



**SLOVENSKI STANDARD**  
**SIST EN 50604-1:2016/A1:2021**

**01-oktober-2021**

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**Sekundarne litijeve baterije za lahka električna vozila - 1. del: Splošne varnostne zahteve in preskusne metode - Dopolnilo A1**

Secondary lithium batteries for light EV (electric vehicle) applications - Part 1: General safety requirements and test methods

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

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

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**Ta slovenski standard je istoveten z: EN 50604-1:2016/A1:2021**

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**ICS:**

29.220.30	Alkalni sekundarni členi in baterije	Alkaline secondary cells and batteries
43.120	Električna cestna vozila	Electric road vehicles

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EUROPEAN STANDARD

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ICS 29.220.30

English Version

## 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

This amendment A1 modifies the European Standard EN 50604-1:2016; it was approved by CENELEC on 2021-06-21. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This amendment 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 CEN-CENELEC Management Centre has the same status as the official versions.

[SIST EN 50604-1:2016/A1:2021](#)

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

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

## EN 50604-1:2016/A1:2021 (E)

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## European foreword

This document (EN 50604-1:2016/A1:2021) 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) 2021-12-21
- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2022-06-21
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2024-06-21

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.

This part is read in conjunction with the appropriate part of the withdrawn ISO 12405-1, ISO 12405-2 and ISO 12405-3 and novel ISO 6469-1:2019. Remark: the 1<sup>st</sup> Ed of EN 50604-1 is referencing to ISO 12405-3.

NOTE 1 The following print types are used:

- requirements: in roman type; [SIST EN 50604-1:2016/A1:2021](https://standards.iteh.ai/catalog/standards/sist/d8269fe9-16ef-4df3-94bd-d7e71f99/sist-en-50604-1-2016-a1-2021)
- test specifications: *in italic type*; <https://standards.iteh.ai/catalog/standards/sist/d8269fe9-16ef-4df3-94bd-d7e71f99/sist-en-50604-1-2016-a1-2021>
- notes: in small roman type.

This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

**EN 50604-1:2016/A1:2021 (E)****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 can 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 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 are considered as an important issue.

The EN 50604-1 series is read in conjunction with ISO 12405-3:2014 (withdrawn) and ISO 6469-1:2019 (for this amendment). The clauses of the particular requirements in EN 50604-1 supplement or modify the corresponding clauses in ISO 12405-3:2014 (withdrawn) and ISO 6469-1:2019 (for this amendment). Where the text indicates an “addition” to or a “replacement” of the relevant requirement, test specification or explanation of ISO 12405-3:2014 (withdrawn) and ISO 6469-1:2019 (for this amendment), these changes are made to the relevant text of ISO 12405-3:2014 (withdrawn) and ISO 6469-1:2019 (for this amendment), which then becomes part of the standard. Where no change is necessary, the words “This 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 could be necessary which are not covered by this document.

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

[SIST EN 50604-1:2016/A1:2021](https://standards.iteh.ai/catalog/standards/sist/d8269fe9-16ef-4df3-94bd-010668100000/sist-en-50604-1-2016-a1-2021)

[https://standards.iteh.ai/catalog/standards/sist/d8269fe9-16ef-4df3-94bd-](https://standards.iteh.ai/catalog/standards/sist/d8269fe9-16ef-4df3-94bd-010668100000/sist-en-50604-1-2016-a1-2021)

This document provides specific test procedures and related requirements to ensure an appropriate and acceptable level of safety of lithium-ion (Li-ion) battery systems specifically developed for propulsion of road vehicles. Propositions for other chemistries are given in informative Annex HH.

This document indicates references 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. Test reports issued and verified by in house testing according to UN 38.3 are also accepted.

## 1 Modification to Clause 1, “Scope”

Replace the 3rd paragraph by the following:

“Light EV includes all electrically propelled vehicles of category L1 up to category L7 according to the definition of ECE-TRANS-WP29-78r6e 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).”

Delete the 5th paragraph.

Add after NOTE and renumber it NOTE 1:

“This document also applies to:

- built-in battery packs/systems in EVs.

NOTE 2 Informative Annex HH gives information on possible tests for other chemistries.”

Replace the first and second point of the last paragraph by:

“

- individual cells;
- non-removable battery systems;”

## 2 Modification to Clause 2, “Normative references”

Add the following new references: [standards.iteh.ai](https://standards.iteh.ai)

”

EN IEC 60812:2018, *Failure modes and effects analysis (FMEA and FMECA) (IEC 60812:2018)*

EN 60529:1991<sup>1</sup>, *Degrees of protection provided by enclosures (IP Code)*

EN 61000-6-7:2015, *Electromagnetic compatibility (EMC) - Part 6-7: Generic standards - Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations (IEC 61000-6-7:2014)*

EN 61326-3-1:2017, *Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 3-1: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) - General industrial applications (IEC 61326-3-1:2017)*

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

EN 62133-2, *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 - Part 2: Lithium systems (IEC 62133-2:2017)*

<sup>1</sup> As impacted by EN 60529:1991/A1:2000, EN 60529:1991/A2:2013, EN 60529:1991/A2:2013/AC:2019-02, EN 60529:1991/AC:2016-12, and EN 60529:1991/corrigendum May 1993.

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EN ISO 178:2010<sup>2</sup>, *Plastics – Determination of flexural properties (ISO 178:2010)*

EN ISO 179 (series), *Plastics – Determination of Charpy impact properties (ISO 179 series)*

EN ISO 2409:2013<sup>3</sup>, *Paints and varnishes – Cross-cut test (ISO 2409:2013)*

EN ISO 4892-2:2013, *Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps (ISO 4892-2:2013)*

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

ISO 6469-1:2019, *Electrically propelled road vehicles — Safety specifications — Part 1: Rechargeable energy storage system (RESS)*

IEC 60695-11-10, *Fire hazard testing - Part 11-10: Test flames - 50 W horizontal and vertical flame test methods*

SAE J 1739:2009, *Potential Failure Mode and Effects Analysis in Design (Design FMEA), Potential Failure Mode and Effects Analysis in Manufacturing and Assembly Processes (Process FMEA)*"

**3 Modification to Clause 3, “Terms and definitions”**

Replace term entry 3.5 by:

“

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**3.5 battery management system (standards.iteh.ai)****BMS**

local energy management system 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 do not have the same functions.

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

Add note to entry to 3.14:

“

Note 1 to entry: In the context of this document, “electric chassis” can be replaced by “enclosure”.”

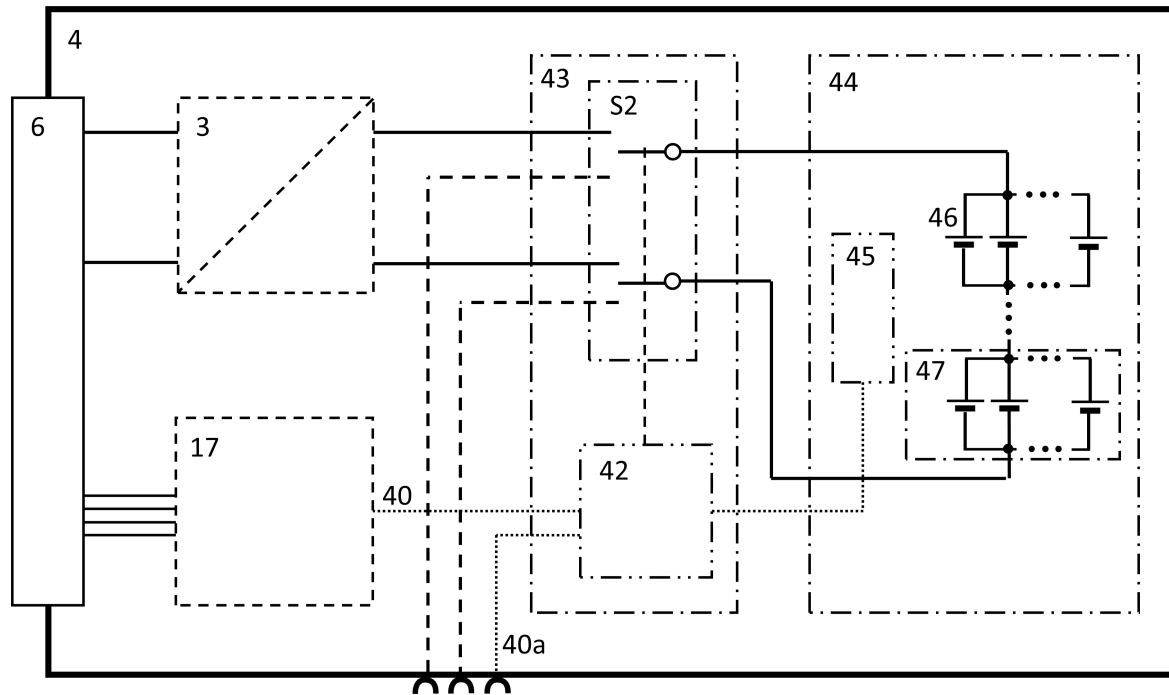
Add the following figure at the end of 3.18:

<sup>2</sup> A newer edition exists: EN ISO 178:2019.

<sup>3</sup> A newer edition exists: EN ISO 2409:2020.



“



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**Key**

- 3 DC/DC converter for removable battery systems
- 4 Removable battery system [SIST EN 50604-1:2016/A1:2021](https://standards.iteh.ai/catalog/standards/sist/d8269fe9-16ef-4df3-94bd-d14c1ae71f99/sist-en-50604-1-2016-a1-2021)
- 6 RESS inlet <https://standards.iteh.ai/catalog/standards/sist/d8269fe9-16ef-4df3-94bd-d14c1ae71f99/sist-en-50604-1-2016-a1-2021>
- 9\* A/B coupler (optional)
- 17 Gateway
- 40 Manufacturer specific communication circuit
- 42 Protective device(s) (active and/or passive)
- 43 Battery Management System
- 44 Battery Pack
- 45 Sensing and balancing electronics/equipment
- 46 Cells
- 47 Cell block
- S2 Switch

**Figure 1 — Example of a removable battery system”**

Replace the term entry of 3.31:

“

**3.31****active protective device**

device integral to the battery pack requiring active control, that is intended for protection from or mitigation of abusive, out of range conditions experienced by the cell or battery

EXAMPLE MOSFET.

Note 1 to entry: The active protective device disconnects source or sink if the BMS detects parameters outside of the normal operating conditions.”

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Add new term entries:

“

**3.33****local energy management system****local EMS**

active device's internal system that protects the energy buffer, source or load from damage, monitors and increases the lifetime of the buffer, source or load, maintains the buffer, and source or load in a functional state

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

**3.34****A/B coupler**

means enabling the connection and disconnection of RESS to an EV

[SOURCE: IEC/TS 61851-3-1]

**3.35****RESS coupler**

means enabling the connection of RESS to an EV or a DRI EV supply equipment

[SOURCE: IEC PAS 62840-3]

**3.36****keyed connector**

part of coupler with a unique mechanical profile which can only be mated with each other in a particular orientation and which does not allow mating with the counterpart with a different design

EXAMPLE 1 Hollow plugs of simple shape, where sockets-outlet compensate the variations of hollow plugs with a slightly different inner and/or outer diameter of the plug.

EXAMPLE 2 Plugs for applications or charging systems that do not meet the electrical requirements of the specific interface. “

<https://standards.iteh.ai/catalog/standards/sist/d8269fe9-16ef-4df3-94bd-d14c1ae71f99/sist-en-50604-1-2016-a1-2021>

**4 Modification to subclause 5.2, “Test sequence plan”**

Delete the 2<sup>nd</sup> paragraph.

“**Addition**”:

Add the following paragraph at the end of the subclause:

“For details on test sequences and numbers of samples, see Annex GG, Table GG.1.

NOTE EMC could be subject to further tests.”

**5 Modification to subclause 5.101, “Battery pack/system requirements”**

Replace Table 1 by:

"

Table 1 — Battery system requirements

Subsystem	Requirement
cell	<p>Battery packs/systems shall contain only Li-ion cells which comply with the UN Recommendations on the Transport of Dangerous Goods - Manual of Tests and Criteria: Section 38.3, and with one of the following:</p> <ul style="list-style-type: none"> <li>— relevant Li-ion battery cell standard EN 62660-3; or</li> <li>— relevant Li-ion battery cell standard EN 62133-2.</li> </ul> <p>Compliance is checked by a valid certificate.</p> <p>NOTE Battery packs/systems containing cells with other chemistries are shown in Annex HH.</p>
BMS	<p>The BMS shall be an integral part of the removable battery system. The BMS shall provide (see 3.5 and 5.106):</p> <ul style="list-style-type: none"> <li>— controlling of charging/discharging process;</li> <li>— active or passive protective devices (see 5.104);</li> <li>— protective devices as part of BMS (see 5.104): <ul style="list-style-type: none"> <li>— avoiding overcharge/overdischarge,</li> <li>— detection of internal short-circuits,</li> <li>— respecting temperature limits at least one temperature sensor which measures the temperature of the interior of the battery pack/system as close as possible to the most critical spot according to the design,</li> </ul> </li> <li>— compatibility check between battery system and connected equipment.</li> </ul> <p><b>Manufacturer specific solutions:</b></p> <ul style="list-style-type: none"> <li>— Clear assignment of connected equipment with keyed connectors, which ensures to operate the battery within its voltage- and current specifications during charging and discharging and which prevents reverse polarity connections. Standard connectors (e.g. EN 60320 series) shall not be used.</li> <li>— compatibility check provided by manufacturer including the following minimum information / parameters: <ul style="list-style-type: none"> <li>— device type;</li> <li>— supported functionality;</li> <li>— device manufacturer or responsible vendor;</li> <li>— software version;</li> <li>— hardware version;</li> <li>— minimum voltage;</li> <li>— maximum voltage;</li> <li>— max. continuous input current;</li> <li>— max. continuous output current;</li> <li>— complete documentation of the compatibility check.</li> </ul> </li> </ul>