Technical Specification

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# Electrically propelled road vehicles — Functional and safety requirements for power transfer between vehicle and external electric circuit —

## Part 5: Automatic conductive power transfer

*Véhicules routiers à propulsion électrique — Exigences fonctionnelles et de sécurité pour le transfert de puissance entre le véhicule et le circuit électrique externe —*

*Partie 5: Transfert de puissance automatique par conduction*



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# Foreword

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

A list of all parts in the ISO 5474 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 specifies requirements for the onboard side of an automatic connection system to charge electric vehicles. It gives guidance in terms of safety and compatibility with the offboard side of automatic connection systems.

Technological maturity:

It is pointed out, that this document has been established in parallel to the technological development of automatic connection systems. Due to the fact that the experience with the technology is very limited, the requirements given in this document do not comprehensively cover all aspects/requirements for an interoperable operation at this stage. Current and future product developments will continuously prove, disprove and refine the requirements of this document.

Furthermore, it is worthwhile to mention that at the date of publication of this document, no standard for a vehicle coupler of category 3 (at the underbody of the vehicle) is available.

Relation to other parts of the ISO 5474 series:

There is no direct relation of content or structure of this document to any other part of the ISO 5474 series (including ISO 5474-1). Wherever needed, other parts of the series are specifically referenced.

# Electrically propelled road vehicles — Functional and safety requirements for power transfer between vehicle and external electric circuit —

## Part 5: Automatic conductive power transfer

## 1 Scope

This document defines requirements for the onboard system (vehicle side) related to the automatic connection for conductive alternating current (AC) and/or direct current (DC) power transfer between electrically propelled road vehicles (EVs) and external electric circuits. This document addresses the following aspects:

— electrical and mechanical safety requirements;

— compatibility requirements;

— environmental conditions;

— functionality requirements;

— test procedures.



This document applies to:

— EVs supporting automatic connection of a vehicle inlet according to IEC 62196-2, IEC 62196-3, IEC TS 62196-3-1 or IEC TS 63379[1)] (category 1) and



— EVs supporting automatic connection of a category 3 vehicle inlet or category 3 plug (typically at the underbody of the vehicle) according to IEC TS 61851-26.

NOTE 1 IEC TS 61851-26 does not include automatic connection of vehicle inlets or plugs of category 1 and category 2, that can also be mounted at the underbody of the vehicle.

Requirements for EVs equipped with an ACD or ACD counterpart of category 2 are specified in EN 50696 and IEC 63407[2)].

Requirements for simultaneous operation of multiple power transfer interfaces are under consideration and not covered in this document.

NOTE 2 Requirements for ACD infrastructure, communication sequence and communication interface are specified in IEC 61851-23-1, IEC TS 61851-26 and IEC TS 61851-27.

NOTE 3 EMC requirements for vehicles conductively connected to the supply network are defined in IEC 61851-21-1.

1) Under preparation. Stage at the time of publication: IEC TS/CDM 63379:2023.

2) Under preparation. Stage at the time of publication: IEC/CDM 63407:2023.

## 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 5474-1[3], *Electrically propelled road vehicles — Functional requirements and safety requirements for power transfer — Part 1: General requirements for conductive power transfer*

ISO 5474-2[4], *Electrically propelled road vehicles — Functional requirements and safety requirements for power transfer — Part 2: AC power transfer*

ISO 5474-3[5], *Electrically propelled road vehicles — Functional requirements and safety requirements for power transfer — Part 3: DC power transfer*

ISO 10218-1:2011, *Robots and robotic devices — Safety requirements for industrial robots — Part 1: Robots*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

IEC TS 61851-26[6], *Electric vehicle conductive charging system — Part 26: EV supply equipment with automated connection of a vehicle coupler located at the underbody of an electric vehicle*

IEC TS 61851-27[7], *Electric vehicle conductive charging system — Part 27: EV supply equipment with automated connection of a vehicle coupler according to IEC 62196-2 or IEC 62196-3*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 5474-1 and the following 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 https://www.electropedia.org/

**3.1**
**ACD onboard system**
system with automatic *docking* (3.6) and *undocking* (3.14) functions installed in a vehicle and used in combination with an *automatic EV supply equipment* (3.3)

**3.2**
**automatic connection device**
**ACD**
active device where the physical connection between an electric vehicle (EV) supply equipment and vehicle is made without user interaction providing an electromechanical interface

Note 1 to entry: Preparatory steps taken by the user to allow for automatic charging (e.g. opening inlet cover) are not seen as part of establishing the physical connection.

Note 2 to entry: This term is derived from the term automated connection device.

[SOURCE: IEC 61851-23-1:—[8], 3.1.203, modified — The original term was "automated connection device" and Notes to entry were added.]

3) Under preparation. Stage at the time of publication: ISO/FDIS 5474-1:2024.

4) Under preparation. Stage at the time of publication: ISO/FDIS 5474-2:2024.

5) Under preparation. Stage at the time of publication: ISO/FDIS 5474-3:2024.

6) Under preparation. Stage at the time of publication: IEC/CD TS 61851-26:2023.

7) Under preparation. Stage at the time of publication: IEC/CD TS 61851-27:2023.

8) Under preparation. Stage at the time of publication: IEC/CDV 61851-23-1:2023.

**3.3**
**automatic EV supply equipment**
electric vehicle (EV) supply equipment with automatic *docking* (3.6) and *undocking* (3.14) functions

**3.4**
**communication for docking and undocking**
communication between the *supply equipment communication controller (SECC)* (3.13) and the *electric vehicle communication controller (EVCC)* (3.7) for *docking* (3.6) and *undocking* (3.14)

**3.5**
**communication for power transfer**
communication session established between the *supply equipment communication controller (SECC)* (3.13) and the *electric vehicle communication controller (EVCC)* (3.7), used for charging control

**3.6**
**docking**
process in which a *manipulator* (3.9) performs a controlled motion and mates either a plug to a socket-outlet or a vehicle connector to a vehicle inlet

Note 1 to entry: Other actuators in addition to the manipulator might be used, e.g. for opening of the inlet cover or for drawing the vehicle connector into the vehicle inlet.

**3.7**
**EV communication controller**
**EVCC**
embedded system, within the electric vehicle (EV), that implements the communication between the EV and the *supply equipment communication controller (SECC)* (3.13) in order to support specific functions

Note 1 to entry: Such specific functions could be, e.g. controlling input and output channels, encryption, or data transfer between EV and *SECC* (3.13).

[SOURCE: ISO 15118-1:2019, 3.1.31, modified — “vehicle” was replaced by “electric vehicle”.]

**3.8**
**immobilization**
inhibition of vehicle movement by its own propulsion system

**3.9**
**manipulator**
machine, the mechanism of which usually consists of a series of segments jointed or sliding relative to one another, for the purpose of grasping and/or moving objects (pieces or tools) usually in several degrees of freedom

[SOURCE: ISO/TR 11065:1992, 387, modified — Second sentence deleted.]

**3.10**
**mating space**
spatial envelope of points with specified range of orientations where mating of the vehicle connector and vehicle inlet or plug and socket-outlet is possible

**3.11**
**package space**
space around the vehicle inlet or socket-outlet where no obstacles are allowed

**3.12**
**point to point signal**
**P2PS**
unidirectional wireless link between the electric vehicle (EV) and *automatic EV supply equipment* (3.3)

Note 1 to entry: The P2PS is used for identification and for position detection of vehicle inlet or socket-outlet in the context of *docking* (3.6).

EXAMPLE Image recognition with camera-based inlet detection.

[SOURCE: IEC 61980-2:2021, 3.17, modified — “EV device” changed to “EV”, “supply device” changed to “EV supply equipment” and Note 1 to entry added.]

**3.13**
**supply equipment communication controller**
**SECC**
entity which implements the communication to one or multiple *electric vehicle communication controller(s) (EVCC) (s)* (3.7)

Note 1 to entry: Further details regarding possible architectures are given in ISO 15118-1:2019, Annex A.

Note 2 to entry: Functions of a supply equipment communication controller can control input and output channels, data encryption, or data transfer between the *EVCC* (3.7) and *SECC* (3.12).

[SOURCE: ISO 15118-1:2019, 3.1.68, modified — “and which may be able to interact with secondary actors” is deleted, Note 1 to entry is deleted, in Note 2 to entry “ISO 15118-1:2019” is added and in Note 3 to entry “may” is replaced by “can” and “vehicle” is replaced by “EVCC”.]

**3.14**
**undocking**
process in which a *manipulator* (3.9) performs a controlled motion and unmates either a plug from a socket-outlet or a vehicle connector from a vehicle inlet

Note 1 to entry: Other actuators in addition to the manipulator might be used, e.g. for closing of the inlet cover or for ejecting the vehicle connector from the vehicle inlet.

# 4 System architecture

## 4.1 General

To establish a general baseline for the requirements defined in this document, the automatic charging system is structured into functional entities. Figure 1 shows an example of the system architecture including a structure of functional entities.

NOTE The same example of system architecture is used in IEC TS 61851-26 and IEC TS 61851-27.