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

**Part 1:  
High-power applications**

*Véhicules routiers à propulsion électrique — Spécifications d'essai pour  
packs et systèmes de batterie de traction aux ions lithium —*

*Partie 1: Applications à haute puissance*



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## 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 12405-1 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 systems*:

- *Part 1: High-power applications*
- *Part 2: High-energy applications*

## 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 for use as a power source for the propulsion of electric road vehicles are significantly different from those batteries used for consumer electronics or stationary usage.

This part of ISO 12405 provides specific test procedures for lithium-ion battery packs and systems specially developed for propulsion of road vehicles. This part of ISO 12405 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 manufactures 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 the practical usage of standards.

For specifications for battery cells, see IEC 62660-1 and IEC 62660-2.

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



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

## Part 1: High-power applications

### 1 Scope

This part of ISO 12405 specifies test procedures for lithium-ion battery packs and systems for use in electrically propelled road vehicles.

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

Therefore, this part of ISO 12405 specifies standard test procedures for basic characteristics of performance, reliability and abuse of lithium-ion battery packs and systems.

This part of ISO 12405 enables the setting up of a dedicated test plan for an individual battery pack or system subject to agreement between the 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 this part of ISO 12405 to configure a dedicated test plan.

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

NOTE 1 Typical applications for high-power battery packs and systems are hybrid electric vehicles (HEVs) and fuel cell vehicles (FCVs).

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: Test — Mounting of specimens for vibration, impact and similar dynamic tests*

IEC 60068-2-64:2008, *Environmental testing — Part 2-64: Tests — Test Fh: Vibration, broadband random and guidance*

### 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, manages, 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 5.5.1 for further explanation.

**3.2**  
**battery pack**  
energy storage device that includes cells or cell assemblies normally connected with cell electronics, voltage class B circuit and overcurrent shut-off device, including electrical interconnections, interfaces for external systems

NOTE 1 For further explanation, see 5.4 and A.2.

NOTE 2 Examples of external systems are cooling, voltage class B, auxiliary voltage class A and communication.

**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 For further explanation, see 5.5.2, 5.5.3, A.3.1 and A.3.2. 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**  
**C**  
electrical charge that can be delivered from a battery pack or system under specified conditions

NOTE The capacity is often expressed in ampere-hours (A·h), where  $1 \text{ A} \cdot \text{h} = 3\,600 \text{ C}$ .

**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 by the BCU.