
**Electrically propelled road vehicles —
Safety specifications —**

**Part 2:
Vehicle operational safety**

*Véhicules routiers électriques — Spécifications de sécurité —
Partie 2: Sécurité fonctionnelle du véhicule*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 37, *Electrically propelled vehicles*.

This fourth edition cancels and replaces the third edition (ISO 6469-2:2018), which has been technically revised.

The main changes are as follows:

- introduction of requirements for an external sound generation system;
- introduction of requirements for the operation of auxiliary electric systems;
- addition of an informative annex on standardized symbols for driver information.

A list of all parts in the ISO 6469 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is the second part of the ISO 6469 series that provide safety specifications for electrically propelled road vehicles.

Electrically propelled road vehicles have different functions and characteristics compared to conventional vehicles.

This document addresses such characteristics with regard to the operational safety of electrically propelled road vehicles.

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Electrically propelled road vehicles — Safety specifications —

Part 2: Vehicle operational safety

1 Scope

This document specifies requirements for operational safety specific to electrically propelled road vehicles, for the protection of persons inside and outside the vehicle.

Relevant requirements for motorcycles and mopeds are outside the scope of this document, they are described in the ISO 13063 series.

This document does not provide comprehensive safety information for manufacturing, maintenance, and repair personnel.

This document does not consider specific aspects of driving automation features.

NOTE 1 For the definition of the term “driving automation features”, see SAE J3016.

EMC is not covered by this document.

NOTE 2 For EMC see ISO 11451 and IEC 61851-21-1.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

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

3.1 auxiliary electric system

vehicle system, other than for vehicle propulsion, that operates on electric energy

[SOURCE: ISO 6469-3:2021, 3.1]

3.2 case A

connection of an *electrically-propelled vehicle (EV)* (3.6) to the supply network with a plug and cable permanently attached to the EV

[SOURCE: IEC 61851-1:2017, 3.1.10]

3.3

case B

connection of an *electrically-propelled vehicle (EV)* (3.6) to the AC supply network with a cable assembly detachable at both ends

[SOURCE: IEC 61851-1:2017, 3.1.11]

3.4

case C

connection of an *electrically-propelled vehicle (EV)* (3.6) to the AC supply network utilizing a cable and *vehicle connector* (3.16) permanently attached to the EV charging station

[SOURCE: IEC 61851-1:2017, 3.1.12]

3.5

driving-enabled mode

operating mode in which the vehicle can be moved by its own *propulsion system* (3.12) by one action

Note 1 to entry: Examples for this action are: pressure to the accelerator pedal, activation of an equivalent control, release of the brake system.

3.6

electrically-propelled vehicle

EV

vehicle with one or more electric drive(s) for vehicle propulsion

[SOURCE: ISO 6469-3:2021, 3.15]

3.7

external electric circuit

electric circuit which connects to the *vehicle power supply circuit* (3.18) using the plug [*case A* (3.2)], the vehicle inlet [*case B* (3.3) and *case C* (3.4)], the ACD counterpart [*case D*] or the ACD [*case E*] or electric circuit which is magnetically coupled with the secondary coil

3.8

external electric power supply

electric power source that is not part of the vehicle for supplying electric energy to a vehicle

[SOURCE: ISO 17409:2020, 3.28]

3.9

external sound generation system

system that provides an acoustic signal to the external environment of the vehicle for the purpose to provide information to pedestrians

[SOURCE: ISO 16254:2016, 3.3]

Note 1 to entry: Some documents use the equivalent term “acoustic vehicle alerting system (AVAS)”.

3.10

fuel cell system

system, typically containing the following subsystems: fuel cell stack, air processing, fuel processing, thermal management, water management, and their control

[SOURCE: ISO 6469-3:2021, 3.21]

3.11**FCV****fuel cell vehicle**

electrically-propelled vehicle (3.6) with a *fuel cell system* (3.10) as the power source for vehicle propulsion

Note 1 to entry: An FCV may also have a *rechargeable energy storage system (RESS)* (3.13) or another power source for vehicle propulsion.

3.12**propulsion system**

combination of power source and powertrain for vehicle propulsion

3.13**RESS****rechargeable energy storage system**

rechargeable system that stores energy for delivery of electric energy for the electric drive

EXAMPLE Batteries, capacitors.

[SOURCE: ISO 6469-1:2019, 3.22]

3.14**single-point failure**

system failure caused by the failure of only one of its constituent items

3.15**state of charge****SOC**

available capacity of a *rechargeable energy storage system (RESS)* (3.13) or RESS subsystem expressed as a percentage of rated capacity

[SOURCE: ISO 6469-1:2019, 3.26]

3.16**vehicle connector**

part of a vehicle coupler integral with or intended to be attached to the cable assembly

[SOURCE: IEC 62196-1:2014, 3.3.1]

3.17**vehicle inlet**

part of a vehicle coupler incorporated in, or fixed to, an *electrically propelled vehicle (EV)* (3.6)

[SOURCE: IEC 62196-1:2014, 3.3.2]

3.18**vehicle power supply circuit**

voltage class B electric circuit which includes all parts that are galvanically connected to the *vehicle inlet* (3.16) [case B (3.3), case C (3.4)] or the plug [case A (3.2)] and that is operational when connected to an *external electric power supply* (3.8)

4 Environmental and operating conditions

The requirements given in this document 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 the ISO 16750 series, ISO 21498-1 and the ISO 19453 series for guidance.

5 Operational safety

5.1 General

Measures shall be implemented to manage credible single-point failures specific to electrically-propelled vehicles.

Examples for measures that address single-point failures are:

- normally open switches;
- normally closed fuel valves.

5.2 Driving-enabled mode

Movement of the vehicle by its propulsion system shall be possible only in the driving-enabled mode.

To switch the propulsion system from shut-off condition to driving-enabled mode, at least two deliberate and distinctive actions shall be necessary.

For reactivation of the propulsion system after its automatic or manual shut-off, the requirements for activating the driving enabled mode shall apply.

The vehicle shall indicate to the driver that the propulsion system is in driving enabled mode.

A main switch function and its actuation are required to activate and to deactivate the propulsion system. It shall be designed according to 5.1.

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

If the vehicle is not in the driving-enabled mode, the power sources of the propulsion system (e.g. fuel cell system, RESS) may be active.

5.3 Driving

5.3.1 Indication of reduced propulsion power

If the electric propulsion system is equipped with a means to automatically reduce the vehicle propulsion power, it is recommended to indicate significant reductions to the driver.

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

5.3.2 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 (e.g. a visual or audible signal). At the first indication of the low state of charge specified by the vehicle manufacturer, the vehicle shall meet the following requirements.

- a) The vehicle shall be capable of being driven out of the traffic area using its own propulsion system.
- b) A minimum energy reserve shall still be available for the lighting system, when there is no independent energy storage for the auxiliary electric systems.

5.3.3 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.

To switch between the forward and backward (reverse) directions, either:

- two separate actions by the driver shall be required; 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.

The vehicle shall indicate the selected drive direction to the driver.

EXAMPLE The selected drive direction is indicated by the letters “D” and “R” or by symbol M.12 (see [Annex A](#)) with right or left arrow head omitted.

5.3.4 External sound generation system

5.3.4.1 General

The vehicle may be equipped with an external sound generation system.

5.3.4.2 Sound generation

The external sound generation system, if any, shall automatically generate a sound in the minimum range of vehicle speed from start up to at least 20 km/h and during reversing.

NOTE 1 In some countries, the minimum range of vehicle speed is subject to national regulations.

NOTE 2 In some countries, operation of the external sound generation system when the internal combustion engine is in operation is not allowed by national regulations.

The vehicle may emit a sound when stationary.

For vehicles having a reversing sound warning device, it may not be necessary for the external sound generation system to generate a sound whilst reversing.

5.3.4.3 Sound type and volume

The sound to be generated by the external sound generation system shall be a continuous sound that provides information to the pedestrians and other road users of a vehicle in operation. The sound shall be easily indicative of vehicle behaviour, for example, through the automatic variation of sound level or characteristics in synchronisation with vehicle speed.

The vehicle manufacturer may provide a possibility for the driver to select among different sounds.

5.3.4.4 Pause function

The external sound generation system may be fitted with a mechanism to enable the driver to halt the operation of an external sound generation system (“pause function”), which is easily accessible by the vehicle driver in order to allow engaging and disengaging. Where a pause function is fitted, the external sound generation system shall default to the switched-on position upon restarting of the vehicle.

NOTE In some countries, the pause function is not allowed by national regulations.

5.3.4.5 Attenuation

The external sound generation system sound level may be attenuated during periods of vehicle operation. In those cases, the external sound generation system sound level shall exceed a minimum level.

5.3.4.6 Testing

For testing of the external sound generation system, see ISO 16254.

5.4 Parking

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

5.5 Operation of auxiliary electric systems

This subclause applies to auxiliary electric systems that are conductively connected to the electric propulsion system.

EXAMPLE 1 Lift, crane.

Since an electrically propelled vehicle emits significantly less audible noise compared with a conventional vehicle, the vehicle manufacturer shall take measures to protect persons from hazards related to the activation, operation or deactivation of such systems.

EXAMPLE 2 Mechanical or thermal hazards.

NOTE The external sound generation system can be used to emit an audible warning.

5.6 Connection of the vehicle to an external electric circuit

Vehicle movement by its own propulsion system shall be disabled when

- the plug of the vehicle power supply circuit is mated to a socket-outlet (case A) or
- a vehicle connector of the external electric circuit is mated to the vehicle inlet (case B or case C).

NOTE Explanatory figures for case A, case B and case C are given in IEC 61851-1.

The requirement is deemed to be fulfilled if the vehicle is designed such that a mated plug (case A) or mated vehicle connector (case B or case C) obviously prevents the operation of the vehicle controls for propulsion.

6 Owner's manual

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

7 Information for first responders and emergency services

The vehicle manufacturer shall provide special information for handling and safety of an electrically propelled vehicle after an accident for first responders and emergency services by appropriate documentation.

NOTE For example, guidance on emergency response is given in the ISO 17840 series, SAE J2578 and SAE J2990.