INTERNATIONAL STANDARD

ISO 6469-2

Second edition
2009-09-15

Electrically propelled road vehicles — Safety specifications —

Part 2: Vehicle operational safety means and protection against failures

Véhicules routiers électriques — Spécifications de sécurité —

Partie 2: Mesures de sécurité fonctionelle et protection contre les défaillances du véhicule

Reference number
ISO 6469-2:2009(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Page

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 6469-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 21, *Electrically propelled road vehicles*.

This second edition cancels and replaces the first edition (ISO 6469:2:2001), which has been technically revised.

ISO 6469 consists of the following parts, under the general title *Electrically propelled road vehicles — Safety specifications*:

— *Part 1: On-board rechargeable energy storage system (RESS)*

— *Part 2: Vehicle operational safety means and protection against failures*

— *Part 3: Protection of persons against electric shock*

Electrically propelled road vehicles — Safety specifications —

Part 2: Vehicle operational safety means and protection against failures

1 Scope

This part of ISO 6469 specifies requirements for operational safety means and protection against failures related to hazards specific to electrically propelled road vehicles, including battery-electric vehicles (BEVs), fuel-cell vehicles (FCVs) and hybrid electric vehicles (HEVs), for the protection of persons inside and outside the vehicle and the vehicle environment.

This part of ISO 6469 does not apply to motorcycles and vehicles not primarily intended as road vehicles, such as material handling trucks or fork-lift trucks.

Requirements related to internal combustion engine (ICE) systems of HEVs are not covered in this part of ISO 6469.

This part of ISO 6469 applies only if the maximum working voltage of the on-board electrical propulsion system is lower than the upper voltage class B limit (see 3.11).

This part of ISO 6469 does not provide comprehensive safety information for manufacturing, maintenance and repair personnel.

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 11451 (all parts), *Road vehicles — Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy*

3 Terms and definitions

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

3.1
auxiliary electric system
on-board vehicle system, other than for vehicle propulsion, which operates on electric energy

3.2
battery-electric vehicle
BEV
electric vehicle with only a **traction battery** as the power source for vehicle propulsion

NOTE The abbreviation BEV is often shortened to EV.

3.3
drive direction control
device physically actuated by the driver for selecting the driving direction of the road vehicle (forward or backward)

EXAMPLE Lever or push-button switch.

3.4
driving-enabled mode
only operating mode in which the vehicle can be moved by its own propulsion system

3.5
electric drive
combination of an electric motor and associated power electronics for the conversion of electric to mechanical power and vice versa

3.6
electrically propelled vehicle
vehicle with one or more **electric drive(s)** (3.5) for vehicle propulsion

3.7
BEV operating mode
operating mode of a **HEV** (3.9), in which only the **RESS** (3.10) is used for energy supply for vehicle propulsion and possibly auxiliary electric systems

3.8
fuel-cell vehicle
FCV
electric vehicle with a fuel-cell system as the power source for vehicle propulsion

NOTE A FCV may also have a RESS or another power source for vehicle propulsion.

3.9
hybrid electric vehicle
HEV
vehicle with at least one **RESS** (3.10) and one fuelled power source for vehicle propulsion

EXAMPLE ICE or fuel-cell systems are typically types of fuelled power sources.

3.10
rechargeable energy storage system
RESS
system that stores energy for delivery of electric energy and which is rechargeable

EXAMPLE Batteries, capacitors.

3.11
voltage class B
classification of an electric component or circuit as belonging to voltage class B, if its maximum working voltage is > 30 V a.c. and $\leqslant 1\,000$ V a.c., or > 60 V d.c. and $\leqslant 1\,500$ V d.c., respectively

NOTE For more details, see ISO 6469-3.

4 Environmental and operating conditions

The requirements given in this part of ISO 6469 shall be met across the range of environmental and operating conditions for which the electrically propelled vehicle is designed to operate, as specified by the vehicle manufacturer.

NOTE See ISO 16750 for guidance.

5 Operational safety

5.1 Propulsion system, power-on/power-off procedure

For the power-on procedure of the vehicle propulsion system, at least two deliberate and distinctive actions shall be performed in order to go from the power-off mode to the driving-enabled mode.

Only one action is required to go from the driving-enabled mode to the power-off mode.

A main switch function shall be an integral part of the power-on/power-off procedure. If the power-on/off procedure of the propulsion system is activated by the car key system, it shall be designed according to the operational safety design.

It shall be indicated to the driver, continuously or temporarily, that the propulsion system of the electrically propelled vehicles is ready for driving.

After an automatic or manual turn-off of the propulsion system, it shall only be possible to reactivate it by the power-on procedure, as described.

NOTE If FCVs are deactivated by a main switch function, the fuel-cell system can remain active to perform certain functions as required by the system.

5.2 Connection of the vehicle to an off-board electric power supply

If the on-board RESS of the vehicle propulsion system can be externally charged by the user, vehicle movement by its own propulsion system shall be impossible as long as the vehicle is physically connected to the off-board electric power supply (e.g. mains, off-board charger). This requirement does not refer to voltage class A auxiliary electric systems.

5.3 Driving

5.3.1 Indication of reduced power

If the electric propulsion system is equipped with a means to automatically reduce the vehicle propulsion power, significant reductions should be indicated to the driver.

NOTE Such means could limit the effects of a fault in the propulsion system or of an excessive power demand by the driver.

5.3.2 Indication of low energy content of RESS

If a low state of charge (SOC) in the RESS has a relevant impact on the vehicle driving performance, a low energy content of the RESS shall be indicated to the driver by an obvious device (e.g. a visual or audible signal). At the indicated low state of charge specified by the vehicle manufacturer, the vehicle shall meet the following requirements.

a) It shall be possible to move the vehicle out of the traffic area using its own propulsion system.

b) A minimum energy reserve shall still be available for the lighting system as required by National and/or International Standards or regulations, when there is no independent energy storage for the auxiliary electrical systems.

5.4 Driving backwards

If driving backwards is achieved by reversing the rotational direction of the electric motor, the following requirements shall be met to prevent unintentional switching into reverse when the vehicle is in motion:

Switching between the forward and backward (reverse) directions shall require

— either two separate actions by the driver, or

— if only one driver action is required, a safety device shall allow the transition only when the vehicle is stationary or moving slowly, as specified by the manufacturer.

If driving backwards is not achieved by reversing the rotational direction of the electric motor, National or International Standards or legal requirements for driving backwards for vehicles propelled by ICE shall apply.

5.5 Parking

When leaving the vehicle, it shall be indicated to the driver whether the electric propulsion system is still in the driving-enabled mode.

No unexpected movement of the vehicle due to the electric drive shall be possible after the driver has switched to the power-off mode.

5.6 Electromagnetic compatibility

5.6.1 Susceptibility

All electric and electronic functions of electrically propelled vehicles, which could affect safe operation of the vehicle, shall be functionally tolerant of the electromagnetic environment to which the vehicle will normally be exposed. This includes fluctuating voltage and load conditions, and electric transients.

The vehicle shall be tested according to the appropriate parts of ISO 11451. The reference field strength shall be according to National or International Standards or legal requirements, but shall be at least 30 V/m.

5.6.2 Emissions

The vehicle shall fulfil applicable National or International Standards (i.e. CISPR 12) or legal requirements.

6 Protection against failures

6.1 Fail-safe design

The design of systems and components specific to electrically propelled vehicles shall consider fail-safe design.

For example, electric drive and fuel systems shall be switched off and de-energized when deactivated.

6.2 First failure response

Measures shall be implemented to manage credible single-point failures.

6.3 Unintentional vehicle behaviour

Unintentional acceleration, deceleration and reversal of direction of a vehicle caused by single-point hardware or software failures (first failures) in systems and components specific to electrically propelled vehicles shall be minimized.

7 Owner's guide or manual

Special attention shall be given in the owner's manual to aspects specific to the vehicle.

8 Marking

The vehicle shall be marked in accordance with applicable National or International Standards or legal requirements.

9 Emergency response

The manufacturer of the vehicle shall have information available for safety personnel and/or emergency responders with regard to dealing with accidents involving a vehicle.

NOTE For example, guidance on appropriate emergency response can be found in SAE J2578.