



FINAL DRAFT International Standard

ISO/FDIS 5474-2

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

Part 2: AC power transfer

ISO/TC 22/SC 37

Secretariat: DIN

Voting begins on:
2024-01-03

Voting terminates on:
2024-02-28

iteh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO/FDIS 5474-2](#)

<https://standards.iteh.ai/catalog/standards/iso/dfb7148d-b3d0-47f5-aa7b-e192c9484b91/iso-fdis-5474-2>

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL REGULATIONS.

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO/FDIS 5474-2](https://standards.iteh.ai/catalog/standards/iso/dfb7148d-b3d0-47f5-aa7b-e192c9484b91/iso-fdis-5474-2)

<https://standards.iteh.ai/catalog/standards/iso/dfb7148d-b3d0-47f5-aa7b-e192c9484b91/iso-fdis-5474-2>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 System architecture	3
5 Environmental and operational conditions	5
6 General safety requirements	5
6.1 General.....	5
6.2 Protection of persons against electric shock.....	6
6.2.1 General.....	6
6.2.2 Compatibility with external safety devices.....	6
6.2.3 Insulation resistance.....	6
6.2.4 Touch current.....	6
6.2.5 Insulation coordination.....	6
6.2.6 Protective conductor.....	7
6.2.7 Basic protection when connected to an external electric circuit.....	7
6.2.8 Requirements for unmated vehicle contacts.....	7
6.3 Protection against thermal incident.....	7
6.3.1 Requirements for normal operation.....	7
6.3.2 Overcurrent protection.....	7
6.3.3 Residual energy after disconnection related to thermal incident.....	8
6.3.4 Arc protection.....	8
6.4 Vehicle movement.....	8
6.5 AC or DC electric power at the same contacts.....	8
7 Electromagnetic compatibility	8
8 Protection in case of unintended power transfer	8
9 Functional requirements	9
9.1 Voltage and frequency ranges for normal operation.....	9
9.2 Inrush current.....	9
9.3 Load current.....	9
9.4 Active factor.....	10
9.5 Phase order and number of phases in three-phase operation.....	11
9.6 Requirements for the plug and cable (case A).....	11
9.7 Requirements for the vehicle inlet.....	11
9.8 Compatibility with self test functions of EV supply equipment.....	11
10 Additional requirements for reverse power transfer	11
10.1 General.....	11
10.2 Safety requirements.....	12
10.2.1 General.....	12
10.2.2 Reverse power transfer in grid forming mode to unearthed external circuit (vehicle to load).....	12
10.2.3 Reverse power transfer in grid following mode to earthed external circuit (vehicle to grid).....	14
10.2.4 Reverse power transfer in grid forming mode to earthed external circuit (vehicle to home).....	14
10.3 Functional requirements.....	15
10.3.1 General.....	15
10.3.2 Reverse power transfer in grid forming mode.....	15
10.3.3 Reverse power transfer in grid following mode.....	15
11 Requirements for power transfer to on-board standard socket-outlets	15
11.1 General.....	15

ISO/FDIS 5474-2:2023(en)

11.2	Protective conductor	16
11.3	Insulation resistance.....	16
12	Owner's manual and marking.....	16
13	Test procedure.....	16
13.1	General.....	16
13.2	Resistance of protective conductor	16
13.3	Insulation resistance.....	16
13.4	Withstand voltage test.....	16
13.5	Measurement of touch current.....	17
13.6	Inrush current test.....	20
	13.6.1 General.....	20
	13.6.2 Measurement.....	21
Annex A	(informative) Examples of circuit diagrams for different configurations of chargers on-board an electric vehicle.....	22
Bibliography		28

iTeh Standards (<https://standards.iteh.ai>) Document Preview

[ISO/FDIS 5474-2](https://standards.iteh.ai/catalog/standards/iso/dfb7148d-b3d0-47f5-aa7b-e192c9484b91/iso-fdis-5474-2)

<https://standards.iteh.ai/catalog/standards/iso/dfb7148d-b3d0-47f5-aa7b-e192c9484b91/iso-fdis-5474-2>

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 document 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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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*.

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.

<https://standards.iteh.ai/catalog/standards/iso/d1b7148d-b3d0-47f5-aa7b-e192c9484b91/iso-fdis-5474-2>

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

Part 2: AC power transfer

1 Scope

This document in combination with ISO 5474-1 specifies requirements for conductive power transfer using alternating current (AC) with a voltage up to 1 000 V a.c. between electrically-propelled road vehicles and external electric circuits.

This document provides requirements for conductive charging in modes 2, 3 according to IEC 61851-1 and reverse power transfer.

NOTE External electric circuits are not part of the vehicle.

This document applies to the vehicle power supply circuits. Examples of circuit diagrams for different configurations of chargers on-board electric vehicles are shown in [Annex A](#).

This document also provides requirements for reverse power transfer through on-board standard socket-outlets and/or a EV plug or vehicle inlet according to IEC 62196-1 or IEC 62196-2 conductively connected to the vehicle power supply circuit. Requirements for AC power transfer using a charger without at least simple separation are under consideration.

This document does not provide:

- requirements for simultaneous operation of multiple power transfer interfaces and
- requirements for power transfer while driving (electric road systems)

but they are under consideration.

This document does not provide:

- requirements for mopeds and motorcycles (which are specified in ISO 18246);
- comprehensive safety information for manufacturing, maintenance and repair personnel;
- requirements for vehicle to load adapters.

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:—¹⁾, *Electrically propelled road vehicles — Functional requirements and safety requirements for power transfer — Part 1: General requirements for conductive power transfer*

1) First edition under preparation. Stage at the time of publication: ISO/FDIS 5474-1:2023.

ISO 6469-3:2021, *Electrically propelled road vehicles — Safety specifications — Part 3: Electrical safety*

IEC 60038, *IEC standard voltages*

IEC 60364-4-43, *Low-voltage electrical installations — Part 4-43: Protection for safety — Protection against overcurrent*

IEC 60364-8-82:2022, *Low-voltage electrical installations — Part 8-82: Functional aspects - Prosumer's low-voltage electrical installations*

IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage supply systems — Part 1: Principles, requirements and tests*

IEC 60898-1:2015, *Electrical accessories — Circuit-breakers for overcurrent protection for household and similar installations — Part 1: Circuit-breakers for a.c. operation*

IEC 61851-1:2017, *Electric vehicle conductive charging system — Part 1: General requirements*

IEC 62196-1, *Plugs, socket-outlets, vehicle connectors and vehicle inlets — Conductive charging of electric vehicles — Part 1: General requirements*

IEC 62196-2, *Plugs, socket-outlets, vehicle connectors and vehicle inlets — Conductive charging of electric vehicles — Part 2: Dimensional compatibility and interchangeability requirements for a.c. pin and contact-tube accessories*

ISO 15118 (all parts), *Road vehicles — Vehicle to grid communication interface*

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 <https://standards.iteh.ai/catalog/standards/iso/d1b7148d-b3d0-47f5-aa7b-e192c9484b91/iso-fdis-5474-2>

active factor

$\cos \varphi$

for a two-terminal element or a two-terminal circuit under sinusoidal conditions, ratio of the active power to the apparent power

[SOURCE: IEC 60050-131:2002, 131-11-49, modified — The symbol “ $\cos \varphi$ ” was added and the note deleted.]

3.2

protective separation

electrically protective separation

separation of one electric circuit from another by means of:

- double insulation; or
- basic insulation and electrically protective screening (shielding); or
- reinforced insulation

[SOURCE: IEC 60050-826:2004, 826-12-29]

3.3
vehicle-to-load
V2L

power transfer from the vehicle power supply circuit to at least one external electric load, where the load is assumed to be without permanent connection to protective earth

Note 1 to entry: The external electric load can be connected to the vehicle power supply circuit via an on-board standard socket-outlet, or the vehicle inlet, directly or using a *V2L adapter* (3.4).

3.4
V2L adapter

equipment which connects to the vehicle power supply circuit using the vehicle inlet and provides at least one standard socket-outlet for external electric loads

3.5
grid forming mode

mode of reverse power transfer not in parallel with the supply network

3.6
grid following mode

mode of reverse power transfer in parallel and following the operational parameters of the supply network

3.7
isolation

disconnection providing adequate insulation between electrical equipment, a system, an installation or part of an installation and their energy sources

[SOURCE: IEC 60050-195:2021, 195-06-23]

4 System architecture

ISO 5474-1:—²⁾, Clause 4 applies except as follows.

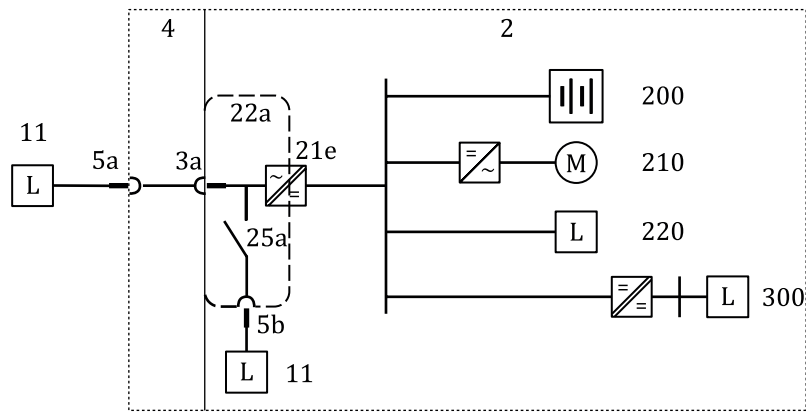
Addition:

An example for vehicle-to-load AC reverse power transfer (AC reverse power transfer in grid forming mode to unearthed external circuit) is provided in [Figure 1](#).

An example for vehicle-to-grid AC reverse power transfer (AC reverse power transfer in grid following mode to earthed external circuit) is provided in [Figure 2](#).

An example for of vehicle-to-home AC reverse power transfer (AC reverse power transfer in grid forming mode or grid following mode to earthed external circuit) is provided in [Figure 3](#).

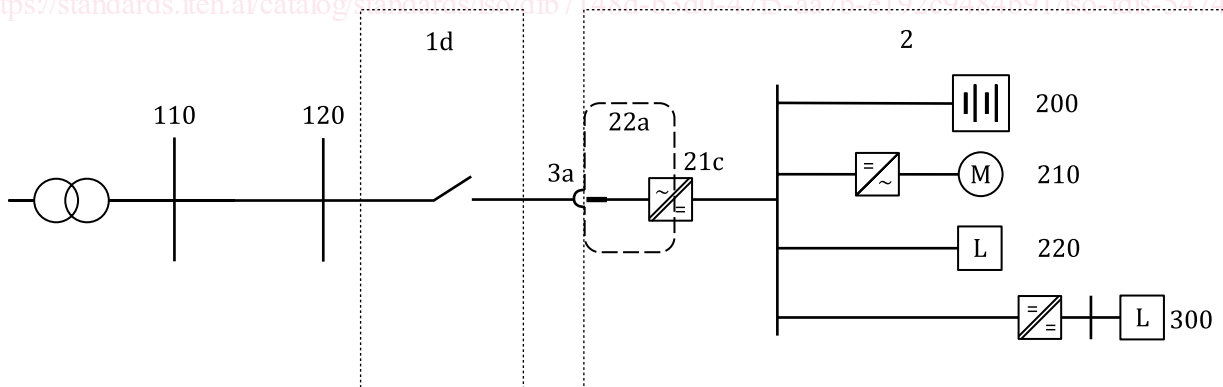
2) First edition under preparation. Stage at the time of publication: ISO/FDIS 5474-1:2024.



Key

- 2 EV
- 3a AC vehicle coupler
- 4 V2L adapter
- 5a socket-outlet provided by V2L adapter and standard plug
- 5b standard socket-outlet provided on-board the vehicle and standard plug
- 11 AC load
- 21e bidirectional power converter with at least simple separation in grid forming mode
- 22a vehicle power supply circuit
- 25a disconnection device
- 200 RESS
- 210 electric drive
- 220 other voltage class B electric loads
- 300 voltage class A electric loads

Figure 1 — Single-line diagram of example of vehicle-to-load AC reverse power transfer (AC reverse power transfer in grid forming mode to unearthed external circuit)

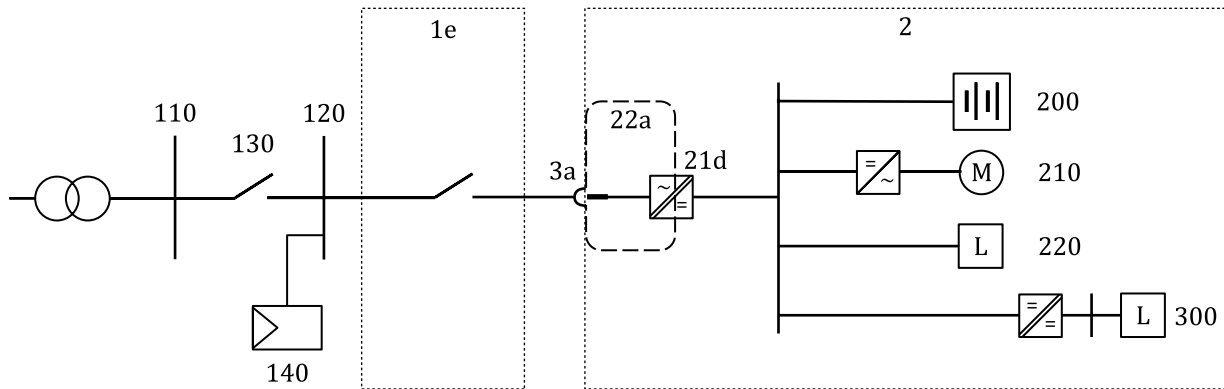


Key

- 1d AC EV supply equipment capable of RPT function grid connected
- 2 EV
- 3a AC vehicle coupler
- 21c bidirectional power converter with at least simple separation in grid following mode
- 22a vehicle power supply circuit
- 110 public network
- 120 local distribution
- 200 RESS

- 210 electric drive
- 220 other voltage class B electric loads
- 300 voltage class A electric loads

Figure 2 — Single-line diagram of example of vehicle-to-grid AC reverse power transfer (AC reverse power transfer in grid following mode to earthed external circuit)



Key

- 1e AC EV supply equipment capable of RPT function islanded without grid connection
- 2 EV
- 3a AC vehicle coupler
- 21d bidirectional power converter with at least simple separation in grid forming mode or grid following mode
- 22a vehicle power supply circuit
- 110 public network
- 120 local distribution
- 130 switching device for islanding
- 140 PV system
- 200 RESS
- 210 electric drive
- 220 other voltage class B electric loads
- 300 voltage class A electric loads

Figure 3 — Single-line diagram of example of vehicle-to-home AC reverse power transfer (AC reverse power transfer in grid forming mode or grid following mode to earthed external circuit)

5 Environmental and operational conditions

ISO 5474-1:—, Clause 5 applies.

6 General safety requirements

6.1 General

ISO 5474-1:—, 6.1 applies.