SLOVENSKI STANDARD
SIST EN 50604-1:2016

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Sekundarne litijeve baterije za 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 light EV (electric vehicle) applications - Part 1: General safety requirements and test methods

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

Lithium-Sekundärbatterien für Anwendungen in leichten Elektrofahrzeugen - Teil 1: Allgemeine Sicherheitsanforderungen und Prüfverfahren

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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

This document (EN 50604-1:2016) has been prepared by CLC/TC 21X “Secondary cells and batteries”.

The following dates are fixed:

• latest date by which the existence of this document has to be announced at national level	(doa)	2017–01–04
• latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2017–07–04
• latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	2019–07–04

The goal of this standard is to increase safety of battery packs/ systems which contain lithium battery technologies in combination with their voltage converter unit for use in light electric vehicles.

Part 1 sets definitions, safety issues and test procedures.

This standard was designed to assess aspects on battery pack/system level.

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This standard covers the Principal Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

This standard covers the Principal Elements of the Safety Objectives for battery packs/systems Designed for Use by Light EVs (Directive 2002/24/EC, Regulation (EU) 168/2013).

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Light EV includes all electrically propelled two, three and four wheeled vehicles of category L1 up to Category L7 according to the definition of ECE/TR ANS-WP29-78r2e and all electrically propelled or assisted cycles including plug-in hybrid road vehicles (PHEV), that derive all or part of their energy from on-board rechargeable energy storage systems (RESS).

This standard covers issues mentioned in EU Mandate M/468 and M/533.

This part is to be used in conjunction with the appropriate part of the ISO 12405- series.

NOTE The following print types are used:

– requirements: in roman type;

– test specifications: in italic type;

– notes: in small roman type.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

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Introduction

Lithium-ion battery systems are efficient rechargeable energy storage systems for electrically propelled road vehicles. The requirements for lithium-ion battery systems to be used as power source for the propulsion of electric road vehicles are significantly different to those batteries used for consumer electronics or for stationary applications.

Lithium-ion batteries may store electricity at relatively high-energy density compared to other battery chemistries currently available. Under current state of art, most lithium-ion batteries use organic electrolytes which are classified as Class 3 “flammable liquid” under “UN Recommendations on the Transport of Dangerous Goods – Model Regulations”. Therefore, mitigating potential hazards associated with fire or explosion of lithium-ion batteries is considered an important issue.

EN 50604-1 will be read in conjunction with ISO 12405-3. The clauses of the particular requirements in EN 50604-1 supplement or modify the corresponding clauses in ISO 12405-3. Where the text indicates an “addition” to or a “replacement” of the relevant requirement, test specification or explanation of ISO 12405-3, these changes are made to the relevant text of ISO 12405-3, which then becomes part of the standard. Where no change is necessary, the words “This (sub)clause of ISO 12405-3:2014 is applicable” are used.

Test items were selected to simulate conditions likely to occur during handling (e.g. removal or replacement) or during 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.

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This European Standard provides specific test procedures and related requirements to ensure an appropriate and acceptable level of safety of lithium-ion battery systems specifically developed for propulsion of road vehicles.

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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 system 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.

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1 Scope

This European Standard specifies test procedures and provides acceptable safety requirements for voltage class A and voltage class B removable lithium-ion battery (packs and) systems, to be used as traction batteries of or for electrically propelled road vehicles. This European Standard is related to the testing of safety performance of battery packs and systems for their intended use for a vehicle.

This European Standard is not intended to be applied for the evaluation of the safety of battery packs/systems storage, vehicle production, repair and maintenance services.

Light EV includes all electrically propelled two, three and four wheeled vehicles of category L1 up to Category L7 according to the definition of ECE/TR ANS-WP29-78r2e and all electrically propelled or assisted cycles including plug-in hybrid road vehicles (PHEV), that derive all or part of their energy from on-board rechargeable energy storage systems (RESS).

This European Standard enables setting up a dedicated test plan for an individual battery pack/system subject to an agreement between customer and supplier. If required, the relevant test procedures and/or test conditions of lithium-ion battery packs and systems may be selected from the standard tests provided in this standard to configure a dedicated test plan.

This European Standard applies to all battery systems intended to be used in conjunction with products or systems described in the IEC/TS 61851-3 series.

NOTE Testing on cell level is specified in the IEC 62660 series.

This European Standard does not apply to:

– lithium cells;

– batteries other than lithium ion types;

– primary Batteries(including lithium types);

– batteries covered by the ISO 12405- series.

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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.

ISO 12405-3:2014, *Electrically propelled road vehicles — Test specification for lithium-ion traction battery packs and systems — Part 3: Safety performance requirements*

This clause of ISO 12405-3:2014 is applicable except as follows:

Additions:

EN 60068-2-47, *Environmental testing — Part 2-47: Test — Mounting of specimens for vibration, impact and similar dynamic tests (IEC 60068-2-47)*

EN 60335-2-29, *Household and similar electrical appliances — Safety — Part 2-29: Particular requirements for battery chargers (IEC 60335-2-29)*

EN ISO 14021, *Environmental labels and declarations — Self-declared environmental claims (Type II environmental labelling) (ISO 14021)*

EN ISO 4892-2, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps (ISO 4892-2)*

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EN ISO 7010:2012, *Graphical symbols - Safety colours and safety signs - Registered safety signs (ISO 7010:2011)*

EN ISO 13849 (all parts), *Safety of machinery — Safety-related parts of control systems (ISO 13849, all parts)*

IEC 60335-1, *Household and similar electrical appliances — Safety — Part 1: General requirements*

IEC 60417:2002, *Graphical symbols for use on equipment — 12-month subscription to online database comprising all graphical symbols published in IEC 60417*

IEC/TS 60479-2:2007, *Effects of current on human beings and livestock — Part 2: Special aspects*

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

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC/TS 61851-3-1:2016[1)], *Electric Vehicles conductive power supply system — Part 3-1: General Requirements for Light Electric Vehicles (LEV) AC and DC conductive power supply systems*

IEC/TS 61851-3[2)], *Electric Vehicles conductive power supply system*

IEC/TS 62196-4[3)], *Plugs, socket-outlets, and vehicle couplers — Conductive charging of electric vehicles — Part 4: Dimensional compatibility and interchangeability requirements for a.c., d.c. and a.c./ d.c. vehicle couplers for Class II or Class III light electric vehicles (LEV)*

IEC 62660 (all parts), *Secondary lithium-ion cells for the propulsion of electric road vehicles*

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3 Terms and definitions

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For the purposes of this document, the terms and definitions given in ISO/TR 8713 and ISO 12405-3 and the following apply.

Addition:

3.1
battery control unit
BCU
electronic device that controls, manages, detects or calculates electric and thermal functions of the battery system and that provides communication between the battery system and other vehicle controllers

Note 1 to entry: See also Annex AA for further explanation.

[SOURCE: ISO 12405-3:2014, 3.1]

1) Under consideration.

2) Under consideration.

3) Under consideration.

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3.2
battery pack
energy storage device that includes cells or cell assemblies normally connected with cell electronics, voltage class A or B circuit and overcurrent shut-off device, including electrical interconnections, interfaces for external systems

Note 1 to entry: For further explanation, see AA.2.

Note 2 to entry: Examples of external systems are cooling, voltage class B, auxiliary voltage class A and communication.

[SOURCE: ISO 12405-3:2014, 3.2, modified — The original definition mentioned voltage class B circuit only.]

3.3
battery pack subsystem
representative portion of the battery pack

[SOURCE: ISO 12405-3:2014, 3.3]

3.4
battery system
energy storage device that includes cells or cell assemblies or battery pack(s) as well as electrical circuits and electronics

Note 1 to entry: For further explanation, see Annex AA. Battery system components can also be distributed in different devices within the vehicle.

Note 2 to entry: Examples of electronics are the BCU and contactors.

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[SOURCE: ISO 12405-3:2014, 3.4, modified — The former cross-reference to “A.3.1 and A.3.2” has been updated as “Annex AA” here.]

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3.5
battery management system
BMS
local energy management system (EMS Unit) for the battery system, protecting the battery system from damage, monitoring and increasing the lifetime, and maintaining the functional state

Note 1 to entry: BMS and BCU according to the ISO 12405- series do not have the same functions.

[SOURCE: IEC/TS 61851-3-4]

3.6
capacity
total number of ampere-hours and/or watt-hours that can be withdrawn from a fully charged battery under specified conditions

[SOURCE: ISO 12405-3:2014, 3.6, modified — “And/or watt-hours” has been added in the present definition.]

3.7
cell electronics
electronic device that collects and possibly monitors thermal or electric data of cells or cell assemblies and contains electronics for cell balancing, if necessary

Note 1 to entry: The cell electronics may include a cell controller. The functionality of cell balancing may be controlled by the cell electronics or it may be controlled by the BCU.

[SOURCE: ISO 12405-3:2014, 3.7, modified — The verb “may” is used three times in the present definition instead of “can” in the original one.]

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3.8
customer
party that is interested in using the battery pack or system and, therefore, orders or performs the test

EXAMPLE A vehicle manufacturer.

[SOURCE: ISO 12405-3:2014, 3.8]

3.9
device under test
DUT
battery pack or battery system, within EN 50604-1

[SOURCE: ISO 12405-3:2014, 3.9, modified — The definition was updated so as to mention “within EN 50604-1” instead of “in this part of ISO 12405” in the original one.]

3.10
explosion
sudden release of energy sufficient to cause pressure waves and/or projectiles that may cause structural and/or physical damage to the surrounding of the DUT

Note 1 to entry: The kinetic energy of flying debris from the battery pack or system may be sufficient to cause damage to the surrounding of the DUT as well.

[SOURCE: ISO 12405-3:2014, 3.10, modified — The verb “may” is used in the Note 1 to entry instead of “can” in the NOTE in the original definition.]

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3.11
fire
continuous emission of flames from a DUT (approximately more than one second)

Note 1 to entry: Sparks and arcing are not considered as flames.

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Note 2 to entry: Smoke is not considered as fire.

[SOURCE: ISO 12405-3:2014, 3.11, modified — Note 2 to entry was added.]

3.12
high-energy application
characteristic of device or application, for which the numerical ratio between maximum allowed electric power output (power in W) and electric energy output (energy in Wh) at a 1 C discharge rate at RT for a battery pack or system is typically less than 10 C

Note 1 to entry: Typically high-energy battery packs and systems are designed for applications in BEVs.

[SOURCE: ISO 12405-3:2014, 3.13, modified — “Typically lower than 10” was replaced with “typically less than 10 C” in the present definition.]

3.13
high-power application
characteristic of device or application, for which the numerical ratio between maximum allowed electric power output (power in W) and electric energy output (energy in Wh) at a 1 C discharge rate at RT for a battery pack or system is typically equal or greater than 10 C

Note 1 to entry: Typically high-power battery packs and systems are designed for application in HEVs and FCVs.

[SOURCE: ISO 12405-3:2014, 3.14, modified — “Or higher than 10” was replaced with “or greater than 10 C” in the present definition.]

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3.14
isolation resistance
resistance between live parts of voltage class B electric circuit and the electric chassis as well as the voltage class A system

[SOURCE: ISO 12405-3:2014, 3.15]

3.15
leakage
escape of liquid or gas from a DUT except for venting

[SOURCE: ISO 12405-3:2014, 3.16]

3.16
maximum working voltage
highest value of a.c. voltage (rms) or of d.c. voltage which may occur in an electrical system under any normal operating conditions according to the supplier's specifications, disregarding transients

[SOURCE: ISO 12405-3:2014, 3.17, modified — "According to the battery manufacturer's specifications" was replaced with "according to the supplier's specifications" in the present definition.]

3.17
rated capacity
supplier's specification of the total number of ampere-hours and/or watt-hour that can be withdrawn from a fully charged battery pack or system for a specified set of test conditions such as discharge rate, temperature, discharge cut-off voltage, etc

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[SOURCE: ISO 12405-3:2014, 3.20, modified — "And/or watt-hour" was added into the present definition.]

3.18
removable RESS (battery system/pack)
RESS that can be moved /removed from an EV by hand (portable RESS) or with the assistance of an installation/device (mobile RESS)

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[SOURCE: IEC/TS 61851-3-4]

3.19
portable RESS (battery system/pack)
RESS that may be moved /removed from an EV while in operation, having a mass less than 12 kg

[SOURCE: IEC/TS 61851-3 series, modified — "Equipment" was replaced with "RESS".]

3.20
mobile RESS
RESS that may be moved while not in operation, having a mass greater than 12 kg and equipped with wheels for moving or by using an assistance equipment or inside of a battery swap system

[SOURCE: IEC/TS 61851-3 series, modified — "Equipment" was replaced with "RESS".]

3.21
room temperature
RT
temperature of (25 ± 2) °C

[SOURCE: ISO 12405-3:2014, 3.21]