

STN	Akumulátorové lítium-iónové články na pohon elektrických cestných vozidiel Časť 1: Skúšanie prevádzkových vlastností	STN EN IEC 62660-1 36 4360
------------	---	--

Secondary lithium-ion cells for the propulsion of electric road vehicles - Part 1: Performance testing

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. 07/19

Obsahuje: EN IEC 62660-1:2019, IEC 62660-1:2018

Oznámením tejto normy sa od 16.01.2022 ruší
STN EN 62660-1 (36 4360) z novembra 2011

129154

EUROPEAN STANDARD

EN IEC 62660-1

NORME EUROPÉENNE

EUROPÄISCHE NORM

February 2019

ICS 29.220.20; 43.120

Supersedes EN 62660-1:2011

English Version

**Secondary lithium-ion cells for the propulsion of electric road vehicles - Part 1: Performance testing
(IEC 62660-1:2018)**

Éléments d'accumulateurs lithium-ion pour la propulsion
des véhicules routiers électriques - Partie 1: Essais de
performance
(IEC 62660-1:2018)

Lithium-Ionen-Sekundärzellen für den Antrieb von
Elektrostraßenfahrzeugen - Teil 1: Prüfung des
Leistungsverhaltens
(IEC 62660-1:2018)

This European Standard was approved by CENELEC on 2019-01-16. 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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, 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 62660-1:2019 (E)**European foreword**

The text of document 21/975/FDIS, future edition 2 of IEC 62660-1, prepared by IEC/TC 21 "Secondary cells and batteries" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62660-1:2019.

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) 2019-10-16
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2022-01-16

This document supersedes EN 62660-1:2011.

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 62660-1:2018 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 62660-2	NOTE	Harmonized as EN 62660-2
IEC 62660-3	NOTE	Harmonized as EN 62660-3
IEC 61434:1996	NOTE	Harmonized as EN 61434:1996 (not modified)

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>
ISO/TR 8713	-	Electrically propelled road vehicles - Vocabulary	-	-



IEC 62660-1

Edition 2.0 2018-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Secondary lithium-ion cells for the propulsion of electric road vehicles –
Part 1: Performance testing**

**Éléments d'accumulateurs lithium-ion pour la propulsion des véhicules routiers
électriques –
Partie 1: Essais de performance**





THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2018 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 corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

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 also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 21 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

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.

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.

Catalogue IEC - webstore.iec.ch/catalogue

Application autonome pour consulter tous les renseignements bibliographiques sur les Normes internationales, Spécifications techniques, Rapports techniques et autres documents de l'IEC. Disponible pour PC, Mac OS, tablettes Android et iPad.

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 aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne de termes électroniques et électriques. Il contient 21 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.

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 62660-1

Edition 2.0 2018-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Secondary lithium-ion cells for the propulsion of electric road vehicles –
Part 1: Performance testing**

**Éléments d'accumulateurs lithium-ion pour la propulsion des véhicules routiers
électriques –
Partie 1: Essais de performance**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.220.20; 43.120

ISBN 978-2-8322-6288-7

**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
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	7
4 Test conditions	8
4.1 General.....	8
4.2 Measuring instruments.....	9
4.2.1 Range of measuring devices.....	9
4.2.2 Voltage measurement.....	9
4.2.3 Current measurement	9
4.2.4 Temperature measurements	9
4.2.5 Other measurements	10
4.3 Tolerance	10
4.4 Thermal stabilization.....	10
5 Dimension measurement	10
6 Mass measurement	12
7 Electrical measurement	12
7.1 General.....	12
7.2 General charge conditions	12
7.3 Capacity	12
7.4 SOC adjustment.....	13
7.5 Power	13
7.5.1 General	13
7.5.2 Test method	13
7.5.3 Calculation of power density.....	14
7.5.4 Calculation of regenerative power density.....	15
7.6 Energy.....	15
7.6.1 General	15
7.6.2 Test method	16
7.6.3 Calculation of energy density.....	16
7.7 Storage test	17
7.7.1 General	17
7.7.2 Charge retention test	17
7.7.3 Storage life test	18
7.8 Cycle life test.....	18
7.8.1 General	18
7.8.2 BEV cycle test	18
7.8.3 HEV cycle test.....	22
7.9 Energy efficiency test.....	26
7.9.1 General	26
7.9.2 Common tests for BEV and HEV applications	26
7.9.3 Test for cells of BEV application	28
7.9.4 Energy efficiency calculation for cells of HEV application.....	29
Annex A (informative) Selective test conditions.....	31
Annex B (informative) Cycle life test sequence	33

Annex C (informative) Current-voltage characteristic test.....	36
C.1 General.....	36
C.2 Test method.....	36
Bibliography.....	39
Figure 1 – Example of temperature measurement of cell.....	9
Figure 2 – Examples of maximum dimensions of cell	11
Figure 3 – Dynamic discharge profile A for BEV cycle test	20
Figure 4 – Dynamic discharge profile B for BEV cycle test	22
Figure 5 – Discharge-rich profile for HEV cycle test	24
Figure 6 – Charge-rich profile for HEV cycle test.....	25
Figure 7 – Typical SOC swing by combination of two profiles for HEV cycle test	26
Figure B.1 – Test sequence of BEV cycle test.....	34
Figure B.2 – Concept of BEV cycle test.....	35
Figure C.1 – Test order of the current-voltage characteristic test	37
Table 1 – Discharge conditions	12
Table 2 – SOC and temperature condition for power test	13
Table 3 – Dynamic discharge profile A for BEV cycle test	20
Table 4 – Dynamic discharge profile B for BEV cycle test	21
Table 5 – Discharge-rich profile for HEV cycle test	24
Table 6 – Charge-rich profile for HEV cycle test.....	25
Table A.1 – Capacity test conditions	31
Table A.2 – Power test conditions	31
Table A.3 – Cycle life test conditions	31
Table A.4 – Conditions for energy efficiency test for BEV application.....	32
Table B.1 – Test sequence of HEV cycle test.....	35
Table C.1 – Charge and discharge current for the current-voltage characteristic test	36

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SECONDARY LITHIUM-ION CELLS FOR THE PROPULSION OF ELECTRIC ROAD VEHICLES –

Part 1: Performance testing

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 62660-1 has been prepared by IEC technical committee 21: Secondary cells and batteries.

This second edition cancels and replaces the first edition published in 2010. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) The purpose of each test has been added.
- b) The power test has been revised for clarification, and an informative part of the current-voltage characteristic test has been moved to the new Annex C.

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

FDIS	Report on voting
21/975/FDIS	21/985/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 the parts in the IEC 62660 series, published under the general title *Secondary lithium-ion cells for the propulsion of electric road vehicles*, 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.

INTRODUCTION

The commercialization of electric road vehicles including battery, hybrid and plug-in hybrid electric vehicles has been accelerated in the global market, responding to the global concerns on CO₂ reduction and energy security. This, in turn, has led to rapidly increasing demand for high-power and high-energy-density traction batteries. Lithium-ion batteries are estimated to be one of the most promising secondary batteries for the propulsion of electric vehicles. In the light of the rapid spread of hybrid electric vehicles and the emergence of battery and plug-in hybrid electric vehicles, a standard method for testing performance requirements of lithium-ion batteries is indispensable for securing a basic level of performance and obtaining essential data for the design of vehicle systems and battery packs.

This document specifies performance testing for automobile traction lithium-ion cells that basically differ from the other cells including those for portable and stationary applications specified by other IEC standards. For automobile application, it is important to note the usage specificity; i.e. the design diversity of automobile battery packs and systems, and specific requirements for cells and batteries corresponding to each of such designs. Based on these facts, the purpose of this document is to provide a basic test methodology with general versatility, which serves a function in common primary testing of lithium-ion cells to be used in a variety of battery systems.

This document is associated with ISO 12405-4 [1]¹.

IEC 62660-2 [2] specifies the reliability and abuse testing for lithium-ion cells for electric vehicle application.

IEC 62660-3 [3] specifies the safety requirements of lithium-ion cells for electric vehicle application.

¹ Numbers in square brackets refer to the Bibliography.

SECONDARY LITHIUM-ION CELLS FOR THE PROPULSION OF ELECTRIC ROAD VEHICLES –

Part 1: Performance testing

1 Scope

This part of IEC 62660 specifies performance and life testing of secondary lithium-ion cells used for propulsion of electric vehicles including battery electric vehicles (BEV) and hybrid electric vehicles (HEV).

NOTE 1 Secondary lithium-ion cell used for propulsion of plug-in hybrid electric vehicle (PHEV) can be tested by the procedure either for BEV application or HEV application, according to the battery system design, based on the agreement between the cell manufacturer and the customer.

This document specifies the test procedures to obtain the essential characteristics of lithium-ion cells for vehicle propulsion applications regarding capacity, power density, energy density, storage life and cycle life.

This document provides the standard test procedures and conditions for testing basic performance characteristics of lithium-ion cells for vehicle propulsion applications, which are indispensable for securing a basic level of performance and obtaining essential data on cells for various designs of battery systems and battery packs.

NOTE 2 Based on the agreement between the cell manufacturer and the customer, specific test conditions can be selected in addition to the conditions specified in this document. Selective test conditions are described in Annex A.

NOTE 3 The performance tests for the electrically connected lithium-ion cells can be performed with reference to this document.

NOTE 4 The test specification for lithium-ion battery packs and systems is defined in ISO 12405-4 [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.

ISO/TR 8713, *Electrically propelled road vehicles – Vocabulary*

koniec náhľadu – text ďalej pokračuje v platenej verzii STN