a gradient of less than 2 K per hour.

4 Safety considerations

4.1 Special considerations

All tests, which could be negatively influenced by integration of the battery into the vehicle (e. g. installation into the frame), shall be tested with the battery integrated into the vehicle. Such tests can be conducted on specially prepared samples (e. g. parts of frames of vehicle) provided that the results are representative for the results of testing the assembled product (battery installed).

4.2 Precautions when conducting tests

Some of the tests specified can be hazardous to the persons carrying them out; all appropriate measures to protect personnel and affected environment from possible chemical, burn or explosion hazards should be taken.

NOTE More details are provided in G.2.

4.3 Evaluation of protective devices and electronic circuits

Evaluation option 1: Active protective devices bypassed

Protective devices which have not been tested according to or do not comply with the functional safety standard IEC 61508 or DIN/EN 13849 (Performance Level C).

NOTE 1 On request of the applicant also passive protective devices which comply with the functional safety standard can be bypassed in addition. This condition shall be stated in the corresponding test report.

NOTE 2 For affected test items refer to 6.1.1.1, 6.1.2.1 and 6.1.4.

Evaluation option 2: All protective circuits operating

Protective devices which are considered to be reliable according to the functional safety standard of IEC 61508 or DIN/EN 13849 (Performance Level C).

NOTE 3 single fault tests are conducted for components and assembly – refer to 3.3.

Test can be performed either under evaluation option 1 or 2.

4.4 Thermoplastic materials exposed to sunlight

All non-metallic materials exposed to UV radiation (sunlight) shall be tested according to ISO 4892-2 condition A. The test has to be performed without cells in the housing, but the temperature inside the housing must be recorded.

NOTE Examples of materials that could be affected: thermoplastic enclosure materials, wire and cable insulation, thermoplastic parts of connectors.