

SLOVENSKI STANDARD oSIST prEN IEC 62660-3:2021

01-april-2021

Sekundarni litij-ionski členi za pogon električnih cestnih vozil - 3. del: Varnostne zahteve

Secondary lithium-ion cells for the propulsion of electric road vehicles - Part 3: Safety requirements

Lithium-Ionen-Sekundärzellen für den Antrieb von Elektrostraßenfahrzeugen - Teil 3: Sicherheitsanforderungen eh STANDARD PREVIEW

Eléments d'accumulateurs lithium-ion pour la propulsion des véhicules routiers électriques - Partie 3: Exigences de sécurité

https://standards.iteh.ai/catalog/standards/sist/324bb41a-42b8-42b8-

Ta slovenski standard je istoveten 2:3fb7/osprEN IEC 62660-3:2021

ICS:

29.220.20 Kislinski sekundarni členi in Acid secondary cells and

batteries batteries

43.120 Električna cestna vozila Electric road vehicles

oSIST prEN IEC 62660-3:2021 en

oSIST prEN IEC 62660-3:2021

iTeh STANDARD PREVIEW (standards.iteh.ai)

oSIST prEN IEC 62660-3:2021 https://standards.iteh.ai/catalog/standards/sist/324bb41a-42b8-42b8-9dd1-5ae554333fb7/osist-pren-iec-62660-3-2021 PROJECT NUMBER: IEC 62660-3 ED2



21/1082/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

	DATE OF CIRCULATION: 2021-02-26		CLOSING DATE FOR VOTING: 2021-05-21		
	SUPERSEDES DOCUMENTS:				
	21/1057/CD, 21/1079/CC				
IEC TC 21 : SECONDARY CELLS AND BAT	ITERIES				
SECRETARIAT:		SECRETARY:			
France		Mr Yves Boudou			
OF INTEREST TO THE FOLLOWING COMMI	TTEES:	PROPOSED HORIZONTAL STANDARD:			
SC 21A,TC 69					
iTeh	STANDA	Other TC/SCs are any, in this CDV to	requested to indicate their interest, if o the secretary.		
FUNCTIONS CONCERNED:	(standard	ls.iteh.ai)			
☐ EMC ☐ ENVIR	RONMENT OSIST prEN IEC	Quality assur, 62660-3:2021	ANCE SAFETY		
SUBMITTED FOR CENELEC PARALLEI 9dd	1	dendwoistsubMnt4eb			
Attention IEC-CENELEC parallel vot	ing				
The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting.					
The CENELEC members are invited to vote through the CENELEC online voting system.					
This document is still under study and	subject to change. I	t should not be use	d for reference purposes.		
Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.					
TITLE:					
Secondary lithium-ion cells for the propulsion of electric road vehicles - Part 3: Safety requirements					
PROPOSED STABILITY DATE: 2025					
NOTE FROM TC/SC OFFICERS:					

Copyright © 2021 International Electrotechnical Commission, IEC. All rights reserved. It is permitted to download this electronic file, to make a copy and to print out the content for the sole purpose of preparing National Committee positions. You may not copy or "mirror" the file or printed version of the document, or any part of it, for any other purpose without permission in writing from IEC.

1 2

CONTENTS

3	FOREWOR	D	4
4	1 Scope.		6
5	2 Normat	ive references	6
6		and definitions	
7		nditions	
=		eneral	
8 9		eneral energy instruments	
10	4.2 101	Range of measuring devices	
11	4.2.2	Voltage measurement	
12	4.2.3	Current measurement	
13	4.2.4	Temperature measurements	
14	4.2.5	Other measurements	
15	_	olerance	
16		hermal stabilization	
17	5 Electric	al measurement	10
18	5.1 G	eneral charge conditions	10
19			
20	5.3 S	apacity <mark>iTeh STANDARD PREVIEW</mark> OC adjustment	11
21	6 Safety	tests (standards.iteh.ai)	11
22	6.1 G	eneral	11
23	6.2 M	lechanical tests <u>oSIST prEN IEC 62660-3:2021</u> Mechanical shock ydd1-5ae554333ib7/osisi-pren-iec-62660-3-2021	12
24	6.2.1	https://standards.iteh.ai/catalog/standards/sist/324bb41a-42b8-42b8- Mechanical shock	12
25	6.2.2	9dd1-5ae554333fb*//osist-pren-iec-62660-3-2021 Crush	12
26	6.3 TI	hermal test	
27	6.3.1	High temperature endurance	13
28	6.3.2	Temperature cycling	
29	6.4 E	lectrical tests	
30	6.4.1	External short-circuit	14
31	6.4.2	Overcharge	14
32	6.4.3	Forced discharge	14
33	6.4.4	Internal short-circuit test	15
34	Annex A (int	formative) Operating region of cells for safe use	16
35	A.1 G	eneral	16
36	A.2 C	harging conditions for safe use	16
37	A.2.1	General	16
38	A.2.2	Consideration on charging voltage	16
39	A.2.3	Consideration on temperature	17
40	A.3 E:	xample of operating region	18
41	Annex B (int	formative) Explanation for the internal short-circuit test	20
42	B.1 G	eneral concept	20
43		ternal short-circuit caused by the particle contamination	
44		ormative) Alternative internal short-circuit test (6.4.4.2.2)	
45	•	eneral	
46		est preparation and test set-up	
17		Preparation of cell before the test	

oSIST prEN IEC 62660-3:2021

	IEC CDV 6	2660-3 © IEC 2021 – 3 –	21/1082/CDV
48	C.2.2	Test setup	23
49	C.2.3	Preliminary test	24
50	C.3 7	Test procedure	25
51	C.4 A	Acceptance criteria	26
52	Bibliograph	ny	27
53			
54	Figure 1 –	Example of temperature measurement of cell	10
55	Figure 2 –	Example of crush test	13
56	Figure A.1	- An example of operating region for charging of typical lithium-ion	cells18
57	Figure A.2	- An example of operating region for discharging of typical lithium-i	on cells19
58	Figure C.1	- Method of removing hard case	22
59	Figure C.2	- Example of case thinning	22
60	Figure C.3	- Example of hard case removal method during cell manufacturing .	23
61	Figure C.4	- Example 1 of fixation of cell	23
62	Figure C.5	- Example 2 of fixation of cell	24
63	Figure C.6	- Example of abrupt voltage drop	25
64			
65	Table B.1 -	- Examples of the internal short-circuit of cell	21
66	Table C.1 -	- Test setup image for voltage measurementR.RVFV	24
67 68		(standards.iteh.ai)	

oSIST prEN IEC 62660-3:2021 https://standards.iteh.ai/catalog/standards/sist/324bb41a-42b8-42b8-9dd1-5ae554333fb7/osist-pren-iec-62660-3-2021

INTERNATIONAL ELECTROTECHNICAL COMMISSION

70

69

71 72

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

73

Part 3: Safety requirements 75

76

FOREWORD

77 78

79 80

81

82

83

84 85

86 87

95

96 97 98

99

100

101 102

106

108

109

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 nongovernmental 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.

- 88 89 90
- 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.
- 91 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 92 Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any 93 misinterpretation by any end user. (Standards.Iten.al) 94
 - 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
 - 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.
- 103 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and 104 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 105 107 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 110 patent rights. IEC shall not be held responsible for identifying any or all such patent rights. 111
- International Standard IEC 62660-3 has been prepared by IEC technical committee 21: 112 Secondary cells and batteries. 113
- This second edition cancels and replaces the first edition published in 2016. This edition 114 constitutes a technical revision. 115
- This edition includes the following significant technical changes with respect to the previous 116 edition: 117
- The new method for the internal short-circuit test has been added in 6.4.4.2.2 and Annex 118 C, as an alternative option to the test in 6.4.4.2.1. 119
- The vibration test has been deleted. b) 120
- The test conditions of overcharge (6.4.2.2) have been partially revised. 121
- The text of this International Standard is based on the following documents: 122

IEC CDV 62660-3 © IEC 2021

- 5 -

21/1082/CDV

FDIS	Report on voting
21/XX/FDIS	21/XX/RVD

123 124

125

- Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.
- 126 This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.
- A list of all parts in the IEC 62660 series, published under the general title Secondary lithiumion cells for the propulsion of electric road vehicles, can be found on the IEC website.
- The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- 135 amended.
- A bilingual version of this publication may be issued at a later date.

137 138

iTeh STANDARD PREVIEW (standards.iteh.ai)

139 140 The National Committees are requested to note that for this publication the stability date is 20XX.

https://standards.iteh.ai/catalog/standards/sist/324bb41a-42b8-42b8-

9dd1-5ae554333fb7/osist-pren-iec-62660-3-2021

141 142 THIS TEXT IS INCLUDED FOR THE INFORMATION OF THE NATIONAL COMMITTEES AND WILL BE DELETED AT THE PUBLICATION STAGE.

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.

143

144

145

146

21/1082/CD

- 6 -

SECONDARY LITHIUM-ION CELLS FOR THE PROPULSION

OF ELECTRIC ROAD VEHICLES -

Part 3: Safety requirements

IEC CDV 62660-3 © IEC 2021

148

149 150

151

152 153

154

155

173

Scope 156 1

This part of IEC 62660 specifies test procedures and acceptance criteria for safety 157 performance of secondary lithium-ion cells and cell blocks used for propulsion of electric 158 vehicles (EV) including battery electric vehicles (BEV) and hybrid electric vehicles (HEV). 159

This document intends to determine the basic safety performance of cells used in a battery 160 pack and system under intended use and reasonably foreseeable misuse or incident, during 161 the normal operation of the EV. The safety requirements of the cell in this document are 162 based on the premise that the cells are properly used in a battery pack and system within the 163 limits for voltage, current and temperature as specified by the cell manufacturer (cell operating region). 164 165

The evaluation of the safety of cells during transport and storage is not covered by this 166 document. 167

oSIST prEN IEC 62660-3:2021

168 NOTE 1 The safety performance requirements for lithium-ion battery packs and systems are defined in ISO 6469-169 1. The specifications and safety requirements for lithium-ton battery packs and systems of electrically propelled mopeds and motorcycles are defined in ISO 18243. IEC 62619 covers the safety requirements for the lithium-ion 170 cells and batteries for industrial application including, e.g. forklift truck, golf cart, and automated guided vehicle. 171

172 NOTE 2 Information on the cell operating region is provided in Annex A.

2 **Normative references**

- 174 The following documents are referred to in the text in such a way that some or all of their
- 175 content constitutes requirements of this document. For dated references, only the edition
- 176 cited applies. For undated references, the latest edition of the referenced document (including
- any amendments) applies. 177
- IEC 61434, Secondary cells and batteries containing alkaline or other non-acid electrolytes -178
- Guide to the designation of current in alkaline secondary cell and battery standards 179
- 180 IEC 62619:20--, 1 Secondary cells and batteries containing alkaline or other non-acid
- electrolytes Safety requirements for secondary lithium cells and batteries, for use in 181
- industrial applications 182
- IEC 62660-2:2018, Secondary lithium-ion cells for the propulsion of electric road vehicles 183
- Part 2: Reliability and abuse testing 184
- 185 ISO/TR 8713, Electrically propelled road vehicles – Vocabulary

¹ Under development

IEC CDV 62660-3 © IEC 2021

-7-

21/1082/CDV

86	Terms			

- For the purposes of this document, the terms and definitions given in ISO/TR 8713 and the
- 188 following apply.
- 189 ISO and IEC maintain terminological databases for use in standardization at the following
- 190 addresses:
- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp
- 193 **3.1**

1

- 194 battery electric vehicle
- 195 **BEV**
- 196 electric vehicle with only a traction battery as power source for vehicle propulsion
- 197 **3.2**
- 198 cell block
- a group of cells connected together in parallel configuration with or without protective devices,
- e.g. fuse or positive temperature coefficient resistor (PTC), not yet fitted with its final housing,
- 201 terminal arrangement and electronic control device
- 202 **3.3**
- 203 cylindrical cell :Tob CTANDADD DDEVIEVA
- cell with a cylindrical shape in which the overall height is equal to or greater than the diameter
- 205 [SOURCE: IEC 60050-482:2004 482-0239 rds.iteh.ai)
- 206 **3.4** <u>oSIST prEN IEC 62660-3:2021</u>
- 207 **explosion** https://standards.iteh.ai/catalog/standards/sist/324bb41a-42b8-42b8-
- failure that occurs when a cell-confainer 7 open violently and major components are forcibly
- 209 expelled
- 210 3.5
- 211 **fire**
- emission of flames from a cell or cell block for more than 1 s
- Note 1 to entry: Sparks and arcing are not considered as flames.
- **3.6**
- 215 hybrid electric vehicle
- 216 **HEV**
- 217 vehicle with both a rechargeable energy storage system and a fuelled power source for
- 218 propulsion
- 219 **3.7**
- 220 internal short-circuit
- 221 unintentional electrical connection between the negative and positive electrodes inside a cell
- **3.8**
- 223 leakage
- visible escape of liquid electrolyte from a part except vent, such as case, sealing part and/or
- terminals of the cell
- **3.9**
- 227 nominal voltage
- suitable approximate value of the voltage used to designate or identify a cell

21/1082/CD IEC CDV 62660-3 © IEC 2021 -8-[SOURCE: IEC 60052-482:2004, 482-03-31, modified - Deletion of "a battery or an 229 electrochemical system" at the end of the definition.] 230 3.10 231 232 pouch cell cell having the shape of a parallelepiped whose faces are rectangular and with a prismatic 233 flexible laminate film case housing 234 3.11 235 prismatic cell 236 237 cell having the shape of a parallelepiped whose faces are rectangular and with a prismatic 238 hard case housing [SOURCE: IEC 60050-482:2004, 482-02-38, modified - "qualifies a cell or a battery" has been 239 replaced with "cell", and "and with a prismatic hard case housing" has been added.] 240 3.12 241 rated capacity 242 243 capacity value of a cell in ampere hours (Ah) determined under specified conditions and 244 declared by the cell manufacturer 245 246 Note 1 to entry: n in Cn is the time base in hours (h). In this document, n = 3 for BEV application and n = 1 for HEV application unless otherwise specified STANDARD PREVIEW 247 3.13 248 (standards.iteh.ai) reference test current 249 250 reference test current in amperes (A) which is expressed as 251 https://standards.iteh.ai/catalog/standards/sist/324bb41a-42b8-42b8- $I_{\mathsf{t}} = C_{\mathsf{n}} / 1$ 252 9dd1-5ae554333fb7/osist-pren-iec-62660-3-2021 253 Note 1 to entry: 1 has a dimension of time in hours (h). Note 2 to entry: See IEC 61434:1996 [4], Clause 2. 254 255 3.14 256 rupture 257 mechanical failure of a container case of cell induced by an internal or external cause, 258 resulting in exposure or spillage but not ejection of materials 259 3.15 secondary lithium-ion cell 260 261 secondary single cell whose electrical energy is derived from the insertion/extraction reactions 262 of lithium-ions between the negative electrode and the positive electrode 263 264 Note 1 to entry: The secondary cell is a manufactured unit providing a source of electrical energy by direct conversion of chemical energy. The cell consists of electrodes, electrolyte, container, terminals, and if any, separators. The electrode can be monopolar or bipolar. Current collector of the former has active material of single 265 266

polarity and the latter has positive and negative electrode active materials. The electrolyte includes an ionic

conductive liquid or solid, or a mixture of them. The cell is designed to be charged electrically.

3.16

267

268

270 state of charge

271 **SOC**

272 capacity in a cell expressed as a percentage of rated capacity

IEC CDV 62660-3 © IEC 2021

_ 9 _

21/1082/CDV

772	2	4	7
273	.5	1	•

- 274 venting
- release of excessive internal pressure from a cell in a manner intended by design to preclude 275
- rupture or explosion 276

Test conditions 277

General 4.1 278

- Unless otherwise stated in this document, cells shall be tested at room temperature. The room 279
- temperature is $25 \, ^{\circ}\text{C} \pm 2 \, \text{K}$ in this document. 280
- The details of the instrumentation used shall be provided in any report of results. 281
- Cell blocks can be tested as an alternative of cells according to the agreement between the 282
- cell manufacturer and the customer. 283
- Concerning the cell for plug-in hybrid electric vehicle (PHEV), the cell manufacturer can select 284
- either the test condition of BEV application or HEV application. 285
- NOTE Test and measurement can be conducted in a fixture as recommended by the cell manufacturer. 286

287 4.2

Measuring instruments ITeh STANDARD PREVIEW

4.2.1 Range of measuring devices 288

standards.iteh.ai)

- The instruments used shall enable the values of voltage and current to be measured. The 289
- range of these instruments and measuring methods shall be chosen so as to ensure the 290
- accuracy specified for each test accuracy standards.iteh.ai/catalog/standards/sist/324bb41a-42b8-42b8-291

9dd1-5ae554333fb7/osist-pren-iec-62660-3-2021

- For analogue instruments, this implies that the readings shall be taken in the last third of the 292
- graduated scale. 293
- Any other measuring instruments may be used provided they give an equivalent accuracy. 294

4.2.2 Voltage measurement 295

The resistance of the voltmeters used shall be at least 1 M Ω /V. 296

4.2.3 **Current measurement** 297

- The entire assembly of ammeter, shunt and leads shall be of an accuracy class of 0,5 or 298
- better. 299

300

4.2.4 **Temperature measurements**

- The cell temperature shall be measured by use of a surface temperature measuring device 301
- capable of an equivalent scale definition and accuracy of calibration as specified in 4.2.1. The 302
- temperature should be measured at a location which most closely reflects the cell or cell block 303
- temperature. The temperature may be measured at additional appropriate locations, if 304
- necessary. 305
- 306 The examples for temperature measurement are shown in Figure 1. The instructions for
- 307 temperature measurement specified by the cell manufacturer shall be followed.