

STN	Bezpečnostné požiadavky na akumulátorové batérie a inštalácie batérií Časť 6: Bezpečná prevádzka lítium-iónových batérií pri trakčných aplikáciách	STN EN IEC 62485-6 36 4380
------------	---	--

Safety requirements for secondary batteries and battery installations - Part 6: Safe operation of lithium-ion batteries in traction applications

Táto norma obsahuje anglickú verziu európskej normy.
This standard includes the English version of the European Standard.

Táto norma bola oznámená vo Vestníku ÚNMS SR č. 05/21

Obsahuje: EN IEC 62485-6:2021, IEC 62485-6:2021

132714

EUROPEAN STANDARD

EN IEC 62485-6

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2021

ICS 29.220.20; 29.220.30

English Version

**Safety requirements for secondary batteries and battery installations - Part 6: Safe operation of lithium-ion batteries in traction applications
(IEC 62485-6:2021)**

Exigences de sécurité pour les batteries d'accumulateurs et les installations de batteries - Partie 6: Fonctionnement en toute sécurité des batteries ions-lithium dans les applications de traction
(IEC 62485-6:2021)

Sicherheitsanforderungen an sekundäre Batterien und Batterieanlagen – Teil 6: Sicherer Betrieb von Lithium-Ionen-Batterien in Traktionsanwendungen
(IEC 62485-6:2021)

This European Standard was approved by CENELEC on 2021-02-09. 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.

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

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



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 IEC 62485-6:2021 (E)**European foreword**

The text of document 21/1071/FDIS, future edition 1 of IEC 62485-6:2021, prepared by IEC/TC 21 "Secondary cells and batteries" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62485-6:2021.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2021-11-09
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2024-02-09

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.

Endorsement notice

The text of the International Standard IEC 62485-6:2021 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60664 (series)	NOTE	Harmonized as EN 60664 (series)
IEC 60730-1:2013	NOTE	Harmonized as EN 60730-1:2016 (modified)
IEC 60730-1:2013/A1:2015	NOTE	Harmonized as EN 60730-1:2016/A1:2019 (not modified)
IEC 60730-1:2013/A2:2020	NOTE	Harmonized as EN 60730-1:2016/A2:— ¹ (not modified)
IEC 60812	NOTE	Harmonized as EN IEC 60812
IEC 60900	NOTE	Harmonized as EN IEC 60900
IEC 61025	NOTE	Harmonized as EN 61025
IEC 61429	NOTE	Harmonized as EN 61429
IEC 61508-1	NOTE	Harmonized as EN 61508-1
IEC 62281	NOTE	Harmonized as EN IEC 62281
IEC 62485-1	NOTE	Harmonized as EN IEC 62485-1
IEC 62485-3:2014	NOTE	Harmonized as EN 62485-3:2014 (not modified)
IEC 62902	NOTE	Harmonized as EN IEC 62902
IEC 62928	NOTE	Harmonized as EN IEC 62928
IEC 62660 (series)	NOTE	Harmonized as EN 62660 (series)

¹ To be published. Stage at the time of publication: EN 60730-1:2016/FprA2:2020.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60204-1	-	Safety of machinery - Electrical equipment of machines - Part 1: General requirements	EN 60204-1	-
IEC 60364-4-41	2005	Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock	HD 60364-4-41	2017
+A1	2017		+ A11	2017
-	-		+ A12	2019
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	-	-
IEC 61000-1-2	-	Electromagnetic compatibility (EMC) - Part 1-2: General - Methodology for the achievement of functional safety of electrical and electronic systems including equipment with regard to electromagnetic phenomena	EN 61000-1-2	-
IEC 61000-6-1	-	Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity standard for residential, commercial and light-industrial environments	EN IEC 61000-6-1	-
IEC 61000-6-2	-	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments	EN IEC 61000-6-2	-
IEC 61000-6-3	-	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for equipment in residential environments	EN IEC 61000-6-3 ²	-

² To be published. Stage at the time of publication: prEN IEC 61000-6-3:2019.

EN IEC 62485-6:2021 (E)

IEC 61000-6-4	-	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments	EN IEC 61000-6-4	-
IEC 61000-6-7	-	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	EN 61000-6-7	-
IEC 61140	-	Protection against electric shock - Common aspects for installation and equipment	EN 61140	-
IEC 62619	2017	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries, for use in industrial applications	EN 62619	2017
IEC 62620	2014	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Secondary lithium cells and batteries for use in industrial applications	EN 62620	2015
ISO 3864	series	Graphical symbols - Safety colours and safety signs	-	-
-	-	Safety of industrial trucks - Electrical requirements - Part 1: General requirements for battery powered trucks	EN 1175-1	1998
			+A1	2010



IEC 62485-6

Edition 1.0 2021-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Safety requirements for secondary batteries and battery installations –
Part 6: Safe operation of lithium ion batteries in traction applications**

**Exigences de sécurité pour les batteries d'accumulateurs et les installations
de batteries –
Partie 6: Fonctionnement en toute sécurité des batteries ions-lithium dans
les applications de traction**

**THIS PUBLICATION IS COPYRIGHT PROTECTED****Copyright © 2021 IEC, Geneva, Switzerland**

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC online collection - oc.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC -**webstore.iec.ch/advsearchform**

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC online collection - oc.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.



IEC 62485-6

Edition 1.0 2021-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Safety requirements for secondary batteries and battery installations –
Part 6: Safe operation of lithium ion batteries in traction applications**

**Exigences de sécurité pour les batteries d'accumulateurs et les installations
de batteries –
Partie 6: Fonctionnement en toute sécurité des batteries ions-lithium dans
les applications de traction**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.220.20; 29.220.30

ISBN 978-2-8322-9126-9

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	8
4 Protection against electric shock by the battery and charger.....	10
4.1 General.....	10
4.2 Basic protection and fault protection	10
4.3 Basic protection and fault protection when discharging the traction battery on the vehicle (battery disconnected from charger/mains).....	11
4.3.1 Batteries up to and including 60 V DC	11
4.3.2 For batteries exceeding 60 V DC up to and including 120 V DC.....	11
4.3.3 Batteries exceeding 120 V DC but not exceeding 1 500 V DC.....	11
4.4 Basic protection and fault protection when charging the traction battery.....	11
5 Prevention of short-circuits and protection from other effects of electric current.....	12
5.1 Cables and connectors	12
5.2 Protective measures during maintenance.....	12
5.3 Battery insulation	13
5.3.1 Insulation resistance.....	13
5.3.2 Insulation resistance measurement.....	13
6 Provisions against hazards.....	13
6.1 General.....	13
6.2 Charging modes.....	13
6.3 Temperature influence on the charge voltage and limiting of charge current	14
6.4 Overcharging or overdischarging under fault conditions	14
6.5 Prevention of electrostatic discharges when working with batteries	14
7 Provision against hazards by chemical substances.....	14
7.1 General.....	14
7.2 Initial actions in case of hazardous chemical release	14
7.3 Eye or skin contact	14
7.4 Swallowing.....	14
7.5 Respiratory tract	15
7.6 Burns.....	15
8 Battery containers and enclosures.....	15
9 Battery change	15
10 Battery peripheral equipment/accessories	15
10.1 Battery management system	15
10.2 Thermal management systems and series installation	16
10.3 Connectors (plugs/sockets).....	16
11 Charge current requirements	16
11.1 Peak voltage/current by charging	16
11.2 Superimposed ripple current	17
11.3 Maximum ripple current.....	17
12 Identification labels, warning notices and instructions for use, installation and maintenance.....	17
12.1 General.....	17
12.2 Warning labels	17

12.3	Identification label.....	18
12.4	Instructions	18
12.5	Other labels	18
13	Transportation, storage, disposal and environmental aspects	18
13.1	Packing and transport.....	18
13.2	Disassembly, disposal, and recycling of batteries.....	19
13.3	Storage.....	19
14	Inspection and monitoring.....	19
15	EMC for traction application.....	19
	Annex A (informative) Cell behaviour inside and outside of operating region.....	20
	Annex B (normative) Electromagnetic compatibility (EMC)	21
B.1	Case 1 – EMC requirements of battery systems depending of each end- device application	21
B.2	Case 2 – EMC requirements for testing battery system as an end-device.....	21
	Bibliography.....	22
	Figure A.1 – An example for operating region of lithium ion cell	20

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SAFETY REQUIREMENTS FOR SECONDARY
BATTERIES AND BATTERY INSTALLATIONS –**
Part 6: Safe operation of lithium ion batteries in traction applications**FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62485-6 has been prepared by IEC technical committee 21: Secondary cells and batteries.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
21/1071/FDIS	21/1077/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

SAFETY REQUIREMENTS FOR SECONDARY BATTERIES AND BATTERY INSTALLATIONS –

Part 6: Safe operation of lithium ion batteries in traction applications

1 Scope

This part of IEC 62485 applies to battery installations used for electric off-road vehicles; it does not cover the design of such vehicles.

Examples of the main applications are:

- industrial
 - cleaning machines,
 - trucks for material handling, for example, lift trucks, tow trucks, automatic guided vehicles,
 - electrically propelled lifting platforms;
- other applications
 - electric powered boats and ships.

This document covers the safety aspects of battery installations in such applications. This document does not cover railway vehicles, for traction railway application, see IEC 62928.

This document does not cover batteries and battery installations for the propulsion of electric road vehicles. In the event of there being a variation of requirements between this document and those of a relevant product standard (e.g. goods vehicles, bicycles, wheel chairs, golf carts), then the product standard requirements take precedence.

Lithium ion cells and batteries used in traction industrial application are intended to fulfil safety requirements in accordance with IEC 62619.

The maximum voltages are limited to AC 1 000 V and to DC 1 500 V, and the principal measures for protection against hazards, generally from electricity, gas emission and electrolyte to prevent fire and explosion are described.

This document provides requirements on safety aspects associated with the installation, use, inspection, maintenance and disposal of lithium ion batteries. Batteries containing lithium metal are not covered by this document.

In general, the safety requirements for secondary batteries and battery installations – General safety information and definitions are specified for lead-acid, nickel-cadmium and nickel-metal hybrid batteries in accordance with IEC 62485-1.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60204-1, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 62485-6:2021 © IEC 2021

– 7 –

IEC 60364-4-41:2005, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*
IEC 60364-4-41:2005/AMD1:2017

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

IEC 61000-1-2, *Electromagnetic compatibility (EMC) – Part 1-2: General – Methodology for the achievement of functional safety of electrical and electronic systems including equipment with regard to electromagnetic phenomena*

IEC 61000-6-1, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity standard for residential, commercial and light-industrial environments*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) – Part 6-2: Generic standards – Immunity standard for industrial environments*

IEC 61000-6-3, *Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments*

IEC 61000-6-7, *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 61140, *Protection against electric shock – Common aspects for installation and equipment*

IEC 62619:2017, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries, for use in industrial applications*

IEC 62620:2014, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for use in industrial applications*

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

EN 1175-1:2011, *Safety of industrial trucks – Electrical requirements – Part 1: General requirements for battery powered trucks*

UN Regulation No. 100 (UN R 100):2011, *Uniform provisions concerning the approval of vehicles with regard to specific requirements for the electric power train*

koniec náhľadu – text ďalej pokračuje v platenej verzii STN