INTERNATIONAL STANDARD

ISO 15118-1

Second edition
2019-04

Road vehicles — Vehicle to grid communication interface —

Part 1: General information and use-case definition

Véhicules routiers — Interface de communication entre véhicule et réseau électrique —

Partie 1: Informations générales et définition de cas d'utilisation

Reference number
ISO 15118-1:2019(E)

© ISO 2019



COPYRIGHT PROTECTED DOCUMENT

© ISO 2019

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
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword ..... **v**
Introduction ..... **vi**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **2**
3.1 General terms 2
3.2 Control modes 13
3.3 Architecture channel 13
3.4 Forward and reverse power transfer 13
3.5 Minimum and maximum energy request limits 13
3.6 Source generator modes 14
4 Abbreviated terms **14**
5 Requirements **15**
5.1 List of requirements 15
5.2 General communication requirements 15
5.3 User-specific requirements 16
5.3.1 Reliability, availability, error handling and error reporting 16
5.3.2 Private data protection 17
5.3.3 Ease of use 17
5.4 OEM-specific requirements 17
5.5 Utility-specific requirements 18
5.5.1 Power limiting for grid control or local energy control 18
5.5.2 Current and voltage limits for EV supply equipment protection 19
5.5.3 Current and voltage limits for EV protection 19
5.5.4 Authorization of charging services 19
5.5.5 Authorization of energy transfer from the EV to the EV supply equipment 20
5.5.6 Retrofitting 20
5.6 Wireless communication requirements 20
5.6.1 General 20
5.6.2 Communication infrastructure requirements 20
5.7 RPT description 21
5.7.1 General 21
5.7.2 General information and requirements 22
5.8 Traceability requirements 22
6 Actors **23**
7 Use case elements **24**
7.1 General 24
7.2 Task groups 25
7.3 Task groups description 26
7.3.1 Start of communication process [A] 26
7.3.2 Plug-in and forced HLC 28
7.3.3 WA1: discovery with reservation 29
7.3.4 Plug-in with concurrent IEC 61851-1 and HLC 29
7.3.5 WA2: discovery without reservation 30
7.4 Communication set-up [B] 31
7.4.1 EVCC/SECC conductive communication set-up 31
7.4.2 WB1: EVCC/SECC wireless communication set-up 32
7.5 Certificate handling [C] 32
7.5.1 Certificate update 32
7.5.2 Certificate installation 33
7.6 Identification and authorization [D] 35
7.6.1 Overview 35

© ISO 2019 – All rights reserved

7.6.2 Authorization using contract certificates performed at the EV supply equipment 36
7.6.3 Authorization using contract certificates performed with the help of an SA 37
7.6.4 Authorization at the EV supply equipment using external credentials performed at the EV supply equipment 39
7.6.5 Authorization at the EV supply equipment using external credentials performed with the help of an SA 40
7.6.6 WD1: Authentication with prior reservation 41
7.7 Pairing and fine positioning 42
7.7.1 WP1: WPT fine positioning 42
7.7.2 WP2: WPT fine positioning without communication support 42
7.7.3 WP3: Conductive energy transfer pairing 43
7.7.4 WP4: WPT pairing 44
7.8 Target setting and energy transfer scheduling [E] 45
7.8.1 AC charging with load levelling based on HLC 45
7.8.2 WE1: WPT target setting and charge scheduling 46
7.8.3 Optimized charging with scheduling from secondary actors 46
7.8.4 DC charging with load levelling based on HLC 48
7.8.5 Resume to authorized charging schedule 49
7.8.6 Reverse power transfer with load levelling based on HLC 50
7.8.7 Reverse power transfer on stand-alone operation 51
7.8.8 Fast responding energy transfer services based on dynamic control mode 52
7.8.9 Managed bidirectional power transfer into the grid and/or into the home 54
7.9 Energy transfer controlling and re-scheduling [F] 56
7.9.1 Energy transfer loop 56
7.9.2 Energy transfer loop with metering information exchange 57
7.9.3 WF1: WPT charging loop 58
7.9.4 Energy transfer loop with interrupt from the SECC 59
7.9.5 Energy transfer loop with interrupt from the EVCC or USER 59
7.9.6 Energy transfer control based on dynamic control mode 60
7.10 Value-added services [G] 62
7.10.1 Value-added services 62
7.10.2 WG1: ACD system status check 63
7.10.3 Energy transfer details 64
7.11 End of energy transfer process [H] 64
7.11.1 General 64
7.11.2 End of energy transfer process 65
7.12 WPT end of charge WH1 66
7.12.1 General 66
7.12.2 WPT end of charge WH1 66
7.13 ACD connect/disconnect WI 68
7.13.1 ACD connect/disconnect WI 68

Annex A (informative) **Conductive charging infrastructure architecture** **69**

Annex B (informative) **Security** **82**

Annex C (informative) **Examples of charging scenarios derived from the use case elements** **88**

Annex D (informative) **Typical RPT system** **106**

Annex E (normative) **Requirement list** **108**

Bibliography **116**

 © ISO 2019 – All rights reserved

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).

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 jointly by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*, and Technical Committee IEC/TC 69, *Electric road vehicles and electric industrial trucks.* The draft was circulated for voting to the national bodies of both ISO and IEC.

This second edition cancels and replaces the first edition (ISO 15118-1:2013) which has been technically revised. The main changes compared to the previous edition are as follows:

— new use cases and requirements for wireless communication, wireless power transfer, automatic connection devices and bidirectional power transfer have been added; and

— as usage of private data and cyber security are becoming an important concern for users, requirements for more traceability and data privacy have also been added.

A list of all parts in the ISO 15118 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.

© ISO 2019 – All rights reserved

Introduction

The pending energy crisis and the necessity to reduce greenhouse gas emissions have led vehicle manufacturers to make a very significant effort to reduce the energy consumption of their vehicles. They are presently developing vehicles partly or completely propelled by electric energy. Those vehicles will reduce the dependency on oil, improve global energy efficiency and reduce the total CO_2 emissions for road transportation if the electricity is produced from renewable sources. To charge the batteries of such vehicles, specific charging infrastructure is required.

Much of the standardisation work on dimensional and electrical specifications of the charging infrastructure and the vehicle interface is already treated in the relevant ISO or IEC groups. However, the question of the interoperability of information transfer between the vehicle, the local installation and the grid is also of the upmost importance.

Such communication is beneficial for the optimisation of energy resources and energy production systems as vehicles can charge or discharge at the most economic or most energy-efficient instants. It is also required to develop efficient and convenient payment systems in order to cover the resulting micro-payments. The necessary communication channel can serve in the future to contribute to the stabilisation of the electrical grid as well as to support additional information services required to operate electric vehicles efficiently.

The requirements of this document form the basic framework for all use cases descriptions and related documents in the ISO 15118 series. This document is the result of a large consensus among all the actors of the electro mobility and is a guideline for implementers of the ISO 15118 series.

© ISO 2019 – All rights reserved

Road vehicles — Vehicle to grid communication interface —

Part 1: General information and use-case definition

1 Scope

This document, as a basis for the other parts of the ISO 15118 series, specifies terms and definitions, general requirements and use cases for conductive and wireless HLC between the EVCC and the SECC.

This document is applicable to HLC involved in conductive and wireless power transfer technologies in the context of manual or automatic connection devices.

This document is also applicable to energy transfer either from EV supply equipment to charge the EV battery or from EV battery to EV supply equipment in order to supply energy to home, to loads or to the grid.

This document provides a general overview and a common understanding of aspects influencing identification, association, charge or discharge control and optimisation, payment, load levelling, cybersecurity and privacy. It offers an interoperable EV-EV supply equipment interface to all e-mobility actors beyond SECC.

The ISO 15118 series does not specify the vehicle internal communication between battery and other internal equipment (beside some dedicated message elements related to the energy transfer).

NOTE 1 Electric road vehicles specifically are vehicles in categories M (used for carriage of passengers) and N (used for carriage of goods) (compare ECE/TR ANS/WP.29/78 ev.2). This does not prevent vehicles in other categories from adopting the ISO 15118 series as well.

NOTE 2 This document is destined to orientate the message set of ISO 15118-2 and ISO 15118-20[1)]. The absence of any particular use case in this document does not imply that it will not be put into practice, with the required messages.

NOTE 3 This document, ISO 15118-2 and ISO 15118-20 are designed to work independent of data transfer medium used. However, the ISO 15118 series is made for fitting the specified data link layers in the corresponding documents in this series.

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/TR 8713, *Electrically propelled road vehicles — Vocabulary*

ISO 15118-2, *Road vehicles — Vehicle to grid communication interface — Part 2: Network and application protocol requirements*

ISO 15118-3, *Road vehicles — Vehicle to grid communication interface — Part 3: Physical and data link layer requirements*

1) Under preparation. Stage at the time on publication: ISO/DIS 15118-20:2019.

© ISO 2019 – All rights reserved

ISO 15118-8, *Road vehicles — Vehicle to grid communication interface — Part 8: Physical layer and data link layer requirements for wireless communication*

ISO 15118-20[2)], *Road vehicles — Vehicle to grid communication interface — Part 20: 2nd generation network and application protocol requirements*

EN 50549-1, *Requirements for generating plants to be connected in parallel with distribution networks — Part 1: Connection to a LV distribution network — Generating plants up to and including Type B*

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

IEC 61980-2, *Electric vehicle wireless power transfer (WPT) systems — Part 2 specific requirements for communication between electric road vehicle (EV) and infrastructure with respect to wireless power transfer (WPT) systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TR 8713 and the following apply.

ISO and IEC maintain terminological 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 General terms

3.1.1
actor
entity which characterizes a role played by a user or any other system that interacts with the subject

3.1.2
ancillary services
services necessary for the operation of an electric power system provided by the system operator and/or by power system users

[SOURCE: IEC IEV Electropedia, 617-3-9, modified — The Note has been removed.]

3.1.3
association
procedure to establish the wireless communication between the *SECC* (3.1.68) controlling the charging infrastructure [e.g. coils for *WPT* (3.1.76)] and the *EVCC* (3.1.31)

3.1.4
authentication
procedure between the *EVCC* (3.1.31) and the *SECC* (3.1.68) or between the USER and the *EV* (3.1.30) supply equipment or the SA, to prove that the provided information [see *identification* (3.1.49)] is either correct, valid, or it belongs to the EVCC, the USER or the SECC

3.1.5
authorization
procedure to verify if an *EV* (3.1.30) is allowed to *charge* (3.1.12) or *discharge* (3.1.22)

3.1.6
automatic connection device
ACD
components supporting the automatic connection and disconnection process for conductive energy transfer between an *EV* (3.1.30) and the *EV supply equipment* (3.1.33 and 3.1.34)

2) Under preparation. Stage at the time of publication: ISO/DIS 15118-20:2019.

© ISO 2019 – All rights reserved

3.1.7
basic signalling
physical signalling according to the *pilot function* (3.1.55)

Note 1 to entry: This definition is provided by IEC 61851-1:2017, Annex A.

3.1.8
battery management system
BMS
electronic device that controls or manages the electric and thermal functions of the battery system and that provides communication between the battery system and other vehicle controllers

3.1.9
bidirectional power converter
BPC
stabilized power supply device which delivers *BPT* (3.1.10) functions

3.1.10
bidirectional power transfer
BPT
combination of forward or reverse power transfer sequences

3.1.11
certificate
electronic document which uses a digital signature to bind a public key with an identity

Note 1 to entry: The ISO 15118 series describes several certificates covering different purposes, e.g. the contract certificate including the EMAID and *OEM* (3.1.52) provisioning certificates.

3.1.12
charge
store electrical energy in the vehicle battery

Note 1 to entry: In the first edition of this document, the words “charge” or “charging” were used intensively as a generic term. In this edition, in order to be more precise and to cover with one word *forward* (3.4.1) and *Reverse Power Transfer* (3.4.2) the terms “charge” and its declinations have been replaced by “energy transfer” when appropriate. When energy transfer is used in a sentence, this means that both directions of power flow are possible.

Note 2 to entry: The term “charge” (and the associated verb) has in this text a precise definition in relation to the amount of energy stored in the *EV* (3.1.30) battery which can be different than the total energy transferred to the EV.

Note 3 to entry: In some sentences, the word “charging” is still used. For example, the words “charging site” are still used.

3.1.13
charger
power converter that performs the necessary functions for charging a battery

3.1.14
charging station operator
CSO
EV supply equipment operator
secondary actor (3.1.64) responsible for the installation and operation of a charging infrastructure (including charging sites) and the management of electricity to provide the requested energy transfer services

Note 1 to entry: The term CPO (Charge Point Operator) is also used in the ISO 15118 series. This term is not recommended for trademark reasons.

© ISO 2019 – All rights reserved

3.1.15
communication session
sequence of time where the *EVCC* (3.1.31) and the *SECC* (3.1.68) interactively exchange digital information in order to manage charging or discharging the *EV* (3.1.30) battery

Note 1 to entry: A communication session can be paused and resumed later several times. The communication session encapsulates zero or more *energy transfer periods* (3.1.37).

3.1.16
contactor
electrically controlled switch used for switching a power circuit

Note 1 to entry: Unlike a circuit breaker, a contactor is not intended to interrupt a short circuit current.

Note 2 to entry: As far as communication is concerned, the contactor occurs as a *trigger* (3.1.70) for the power supply.

3.1.17
credential
document attesting the permission of the *EV* (3.1.30) to be *charged* (3.1.12) or to *discharge* (3.1.22)

3.1.18
demand and prognosis
function that covers the collection of grid and local installation conditions which applies to the actual energy transfer process

EXAMPLE The *sales tariff table* (3.1.63) containing a price, CO_2 content and percentage of renewable energy information vs. time based on grid, energy production, energy demand and customer contract information, along with an optional contract-based current limitation. The *grid schedule* (3.1.46) containing a current vs. time limitation at the specific *EV* (3.1.30) supply equipment due to local installation and local electricity demand situation.

3.1.19
demand clearing house
DCH
entity for grid negotiation that provides information on the load of the grid

Note 1 to entry: The demand clearing house mediates between two clearing partners: an *SECC* (3.1.68) and the part of the power grid connected to this SECC. Most likely this function will be served by a system operator.

Note 2 to entry: Demand clearing house and *meter operator* (3.1.51) may exchange information with each other as well as with other *actors* (3.1.1).

EXAMPLE A DCH typically fulfils the following tasks:

— Collect all necessary information from all parts of the power grid, e.g. current or forecasted load of local transformers, distribution grid, power substation, transmission grid, transmission substation, power plants (including renewable energies) and predicted *energy transfer schedules* (3.1.39) submitted by *EVCCs* (3.1.31).

— Consolidate the collected grid information to a “grid profile” and offer it to SECCs/EVCCs.

— Provide energy transfer schedule proposal for the connected *EV* (3.1.30) to the requesting SECC based on the collected grid profile.

— Inform the SECC as to the necessity for an updated energy transfer schedule if the grid profile has changed.

— On the contrary, the SECC will inform the demand clearing house if the EV's energy transfer schedule has changed.

3.1.20
distributed energy resources
DER
distributed set of one or more energy service resources, including generators, energy storage and controllable load, that can be used to deliver *ancillary services* (3.1.2)

© ISO 2019 – All rights reserved

3.1.21
departure time
point in time when the user intends to unplug the car and/or leave the charging site

3.1.22
discharge
release the electric charge of the vehicle battery

3.1.23
discovery
phase in which an *EV* (3.1.30) obtains a list of available *SECCs* (3.1.68) in its wireless communication range

3.1.24
distribution system operator
DSO
entity responsible for the voltage stability in the distribution grid

Note 1 to entry: Electricity distribution is the final stage in the physical delivery of electricity to the delivery point, e.g. end user, EV supply equipment (3.1.33 and 3.1.34) or parking operator.

Note 2 to entry: A distribution system network carries electricity from the transmission grid and delivers it to consumers. Typically, the network would include medium-voltage power lines, electrical substations and low-voltage distribution wiring networks with associated equipment.

3.1.25
e-mobility needs
mobility needs expressed by the *EV* (3.1.30) user in terms of *departure time* (3.1.21), *minimum* (3.5.1) and *maximum energy request* (3.5.2) and target energy request

3.1.26
e-mobility operator clearing house
EMOCH
entity mediating between two clearing partners to provide validation services for roaming regarding contracts of different *EMSPs* (3.1.27)

Note 1 to entry: EMOCH mediates for the purpose of:

— collecting all necessary contract information like the EMAID, the EMSP, the communication path to the EMSP, roaming fees, begin and end dates of the contract, etc.;

— providing the *SECC* (3.1.68) with confirmation that an EMSP will pay for a given EMAID [*authorization* (3.1.5) of valid contract]; and

— transferring an *SDR* (3.1.66) after each *energy transfer period* (3.1.37) to connect the EMSP and the *EP* (3.1.29) of the identified contract.

Note 2 to entry: The EMOCH, EMSP and *meter operator* (3.1.51) may exchange information with each other as well as other *actors* (3.1.1).

3.1.27
e-mobility service provider
EMSP
entity with which the customer has a contract for all services related to the *EV* (3.1.30) operation

Note 1 to entry: Typically, the EMSP will include some of the other *actors* (3.1.1), like the spot operator or *EP* (3.1.29), and has a close relationship with the *distribution system operator* (3.1.24) and *meter operator* (3.1.51). An *OEM* (3.1.52) or utility could also fulfil such a role.

Note 2 to entry: The EMSP validates EMAIDs from his customers, which were received either from the *EMOCH* (3.1.26), other EMSPs or spot operators the customer is in relation with.

Note 3 to entry: The EMSP issues EMAIDs to his customers.

© ISO 2019 – All rights reserved

3.1.28
electric energy meter
EEM
equipment for measuring electrical energy by integrating power with respect to time

Note 1 to entry: The equipment complies with IEC 62052-11 and IEC 62053-21, IEC 62053-52.

Note 2 to entry: Some *use cases* (3.1.71) need the amount of electric energy measured by the electric energy meter and communicated through the *SECC* (3.1.68) to the *EVCC* (3.1.31), while other scenarios do not need a separate electric energy meter. The *EV* (3.1.30) may get this information and use it according to the *OEM's* (3.1.52) intentions.

3.1.29
electricity provider
EP
entity whose activity is the wholesale purchase of electricity and the subsequent direct resale to a client through a contract

Note 1 to entry: The provider may also deliver energy related services.

Note 2 to entry: Provider can generate flexibilities through modulation of electricity prices (Time-of-Use, Critical Peak Prices...), flexibilities which can have value on energy markets and/or for network operations.

3.1.30
electric vehicle
EV
all road vehicles, including plug-in hybrid road vehicles (PHEV), that derive all or part of their energy from on-board rechargeable energy storage systems (RESS)

[SOURCE: IEC 61851-1:2017, 3.1.32]

3.1.31
electric vehicle communication controller
EVCC
embedded system, within the vehicle, that implements the communication between the vehicle and the *SECC* (3.1.68) 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 the vehicle and the SECC.

3.1.32
electric vehicle power system
EV power system
equipment or combination of equipment providing dedicated functions to supply electric power in both directions:

— from an electrical installation or supply network to an *EV* (3.1.30) for the purpose of charging; and

— from a *DER* (3.1.20) in the EV to supply network or the grid for the purpose of discharging

Note 1 to entry: The former function is equal to the *EV supply equipment* (3.1.33 and 3.1.34), provided by IEC 61851-1.

© ISO 2019 – All rights reserved

3.1.33
electric vehicle supply equipment
EV supply equipment
<conductive power transfer> conductors, including the phase(s), neutral and protective earth conductors, the *EV* (3.1.30) couplers, attached plugs, and all other accessories, devices, *power outlets* (3.1.58) or apparatuses installed specifically for the purpose of delivering energy from the premises wiring to the EV and allowing communication between them as necessary

Note 1 to entry: This document will keep the wording "EV supply equipment" for any energy transfer process but the definition will depend on the technology used.

3.1.34
electric vehicle supply equipment
EV supply equipment
<wireless power transfer> off-board electronics that supply the electric power through the primary and secondary device to the *EV* (3.1.30) including all housings and covers

[SOURCE: IEC 61980-1:2015, 3.3]

3.1.35
electronic control unit
ECU
unit providing information regarding the vehicle

3.1.36
energy management system
EMS
system that controls the electric power transfer among the *DER* (3.1.20), premises appliances and the grid

Note 1 to entry: The EMS is similar to the HEMS or *PNEMS* (3.1.57).

3.1.37
energy transfer period
sequence of time between the beginning of energy transfer and the end of the energy transfer

EXAMPLE 1 One or many periods of charging or discharging the battery, doing pre-conditioning or post-conditioning.

EXAMPLE 2 Energy transfer can be achieved, for example, through a cable connection or though *WPT* (3.1.76).

EXAMPLE 3 End of energy transfer can be achieved, for example, with the disconnection of the cable or with leaving the parking place.

3.1.38
energy transfer scenario
combination of *use case* (3.1.71) elements to fulfil a specific energy transfer use case

3.1.39
energy transfer schedule
scheme which contains the power limits for charging or discharging the battery during an *energy transfer period* (3.1.37)

Note 1 to entry: The *EV* (3.1.30) should apply the negotiated limits as close as possible, to allow power balancing for the *EMS* (3.1.36) or the *DSO* (3.1.24).

EXAMPLE The schedule is calculated based on the *target setting* (3.1.69), *sales tariff table* (3.1.63) and *grid schedule* (3.1.46) information, respecting the corresponding current limitations, i.e. using the lowest current value.

© ISO 2019 – All rights reserved

3.1.40
energy transfer method
element which allows the *EV* (3.1.30) to select its desired energy transfer methods in case both the *EV supply equipment* (3.1.33 and 3.1.34) and the EV support multiple energy transfer methods and different plugs and sockets

Note 1 to entry: See IEC 62196.

3.1.41
EV supply equipment ID
EVSEID
unique *identification* (3.1.49) of the *EV supply equipment* (3.1.33 and 3.1.34)

3.1.42
external identification means
EIM
external means that authorized the coupled *EV* (3.1.30) to be served by services from the *EV supply equipment* (3.1.33 and 3.1.34)

EXAMPLE NFC, RFID, SMS credit/debit card, smartphone or web application, phone call.

Note 1 to entry: EIM also support "charging for free" (fair mode) to be given a positive *authorization* (3.1.5) every time.

3.1.43
fast responding services
services adapted to energy *secondary actors*' (3.1.64) real-time constraints leading to data exchanges limited to energy level boundaries

Note 1 to entry: Energy secondary actors' real-time constraints are in the order of a few seconds.

3.1.44
fleet operator
FO
person or legal entity operating several *EVs* (3.1.30) and who can have the contracts with the *EMSP* (3.1.27)

3.1.45
flexibility operator
party which aggregates flexibilities for its customers

3.1.46
grid schedule
function which sets the power level at a specific time based on the local grid situation

Note 1 to entry: Parameters to calculate the grid schedule are e.g. local grid demand and supply situation, actual and forecast.

3.1.47
high level communication
HLC
bidirectional digital communication using protocol and messages and physical and data link layers

Note 1 to entry: As specified in the ISO 15118 series.

Note 2 to entry: HLC in the ISO 15118 series is compliant with the term digital communication in SAE J1772, SAE 2836, SAE 2847 and SAE 2931.

© ISO 2019 – All rights reserved

3.1.48
human machine interface
HMI
interface allowing the *vehicle user* (3.1.75) to receive information relative to the energy transfer process and provide input to the energy transfer system

Note 1 to entry: All information from a user (input) or displayed to a user (output) will be performed through an HMI.

Note 2 to entry: The HMI could be implemented as a function of the *EV* (3.1.30), *EV supply equipment* (3.1.33 and 3.1.34), mobile phone, etc.

3.1.49
identification
procedure for the *EVCC* (3.1.31) or USER to provide its identifying information for the purpose of *authorization* (3.1.5), mostly to provide its capability for payments

EXAMPLE Contract *certificate* (3.1.11), credit card number, etc. and/or procedure for the *SECC* (3.1.68) to provide the *EV supply equipment ID* (3.1.41) to the EVCC.

Note 1 to entry: For simplicity reasons, within the ISO 15118 series, the term "identification" includes also the *authentication* (3.1.4) of the provided identifying information, i.e. this information is correct, or it belongs to the EVCC, the USER or the SECC.

3.1.50
level selector
function to select the lowest value among the data issued from the *demand and prognosis* (3.1.18) function, and then to feed the result to scheduling function

Note 1 to entry: This function may be implemented in the *EV* (3.1.30) or the *EV supply equipment* (3.1.33 and 3.1.34).

3.1.51
meter operator
MO
body having the legal responsibility for the installation and maintenance of the *EEM* (3.1.28)

3.1.52
original equipment manufacturer
OEM
producer who manufactures products or components that are purchased by a company and retailed under that purchasing company's brand name

Note 1 to entry: The OEM refers to the company that originally manufactured the product.

Note 2 to entry: When referring to automotive parts, the OEM designates a replacement part made by the manufacturer of the original part.

3.1.53
pairing
process by which a vehicle is correlated with the unique *EV supply equipment* (3.1.33 and 3.1.34) at which it is located and from which the power will be transferred either through a cable or through a wireless technology

Note 1 to entry: The pairing process is sometimes called the "*association* (3.1.3) problem".

3.1.54
paying unit
PU
device on the *EV supply equipment* (3.1.33 and 3.1.34) side that offers payment methods

EXAMPLE Payment methods: *EIM* (3.1.42), cash, credit cards, etc.

© ISO 2019 – All rights reserved

Note 1 to entry: If the *EVCC* (3.1.31) normally chooses a payment method, then the paying unit indicates to the *SECC* (3.1.68) whether the customer is authorized or not.

3.1.55
pilot function
means, electronic or mechanical, that ensures the conditions related to the safety or the transmission of data required for the mode of operation, compliant with IEC 61851-1

3.1.56
plug and charge
park and charge for WPT
PnC
identification (3.1.49) mode where the customer just has to plug or park, in case of *WPT* (3.1.76), their vehicle and all aspects of energy transfer are automatically taken care of with no further intervention from the driver

Note 1 to entry: The aspects of energy transfer may include load control, *authorization* (3.1.5) and billing.

3.1.57
private network energy management system
PNEMS
functional component responsible for managing equipment consuming, producing or storing electricity in the private network

Note 1 to entry: A PNEMS provides the expected services while fulfilling contracted conditions with the electricity supplier, the *DSO* (3.1.24), the *flexibility operator* (3.1.45) or any other system operators.

Note 2 to entry: A PNEMS negotiates with the *CSO* (3.1.14) the power available for the charging site and the cluster of *EV supply equipment* (3.1.33 and 3.1.34) within the frame of an operational planning function and a real time balance function.

Note 3 to entry: In this document the PNEMS is also called *EMS* (3.1.36).

3.1.58
power outlet
socket outlet or, in the case of a fixed cable, connector, that provides power to the *EV* (3.1.30), typically to be installed with the fixed wiring

3.1.59
power outlet ID
unique *identification* (3.1.49) of the *power outlet* (3.1.58) to the vehicle

3.1.60
power transfer control
function that confirms the maximum current which is allowed to be transferred from or to the *EV supply equipment* (3.1.33 and 3.1.34) based on the *energy transfer schedule* (3.1.39)

Note 1 to entry: Actual charge current to the battery should be controlled by the *BMS* (3.1.8). It is not in scope of the ISO 15118 series.

3.1.61
primary actor
entity involved directly in the energy transfer process

3.1.62
pulse width modulation
PWM
pulse control in which the pulse width or frequency, or both, are modulated within each fundamental period to produce a certain output waveform

© ISO 2019 – All rights reserved

3.1.63
sales tariff table
function of price related information over time

Note 1 to entry: The sales tariff table provides input for calculating an *energy transfer schedule* (3.1.39).

Note 2 to entry: The sales tariff table can be issued by a *secondary actor* (3.1.64), e.g. *EP* (3.1.29), *EMS* (3.1.36) or *EMSP* (3.1.27).

Note 3 to entry: The sales tariff table should reflect "supply and demand balance of the electricity provider" and "usage of green energy" (e.g. wind mill, photovoltaic).

Note 4 to entry: Information of the chosen tariff should be included in the service detail record.

Note 5 to entry: The sales tariff table can be updated periodically. It may differ by country or EP.

Note 6 to entry: There may be multiple sales tariff tables existing for one customer.

Note 7 to entry: The sales tariff table information should be constructed in such a way that normal fluctuations on the grid side will not lead to an insufficiently charged *EV* (3.1.30) or cost increase.

Note 8 to entry: The contract-based current limitation might vary over time, e.g. lower value during daytime and higher value during the night.

3.1.64
secondary actor
entity involved indirectly in the energy transfer process

Note 1 to entry: Secondary actors may exchange information between each other.

Note 2 to entry: Secondary actors could also be a single entity.

3.1.65
semi-online
status where the *SECC* (3.1.68) or any other device in general has the ability to go online, but being online is not required synchronously to the referring *use case(s)* (3.1.71)

3.1.66
service detail record
SDR
data package with all necessary information that an *EMSP* (3.1.27) needs for billing, informing the customer about the *V2G* (3.1.74) session and to ensure traceability of the transactions.

Note 1 to entry: Some data may be sent from the *EV supply equipment* (3.1.33 and 3.1.34). Some data may be originally owned by the *EMOCH* (3.1.26). Some data may be created at the EMOCH. Some records are sent to EMSP for billing or informing their customers.

3.1.67
service provider
secondary actor (3.1.64) which offers *value-added services* (3.1.72) to customers throughout the *CSO* (3.1.14)

Note 1 to entry: An EMAID may be used for activation.

3.1.68
supply equipment communication controller
SECC
entity which implements the communication to one or multiple *EVCCs* (3.1.31) and which may be able to interact with *secondary actors* (3.1.64)

Note 1 to entry: See ISO 15118-2.

Note 2 to entry: Further details regarding possible architectures are given in Annex A.

© ISO 2019 – All rights reserved

Note 3 to entry: Functions of a *supply equipment communication controller* (3.1.68) may control input and output channels, data encryption, or data transfer between the vehicle and the SECC.

3.1.69
target setting
function which covers the following user demand-related information:

— *departure time* (3.1.21);

— amount of energy required for charging or available for discharging;

— *energy transfer schedule* (3.1.39); and

— energy transfer type

3.1.70
trigger
event that will start or be a condition in the *use case* (3.1.71)

3.1.71
use case
description of a system's behaviour as it responds to a request that originates from outside that system

Note 1 to entry: In systems engineering, a use case describes "who" can do "what" with the system in question. The use case technique is used to capture a system's behavioural requirements by detailing scenario-driven threads through functional requirements.

Note 2 to entry: The term "*energy transfer scenario* (3.1.38)" is used simultaneously to the term "use case" within this document.

3.1.72
value-added services
VAS
elements not directly needed for the pure energy transfer between the *EV* (3.1.30) and the *EV supply equipment* (3.1.33 and 3.1.34)

3.1.73
vehicle coupler
means of enabling the manual connection of a flexible cable to an *EV* (3.1.30) for the purpose of charging or discharging the traction batteries, consisting of two parts: a vehicle connector and a vehicle inlet

3.1.74
vehicle to grid
V2G
plug-in *electric vehicle* (3.1.30) interaction with the electric grid, including charging as well as discharging and bi-directional communication interface

Note 1 to entry: The first part of this definition is excerpted from the scope of the V2G Domain Expert Working Group, SGIP, NIST.

3.1.75
vehicle user
person or legal entity using the vehicle and providing information about driving needs and consequently influencing energy transfer patterns

Note 1 to entry: Driving needs, such as range and time of availability, are necessary to achieve the most appropriate *energy transfer scenario* (3.1.38).

3.1.76
wireless power transfer
WPT
transfer of electrical energy from a power source to an electrical load via electric and or magnetic fields or waves between a primary and a secondary device

© ISO 2019 – All rights reserved

3.2 Control modes

3.2.1
scheduled mode
control mode where the *EVCC* (3.1.31) and *SECC* (3.1.68) have negotiated a power profile fulfilling the user's mobility needs and based on the energy target, power and tariff information

Note 1 to entry: In this control mode, the *EV* (3.1.30) is in charge of fulfilling the user's mobility needs.

3.2.2
dynamic mode
control mode, without negotiation, where a *secondary actor* (3.1.64) system controls the power flow fulfilling the user's mobility needs and its own constraints

3.3 Architecture channel

3.3.1
dual architecture channel
electrical and information architecture in which two separate energy meters are used for the forward and reverse power flow

3.3.2
single architecture channel
electrical and information architecture in which one single energy meter is used for both the forward and reverse power flows

3.4 Forward and reverse power transfer

3.4.1
forward power transfer
FPT
power transfer from the external power supply to the vehicle battery via the *EV supply equipment* (3.1.33 and 3.1.34)

3.4.2
reverse power transfer
RPT
power transfer from the vehicle battery to home, loads or grid via the *EV supply equipment* (3.1.33 and 3.1.34)

3.5 Minimum and maximum energy request limits

3.5.1
minimum energy request
minimum energy stored in the battery requested by the *EV* (3.1.30) at any time during the *BPT* (3.1.10) period

Note 1 to entry: If the difference between the current state of charge and the minimum energy request is negative, immediate charging has to be performed.

3.5.2
maximum energy request
maximum energy stored in the battery requested by the *EV* (3.1.30) at any time during the *BPT* (3.1.10) period

Note 1 to entry: If the difference between the current state of charge and the maximum energy request is positive, immediate discharging can be required.

© ISO 2019 – All rights reserved

3.6 Source generator modes

3.6.1
voltage source generator mode
mode in which the system {*EV* (3.1.30) + *EV supply equipment* (3.1.33 and 3.1.34)} is able to power wires that would not be powered otherwise

3.6.2
current source generator mode
mode in which the system {*EV* (3.1.30) + *EV supply equipment* (3.1.33 and 3.1.34)} is able to supply current independently of the voltage

4 Abbreviated terms

ACD	automatic connection device
BMS	battery management system
CSO	charging station operator
DCH	demand clearing house
EBC	EV supply equipment booking confirmation
ECU	electronic control unit
EEM	electric energy meter
EIM	external identification means
EMAID	e-mobility authentication identifier
EMOCH	e-mobility operator clearing house
EMS	energy management system
EMSP	e-mobility service provider
EP	electricity provider
EV	electric vehicle
EVCC	electric vehicle communication controller
EVPS	electric vehicle power supply
EVSEID	electric vehicle supply equipment identifier
FO	fleet operator
FPT	forward power transfer
GW	gateway
HAN	home area network
HEMS	home energy management system
HLC	high level communication

© ISO 2019 – All rights reserved