BS EN 61982-4:2016

BSI Standards Publication

Secondary batteries (except lithium) for the propulsion of electric road vehicles

Part 4: Safety requirements of nickel-metal hydride cells and modules

bsi.

National foreword

This British Standard is the UK implementation of EN 61982-4:2016. It is identical to IEC 61982-4:2015.

The UK participation in its preparation was entrusted to Technical Committee PEL/21, Secondary cells and batteries.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2016

ISBN 978 0 580 86850 4
ICS 29.220.20

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 May 2016.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 61982-4

February 2016

ICS 29.220.20

English Version

Secondary batteries (except lithium) for the propulsion of electric road vehicles - Part 4: Safety requirements of nickel-metal hydride cells and modules (IEC 61982-4:2015)

Accumulateurs (excepté lithium) pour la propulsion des véhicules routiers électriques - Partie 4: Exigences de sécurité pour les éléments et modules d'accumulateurs nickel métal-hydrure (IEC 61982-4:2015)

Sekundärbatterien (außer Lithium) für den Antrieb von Elektrostraßenfahrzeugen - Teil 4: Sicherheitsanforderungen an Nickel-Metallhydrid-Zellen und -Module (IEC 61982-4:2015)

This European Standard was approved by CENELEC on 2015-12-01. 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, 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: Avenue Marnix 17, B-1000 Brussels

European foreword

The text of document 21/852/CDV, future edition 1 of IEC 61982-4, prepared by IEC/TC 21 "Secondary cells and batteries" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61982-4:2016.

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) 2016-09-01
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2018-12-01

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

Endorsement notice

The text of the International Standard IEC 61982-4:2015 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 60051	NOTE	Harmonized in EN 60051 series.
IEC 60359	NOTE	Harmonized as EN 60359.
IEC 61982	NOTE	Harmonized as EN 61982.
IEC 62660-2	NOTE	Harmonized as EN 62660-2.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When 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.

Publication	Year	Title	EN/HD	Year
IEC 60050-482	2004	International Electrotechnical Vocabulary (IEV) - Part 482: Primary and secondary cells and batteries	-	-
IEC 61434	-	Secondary cells and batteries containing alkaline or other non-acid electrolytes - Guide to the designation of current in alkaline secondary cell and battery standards	EN 61434	-

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SECONDARY BATTERIES (EXCEPT LITHIUM) FOR THE PROPULSION OF ELECTRIC ROAD VEHICLES –

Part 4: Safety requirements of nickel-metal hydride cells and modules

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 61982-4 has been prepared by IEC technical committee 21: Secondary cells and batteries.

The text of this standard is based on the following documents:

CDV	Report on voting
21/852/CDV	21/866/RVC

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

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

A list of all parts in the IEC 61982 series, published under the general title *Secondary batteries (except lithium) 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
- amended.

INTRODUCTION

The electric road vehicles (EV) including hybrid electric vehicles (HEV) begin to diffuse in the global market with backing from global concerns on CO_2 reduction and clean energy, as well as from relevant technology advancement and cost reduction. Nickel-metal hydride (Ni-MH) batteries have advantages in cost and balanced performance, and have been used extensively for EV application, especially for the propulsion of HEV.

This standard provides the safety test procedures and acceptance criteria of Ni-MH batteries (cells and modules) for EV application in order to evaluate their basic safety performance. For automobile application, it is important to note the designing diversity of battery packs and systems, and specific requirements for cells corresponding to each of such designs. Based on these facts, the purpose of this standard is to provide a basic level of safety test methodology and criteria with general versatility, which serves a function in common primary testing of cells or modules to be used in a variety of battery systems.

For specific requirements for the safety of cell differ depending on the system designs of battery pack or vehicle, final pass-fail criteria of cell are to be based on the agreement between the cell manufacturers and the customers.

SECONDARY BATTERIES (EXCEPT LITHIUM) FOR THE PROPULSION OF ELECTRIC ROAD VEHICLES –

Part 4: Safety requirements of nickel-metal hydride cells and modules

1 Scope

This Part of IEC 61982 specifies test procedures and acceptance criteria for safety performance of nickel-metal hydride (Ni-MH) secondary cells and modules used for the propulsion of electric vehicles (EV) including battery electric vehicles (BEV) and hybrid electric vehicles (HEV).

This standard intends to secure the basic safety performance of the cell as used in a battery system under intended use and reasonably foreseeable misuse, during the normal operation of EV. The safety requirements of the cell in this standard are based on the premise that the cells and modules are properly used in a battery pack and system within the limit of voltage, current and temperature as specified by the cell manufacturer.

The evaluation of the safety of batteries during transport and storage is not covered by this standard.

NOTE 1 In this standard, Ni-MH cells mean the sealed nickel-metal hydride cells: these are sealed cells that use nickel hydroxide at the positive electrode, a hydrogen absorbing alloy at the negative electrode, and alkaline aqueous solution such as potassium hydroxide as the electrolyte. Sealed-type cells are those that can maintain their sealed condition and do not release gas or liquid when electrically charged and discharged within the temperature range specified by the cell manufacturer. These cells are equipped with a gas release mechanism to prevent explosion.

NOTE 2 In this standard, all the description on the cell are applicable to the module under the test.

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.

IEC 60050-482:2004, *International Electrotechnical Vocabulary (IEV) – Part 482: Primary and secondary cells and batteries*

IEC 61434, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Guide to designation of current in alkaline secondary cell and battery standards*

3 Terms and definitions

For the purposes of this document, the terms and definitions and those given in IEC 60050-482, as well as the following apply.

3.1
battery electric vehicle
BEV
electric vehicle with only a traction battery as power source for vehicle propulsion

3.2
explosion
failure that occurs when a cell container opens violently and major components are forcibly expelled

3.3
fire
emission of flames from a cell

3.4
hybrid electric vehicle
HEV
vehicle with both a rechargeable energy storage system and a fuelled power source for propulsion

3.5
module
group of cells connected together in a series and/or parallel configuration with or without protective devices, e.g. fuse or positive temperature coefficient (PTC), not yet fitted with its final housing, terminal arrangement and electronic control device

3.6
rated capacity
capacity value of a cell or battery determined under specified conditions and declared by the manufacturer

Note 1 to entry: The rated capacity Cn of a cell or battery is declared by the cell manufacturer.

[SOURCE: IEC 60050-482:2004, 482-03-15, modified – Addition of Note to entry.]

3.7
ambient temperature
temperature of 25 °C ± 2 K

3.8
state of charge
SOC
available capacity in a battery expressed as a percentage of the rated capacity

4 General test requirements

4.1 Accuracy of measuring instruments

4.1.1 Electrical measuring instruments

4.1.1.1 Range of measuring devices

The instruments used shall enable the values of voltage and current to be correctly measured. The range of these instruments and measuring methods shall be chosen so as to ensure the accuracy specified for each test. For analogue instruments, this implies that the readings shall be taken in the last third of the graduated scale. Any other measuring instruments may be used provided they give an equivalent accuracy.

4.1.1.2 Voltage measurement

The instruments used for voltage measurement shall be voltmeters of an accuracy class equal to 0,5 or better. The resistance of the voltmeters used shall be at least 1 000 Ω/V (see IEC 60051 series).

4.1.1.3 Current measurement

The instruments used for current measurement shall be ammeters of an accuracy class equal to 0,5 or better. The entire assembly of ammeter, shunt and leads shall be of an accuracy class of 0,5 or better (see IEC 60051 series or refer to IEC 60359).

4.1.2 Tolerance

The overall accuracy of controlled or measured values, relative to the specified or actual values, shall be within these tolerances:

a) ± 1 % for voltage;

b) ± 1 % for current;

c) ± 2 K for temperature;

d) ± 0,1 % for time;

e) ± 0,1 % for dimensions.

These tolerances comprise the combined accuracy of the measuring instruments, the measurement technique used, and all other sources of error in the test procedure.

4.2 General test conditions

4.2.1 Test temperature

If not otherwise defined, before each test, the cell shall be stabilised at the ambient temperature for a period between 1 h and 4 h.

Unless otherwise stated in this standard, the cell shall be tested at the ambient temperature.

4.2.2 Temperature measurements

The cell temperature shall be measured by use of a surface temperature measuring device capable of an equivalent scale definition and accuracy of calibration as specified in 4.1.2. The temperature should be measured at a location which most closely reflects the cell temperature. The temperature may be measured at additional appropriate locations, if necessary.

The examples for temperature measurement are shown in Figure 1. The instructions for temperature measurement specified by the cell manufacturer shall be followed.

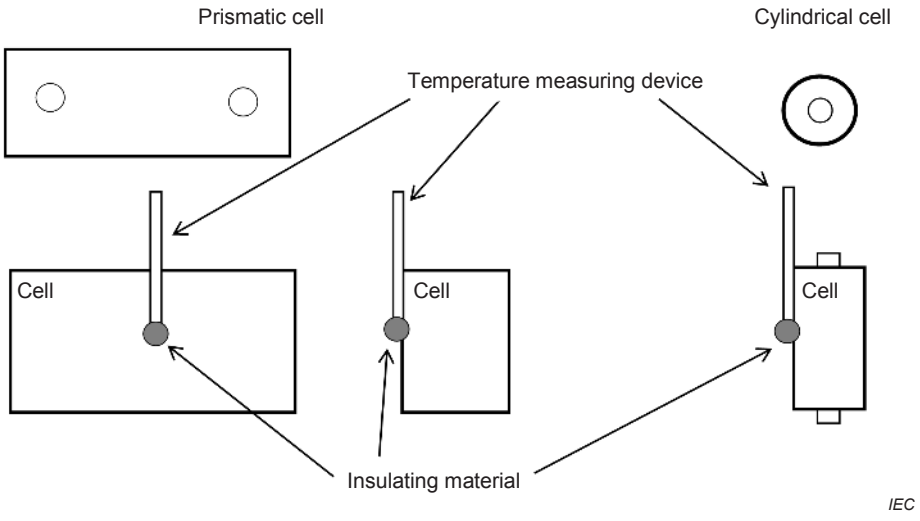

Figure 1 – Example of temperature measurement of cell

4.2.3 Dimension measurement

The maximum dimension of the total width, thickness or diameter, and length of a cell shall be measured up to three significant figures in accordance with the tolerances in 4.1.2.

The examples of maximum dimension are shown in Figures 2a) to 2d).

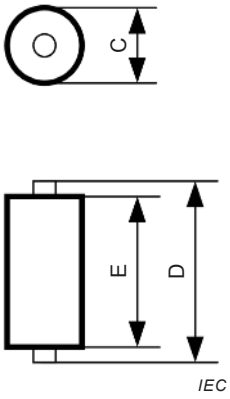

Figure 2a) – Cylindrical cell (type a)

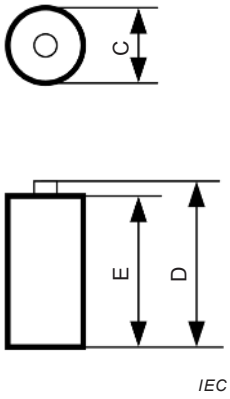

Figure 2b) – Cylindrical cell (type b)

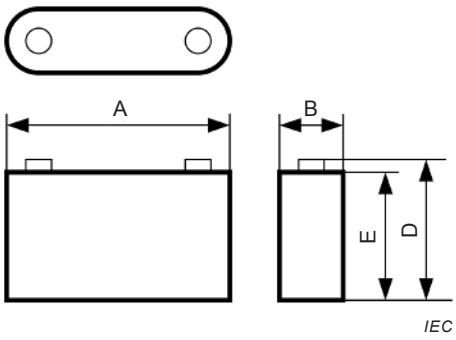

Figure 2c) – Prismatic cell (type a)

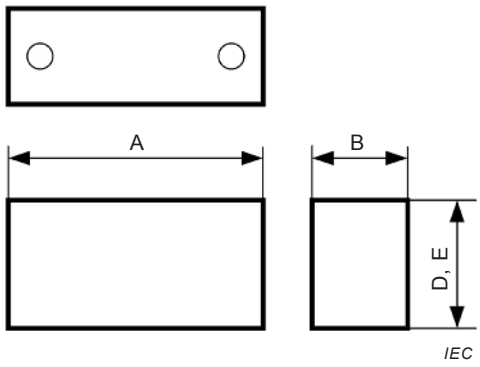

Figure 2d) – Prismatic cell (type b)

Key

A total width

B total thickness

C diameter

D total length (including terminals)

E total length (excluding terminals)

Figure 2 – Examples of maximum dimension of cell

5 Electrical measurement

5.1 General charge conditions

Unless otherwise stated in this standard, prior to electrical measurement, the cell shall be charged as follows.

Step 1 Prior to charging, the cell shall be discharged at the ambient temperature at a constant current of 1/3 I_t A down to a final voltage specified by the cell manufacturer.

Step 2 Then, the cell shall be charged, at the ambient temperature, according to the charging method declared by the cell manufacturer.

5.2 Capacity

Before the SOC adjustment in 5.3, the capacity of test cell shall be confirmed to be the rated value in accordance with the following steps.

Step 1 The cell shall be charged in accordance with 5.1. After the charge, the cell temperature shall be stabilized in accordance with 4.2.1.

Step 2 The cell shall be discharged at 1 I_t A down to 0,9 V at the ambient temperature. The upper limit of the discharge current shall be 200 A. When testing modules, the final voltage is the product of the final voltage of a cell and the number of cells connected in series in the module.

The method of designation of test current I_t A is defined in IEC 61434.

Step 3 Measure the discharge duration until the specified final voltage is reached, and calculate the capacity of the cell, expressed in Ah to three significant figures.

5.3 State of charge (SOC) adjustment

The test cells shall be charged as specified below. The SOC adjustment is the procedure to be followed for preparing cells to the various SOCs for the tests.

Step 1 The cell shall be charged in accordance with 5.1.

Step 2 The cell shall be left at rest at ambient temperature in accordance with 4.2.1.

Step 3 The cell shall be discharged at a constant current of 1/3 I_t (A) at ambient temperature for (100 – n)/100 × 3 h, where n is SOC (% Cn Ah) to be adjusted for each test.

6 Safety tests

6.1 General

The safety tests in this clause shall be performed on a cell or module that is not more than six months old under the conditions specified by the cell manufacturer.

The number of cells under each test can be determined according to the agreement between the cell manufacturer and the customer.

For all the tests specified in this clause, the test installation shall be reported including the securement and wiring of the cell or module.

NOTE If necessary, to prevent deformation, the cell can be maintained during the test in a manner that does not violate the test purpose.

6.2 Mechanical test

6.2.1 Mechanical shock

6.2.1.1 General

This test is to verify the safety performance of the cell under inertial loads which may occur during a vehicle crash.

6.2.1.2 Test

The test shall be performed as follows.

Step 1 Adjust the SOC of the cell to 100 % Cn Ah for BEV application and 80 % Cn Ah for HEV application in accordance with 5.3.

Step 2 The cell shall be secured to the testing machine by means of a rigid mount which will support all mounting surfaces of the cell.

Step 3 Apply a half-sine shock of peak acceleration of 50 g_n and pulse duration of 11 ms to the cell. The cell shall be subjected to three shocks in the positive direction followed by three shocks in the negative direction of each of three mutually perpendicular mounting positions of the cell for a total of 18 shocks.

6.2.1.3 Acceptance criteria

During the test, the cell shall exhibit no evidence of fire or explosion.

6.2.2 Crush

6.2.2.1 General

This test is performed to characterize the cell response to external load forces that may cause deformation.

6.2.2.2 Test

The test shall be performed as follows.

Step 1 Adjust the SOC of the cell to 100 % Cn Ah for BEV application and 80 % Cn Ah for HEV application in accordance with 5.3.

Step 2 The cell shall be placed on an insulated solid flat surface and be crushed with a crushing tool in the shape of round or semi-circular bar, or in the shape of a sphere or hemisphere with a 150 mm diameter. It is recommended to use the round bar to crush a cylindrical cell and the sphere for a prismatic cell (see Figure 3). The force for the crushing shall be applied in direction nearly perpendicular to the layered face of the positive and negative electrodes inside the cell. The force shall be applied to the approximate centre of the cell as shown in Figure 3. The crush speed shall be less than or equal to 6 mm/min.

Step 3 The force shall be released when an abrupt voltage drop of one-third of the original cell voltage occurs, or a deformation of 15 % or more of initial cell dimension occurs, or the force of 1 000 times the weight of the cell is applied, whichever comes first. The cells shall be under observation for 24 h or until the cell temperature declines by 80 % of the maximum temperature rise, whichever is the sooner.

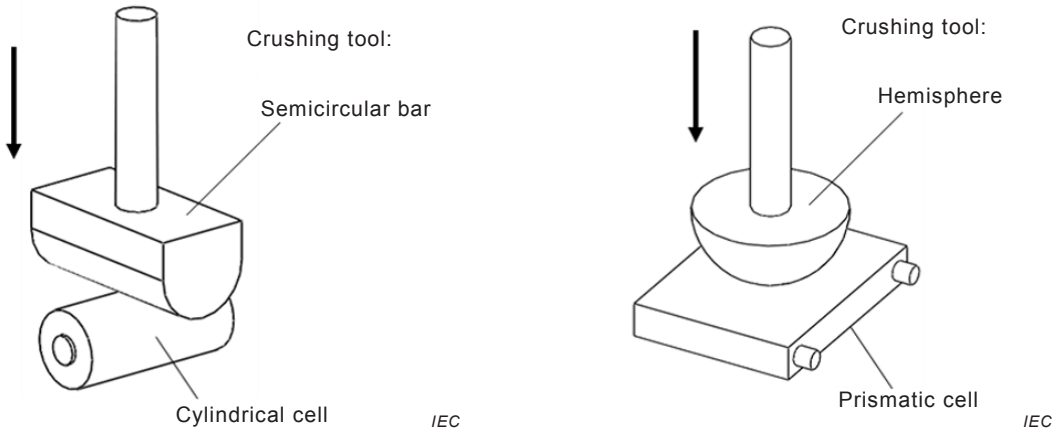

Figure 3 – Example of crush test

6.2.2.3 Acceptance criteria

During the test, the cell shall exhibit no evidence of fire or explosion.

6.2.3 Vibration

6.2.3.1 General

This test is to verify the safety performance of the cell under a vibration environment which the cell will likely experience during the normal operation of the vehicle.

6.2.3.2 Test

The test shall be performed as follows.

Step 1 Adjust the SOC of the cell to 100 % for BEV application and 80 % for HEV application in accordance with 5.3.

Step 2 The cell shall be subjected to a vibration having a sinusoidal waveform with a logarithmic sweep between 7 Hz and 50 Hz and back to 7 Hz traversed in 15 min. This cycle shall be repeated 12 times for a total of 3 h in the vertical direction of the mounting orientation of the cell as specified by the cell manufacturer.

The correlation between frequency and acceleration shall be as shown in Table 1:

Table 1 – Frequency and acceleration

Frequency Hz	**Acceleration** m/s^2
7 to 18	10
18 to 30	gradually reduced from 10 to 2
30 to 50	2
NOTE 1 A higher acceleration level as well as a higher maximum frequency can be used at the request of the cell manufacturer. NOTE 2 A vibration test profile determined by the vehicle manufacturer can be used as a substitute for the frequency – acceleration correlation of Table 1.	

Step 3 The test shall end with an observation period of 1 h at the ambient temperature.

6.2.3.3 Acceptance criteria

During the test, the cell shall exhibit no evidence of fire or explosion.

6.3 Thermal test

6.3.1 High temperature endurance

6.3.1.1 General

This test is performed to simulate a high-temperature environment that the cell will experience during the normal operation of the vehicle, and to verify the safety performance of the cell under such conditions.

6.3.1.2 Test

The test shall be performed as follows.

Step 1 Adjust the SOC of the cell to 100 % Cn Ah for BEV application and 80 % Cn Ah for HEV application in accordance with 5.3.

Step 2 The cell shall be placed in a gravity or circulating air convection oven. The oven temperature shall be 60 °C ± 2 K. The cell shall remain at this temperature for 2 h. Then, the cell shall be placed at ambient temperature and be observed for 1 h in the oven.

NOTE If necessary, to prevent deformation, the cell can be maintained during the test in a manner that does not violate the test purpose.

6.3.1.3 Acceptance criteria

During the test, the cell shall exhibit no evidence of fire or explosion.

6.3.2 Temperature cycling

6.3.2.1 General

This test is performed to simulate the low and high temperature environment alternately which causes expansion and contraction of cell components, and to verify the safety performance of the cell under such conditions.

6.3.2.2 Test

The test shall be performed as follows.

Step 1 Adjust the SOC of the cell to 100 % Cn Ah for BEV application and 80 % Cn Ah for HEV application in accordance with 5.3.

Step 2 All protection devices, which would affect the function of the cell and which are relevant to the outcome of the test shall be operational.

Step 3 The cell shall be stored for at least 6 h at a test temperature equal to 60 °C ± 2 K or higher if requested by the cell manufacturer, followed by storage for at least 6 h at a test temperature equal to -40 °C ± 2 K or lower if requested by the cell manufacturer. The maximum time interval between the test temperature extremes shall be 30 min. This procedure shall be repeated until a minimum of 5 total cycles are completed, after which the cell shall be stored for 24 h at ambient temperature.

Step 4 The test shall end with an observation period of 1 h at the ambient temperature.

6.3.2.3 Acceptance criteria

During the test, the cell shall exhibit no evidence of fire or explosion.

6.4 Electrical test

6.4.1 External short circuit

6.4.1.1 General

This test is performed to verify the safety performance of the cell for external short circuit.

6.4.1.2 Test

The test shall be performed as follows.

Step 1 The cell shall be fully charged in accordance with 5.1.

Step 2 The cell shall be short-circuited by connecting the positive and negative terminals with an external resistance for 10 min. A total external resistance per cell shall be equal to or less than 5 mΩ as agreed between the customer and the cell manufacturer.

Step 3 The cell shall be observed for 1 h after the test at ambient temperature.

6.4.1.3 Acceptance criteria

During the test, the cell shall exhibit no evidence of fire or explosion.

6.4.2 Overcharge

6.4.2.1 General

This test is performed to verify the safety performance of the cell for overcharge.

6.4.2.2 Test

The test shall be performed as follows.

Step 1 Adjust the SOC of the cell to 100 % Cn Ah in accordance with 5.3.

Step 2 Continue charging the cell beyond the 100 % Cn Ah SOC with the charging current specified by the cell manufacturer at ambient temperature using a power supply sufficient to provide the constant charging current.

When the voltage of the cell reaches 3 V, continue the charge to 200 % of the rated capacity while maintaining the voltage at 3 V.

Step 3 The cell shall be observed for 1 h after the test at ambient temperature.

6.4.2.3 Acceptance criteria

During the test, the cell shall exhibit no evidence of fire or explosion.

6.4.3 Forced discharge

6.4.3.1 General

This test is performed to verify the safety performance of the cell for over discharge.

6.4.3.2 Test

Discharge a fully discharged cell at 1 I_t A for 90 min. When the voltage of the cell reaches -3 V before 90 min, continue the discharge to a 150 % of the rated capacity while maintaining the voltage of –3 V.

6.4.3.3 Acceptance criteria

During the test, the cell shall exhibit no evidence of fire or explosion.

Bibliography

IEC 60051 (all parts), *Direct acting indicating analogue electrical measuring instruments and their accessories*

IEC 60359, *Electrical and electronic measurement equipment – Expression of performance*

IEC 61982, *Secondary batteries (except lithium) for the propulsion of electric road vehicles – Performance and endurance tests*

IEC 62660-2, *Secondary lithium-ion cells for the propulsion of electric road vehicles – Part 2: Reliability and abuse testing*

_____

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.