

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**





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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

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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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TR 8713 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 battery electric vehicle

BEV

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

3.2 hybrid electric vehicle

HEV

vehicle with both a rechargeable energy storage system and a fuelled power source for propulsion

3.3 rated capacity

C_n

capacity value of a cell in ampere hours (Ah) determined under specified conditions and declared by the cell manufacturer

Note 1 to entry: n in C_n is the time base in hours (h). In this document, $n = 3$ for BEV application and $n = 1$ for HEV application unless otherwise specified.

3.4

I_t

reference test current in amperes (A) which is expressed as

$$I_t = C_n / 1$$

Note 1 to entry: 1 has a dimension of time in hours (h).

Note 2 to entry: See IEC 61434:1996 [4], Clause 2.

3.5 room temperature

temperature of $25\text{ °C} \pm 2\text{ K}$

3.6 secondary lithium-ion cell

secondary single cell whose electric energy is derived from the insertion and extraction reactions of lithium ions between the anode and the cathode

Note 1 to entry: The secondary lithium-ion cell is a basic manufactured unit providing a source of electric energy by direct conversion of chemical energy. It consists of electrodes, separators, electrolyte, container and terminals, and is designed to be charged electrically.

3.7 state of charge

SOC

capacity in a cell expressed as a percentage of rated capacity

3.8 charge retention

ability of a cell to retain capacity on open circuit under specified conditions of storage

4 Test conditions

4.1 General

The details of the instrumentation used shall be provided in any report of results.

Test and measurement shall be conducted with caution to prevent a short circuit.