
**Electrically propelled road vehicles —
Test specification for lithium-ion traction
battery packs and systems —**

Part 2:
High-energy applications

*Véhicules routiers à propulsion électrique — Spécifications d'essai pour
des installations de batterie de traction aux ions lithium —*

Partie 2: Applications à haute énergie



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Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Symbols and abbreviated terms	4
5 General requirements	5
5.1 General conditions	5
5.2 Test sequence plan	6
5.3 Tests	6
5.4 Battery pack - typical configuration	8
5.5 Battery system - typical configuration	8
5.6 Preparation of battery pack and system for bench testing	11
6 General tests	11
6.1 Pre-conditioning cycles	11
6.2 Standard cycle (SC)	12
7 Performance tests	12
7.1 Energy and capacity at RT	12
7.2 Energy and capacity at different temperatures and discharge rates	14
7.3 Power and internal resistance	17
7.4 Energy efficiency at fast charging	24
7.5 No load SOC loss	26
7.6 SOC loss at storage	28
7.7 Cycle life	29
8 Reliability tests	40
8.1 Dewing (temperature change)	40
8.2 Thermal shock cycling	43
8.3 Vibration	43
8.4 Mechanical shock	49
9 Abuse tests	50
9.1 Information	50
9.2 Short circuit protection	50
9.3 Overcharge protection	51
9.4 Over-discharge protection	51
Annex A (informative) Battery pack and system and overview on tests	53
Annex B (informative) Examples of data sheets for battery pack and system testing	55
Annex C (informative) Example of test conditions	59
Bibliography	60

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 12405-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 21, *Electrically propelled road vehicles*.

ISO 12405 consists of the following parts, under the general title *Electrically propelled road vehicles — Test specification for lithium-ion traction battery packs and systems*:

— *Part 1: High-power applications*

— *Part 2: High-energy applications*

The following part is under preparation:

— *Part 3: Safety performance requirements*

Introduction

Lithium-ion based battery systems are an efficient alternative energy storage system for electrically propelled vehicles. The requirements for lithium-ion based battery systems to be used as a power source for the propulsion of electric road vehicles are significantly different from those for batteries used for consumer electronics or stationary usage.

ISO 12405 provides specific test procedures for lithium-ion battery packs and systems specially developed for propulsion of road vehicles. It specifies such tests and related requirements to ensure that a battery pack or system is able to meet the specific needs of the automobile industry. It enables vehicle manufacturers to choose test procedures to evaluate the characteristics of a battery pack or system for their specific requirements.

A coordination of test specifications for battery cells, packs and systems for automotive application is necessary for practical usage of standards.

Specifications for battery cells are given in IEC 62660-1 and IEC 62660-2.

Some tests as prescribed within this specification are based on existing specifications: *USABC*, *EUCAR*, *FreedomCar* and other sources.

Electrically propelled road vehicles — Test specification for lithium-ion traction battery packs and systems —

Part 2: High-energy applications

1 Scope

ISO 12405 specifies test procedures for lithium-ion battery packs and systems to be used in electrically propelled road vehicles.

The specified test procedures enable the user of ISO 12405 to determine the essential characteristics of performance, reliability and abuse of lithium-ion battery packs and systems. They also assist the user in comparing the test results achieved for different battery packs or systems.

Therefore the objective of ISO 12405 is to specify standard test procedures for the basic characteristics of performance, reliability and abuse of lithium-ion battery packs and systems.

ISO 12405 enables the setting up of a dedicated test plan for an individual battery pack or system subject to an agreement between customer and supplier. If required, the relevant test procedures and/or test conditions of lithium-ion battery packs and systems can be selected from the standard tests provided in ISO 12405 to configure a dedicated test plan.

This part of ISO 12405 specifies the tests for high-energy battery packs and systems.

NOTE 1 Typical applications for high-energy battery packs and systems are battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV).

NOTE 2 Testing on cell level is specified in IEC 62660-1 and IEC 62660-2.

2 Normative references

The following referenced documents are indispensable for the application 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 6469-1, *Electrically propelled road vehicles — Safety specifications — Part 1: On-board rechargeable energy storage system (RESS)*

ISO 6469-3, *Electrically propelled road vehicles — Safety specifications — Part 3: Protection of persons against electric shock*

ISO 16750-1, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 1: General*

ISO 16750-3, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 3: Mechanical loads*

ISO 16750-4, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 4: Climatic loads*

IEC 60068-2-30, *Environmental testing — Part 2-30: Tests — Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-47, *Environmental testing — Part 2-47: Tests — Mounting of specimens for vibration, impact and similar dynamic tests*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 battery control unit BCU

electronic device that controls or manages or detects or calculates electric and thermal functions of the battery system and that provides communication between the battery system and other vehicle controllers

NOTE See also 5.5.1 for further explanation.

3.2 battery pack

mechanical assembly comprising battery cells and retaining frames or trays, and possibly components for battery management

NOTE See 5.4 and A.2 for further explanation.

3.3 battery system

energy storage device that includes cells or cell assemblies or battery pack(s) as well as electrical circuits and electronics

NOTE 1 See 5.5.2, 5.5.3, A.3.1 and A.3.2 for further explanation. Battery system components can also be distributed in different devices within the vehicle.

NOTE 2 Examples of electronics are the BCU and contactors.

3.4 capacity

total number of ampere hours that can be withdrawn from a battery under specified conditions

3.5 cell electronics

electronic device that collects and possibly monitors thermal and electric data of cells or cell assemblies and contains electronics for cell balancing, if necessary

NOTE The cell electronics may include a cell controller. The functionality of cell balancing may be controlled by the cell electronics or it may be controlled by the BCU.

3.6 customer

party that is interested in using the battery pack or system and therefore orders or performs the test

EXAMPLE vehicle manufacturer

3.7 device under test DUT

battery pack or battery system

3.8 energy density

amount of stored energy related to the battery pack or system volume

NOTE 1 The battery pack or system includes the cooling system, if any, to the point of a reversible attachment of the coolant lines or air ducts, respectively.

NOTE 2 Energy density is expressed in watt hours per litre (W·h/l).